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Age effects in Swedish local labour markets

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by

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Abstract

The paper studies the effects of changes in the age structure on aggregate labour market performance using a panel of Swedish local labour markets. The methodology of Shimer (2001) is used for studying the effects of youth cohort size and is extended to include the full age distribution. The results show that young workers benefit from belonging to a large cohort. This is in line with previous results for the US. Furthermore it is shown that most of the positive effect for young workers is due to an inward shift in the Beveridge-curve even though tightness seems to increase as well. In contrast to the US experience, older workers in Sweden do not benefit from large youth cohorts. Further results show that large numbers of 50 to 60 year old workers have an adverse effect on the labour market. This is consistent with negative externalities from well-matched individuals.

Keywords: Unemployment, cohort crowding, age structure, matching
JEL classification: J10, J21, J60

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1 Introduction

The topic of this paper is the labour market effects of changes in the age composition of the working-aged population. Macro and labour economists have been discussing the relationship between the age structure and labour markets for at least 30 years. The general idea has been that more young people should result in a higher unemployment rate since the youth unemployment rate is higher than the average unemployment rate.[1]

Studies of indirect effects have previously focused on identifying "cohort crowding" effects, i.e. the hypothesis that young workers perform worse on the labour market if they belong to large cohorts.[2] These studies, which mainly used time series data and older cohorts as control groups, generally found negative cohort size effects for young workers.

The methodology used in the "cohort crowding" literature assumes that cohort size only affects the members of that particular cohort. In a recent paper, Shimer (2001) challenges this idea. Studying a panel of US states, Shimer finds that an increase in the share of young workers in the economy *reduces* the unemployment rate and increases the labour force participation rate. Similar effects are observed for the average and all age-specific unemployment rates as well as for the participation rates of all age groups. The effects are particularly strong for *older* workers, which reconciles the results with the cohort crowding literature that used older workers as a control group.

The empirical results are important for several reasons. If economies with a younger labour force are more attractive to firms, one will expect regions from which young workers migrate to lose their ability to attract firms. Hence, emigration of young workers would worsen the labour market conditions of all remaining workers in the original region. If these findings are robust there are strong implications for policies that affect regional mobility. Naturally, it is necessary to know the underlying mechanisms to fully understand the policy implications.[3]

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[1] Perry (1970) is the seminal paper; two more recent examples are Gordon (1982) and Shimer (1998).
[2] See Bloom et al (1987) for a review and Korenman & Neumark (2000) for a recent study.
[3] One such issue is whether or not the effects of immigration resemble those of young workers entering the labour market.

Standard labour market models such as the matching model (Pissarides, 2000) can not explain these findings. A standard matching model predicts an increase in the unemployment rate when the youth share is increased since young people enter the labour market unmatched and it takes time to find a job. In an attempt to find a consistent explanation for the empirical results, Shimer (2001) develops a matching model ("the Fluid Labour Market hypothesis") with match-specific productivity, on-the-job search and increasing returns to scale in the matching process. He shows that the tendency for young workers to be poorly matched can reduce the expected search costs for firms and, thereby, increase the number of firms (jobs) per worker in equilibrium so that unemployment goes down for all workers.

This paper contributes to the literature by giving additional empirical evidence on the labour market effects of changes in the age structure. The empirical approach used in Shimer (2001) is applied to Swedish local labour market data to study how unemployment and participation rates are affected by the age structure in a different institutional setting. In addition to being of interest in its own right, this should shed some further light on possible explanations for the US experience.

To further investigate the relationship between the age structure and the labour market, the paper estimates the effects of other changes in the age structure. This allows us to free the results from an arbitrary restriction on the ages at which a worker should be classified as a young worker. Furthermore it allows us to study the effects of the share of older people on the economy, an issue of growing importance considering the ageing population in many OECD-countries.

The estimates of the effects of large youth cohorts show that young workers benefit from belonging to a large cohort, at least in terms of lower unemployment. This is in line with the results in Shimer (2001) and contradicts the cohort-crowding hypothesis. There are little or no effects on prime aged labour market performance. Quite in contrast to the US experience, the Swedish results indicate that large youth cohorts adversely affect the oldest workers.

The models that allow the full age distribution to affect the labour market show that the youth share effects are robust to this alteration. Furthermore, a large share of workers aged 50-60 has a negative impact on labour market performance of most age groups, both in terms of higher unemployment and lower employment.

It is also shown that more of the positive employment effect from large youth cohorts is manifested in manufacturing and mining than in construction and services. This indicates that local product demand is not the mechanism at work. Furthermore, estimates of youth share effects on tightness are positive, but most of the effect on youth unemployment rates appears to come from a shift in the Beveridge curve. This is consistent with an explanation of based on increased matching efficiency in the youth labour market.

The paper is structured as follows. *Section 2* discusses the data, *Section 3* presents evidence of age-effects on unemployment, labour force participation and employment. *Section 4* gives further evidence by deriving partial effects, and *Section 5* summarizes.

2 Data

The data have been collected from various sources. Population data come from Statistics Sweden's population register (RTB) that contains information on age and the place of residence for all individuals living in Sweden on December 31st each year. These data are available for all years since 1968.

The data on employment come from Statistics Sweden's RAMS register that documents the employment in November of all individuals in the population register. The data are available for each municipality from 1985.

Unemployment and vacancy data come from the National Labour Market Board (AMS). The data contain information on the number of registered vacancies and the number of individuals registered as openly unemployed at an unemployment office. The numbers of unemployed by municipality and age group are measured at the end of November each year to match the employment data as close as possible. The number of unemployed workers has been grouped into the following age categories: 16-19, 20-24, 25-54 and 55-64.[4]

It should be noted that this paper only considers the openly unemployed workers as being unemployed while the share of workers enrolled in labour

[4] The data for the period 1985-90 come from AMS-archives and were grouped this way. The data from 1991 onwards have been constructed from AMS "event database" HÄNDEL The unemployment figures are based on the number of individuals in "applicant-categories" 11-14 and differ somewhat from AMS official unemployment series. However, this seems to be the most consistent way to construct the series.

market programs in Sweden is quite large.[5] The program participants will be treated identically to individuals enrolled in regular education for the purpose of this paper, i.e. they are considered as being out of the labour force.[6] Unfortunately, it is not possible to test the sensitivity of the results in this dimension since age-specific data on the number of program participants at the municipal level are unavailable before 1991.

All the data have been collected at the municipal level. However, some of the municipalities are rather arbitrary administrative divisions of greater labour market regions. Thus, the data have been aggregated up to match Statistics Sweden's definitions of local labour markets (LLM:s). The algorithm that generated the LLM:s uses data on commuting habits to aggregate municipalities with frequent cross-border commuting into one LLM. Thus, using the LLM as the unit of observation should reduce any potential impact of spatial correlation due to commuting.

Statistics Sweden has updated the LLM definitions every five years since 1988. The definition used in this paper is from 1993, the year closest to the middle of the sample period. Thus, the original 284 municipalities are aggregated into 109 LLM:s.[7] Descriptive statistics for the LLM:s are presented in *Table 1*.

[5] In fact, Calmfors et al (2002) show that expenditures on active labour market policy as a fraction of GDP was higher in Sweden than in any other country during 1986-95.

[6] From a search theoretical perspective this is probably a good approximation since available evidence shows that the job-search intensity of program participants is much lower than that of the openly unemployed (Calmfors et al, 2002).

[7] One small deviation from the official definition has been done; the municipality of Nyköping was split into three parts in 1992 and the two new municipalities Trosa and Gnesta were included in another LLM according to the 1993 definition. They will however have to be included in the Nyköping LLM in the analysis in order to get the time series consistent.

Table 1. Descriptive statistics for 109 LLM:s (averages over 1985-99).

