Educated Cities and Regional Centralization

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Abstract

This paper provides an overview of Danish student to population ratios in post-primary education from 1982 to 2013. Using administrative register data I document a nationally increased share of enrolled students to population over the 32 years period. The increase followed a pattern of regional centralization where the shares of students rose significantly more in urban municipalities than non-urban municipalities. The highest shares of students as well as fastest increases were seen in the municipalities of the four largest cities, Copenhagen, Århus, Odense, and Aalborg. At the national level, the increases in shares of students to population was driven by medium length and long tertiary as well as high school enrollment. The tertiary enrolled students, however, were unproportionally centred in the urban municipalities. Non-urban municipalities had relatively higher levels of high school and vocational education students to population both in 1982 and 2013. The paper is concluded with suggestions for future research linking these patterns of regional centralization to challenges such as technological skill-bias and an increasing importance of continuous learning, as well as inequality and social mobility.

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1 Introduction

This paper provides descriptive statistics on spatial trends in Danish post-primary education enrollment from 1982 to 2013. It serves as a potential resource for future research into regional dynamics of the Danish education system, as well as a source for informing public debate on regional disparities in Denmark.

A recurring theme in Danish public discussions is that of "Peripheral Denmark" (*Udkantsdanmark*), touching on topics such as population decline, health problems, and lacking employment opportunities (see e.g. Houlberg and Hjelmar 2014; Petersen and Pihl-Andersen 2016; and Samson 2015). An often overlooked question is how students are distributed across the country, and how this might affect local economic environments. Recent Danish research has touched on the topic of the spatial distributions of student, but often use a short timespan to investigate patterns of enrollment and student location, leaving the long run developments uncharted.[1] Statistics Denmark and the Ministry of Education also provide updated information on educational enrollment from 2005, while longer series do not provide information that is continuously updated.[2] In this paper, I use Danish register data to document spatial distributions of students enrolled in post-primary education[3] to population by area of residence over the period 1982 to 2013.

I document a pattern of regional centralization of students in urban municipalities from 1982 to 2013. At the national level the share of students to population increased nearly monotonically from 1982 to 2013. The main drivers of this increased proportion of the population enrolled in education was enrollment in medium length and long tertiary education as well as high school enrollment. The development was, however, unevenly distributed across the country. The municipalities containing the four largest cities in Denmark experienced the main part of the increase in students to population ratios. Using alternate groupings of the municipalities by region and by degree of 'rurality' I show that the driving enrollment in these urban municipalities is medium length and long tertiary education and to a lesser extend high school enrollment. Non-urban municipalities, characterizes as intermediate, rural, and peripheral, are broadly similar in terms of levels and increases in shares of students to population. Increased shares is related to high school and vocational education, both at the secondary level. From distributing students and the population across regions I find that the increases of students to populations shares were broadly similar across four out of five regions, each of which inhabits part of the urban municipalities. Only the Zealand region, which does not contain one of the four largest cities and few urban municipalities, lagged behind the

[1] Høst and Sørensen (2015) and Region Hovedstaden (2013) investigate the effect of geographical distance on students' likelihood of educational enrollment during 2006-2011 and 2008-2013 respectively, and Danmark På Vippen (2016) shows a centralization in the locations where students can pursue education (not the students actual location) from 2009-2016.

[2] Both sources are based on Danish Student Registers ("*Elevregisteret*") paired with supplemental register information (Statistics Denmark, 2014; Ministry of Education, 2017a). For a general description of the Danish education registers which the statistics in this paper also utilize, see Jensen and Rasmussen (2010).

[3] A brief introduction to the education Danish education system and the associated education types follow in the next section.

other municipalities developments until 2008. Overall, Denmark experienced a patterns of regional centralization of students, where the areas with the strongest increases in students to population was driven by enrollment in tertiary versus secondary education.

In the following sections I first describe the underlying data and methodological considerations. Next follow a presentation of the descriptive statistics in order of national, municipal, regional, and classified municipal findings. In the final section I conclude on the findings and make suggestions for future research.

2 Data and Methodological Considerations

In order to investigate the spatial distribution of Danish students I use register data provided by Statistics Denmark. The Danish registers is a set of datasets containing information on all individuals in Denmark with a with a social security number (CPR). The information includes the area of residence and current enrollment in education from 1982 to 2013. The choice of time frame for the investigation was limited by this data availability. In the next paragraphs I introduce methodological considerations related to the descriptive analysis.

The paper is based on enrollment to population numbers, using population sizes from the register data. Due to limitations in the data access, age of the individuals in the register data was not available. As a result, it was not a possibility to use register population sizes to investigate other measures such as students to population under 30 and to working age population (15-64 years old). An alternative to using register data is to use population size measures from other sources. In the appendix I include results using such populations measures gathered from Statistics Denmark for each of the analysis sections. The results are qualitatively similar to those of the total population statistics in most cases.

Levels and types of educations are central to understanding links between student bodies and topics such as social mobility and technological skill-bias. In the analysis, I distinguish between different levels of education (e.g. high school and short tertiary education), leaving for future research to investigate types of educations (such as engineering and literature studies). The levels in the Danish education system can be found in appendix A, figure 7. The levels of education I consider are *preparatory education*, *high school*, *vocational education*, *short tertiary*, *medium length tertiary*, and *long tertiary education*.[4] Table 3 provides a translation between figure 7 and the notation I use in this paper as well as the average lengths of each education. For each individual, the level of education is identified from the specific education pursued (e.g. auto-mechanic, high school math teacher, etc.). Some educations have changed official classification over the period 1982 to 2013.[5] In order to preserve a systematic comparison over time where changes in student bodies relate to choices of student enrollment, and not government agencies changing classifications, I adopt a 2013-level

[4]Preparatory education takes a special place among the educations as it functions as a preparing step to pursuing other secondary education for students that do not yet feel ready to do so.

[5]Hospital nursing has, for example, been classified as short tertiary education and is currently classified as a medium length tertiary education.

classification (Statistics Denmark, 2017a).[6] I focus on levels above primary education for two reasons: Firstly, in 2007 a change in the register classification of primary education massively increased the measured shares of students enrolled in primary education. Secondly, students are only required to choose their field of studies following primary education. In addition, I merge academic bachelor, Master's, and PhD students in the category long tertiary education. This is done for two reasons: Firstly, prior to the year 2000 the data suggests that several bachelor programs are mistakenly categorized as Master's programs. Separate classification would overestimate the amount of enrolled Master's students and underestimate the amount of bachelor's students. Secondly, the amount of PhD students in Denmark is sufficiently small that data confidentiality concerns restricts distributing these separately across spatial entities.[7] Merging them with other long tertiary educations, this problem is overcome. The amount of these students are furthermore so small that long tertiary enrollment rates are not significantly affected by the addition.

I consider four levels of spatial aggregation in the analysis: National, regional, municipal, and groups of municipalities classified by degrees of 'rurality'.[8] The aggregation of primary interest is municipalities as the smallest administrative units of residence that students can be distributed across. A 2007 structural reform merged a total of 271 pre-reform to 98 post-reform municipalities. I use post-reform entities when referring to municipalities in the analysis. Similarly 13 counties were merged into 5 regions of which I use the latter entities in the analysis; *The Capital Region* (Capital), *The Central Region* (Central), *The Northern Region* (Northern), *The Southern Region* (Sourthern) and *Region Zealand* (Zealand). Figure 1a shows the regional geography of Denmark and columns one and two in table 4 in appendix B link municipalities to regions for the reader who is unfamiliar with Danish geography.

To discuss the degree to which developments in enrolled students to population and municipal characteristics are related I provide findings within a non-administrative classification of municipalities. As no official and broadly applied classification that considers peripheral and urban municipalities exists any choice of a classification is necessarily carries a degree arbitrariness. In the paper, I use a 2011 classification of municipalities created by Danish Ministry of Food Agriculture and Fisheries (2011) which divides municipalities into one of the four categories *Peripheral*, *Rural*, *Intermediate*, and *Urban* according to their degree of "rurality" with a total of 16, 30, 17, and 35 municipalities respectively. Figure 1b shows a map of Danish regions with shades of grey representing the different categories of municipalities.

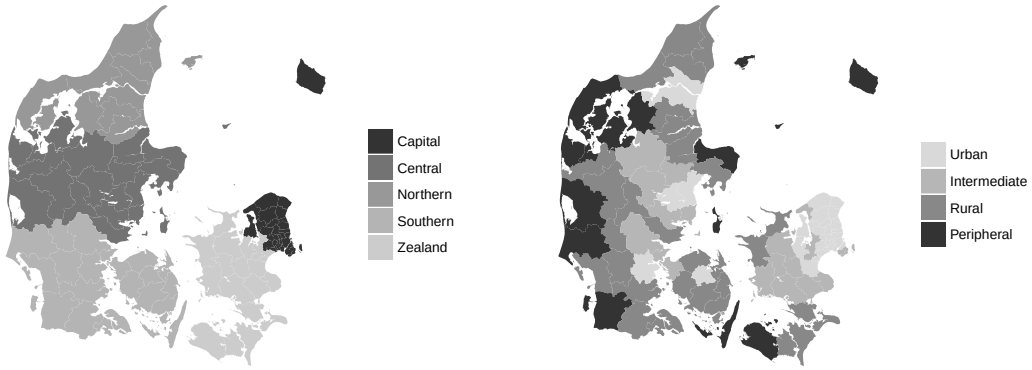
[6] A small set of educations observed in the registers do not have a level-classification in 2013, including particular jewellery designer and some music educations. I use characteristics of the education-providing schools and similar educations to classify these manually. Their numbers are, in addition, insignificant compared to the population wide numbers of enrolled students and do not affect the results of the analysis.

[7] Due to data security concerns, researchers are not allowed to display cells with less than 4 observations from the individual level data in the registers.

[8] A small percentage of individuals, ranging from 1 to 3.2 percent of the total register population (see figure 8 in appendix C) do not have residence information recorded. I include these individuals in analyses at the national level, and leave them out of regional, municipal, and classified municipality investigations where they cannot be attributed to a local area. Leaving these individuals out of the national analysis does not markedly affect the results.

Figure 1: Maps of Danish Regions, and Municipalities by Classification

(a) Danish Regions (b) 'Rurality' Classification



The classification was developed for evaluation and program development in the Danish Rural Development Programme of 2007-2013. It is based on 14 indicators that are combined in a single 'rurality' score.[9] The classification provide a first approximation to defining peripheral, urban, and other types of municipalities. To support the results, I show in appendix H.2 that an alternate classification based on Danish tax law provides qualitatively similar results.[10] Columns three and four in table 4 in appendix B show each municipality's type in each of the two classifications.

When analysing educational enrollment, existing research often emphasize gender and age (see e.g. Deming et al. 2014; Ganguli et al. 2012; and Klausen 2016). In the register access used for this paper, these informations were limited to the subset of the population that had been employed at any point over the period 1982-2013.[11] As a result, these characteristics

[9]The indicators were (1) Population per km^2, (2) Population in rural areas or towns with less than 1,000 inhabitants, (3) Proportion of the municipality's area in rural zones, (4) Percentage employed in agricultural enterprises, (5) Percentage of the population aged 17-64 years, (6) Percentage of population aged 25-44 years, (7) Employment trends, 1994-2004, (8) Population trends, 1994-2004, (9) Average distance to a motorway, (10) Jobs in proportion to employees (dependence on commuting), (11) Percentage of workforce with basic schooling, 2005, (12) Percentage of the workforce with medium-cycle or tertiary education, 2005, (13) Average distance to areas with a high surplus of jobs, 2004, and (14) Taxation base per capita, 2007.

[10]Other potential classifications schemes includes the classifications of municipalities by the 2010 Danish government in relation suggestions for improvement of peripheral Denmark Regeringen (2010) or the municipal compensation system whereby certain municipalities with better taxation foundations transfer funds to other municipalities (Sommer, 2017). Both classifications closely resemble the ones included, however, suggesting that the included classifications may be examplary.

[11]For this paper, I use data made available by Statistics Denmark to the IKE and IMPAKT research groups at Aalborg University, covering 1982-2013. This access only includes information on particular background variables such as gender and age for employed individuals. For a description of the IDA database containing these variables, see Timmermans (2010). For non-employed individuals these time-monotonically and time-invariant variables can be imputed if the individual has been employed at any point during 2010. For individuals in employment during the period 1982-2013, time-fixed or monotonic variables, such as age and gender, can be imputed for years where the individual is not employed. Some individuals are not employed in any year during the period 1982-2013 and therefore will not have information on gender and age. This is more likely to happen for younger cohorts, and as a result gender and age information becomes missing more frequently in later years.

cannot be fully incorporated in the analysis. I include gender as a characteristic in the national statistics in appendix E.2 but leave remaining analyses for future investigation.

3 An Overview of Student Enrollment in Denmark

The descriptive statistics are introduced in the following order: Initially I present national student to population shares and then distribute across levels of education. This shows increasing shares of students to population from 1982 to 2013, a trend driven by high school, medium length tertiary, and long tertiary student enrollment. I next show municipal findings, which suggests that the main share of the national increases appeared in municipalities containing the four largest cities in the country. Distributing the students across regions, I show that the increases in student to population ratios were rather evenly distributed between four out of five regions, the ones that contains the four largest cities. Finally, by using the 'rurality' classification, I show that the increases are indeed primarily found in the urban municipalities and driven by tertiary enrollment, whereas the remaining municipalities fare relatively similarly in terms of lower increases in enrollment rates that were driven by secondary education.

3.1 National Statistics

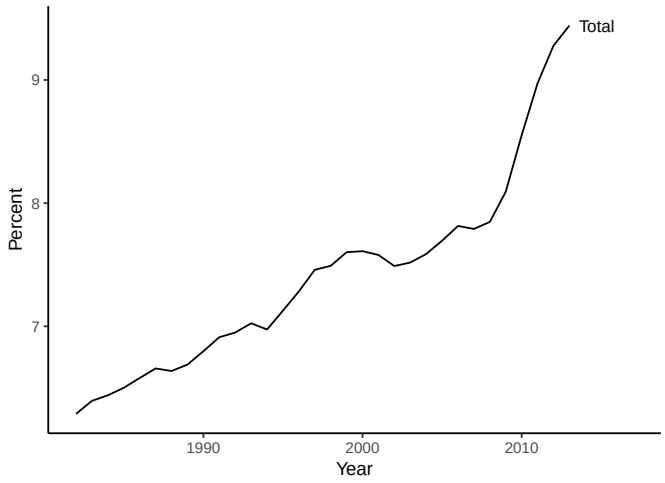
At the national level, the main finding is a share of enrolled students to population rising from 6.29 to 9.44 percent over the period 1982-2013. An increase of 3.15 percentage points (PP) and 50.13 percent. Figure 2 shows the share of enrolled students to the total population, highlighting this development. From the figure furthermore see an acceleration of the growth of students to population after 2008, going from 7.6 percent to about 9.44 percent of the population taking education from 2009 to 2013.[12]

Different levels of education contribute differently to the national share of students. I distribute student to population shares across levels of education in figure 3a, and figure 3b shows the corresponding index values with base in 1982. Firstly, the largest increases in student to population shares is found within long tertiary education, in which the share increased from around 1.15 to 2.59 percent of the population, a relative increase of nearly 150 percent. Medium length tertiary education increased from around .77 percent to around 1.4 percent, a relative increase of 109 percent. Short tertiary education also increased by 113 percent, but started from just .2 percent. As a result it contributed with a minor share of the total increase in the student to population ratio.[13] The share of students in high schools rose from 1.8 percent of the population in the early 2000's to 2.6 percent by 2013. As was the case for the tertiary educations, a significant part of this increase took place after

[12]Though no causal connections can be made, this suggests a relationship to the large economic downturn. Correlations between the change in student to population shares and growth in GDP per capita is -0.23, with the negative correlation primarily driven by post-crisis observations.

