Tools and Techniques for Economic Decision Analysis

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Chapter 7
Modeling Labor Market Flows on the Basis of Sectoral Employment in Europe

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ABSTRACT

By tracking the cross-sectoral distribution of employment growth, it is possible to significantly improve the ability to understand aggregate fluctuations of labor force. Adequate model can provide information which sectors have stronger impact on unemployment-to-employment transitional probability. The main goal of this research is modeling the influence of sectoral employment on outflow rate across Europe during economic crisis. Authors argue that shifts in sectoral demand have strong influence on cyclical variation in unemployment-to-employment transition. Study also uncovers highly linear relationships of outflow rate from unemployment to employment and job flows at sectoral level. Empirical data proved a strong positive correlation between dispersion of employment growth across sectors and outflow rate in Europe. Shifts in demand from some sectors to the others are responsible for significant fraction of unemployment-to-employment transition probability. Reallocation shocks accounted for about 70 to 80 percent variability of outflow rates across Europe, during the 2008-2012.

INTRODUCTION

The importance of sectoral reallocation as a source of labor market flows is well known fact and it is often cited in scientific literature. Sector specific shocks are changing the pattern of labor market demand among sectors. On the basis of relation between different sectors and indicators of unemployment flows it is possible to discover which sectors are more correlated with creation of jobs and leaving the unemployment status during the recent years. By tracking the cross-sectoral distribution of employment growth, and through implementation of robust models of sectoral behavior, it is possible to significantly

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improve the ability to understand aggregate fluctuations of labor force. This information is very significant for policy makers in order to create labor market policies in efficient way. The econometrical model will provide us with information which sectors have stronger impact on reduction of unemployment throughout Europe in the last several years.

In scientific literature significant number of theoretical models of labor market are trying to explain labor market flows (hires and separations) and job gains and losses at the individual level. Authors are trying different approach, starting from sectoral-level and cross-sectional data to study the relationship between unemployment-to-employment transitional probability and job flows over five years, from 2008 to 2012. The similar approach is possible to find in Davis, Faberman, and Haltiwanger (2011). The five year period is in focus because it covers the period of "great recession" as it was named in the paper from Christiano et al. (2014).

The main goal of the research is to analyze the influence of employment shares across industrial sectors on outflow rate in European countries. Authors argue that shifts in labor demand among sectors, rather than changes in the level of aggregate demand, are the cause of cyclical variation in unemployment-to-employment transition in Europe. This study also uncovers highly linear relationships of outflow rate from unemployment to employment and job flows at sectoral level. Specific implications of the findings will be better policy measures in the field of labour market across different sectors. If we understand how different sectors behave during economic crisis in terms of employment and unemployment, it is possible to develop specific policy measures targeting sectors with greater impact on outflow rates in order to mitigate the negative effects of economic crisis on labor force.

Outflow rate is the measure of how fast an unemployed person can find a payed work (unemployment-to-employment transition). This is actually a probability of unemployed person to find a job, and it corresponds to instantaneous rates of transition on a monthly basis. There is also the inflow rate as a probability for employed person to become unemployed. Both indicators were calculated on the basis of ILO methodology. More on indicators of labor market flows can be found in Elsby et al. (2013), Shimer (2007), or Shimer (2012).

Inflow and outflow rates were designed to overcome simple stock approach and to help in more detailed analysis of labor market fluctuations and to understand the variation of unemployment from two aspects:

1. Employment-to-unemployment (separations); and
2. Unemployment-to-employment (job findings).

These measures of transition from one state to another are useful tool for targeting labor market policies in a specific way at certain subgroups of labor force or tool for adjusting the same policies and recommendations in accordance with domination of one kind of transition over another. Inflow and outflow rates are especially informative when they are analyzed in the context of economic cycles to better understand labor market upturns and downturns.

When it comes to the unemployment dynamics, there are differences in the scientific literature what leads cyclical changes in unemployment: inflows or job findings (outflows). One part of the researchers is claiming that unemployment-to-employment transition dominates and employment-to-unemployment transition has no cyclical impact. These findings were given by King (2011), Hall (2005), Shimer (2007), Shimer (2007), Gali and Blanchard (2008), Gertler and Trigari (2009), etc. According to King, the importance of unemployment-to-employment is very significant: "In summary, the results show that, while vacancies and separations both account for significant fractions of the cyclical fluctuations in unemployment, variation in the rate at which the unemployed exit the labor force can be viewed as the most important cyclical driver of the unemployment rate." (King, 2011).