Variable	Age group	Mean	Std	Min	Median	Max
Unemployment rate	16-24	0.126	0.032	0.032	0.125	0.214
	16-19	0.090	0.022	0.022	0.090	0.156
	20-24	0.136	0.036	0.037	0.134	0.232
	25-64	0.064	0.020	0.024	0.060	0.143
	25-54	0.061	0.019	0.024	0.058	0.136
	55-64	0.076	0.026	0.024	0.071	0.177
	All (16-64)	0.071	0.020	0.025	0.068	0.147
Labour force participation rate	16-24	0.554	0.035	0.426	0.552	0.694
	16-19	0.304	0.037	0.205	0.300	0.496
	20-24	0.764	0.043	0.645	0.768	0.861
	25-64	0.838	0.025	0.708	0.841	0.901
	25-54	0.890	0.019	0.780	0.893	0.926
	55-64	0.660	0.054	0.454	0.671	0.794
	All (16-64)	0.787	0.023	0.657	0.788	0.857
Employment to population rate	16-24	0.490	0.042	0.341	0.486	0.672
	16-19	0.283	0.038	0.179	0.279	0.486
	20-24	0.666	0.049	0.500	0.662	0.825
	25-64	0.786	0.037	0.614	0.789	0.880
	25-54	0.836	0.029	0.675	0.838	0.903
	55-64	0.612	0.063	0.402	0.624	0.776
	All (16-64)	0.732	0.034	0.565	0.735	0.836
Youth share	16-24/16-64	0.183	0.018	0.133	0.185	0.237
Population	All (16-64)	49 926	125 626	1 930	16 700	1 130 458

Note: The statistics are for the variation between LLM averages over 1985-99.

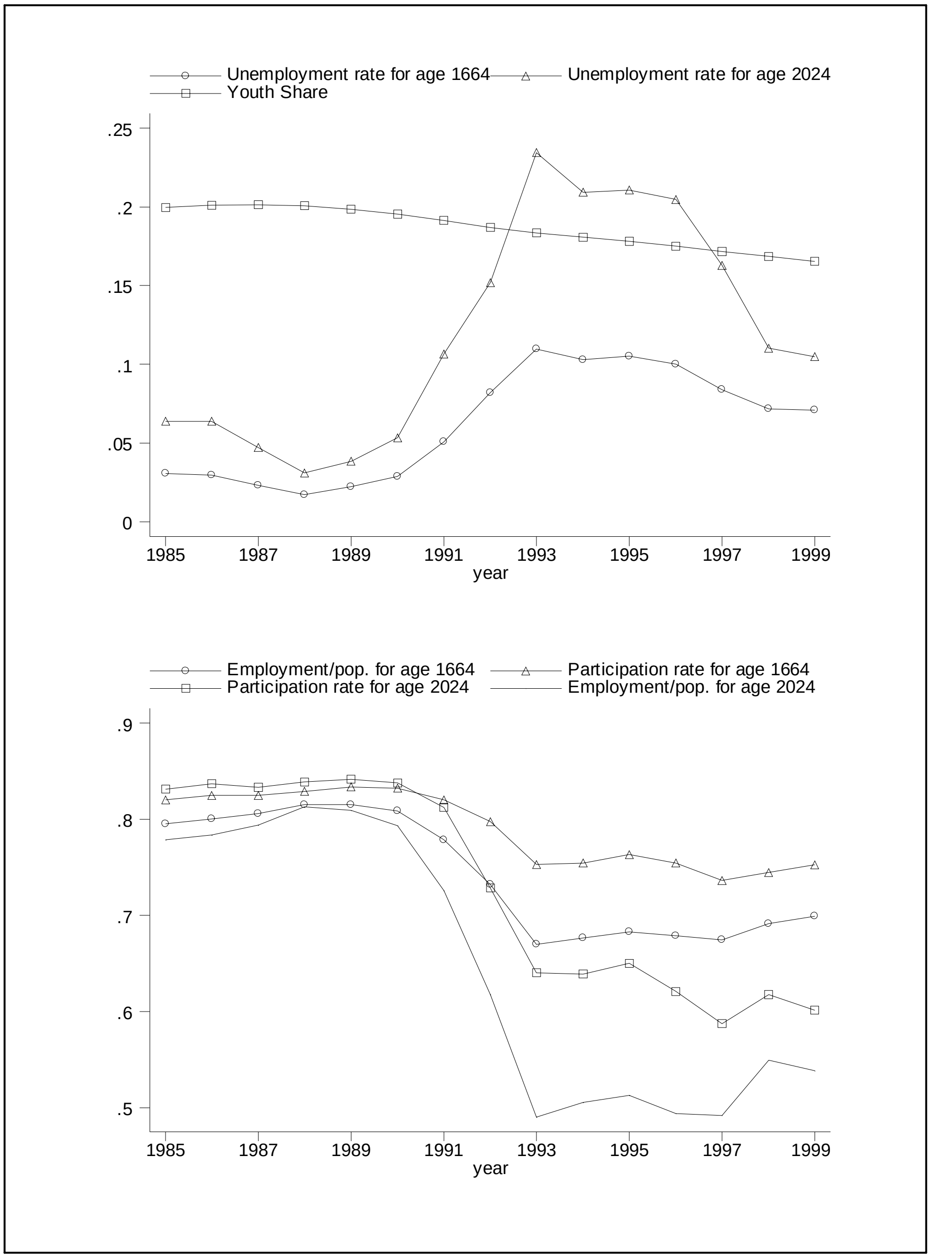

Figure 1. Averages over local labour markets of the youth share and the unemployment, employment and participation rates of all workers and workers aged 20-24.

Figure 1 shows the national averages over time for some of the data used in the paper. Two distinct features can be seen from these graphs: there was a negative trend in the share of young workers, and there was a severe worsening of labour market conditions during the first years of the 1990's. Time dummies will be used in the empirical specification to avoid identifying effects from this aggregate pattern.

3 Age structure and unemployment

The starting point of this section will be to study how the share of young working aged individuals affects the labour market. This is accomplished by applying an empirical approach similar to Shimer (2001) on Swedish data. The youth share (*YS*) will be defined as

$$YS_{it} \equiv \left(\frac{\text{population aged 16 - 24}}{\text{population aged 16 - 64}} \right)_{it}, \qquad (1)$$

where i indexes the local labour market and t the year.

Table 2. Validity of the instruments.

	No fixed effects	Including area and year fixed effects
Estimate	1.025	0.612
(Standard error)	(0.013)	(0.016)
[t-value]	[78.6]	[38.4]
R^2	0.79	0.94

Note: Dependent variable is the youth share, estimates are for the instrument defined in equation (2). Sample is a panel of 109 local labour markets during 1985-99.

Migration could be a potential problem for this study, particularly since some of the local labour markets are quite small (see *Table 1*). It is possible that young workers in Sweden are more mobile than older workers are.[8] To the extent that the mobility is motivated by labour market conditions, we may have problems with reversed causality where low unemployment rates may generate high youth shares. The solution will be to use age structure of the 16 years younger population, lagged 16 years, as an instrument to avoid problems of endogenous youth shares.[9] The instrument is equal to the youth share such as it *would have been*, had there been no migration (or deaths) among the relevant cohorts during the last 16 years. Thus, for the youth share in LLM i in year t the instrument will be constructed according to the following:

$$\text{Instrument for } YS_{it} \equiv \left(\frac{\text{population aged 0 - 8}}{\text{population aged 0 - 48}} \right)_{i,t-16} \qquad (2)$$

This instrument predicts the future youth share well as is evident from *Table 2* above which shows estimates from first stage regressions and *Figure 2* below which plots the youth share against its instrument.

[8] Indeed this is indicated e.g. by Storrie and Nättorp, 1997.
[9] Korenman and Neumark (2000) and Shimer (2001) have used lagged birth rates as instrumental variables. Since Swedish municipality-level birth rates only are available from 1968, they can not be used as instruments in this study.

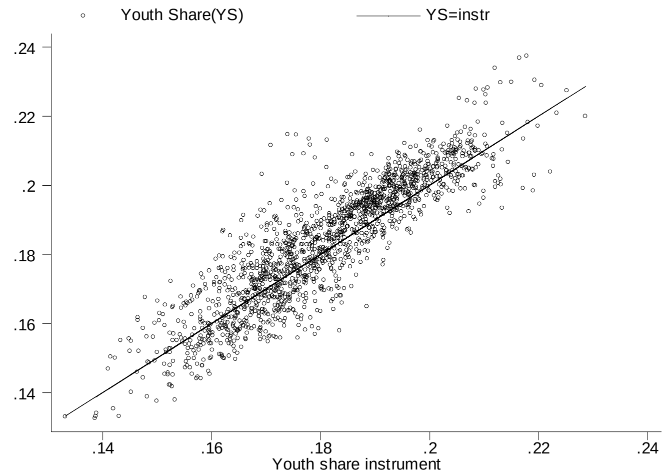

Figure 2. The youth share and the instrument (see equation 2).

