

ECONOMETRIC MODELS AND DATA PROCESSING FRAMEWORK FOR MONITORING OF YOUTH LABOR MARKET IN POLAND

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This article addresses the issue of econometric approaches and necessary data support systems for monitoring of youth labor market in Poland. Based on the panel data of 16 voivodeships for the 2000–2010 period, it is established that higher education is the factor behind a decrease in the youth unemployment rate, regardless of the type of the institution — public or private. While there is a standard inverse relationship between the output growth and youth unemployment, it is likely that higher investment rate has an opposite effect. Our analysis highlights importance of several key policy issues to addressing current high youth unemployment rate in Poland, as educational mismatch or job search problems. In this regard, necessary data processing framework is outlined.

Keywords: youth unemployment rate, labor market monitoring, higher education

1. Introduction

Following the 2008–2009 world economic crisis, there is a resurgence in the unemployment of young people (aged 15–24) in Poland, similar to other European countries. The recession has exacerbated long standing disparities between European countries in this respect [3]. While youth unemployment in Germany has been falling since the mid 2000s, remained low and stable throughout the economic crisis in Netherlands and Switzerland, it has risen up above 45 percent in Spain and Greece. As remarked by Dietrich [4], “the danger of a ‘lost generation’ is no longer

merely the writing on the wall, but is becoming a terrifying reality". The impacts of economic crisis on youth unemployment are of concern at least for two key reasons: 1) missing opportunities which could contribute to output losses and social unrest, 2) high vulnerability of young people to the effects of crisis due to low income, sectoral preferences, weak political influence, low priority for investment in young people by employers [7, p. vi]. Beyond the negative effects on future wages and employability, youth unemployment often create permanent scars through the harmful effects on a number of other outcomes, including happiness, job satisfaction and health [10].

Significant cross-country differences in youth unemployment used to be explained by a number of reasons including the education system, labour market institutions and the strength of the national economy [3]. It is well recognized that there are many reasons for youth unemployment: macroeconomic situation, training systems, labour market and employment policies, stratification and distribution of opportunities in society [4], lack of income support schemes and fiscal incentives, as well as low entrance wages, bad quality jobs, diffusion of non standard labour contracts, the mismatch between the knowledge acquired through formal education and the skills required by the labour market [2]. For Poland, it is claimed that crisis-driven issues (especially the further decline in labour demand and constrained spending on labour market policy) are combined with structural problems (low labour demand, problems with the education system and labour market transitions, as well as skills mismatches) [9]. As early as of the end of 1979s, it had been noticed that of all of the factors involved in the problem of youth unemployment, the effects of the minimum wage were most extensively debated [11, p. 3].

Our aim is to analyse the factors behind youth unemployment rate in Poland and outline conceptual features of youth labor market monitoring. The structure of the paper is the following. Section 2 illustrates several important analytical issues in regard to the problem of youth unemployment. Section 3 presents data and statistical model. Empirical results are reported in Section 4. Discussion of the data processing system for graduate career path surveys as an integral part of youth labor market monitoring is subject of Section 5. As usually, a final section concludes the paper.

2. Analytical framework

Although youth unemployment is more sensitive to business cycle conditions than adult unemployment, business cycles are not sufficient to explain country differences in the level of youth unemployment [4]. Among countries with low youth unemployment, such features as a strong dual apprenticeship system (Germany), active market policies (Denmark), flexibility of the labour market

(Netherlands), ‘work for the dole’ programme (Australia) play a role [3]. In order to tackle the problem of high youth unemployment in the U.K., several proposals are made: policy measures to maximise engagement of large corporates in the apprenticeship system, stronger employer engagement in the design and delivery of apprenticeship frameworks and training, review the current balance between academic content and on the job training for all apprenticeship frameworks, implementation of early activation policies to avoid the scarring effects of long term unemployment, better opportunities for private sector on the job training for young unemployed people, more local control and better co-ordination between agencies, authorities and government departments, a guaranteed part-time job for six months for all unemployed young people combined with intensive support from providers, better integration between school and the labour market by allowing young people to experience a variety of employment opportunities.