Opposite statement is that separations (inflow rate) accounts closely or around the half of unemployment variance and leads cyclical variations (Fujita and Ramey (2009), Elsby et al. (2009), Petrongolo and Pissarides (2008), etc.). Most of these findings were based on the data from U.S. labor market. This research relies on the finding of the first group of authors and the focus in this paper will be exclusively on the outflow rate. The cross sectoral volatility series in employment are used to assess the importance of reallocation shocks for unemployment-to-employment transition probability fluctuations.

Elsby et al. (2013) in their research confirmed "counter cyclicality of the employment-to-unemployment transition probability, and the corresponding procyclicality of the unemployment-to-employment transition probability" on the basis of "gross flows" data from the Current Population Study (CPS) in USA. Authors' goal was to test the procyclicality of the unemployment-to-employment transition probability on the basis of the employment shifts across industries in European countries. Econometrical results will give us the possibility to recognize industries with strongest influence on the unemployment-to-employment transition probability in Europe through regression of outflow rate on sectoral employment.

First level of economic activity aggregation comprises three broad sectors: agriculture, industry and services. The textbook case of economic development is that reallocation of jobs is moving from agriculture to industry and to services sector at the end. Since authors would like to capture variation on more detailed level, they decided to focus the analysis on the second level of aggregation. The second level is based on the ISIC classification of sectors (International Standard Industrial Classification of all Economic Activities, Revision 4 (2008)). The main variables are percentages of employed persons in certain sector of total employment. Since broad classification onto three sectors can hide pattern of labor force movements, breakdown onto 19 sectors on the second level will help us in identification of more prosperous economic activities throughout Europe. This kind of analysis can serve as a guide for policy makers in order to improve skill match between labor market supply and demand through educational systems and training programs.

Before econometric analysis authors will conduct descriptive analysis of outflow rates and cluster analysis in order to compare the variations of sectoral employment across European countries and to discover the groups of similar countries. The cluster analysis will be conducted on the basis of differences between two periods. Differences were calculated from the employment shares at the beginning of economic crisis (2008) and with the latest available data (2012) in order to monitor the changes in sectoral structure across countries during the period of five years.

The paper is organized as following: After introduction, in Section 1 authors are giving the overview of the state-of-the-art in the field of labor market flows and cyclicality. In Section 2 authors are presenting the scientific methods implemented in this research and the data. Section 3 presents the results of cluster analysis and econometric models for three kinds of outflow rates. Finally, the last Section is dedicated to discussion and conclusions.

LITERATURE REVIEW

In the field of labor economy, relations between labor market flows and industrial sector from the aspect of cyclicality is the subject in the substantial number of scientific papers (Abraham and Katz (1984), Brainard and Cutler (1990), Barnichon et al. (2011), Corvers and Dupuy (2009), Davis, Faberman, and

Haltiwanger (2006), and especially Davis et al. (2011)Braun et al. (2006), Braun et al. (2007) and many others).

For example, Foster and Poschl (2009) were underlying importance of labor mobility at cross-sectional level for employment flows. Mukoyama (2013) is analyzing the job-to-job transitions in the USA and its cyclicality. Fujita and Ramey (2006) were suggesting that age is important factor and prime-age workers are demonstrating extremely countercyclical behavior while young workers on the other hand have procyclical adjustments. More general, Krusell et al. (2012), in their paper about labor supply and business cycles, are suggesting that it would be useful assessing relations between business cycles and various groups of population.

There are two aspects of looking at the problem of unemployment variations, through aggregate demand and sectoral shifts. Abraham and Katz (1984, p. 1) are suggesting that both explanations for cyclical unemployment have different policy implications and "the degree to which each of these two possible sources contributes to cyclical unemployment is a matter of considerable importance."

On the one hand, Keynesian economists are explaining unemployment through aggregate disturbances as the cause of business cycles, while on the other side business cycle theories are claiming that sectoral shocks and imperfect labor market adjustment are primarily responsible for labor market flows. Brainard and Cutler comment that constant debate "over the causes of unemployment persist in large part because it is difficult to distinguish empirically between unemployment associated with reallocation versus aggregate shocks." (Brainard & Cutler, 1990, p. 1).