3.1 The effects of youth cohort size

The estimates will be based on a double fixed-effects (area and year) specification similar to Shimer's (2001). Denoting the unemployment rate for age group k by UR^k and the youth share by YS yields the model:

$$UR_{it}^{k} = \alpha_i^k + \beta_t^k + \gamma^k YS_{it} + \varepsilon_{it}^k \qquad (3)$$

This model is estimated using the instrument defined in equation (2) with several different dependent variables such as the unemployment rate, the participation rate and the employment to population rate of different age groups (16-19, 20-24, 25-54, 55-64 and 16-64).[10]

Shimer (2001) estimated models where the youth share as well as the dependent variables entered in logarithms. However, this is slightly problematic since the estimates may change if we chose to estimate the effects of the share of older workers instead (the logs of these shares are not perfectly correlated even thought the actual shares are). For the estimates of the youth share effect this should not be a major concern, but the model is not well suited for an analysis where more age groups are allowed to affect the labour market as in

[10] Denoting the number of unemployed by U, employed by E and the population by Pop we get the unemployment rate UR = U/(U+E), the participation rate PR = (U+E)/Pop and the employment to population rate ER = E/Pop.

Section 3.3. The reason is that we know *by definition* that the sum of changes in the population shares *must* equal zero, but this is not true for the logarithms of the shares. Thus, the estimates can be sensitive to the choice of reference group in a logarithmic specification.[11] The base-line model used in this paper will therefore be linear.[12]

Estimates of youth share effects on age-specific unemployment, employment to population and participation rates are found in *Table 3*. The estimates have Newey-West corrected standard errors since estimation of equation (3) generates first order autocorrelated residuals (e.g. 0.55 for the average unemployment rate and 0.41 for the unemployment rate of 20-24 year olds). There are no signs of higher order autocorrelation.

Table 3. Estimates of the youth share effect.

Age group of dependent variable	Dependent variable		
	Unemployment rate	Labour force participation rate	Employment to population rate
16-19	-0.805** (0.231)	1.320** (0.244)	1.452** (0.234)
20-24	-0.637** (0.217)	1.606** (0.266)	1.927** (0.287)
25-54	0.182* (0.088)	0.310** (0.077)	0.172 (0.107)
55-64	0.495** (0.168)	-0.763** (0.227)	-0.882** (0.183)
All (16-64)	0.167 (0.097)	0.129 (0.088)	0.065 (0.097)

Note: Estimates are for the effects of the youth share defined as the share of 16-64 year old individuals that are 16-24 years old. Regressions are based on IV models (instrument: see equation 2) with fixed area (109 LLM:s) and year effects, see equation (3). Sample period is 1985-99 and sample size is 1635. First order Newey-West corrected standard errors are in parentheses. *Statistical significance at 5 % level. **Statistical significance at 1 % level.

[11] In principle it is possible to estimate effects of all age groups without a reference group if the shares enter in logarithms, clearly resulting in nonsense estimates that cannot be interpreted since the shares by definition always sum to one.

[12] An additional advantage of the linear model is that the autocorrelation problem discussed below is much worse in the logarithmic model.

The estimates show that young workers benefit from belonging to a large cohort. Large youth cohorts give lower youth unemployment rates as well as higher participation and employment rates. The effects on youth unemployment rates are of quite large magnitudes. An estimate of -1 predicts a 1.8 percentage points increase in the dependent variable if the youth share is increased with one standard deviation. Thus, the estimate for the effect on the unemployment rate of 20 to 24 year olds (-0.64) implies a decrease of the unemployment rate of roughly 1.2 percentage points if the youth share is increased by one standard deviation. This is quite in contrast to the "cohort-crowding" hypothesis.

The evidence from the youth cohort size on prime aged workers labour market outcome is incoherent. The estimates point to an increase in the unemployment rate as well as the participation rate. The resulting effect on employment is insignificant and positive.

The oldest workers seem to be adversely affected by large youth cohorts in terms of higher unemployment and lower labour force participation and employment.

The effect on the local average unemployment rate, which includes a compositional effect (since younger workers have higher unemployment rates than other workers, see *Table 1*) has a positive sign but is insignificantly different from zero. The effects on participation and employment rates are also positive in sign, but insignificant.

While comparing the results to a null-hypothesis of no effects at all from changes in the age structure is quite natural, it is also possible to compare the results to a null hypothesis of *only compositional effects*. The compositional effects can by calculated by assuming that all age specific rates are constant. Thus, using the numbers in *Table 1* we get derivatives with respect to the youth share that should equal 0.020 for the average unemployment rate, –0.285 for the average participation rate and –0.295 for the average employment rate if the age specific unemployment, participation and employment rates were constant.[13] Studying *Table 3* we see that the estimated youth share effects on average employment and participation rates are significantly different from the null-hypothesises of only compositional effects. The effect on the average un-

[13] The derivatives are calculated according to the following: For the participation rate $dPR/dYS= PR_{16\text{-}24}- PR_{25\text{-}64}$. And for the employment rate $dER/dYS= ER_{16\text{-}24}- ER_{25\text{-}64}$. For the unemployment rate $dUR/dYS= UR_{16\text{-}24}* PR_{16\text{-}24}/PR_{16\text{-}64}- UR_{25\text{-}64}* PR_{25\text{-}64}/PR_{16\text{-}64}$.

employment rate is on the other hand not significantly different from the null hypothesis of only compositional effects.

The appendix shows estimates of youth share effects from a variety of different models. The results show that the estimates are robust to many different treatments of the autocorrelation problem, such as including a lagged dependent variable, using an AR (1) correction or aggregating up the data to 5-year averages. It is also shown that the results are robust to a logarithmic specification and to the use of area trends instead of year dummies. Further results also show that the estimated effects are very stable over time. The only caveat is that the estimates do not appear to be very robust to estimation in differences, this is particularly true for the employment rate results for 16-19 year olds.

3.2 Comparing the results to Shimer (2001)

Overall, the estimates presented above confirm the results in Shimer (2001) regarding the effects on young workers of belonging to a large cohort. The youth unemployment rates are decreased and we also see a significant increase in labour force participation and employment. The evidence for prime aged workers on the other hand is mixed. The results for older workers presented above differ substantially from the results derived for the US in Shimer (2001). The main difference is that older workers appear to be adversely affected by large youth cohorts in Sweden – whereas they benefit in the US.

This section will replicate the model from Shimer (2001) as closely as possible to ensure that the difference in results is not driven by differences in specifications. The specification of Shimer (2001) has the youth share, the instrument and the dependent variable entering in logarithms. Furthermore, it uses an FGLS AR (1) correction to deal with the autocorrelation problem. Thus, denoting the estimated autocorrelation parameter by $\hat{\rho}$, the estimated model can be written as: [14]

$$\ln UR_{it}^{k} - \hat{\rho}\ln UR_{it-1}^{k} = \alpha_{i}^{k} + \beta_{t}^{k} + \gamma^{k}\left(\ln YS_{it} - \hat{\rho}\ln YS_{it-1}\right) + \varepsilon_{it}^{k} \quad (4)$$

[14] The FGLS procedure used for the estimation is Cochrane-Orcutt (Green, 1997 p. 748-49).

Results are presented in *Table 4*.[15] The table reproduces some results from Shimer (2001) for comparison, estimates for males only are used in the cases where only gender-separated results where reported. The only difference between the estimated models is that the Swedish model uses the log of the lagged population structure as the instrument whereas the US model of Shimer (2001) uses the log of lagged birth rates. The table clearly shows that the estimated effects in the two countries are similar for young workers whereas they do differ for older workers. The difference in results is largest for the oldest age group.

Table 4. Estimates of the youth share effect: logarithmic AR(1) specifications.

Age group of dependent variable	ln(Unemployment rate)		ln(Participation rate)	
	Sweden	*USA (Shimer, 2001)*	Sweden	*USA (Shimer, 2001)*
16-19	-2.912** (0.707)	*-1.012* (0.512)*	0.136 (0.245)	*0.565** (0.145)*
20-24	-1.549** (0.539)	*-2.180** (0.419)*	0.325** (0.092)	*0.197** (0.044)*
25-54	-0.673 (0.437)	*-2.346** (0.356)*	0.040* (0.020)	*0.068** (0.024)*
55-64	0.193 (0.486)	*-3.994** (0.725)*	0.001 (0.058)	*0.179* (0.075)*
All (16-64)	-0.269 (0.409)	*-1.807** (0.307)*	-0.022 (0.027)	*0.102** (0.035)*
Observations	1526	*784-882*	1526	*784-882*

Note: Estimates are for the effects of the *log of* the youth share defined as the share of 16-64 year old individuals that are 16-24 years old. Regressions are based on IV models with fixed area (109 LLM:s or 51 States) and year effects, see equation (4), instruments are the logarithm of equation 2 for Sweden and the logarithm of average birth rates lagged 16-24 years for the US. The models are AR(1) corrected, see equation (4). Sample period for Sweden is 1985-99. Estimates for the US from Shimer (2001) are for males only (except for the 25-54 year olds), based on a state level panel, sample period is 1978-96 with some missing values. Standard errors are in parentheses. *Statistical significance at 5 % level. **Statistical significance at 1 % level.