[13]Part of the increase in medium-length and long tertiary education can be explained by the longer time-span in which individuals remain students in this group (4 and 5 years (8 for PhD's) compared to 2 for short tertiary education)

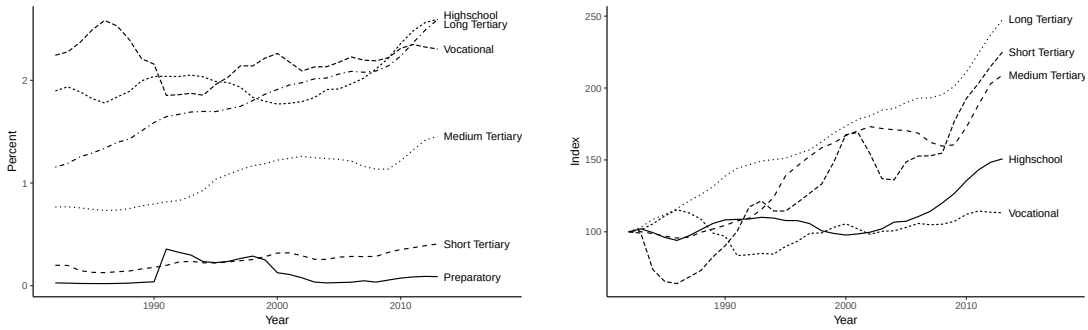
Figure 2: Enrolled students as a share of the total Danish population, 1982-2013



2008. The average yearly increases were merely .06 before 2008 compared to .27 PP following 2008. Finally, vocational education enrollment started and ended at roughly 2.3 percent of the population but fluctuated in the 1980's and 1990's. In the same period, as vocational enrollment fell by .4 PP, preparatory education increased by .4 PP from almost 0 percent. After 2000 both educations return to their early 1980's values.

Figure 3: Enrolled students by level of education as a share of the total Danish population, 1982-2013, and corresponding index values with base year 1982, 1982-2013

(a) Percentage share of total population. (b) Index values



Note: Part (b) leaves out preparatory education as the index values of this explodes due to the particularly near 0 percent 1982 value.

The Danish population became more likely to attend education from 1982 to 2013. When pursuing education, this increasingly was high school as well as medium length and long tertiary education. These were the main drivers of a 3.15 PP increase in total student to population shares from 1982 to 2013. In the next section I spatially disaggregate these findings, looking at distributions of students at the municipal level.

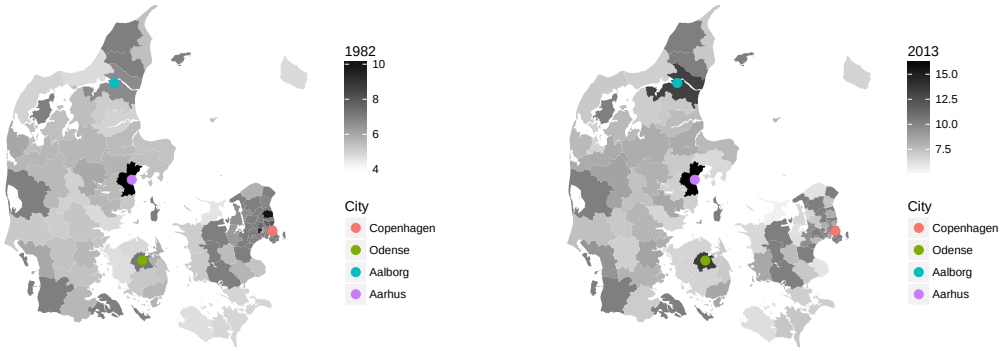
3.2 Municipalities

In this section, I show that the increases in shares of students was unevenly distributed across municipalities. The strongest growth in students to population shares appeared in the municipalities containing the four largest cities.

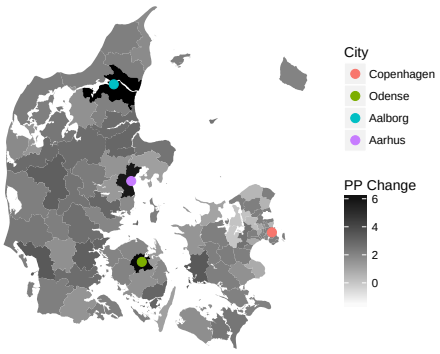
Figure 4: Municipalities: Enrolled students to population shares and percentage point changes, 1982 and 2013

(a) Share - 1982

(b) Share - 2013



(c) Percentage Point Change, 1982-2013



Note: The maps show enrolled students in secondary and tertiary education to total population size at municipal levels. Percentages shares for 1982 and 2013 are shown in figure (a) and (b). Percentage point increases from 1982 to 2013 are shown in figure (c). Added to each plot is four dots showing each of the four largest cities, Copenhagen, Odense, Aalborg, and Aarhus.

Maps of the Danish municipalities are found in figure 4 where dots represent the four largest cities in Denmark: Copenhagen, Århus, Odense, and Aalborg. Colors indicate (4a) shares of enrolled students to population in 1982, (4b) 2013 shares, and (4c) percentage point increases from 1982 to 2013. In addition, table 5 in appendix F shows the 1982 and 2013 top 20 municipalities in terms of enrolled students to population.[14]In 1982, Copenhagen and

[14]For the interested reader, table 6 in the same appendix F shows enrolled students to population by

Århus had the largest student to total population ratios. Nevertheless, the distributions of students to population sizes across Denmark was significantly more even in 1982 than 2013. By 2013 the municipalities with the four largest cities have the highest shares of students ranging between 13.1 (Aalborg) and 16.2 percent (Århus) and make up the top of the student to population ranking. From figure 4 part (c) we see that the largest increases in shares of students also appeared in these municipalities. This development suggests that the increases in student to population ratios was largely driven by these particular municipalities, and that peripheral municipalities have been losing out on the increases in shares of students to population. Educational enrollment (by students' residence) seems to follow a pattern of *regional centralization*. In the next sections I introduce regional and 'rurality' classified municipality distributions of students which emphasizes this pattern.

3.3 Regions

The municipal distribution of student shares suggests a pattern of regional centralization. Under this pattern, the Danish regions would be expected to see somewhat similar increases in their shares of students, except from the Zealand region where none of the 4 largest cities are located. Looking at figure 5, which shows regional distributions of students to population, this pattern is indeed found in the data. The Capital, Central and Northern regions experienced increases of 3.27, 3.36, and 3.78 PP respectively, starting from 7.25, 6.61, and 5.62 percent in 1982. While the North and Southern regions both started at approximately similar 1982 levels, the Southern region experienced a slightly smaller increase of 2.99 PP, having a 8.7 percent students to population share in 2013. All of these regions also experienced an accelerated increase in students to population ratios following 2008. Table 10 in appendix G.2 shows the average yearly PP increases from 1982-2008 and 2008-2013. Only the Zealand region does not appear to have experienced significant increases in the student to population ratio before 2008.[15] We may also note that, looking at the index values, part of the Zealand story is an increase in the absolute value of students. This furthermore suggests that while Zealand saw increases in population size, relatively fewer young students located themselves there compared to the other four regions.

Distributing across levels of education, table 1 shows the 1982 and 2013 percentage and the corresponding percentage point change in students to population shares.[16] For all regions except Zealand the largest increases appeared in long tertiary education, ranging from 1 to 2 PP. The Capital, however, experienced the strongest increase at 2 PP. The increases range from 1.1 PP for the Southern region to 2 PP for the Capital region. The Zealand region stands out a low .4 PP increase. The second and third largest increases appeared in medium length

education level for the Danish municipalities in 1982 and 2013 as well as increases.

[15] This development is similar for students to working age population shares, but not entirely for shares of students to population under 30. Figure 17 in appendix G.3 shows these distributions. Here Zealand experienced somewhat similar developments as the remaining regions. This can partly be explained by fewer families settling in the Zealand region across the period 1982-2013, raising the ratio of students to individuals under 30.

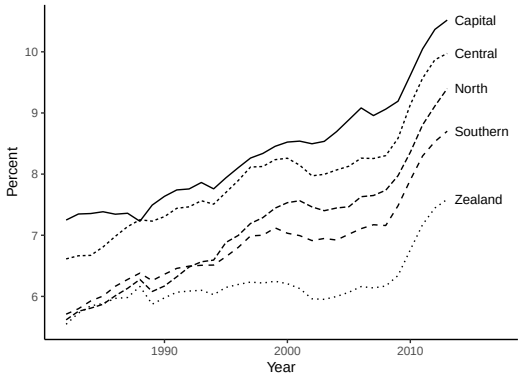
[16] Figure 16 in appendix G.2 graphically depicts the PP changes from 1982 to 2013.

Table 1: Regional student to population shares distributed by level of education, 1982 and 2013.

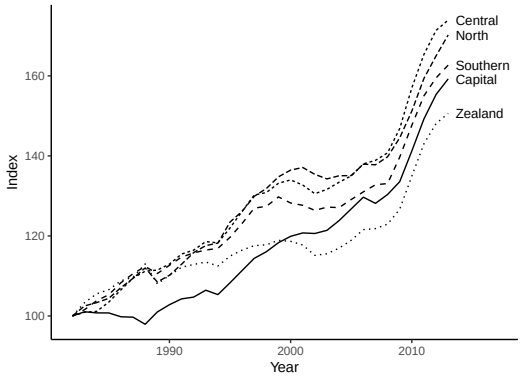
Region	Level	1982	2013	PP Change
Capital	Preparatory	0.03	0.06	0.04
	Highschool	1.90	2.44	0.54
	Vocational	1.95	1.81	-0.13
	Short Tertiary	0.27	0.40	0.14
	Medium Tertiary	0.95	1.62	0.67
	Long Tertiary	2.16	4.18	2.02
Central	Preparatory	0.05	0.08	0.03
	Highschool	1.98	2.76	0.78
	Vocational	2.35	2.50	0.15
	Short Tertiary	0.19	0.46	0.27
	Medium Tertiary	0.80	1.66	0.86
	Long Tertiary	1.23	2.51	1.27
North	Preparatory	0.01	0.10	0.10
	Highschool	1.93	2.63	0.71
	Vocational	2.42	2.74	0.32
	Short Tertiary	0.13	0.36	0.23
	Medium Tertiary	0.63	1.38	0.75
	Long Tertiary	0.51	2.19	1.68
Southern	Preparatory	0.02	0.11	0.09
	Highschool	1.87	2.75	0.87
	Vocational	2.46	2.61	0.15
	Short Tertiary	0.18	0.36	0.18
	Medium Tertiary	0.71	1.35	0.64
	Long Tertiary	0.47	1.53	1.07
Zealand	Preparatory	0.02	0.13	0.10
	Highschool	1.89	2.68	0.79
	Vocational	2.45	2.58	0.13
	Short Tertiary	0.16	0.28	0.12
	Medium Tertiary	0.55	1.03	0.48
	Long Tertiary	0.47	0.88	0.41

Figure 5: Student to population percentages and index by regions, 1982-2013.

(a) Share of population in education



(b) Index values



tertiary, ranging between .5 and .9 PP for the Zealand and Central region respectively, and high school education with the Southern region experiencing the largest increase at about .9 PP while the Capital region increased the least by .54. Only in vocational education does one region (the Capital region) experience a decline of .13 PP in the share of enrolled students to population while vocational educational enrollment increased outside the Capital region, and particularly strongly in the Zealand region with an increase of .4 PP.

This section supports the finding of a regional centralization in the student to population shares from 1982 to 2013. All regions, except Zealand that is without a large-city municipality, experience broadly similar increases in the share of students to population. Some differences were discernible in terms of the levels of education that the students pursue, but an overall tendency of the largest increases being found in long tertiary education was evident across all regions except Zealand.

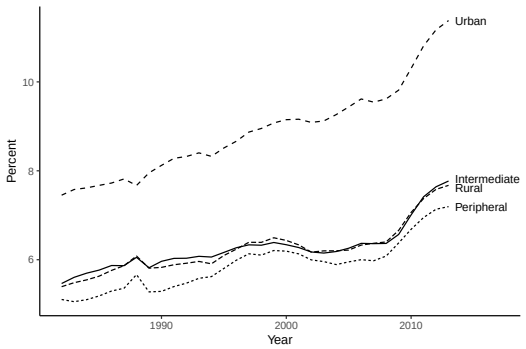
3.4 Center-Periphery Distributions

In this section I illustrate how student to population ratios differ between municipalities when these are classified by degree of 'rurality'. Findings for the alternate classification are available in appendix H.2.

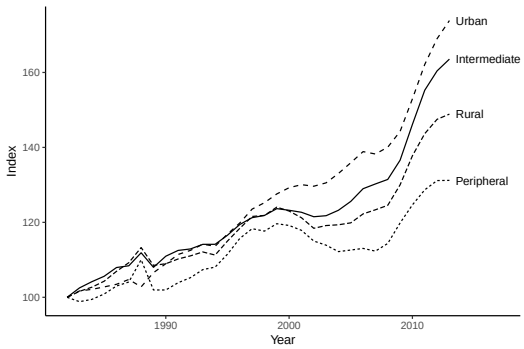
I start by describing total student to population shares across the four classes of municipalities; urban, intermediate, rural, and peripheral. Figure 19 shows the student to population shares for each group of municipalities, as well as corresponding index values with base in 1982. Firstly, the urban municipalities started from higher levels of students in 1982 at 7.45 percent compared to 5.46, 5.39, and 5.11 percent for intermediate, rural, and peripheral municipalities respectively. Similarly, the urban municipalities experienced the largest increase in students to population of 3.93 PP, almost double the increases in the remaining municipalities. The urban municipalities ended up at roughly 50 percent higher levels of student to population by 2013 compared to the other municipalities. Looking at the relative share of student disguises that the intermediate, rural municipalities saw different developments in the absolute amount of students over time. This can be read from figure 6b with index values.

Figure 6: 'Rurality' classification: Enrolled students to population percentages and 1982 based index, 1982 to 2013

(a) Shares of individuals in education



(b) Index values



Intermediate municipalities saw markedly higher increases in the relative amount of students from 1982 to 2013 with a total percentage increase of about 65 percent. The peripheral municipalities experienced the smallest increase of just 32 percent, and rural municipalities lies in the middle as their student body increased by about 45 percent in total. The largest percentage increase, however, still appeared in the urban municipalities at about 70 percent.

The results of disaggregating by level of education shows similarly prevalent differences between urban and the remaining municipalities. Table 2 contains the 1982 and 2013 student to population percentages by level of education levels and municipality classes.[17] From the table we see that the largest increase in the shares of students appear in urban municipalities in long tertiary education which went up by 2.31 PP to 4.44 percent in 2013. The only decrease in students to population is also found in urban municipalities where the share of vocational education students actually drop by .11 PP from 2.09 percent. Across intermediate, rural, and peripheral municipalities, the largest increases in students to population appear for high schools students with increases ranging from .81 and .86 PP and 2013 shares reaching 2.72, 2.81, and 2.72 percent respectively. It is also noteworthy that the urban municipalities have the highest percentage levels of tertiary education students across short, medium length, and long tertiary education for both 1982 and 2013 at a total of 6.79 percent in 2013. In the same year peripheral municipalities had a share of 1.49 percent tertiary education students to population, rural municipalities 2.14 percent, and finally intermediate municipalities had a total of 2.33 percent. Vocational education is the only level in which the non-urban municipalities have higher percentages in both 1982 and 2013 ranging from 2.37 to 2.47 percent and 2.71 to 2.87 percent respectively.

