Thünen-Series of Applied Economic Theory

Thünen-Reihe Angewandter Volkswirtschaftstheorie

Working Paper No. 89

The Distribution of Unemployment by Age and

the Unemployment Rate - A Puzzle?

by

Carsten Ochsen

Universität Rostock

Wirtschafts- und Sozialwissenschaftliche Fakultät
Institut für Volkswirtschaftslehre
2008

The Distribution of Unemployment by Age and the Unemployment Rate - A Puzzle?

Carsten Ochsen[*]

June 4, 2008

Abstract

This paper examines the effects of the distribution of unemployment by age on the level of unemployment. We provide an extension of the standard equilibrium unemployment model that allows for age dependent job finding probabilities and quit rates. In the empirical part of the paper we apply a panel estimator on data for a set of OECD countries to test the implications of the theoretical model. The results provide the somewhat surprising evidence that the distribution of unemployment by age has a hump-shape effect on the unemployment rate.

Keywords: Distribution of Unemployment by Age, Duration of Unemployment

JEL classification: J11, J64

---

[*]Department of Economics, University of Rostock; Correspondence: Carsten Ochsen, Department of Economics, University of Rostock, Ulmenstrasse 69, 18057 Rostock, Germany, e-mail: carsten.ochsen@uni-rostock.de

1   Introduction

This paper examines the effects of the distribution of unemployment by age on the unemployment rate. Since aging of the labor force will fundamentally change the shares of younger and older people that supply labor in most of the industrialized countries, it seems to be important to analyze if shifts in the age structure will change the level of the unemployment rate. From unemployment statistics it is known that the unemployment rate for the age group 55 to 64 years is lower than the unemployment rates for the age group 16 to 24 years and the prime-age group (25 to 54 years) in most of the OECD countries.[1] Hence, there are age specific differences. In addition, it is observed empirically that the average duration of unemployment increases with age while the quit rate decreases with increasing age.[2]

One way to estimate the effects of the age structure on unemployment is the shift-share approach. An example is Shimer (1998), who attributes changes in US unemployment to variations in the population shares of age groups with low and high age-specific unemployment rates. However, the results are driven by the age group specific cohort sizes and do not provide information about age related flow rates. In contrast to this Shimer (2001) estimates the impact of changes in the population share of the young (age 16 to 24) on unemployment in the US. In this case it is possible to draw conclusions about the relative flow rates for the young only. The contribution of this paper to the literature is twofold. First, our approach allows to draw conclusions about differences in age dependent net flow rates on the labor market. In contrast to Shimer (1998) we can separate the flow effects from cohort effects and unlike Shimer (2001) we consider shifts in the age distribution of the unemployed instead of a single population share. Second, the empirical results are related to a set of 16 OECD countries and, hence, allows more general conclusions.

In section 2 we provide an extension of the standard equilibrium un-employment model that allows for age dependent job finding probabilities and quit rates. In section 3 we apply different panel estimators on data for 16 OECD countries to test the implications of the theoretical model. The results provide the somewhat surprising evidence that the distribution of unemployment by age has a hump-shape effect on the unemployment rate. That is, the larger the share of prime-age (25 to 54 years) unemployed, the higher the unemployment rate.

---

[1] See, for example, the OECD Employment Outlook.

[2] See, for example, Burgess (1993), Pissarides and Wadsworth (1994), Coles and Smith (1996).

2 The Model

The aim of this paper is to analyze how the distribution of unemployment by age affects the level of the unemployment rate. Put differently, we want to examine if age dependent net flow rates on the labor market exist and, hence, affect the unemployment rate. Using a weighted summation of age dependent unemployment rates is not suitable, because this would mix the flow rate differences with the cohort size differences. On this account we favor an approach that is solely conditional on aggregated labor supply. We extend the standard equilibrium unemployment model by age dependent job finding probabilities and quit rates. In the standard approach for steady state unemployment stock-flow models the equilibrium unemployment rate is a function of idiosyncratic shocks, λ, and the average job finding probability, p:

$$u = \frac{\lambda}{\lambda + p\left(\theta\right)} \tag{1}$$

The equilibrium in search and matching models usually depends on a measure of the tightness of the labor market defined as the ratio of vacancies to unemployed, $\theta = V/U$. The probability p depends on the labor market tightness θ because it determines how successful search is. It is easy to see that the probability $p\left(\theta\right)$ can be interpreted as a weighted average with weights, for example, given by the distribution of unemployment by age.