[15] Some small LLM:s do not have unemployed people in all age groups in all years, resulting in missing values when the unemployment rate is in logarithms (22 cases for 16-19 year olds, 2 cases for 20-24 year olds and 2 cases for 55-64 year olds). These missing values have been imputed to equal the minimum observed value of the unemployment rate in that age group (e.g. 0.0024 for 16-19 and 0.0029 for 20-24 year olds) to avoid problems of an endogenously unbalanced panel.

3.3 The effects of older cohorts

The results in *Section 3.1* and *3.2* showed that Swedish and US data generate similar estimates of youth share effects on the labour market outcomes of young workers. Meanwhile, estimates of youth share effects on the outcomes of older workers differed substantially.

A possible explanation for the differences in estimates between Sweden and the US is that the correlations between the youth share and other demographic changes might differ between the two countries. This could be illustrated by the following hypothetical example: Suppose that a high share of young workers also is associated with a large number of 35 to 45 year old workers. Assume further that this age group has a lower propensity to be unemployed than other workers in the age interval 25 to 54 do. This would imply that compositional changes *within this age group* that are correlated with the youth share will generate a negative bias on the youth shares estimates for the age group 25 to 54.

The ideal situation for identifying the effects of changes in the youth cohort size is when the youth share is uncorrelated with changes in the age structure *within* the two respective groups (young and old workers). This is not necessarily the case, and we may get misleading results if the labour market is affected by demographic changes within the two groups as well.

Figure 3 shows the correlations between the relative size (population share) of each one-year age group and the instrument for the youth share. The population share (for age j=16,17,..,64) is defined as:

$$S_{it}^{j} \equiv \left(\frac{\text{population aged } j}{\text{population aged 16 - 64}} \right)_{i,t} \tag{5}$$

The figure shows that the instrument for the youth share is positively correlated not only with the share of young workers, but also with the shares of 35 to 45 year-olds.[16] This is true both for the raw correlations and for the residuals after removing the fixed effects. The positive correlation is perhaps not surprising since these are the most likely age groups of the young workers' parents. Interesting to note is the strong cyclical pattern in the raw data where there seem to be peaks with 20 year intervals.

[16] Previous versions of this paper included a similar figure for the correlations between the actual youth share and the one-year population shares. That figure was close to identical to the one presented here.

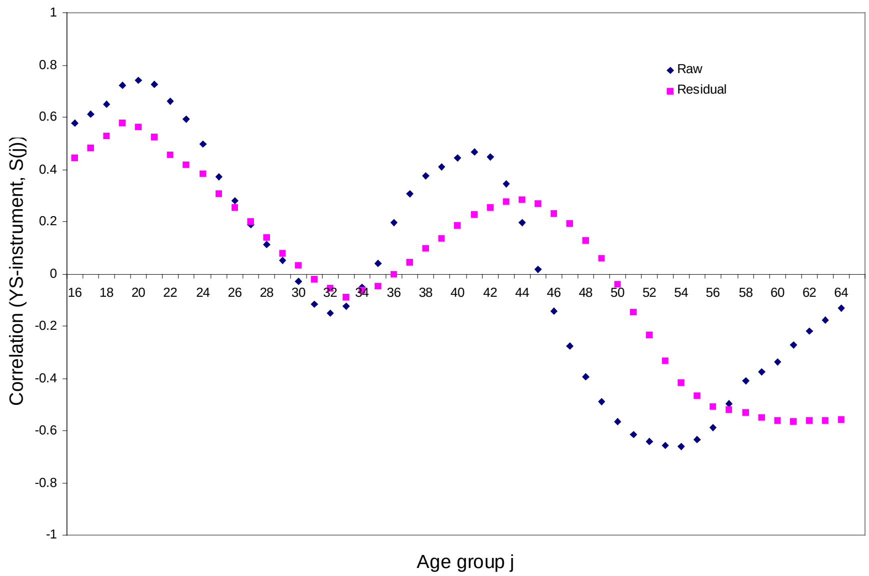

Figure 3. The correlations between the relative size of each age group and the instrument for the youth share (see equation, 2). Correlations are for the raw data and for residuals from regressions on area and year fixed effects.

The correlation structure is important since we expose ourselves to the risk of mixing youth share effects with effects of the population shares of older age groups if those are unaccounted for in the empirical model. Thus, the remaining part of this section will study the effects of the entire age distribution on the labour market to assess the robustness of the results presented earlier.

Studying the outcomes of group k, and using the population shares S^{j} (j=16,…64) as explanatory variables, we have the model:

$$UR_{it}^{k} = \alpha_{i}^{k} + \beta_{t}^{k} + \sum_{j=16}^{64} \gamma_{j}^{k} S_{it}^{j} + \varepsilon_{it}^{k} \qquad (6)$$

A normalisation is required since the population shares always sum to one. One convenient reference point is to restrict the sum of the estimates to zero:

$$\sum_{j=16}^{64} \gamma_{j}^{k} = 0\,. \qquad (7)$$

In practice it is difficult to estimate all the 49 population share parameters separately due to their inherent colinearity. There are two different solutions to this problem in the literature, use wider age groups or restrict the estimates to follow a polynomial functional form (see Fair & Dominguez, 1991 and Higgins, 1998). The second strategy will be followed here due to the availability of high quality data on the size of each one-year age group. However, the strategies yield very similar results. It will be assumed that the pattern of the population share parameters can be approximated by a fourth order polynomial functional form in age.[17] This gives a set of 49 linear restrictions on the original parameters according to

$$\gamma_j = a + b \cdot j + c \cdot j^2 + d \cdot j^3 + e \cdot j^4 \ , \ \ j = (16,....,64)\,. \quad (8)$$

Equation (6) is estimated after the data has been transformed according to the normalisation (7) and the set of linear restrictions (8). The transformations are trivial since all restrictions are linear, see Fair and Dominguez, (1991) for details. This leaves the parameters, *b* to *e*, to be estimated.[18] After estimation it is possible to recover the original parameters (γ_{16}-γ_{64}) with standard errors from equation (8).[19]

The issue of endogenous migration that may change the population structure is still a potential problem. To avoid this problem we will use instruments corresponding to the youth share instrument defined in equation (2), i.e. a 16 years lagged measure of 16 years younger population:

$$\text{Instrument for } S_{it}^{j} \equiv \left(\frac{\text{population aged } j-16}{\text{population aged 0 - 48}} \right)_{i,t-16} \qquad (9)$$

All estimates in this section will be based on IV models with fixed area and year effects and Newey-West corrected standard errors, but using an AR(1) correction instead would yield very similar results. Estimates are displayed graphically in *Figure 4*. On the x-axis we see the age groups (j = 16,..,64) and the y-axis displays the estimates (the γ_j:s) of the corresponding population share effect. The estimates should be interpreted with the normalisation of equation (7) in mind, i.e. that they always sum to zero. Thus, a significant positive employment rate estimate for age group j (i.e. $\gamma_j > 0$) implies a positive effect on employment if the share of j years old workers ($S^{\,j}$) is increased and all other shares are reduced correspondingly.

[17] The choice of a fourth order restriction is based on the observation that many of the estimates show signs of a third order functional form with one min and one max. Allowing for one additional parameter should ensure that this pattern is not generated by the imposed restriction.
[18] The parameter *a* is derived using (7).
[19] The standard errors are calculated directly from equation (8) after estimation of the parameters *a* to *e* using the covariance matrix of these estimates; this is possible since the j:s of the polynomial restriction are nonstochastic.

The panels of *Figure 4* show that the effects on the two outcome variables, the unemployment rate and the employment to population rate, are mirror images. The age groups that have a negative effect on unemployment have a positive effect on employment in most cases. It is also clear that the estimates of the effects of young workers presented in *Section 3.1* largely stay unaffected by the inclusion of other age groups.

A large share of workers in the age groups 50 to 60 has an adverse effect on the outcomes of most workers, both in terms of higher unemployment and lower employment. The only exception is the employment rate of the oldest age group (aged 55-64) that increases with the number of 55 year old workers. This is probably a compositional effect since the labour force participation of this group is declining sharply with age.