In this section we once again see evidence of regional centralization. The urban municipalities are the main drivers of increases in student to population shares while the remaining municipalities are relatively undistinguishable in terms of student to population changes over the 1982 to 2013 period. In addition, it appears that the drivers of this divergence between

[17] See also figure 18 in appendix H.1.1 for a graphical illustration.

Table 2: 'Rurality' classification, enrolled students to population distributed by level of education, 1982 and 2013 and percentage point change.

Group	Level	1982	2013	PP Change
Peripheral	Preparatory	0.03	0.11	0.09
	High school	1.91	2.72	0.81
	Vocational	2.42	2.87	0.45
	Short Tertiary	0.11	0.25	0.15
	Medium Tertiary	0.45	0.80	0.35
	Long Tertiary	0.20	0.44	0.24
Rural	Preparatory	0.02	0.12	0.10
	High school	1.89	2.71	0.81
	Vocational	2.47	2.71	0.24
	Short Tertiary	0.14	0.30	0.15
	Medium Tertiary	0.58	1.11	0.52
	Long Tertiary	0.28	0.73	0.45
Intermediate	Preparatory	0.03	0.11	0.08
	High school	1.86	2.72	0.86
	Vocational	2.37	2.60	0.23
	Short Tertiary	0.16	0.33	0.17
	Medium Tertiary	0.63	1.12	0.49
	Long Tertiary	0.41	0.88	0.47
Urban	Preparatory	0.03	0.07	0.03
	High school	1.94	2.55	0.61
	Vocational	2.09	1.98	-0.11
	Short Tertiary	0.26	0.47	0.21
	Medium Tertiary	1.00	1.88	0.88
	Long Tertiary	2.13	4.44	2.31

large city and remaining municipalities is tertiary education. While intermediate, rural, and peripheral municipalities have relatively equivalent shares of high school students and higher shares of vocational education students across time, this does not make up for the differences in tertiary education.

4 Conclusion

In this paper, I use administrative register data to map the developments in spatial distributions of enrolled students to population shares from 1982 to 2013 in Denmark. The findings suggest a regional centralization of students driven mainly by shares of students enrolled in higher education in large-city municipalities.

I find an increase in shares of enrolled students from 6.29 percent in 1982 to 9.44 percent in 2013 at the national level. The main share of this increase was driven by enrollment in long tertiary (bachelor's, master's, and PhD level education), medium length tertiary, as well as high school. However, the increased student to population shares was unevenly distributed across municipalities. The municipalities that contain the four largest cities, Copenhagen, Århus, Odense, and Aalborg experienced the largest increases over time, and make up the municipalities with the highest student to population ratios by 2013. Regional patterns of student to population increases were broadly similar for the Northern, Central, Southern, and Copenhagen regions, the four regions containing the four largest cities, with some differences in the rate of increase in tertiary education. Zealand, which does not possess any of the four largest cities, experienced lower increases across the period. Finally, I distribute students across groups of municipalities by degree of 'rurality', ranging from *peripheral*, over *rural* and *intermediate* to *urban*. I find that the largest increases in shares of students happened in urban municipalities, driven by medium length and long tertiary education as well as high school enrollment. Outside of the urban municipalities increases in students to population shares are driven by vocational education and high school enrollment, and total increases in students to population ratios were significantly lower. The Danish population became increasingly likely to attend education beyond primary school over the period 1982-2013. The increased share of students were, however, not distributed evenly across the country and were more likely to be found pursuing tertiary education in large-city municipalities when doing so.

The pattern of regional centralization of students that I document can potentially create unequal distributions of skills and capabilities across the country. As a result, it becomes natural to ask how regional economic and social developments are contingent on the distribution of students as the economy is facing the impact of technological skill-bias (Autor et al., 2003) and rising importance of continuous learning (Lundvall, 2004). In addition, we may ask how income inequality and social mobility relates to the education system and the distributions of students across Denmark (Autor, 2014; Landersø and Heckman, 2016; Munk and Baklanov, 2014). Future research into these questions may well benefit both from using the register data that underlies this paper as well as the results I present.

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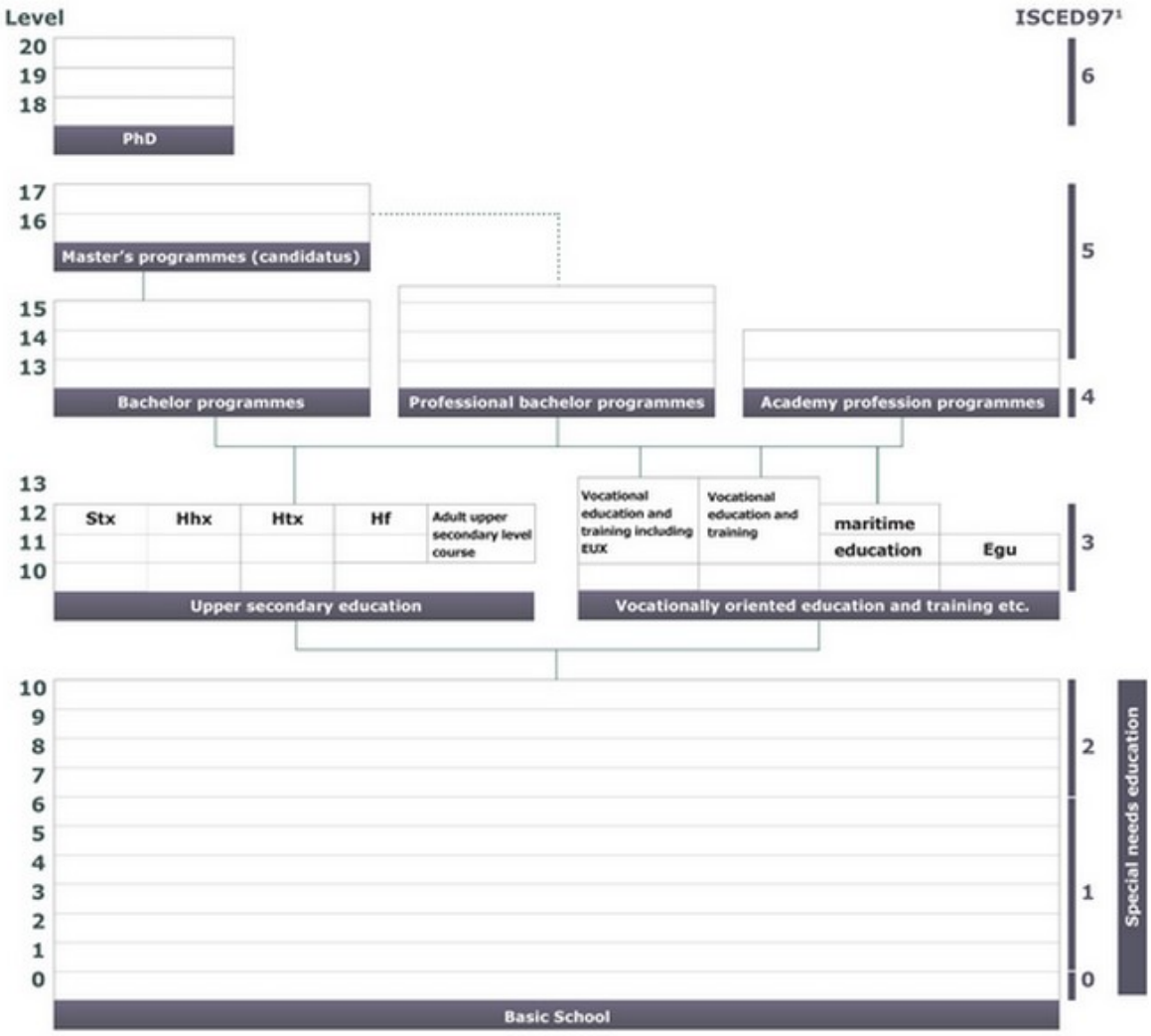
A The Danish Education System

Figure 7: The Danish Education System



Note: The figure shows overview of education in the Danish education system together with their corresponding ISCED97 classification. Source: Danish Ministry of Education 2017b. Translations between the notation in this paper and the figure are as follows: Basic School = Primary Education; Upper secondary education = High school; Vocationally oriented education and training etc. = Vocational; Professional bachelor programmes = Medium length tertiary; Academy profession programmes = short tertiary; Bachelor programmes = Long tertiary; Master's programmes (candidatus) = Long tertiary; PhD = Long tertiary.

Table 3: Ministry of Education classification conversion to classification used in this paper

Ministry of Education Classification	Present Classification	Typical length
Basic school	Primary education	10 years
Preparatory Education	Preparatory education	1 year
Upper secondary education	High school	3 years
Vocationally oriented education and training etc.	Vocational	4 years
Academy profession programmes	Short tertiary	2 years
Professional bachelor programmes	Medium length tertiary	3.5 years
Bachelor programmes	Long tertiary	3 years (often followed by 2 years master)
Master's programmes	Long tertiary	2 years (preceded by 3 years bachelor)
PhD	Long tertiary	3 years

B Danish Municipalities, Regions, and Center-Periphery Classifications

Table 4: Danish Municipalities, Regions, and classifications of Center-Periphery

Municipality	Region	'Rurality' Classification	Alternate Classification
Albertslund	Capital	Urban	Center
Allerød	Capital	Urban	Center
Assens	Southern	Rural	Intermediate
Ballerup	Capital	Urban	Center
Billund	Southern	Rural	Intermediate
Bornholm	Capital	Peripheral	Periphery
Brøndby	Capital	Urban	Center
Brønderslev	Northern	Rural	Periphery
Dragør	Capital	Intermediate	Center
Egedal	Capital	Urban	Center
Esbjerg	Southern	Rural	Intermediate
Fanø	Southern	Rural	Intermediate
Favrskov	Central	Intermediate	Intermediate
Faxe	Zealand	Intermediate	Intermediate
Fredensborg	Capital	Urban	Center
Fredericia	Southern	Intermediate	Intermediate
Frederiksberg	Capital	Urban	Center
Frederikshavn	Northern	Rural	Periphery
Frederikssund	Capital	Urban	Center
Furesø	Capital	Urban	Center
Faaborg-Midtfyn	Southern	Rural	Periphery
Gentofte	Capital	Urban	Center
Gladsaxe	Capital	Urban	Center
Glostrup	Capital	Urban	Center
Greve	Zealand	Urban	Center
Gribskov	Capital	Urban	Center
Guldborgsund	Zealand	Rural	Periphery
Haderslev	Southern	Rural	Intermediate
Halsnæs	Capital	Intermediate	Center
Hedensted	Central	Rural	Intermediate
Helsingør	Capital	Urban	Center

Table 4 – continued from previous page

Municipality	Region	'Rurality' Classification	Alternate Classification
Herlev	Capital	Urban	Center
Herning	Central	Rural	Intermediate
Hillerød	Capital	Urban	Center
Hjørring	Northern	Rural	Periphery
Holbæk	Zealand	Intermediate	Intermediate
Holstebro	Central	Rural	Intermediate
Horsens	Central	Intermediate	Intermediate
Hvidovre	Capital	Urban	Center
Høje-Taastrup	Capital	Urban	Center
Hørsholm	Capital	Urban	Center
Ikast-Brande	Central	Rural	Intermediate
Ishøj	Capital	Urban	Center
Jammerbugt	Northern	Rural	Intermediate
Kalundborg	Zealand	Rural	Intermediate
Kerteminde	Southern	Rural	Intermediate
Kolding	Southern	Urban	Intermediate
København	Capital	Urban	Center
Køge	Zealand	Urban	Center
Langeland	Southern	Peripheral	Periphery
Lejre	Zealand	Urban	Center
Lemvig	Central	Peripheral	Intermediate
Lolland	Zealand	Peripheral	Periphery
Lyngby-Taarbæk	Capital	Urban	Center
Læsø	Northern	Peripheral	Periphery
Mariagerfjord	Northern	Rural	Intermediate
Middelfart	Southern	Intermediate	Intermediate
Morsø	Northern	Peripheral	Periphery
Norddjurs	Central	Peripheral	Periphery
Nordfyns	Southern	Rural	Intermediate
Nyborg	Southern	Rural	Intermediate
Næstved	Zealand	Intermediate	Intermediate
Odder	Central	Intermediate	Intermediate
Odense	Southern	Urban	Center
Odsherred	Zealand	Rural	Intermediate
Randers	Central	Rural	Intermediate
Rebild	Northern	Rural	Intermediate
Ringkøbing-Skjern	Central	Peripheral	Intermediate

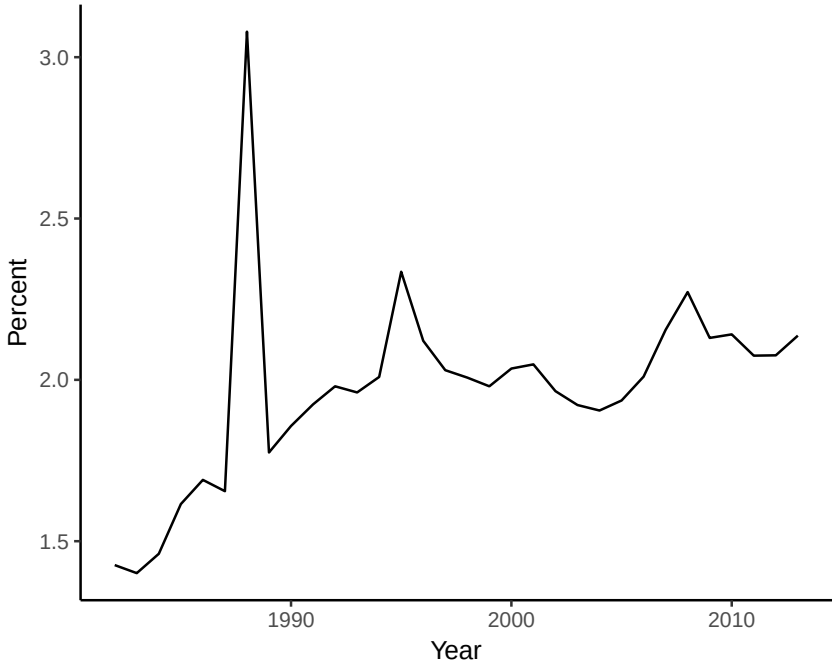
Table 4 – continued from previous page

Municipality	Region	'Rurality' Classification	Alternate Classification
Ringsted	Zealand	Intermediate	Intermediate
Roskilde	Zealand	Intermediate	Center
Rudersdal	Capital	Urban	Center
Rødovre	Capital	Urban	Center
Samsø	Central	Peripheral	Periphery
Silkeborg	Central	Intermediate	Intermediate
Skanderborg	Central	Urban	Intermediate
Skive	Central	Peripheral	Intermediate
Slagelse	Zealand	Intermediate	Intermediate
Solrød	Zealand	Urban	Center
Sorø	Zealand	Intermediate	Intermediate
Stevns	Zealand	Intermediate	Center
Struer	Central	Peripheral	Intermediate
Svendborg	Southern	Rural	Periphery
Syddjurs	Central	Rural	Intermediate
Sønderborg	Southern	Rural	Intermediate
Thisted	Northern	Peripheral	Intermediate
Tønder	Southern	Peripheral	Periphery
Tårnby	Capital	Intermediate	Center
Vallensbæk	Capital	Urban	Center
Varde	Southern	Peripheral	Intermediate
Vejen	Southern	Rural	Intermediate
Vejle	Southern	Intermediate	Intermediate
Vesthimmerlands	Northern	Peripheral	Periphery
Viborg	Central	Intermediate	Intermediate
Vordingborg	Zealand	Rural	Intermediate
Ærø	Southern	Peripheral	Periphery
Aabenraa	Southern	Rural	Intermediate
Aalborg	Northern	Urban	Center
Aarhus	Central	Urban	Center

C Individuals with missing geographical Location, 1982-2013

Figure 8 shows the share of the total population in the Danish registers for which no geographical information is available during 1982-2013.

