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Geographical Income Polarization

House prices and labour market linkages

RESEARCH DEPARTMENT OF EMPLOYMENT AND INTERGRATION

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Abstract: In this paper we estimate the degree, composition and development of geographical income polarization based on data at the individual and municipal level in Denmark from 1984 to 2002. Rising income polarization is reconfirmed when applying new polarization measures, the driving force being greater inter municipal income inequality. Counter factual simulations show that rising property prices to a large part explain the rise in polarization. One side-effect of polarization is tendencies towards a parallel polarization of residence location patterns, where low skilled individuals tend to live in cheaper areas, and highly skilled individuals in more expensive areas. This may threaten cohesion in the comprehensive universal welfare state of Denmark.

Key words: Income polarization; municipality; social cohesion; labour market

JEL classifications: D31; D63; I31

1. Introduction

Rising inequality in many Western countries is by now well documented (LIS, 2007; WIDER, 2007; IMF, 2007), but perhaps somewhat surprising, the rising inequality has also been seen in a universal welfare state like the Danish one, where the gini coefficient rose 10 % from 1984 to 2002 from 0.224 to 0.246 (Hussain, 2008). Rising inequality has increased polarization, but to a less degree

(about 5 %). One possible problem with polarization is that it may lower social cohesion and create social unrest (Esteban and Ray, 1994). Jonassen (2007) argues that increased economic polarization might restrain the extension of employment networks, and thus hinder social mobility. This leads us to investigate whether polarization has increased when categorizing people into distinct classes defined by the municipality they are living in, and also look at whether this has led to a skill biased concentration of residential location, which is one way in which these causes of less social cohesion may manifest them self. One reason for looking at regional differences is anecdotic evidence from news media that income has become more important when deciding where to live. This has not before been analysed for Western countries. Earlier analyses regarding geographical income polarization exist for China (Zhang and Kanbur, 2002) showing tendencies towards somewhat lower urban-rural polarization (-33 %) and much greater coast-inland polarization (184 %) during the period 1983 to 1995. Basically the polarization measure in Zhang and Kanbur is defined by the total inter-regional inequality divided by total intra-regional inequality. We will be following this methodology of Zhang and Kanbur. Geographical polarization patterns will be exemplified by using rich administrative Danish data set covering 1984-2002.

In the next section we lay the foundation for the applied income distribution measures. The macro economic context is briefly presented in Section 3, and Section 4 contains a description of the data. In Section 5 we look at residence location patterns for different groups on the labour market. The last section summarizes the findings.

2. Polarization and inequality measures

Earlier analyses with the same data as used here (Hussain, 2008) followed the identification-alienation framework (IA) developed in Duclos et al. (2004). According to this framework

polarization rises when there is a higher degree of identification in groups of the population (higher income density) and/or if the income distance between groups increases (higher alienation). Transformed kernel income density estimates represent identification and (half) the gini coefficient represents alienation. The approach in Zhang-Kanbur (2002) is seemingly different but may somewhat nevertheless be interpreted in the IA-framework as they apply between-region and within-region inequality, where the former could be seen as a measure of alienation and the latter as a measure of identification. The ratio of the latter to the former is than taken to be a measure of polarization. This measure is well-suited for our analyses as we want to classify families according to the municipality in which they have their housing. Other polarization measures also allow categorization of the population (Esteban and Ray, 1994; Wang and Tsui, 2000), but only according to income classes.

The generalized entropy measure is additively decomposable and thus total inequality can be decomposed into inter and intra inequality contributions from different categorizations of the population. The generalized entropy measure depends on the ethical parameter α and is defined as

$$(1)\qquad \begin{cases} E_\alpha(y) = \sum_{j=1}^{m} \omega_j \left(\frac{\mu_j}{\mu}\right)^\alpha E_\alpha(y^j) + \sum_{j=1}^{m} \frac{\omega_j}{\alpha(\alpha-1)}\left[\left(\frac{\mu_j}{\mu}\right)^\alpha - 1\right] & , \alpha \neq 0,1 \\ E_0(y) = \sum_{j=1}^{m} \omega_j E_0(y^j) + \sum_{j=1}^{m} \omega_j \ln\frac{\mu}{\mu_j} & , \alpha = 0 \\ E_1(y) = \sum_{j=1}^{m} \omega_j \left(\frac{\mu_j}{\mu}\right) E_1(y^j) + \sum_{j=1}^{m} \omega_j \frac{\mu_j}{\mu} \ln\frac{\mu_j}{\mu} & , \alpha = 1 \end{cases}$$

where

$$E_\alpha(y^j) = n_j^{-1}\sum_{i=1}^{n_j}\frac{1}{\alpha(\alpha-1)}\left[\left(\frac{y_i}{\mu_j}\right)^\alpha - 1\right] \qquad ,\alpha \neq 0,1$$