It is worth noting that there are very small effects of workers in the age groups closest to retirement. This is perhaps surprising; at least if we are willing to view the population shares of these age groups as a proxy for the outflow from the labour market.

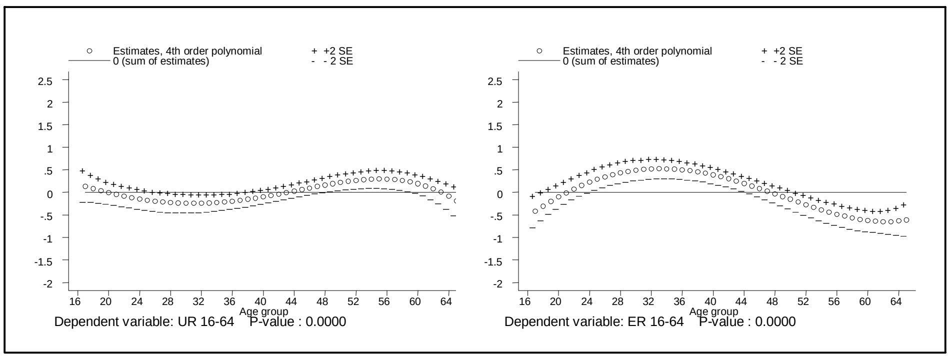

Figure 4a. Estimates of population share effects of the age groups 16, 17,..,64 on average unemployment (UR) and employment (ER) rates. All estimates are based on IV models (instrument: 16 years lagged population shares, see eq. 9). Estimates are restricted to sum to zero and follow a fourth order polynomial form (see eq. 7 and 8). The panels show 2 standard error intervals (Newey-West corrected). P-values are for F-tests of the joint significance of the population share parameters.

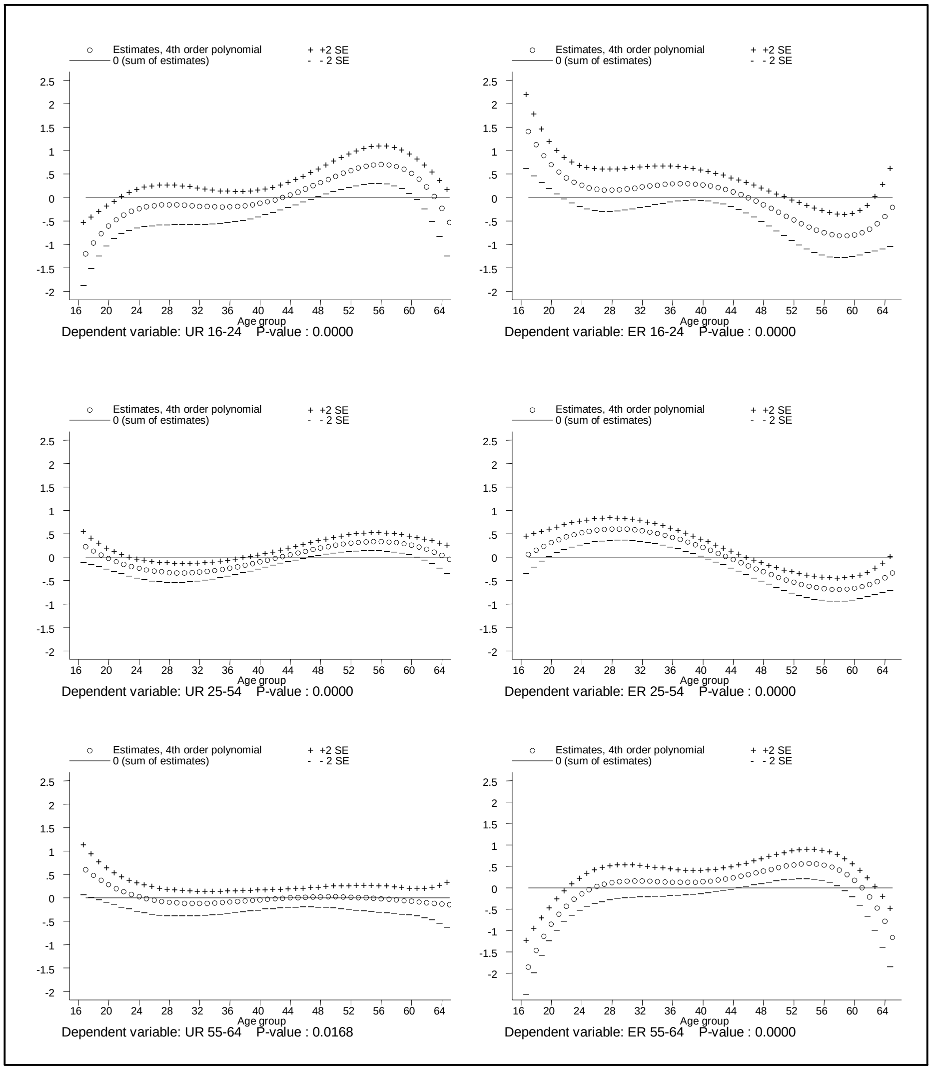

Figure 4b. Estimates of population share effects of the age groups 16, 17,..,64 on age specific (16-24, 25-54 and 55-64) unemployment (UR) and employment (ER) rates. All estimates are based on IV models (instrument: 16 years lagged population shares, see eq. 9). Estimates are restricted to sum to zero and follow a fourth order polynomial form (see eq. 7 and 8). The panels show 2 standard error intervals (Newey-West corrected). P-values are for F-tests of the joint significance of the population share parameters.

As for the interpretation of the results it is clear that the adverse effects from large shares of 50-60 years old workers could be reconciled with the matching theory of Shimer (2001). That theory predicts that the labour market should perform worse the more well-matched individuals there are, and 50-60 year old workers are probably the most well-matched of all. However, the fact that the estimates displayed in *Figure 4* show signs of age effects other than the youth share effects on the labour market outcomes raises an important question regarding the results in Shimer (2001). The question is to what extent demographic changes that are correlated with the youth share (as well as the lagged birth rate that is used as the instrument) are driving the results. Such correlations are indeed bound to appear due to the fact that people tend to have children during a limited age-span, which in the Swedish case generates the pattern shown in *Figure 3*.

4 Partial effects

This section will present further evidence by studying the effects of demographic changes on earnings, sector specific earnings and employment and by decomposing the effect into shifts of, and movements along, the Beveridge curve.

4.1 Employment and earnings by sector

One possible explanation for the positive effects of large youth cohorts on youth labour market performance shown in *Section 3* is an increase local product demand in sectors that employ many young workers. A test of this hypothesis is to study the effects on employment and earnings in different industries.

The data used in this section is constructed from the same micro data as the data on employment used earlier on in the paper. However, Statistics Sweden generated the data separately for Dahlberg and Forslund (1999) and the last two years where added on afterwards. The sample period is therefore one year shorter (1985-98), and the data are divided into slightly different age groups: 18-24, 55-65 and all workers aged at least 16.

Table 5 displays employment-effects from an increase in the youth share on overall employment and separately for three sectors; manufacturing, construction as well as retail and wholesale. It is reasonable to think that manufacturing to a large extent serves a market outside the local labour market area whereas construction as well as retail and wholesale are more locally oriented. Thus, manufacturing should be less affected if the employment effect for young workers is driven by local product demand.

The most notable feature both in terms of youth employment and overall employment is that the manufacturing and mining sector have expanded. The effect is clearly strongest for the young workers. Construction and retail and wholesale employment are either negatively affected, or not affected at all.

The results show that the increase in employment mainly is manifested in the manufacturing sector. Thus, a construction boom, or any other expansion of local product demand, can not readily explain the results. This is in line with the results for the US presented in Shimer (2001).

Since the estimated effects show signs of an increase in the employment for young workers it is natural to ask for the effects on wages. Unfortunately, local wage-level data is not available. Thus, we are restricted to studying effects on annual labour *earnings* for different age groups.

Table 5. Estimates of sector specific youth share effects.