Figure 8: Share of individuals with missing geographical information, 1982-2013.

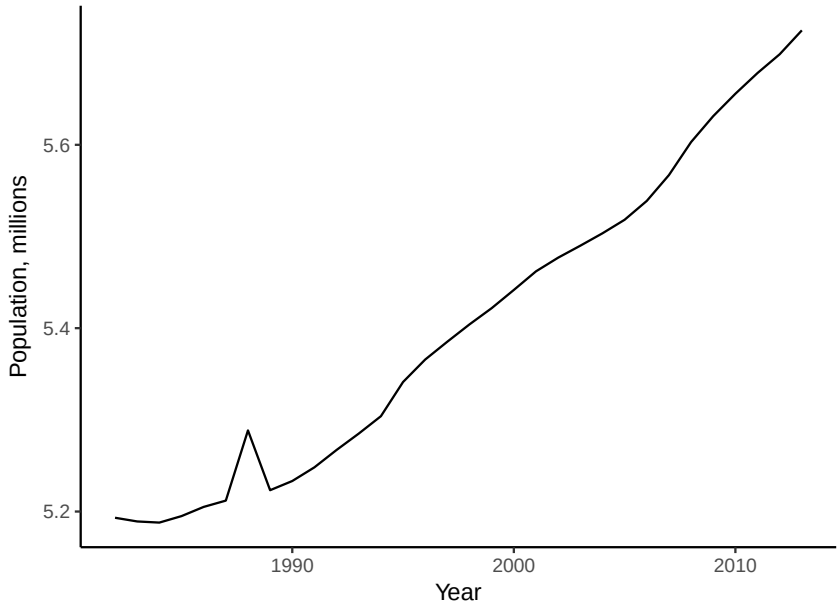


Note: The share of individuals without geographical information relative to the total population available in the register data within the years 1982-2013.

D Population size

Figure 9 shows the population size in millions measured as the number of individuals in the registers from 1982-2013. The spike in 1987 is unaccounted for, but also appears in the population with missing information (see figure 8). This suggests that the sudden increase in the total population is due to a register-error. The spike does not appear to affect results from the analysis. This is partly attributable to the fact that individuals without location information are left out of non-national-level analyses.

Figure 9: Register based populations size, millions, 1982-2013.



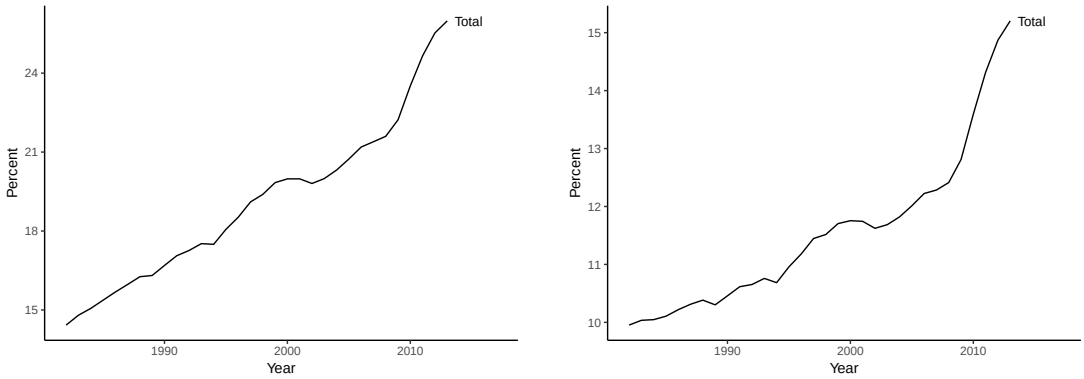
E National Statistics

E.1 Population under 30 and working age population

Figure 10: Enrolled students as a share of the Danish population under 30 and in the working age, 1982-2013, and corresponding index values with base year 1982, 1982-2013

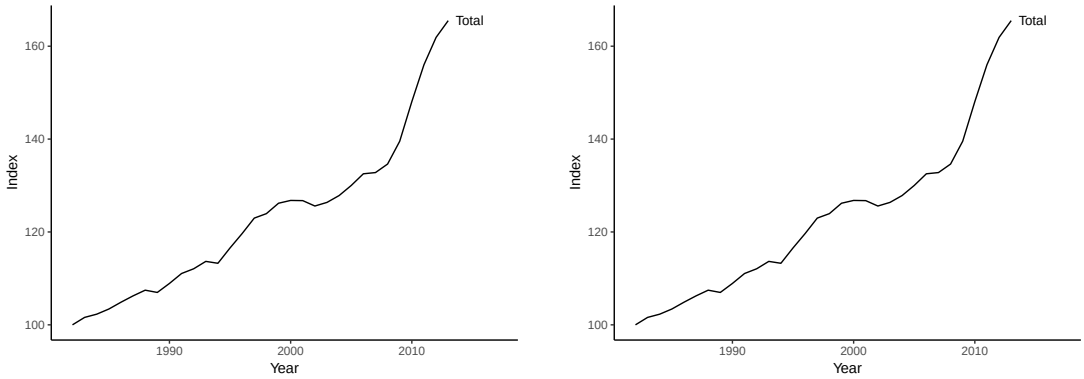
(a) Percentage share, under 30.

(b) Percentage share, working age.



(c) Index values, under 30.

(d) Index value, working age.

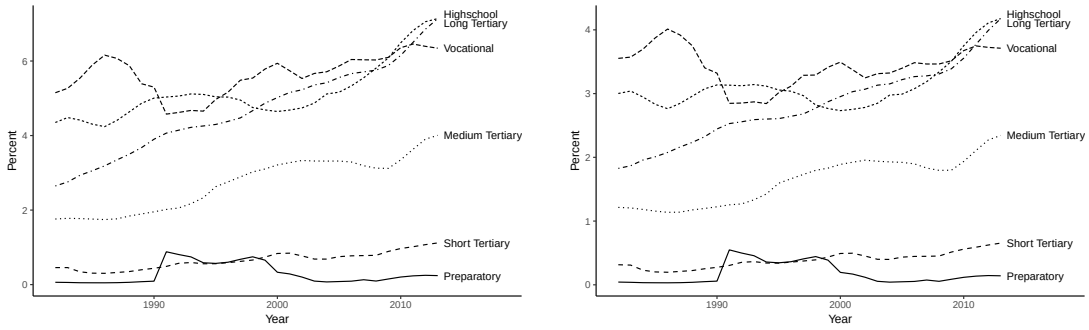


Note: Part (a) and (c) contains information of enrolled students to the share of population under 30 years of age. Part (b) and (d) contains share of enrolled students to the population in the working age, 15-64. Part (c) and (d) leaves out preparatory education as the index values of this explodes due to the particularly near 0 percent 1982 value.

Figure 11: Enrolled students by level of education as a share of the Danish population under 30 and in the working age, 1982-2013, and corresponding index values with base year 1982, 1982-2013

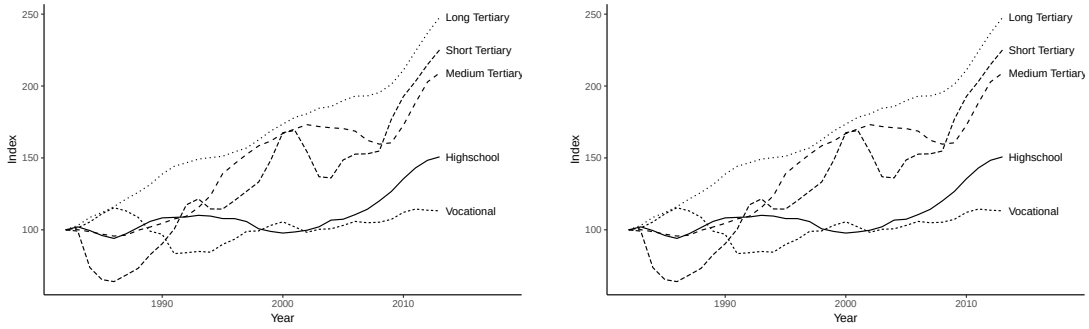
(a) Percentage share, under 30

(b) Percentage share, working age



(c) Index values, under 30

(d) Index value, working age



Note: Part (a) and (c) contains information of enrolled students to the share of population under 30 years of age. Part (b) and (d) contains share of enrolled students to the population in the working age, 15-64. Part (c) and (d) leaves out preparatory education as the index values of this explodes due to the particularly near 0 percent 1982 value. For index values preparatory education has been omitted due to a particularly small 1982 value leading to extreme percentage changes.

E.2 Enrollment by Gender

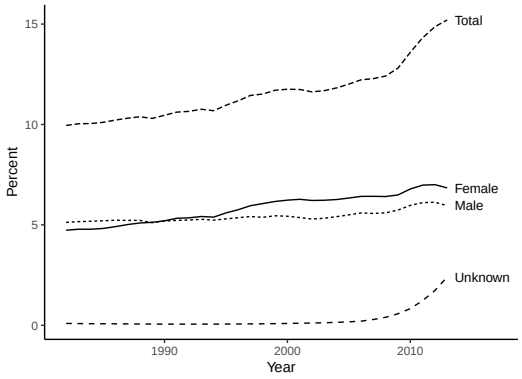
Figure 12a shows the share of total enrolled students to population as well as a stratification of students by gender (*female* and *male*). The curve *unknown* shows the percentage of the population in education with missing information about their gender.[18] The share of students with an unknown gender rises exponentially from 2000 until 2013, making gender based inferences based on the register data uncertain for later periods. We may particularly note that the share of female students surpasses the share of male students in 1990, and in addition a more than 40 percent increase from 1982 to 2000 of female students (figure 12b), compared to an increase of approximately 16 percent for the male share of students. Figure 13 provides publicly available enrollment data for shares of total, female, and male student to population from Statistics Denmark covering 2005-2015. This suggests that the increase of female over

[18] An "unknown" gender arises when an individual has not entered into employment at any point in time during the period 1982-2013, so that this characteristic is captured in the IDA database.

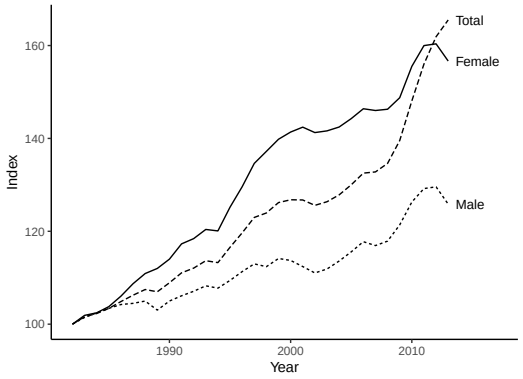
male attendance is persistent after 2005.

Figure 12: Enrolled students as a share of the total Danish population, 1982-2013, and corresponding index values with base year 1982, 1982-2013

(a) Share of population in education

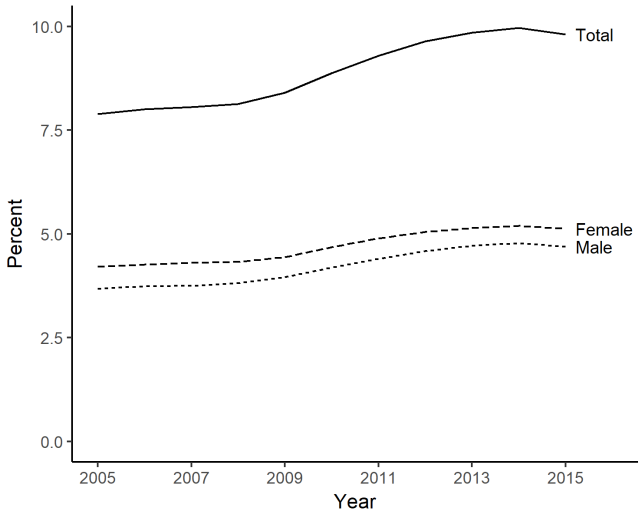


(b) Index values



Note: The curve *Total* in figure *a* is the sum of percentages *Female*, *Male*, and *Unknown*. Unknown gender characterizes missing gender information for an individual. As gender information is only available for individuals that have been employed at some point during the years 1982-2013, we see an increase in the share of students without gender information in the later years. Younger cohorts are increasingly unlikely to have entered the job market, rendering it less likely that gender information is available for this group of individuals. Index values are calculated from individuals series, and the curve for unknown gender has not been shown, but is included in the Total graph.

Figure 13: Total and gender distributed student share of the total population in Denmark, 2005-2015.



Note: The Total graph is the sum of Female and Male graphs.

Note: The graph displays the gender distribution of students as of October 1 in a given year. It shows the percentage of enrolled students relative to the total population. The data has been collected from Statistics Denmark (2017b).

F Municipal Statistics

F.1 Total Population

Table 5: Enrolled students to population in percentages, top 20 municipalities 1982 and 2013.

1982		2013	
Municipality	Percent	Municipality	Percent
Aarhus	10.44	Aarhus	16.25
Rudersdal	9.99	København	14.94
Albertslund	9.40	Odense	13.53
Furesø	8.74	Aalborg	13.18
Lyngby-Taarbæk	8.57	Frederiksberg	12.42
Hørsholm	8.51	Albertslund	10.21
Gentofte	8.10	Lyngby-Taarbæk	9.87
Gladsaxe	7.98	Gladsaxe	9.84
Allerød	7.66	Roskilde	9.58
Ballerup	7.60	Esbjerg	9.37
Dragør	7.53	Herning	8.75
København	7.47	Kolding	8.74
Fanø	7.25	Hvidovre	8.72
Odense	7.20	Ishøj	8.65
Herlev	7.08	Svendborg	8.63
Roskilde	7.02	Horsens	8.56
Egedal	6.98	Slagelse	8.56
Frederiksberg	6.95	Herlev	8.53
Greve	6.89	Gentofte	8.49
Hvidovre	6.87	Randers	8.45

Table 6: Share of population in education by municipality and education level, 1982 and 2013.