$$E_0(y^j) = n_j^{-1}\sum_{i=1}^{n_j}\ln\frac{\mu_j}{y_i} \qquad ,\alpha = 0$$

$$E_1(y^j) = n_j^{-1}\sum_{i=1}^{n_j}\frac{y_i}{\mu_j}\ln\frac{y_i}{\mu_j} \qquad ,\alpha = 1$$

and n is total population size, n_j is population size of municipality j (m municipalities in total), y_i is individual i's income, μ is mean income, μ_j is mean income of municipality j, and ω_j is municipality j's population share (n_j/n). The ethical parameter α represents the sensitivity of the inequality measure to changes in transfers. For example α=0, α=1 and α=2 implies that greater weight is attached to the bottom, middle and the top of the income distribution, respectively. The specific measures $E_0(y)$ and $E_1(y)$ are also referred to as the mean log deviation and the Theil index respectively. The first components on the right hand sides in (1) represent intra-municipality inequality while the second components represent the inter-municipality inequality. Zhang and Kanbur then defines polarization as

$$(2) \qquad \begin{cases} P_\alpha(y) = \left\{\sum_{j=1}^{m}\frac{\omega_j}{\alpha(\alpha-1)}\left[\left(\frac{\mu_j}{\mu}\right)^\alpha - 1\right]\right\} \Big/ \left\{\sum_{j=1}^{m}\omega_j\left(\frac{\mu_j}{\mu}\right)^\alpha E_\alpha(y^j)\right\} & ,\alpha \neq 0,1 \\ P_0(y) = \left\{\sum_{j=1}^{m}\omega_j \ln\frac{\mu}{\mu_j}\right\} \Big/ \left\{\sum_{j=1}^{m}\omega_j E_0(y^j)\right\} & ,\alpha = 0 \\ P_1(y) = \left\{\sum_{j=1}^{m}\omega_j \frac{\mu_j}{\mu}\ln\frac{\mu_j}{\mu}\right\} \Big/ \left\{\sum_{j=1}^{m}\omega_j\left(\frac{\mu_j}{\mu}\right)E_1(y^j)\right\} & ,\alpha = 1 \end{cases}$$

It is clear from (2) that increased inequality between municipalities (the nominator representing alienation) or decreases in inequality inside municipalities (the denominator representing

identification) increases polarization. Inter- and intra-municipal contribution to polarization change is easily calculated by looking at changes in logs in (2), whereby

$$\Delta \ln P_\alpha = \Delta \ln B_\alpha - \Delta \ln W_\alpha \quad (3)$$

where B is the inequality between municipalities and W is the inequality within municipalities.

3. Economic background

The present economic situation is in contrast to the situation before 1994. The new government in 1994 kick-started the economy by different measures aimed at increasing demand, and subsequently introduced labour market reforms to improve work incentives. These policy changes partly explains the unprecedented decrease in unemployment, see Figure 1.

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Figure 1

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1993 was the last year in newer economic history with very low economic activity. The unemployment rate reached a record high level with 12.4 % of the labour force being without jobs. Real GDP growth in 1993 and in the years before was low and negative in some years. Since 1994 the economy has been characterized by rising incomes, higher stock prices and decreasing unemployment. Real property prices have also increased fast in the 1990s, especially concerning flats. Real house prise increases were also high in 1985, but the cumulated rise over the ten year period up to 1985 was zero. In contrast, the change in the 1990s has been continuously positive

and reached a ten year cumulated change in 2002 of almost 50%. Huge rises in property prices started in 1994, where house prices rose 9 % and flats 7 %, while prices of both types of property decreased in 1993. An obvious interest in analysing potential effects on polarization thus arises on this background.

4. Data

Statistics Denmark has supplied the data set which originates from administrative registers concerned with demography, education, income, taxes, and the labour market. It is a longitudinal data set containing the whole population living in Denmark in any year between 1984 and 2002. Information from different registers and different years for a given individual is merged via a unique personal ten digit ID number which is held by all citizens residing in Denmark.

Top and bottom coding was applied in order to reduce the effects of extremely high incomes. Thus persons with incomes above 30 time average income were excluded, as were persons with zero or negative incomes. This may bias results, but the excluded cases account for less than 1 % of the observations in any of the years 1984-2002. The applied income concept is equivalised disposable household income, which is a standard measure of consumption possibilities. This means that all incomes are included and all income taxes and mandatory contributions are subtracted. E.g. wages, capital income, rents, labour market contributions, and pension contributions are taken into account. Also public (e.g. UIB and social assistance, sickness payment) and private (e.g. ex spouse and child alimony) transfers are included. The income value of owner occupied housing is set at 4 % of the Tax Authorities' estimated value of the house or flat. The equivalence scale is equal to the square root of the number of household members. We assume an equal intra household

distribution of income so that each household member is assigned the same equivalised household income. The household is the economic unit, but all analyses are based on individuals.