Assuming wage flexibility across two sectors — a covered sector, in which workers receive the minimum wage, and an uncovered sector, in which wages are set by the supply and demand, effects of the minimum wage are shown in Figure 1 [11, pp. 3–16]. The supply schedule S shows the number of workers who are willing to work at any given wage, while the demand schedule D characterized the number of workers who are demanded by employers at any wage. At the initial equilibrium (p. A), the labor market clears at the wage level of W_0 . Following an increase in the minimum wage ($W_0 \rightarrow W_1$), there is a decrease in the number of workers in the covered sector from N_0 to N_1 in the short run. Assuming greater labor market flexibility in the long run, employment further decreases from N_1 to N_2 over time, as firms replace some unskilled labor by higher skilled labor and capital (p. B’). Supply effects can work in two directions. The higher wage in the covered sector could either attract some workers from the uncovered to covered sector or exert pressure on workers to leave the covered sector and enter the uncovered sector. Another option is leaving the labor market and staying voluntarily unemployed. Avoidance strategies include prolonging of or returning to education as well as interregional mobility [4].

Initially, potential labor supply at the higher wage level is N_3 (p. C). As the most likely effect of higher wages is a fall in labor supply (a leftward shift of the supply curve to S^*), it contributes to a decrease in the unemployment rate in the covered sector, but the employment stays below the equilibrium level at N_1 (short run) or N_2 (long run). As some workers could enter the uncovered sector, it is likely to increase labour supply ($S_u \rightarrow S_u^*$). In the consequence of expansionary labour supply shift, there is an increase of employment in the uncovered sector combined with a downward wage pressure ($w_0 \rightarrow w_1^u$). Assuming domination of the covered sector developments, total employment is likely to decrease.

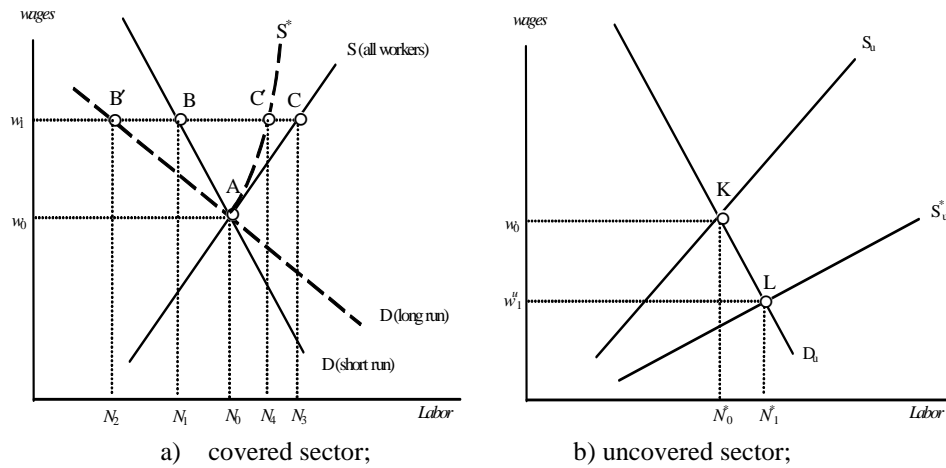


Figure 1. Labor market effects of wage pressure
 Source: [11, pp. 3–16]

Though higher wages create job opportunities in the uncovered sector, university graduates could feel it uncomfortable to accept jobs at significantly lower wage level than on average in the economy. On the other hand, university graduates should suffer from worsening of the demand conditions on the covered sector. Combination of both factors implies the inverse relationship between the wage level and youth unemployment, with an increase in the youth unemployment rate to follow. Such a result is empirically supported. Using a pooled cross-section time-series data set comprising 17 OECD countries for the period 1975–2000, Neumark and Wascher [8, pp. 223–248] established that minimum wages cause employment losses among youths, though the employment effects of minimum wages vary considerably across countries. Addressing this issue, Jimeno and Rodríguez-Palenzuela [5] develop a model which suggests that obtaining similar unemployment rates for prime age and young workers requires a certain degree of wage flexibility.