Barnichon et al. (2011) were trying to explain Beveridge curve gap in USA through industry decomposition. They were trying to decompose the deviations from the Beveridge curve on the basis of micro data from Job Openings and Labor Turnover Survey (JOLTS). They have found that most of the recent deviations from the Beveridge curve can be explained through shortfalls in hires per vacancy and this phenomenon is spread across all industrial sectors, but especially in the construction, transportation, utilities, leisure, and hospitality.

Davis, Faberman, and Haltiwanger (2006) claim that the labor market flow magnitudes vary substantially across industrial sectors, even if industry groups were defined broadly. There is an example about job flow rates in construction and leisure & hospitality where flow rates are three times larger than in manufacturing. These variations in magnitude and nature of ins and outs of unemployment have significant impact on management of working force, the incidence of unemployment, and the response of unemployment to industry-level shocks.

In other paper from the same authors, there is a statement that "economic and statistical models of worker flow behavior in the cross section can significantly enhance our understanding of aggregate hires, separations, layoffs and quits" (Davis, Faberman, & Haltiwanger, 2011, p. 30).

The last economic crisis had strong impact on the cyclical behavior of unemployment. According to Elsby et al. (2011, p. 2) "The labor market downturn that accompanied the 2007-2009 recession was the most severe experienced in the postwar era, and the subsequent recovery has been tentative and uneven." The same group of authors is claiming that labor demand recovered modestly and it is not enough to generate significant drop of unemployment rate. This is why we have to analyze the labor market flows during great recession to discover which industries had more significant impact on the recovery of labor market in the context of creating efficient employment policies.

Modeling of labor market flows across sectors on the basis of econometrical techniques is in a way standard approach. Shimer argues that "if one wants to understand fluctuations in unemployment, one must understand fluctuations in the transition rate from unemployment to employment, the 'outs of unemployment" (Shimer, 2007). For example, Corvers and Dupuy (2009) were trying to estimate labor demand across sectors and occupations by using the system dynamic OLS techniques. They used the employment data from Labor Force Survey (LFS) of Statistics Netherlands. The major goal was to document the importance of short run dynamics of occupational employment among sectors, although they also estimated long run relations between sectoral and occupational employment. They discovered substantial differences within industries in the importance of intersectoral dynamics. Some sectors are strongly affected by intersectoral dynamics, like agriculture, transport, and banking and insurance, while many manufacturing industries are barely affected by other sectors in the short run.

Many other authors also conducted worker flows analysis but from the perspective of individuals (Blanchard, Diamond, Hall et al. (1990), Fallick and Fleischman (2004), Shimer (2007), Fujita et al. (2007), Fujita et al. (2008), etc.), Mueller (2012). This type of research studies is based on the longitudinal data on the individual employment status and cross-sectional data of employment duration and unemployment spells. The major goal of this studies is estimation of different labor market flows (between jobs, into and out of employment, unemployment, activity, and inactivity).

Large part of scientific sources about labor market flows is focused on the labor market of USA and their cyclicality. It is described and analyzed in details from many aspects. For example, Christiano et al. (2010) were analyzing involuntary unemployment and business cycles. Also, in Cristiano et al. (2013) they were writing about unemployment and business cycles, then Braun et al. (2007) were describing supply and demand shocks and labor market fluctuations, Hall (2005) tried to explain labor market flows in USA over the past fifty years, especially in the periods of crisis, etc.

There is significantly smaller number of papers about labor market flows in Europe. For example, in the paper from Elsby et al. (2008), authors are providing a set of comparable estimates for the inflow and outflow rates from unemployment for 14 OECD countries by using publicly available data collected through labor force surveys. Smith (2010) is examining the importance of job finding and separation in UK on the basis of data from British Household Panel Survey. Perhaps the problem is in the lack of reliable and elaborate data from all European countries. The results from Elsby et al. (2008) showed that among Anglo-Saxon countries inflow rates are contributing to unemployment variations by 20%, while outflow rates are contributing by 80%. In European countries this proportion is approximately 50:50 percent.