Data concerning labour market issues is also from Statistics Denmark's' administrative registers.

Prices of owner-occupied homes and other variables used in the multivariate analyses

Property price information at the municipal level is obtained from The Association of Danish Mortgage Banks (Realkreditraadet, 2008), whose members cover 100 % of the mortgage finance market regulated by the Danish Financial Services Act and the Danish Mortgage Loans and Mortgage Bonds Act. They have prices for houses, flats, and weekend cottages (respectively representing 74/65, 18/25, and 7/10 % of owner-occupied sales in 1995/2002), but here we only include houses because information on flats is missing for a significant number of municipalities. And since there are 276 municipalities in Denmark both in 1995 and 2002 we can not afford to loose too many municipalities before sample size issues becomes important. Finally, inclusion of flats would introduce a selectivity problem across municipalities. The price is measured in Danish kroner (DKK) per square metre. 1995 prices are inflated to 2002 price level.

Other variables used in regressions includes municipal level information about crime rates, municipal tax levels, unemployment rates, expenses on culture, child care facilities, etc. This information is obtained from the Municipal Key Figures database (Ministry of the Interior, 2003).

5. Results

Applying the methodology set out in (1) and (2) we present polarization and inequality indices in Figure 2. Polarization was 0.049 in 1984, fell to the lowest level in the period to 0.045 in 1993, and

ended up with the highest level at 0.056 in 2002. This represents a 15 % change over the 19 years. In contrast the change in the Duclos et al. (2004) polarization index is 5 % (Hussain, 2008). This difference is not too surprising since we apply other measures aimed at geographical income polarization, and the underlying inequality index is also different. Here we apply the generalized entropy index while Hussain (2008) apply the gini coefficient. Inequality change measured by the gini was almost 10 % and inequality measured by the GE is 13 %, which is not that different.

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Figure 2

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There seems to be some positive co-movement between polarization and inequality, and the R^2 from an OLS regression on levels is 0.41 with very significant parameters. But a regression using changes only gives a R^2 equal to 0.04, and with insignificant parameters. Instead, polarization and inequality each are very much correlated to the two components making up the measures, namely inter and intra municipal inequality, see Figure 3a and 3b. Polarization is linked to inter-municipal inequality, especially in the first part of the period. Level-OLS R^2 is 0.84 and change-OLS R^2 is 0.61. Inequality and intra-municipal inequality are almost perfectly correlated, which is not surprising since intra-inequality contributes with about 95 % to total inequality.

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Figure 3a, Figure 3b

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Until now polarization has been analysed by assuming that the ethical parameter is 0. But polarization is strongly affected by this choice, see Figure 4. Thus, applying α=1 or α=2 reduces polarization from 1984 to 2002, whereas it increased when α=0. But it is also clear from Figure 4 that all indices rose from 1993 (the year with low economic activity).

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Figure 4

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The role of house prices

As mentioned in the data section the income value of owner occupied housing is set to 4 % of the property value estimated by the Tax Authorities. A straight forward way of measuring the effect of property prices on polarization is to apply a counter factual equivalised disposable income where the value of owner occupied housing has been excluded. In the beginning of the period (1984-1986) that reduces average equivalised disposable income with 6-7 % or 1,100 EUR at 2002 prices. At the end of the period (2000-2002) the income reduction is 11 % or 2,600 EUR.

The effects on polarization and sub-indices are presented in Table 1. Excluding housing reduces polarization with around 25 %, regardless of the applied polarization index. The reduction is smaller in the beginning than at the end of the analysed 19 year period. Inequality on the other hand is virtually unchanged when excluding housing value (reductions around 2-3 %). In some cases, in the beginning and in the middle of the period, it actually exceeds actual income polarization, while the reduction is somewhat greater at the end of the period.

The existence of owner occupied housing income thus definitely seems to increase polarization but leaves inequality less affected. The effect on income distribution changes is looked upon next. P_0 for actual income increased 15 % form 1984 to 2002 and 26 % from 1993 to 2002 (Table 1 lower part). But with counter factual income there was actually a decrease over the period (-5 %) and less increase from middle to the end (18 %). This is a general pattern with polarization increasing less when excluding housing income, the effect being bigger the higher the α. The mechanism behind this is that the excess increase in inter municipal inequality compared to intra municipal inequality is greater when including housing income than when excluding it. The conclusion is that the huge rise in house prises has contributed to increased polarization over the period.

Inequality change, in contrast to polarization change, is even more affected when excluding housing income. The change in inequality without housing income is thus only between 24 and 58 % of the inequality change when including housing income. The greatest effect is for GE_0, where the rise in counter factual inequality is 3 % for 1993-2002, but 11 % for actual inequality.