Choudhry *et al.* [2] estimate the relationship between financial crises and youth unemployment rate on a large panel of about 70 countries for the period 1980–2005. It is obtained that financial crises lead to increase in youth unemployment rate, along with such factors as slow GDP growth and disinflation. Scarpetta *et al.* [10] argue that young workers should be given support in order not to lose contact with the labour market, including income support to sustain job search, reduction of the gap between temporary and permanent contracts and diversification of educational choices, with a focus on the acquisition of qualifications that are valued by employers. Bivand *et al.* [1] recommend that schools and businesses work more closely together in shaping approaches for a decrease in youth unemployment. Among other solutions as universal youth credit or expansion of apprenticeships program, a highly targeted wage subsidy for young workers is proposed.

3. Data and statistical model

Our baseline regression model accounts for the general unemployment rate and human capital accumulation:

$$UN24_{it} = \beta_0 + \beta_1 UN_{it} + \beta_2 \Delta Y_{it} + \beta_3 I_{it} + \beta_4 \log S_{it} + \varepsilon_{it}, \quad (1)$$

where $UN24_{it}$ is the unemployment rate of young people of 16–24 age (in percent), UN_{it} is the general unemployment rate (in percent), ΔY_{it} is the output growth rate (in percent), I_{it} is the investment rate (in percent of GDP), S_{it} is the number of students per 1000 of population, ε_{it} are idiosyncratic errors, which are not correlated with independent variables.

The youth unemployment rate is supposed to be dependent on the general unemployment rate ($\beta_1 > 0$), and inversely related to the GDP growth rate ($\beta_2 < 0$). Investment effects are rather ambiguous ($\beta_3 \lessgtr 0$), as there could be a substitution away from a less-experienced young labor force but at the same time it is not ruled out that investment-induced higher demand for labor contributes to a higher employment and thus to a decrease in the unemployment rate. Assuming accumulation of human capital during university studies, number of students (or graduates) should be a factor behind lower youth unemployment. Also, it is possible that higher education serves as a sort of buffer in the case of labor market tightening, which brings about the same inverse relationship between the number of students and the unemployment rate.

Referring to the theoretical analysis above (Fig. 1), an alternative specification accounts for the wage effects:

$$UN24_{it} = \gamma_0 + \gamma_1 UN_{it} + \gamma_2 \Delta Y_{it} + \gamma_3 \Delta \log W_{it} + \gamma_4 \log S_{it} + \varepsilon_{it}, \quad (2)$$

where W_{it} is the nominal wage (in zlotys).

In both specifications, educational effects are studied not only by the impact of the number of students and university graduates, but across the number of students at public and non-public higher education institutions as well.

Using Poland's data on the general and youth unemployment rates (Fig. 2), N and $N24$ respectively, it is not difficult to illustrate a notion by Polakowski [9, p. 2] that the increase in the level of youth unemployment in Poland since 2008 has not been dramatic due to comparatively high level of youth unemployment in previous years. Similar to other countries, the youth unemployment rate is on average much higher than the general unemployment rate. This regularity does not hold only for Warminsko-Mazurskie, Zachodniopomorskie and Lubuskie voivodships. The youth unemployment is on average above 20 percent, though on a downward trend that has been reversed since the 2008–2009 world financial crisis. Post-crisis developments are similar for the general unemployment rate.

4. Empirical results

Our panel data estimates for the youth unemployment rate are presented in Table 1. All regression models have a coefficient of determination R^2 ranging from 0,68 to 0,71, which is high enough by the standards of a typical first differences specification. Regardless of the estimator used — fixed effects (FE) or random effects (RE), the unemployment rate among young people aged 15–24 is closely related to the general unemployment rate. Actually, an increase of UN_t by a percentage point is transformed into 0,46 to 0,65 percent of the higher youth