Municipality	Education	1982	2013	PP Change	Relative Change
Albertslund	Highschool	2.95	2.90	-0.05	-1.80
	Vocational	3.00	2.82	-0.18	-5.93
	Short Tertiary	0.32	0.42	0.11	33.13
	Medium Tertiary	1.08	1.66	0.59	54.30
	Long Tertiary	1.98	2.34	0.37	18.49

Table 6 – continued from previous page

Municipality	Education	1982	2013	PP Change	Relative Change
Allerød	Highschool	3.32	4.08	0.76	22.83
	Vocational	2.10	1.23	-0.87	-41.28
	Short Tertiary	0.19	0.22	0.02	11.85
	Medium Tertiary	0.65	0.66	0.01	1.51
	Long Tertiary	1.33	1.57	0.23	17.48
Assens	Highschool	1.69	2.49	0.79	46.76
	Vocational	2.25	2.60	0.35	15.77
	Short Tertiary	0.12	0.23	0.11	88.12
	Medium Tertiary	0.32	0.62	0.30	94.81
	Long Tertiary	0.32	0.69	0.37	115.12
Ballerup	Highschool	2.53	2.72	0.19	7.67
	Vocational	3.09	2.33	-0.76	-24.55
	Short Tertiary	0.19	0.37	0.18	92.16
	Medium Tertiary	0.79	1.47	0.68	86.69
	Long Tertiary	0.93	1.49	0.56	60.71
Billund	Highschool	1.89	3.15	1.25	66.10
	Vocational	2.57	2.72	0.14	5.56
	Short Tertiary	0.16	0.17	0.01	7.29
	Medium Tertiary	0.28	0.66	0.37	131.42
	Long Tertiary	0.17	0.49	0.31	183.98
Bornholm	Highschool	1.71	2.49	0.78	45.79
	Vocational	2.56	2.80	0.25	9.59
	Short Tertiary	0.08	0.11	0.02	27.94
	Medium Tertiary	0.29	0.84	0.56	195.52
	Long Tertiary	0.15	0.44	0.29	189.17
Brøndby	Highschool	2.11	2.48	0.37	17.52
	Vocational	2.56	2.51	-0.05	-1.86
	Short Tertiary	0.23	0.34	0.10	44.71
	Medium Tertiary	0.65	1.26	0.61	93.75
	Long Tertiary	0.98	1.55	0.57	58.17
Brønderslev	Highschool	2.03	2.58	0.55	27.00
	Vocational	2.28	2.61	0.33	14.30
	Short Tertiary	0.13	0.16	0.03	19.31
	Medium Tertiary	0.55	0.81	0.26	46.63
	Long Tertiary	0.30	0.77	0.47	157.36
Dragør	Highschool	3.06	3.37	0.31	10.28
	Vocational	2.29	1.21	-1.08	-47.06
	Short Tertiary	0.15	0.15	0.00	1.10

Table 6 – continued from previous page

Municipality	Education	1982	2013	PP Change	Relative Change
	Medium Tertiary	0.78	0.57	-0.21	-27.01
	Long Tertiary	1.21	1.14	-0.07	-6.15
Egedal	Highschool	2.77	3.17	0.40	14.51
	Vocational	2.68	2.02	-0.66	-24.68
	Short Tertiary	0.24	0.23	-0.01	-3.74
	Medium Tertiary	0.55	0.69	0.14	25.52
	Long Tertiary	0.69	1.07	0.38	54.58
Esbjerg	Highschool	1.81	2.89	1.08	59.62
	Vocational	2.62	2.62	0.00	0.12
	Short Tertiary	0.16	0.48	0.32	200.10
	Medium Tertiary	1.13	2.03	0.90	80.30
	Long Tertiary	0.25	1.22	0.97	395.89
Favrskov	Highschool	2.00	2.99	1.00	49.79
	Vocational	2.55	2.45	-0.10	-3.95
	Short Tertiary	0.16	0.25	0.09	59.57
	Medium Tertiary	0.33	0.58	0.24	73.37
	Long Tertiary	0.58	0.82	0.23	40.06
Faxe	Highschool	2.00	2.64	0.64	31.71
	Vocational	2.35	2.89	0.54	22.97
	Short Tertiary	0.18	0.27	0.09	48.23
	Medium Tertiary	0.76	0.79	0.03	4.18
	Long Tertiary	0.34	0.56	0.22	64.90
Fredensborg	Highschool	2.54	3.10	0.56	22.09
	Vocational	1.95	1.70	-0.25	-12.87
	Short Tertiary	0.20	0.25	0.05	26.24
	Medium Tertiary	0.74	0.75	0.01	1.57
	Long Tertiary	1.37	1.45	0.08	6.08
Fredericia	Highschool	1.89	2.84	0.95	50.24
	Vocational	2.54	3.12	0.58	22.81
	Short Tertiary	0.13	0.33	0.20	144.95
	Medium Tertiary	0.41	1.04	0.63	151.94
	Long Tertiary	0.31	0.84	0.54	175.75
Frederiksberg	Highschool	1.35	1.74	0.39	29.04
	Vocational	1.08	1.10	0.02	2.27
	Short Tertiary	0.33	0.46	0.13	39.63
	Medium Tertiary	1.03	1.89	0.86	82.85
	Long Tertiary	3.15	7.20	4.04	128.24
Frederikshavn	Highschool	1.81	2.62	0.81	44.59

Table 6 – continued from previous page

Municipality	Education	1982	2013	PP Change	Relative Change
	Vocational	2.74	2.90	0.16	5.72
	Short Tertiary	0.23	0.21	-0.02	-10.34
	Medium Tertiary	0.39	0.82	0.43	109.17
	Long Tertiary	0.22	0.55	0.33	149.29
Frederikssund	Highschool	1.95	2.69	0.74	37.92
	Vocational	3.03	2.26	-0.78	-25.58
	Short Tertiary	0.19	0.21	0.01	5.90
	Medium Tertiary	0.77	0.66	-0.11	-14.13
	Long Tertiary	0.64	0.76	0.12	19.39
Furesø	Highschool	3.52	3.81	0.29	8.26
	Vocational	1.95	1.39	-0.56	-28.63
	Short Tertiary	0.25	0.22	-0.03	-11.81
	Medium Tertiary	0.97	0.71	-0.27	-27.44
	Long Tertiary	2.01	1.78	-0.23	-11.40
Faaborg-Midtfyn	Highschool	1.86	2.47	0.61	32.70
	Vocational	2.43	2.64	0.21	8.63
	Short Tertiary	0.15	0.19	0.04	24.08
	Medium Tertiary	0.43	0.66	0.23	52.87
	Long Tertiary	0.33	0.71	0.38	113.01
Gentofte	Highschool	2.68	3.68	1.00	37.38
	Vocational	1.00	0.78	-0.22	-22.25
	Short Tertiary	0.27	0.31	0.03	12.29
	Medium Tertiary	0.90	0.84	-0.06	-7.00
	Long Tertiary	3.23	2.86	-0.37	-11.54
Gladsaxe	Highschool	2.14	2.91	0.77	35.98
	Vocational	2.23	1.96	-0.26	-11.78
	Short Tertiary	0.25	0.41	0.16	65.38
	Medium Tertiary	1.13	1.61	0.48	43.10
	Long Tertiary	2.20	2.84	0.64	29.11
Glostrup	Highschool	1.78	2.26	0.49	27.51
	Vocational	2.42	2.25	-0.17	-7.21
	Short Tertiary	0.24	0.40	0.16	65.46
	Medium Tertiary	0.82	1.54	0.72	88.27
	Long Tertiary	0.97	1.72	0.76	78.30
Greve	Highschool	2.68	3.15	0.47	17.56
	Vocational	2.73	2.19	-0.54	-19.83
	Short Tertiary	0.24	0.26	0.02	8.09
	Medium Tertiary	0.45	0.84	0.40	88.31

Table 6 – continued from previous page

Municipality	Education	1982	2013	PP Change	Relative Change
	Long Tertiary	0.76	1.22	0.46	60.65
Gribskov	Highschool	2.08	2.59	0.51	24.76
	Vocational	2.51	2.11	-0.41	-16.21
	Short Tertiary	0.13	0.14	0.01	4.97
	Medium Tertiary	0.43	0.61	0.17	39.14
	Long Tertiary	0.59	0.70	0.11	19.41
Guldborgsund	Highschool	1.62	2.31	0.69	42.42
	Vocational	2.38	2.95	0.57	23.94
	Short Tertiary	0.10	0.23	0.13	120.69
	Medium Tertiary	0.57	1.27	0.70	121.91
	Long Tertiary	0.20	0.43	0.22	110.56
Haderslev	Highschool	1.94	3.10	1.16	59.67
	Vocational	2.40	2.51	0.10	4.34
	Short Tertiary	0.12	0.23	0.11	86.87
	Medium Tertiary	0.68	1.55	0.86	126.54
	Long Tertiary	0.19	0.56	0.37	193.38
Halsnæs	Highschool	1.58	2.23	0.65	41.34
	Vocational	2.58	2.17	-0.42	-16.14
	Short Tertiary	0.16	0.15	-0.01	-3.76
	Medium Tertiary	0.45	0.60	0.15	32.86
	Long Tertiary	0.42	0.62	0.20	48.42
Hedensted	Highschool	1.85	2.65	0.80	43.32
	Vocational	2.33	2.68	0.35	15.00
	Short Tertiary	0.14	0.19	0.05	32.42
	Medium Tertiary	0.30	0.59	0.28	93.30
	Long Tertiary	0.14	0.53	0.39	269.13
Helsingør	Highschool	2.35	2.83	0.49	20.69
	Vocational	2.20	1.98	-0.21	-9.66
	Short Tertiary	0.17	0.26	0.09	50.03
	Medium Tertiary	0.81	0.96	0.15	18.54
	Long Tertiary	1.04	1.16	0.12	11.95
Herlev	Highschool	2.13	2.45	0.33	15.33
	Vocational	2.58	2.40	-0.19	-7.28
	Short Tertiary	0.22	0.43	0.20	92.05
	Medium Tertiary	0.98	1.50	0.52	53.45
	Long Tertiary	1.13	1.71	0.58	51.57
Herning	Highschool	2.01	2.72	0.71	35.13
	Vocational	2.39	2.63	0.24	10.03

Table 6 – continued from previous page

Municipality	Education	1982	2013	PP Change	Relative Change
	Short Tertiary	0.17	0.74	0.58	346.78
	Medium Tertiary	0.67	1.53	0.87	129.26
	Long Tertiary	0.31	1.03	0.72	235.05
Hillerød	Highschool	2.31	3.34	1.03	44.81
	Vocational	2.44	1.98	-0.46	-18.86
	Short Tertiary	0.20	0.26	0.07	34.67
	Medium Tertiary	0.93	1.29	0.36	38.85
	Long Tertiary	1.12	1.30	0.17	15.52
Hjørring	Highschool	1.83	2.86	1.03	56.04
	Vocational	2.36	3.01	0.65	27.31
	Short Tertiary	0.11	0.21	0.10	94.72
	Medium Tertiary	0.80	1.30	0.51	63.96
	Long Tertiary	0.27	0.65	0.38	140.71
Holbæk	Highschool	1.83	2.76	0.93	50.82
	Vocational	2.32	2.48	0.16	6.95
	Short Tertiary	0.15	0.23	0.08	52.12
	Medium Tertiary	0.78	0.86	0.08	10.18
	Long Tertiary	0.51	0.85	0.34	66.61
Holstebro	Highschool	2.08	2.84	0.75	36.21
	Vocational	2.33	2.72	0.39	16.80
	Short Tertiary	0.11	0.38	0.27	240.37
	Medium Tertiary	0.83	1.73	0.89	106.85
	Long Tertiary	0.24	0.68	0.44	186.68
Horsens	Highschool	1.96	2.49	0.53	26.84
	Vocational	2.23	2.49	0.26	11.68
	Short Tertiary	0.20	0.55	0.35	172.58
	Medium Tertiary	0.85	2.02	1.17	138.01
	Long Tertiary	0.34	0.91	0.57	168.34
Hvidovre	Highschool	1.90	2.47	0.57	30.04
	Vocational	2.68	2.48	-0.20	-7.59
	Short Tertiary	0.26	0.41	0.15	59.67
	Medium Tertiary	0.83	1.31	0.48	57.71
	Long Tertiary	1.19	1.99	0.80	67.63
Høje-Taastrup	Highschool	1.83	2.49	0.65	35.68
	Vocational	2.39	2.42	0.04	1.49
	Short Tertiary	0.31	0.35	0.04	13.94
	Medium Tertiary	0.42	1.15	0.73	172.49
	Long Tertiary	0.74	1.41	0.68	91.90

Table 6 – continued from previous page

Municipality	Education	1982	2013	PP Change	Relative Change
Ikast-Brande	Highschool	1.75	2.91	1.16	66.66
	Vocational	2.49	2.80	0.31	12.38
	Short Tertiary	0.12	0.29	0.18	153.15
	Medium Tertiary	0.45	0.87	0.42	93.59
	Long Tertiary	0.19	0.57	0.38	194.85
Ishøj	Highschool	1.58	2.68	1.10	69.29
	Vocational	2.24	2.66	0.42	18.55
	Short Tertiary	0.21	0.36	0.15	71.51
	Medium Tertiary	0.47	1.32	0.85	181.00
	Long Tertiary	0.73	1.53	0.80	109.60
Jammerbugt	Highschool	1.98	2.64	0.66	33.20
	Vocational	2.19	2.70	0.51	23.34
	Short Tertiary	0.07	0.20	0.13	173.11
	Medium Tertiary	0.29	0.63	0.35	121.20
	Long Tertiary	0.24	0.66	0.41	170.18
Kalundborg	Highschool	1.72	2.46	0.74	43.22
	Vocational	2.61	2.66	0.05	2.05
	Short Tertiary	0.14	0.23	0.09	60.25
	Medium Tertiary	0.39	0.63	0.24	61.66
	Long Tertiary	0.24	0.46	0.22	89.72
Kerteminde	Highschool	1.89	2.61	0.72	37.99
	Vocational	2.73	2.71	-0.02	-0.58
	Short Tertiary	0.15	0.20	0.05	35.42
	Medium Tertiary	0.60	0.71	0.12	19.90
	Long Tertiary	0.42	0.79	0.38	91.26
Kolding	Highschool	1.82	2.82	1.00	54.80
	Vocational	2.53	2.60	0.07	2.71
	Short Tertiary	0.23	0.54	0.31	132.20
	Medium Tertiary	0.58	1.14	0.55	94.71
	Long Tertiary	0.41	1.56	1.15	280.43
København	Highschool	1.01	1.63	0.62	61.72
	Vocational	1.45	1.73	0.28	19.33
	Short Tertiary	0.33	0.60	0.27	82.08
	Medium Tertiary	1.26	2.65	1.39	110.29
	Long Tertiary	3.40	8.28	4.87	143.21
Køge	Highschool	1.96	2.89	0.93	47.23
	Vocational	2.56	2.60	0.03	1.24
	Short Tertiary	0.17	0.37	0.20	118.64

Table 6 – continued from previous page

Municipality	Education	1982	2013	PP Change	Relative Change
	Medium Tertiary	0.43	1.01	0.58	133.24
	Long Tertiary	0.63	0.97	0.34	53.35
Lejre	Highschool	2.09	2.90	0.80	38.34
	Vocational	2.82	1.87	-0.95	-33.59
	Short Tertiary	0.14	0.17	0.03	19.36
	Medium Tertiary	0.46	0.51	0.04	9.63
	Long Tertiary	0.78	0.76	-0.02	-2.57
Lemvig	Highschool	2.24	3.28	1.04	46.50
	Vocational	2.50	2.72	0.22	8.87
	Short Tertiary	0.10	0.24	0.14	135.83
	Medium Tertiary	0.92	1.03	0.11	12.25
	Long Tertiary	0.22	0.49	0.27	127.09
Lolland	Highschool	1.64	2.08	0.45	27.35
	Vocational	2.45	2.99	0.54	21.84
	Short Tertiary	0.09	0.14	0.05	59.62
	Medium Tertiary	0.34	0.71	0.37	106.89
	Long Tertiary	0.18	0.29	0.11	61.87
Lyngby-Taarbæk	Highschool	2.26	2.92	0.66	29.07
	Vocational	1.55	1.11	-0.44	-28.65
	Short Tertiary	0.30	0.44	0.15	48.86
	Medium Tertiary	1.34	1.42	0.08	6.07
	Long Tertiary	3.10	3.95	0.85	27.31
Mariagerfjord	Highschool	1.85	2.73	0.88	47.69
	Vocational	2.50	3.13	0.62	24.78
	Short Tertiary	0.11	0.29	0.18	172.58
	Medium Tertiary	0.33	0.74	0.41	126.23
	Long Tertiary	0.17	0.72	0.55	323.20
Middelfart	Highschool	1.76	2.72	0.96	54.62
	Vocational	2.24	2.35	0.11	4.91
	Short Tertiary	0.11	0.20	0.09	77.67
	Medium Tertiary	0.35	0.56	0.21	58.85
	Long Tertiary	0.25	0.72	0.47	187.65
Morsø	Highschool	1.68	2.69	1.02	60.57
	Vocational	1.89	2.86	0.97	51.52
	Short Tertiary	0.08	0.24	0.16	202.66
	Medium Tertiary	0.24	0.76	0.53	221.24
	Long Tertiary	0.19	0.30	0.11	60.02
Norddjurs	Highschool	2.09	2.76	0.68	32.49