Labour market linkages

How does increased geographical polarization affect the labour market? Our way of looking at this reflects our focus on polarization and the corresponding issue of social cohesion. Thus, at the municipal level we analyse correlations between wage earners' skills distribution (basic, medium and high skills, which represents 75 % of all employed people in Denmark in both 1995 and 2002) in municipalities and the level of property prices in the same municipalities. The presence of e.g. medium skilled wage earners (school teachers, police men/women, and nurses are in this category) may decline in high house price municipalities, while the presence of more highly skilled individuals

increases. This may indicate less social cohesion since individuals with different educational backgrounds less frequently will meet each other with the risk of increased alienation.

Although the low, medium and highly skilled employed have a constant 75 % of the working population, the distribution inside the group has changed, so that there are fewer people with basic skills, and more with medium or high skills, see Table A1 in the Appendix. The same table also clearly reveals the huge price rise on houses, with no municipalities having average prices over 11,000 DKK per square metre in 1995, while prices up to 18,000 existed in 2002. The table also suggests a huge negative correlation between the fractions of employed with basic skills and the housing prices in a municipality. The share of medium and highly skilled people in municipalities on the other hand is higher the higher the house prices. This clearly indicates that more alike skilled people concentrate in municipalities depending on house prices. This conclusion is in contrast to another Danish study (Damm, Schultz-Nielsen and Tranaes, 2006) measuring geographical income distribution in the same period as in this paper, since they conclude that Danes' house location patterns are no less socially mixed at the end of the period compared to the start of the period. A reason for the observed differences in results may be their use of other indices to compare geographical changes – they apply the *D*-index, which measure the degree of redistribution necessary to equalize incomes across regions.

But at this stage we can not confirm anecdotical evidence in Danish media and political debates that teachers, policemen and nurses (medium skills level) have been "forced" away from more expensive areas.

The distribution of skills may change because people shift to places where they can afford the housing. But other factors in a municipality may also be important, e.g. working prospects, crime rates, schooling quality, and cultural opportunities. These kinds of factors are next included in a fixed effects model[1] in order to estimate the correlation between house prices and skills distribution, see Table 2. Summary statistics for the regression data are presented in Table A2 in the Appendix, where the more unequal increases in house prices from 1995 to 2002 is clearly visible – compare the average with the median to measure right skewness. Other explanatory variables were also tried (e.g. class size in basic schooling, municipal and county tax rate), but they were excluded as they were insignificant in regressions for all three skill levels. The estimated parameters indicate that highly skilled people can escape high crime areas, and seems to be attracted by higher cultural expenditure. Employed with low skills on the other hand are less frequent in municipalities with high tax rates or expenditure on cultural activities or child care facilities.

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Table 2

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Even after including other explanatory variables house prices still significantly affects the fraction of people with a given skill level living in a municipality. But the effect seems far from linear, except for people with high skills. The effects of house prices using these estimates, as well as estimates from OLS models for 1995 and 2002, are illustrated in Figure 5 (fitted values from OLS

[1] A logit transformation in stead of directly using fractions as response variables was not used because some municipalities have 0 values regarding some fractions (professions regressions), and furthermore there was not much of a problem regarding fitted fractions outside the 0-100 % interval. Actually the logit transformation was tried, thus reducing the sample size, but the results (meaning the fractions extrema as a function of house prices) were virtually unchanged.

and fixed effect regressions[2]). The OLS regressions very much reflect the excessive effects of house prices seen in Table A2, e.g. high sensitivity to house price increases at all skill levels. In contrast, the fixed effects model shows much less variation in skill fractions when house prices change. Furthermore, the fixed effects model produces another interesting pattern, namely that the fraction of medium skilled people only increases up to a certain level (15,000 DKK per square metre) when house prices rise, after which the fraction of this individuals with this skill level decreases. Our analysis thus does lend some support to the hypotheses that employed with low or medium skills are having difficulties affording housing in areas of high house prices.

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Figure 5

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Making a similar analysis by educational levels produces somewhat the same patterns, see Table A3 in the Appendix. The share of individuals with short or long further education (bachelor or masters level) increases with the house price level, whereas it decreases for individuals with basic schooling or vocational training. Also more specifically we look at public service personal caring for people as a part of the Danish welfare state. These people together with policemen are mentioned as groups which may not be able to afford to live in areas with high house prices. Figure A1 in the appendix shows that the anecdotical evidence is very much reflected in data. Thus, the share of teachers, nurses, police, children and youth educationists, and social and health workers is lower when house prices rise above a certain level.

[2] Fitted values are calculated as $\hat{y}(p) = \bar{y} - (\hat{\alpha}\bar{p} + \hat{\beta}\bar{p}^2) + \hat{\alpha}p + \hat{\beta}p^2$, where y is the fraction of individuals with a given characteristic (e.g. skills or educational levels), and p is the house price. Bar over a variable represents the average over all municipalities and both years. The estimated parameters are from fixed effects regressions.