SCIENTIFIC METHODS

For the analysis authors were using the KILM comprehensive database of country-level data (Key Indicators of the Labor Market). KILM (8th Edition software) is multi-functional research tool of the International Labor Organization (ILO). Authors have created small panel-data series with 33 European countries over 5 year period (from 2008 to 2012). Data for 2012 were the latest available data.

Indicators of labor market fluctuations (inflow and outflow rates) in KILM database are displayed as estimates of unemployment transitions on monthly basis from employment to unemployment and unemployment to employment. Estimations were done on the basis of data on unemployment spells of different durations (less than one month, less than 3 months, less than 6 months, and less than one year). In the case of duration of less than one month, estimations were conducted following the methodology presented by Shimer (2012).

KILM database also contains weighted estimates of fluctuation rates, which are calculated on the basis of the methodology presented by Elsby et al. (2013). The weighted estimates of labor market flows were implemented when there is no evidence of unemployment duration or duration of less than one month.

Through modeling authors have implemented standard econometrical procedure for panel data series and model selection was based on the Breusch-Pagan test and Hausman test for the selection between fixed and random effects. Authors have created three models using three different indicators of unemployment-to-employment transition probability as dependent variables:

- Outflow rate defined by Elsby et al. (2013) (OutE)
- Outflow rate for unemployment spells of less than 12 months (OutSd12)
- Weighted outflow rate (OutWeighted).

As independent variables authors were using employment shares of 19 out of 22 industrial sectors according to ISIC classification of sectors (International Standard Industrial Classification of all Economic Activities, Revision 4 (2008)).

In order to avoid perfect multicollinearity, three categories were excluded from the analysis: T - Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use; U - Activities of extraterritorial organizations and bodies; X - Not classifiable by economic activity. Also, for these three variables there are differences in national classifications and missing data problem because many countries did not report data for the categories in question. According to KILM (ILO, 2014) employment-by-sector indicators can be different across countries in the case of female employment in armed forces, self-employment and contributing family members. This elimination causes some limitations to this study but does not actually interfere significantly with the results and conclusions because the obtained models cover all major sectors of economic activity.

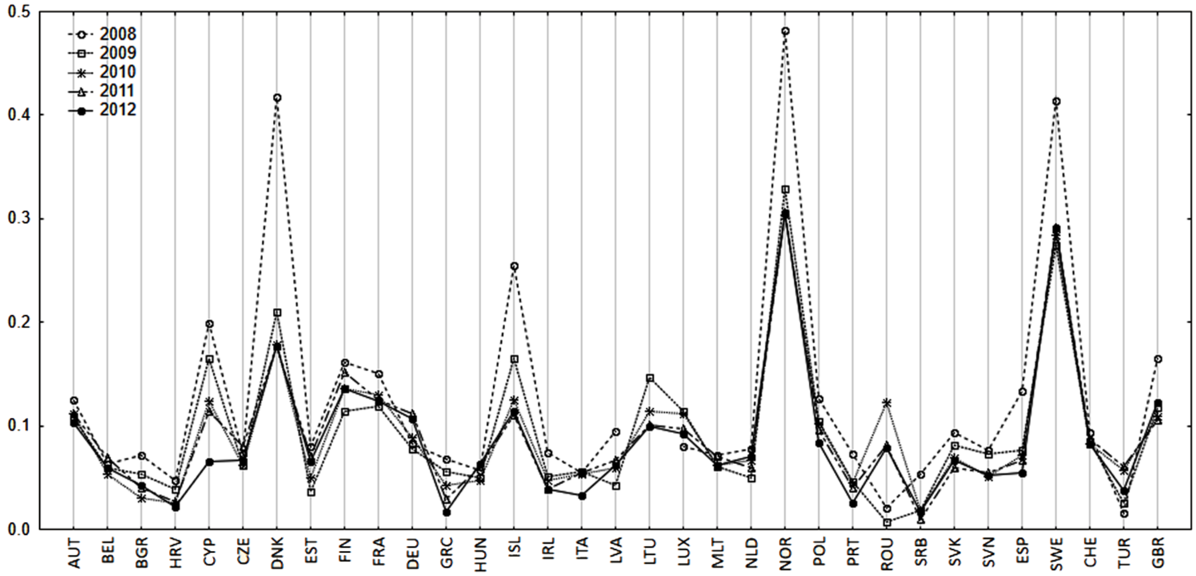
At the beginning of the analysis authors have done descriptive analysis of outflow rates and non-hierarchical clustering in order to compare the shares of sectoral employment across European countries and to identify the groups of similar countries. The cluster analysis has been conducted on the basis of differences in employment shares between two periods, between 2008 and 2012.