Table 6 – continued from previous page

Municipality	Education	1982	2013	PP Change	Relative Change
	Vocational	2.56	3.29	0.73	28.33
	Short Tertiary	0.14	0.39	0.25	177.18
	Medium Tertiary	0.23	0.77	0.54	235.68
	Long Tertiary	0.26	0.48	0.21	80.02
Nordfyns	Highschool	1.82	2.37	0.55	29.98
	Vocational	2.26	2.83	0.57	25.05
	Short Tertiary	0.11	0.21	0.10	87.79
	Medium Tertiary	0.35	0.64	0.29	83.08
	Long Tertiary	0.31	0.62	0.31	101.65
Nyborg	Highschool	1.88	2.64	0.76	40.22
	Vocational	2.38	2.43	0.05	2.20
	Short Tertiary	0.23	0.34	0.11	50.12
	Medium Tertiary	0.47	0.85	0.38	79.82
	Long Tertiary	0.34	0.86	0.52	150.03
Næstved	Highschool	1.91	2.73	0.81	42.54
	Vocational	2.32	2.72	0.40	17.03
	Short Tertiary	0.15	0.36	0.21	141.07
	Medium Tertiary	0.71	1.36	0.65	92.10
	Long Tertiary	0.37	0.79	0.42	111.67
Odder	Highschool	1.80	2.81	1.01	56.45
	Vocational	2.31	2.30	-0.01	-0.41
	Short Tertiary	0.17	0.28	0.11	67.20
	Medium Tertiary	0.33	0.71	0.37	111.17
	Long Tertiary	0.54	0.78	0.25	45.63
Odense	Highschool	1.82	2.51	0.69	37.66
	Vocational	2.24	2.47	0.23	10.07
	Short Tertiary	0.28	0.63	0.35	121.94
	Medium Tertiary	1.27	2.65	1.37	108.17
	Long Tertiary	1.56	5.19	3.63	232.98
Odsherred	Highschool	1.61	2.01	0.40	24.65
	Vocational	2.29	2.48	0.19	8.43
	Short Tertiary	0.10	0.13	0.03	33.14
	Medium Tertiary	0.30	0.51	0.21	72.30
	Long Tertiary	0.27	0.34	0.06	22.47
Randers	Highschool	2.00	2.68	0.68	34.25
	Vocational	2.39	2.96	0.57	23.72
	Short Tertiary	0.14	0.51	0.37	274.93
	Medium Tertiary	0.53	1.25	0.73	138.13

Table 6 – continued from previous page

Municipality	Education	1982	2013	PP Change	Relative Change
	Long Tertiary	0.43	0.98	0.55	127.02
Rebild	Highschool	1.94	2.82	0.88	45.65
	Vocational	2.39	2.70	0.30	12.63
	Short Tertiary	0.09	0.19	0.10	111.33
	Medium Tertiary	0.33	0.54	0.21	63.47
	Long Tertiary	0.35	0.90	0.55	158.80
Ringkøbing-Skjern	Highschool	2.10	3.03	0.94	44.67
	Vocational	2.67	2.77	0.10	3.56
	Short Tertiary	0.12	0.26	0.15	125.17
	Medium Tertiary	0.33	0.83	0.49	148.07
	Long Tertiary	0.18	0.49	0.31	168.40
Ringsted	Highschool	1.62	2.81	1.19	73.55
	Vocational	2.65	2.46	-0.20	-7.38
	Short Tertiary	0.17	0.30	0.13	77.89
	Medium Tertiary	0.57	1.07	0.49	85.69
	Long Tertiary	0.47	0.94	0.47	100.25
Roskilde	Highschool	2.31	3.15	0.84	36.41
	Vocational	2.49	2.27	-0.22	-8.87
	Short Tertiary	0.24	0.50	0.26	110.48
	Medium Tertiary	0.70	1.57	0.86	122.80
	Long Tertiary	1.24	2.00	0.75	60.66
Rudersdal	Highschool	3.85	3.70	-0.14	-3.76
	Vocational	1.47	0.89	-0.58	-39.59
	Short Tertiary	0.26	0.23	-0.03	-11.39
	Medium Tertiary	1.20	0.80	-0.40	-33.52
	Long Tertiary	3.16	2.64	-0.52	-16.55
Rødovre	Highschool	2.03	2.33	0.30	14.85
	Vocational	2.63	2.41	-0.22	-8.43
	Short Tertiary	0.28	0.35	0.06	22.75
	Medium Tertiary	0.67	1.26	0.59	87.09
	Long Tertiary	1.07	1.84	0.77	72.46
Silkeborg	Highschool	1.92	3.00	1.07	55.90
	Vocational	2.47	2.70	0.23	9.23
	Short Tertiary	0.15	0.40	0.25	165.48
	Medium Tertiary	0.95	1.18	0.23	24.27
	Long Tertiary	0.41	0.87	0.46	113.60
Skanderborg	Highschool	1.74	3.14	1.39	79.81
	Vocational	2.41	1.93	-0.47	-19.64

Table 6 – continued from previous page

Municipality	Education	1982	2013	PP Change	Relative Change
	Short Tertiary	0.16	0.22	0.05	33.03
	Medium Tertiary	0.58	0.62	0.05	8.02
	Long Tertiary	0.60	0.93	0.33	54.15
Skive	Highschool	2.13	2.81	0.69	32.25
	Vocational	2.30	3.03	0.73	31.64
	Short Tertiary	0.15	0.38	0.23	158.69
	Medium Tertiary	0.61	0.99	0.38	61.88
	Long Tertiary	0.25	0.51	0.26	106.65
Slagelse	Highschool	1.70	2.58	0.88	51.47
	Vocational	2.45	2.88	0.43	17.59
	Short Tertiary	0.20	0.35	0.15	75.85
	Medium Tertiary	0.51	1.43	0.93	182.46
	Long Tertiary	0.30	1.16	0.87	291.61
Solrød	Highschool	2.38	3.39	1.01	42.48
	Vocational	2.33	1.89	-0.45	-19.08
	Short Tertiary	0.22	0.26	0.03	15.13
	Medium Tertiary	0.41	0.68	0.27	64.64
	Long Tertiary	0.73	1.19	0.46	62.95
Sorø	Highschool	1.81	2.70	0.89	48.99
	Vocational	2.33	2.56	0.23	9.95
	Short Tertiary	0.18	0.20	0.03	13.97
	Medium Tertiary	0.72	1.07	0.35	48.16
	Long Tertiary	0.42	0.80	0.38	89.01
Stevns	Highschool	1.89	2.22	0.33	17.38
	Vocational	2.44	2.51	0.07	2.93
	Short Tertiary	0.17	0.14	-0.03	-19.91
	Medium Tertiary	0.33	0.61	0.28	83.27
	Long Tertiary	0.48	0.56	0.08	15.81
Struer	Highschool	2.17	2.78	0.61	28.17
	Vocational	2.43	2.53	0.10	4.05
	Short Tertiary	0.11	0.21	0.10	86.41
	Medium Tertiary	0.36	0.82	0.45	124.53
	Long Tertiary	0.23	0.40	0.17	76.28
Svendborg	Highschool	1.91	2.71	0.80	42.06
	Vocational	2.28	2.75	0.48	20.93
	Short Tertiary	0.14	0.18	0.04	27.33
	Medium Tertiary	1.01	2.01	1.00	99.70
	Long Tertiary	0.31	0.86	0.55	179.38

Table 6 – continued from previous page

Municipality	Education	1982	2013	PP Change	Relative Change
Syddjurs	Highschool	1.82	2.67	0.84	46.37
	Vocational	2.53	2.23	-0.29	-11.60
	Short Tertiary	0.10	0.19	0.09	94.17
	Medium Tertiary	0.32	0.63	0.31	97.72
	Long Tertiary	0.57	0.73	0.16	27.24
Sønderborg	Highschool	2.08	2.87	0.79	37.81
	Vocational	3.03	2.35	-0.68	-22.37
	Short Tertiary	0.28	0.29	0.02	6.37
	Medium Tertiary	0.67	0.94	0.28	41.48
	Long Tertiary	0.34	0.96	0.62	184.85
Thisted	Highschool	1.96	2.78	0.82	41.91
	Vocational	2.34	2.81	0.47	19.94
	Short Tertiary	0.08	0.27	0.18	217.63
	Medium Tertiary	0.39	0.84	0.45	117.63
	Long Tertiary	0.17	0.38	0.21	123.67
Tønder	Highschool	1.79	2.73	0.95	52.95
	Vocational	2.51	2.99	0.48	19.07
	Short Tertiary	0.11	0.19	0.08	71.96
	Medium Tertiary	0.71	0.69	-0.02	-3.08
	Long Tertiary	0.18	0.49	0.32	177.17
Tårnby	Highschool	1.72	2.42	0.69	40.39
	Vocational	2.44	2.33	-0.11	-4.61
	Short Tertiary	0.24	0.29	0.05	21.62
	Medium Tertiary	0.50	0.99	0.49	98.28
	Long Tertiary	0.89	1.30	0.42	46.81
Vallensbæk	Highschool	2.67	2.97	0.30	11.36
	Vocational	2.50	1.81	-0.69	-27.53
	Short Tertiary	0.24	0.29	0.05	18.99
	Medium Tertiary	0.41	1.04	0.63	155.69
	Long Tertiary	0.93	1.33	0.40	43.46
Varde	Highschool	1.98	3.01	1.02	51.61
	Vocational	2.50	2.75	0.25	10.11
	Short Tertiary	0.14	0.23	0.08	58.60
	Medium Tertiary	0.40	0.93	0.54	134.71
	Long Tertiary	0.16	0.54	0.38	242.30
Vejen	Highschool	2.01	2.74	0.73	36.44
	Vocational	2.68	2.67	-0.01	-0.43
	Short Tertiary	0.14	0.23	0.10	70.96

Table 6 – continued from previous page

Municipality	Education	1982	2013	PP Change	Relative Change
	Medium Tertiary	0.31	0.71	0.40	126.67
	Long Tertiary	0.19	0.53	0.34	180.70
Vejle	Highschool	2.05	2.96	0.91	44.14
	Vocational	2.13	2.55	0.42	19.62
	Short Tertiary	0.12	0.39	0.26	217.46
	Medium Tertiary	0.68	1.12	0.44	64.74
	Long Tertiary	0.27	0.83	0.57	211.52
Vesthimmerlands	Highschool	2.13	2.54	0.40	18.92
	Vocational	2.35	3.01	0.66	28.17
	Short Tertiary	0.09	0.22	0.13	145.94
	Medium Tertiary	0.62	0.65	0.03	5.43
	Long Tertiary	0.27	0.51	0.24	89.47
Viborg	Highschool	2.16	2.93	0.77	35.67
	Vocational	2.32	2.93	0.61	26.09
	Short Tertiary	0.15	0.32	0.17	109.72
	Medium Tertiary	0.67	1.29	0.62	91.50
	Long Tertiary	0.30	0.74	0.44	148.74
Vordingborg	Highschool	1.69	2.56	0.88	52.09
	Vocational	2.22	2.64	0.42	18.97
	Short Tertiary	0.10	0.21	0.11	113.36
	Medium Tertiary	0.62	0.93	0.31	49.22
	Long Tertiary	0.27	0.49	0.22	79.05
Aabenraa	Highschool	1.93	2.76	0.83	43.32
	Vocational	2.89	2.74	-0.15	-5.35
	Short Tertiary	0.15	0.20	0.05	32.19
	Medium Tertiary	0.41	0.87	0.46	112.68
	Long Tertiary	0.22	0.44	0.22	99.82
Aalborg	Highschool	1.99	2.51	0.52	26.35
	Vocational	2.48	2.49	0.00	0.17
	Short Tertiary	0.15	0.61	0.45	300.54
	Medium Tertiary	0.97	2.38	1.41	144.70
	Long Tertiary	1.10	5.13	4.02	364.63
Aarhus	Highschool	1.95	2.58	0.63	32.27
	Vocational	2.15	1.97	-0.18	-8.31
	Short Tertiary	0.36	0.68	0.32	88.88
	Medium Tertiary	1.52	3.24	1.72	112.73
	Long Tertiary	4.35	7.73	3.38	77.74

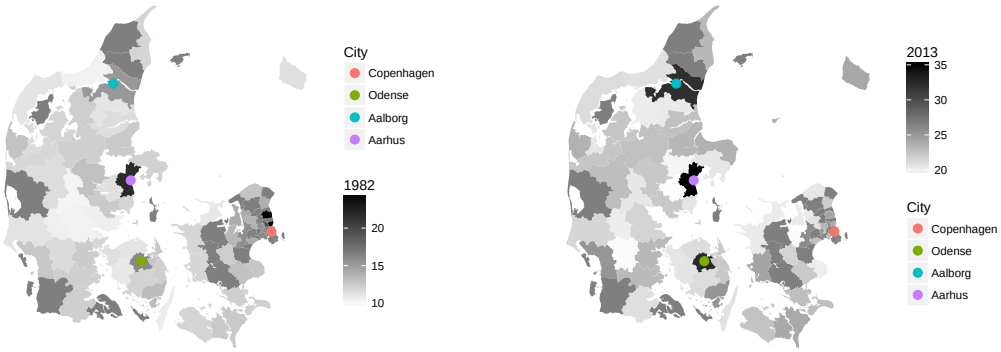
F.2 Population under 30 and Working Age

F.2.1 Municipality Maps

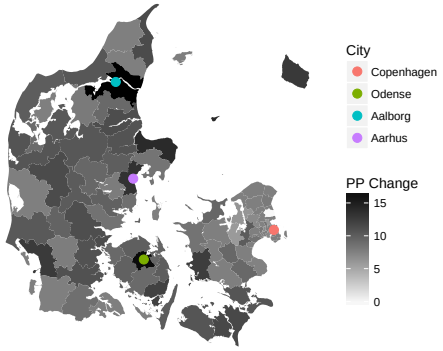
Figure 14: Municipalities: Enrolled students to population under 30, shares and percentage point changes, 1982 and 2013

(a) Share - 1982

(b) Share - 2013



(c) Percentage Point Change, 1982-2013

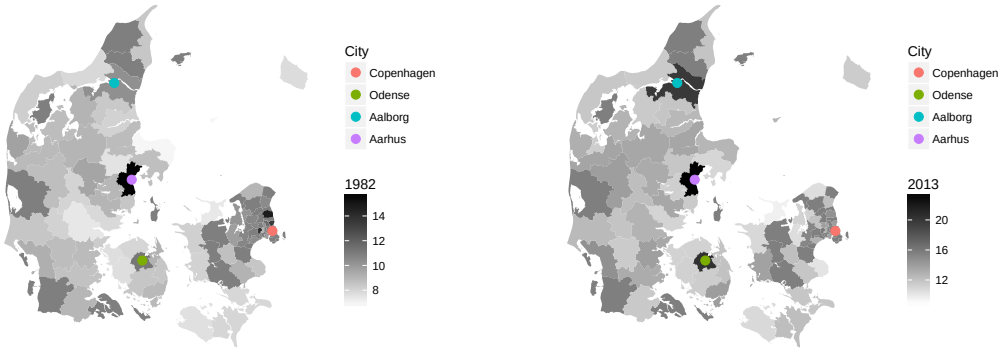


Note: The maps show enrolled students in secondary and tertiary education to population under the age of 30 at municipal levels. Percentages shares for 1982 and 2013 are shown in figure (a) and (b). Percentage point increases from 1982 to 2013 are shown in figure (c). Added to each plot is four dots showing each of the four largest cities, Copenhagen, Odense, Aalborg, and Aarhus.