6. Conclusion

We estimate polarization by using a concept defined as the ratio between inter-municipal inequality and intra-municipal inequality. Inequality is the sum of the same two inequality components. The polarization concept shows that geographical income polarization has increased from 1984 to 2002, and especially since 1993, which was a year with out growth and high unemployment. Polarization is far from highly correlated with inequality. Instead polarization shows high correlation with inter-municipal inequality, while inequality is highly correlated with intra-municipal inequality since this component almost entirely makes up inequality.

Descriptive tables and OLS regressions show huge effects of house prices on the location of labour at different skill levels. More specifically there seems to be a negative correlation between house prices in a municipality and the fraction of people with low skills or low education, while the fraction of highly skilled labour or people with high education is higher in high house price municipalities.

Fixed effects estimations confirm these correlations, but the magnitudes are much smaller. We thus conclude that people with different educational or skill backgrounds tends to mix less as a consequence of the boom on the housing market.

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Tables

***Table 1*. Polarization with and with out the value of owner-occupied housing**

	Including owner occupied housing income			Excluding owner occupied housing income		
	P_0	P_1	P_2	P_0	P_1	P_2
Levels of…						
…polarization:						
Average of 1984-2002	0.050	0.055	0.044	0.038	0.041	0.032
- as % of "including"				75	75	74
1984	0.049	0.061	0.059	0.041	0.051	0.048
1993	0.045	0.051	0.040	0.033	0.037	0.029
2002	0.056	0.058	0.042	0.039	0.041	0.030
…inequality:						
Average of 1984-2002	0.097	0.093	0.125	0.094	0.090	0.122
- as % of "including"				97	97	98
1984	0.094	0.079	0.086	0.092	0.078	0.086
1993	0.096	0.089	0.119	0.095	0.089	0.121
2002	0.106	0.110	0.160	0.097	0.100	0.145
Percentage change in…						
…polarization:						
From 1984 to 2002	15	-5	-28	-5	-19	-37
From 1993 to 2002	26	15	7	18	9	4
- as % of "including"				70	61	52
…inequality:						
From 1984 to 2002	13	39	87	6	28	68
From 1993 to 2002	11	23	34	3	13	20
- as % of "including"				24	54	58
…within inequality:						
From 1984 to 2002	12	39	90	6	29	71
From 1993 to 2002	9	23	34	2	12	20
- as % of "including"				20	54	58
…between inequality:						
From 1984 to 2002	29	33	37	1	4	7
From 1993 to 2002	38	40	43	21	22	24
- as % of "including"				54	55	56

***Table 2*. Fixed effect estimation of the municipal fraction of wage earners at different skills levels. (272 observations from both 1995 and 2002, thus n=544).**

	Low skilled		Medium skilled		Highly skilled	
	Para-meter	Std. error	Para-meter	Std. error	Para-meter	Std. error
Crime rate (thefts per 1,000 inhabitants)	0.0000	0.0075	0.0127*	0.0056	-0.0127*	0.0047
Municipal tax rate (county and municipal)	-0.2776*	0.0672	0.1417*	0.0500	0.1358*	0.0419
Child institution rate per month (DKK)	-0.0018*	0.0005	0.0010*	0.0004	0.0007*	0.0003
Culture expenditure per person (DKK)	-0.0035*	0.0010	0.0014	0.0007	0.0020*	0.0006
Property price (1,000 DKK per m^2)	-2.5247*	0.1932	1.8912*	0.1436	0.6335*	0.1204
Property price squared	0.0767*	0.0083	-0.0693*	0.0062	-0.0074	0.0052

Note: All variables are measured at the municipal level. All amounts inflated to 2002 prices.

* Parameter significant at a 5 % significance level.

Figures

***Figure 1*. Real GDP growth, unemployment rate and real property price changes. Per cent**

***Figure 2*. Polarization (P0) and inequality (GE0)**

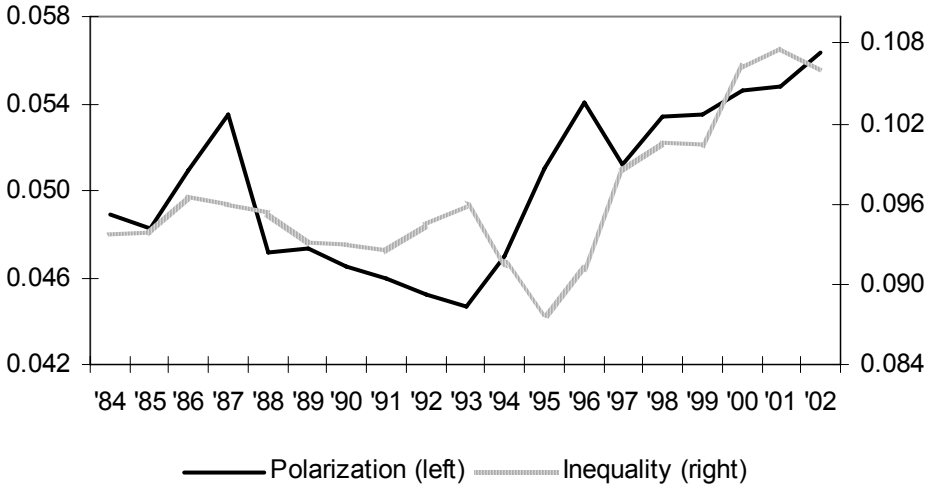


Figure 3a. Polarization (P0)/inequality (GE0), and inter/intra municipal inequality. Index 1984=1