Estimate	Employment rate			ln(Earnings)		
	18-24	55-65	All (16+)	18-24	55-65	All (16+)
All sectors	1.660** (0.284)	-1.011** (0.201)	-0.093 (0.117)	-0.698 (0.367)	-0.035 (0.195)	-0.411** (0.151)
Manufacturing, mining	2.051** (0.307)	0.081 (0.120)	0.761** (0.128)	-0.708 (0.588)	-1.106** (0.354)	-0.533* (0.215)
Construction	-0.072 (0.068)	-0.107** (0.039)	-0.167** (0.032)	-1.845* (0.825)	-0.312 (0.739)	-0.067 (0.283)
Wholesale, retail and communications	-0.015 (0.182)	-0.001 (0.062)	0.063 (0.053)	-0.806 (0.527)	-0.507 (0.430)	-0.780** (0.169)
Observations	1526	1526	1526	1526	1526	1526

Note: Regressions are based on IV models (instrument: see eq., 2) that include fixed area and year effects (equation, 3). The sample consists of 109 local labour markets during 1985-98. Dependent variables are the employment rate and the log of average earnings of different age groups by sector. Newey-West corrected standard errors are in parentheses. *Statistical significance at 5 % level. **Statistical significance at 1 % level.

Estimates displayed in the top row of *Table 5* show, as expected (since young workers earn less), that an increase in the share of young workers is associated with a fall in average earnings. However, in contrast to the US experience of rising age-specific wages, we do not see a positive effect on age specific earnings in the Swedish data, rather there are negative but insignificant estimates for both younger and older workers.[20]

The sector-specific earnings estimates for young workers show, just as the estimates for the average effect did, that young workers earnings are largely unaffected by the youth share except for a drop in construction earnings. Earnings for older workers and average earnings are decreased in the manufacturing sector.

It should be noted that the measure of annual earnings is far from perfect. Earnings by sector are calculated as the total annual earnings by individuals employed in the specific sector in November. This implies that variations in the number of weeks worked during the year will have a very large effect on the estimates. The sign of the bias depends on whether the fraction of November-employed workers that spend parts of the year without employment, or as employed in other sectors, is increased or decreased with the youth share. Andersson (1999) shows that job reallocation is counter-cyclical within Swedish manufacturing, suggesting that the bias is positive, though it is not obvious to what extent business cycle results can be generalised to this kind of supply chocks.

4.2 Tightness and the Beveridge-curve

The model in Shimer (2001) is based on a search theoretical framework. It modifies the standard matching model by introducing on-the-job search and match-specific productivity. Furthermore, there is random matching between all workers and firms instead of between unemployed workers and vacancies as in the standard model. The empirical observation that large youth cohorts are beneficial for all workers is explained as an increasing-returns-to-scale phenomena, where new entrants accept more matches, thus improving the matching process. This reduces firms costs of opening vacancies when youth cohorts are large and, as a result, the labour market will be tighter in equilibrium.

In a standard matching model (Pissarides, 2000), tightness $(\theta = \text{Vacancies}\,(\text{V}) / \text{Unemployed}\,(\text{U}))$ is determined from a free entry condi-

[20] Edin & Holmlund (1995) show, using time series data for Swedish manufacturing, that youth wages are decreased relative to prime aged wages when the youth share is increased. Their specification is however somewhat different in the sense that the dependent variable is relative wages and the only control variable is a time trend.

tion for firms and from wage bargaining. Equilibrium tightness will be a positive function of matching efficiency (ζ) and a negative function of the separation rate (s).

The model determines the unemployment rate at a given tightness from the flow equilibrium[21] (the *Beveridge curve*) in the labour market:

$$u = s/\left[s + \zeta \cdot p\left(\theta(\zeta, s)\right)\right] \tag{10}$$

where $\zeta p(\theta)$ is an unemployed workers probability of finding a job.

Thus, under the assumption that matching efficiency is a function of the youth share, it is possible to decompose the effects of demographic changes into two parts using a log-linear approximation. This will give one effect through changes in the tightness of the labour market and one effect for a given tightness (i.e. an effect through shifts in the Beveridge curve). The youth share will both increase tightness and shift the Beveridge-curve inward if it improves the matching efficiency on the labour market (i.e. if it has a positive effect on ζ).

Focusing on the youth share effect we may write:

$$\frac{d \ln UR^k}{d \ln YS} = \left.\frac{d \ln UR^k}{d \ln YS}\right|_{\theta} + \frac{d \ln UR^k}{d \ln \theta} \frac{d \ln \theta}{d \ln YS}. \tag{11}$$

Note that the expression on the left-hand side, i.e. the overall effect, is the coefficient (γ) that was estimated in *Sections 3.1* and *3.2*. For convenience we may denote the youth share effect on unemployment at a given tightness by η, the effect of tightness on age specific unemployment ϕ and the youth share effect on tightness λ and thus rewrite equation (11) as:

$$\gamma^k = \eta^k + \phi^k \lambda. \tag{12}$$

It is possible to estimate the three right-hand side parameters from two equations. The effect on tightness is given by:

$$\ln(\theta)_{it} = \alpha_i + \beta_t + \lambda \ln(YS)_{it} + \varepsilon_{it}. \tag{13}$$

This equation is common to all age groups (assuming that they all search on a common market). Secondly, we may estimate the effect of tightness on unemployment ϕ^k and the youth share effect for a given tightness η^k:

$$\ln(UR)_{it}^k = \alpha_i^k + \beta_t^k + \eta^k \ln(YS)_{it} + \phi^k \ln(\theta)_{it} + \varepsilon_{it}^k. \tag{14}$$

By estimating the η^k:s we get estimates of the youth share effects at a given tightness, i.e. of shifts in the Beveridge-curves.

[21] The equilibrium condition is that the inflow into unemployment (1-u)s is equal the outflow from unemployment $u\zeta p(\theta)$.

Two alternative definitions of tightness will be used: vacancies per unemployed and vacancies per labour force participant.[22] The standard definition of tightness is vacancies per unemployed but the model in Shimer (2001) assumes that matching takes place between vacancies and all labour force participants, employed or unemployed.

Estimates of youth share effects on tightness (λ) are displayed in the top row of *Table 6*. They show that an increase in the youth share gives a tighter labour market. The estimates are however insignificant at the 5 % level regardless of how tightness is defined. Using unemployment as the denominator yields a slightly lower p-value (6.5 %) than using the size of the labour force (7.2 %).

Table 6. Estimates of partial youth share effects.

Dependent variable	Independent variable	Overall effect		Partial effects		
		Equation (3)		Equations (13) and (14)	θ≡V/U	θ≡V/LF
θ (Tightness)	YS (Youth share)		--	λ	1.579 (0.856)	1.265 (0.702)
UR 16-24	YS	γ	-1.081* (0.432)	η	-0.703 (0.367)	-0.924* (0.426)
	θ		--	ϕ	-0.240** (0.017)	-0.125** (0.019)
UR 55-64	YS	γ	0.226 (0.399)	η	0.450 (0.363)	0.281 (0.398)
	θ		--	ϕ	-0.142** (0.020)	-0.044** (0.016)
UR 16-64	YS	γ	-0.324 (0.359)	η	-0.008 (0.297)	-0.209 (0.355)
	θ		--	ϕ	-0.200** (0.018)	-0.091** (0.015)
Observations			1635		1635	1635

Note: All estimates are based on IV models (instrument: log of eq., 2) with fixed area and year effects and Newey–West corrected standard errors. All variables enter in logarithms. Sample period is 1985-99. UR is the unemployment rate, θ is tightness, V vacancies, U the number of unemployed and LF the size of the labour force. Standard errors are in parentheses. *Statistical significance at 5 % level. **Statistical significance at 1 % level.

[22] Vacancies per working aged inhabitant in the area would give almost identical results.

Further estimates in *Table 6* are based on equation (14), with the unemployment rate as the dependent variable and tightness and the youth share as independent variables in each regression. It is clear from the estimates that the youth share effect at a given tightness is very close to the overall effect. Thus, the main part of the effect on youth unemployment seems to work through a shift in the Beveridge-curve rather than through movements along the curve.

The estimates in *Table 6* give mixed support for the Shimer-model. On the one hand, we see both an increase in tightness and an inward shift of the Beveridge curve (for young workers), just as we would expect from improved matching efficiency. On the other hand, the effect through tightness is not the most important one (which can explain why older workers do not benefit at all) as was hypothesised by Shimer. Rather, the main effect works through a shift in the Beveridge curve. Thus, the main effect should work through factors that affect the flow equilibrium that underlies the Beveridge-curve, such as the search intensity of the young workers. Some caution is however warranted when interpreting the estimates since tightness will be measured with error due to the fact that only vacancies reported to the unemployment office can be observed.

5 Summary

The paper has studied effects on the labour markets of changes in the age distribution using a panel of Swedish local labour markets between 1985 and 1999. The empirical results show that labour market performance is affected by the composition of the working-aged population.