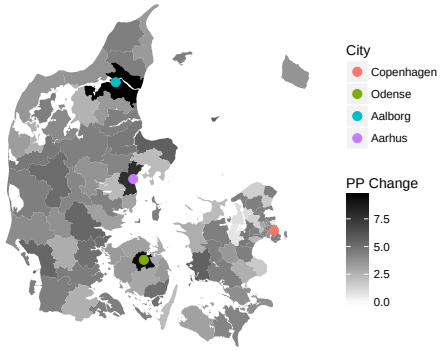
Figure 15: Municipalities: Enrolled students to population in the working age (15-64), shares and percentage point changes, 1982 and 2013

(a) Share - 1982

(b) Share - 2013



(c) Percentage Point Change, 1982-2013



Note: The maps show enrolled students in secondary and tertiary education to population in the working age (15-64) at municipal levels. Percentages shares for 1982 and 2013 are shown in figure (a) and (b). Percentage point increases from 1982 to 2013 are shown in figure (c). Added to each plot is four dots showing each of the four largest cities, Copenhagen, Odense, Aalborg, and Aarhus.

F.2.2 Top 20 Municipalities

Table 7: Share of population in Education by Municipality, less than 30 and working age, 1982 and 2013.

Population under 30				Population in working age			
1982		2013		1982		1982	
Gentofte	24.45	Aarhus	35.22	Aarhus	15.70	Aarhus	23.42
Rudersdal	24.36	København	32.80	Rudersdal	14.72	Odense	20.46
Lyngby-Taarbæk	24.27	Odense	32.52	Albertslund	13.86	Aalborg	19.93
Aarhus	21.91	Aalborg	32.11	Gentofte	13.45	Frederiksberg	18.30
Frederiksberg	21.31	Frederiksberg	30.99	Gladsaxe	11.71	Albertslund	16.03
Hørsholm	20.94	Lyngby-Taarbæk	26.94	Frederiksberg	11.24	Gladsaxe	15.52
København	19.90	Roskilde	25.82	Odense	11.17	Roskilde	15.26
Gladsaxe	19.41	Gladsaxe	25.54	Ballerup	10.90	Esbjerg	14.66
Furesø	18.90	Svendborg	25.24	Roskilde	10.64	Rudersdal	14.56
Dragør	18.49	Esbjerg	25.22	Egedal	10.62	Gentofte	13.99
Albertslund	16.94	Albertslund	25.10	Fredensborg	10.47	Svendborg	13.98
Rødovre	16.86	Rudersdal	24.31	Greve	10.39	Ballerup	13.90
Allerød	16.40	Slagelse	24.28	Aalborg	10.31	Herning	13.90
Odense	16.13	Bornholm	24.09	Herlev	10.18	Kolding	13.85
Fanø	15.94	Guldborgsund	24.07	Frederikssund	10.15	Herlev	13.77
Hvidovre	15.92	Gentofte	23.96	Hvidovre	9.91	Hvidovre	13.69
Ballerup	15.84	Hjørring	23.92	Lejre	9.83	Slagelse	13.68
Roskilde	15.72	Herlev	23.75	Lemvig	9.68	Holstebro	13.55
Glostrup	15.71	Norddjurs	23.58	Silkeborg	9.58	Randers	13.46
Helsingør	15.68	Lemvig	23.51	Esbjerg	9.26	Viborg	13.42

G Regional Developments, 1982-2013

G.1 Regional Population Sizes, 1982 and 2013

The following table shows the total population of Denmark by region for the years 1982 and 2013. Total and percentage changes are calculated. The table shows that the largest region in 1982 and 2013 is the Capital Region of Denmark with 1,578,310 and 1,731,976 inhabitants respectively. The largest growth in inhabitants happens in the Central Region of Denmark, rising by 15,35 percent from 1,103,312 to 1,272,510. The Northern Region of Denmark has both the lowest growth of population (1.74 percent) and the lowest number of inhabitants in 1982 (570,349) and 2013 (580,272). The Southern Region of Denmark starts slightly above and ends slightly below the Central Region of Denmark at 1,125,568 and 1,201,419. Finally, Zealand sees a rather large increase in inhabitants at 10.06 percent, going from 741,716 to 816,359.

Table 8: Region population size, distributed by educational status, 1982 and 2013.

Region	1982	2013	Change	Percentage Change
Capital	1,578,310	1,731,976	153,666	9.74
Central	1,103,212	1,272,510	169,298	15.35
North	570,349	580,272	9,923	1.74
Southern	1,125,568	1,201,419	75,851	6.74
Zealand	741,716	816,359	74,643	10.06

Note: The total number of inhabitants are based on individiual residence information in the Danish registers made available from Statistics Denmark.

G.2 Total Population

Table 9 shows the 1982 and 2013 share of students to population by Danish regions as well as the percentage point (PP) and percentage change in shares from 1982 to 2013.

Table 9: Share of population enrolled in education by regions, 1982 and 2013.

Region	1982	2013	PP Change	Percentage Change
Capital	7.25	10.52	3.27	45.12
Central	6.61	9.97	3.36	50.80
North	5.62	9.40	3.78	67.32
Southern	5.71	8.70	2.99	52.42
Zealand	5.54	7.59	2.04	36.86

Table 10 shows the average yearly percentage point increases in shares of enrolled students

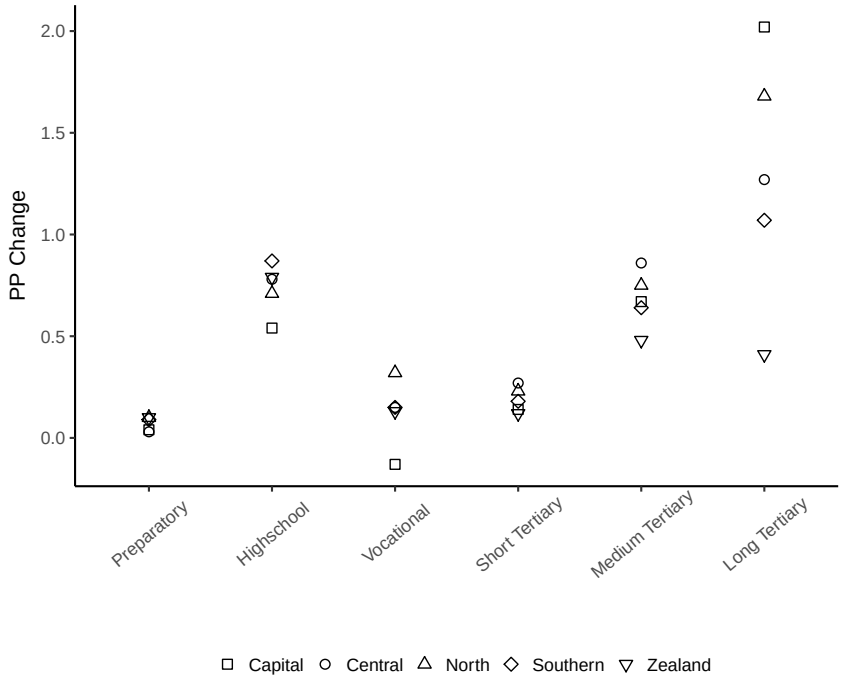
to population over the periods 1982-2008 and 2008-2013.

Table 10: Yearly Percentage Point increases in share of population in education by region, 1982 to 2008 and 2008-2013

	Period	
Region	1982-2008	2008-2013
Capital	0.07	0.29
Central	0.06	0.33
North	0.08	0.33
Southern	0.06	0.31
Zealand	0.02	0.28

Figure 16 show the percentage point changes in enrolled population by region and type of education (level). Each shape of a point corresponds to a region, a 'column' to a level of education, and the height of a point to the PP change in the share of students from 1982 to 2013.

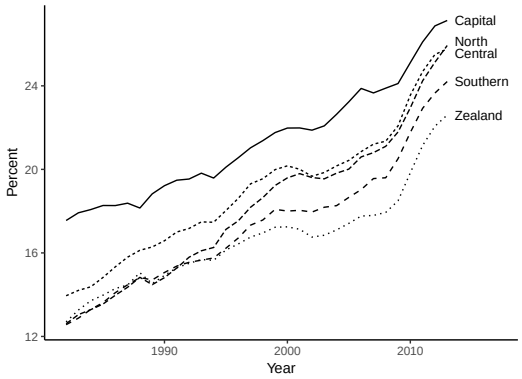
Figure 16: Change in percentage points of regional shares of individuals in different types of education (level) from 1982 to 2013.



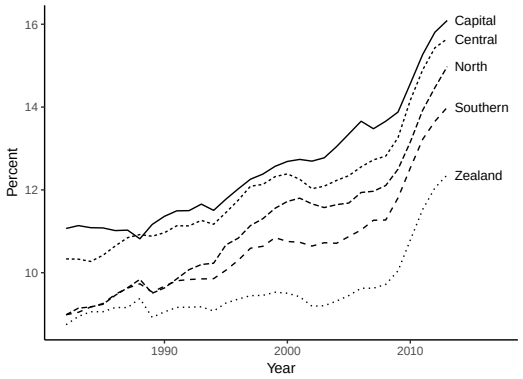
G.3 Population Less Than 30 and Working Age

Figure 17: Student to population percentages and index for Danish regions, 1982-2013.

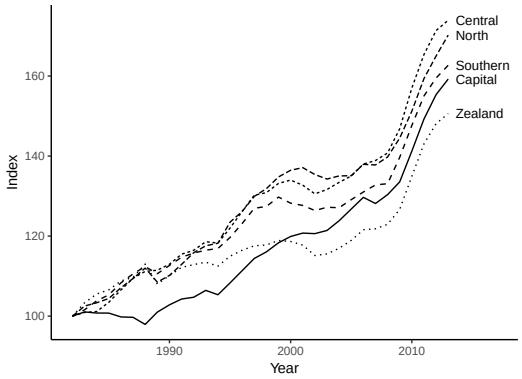
(a) Share of population in education



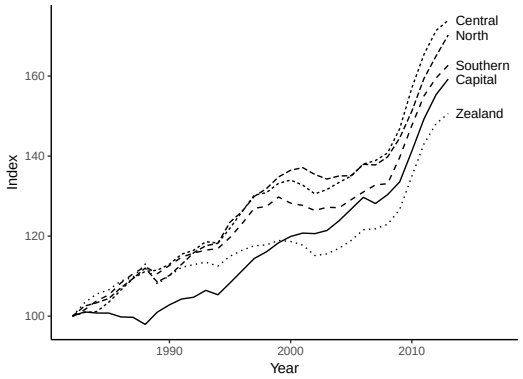
(b) Share of population in education



(c) Index values



(d) Index values



H Center-Periphery

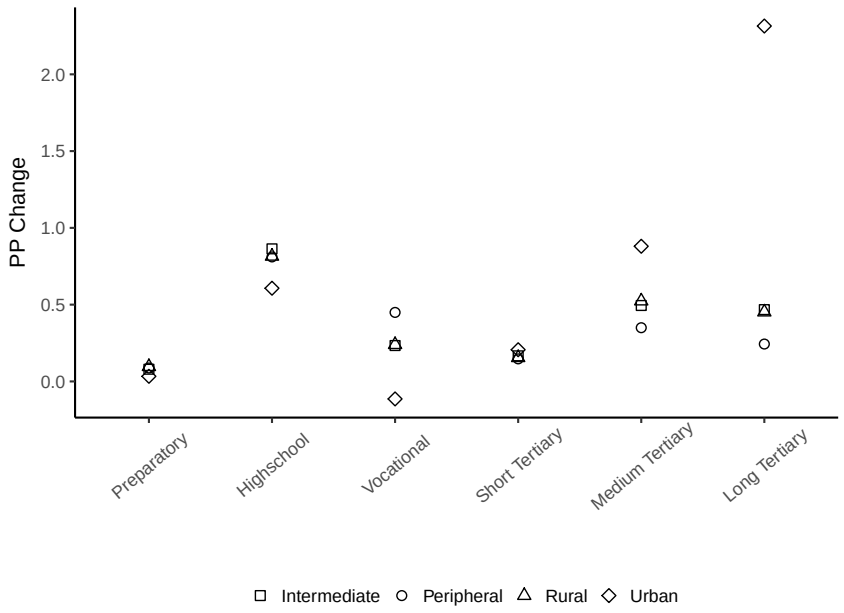
H.1 Rurality Classification

H.1.1 Total Population

Table 11: Share of population in education by municipality category, 1982 and 2013.

Group	1982	2013	PP Change	Percentage Change
Intermediate	5.46	7.77	2.31	42.19
Peripheral	5.11	7.19	2.09	40.91
Rural	5.39	7.67	2.28	42.26
Urban	7.45	11.38	3.93	52.71

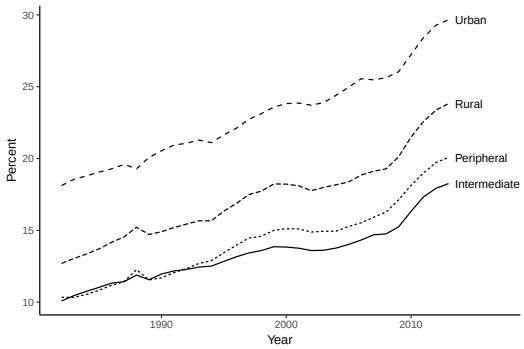
Figure 18: 'Rurality' Classification: Change in percentage share of students to population by level of education, 1982 to 2013



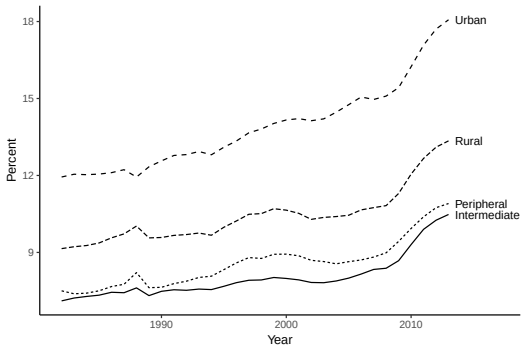
H.1.2 Population Under 30 and in Working Age

Figure 19: 'Rurality' classification: Enrolled students to population under 30 and in working age (15-64), percentages and 1982 based index, 1982-2013

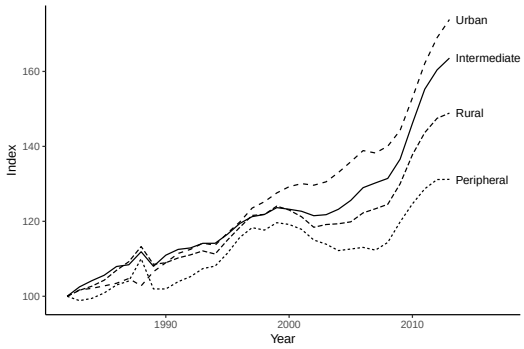
(a) Share, under 30



(b) Share, working age



(c) Index values, under 30



(d) Index values, working age

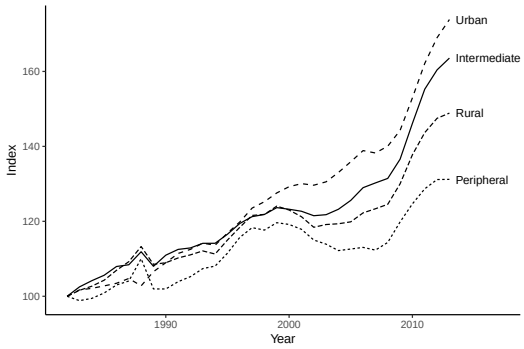


Table 12: 'Rurality' Classification: Share of students to population under 30, distributed by level of education, 1982 and 2013.