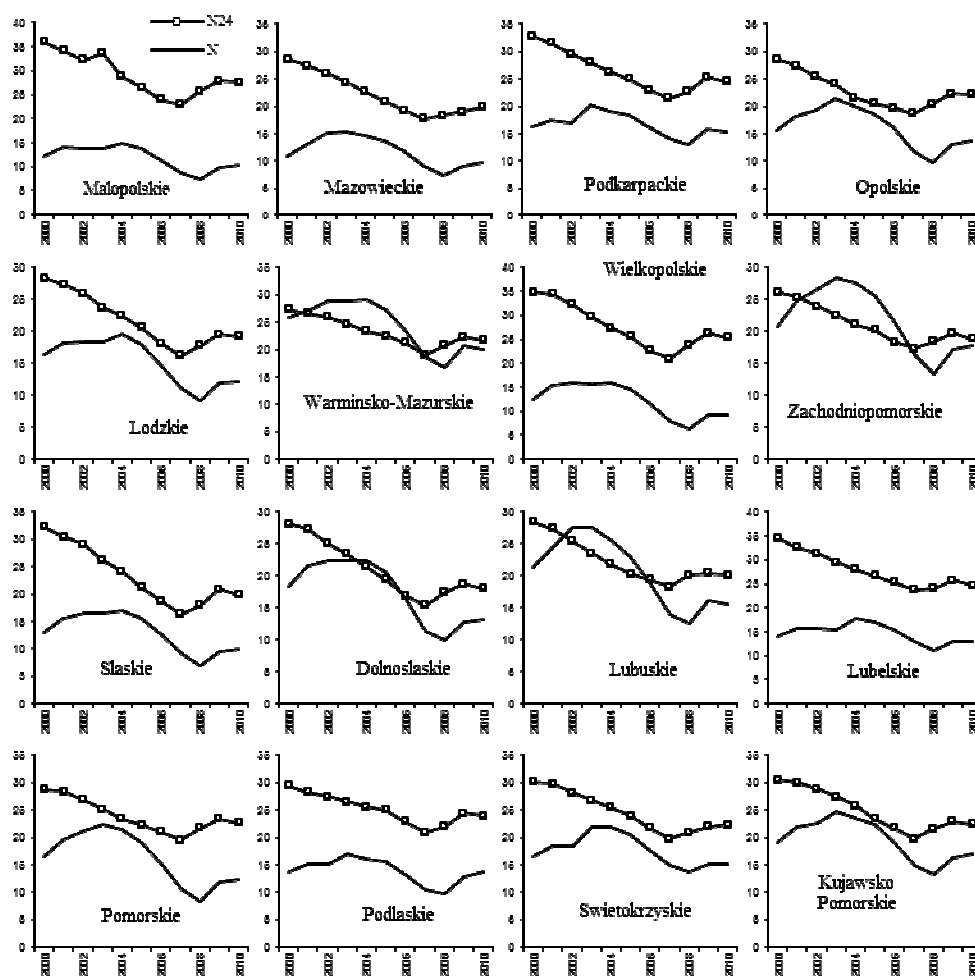


Figure 2. Poland: general and youth unemployment rates (in percent), 2000–2010
Source: GUS

unemployment rate. As expected, higher output growth rate contributes to a decrease in the youth unemployment rate. Higher investment rate is unambiguously associated with the unemployment among Poland's youth. This kind of relationship could be explained by a shift towards higher productivity and stronger demand for skilled labour. As young workers used to be less experienced (even despite a high level formal education), higher investments are working for their disadvantage.

Our important finding is that higher education is a factor behind lower youth unemployment rate. Such a result does not contradict direct relationship between the investment rate and youth unemployment, as in both cases the role of skills as one of the most important factors is underlined. Using the total number of students

Table 1. Determinants of the youth unemployment rate ($UN_{24,t}$) – specifications with number of students and investment rate

Independent variables	Estimators					
	Model 1		Model 2		Model 3	
	FE	RE	FE	RE	FE	RE
UN_t	0,592 (12,06*)	0,515 (9,57*)	0,656 (12,08*)	0,542 (9,50*)	0,464 (8,08*)	0,495 (9,29*)
ΔY_t	-0,304 (-5,72*)	-0,360 (-6,05*)	-0,340 (-6,20*)	-0,392 (-6,52*)	-0,372 (-6,36*)	-0,313 (-6,01*)
I_{t-1}	0,341 (3,67*)	0,277 (2,69*)	0,330 (3,39*)	0,260 (2,46*)	0,278 (2,70*)	0,359 (3,88*)
S_t	-0,221 (-4,79*)	-0,133 (-3,05*)	—	—	—	—
SP_t	—	—	-0,246 (-3,14*)	-0,114 (-1,75***)	—	—
SNP_t	—	—	—	—	-0,214 (-2,96*)	-0,404 (-4,96*)
N	144	144	144	144	144	112
R^2	0,68	0,69	0,68	0,69	0,68	0,71

per 1000 of inhabitants, the FE estimator brings about almost twice as high value of the coefficient on S_t as compared to one obtained the RE estimator. The same feature is observed in specification with the number of students at public universities (SP_t). However, it is just the opposite for specification with the number of students at non-public universities, with the RE estimator providing with much higher estimate of the coefficient on SNP_t in comparison with the FE estimator.