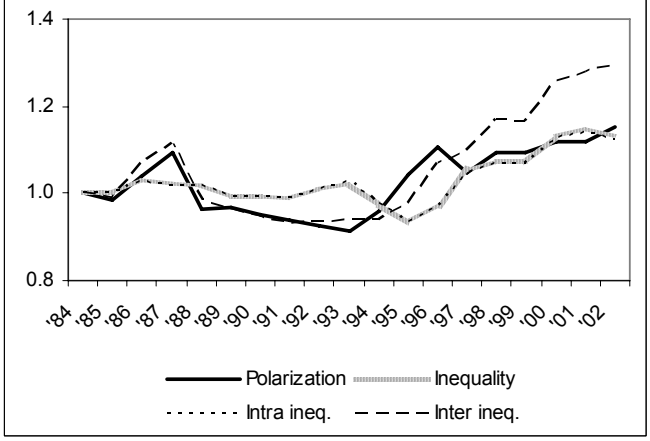


Figure 3b. Zhang-Kanbur polarization, municipalities: % contribution to change compared to 1993, α = 0

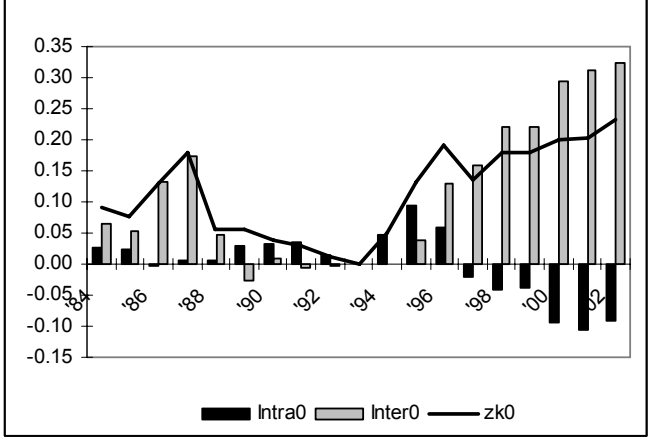


***Figure 4*. Polarization by parameter α. Index 1993=1**

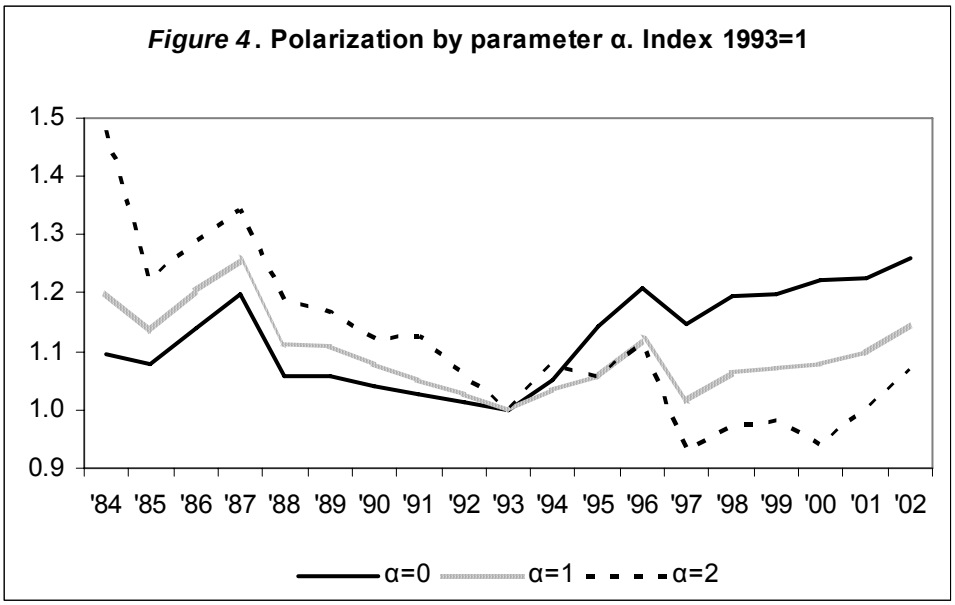
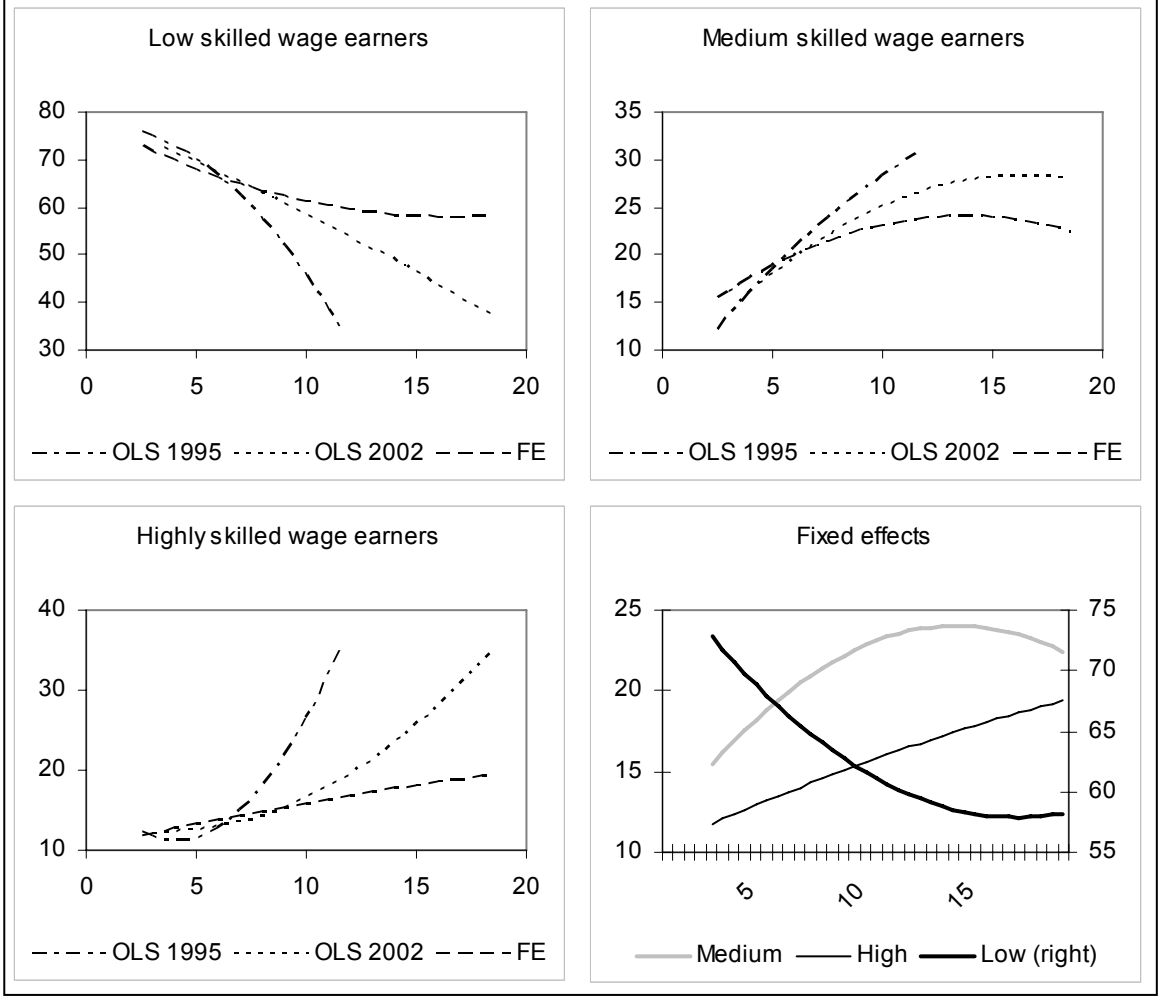


Figure 5. **Municipal skills distribution among wage earners by property prices (1,000 DKK per m^2). Fitted values from OLS and fixed effects models**



Appendix

***Table A1*. Average fraction of municipal skill level by property price (DKK per m2)**

	1995			2002		
	Basic skills	Medium skills	Highly skilled	Basic skills	Medium skills	Highly skilled
2,000	73.3	15.9	10.8			
3,000	74.8	14.2	11	69.4	18.5	12.1
4,000	72.5	16.2	11.2	72.9	15.9	11.2
5,000	70.4	17.8	11.9	69.8	17.9	12.3
6,000	65.5	20.9	13.6	66.9	19.8	13.4
7,000	63.5	22.5	14	64.6	21.5	13.9
8,000	59.1	24.8	16.2	60.5	23.4	16.2
9,000	55.7	26.4	17.9	56.7	24.5	18.8
10,000	40.2	27.9	31.9	60.2	24	15.8
11,000	38.3	28.6	33.1	57.6	25.2	17.2
12,000				56.1	26.7	17.1
13,000				55.7	26.8	17.5
14,000				46.8	29	24.2
15,000				44.5	27.3	28.2
16,000				41.6	28.5	29.9
17,000				34.2	29.7	36
18,000				34.3	28.8	36.9
All	68.8	18.3	12.9	64.5	20.8	14.7