Peripheral	Preparatory	0.05	0.32	0.26
Peripheral	High school	3.87	7.59	3.73
Peripheral	Vocational	4.89	8.00	3.10
Peripheral	Short Tertiary	0.22	0.71	0.49
Peripheral	Medium Tertiary	0.91	2.23	1.32
Peripheral	Long Tertiary	0.40	1.24	0.83
Rural	Preparatory	0.05	0.36	0.31
Rural	High school	4.46	8.41	3.95
Rural	Vocational	5.82	8.42	2.60
Rural	Short Tertiary	0.34	0.93	0.59
Rural	Medium Tertiary	1.37	3.43	2.06
Rural	Long Tertiary	0.66	2.27	1.61
Intermediate	Preparatory	0.05	0.25	0.20
Intermediate	High school	3.44	6.40	2.97
Intermediate	Vocational	4.37	6.11	1.74
Intermediate	Short Tertiary	0.30	0.78	0.47
Intermediate	Medium Tertiary	1.16	2.64	1.48
Intermediate	Long Tertiary	0.76	2.07	1.31
Urban	Preparatory	0.08	0.17	0.09
Urban	High school	4.73	6.65	1.92
Urban	Vocational	5.08	5.15	0.07
Urban	Short Tertiary	0.64	1.22	0.58
Urban	Medium Tertiary	2.42	4.89	2.47
Urban	Long Tertiary	5.17	11.58	6.41

Figure 20: 'Rurality' Classification: Change in percentage share of students to population under 30 by level of education, 1982 to 2013

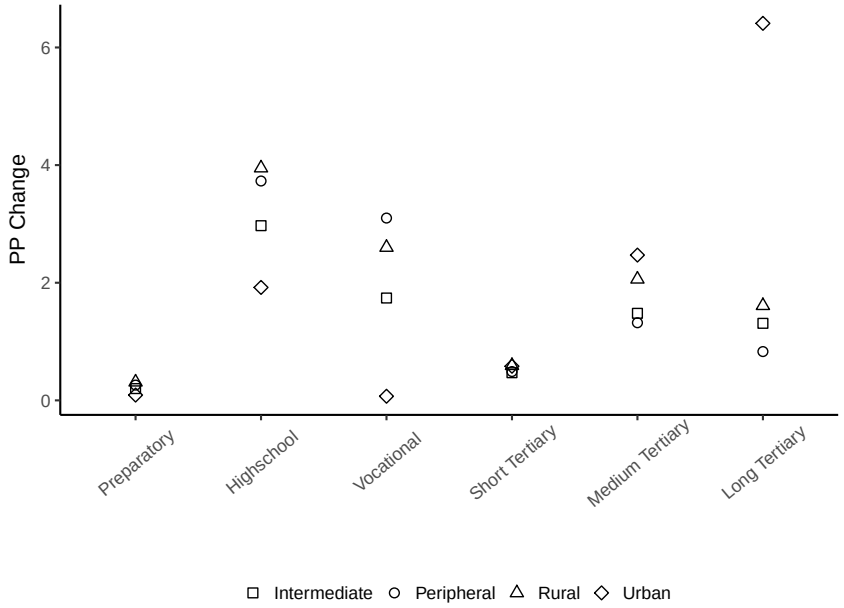
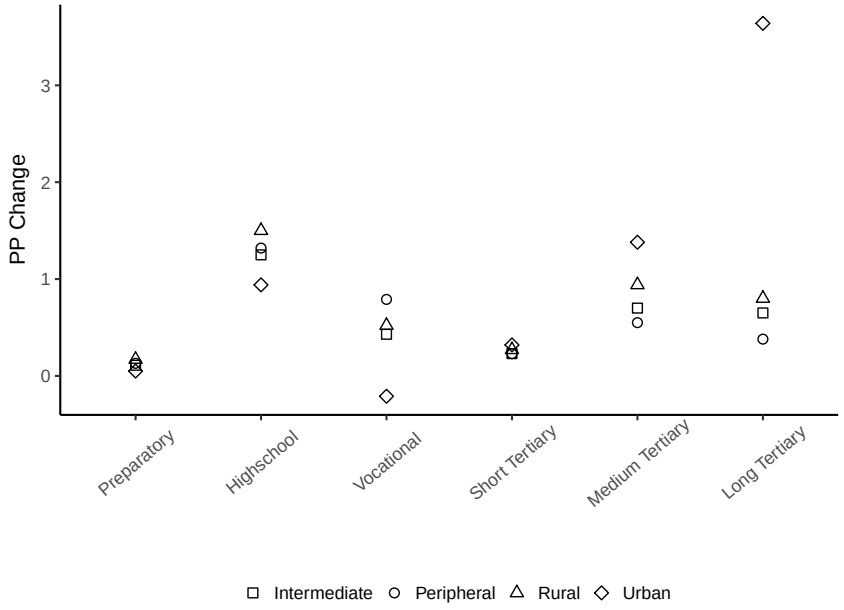


Table 13: 'Rurality' Classification: Share of students to working age population, distributed by level of education, 1982 and 2013.

Group	Level	1982	2013	PP Change
Peripheral	Preparatory	0.04	0.17	0.13
Peripheral	High school	2.81	4.12	1.32
Peripheral	Vocational	3.55	4.34	0.79
Peripheral	Short Tertiary	0.16	0.39	0.23
Peripheral	Medium Tertiary	0.66	1.21	0.55
Peripheral	Long Tertiary	0.29	0.67	0.38
Rural	Preparatory	0.03	0.20	0.17
Rural	High school	3.21	4.71	1.50
Rural	Vocational	4.19	4.72	0.52
Rural	Short Tertiary	0.25	0.52	0.27
Rural	Medium Tertiary	0.99	1.92	0.94
Rural	Long Tertiary	0.47	1.27	0.80
Intermediate	Preparatory	0.04	0.15	0.11
Intermediate	High school	2.42	3.68	1.25
Intermediate	Vocational	3.08	3.51	0.43
Intermediate	Short Tertiary	0.21	0.45	0.23
Intermediate	Medium Tertiary	0.82	1.52	0.70
Intermediate	Long Tertiary	0.54	1.19	0.65
Urban	Preparatory	0.05	0.10	0.05
Urban	High school	3.11	4.05	0.94
Urban	Vocational	3.35	3.14	-0.21
Urban	Short Tertiary	0.42	0.74	0.32
Urban	Medium Tertiary	1.60	2.98	1.38
Urban	Long Tertiary	3.41	7.05	3.64

Figure 21: 'Rurality' Classification: Change in percentage share of students to working age (15-64)population by level of education, 1982 to 2013



H.2 Alternate Classification

The alternatte municipality classification utilize Danish tax legislation. Commuters from "peripheral" municipalities gain tax credits in accordance with this legislation, making it possible to identify governmentally considered peripheral municipalities.[19] The distinction suffers from the fact that the tax legislation changes over time. In this section I use the 2017 classification of peripheral municipalities. Among the on-peripheral municipalities, large city municipalities undoubtedly differ from others. To distinguish the "Non-peripheral municipalities" with particular large-city characteristics I use the "Center" classification developed by Danmark På Vippen (2016).[20] The municipalities included in the "Center" category strongly resemble that of Urban municipalities in the 'rurality' classification. Any municipality not included in the Periphery and Center categories are classified as "Intermediate" municipalities. A map with the municipalities coloured by category is found in figure **??**.

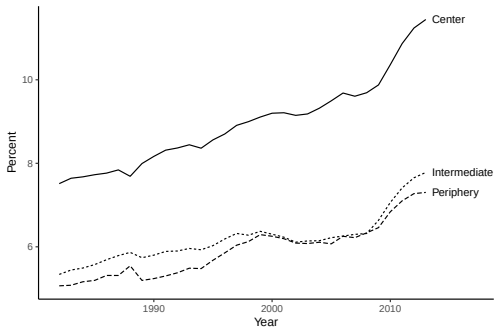
The results of the alternate classification are broadly similar to those from the 'rurality' classification. As expected, the largest shares and increases in enrolled students to population appear in the large-city municipalities. This development is driven by enrollment in tertiary education, with shares of vocational education and high school students to population increasing the strongest in non-Center municipalities.

[19]The full list of municipalities considered as peripheral-municipalities in 2017 according to the Danish Tax authorities include Læsø, Frederikshavn, Brønderslev, Hjørring, Morsø, Norddjurs, Tønder, Vesthimmerland, Langeland, Ærø, Svendborg, Faaborg-Midtfyn, Lolland, Samsø, Bornholm, and Guldborgsund (SKAT, 2017).

[20]This category includes all municipalities in the Capital region except Bornholm, as well as Roskilde, Lejre, Greve, Solrød, Køge, Stevns, Aarhus, Odense, and Aalborg.

Figure 22: Enrolled students to population shares by municipality alternate classification and 1982 based index values, 1982 and 2013

(a) Shares of individuals in education



(b) Index values

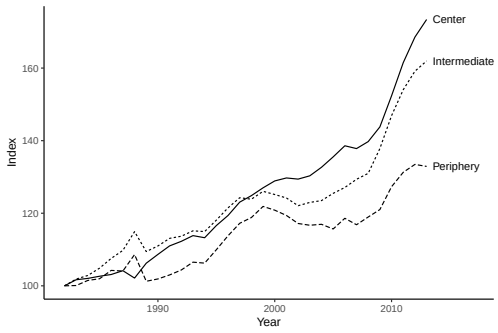


Table 14: Share of population in education by categories of municipalities, 1982 and 2013.

Region	1982	2013	PP Change	Percentage Change
Center	7.51	11.44	3.93	52.32
Periphery	5.07	7.30	2.24	44.16
Remaining	5.34	7.78	2.44	45.73

Figure **??** shows the percentage shares of individuals in education by the municipal categories Center, Intermediate, and Periphery from 1982 to 2013 and figure 22b corresponding 1982 based index values. Table 14 shows the corresponding 1982 and 2013 levels and corresponding PP changes in shares. Most notable is a markedly higher share of students in Center municipalities across time. In 1982, the 7.51 percent students in Center municipalities is 1.5 times higher than the Periphery share of 5.07. Over the period of 1982-2013 Center municipalities see an increase of 3.93 PP, while the Periphery municipalities' share rises by 2.24. By 2013 the Central municipalities have a 1.56 times higher share of students. Over the same period the Periphery and Intermediate municipalities are largely indistinguishable in levels (5.07 and 5.34 percent in 1982, and 7.3 and 7.78 percent in 2013) as well as in developments in shares of students (with changes of 2.24 and 2.44 PP). This suggests that the distinction between Intermediate and Periphery municipalities is not warranted in terms of the share of enrolled students.

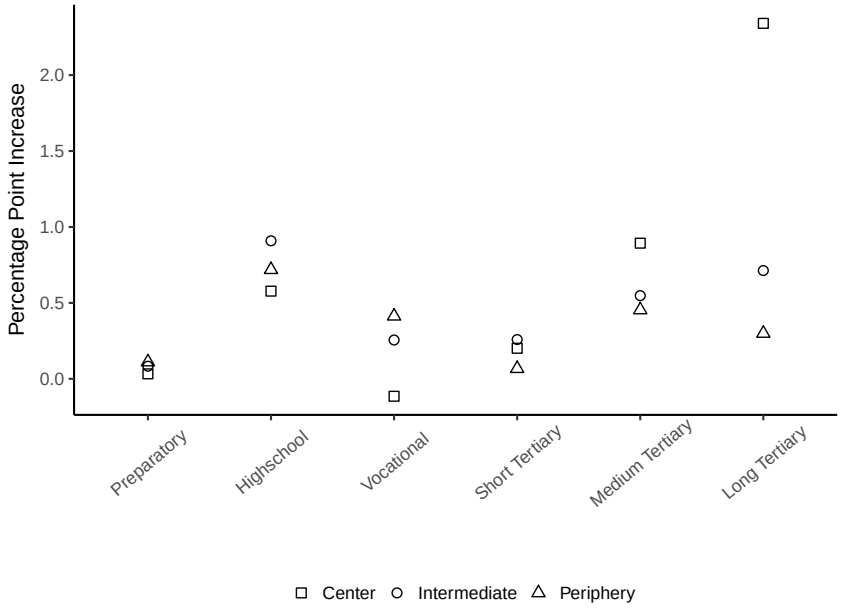
Distributing across levels of education, the developments reveal centralization patterns. Table 15 shows enrolled students to population percentages for 1982 and 2013 and the PP changes from 1982 to 2013 by education level. Figure 23 gives a graphical illustration of the PP changes. Starting with tertiary education, we see the largest increase across education in share of enrolled long tertiary students in the Center municipalities at 2.3 PP. The increases in shares of long tertiary students in Intermediate municipalities is .7 PP while it is .4 for

Table 15: Alternate municipality classification, students to total population by level of education in 1982 and 2013 and corresponding percentage point change.

Category	Level	1982	2013	PP Change
Center	Preparatory	0.03	0.06	0.03
	High school	1.94	2.52	0.58
	Vocational	2.08	1.96	-0.11
	Short Tertiary	0.27	0.47	0.20
	Medium Tertiary	1.01	1.90	0.89
	Long Tertiary	2.19	4.53	2.34
Intermediate	Preparatory	0.03	0.10	0.08
	High school	1.88	2.68	0.80
	Vocational	2.38	2.55	0.18
	Short Tertiary	0.15	0.39	0.24
	Medium Tertiary	0.58	1.08	0.50
	Long Tertiary	0.32	0.98	0.66
Periphery	Preparatory	0.02	0.14	0.12
	High school	1.76	2.54	0.78
	Vocational	2.42	2.87	0.45
	Short Tertiary	0.12	0.20	0.07
	Medium Tertiary	0.52	1.01	0.49
	Long Tertiary	0.23	0.56	0.32

Periphery municipalities. Center municipalities also start from a higher level of long tertiary students enrolled at 2.19 percent compared to 0.32 and .23 percent for Periphery and Intermediate municipalities. A similar pattern of higher increases for the Center Municipalities is present in medium length tertiary enrollment, but with a smaller range of .4 PP between Center (1 PP) and Intermediate and Periphery (both at .6 PP). Once again, we see patterns of centralization. Short tertiary educational enrollment increases are largely similar across categories of municipalities and small in comparison to average medium length and long tertiary education.

Figure 23: Changes in share of individuals in different types of education (level) from 1982 to 2013 by municipality category, using *classification 1*.



In secondary education a different pattern emerges. As a singular finding, the Center municipalities have a decline of .1 PP in the share of students enrolled in vocational enrollment, while Periphery municipalities experience the largest increase in vocational education students to population size of .5 PP. More notably still, the final percentage share of vocational education students in Intermediate and Periphery municipalities exceeds the Center municipalities at 2.55, 2.87, and 1.96 percent respectively. At the high school level, Intermediate and Periphery municipality student shares increase by approximately .9 PP compared to .6 PP in the Central municipalities. As a result of the increases, 2013 percentage shares of students enrolled in high school are almost similar across categories at 2.52, 2.68, and 2.54 percent for Center, Intermediate, and Periphery regions.