Alternative regression model with the nominal wage as an explanatory variable does support previous findings on the general unemployment rate and output growth effects (Table 2). There is strong evidence that the wage growth contributes to higher youth unemployment rate. It is consistent with the theoretical framework of interactions between covered and uncovered sectors, assuming negative net sup-

ply effects in the former (Fig. 1). If control for wage effects, both SP_t and SNP_t bring about similar results, which somewhat contrast with estimates for specification with the investment rate (Table 1). It is worth noting that the FE estimator brings about much higher estimates of the favorable education effects on the youth unemployment rate as compared with the RE estimates. As the Hausman test rejects the null hypothesis of the random effects model at the 1 percent of statistical significance for both specifications — with investment rate (Table 1) and wage growth (Table 2), it only strengthens the conclusion on significant inverse relationship between the number of students and the youth unemployment rate.

Table 2. Determinants of the youth unemployment rate ($UN_{24,t}$) — specifications with number of students and wage growth

Independent variables	Estimators					
	Model 4		Model 5		Model 6	
	FE	RE	FE	RE	FE	RE
N_t	0,524 (11,83*)	0,482 (9,69*)	0,577 (13,04*)	0,512 (10,70*)	0,420 (7,82*)	0,416 (7,41*)
ΔY_t	-0,209 (-3,49*)	-0,247 (-3,74*)	-0,214 (-3,69*)	-0,241 (-3,82*)	-0,264 (-4,55*)	-0,277 (-4,25*)
ΔW_{t-1}	21,008 (2,76*)	16,501 (1,96***)	17,942 (2,44**)	15,425 (1,90***)	21,059 (2,82*)	16,397 (1,97***)
S_t	-0,180 (-3,72*)	-0,092 (-2,07*)	—	—	—	—
SP_t	—	—	-0,355 (-4,97*)	-0,214 (-3,38*)	—	—
SNP_t	—	—	—	—	-0,359 (-4,33*)	-0,194 (-2,71*)
N	128	128	128	128	128	128
R^2	0,69	0,68	0,71	0,70	0,70	0,69

In order to check out robustness of our results, the total number of university graduates is used as explanatory variable across both specifications – with the investment rate and nominal wage growth (Table 3). It is further confirmed that there is a strong direct link between the youth and general unemployment rates, as well as an inverse relationship with output growth. The number of university graduates has a strong and highly significant impact on the youth unemployment. Such finding only strengthens the conclusion on positive contribution of higher education to fighting of youth unemployment. While making use of the number of graduates as explanatory variable rules out the assumption of avoidance strategies [4, p. 4], it is a clear indicator of the human accumulation being a useful hedge against the youth unemployment.

Table 3. Determinants of the youth unemployment rate ($UN_{24,t}$) – specifications with number of graduates

Independent variables	Estimators			
	Model 7		Model 8	
	FE	RE	FE	RE
N_t	0,468 (9,98*)	0,412 (8,37*)	0,447 (9,28*)	0,396 (7,85*)
ΔY_t	-0,318 (-6,98*)	-0,335 (-3,74*)	-0,271 (-4,80*)	-0,289 (-4,71*)
A_t	-0,952 (-7,83*)	-0,948 (-7,40*)	-0,790 (-5,07*)	-0,761 (-4,74*)
ΔI_{t-1}	0,354 (4,28*)	0,307 (3,47*)	—	—
ΔW_{t-1}	—	—	22,190 (3,06*)	17,142 (1,90***)
N	144	144	128	128
R^2	0,64	0,65	0,71	0,71

5. Conceptual features of data processing system for graduate career path surveys

Our results convince that labour market developments, output and wage dynamics are important factors of youth unemployment in general and university graduates in particular. However, these relationships could serve only as general guidelines for instrumental policies at the regional and university levels aimed at minimizing of the youth unemployment. In order to elaborate effective policy options, a detailed set of individual level data is to be analyzed. In this respect, there is a need for the information system based on automatic processing of graduate career path surveys. Its main purpose is to clarify the relationships between labor market conditions and youth unemployment by the use of multivariate data analysis.