RESULTS

Figure 1 is showing the variations of outflow rate (calculated by Elsby et al. (2013)) since the beginning of economic crisis in 2008 until 2012, which are the latest available data from ILO, across European countries. We can see that unemployment-to-employment transition probability dropped during the five year period for almost all countries. The outflow rate is actually gradually dropping down since the beginning of recession. The only positive exception is Germany where the situation is opposite because outflow rate has grown. In the case of Lithuania data for 2008 were missing but it is easy to notice that indicator in question is also decreasing.

The explanation for Germany probably lies in the substantial flexibility of German labor market, where drop of employment in construction (F) and manufacturing (C) is compensated with growth in other sectors which are more resistant to the influence of economic crisis, like electricity, gas, steam and air conditioning supply (D) where outflow rate has grown from 0.8 in 2008 to 1.0 in 2012. The similar cases are sectors I (accommodation and food service activities), J (information and communication), L

Figure 1. Variation of outflow rate according to Elsby et al. (2013) during five-year period (2008-2012)
Source: Author's own calculations.



(real estate activities), M (professional, scientific and technical activities), N (administrative and support service activities), P (education), and Q (human health and social work activities).

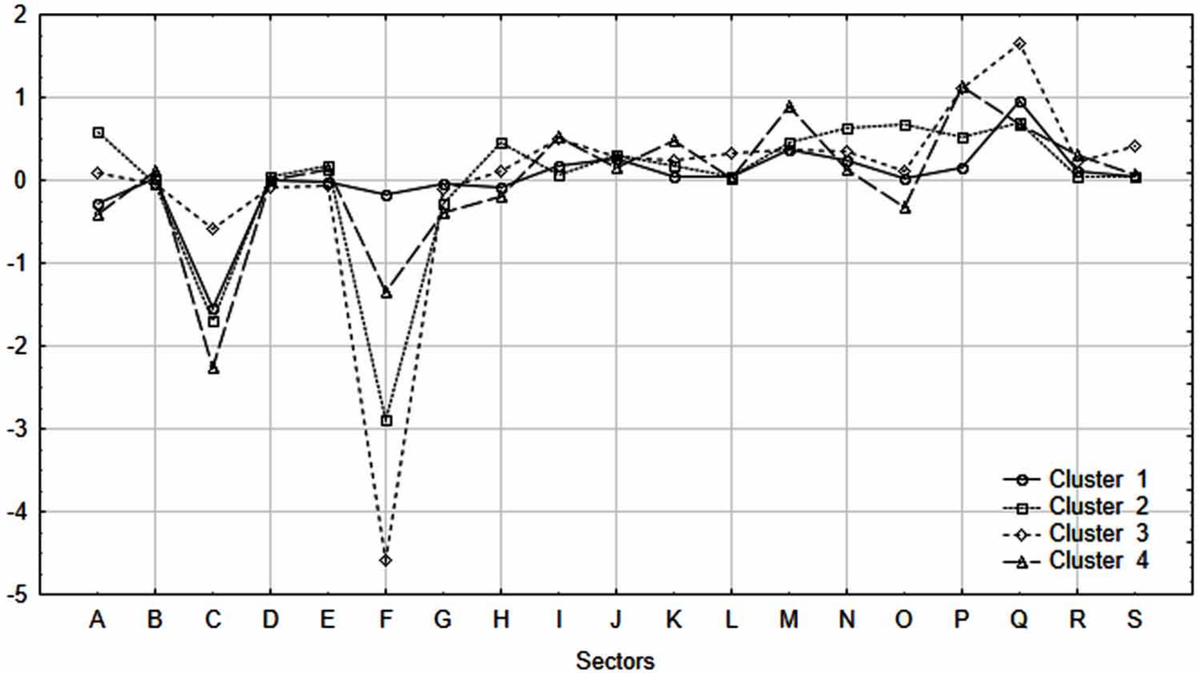
This graph is showing us that the impact of economic crisis is widespread across entire region and unemployment-to-employment transition probability is showing the similar variations in almost all countries. In Appendix there are two more graphs with outflow rates for the 12 months unemployment spells and for weighted estimates of fluctuation rates. The question is which industrial sectors are significantly influencing the variations of outflow rate?