In contrast to the cohort-crowding hypothesis, the results show that young workers benefit from belonging to a large cohort. This is in line with results from the US presented in Shimer (2001). Large youth shares do however not appear to have any positive effects on the older workers, which is in contrast to the US experience. In fact, the results indicate that large youth cohorts may have an adverse effect on the oldest workers.

The estimated youth share effects are robust to models that simultaneously estimate the effects of other demographic changes. In addition, 50 to 60 year old workers are estimated to have an adverse effect on the outcomes of most workers, both in terms of higher unemployment and lower employment. This is consistent with the hypothesis in Shimer (2001) that well-matched workers are congesting the matching process. However, the fact that demographic changes unrelated to the youth share appear to have an effect on the labour market indicates that the US youth share estimates may change if these demographic changes are accounted for.

Some partial effects of changes in the youth share are derived in an attempt to get some guidance as to the relevance of possible explanations for the results. It is shown that it is unlikely that the positive effects for young workers is driven by product demand effects since the major employment effect is in manufacturing, rather than in construction and other local services.

Some further support for a notion that a large youth share reduces youth unemployment through increased matching efficiency is found. The youth share is estimated to have a positive effect on tightness (although with a p-value just over 5 %), but most of the effect on youth unemployment appears to come from an inward shift in the Beveridge-curve. This is consistent with an explanation of increased matching efficiency for young workers.

The results presented in this paper are consistent with the hypothesis from Shimer (2001) that large youth cohorts tend to increase matching efficiency at the youth labour market. Some results also indicate that this is true at the prime aged labour market. Thus, it is perhaps anomalous that the reverse appears to be true at the labour market for the oldest age group.

One interesting feature that separates the older Swedish unemployed from most unemployed workers in the US as well as most young unemployed Swedish workers is the duration of an average unemployment spell. Long-term unemployment is much more common among the older workers than among younger workers in Sweden.[23] It is possible that the mechanisms underlying the experiences of the long-term unemployed differ from those of the short-term unemployed for whom the logic of the matching function may apply more readily. This may be one explanation for the differences in results but more research is clearly needed to clarify the mechanisms underlying the results presented in this paper.

[23] See e.g. Ackum Agell et al (1995).

References

Ackum Agell S, A Björklund and A Harkman (1996) “Unemployment Insurance, Labour Market Programmes and Repeated Unemployment in Sweden” in *Swedish Economic Policy Review* vol (2) No 1, p. 103-28.

Andersson F (1999) “Job flows in Swedish manufacturing 1972-1996” Working Paper 1999:4, Institute for Labour Market Policy Evaluation (IFAU).

Bloom, D E, R B Freeman and S D Korenman (1987), “The Labour-Market Consequences of Generational Crowding” *European Journal of Population* 3, p. 131-176.

Calmfors L, A Forslund and M Hemström (2002) “Does active labour market policy work? Lessons from the Swedish experience” Working Paper 2002:4, Institute for Labour Market Policy Evaluation (IFAU).

Dahlberg, M and A Forslund (1999) “Direct displacement effects of labour market programmes: the case of Sweden”, Working Paper 1999:7, Institute for Labour Market Policy Evaluation (IFAU).

Edin, P-A and B Holmlund (1995) “The Swedish Wage Structure: The Rise and Fall of Solidarity Wage Policy?” in Freeman R B and L F Katz eds. *Differences and changes in wage structures* NBER Comparative Labor Markets Series, University of Chicago Press, Chicago and London. pp. 307-43.

Fair, R C and K M Dominguez (1991) “Effects of the Changing US Age Distribution on Macroeconomic Equations” *American Economic Review* vol (81) No 5, p 1276-94.

Gordon, R (1982) “Inflation, Flexible Exchange Rates, and the Nartural Rate of Unemployment” in Martin Baily ed., *Workers Jobs and Inflation,* Brookings institution, Washington D.C. p. 89-152.

Greene, W H (1997) *Econometric Analysis* 3rd edition, Prentice-Hall International, Inc. Upper Saddle River, New Jersey.

Higgins, M (1998) “Demography National Savings and Capital Flows” *International Economic Review* vol 39, p 341-367.

Korenman, S and D Neumark (2000) “Cohort Crowding and Youth Labor Markets: A Cross-National Analysis” in Blanchflower D G and R B Freeman eds. *Youth Employment and Joblessness in Advanced Countries* NBER Comparative Labor Markets Series, University of Chicago Press, Chicago and London. pp 57-106.

Lindh, T and B Malmberg (1998), “Age structure and Inflation – A Wicksellian interpretation of the OECD data” *Journal of Economic Behaviour & Organization* vol 36 p 19-37.

Perry, G L (1970) “Changing Labor Markets and Inflation” *Brookings Papers on Economic Activity*

Pissarides, C (2000) *Equilibrium Unemployment Theory* 2nd ed. MIT Press, Cambridge Massachusetts.

Shimer, R (1998) “Why is the U.S. Unemployment Rate So Much Lower?” *NBER Macroeconomics Annual*, Vol 13.

Shimer, R (2001) “The Impact of Young Workers on the Aggregate Labor Market” *Quarterly Journal of Economics* 116(3), p 969-1007.

Storrie D & B Nättorp (1997) “Starthjälp. Geografisk rörlighet 1978-1995 och en utvärdering av starthjälpen” EFA-rapport 1997:49, Arbetsmarknadsdepartementet EFA.

Appendix: Robustness of the youth share estimates

Given that the high degree of autocorrelation in the residuals may be of some concern, *Table A1* shows estimates of alternative specifications to further assess the robustness of the results. The first column is a replication of the Newey-West corrected model from *Table 3* in the body of the paper.

The second column shows estimates based on 5-year averages of the variables. This model produces results that are very similar to those of the original model. This is quite reassuring, since the youth share by construction is a slow moving variable.

Yet another solution to the autocorrelation problem is to introduce a lagged dependent variable. Estimates in the third column of *Table A1* show that the long run estimates from such a dynamic model are almost identical to the Newey-West corrected estimates in the first column. The same is true for the AR (1) corrected FGLS estimates in the fourth column of the table. It should be noted however that the estimates with a lagged dependent variable require a large T to be consistent (in this case T=14). With this caveat in mind, it is clear that the estimates are robust to four different treatments of the autocorrelation problem: Newey-West correction of the standard errors, AR (1) corrected FGLS-estimation, aggregation to 5-year averages and the inclusion of a lagged dependent variable.

The models have also been estimated in differences. This does change the results somewhat. The estimated youth share effects on the unemployment rates as well as the employment rates of young workers become insignificant. The unemployment rate estimate for 20-24 year olds and the employment rate estimate for 16-19 year olds also change sign. Including area specific trends by allowing for a fixed area effect after differencing the data, gives similar results.

Table A1. Estimates of the youth share effects, alternative treatments of the autocorrelation problem.

Dep. variable: Variable	Age group	*Basic model*	5 year averages	Lagged dep. variable (long run estimates)	FGLS	Differ-ences	Differences with area trends
UR	16-19	*-0.805*** *(0.231)*	-0.676* (0.317)	-0.791** (0.284)	-0.741** (0.285)	-0.283 (0.722)	-0.060 (0.851)
	20-24	*-0.637*** *(0.217)*	-0.902** (0.285)	-0.708** (0.267)	-0.575* (0.257)	0.295 (0.468)	0.662 (0.550)
	25-54	*0.182** *(0.088)*	0.154 (0.113)	0.209 (0.114)	0.237* (0.099)	0.257 (0.148)	0.321 (0.174)
	55-64	*0.495*** *(0.168)*	0.551** (0.178)	0.454* (0.184)	0.540** (0.160)	0.702** (0.233)	0.892** (0.273)
	All (16-64)	*0.167* *(0.097)*	0.130 (0.115)	0.193 (0.119)	0.241* (0.104)	0.372* (0.154)	0.501** (0.180)
ER	16-19	*1.452*** *(0.234)*	1.516** (0.372)	1.534** (0.375)	0.967** (0.314)	-0.065 (0.431)	-0.584 (0.504)
	20-24	*1.927*** *(0.287)*	2.134** (0.490)	2.331** (0.523)	1.253** (0.352)	0.677 (0.420)	0.210 (0.484)
	25-54	*0.172* *(0.107)*	0.234 (0.162)	0.167 (0.204)	-0.153 (0.120)	-0.146 (0.132)	-0.330* (0.152)
	55-64	*-0.882*** *(0.183)*	-1.015** (0.261)	-0.766** (0.292)	-0.346 (0.176)	-0.339 (0.194)	-0.053 (0.221)
	All (16-64)	*0.065* *(0.097)*	0.120 (0.164)	0.026 (0.214)	-0.310** (0.116)	-0.350** (0.124)	-0.524** (0.142)
Standard errors		*NW*	Uncorrected	Delta	AR (1)	Uncorrected	Uncorrected
Observations		*1635*	327	1526	1526	1526	1526
Column		(1)	(2)	(3)	(4)	(5)	(6)