This follows directly from

$$pu = p\left(\frac{U_1}{L} + \frac{U_2}{L} + ... + \frac{U_n}{L}\right) = p\sum_i \frac{u_i}{u}u = p\sum_i s_i u. \tag{2}$$

U_i (with $i = 1, 2, \ldots, n$) is the age related number of unemployed and L is the labor force. The term $s_i = U_i/U = u_i/u$ is the age dependent share of all unemployed. Equation (2) points out that the assumption of a constant $p\left(\theta\right)$ for a given θ is a special case of a more general approach in which different age specific reemployment probabilities are considered. Hence, according to this equation the level of the unemployment rate depends on the differences in age related reemployment probabilities for a given number of unemployed.

Similar to the average job finding probability, the average idiosyncratic shock in equation (1) can be interpreted as a weighted average with weights given by the distribution of unemployment by age: $\lambda = \sum_i \lambda_i s_i$

In the empirical part of the paper we distinguish between three different age groups only, due to data availability. Hence, for a model with young (Y), prime-age (P) and old (O) unemployed, a steady state equilibrium unemployment is given by

$$u = \frac{\lambda_Y s_Y + \lambda_P s_P + \lambda_O s_O}{\lambda_Y s_Y + \lambda_P s_P + \lambda_O s_O + p_Y(\theta) s_Y + p_P(\theta) s_P + p_O(\theta) s_O}. \quad (3)$$

While λ_i shifts the Beveridge curve outwards, p_i shifts the curve inwards. For s_i the effects are ambiguous. Simply because if one of the shares changes, at least one of the others change too. In addition, it is ambiguous if the net effect of inflow minus outflow for a specific share is above or below the average net value. Equation (3) includes age related job finding probabilities and quit rates that are not weighted by the corresponding labor force size. This allows us to compare the age related net flow rates directly. This is an important difference to the shift share approach mentioned above, for which we are not able to distinguish between flow and cohort effects.

3 Empirical Analysis

In this section we investigate empirically the relation between the unemployment rate and the distribution of unemployment by age. In order to provide a first cross country evidence for our data we calculate correlation coefficients for all countries considered in this paper. Table 1 provides the correlation coefficients for the unemployment rate and the unemployment shares of the age groups young (16 to 24 years), prime-age (25 to 55 years), and old (55 to 64 years). The coefficients refer to 16 OECD countries and the period 1975 to 2000.

The unemployment rate is negatively related to the share of young and old unemployed, but the correlation between the share of prime-age unemployed and the unemployment rate is almost zero. This means that the net flow rates for the young and the old yield a lower unemployment rate. Remember that age group related unemployment rates may yield a different pattern if the corresponding labor force sizes have large differences. The correlations between the shares reveal the shifts in the cohort size due to the demographic change.

Table 1: Correlation Coefficients: Age Groups

	s_Y	s_P	s_O
s_P	-0.9081		
s_O	-0.5428	0.1412	
u	-0.2131	0.0289	-0.5615

s_Y: share of young unemployed (15 to 24 years); s_P: share of prime-age unemployed (25 to 54 years); s_O: share of old unemployed (55 to 64 years); u: unemployment rate.

The data for the standardized unemployment rate (u) and unemployment by age is taken from the OECD online database. Unemployment by age is subdivided into young unemployed (16 to 24 years old), prime-age unemployed (25 to 54 years old), and old unemployed (55 to 64 years old). The corresponding shares have a range of 0 - 1. To get reliable estimates we consider a set of institutional and macroeconomic control variables that are taken from Nickell and Nunciata (2002).[3]

With respect to the countries considered only those are accounted for who provide data for the age groups at lest for ten years: Australia, Belgium, Canada, Denmark, Finland, France, Germany, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, United Kingdom, and USA. The period is 1975 to 1995 due to data availability.

We now analyze econometrically whether the distribution of unemployment by age has an effect on the level of the unemployment rate. In the estimates only two of the three shares can be included, since they sum up to one. We therefore estimate all three possible combinations. This allows to interpret the share effects more specifically, since the estimated effects are always on account of the excluded share. We argue that significantly different estimates for the shares correspond to significantly different net flow rates.

The following equation will be estimated:

$$\log\left(u_{it}\right) = \beta_0 + \beta_1 s_{jit} + \beta_2 s_{kit} + \sum_m \theta_m X_{mit} + \alpha_i + \gamma_t + \epsilon_{it}$$

s_j and s_k are two of the three duration groups (s_Y, s_P, s_O) and α_i and γ_t are fixed cross-country and time effects, respectively, and X is a vector of m control variables. We consider two additional specifications to account in a different way for unobserved heterogeneity. First, instead of time effects we consider a time trend and country specific first order autoregressive terms. Second, we do the same but now with country specific time trends instead of the aggregated time trend. White robust covariances are used to control for cross-equation correlation and different error variances in each cross-section unit.