***Table A2*. Summary statistics for data set applied in regressions. 1995 and 2002. (n=272 in each year)**

	Mean	Std. dev.	Median	Lower quartile	Upper quartile	Mini-mum	Maxi-mum
1995. *Response variables:*							
% with basic skills	68.8	8.2	70.2	65.6	74.3	33.6	82.7
% with medium skills	18.3	4.2	17.5	15.4	20.6	10.2	30.6
% with high skills	12.9	4.6	11.6	10.3	13.8	6.0	37.0
% with basic school	37.1	5.7	37.8	33.6	41.4	21.1	51.6
% with vocational training	44.1	3.4	44.3	42.6	46.0	27.6	53.4
% short further education	4.2	1.1	4.1	3.5	4.8	1.6	7.7
% with BA/B.Sc.	11.3	3.0	10.6	9.3	12.3	7.1	27.2
% with MA/M.Sc.	3.2	2.9	2.4	1.9	3.3	0.7	22.1
Explanatory variables:							
Crime rate (thefts per 1,000 inhabitants)	53.5	29.8	44.5	30.2	71.5	15.7	158.2
Municipal tax rate (county and municipal)	31.0	1.6	30.9	30.0	32.0	24.6	37.5
Child institution rate per month (DKK)	1,742	152	1,718	1,639	1,822	1,146	2,209
Culture expenditure per person (DKK)	205	163	165	84	264	1	933
Property price (1,000 DKK per m2)	5.038	1.707	4.515	3.891	5.693	2.392	11.165
Property price squared	28	21	20	15	32	6	125
2002. *Response variables:*							
% with basic skills	64.5	8.9	66.2	60.8	70.8	29.7	79.1
% with medium skills	20.8	4.2	20.2	17.9	23.6	11.1	31.8
% with high skills	14.7	5.3	13.2	11.4	15.9	7.2	40.2
% with basic school	31.8	4.8	32.3	28.6	35.1	18.4	44.5
% with vocational training	46.2	4.3	47.0	45.3	48.6	24.2	52.4
% short further education	4.7	1.0	4.6	4.0	5.4	2.3	7.0
% with BA/B.Sc.	13.3	3.5	12.6	10.7	14.9	7.4	30.0
% with MA/M.Sc.	4.0	3.7	2.9	2.1	4.1	0.9	25.8
Explanatory variables:							
Crime rate (thefts per 1,000 inhabitants)	51.7	22.8	47.1	35.3	65.4	10.1	121.3
Municipal tax rate (county and municipal)	32.9	1.1	33.0	32.4	33.7	29.0	35.4
Child institution rate per month (DKK)	2,018	175	2,004	1,908	2,100	1,179	2,645
Culture expenditure per person (DKK)	263	192	217	118	345	1	941
Property price (1,000 DKK per m2)	7.192	3.162	6.181	5.024	8.065	3.339	18.230
Property price squared	62	61	38	25	65	11	332

Note: All variables are measured at the municipal level. All amounts are inflated to 2002 price level.
Note: All calculations on educational background are done excluding people under the age of 25 and above the age of 59. Furthermore, all individuals with basic educational level enrolled in another educational program were also excluded.

***Table A3*. Fixed effect estimation of the municipal fraction of wage earners by education**

	Basic		Vocational		Short		BA/B.Sc.		MA/M.Sc.	
	Para-meter	Std. error	Para-meter	Std. error	Para-meter	Std. error	Para-meter	Std. error	Para-meter	Std. error
Crime rate (thefts per 1,000 inhabitants)	-0.0216*	0.0097	0.0243*	0.0082	0.0066*	0.0019	-0.0087*	0.0038	-0.0006	0.0023
Municipal tax rate (county and municipal)	-0.6191*	0.0864	0.4483*	0.0728	0.0383*	0.0169	0.0856*	0.0341	0.0469*	0.0203
Child institution rate per month (DKK)	-0.0055*	0.0007	0.0034*	0.0006	0.0002	0.0001	0.0014*	0.0003	0.0004*	0.0002
Culture expenditure per person (DKK)	-0.0018	0.0013	-0.0014	0.0011	0.0000	0.0003	0.0025*	0.0005	0.0007*	0.0003
Property price (1,000 DKK per m^2)	-2.8486*	0.2482	1.4308*	0.2093	0.4303*	0.0486	1.1108*	0.0980	-0.1233*	0.0584
Property price squared	0.1231*	0.0106	-0.0914*	0.0090	-0.0190*	0.0021	-0.0359*	0.0042	0.0232*	0.0025

* Parameter significant at a 5 % significance level.
Note: All calculations on educational background are done excluding people under the age of 25 and above the age of 59. Furthermore, all individuals with basic educational level enrolled in another educational program were also excluded.

Figure A1. **Municipal distribution of professions (%) among wage earners by property prices (horizontal axis, 1,000 DKK per m^2). Fitted values from six separate fixed effects models.**