Note: Estimates are for the effects of the youth share defined as the share of 16-64 year old individuals that are 16-24 years old. Regressions are based on IV models (instrument: see equation 2) with fixed area (109 LLM:s) and year effects, see equation (3). Sample period is 1985-99. UR (ER) is the unemployment (employment to population) rate. *Column (1)* is a replication from *Table 3*, standard errors have been Newey West-corrected. *Column (2)* has the variables entering as averages over 5-year periods. *Column (3)* includes a lagged dependent variable, the estimates are for the long run effect, standard errors are calculated by the delta-method. *Column (4)* is estimated by the Cochrane-Orcutt procedure to correct for 1st order autocorrelation. *Column (5)* is estimated in first differences. *Column (6)* is estimated in first differences with area trends as fixed area effects after the first differencing. Standard errors are in parentheses. *Statistical significance at 5 % level. **Statistical significance at 1 % level.

Table A2 shows estimates based on a few alternative models. The first column shows OLS estimates of the youth share effect. The most notable features of this column is that the displayed estimates are smaller in size and less significant. In addition we see that the employment rate estimate for 20-24 year olds is positive in the OLS specification. This difference between the IV and OLS estimates is probably explained by the fact that many young individuals move before entering the university, generating a low participation rates in areas with high actual youth shares.

The second column of *Table A2* shows estimates from a model without area fixed effects. The purpose of estimating this model is to show to what extent the estimates are driven by the fixed area-effects. The results show that the effects for young workers are independent of whether or not these fixed effects are included, whereas the estimates for older workers change signs and become significant. The third column shows estimates that include area specific trends instead of year effects, and the estimates are very similar to those of the original model.[24]

The last three columns show estimates of a logarithmic model where the youth share and the instrument as well as the dependent variables enter in logarithms. Only the sign and significance of each estimate can be compared to the basic linear model since the interpretation of the estimates changes with the functional form. The logarithmic model is also estimated in differences with and without trends because of the sensitivity of the linear model to this change. All of these estimates support the impression that the youth unemployment rate is lower the higher the youth share is and that the effect on older workers have the reverse sign. The employment rate estimates are less robust, especially for the 16-19 year olds.

[24] An alternative to the rather crude trends is to introduce control variables based on the interaction between the area fixed effect and the average value of the dependent variable in the rest of the country (thus allowing for an area-specific impact of aggregate shocks). The inclusion of these control variables does not change the results.

Table A2. Estimates of the youth share effects, alternative specifications.

Dep. variable					Logarithmic model		
Variable	Age group	OLS	No fixed area effects	Area trends	Levels	Differences	Differ-ences with area trends
UR	16-19	-0.274 (0.161)	-0.932** (0.138)	-0.998** (0.129)	-2.720** (0.729)	-4.718** (1.787)	-5.198* (2.108)
	20-24	-0.278 (0.143)	-1.895** (0.158)	-1.205** (0.142)	-0.891* (0.438)	-1.071 (0.718)	-1.069 (0.843)
	25-54	0.089 (0.054)	-0.980** (0.082)	-0.130* (0.051)	-0.670 (0.381)	0.047 (0.544)	0.291 (0.638)
	55-64	0.073 (0.099)	-1.280** (0.125)	-0.116 (0.059)	0.226 (0.399)	1.413* (.690)	1.838* (0.814)
	All (16-64)	0.067 (0.059)	-1.098** (0.088)	-0.210** (0.057)	-0.324 (0.359)	0.329 (0.467)	0.598 (0.548)
ER	16-19	0.617** (0.173)	1.912** (0.217)	2.576** (0.156)	0.878** (0.208)	-0.439 (0.330)	-0.986* (0.385)
	20-24	-0.159 (0.244)	1.478** (0.235)	3.124** (0.183)	0.556** (0.092)	0.153 (0.128)	0.008 (0.148)
	25-54	-0.078 (0.068)	1.151** (0.122)	0.675** (0.064)	0.029 (0.027)	-0.039 (0.030)	-0.080* (0.035)
	55-64	-0.138 (0.106)	3.359** (0.225)	-0.226** (0.065)	-0.353** (0.067)	-0.110 (0.061)	-0.006 (0.069)
	All (16-64)	-0.256** (0.072)	1.684** (0.144)	0.771** (0.074)	-0.017 (0.030)	-0.107** (0.033)	-0.152** (0.038)
Standard errors		NW	NW	NW	NW	Uncorrected	Uncorrected
Observations		1635	1635	1635	1635	1526	1526
Column		(1)	(2)	(3)	(4)	(5)	(6)

Note: Estimates are for the effects of the youth share defined as the share of 16-64 year old individuals that are 16-24 years old. Regressions are, *except otherwise noted below*, based on IV models (instrument: see equation 2) with fixed area (109 LLM:s) and year effects, see equation (3). Sample period is 1985-99. UR (ER) is the unemployment (employment to population) rate. *Column (1)* is estimated by OLS. *Column (2)* is estimated without the fixed area effects. *Column (3)* includes area-specific trends instead of the fixed year effects. Columns (4) to (6) has the youth share, its instrument and the dependent variable entering in logarithms. *Column (5)* is estimated in first differences. *Column (6)* is estimated in first differences with area trends as fixed area effects after the first differencing. Standard errors are in parentheses. *NW* indicates that standard errors have been Newey-West corrected for 1st order autocorrelation. *Statistical significance at 5 % level. **Statistical significance at 1 % level.

A possible complication is that changes in the youth share may be spuriously correlated with structural change that disfavour some regions at particular times. A structural shock index was constructed in an attempt to control for this possibility.[25] The index was used as an additional control variable along with the year and area dummies. The inclusion of such an index did not affect any of the youth share estimates, but the index-estimates had an unexpected sign in some of the regressions indicating that it did not fully capture what it was intended to do (and hence the results are not displayed).

Table A3. Estimates of time-specific youth share effects.

Age group of dependent variable	Dependent variable: Unemployment rate			Dependent variable: Employment to population rate		
16-19	-0.712** (0.233)	-0.658** (0.248)	-1.187** (0.284)	1.781** (0.197)	0.526* (0.210)	1.845** (0.240)
20-24	-0.661** (0.178)	-0.504** (0.190)	-0.745** (0.217)	1.662** (0.240)	1.936** (0.255)	2.500** (0.292)
25-54	0.321** (0.062)	0.100 (0.066)	-0.026 (0.076)	-0.024 (0.077)	0.189* (0.082)	0.584** (0.094)
55-64	0.648** (0.100)	0.537** (0.107)	0.110 (0.122)	-1.026** (0.119)	-0.551** (0.127)	-0.964** (0.145)
All (16-64)	0.262** (0.065)	0.162* (0.069)	-0.036 (0.079)	0.007 (0.077)	0.012 (0.083)	0.255** (0.094)
Time period	1985-90	1991-95	1996-99	1985-90	1991-95	1996-99

Note: Estimates are for the effects of the youth share defined as the share of 16-64 year old individuals that are 16-24 years old. Regressions are based on IV models (instrument: see equation 2) with fixed area (109 LLM:s) and year effects, see equation (3). Sample period is 1985-99 and sample size is 1635. The youth share effect is allowed to vary between the 5-year periods. First order Newey-West corrected standard errors are in parentheses. *Statistical significance at 5 % level. **Statistical significance at 1 % level.

To assess whether the estimated parameters are stable over time a model where the youth share effect was allowed to vary between three five year periods was estimated. The results are displayed in *Table A3*. The results show that the estimates are very stable over time, especially for the young and the oldest

[25] The index was constructed in three steps: First a weight was calculated for each area (constant over time) for each industry based on the fraction of the total number of employed workers in that area that where employed in that particular industry. Second, a corresponding weight was calculated for each industry and year (constant over the areas). Third, the index was constructed as the covariance between the area's industry weights and the year's industry weights.

workers. This is quite reassuring given the large variation in the macro environment that is evident from *Figure 1* in the body of the paper.

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