Table 2 displays the main results.[4] Regressions 1 to 3 are specified as standard fixed effects models. The results are in line with the correlation pattern between the shares and the unemployment rate in table 1. That is, the larger the shares of young and old unemployed the lower the overall unemployment rate. However, the effect is significant only for the share of the

---

[3]Institutional control variables are: Benefit replacement rate, benefit duration, employment protection, year to year changes in net union density, and coordination of bargaining. Macroeconomic control variables are: Terms of Trade shocks, labor demand shocks, total factor productivity, real interest rate, and vacancy rate.

[4]Complete results will be provided upon request.

old. Regressions 4 to 6 and 7 to 9 have different specifications with respect to unobserved heterogeneity. According to these results the unemployment rate increases significantly with the share of prime-age unemployed. In addition, we find no statistically significant difference between the net flows of the young and the old. The results provide evidence that the distribution of unemployment by age has a hump-shape effect on the unemployment rate. That is, although the average duration of unemployment increases with age, the overall effect for the age group 55 to 64 years is lower than the effect of the prime-age group (25 to 54 years).

Table 2: Main regression results

	1	2	3	4	5	6	7	8	9
s_Y	1.55	-0.59		-0.95	$-2.15^{\ddagger}$		-0.69	$-2.37^{\ddagger}$	
	(1.12)	(0.52)		(0.68)	(0.38)		(0.77)	(0.30)	
s_P	$2.14^{\dagger}$		0.59	$1.19^{\sharp}$		$2.15^{\ddagger}$	$1.68^{\dagger}$		$2.37^{\ddagger}$
	(1.01)		(0.52)	(0.63)		(0.38)	(0.71)		(0.30)
s_O		$-2.14^{\dagger}$	-1.55		$-1.19^{\sharp}$	0.95		$-1.68^{\dagger}$	0.69
		(1.01)	(1.12)		(0.63)	(0.68)		(0.71)	(0.77)
R^2	0.90	0.90	0.90	0.97	0.97	0.97	0.98	0.98	0.98
fe	✓	✓	✓	✓	✓	✓	✓	✓	✓
te	✓	✓	✓						
at				✓	✓	✓			
ct							✓	✓	✓
ar				✓	✓	✓	✓	✓	✓
n	286	286	286	270	270	270	270	270	270

Notes: dependent variable: log of unemployment rate; s_Y: share of young unemployed; s_P: share of prime-age unemployed; s_O: share of old unemployed; fe: fixed effects; te: time effects; at: aggregated time trend; ct: country time trend; ar: first order autoregressive term; n: observations; $\ddagger$, $\dagger$, $\sharp$: significant at the 1% level, 5% level, 10% level; robust standard error in parenthesis.

This puzzle can be explained by a simple relation. Any given level of aggregated unemployment can arise from a certain number of persons unemployed for a short period of time or a smaller number of unemployed for a long period. Given that the age group 55 to 64 years has the least job finding probability, the inflow rate for the prime-age group must be larger than the corresponding rate for the old unemployed. The surprising part in this result is that this difference has a stronger impact on the unemployment rate than the difference between the age dependent duration of unemployment.

4 Conclusions

This paper examines the effects of the distribution of unemployment by age on the level of unemployment. The results provide evidence that the distribution of unemployment by age has a hump-shape effect on the unemployment rate. This puzzle can be explained by differences in net flow rates. That is, the larger the share of prime-age (25 to 54 years) unemployed, the higher the unemployment rate. This is surprising if one takes the different pattern of age related unemployment rates into account. With respect to the ongoing demographic change this is an important result. Provided that the share of people 25 to 54 years on the labor market deceases for the benefit of older worker (55 to 64 years) in the future, aging on the labor market reduces the unemployment rate, if these effects are not related to birth cohorts (baby boomer or not baby boomer) and age related labor market participation rates do not change noticeable.

5 References

Burgess, S. 1993, A Model of Competition between Unemployed and Employed Searchers: An Application to the Unemployment Outflows in Britain, *Economic Journal* 103, 1190-1204.

Coles, M. and E. Smith, 1996, Cross-Section Estimation on the Matching Function: Evidence from England and Wales, *Economica* 63, 589-597.

Nickell, S.J.; Nunziata, L., 2002, Labour Market Institutions Database, version 2, Centre for Economic Performance.

OECD Online Database, http://www.oecd.org/statsportal/0,2639,en_2825_293564_1_1_1_1_1,00.html

Pissarides, C.A. and J. Wadsworth, 1994, On-the-Job Search: Some Empirical Evidence from Britain, *European Economic Review* 38, 385-401.

Shimer, R., 1998, Why is the U.S. Unemployment Rate so Much Lower?, in B. Bernacke and J. Rotemberg eds, *NBER Macroeconomics Annual*, XIII, Cambridge, MA: MIT Press, 11-61.

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