New system of electronic university graduate surveys as the key element of monitoring of youth labour market should meet several specific requirements, which enable its effective implementation. First, architecture of electronic system should be based on principles of cloud computing. Any higher education institution, which declares its interest in participating in the system, should be able to make use of resources provided with the supplier of the system, with no need to invest in the new equipment. Access to all services should be given via Internet.

Second, it is necessary to make use of advanced statistical methods in a user-friendly way. Necessary instrumental tools for monitoring of youth labour market in Poland and multi-functional analysis of relevant data in the segment of universi-

ty graduates is provided by the OLAP (On-Line Analytical Processing) system. Its main part is the database containing comprehensive information on university graduates (Fig. 3).

Graduate surveys are supposed to provide with data across four dimensions: 1) personal (academic degree, sex, average score etc), 2) institutional (type of higher education institution, department, field of study), 3) competence (definition), 4) geographical (country, region, town). Such a comprehensive dataset allows multi-facet aggregation and analysis of (1) labor market success measured by the wage or job satisfaction levels and/or (2) effectiveness of job search strategies. Using various search queries, it is possible to obtain answers for such questions as the average wage of graduates from technical and economic universities or across fields of study. Assuming flexible database organization, the number of analytical questions to be answered is quite large being dependent on current and strategic goals of university managers and government authorities.

An important component of the automated data processing system is the module of monitoring of labor market competences expected by employers. As graduates are asked to define their subjective perceptions of the level of acquired and required competences, it provides with an opportunity to study phenomena of over- and under-education. On the other hand, employers obtain a possibility to define their preferences for workplace competences, including plans for future activities. Combining with information imported directly from most popular job search portals, it allows defining competence gaps across labor market segments. Such information should be helpful for higher education institutions in defining fields of study and subject curricula in order to minimize differences between higher education and expectations of employers.

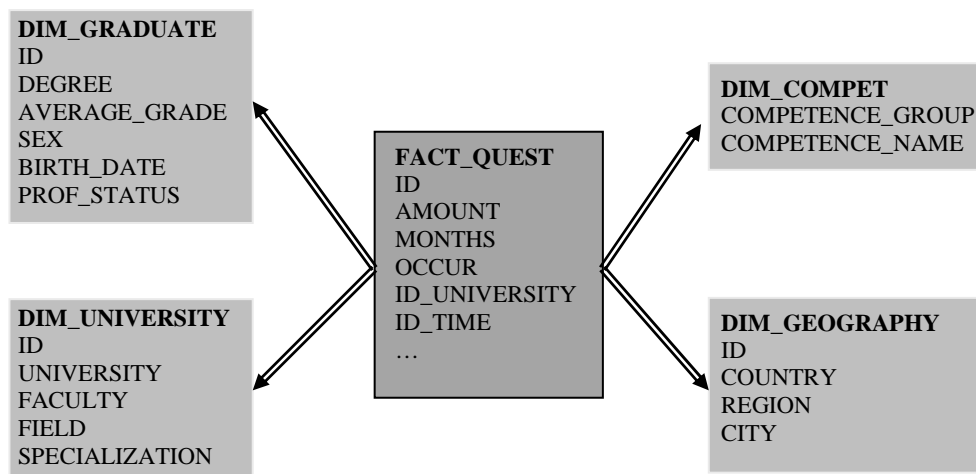


Figure 3. Information content of university graduate career path monitoring

6. Conclusions

Using regional panel data for the 2000–2010 period, it is established that the youth unemployment rate is decreased by higher output growth and improvement in the general unemployment. On the other hand, higher wage growth and investment rate are factors behind higher young unemployment rate. Given importance of labor market developments, output and wage dynamics as well as job search strategies as instrumental determinants of youth unemployment, formulation and implementation of effective policies require development for the information system based on automatic processing of graduate career path surveys. New system of electronic university graduate surveys as the key element of monitoring of youth labour market should be based on the architecture of cloud computing, with any higher education institution being able to make use of resources provided with the supplier of the system, with no need to invest in the new equipment. Also, it is necessary to make use of advanced statistical methods in a user-friendly way.

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