The next step was to conduct cluster analysis of European countries in the case of employment shares across industrial sectors in order to show variations and to discover groups of similar countries. Results of non-hierarchical clustering are showing four different clusters. Analysis of variance discovered that in the case of 8 out of 19 sectors there are statistically significant differences among clusters:

- A - Agriculture, forestry and fishing
- C - Manufacturing
- F - Construction
- H - Transportation and storage
- I - Accommodation and food service activities
- M - Professional, scientific and technical activities
- P - Education
- S - Other service activities.

Complete results of cluster analysis are presented in the Appendix of this paper. The following picture (Figure 2) is showing the average differences of employment shares between 2008 and 2012 across sectors for each cluster separately.

Figure 2. Average differences of sectoral employment shares between 2008 and 2012 across four clusters
Source: Author's own calculations.



Changes in demand are manifested in the following way across sectors: The biggest "losers" are construction (F) and manufacturing (C). Considerable drop of demand is noticed in agriculture, forestry and fishing (A) but not in all countries, and also in the case of transportation and storage (H) and public administration and defence; compulsory social security (O). Some countries actually had the increase of employment in these three sectors. On the other side, the biggest "winners" where employment moved during the period of crisis are accommodation and food service activities (I), financial and insurance activities (K), professional, scientific and technical activities (M), education (P), human health and social work activities (Q), and other service activities (S).

Cluster 1 is the largest group with 13 countries and it is characterized with smallest differences between two periods when it comes to the employment shares across sectors, which means that in almost all sectors the level of employment shares in 2012 is equal to the level in 2008, with exception of sector C (manufacturing) – largest decrease, and Q (human health and social work activities) were they have increase of employment shares. Cluster 2 is comprised out of five Eastern European countries plus Greece and this cluster has the significant drop of employment shares in sector C (manufacturing) and F (construction) and largest positive movement in the case of sector A (agriculture, forestry and fishing), H (transportation and storage), N (administrative and support service activities), and O (Public administration and defense; compulsory social security). Cluster 3 has five countries and with largest negative difference in the case of sector F (construction), while in many other sectors their performance was above the average. Cluster 4 has five countries with largest negative differences in the case of sectors A (agriculture, forestry and fishing), C (manufacturing), H (transportation and storage), and O (administration and defense; compulsory social security), while they have the increase of employment shares in sectors K (Financial and insurance activities), and M (professional, scientific and technical activities). In general, the conclusion is that employment shares during the five years of recession are shifting from production sectors like agriculture, manufacturing and production towards non-industrial, public sectors like education, health, public administration, etc.

From the aspect of policy measures, the results of cluster analysis are suggesting that in the case of the countries from Cluster 1, for improvement of employment and returning to the levels before economic crisis policy measures must be targeted most of all towards manufacturing sector (C), agriculture, forestry and fishing (A) and construction (F). In the case of Cluster 2, policy measures must be targeting increase of employment in manufacturing sector and construction also. Countries in Cluster 3 have extremely difficult problem in the manufacturing sector, but they can continue to implement the existing policy measures in the case of sector Q (human health and social work activities) because that sectors are in relatively better position after crisis then before. Cluster 4 must target its policy measures towards sectors A, C and F, but they can be satisfied with the situation in sectors M (professional, scientific and technical activities) and P (education). Similar sectors are the problem across clusters, but the magnitude is significantly different. Therefore policy measures in construction must have much stronger impact in countries from clusters 2 and 3, while in the case of the countries from cluster 4 stronger impact must be obtained in the case of manufacturing, even at the expense of some other sectors.

Econometric Model

The results of econometric analysis are presented in the following table (Table 1). The difference among three models is in the choice of dependent variable, which is named in the second row of the table.

On the basis of F-test we can conclude that all three models are good because p-values are very small and less than significance level of 1% (last row in Table 1). More detailed tables were given in the Appendix of this paper. In the case of Model 1 authors have selected pooled OLS estimation because in the case of panel data analysis they have obtained high p-values for Breusch-Pagan test (p=0.124651) and Hausman test (p=0.164783). Heteroskedasticity for Model 1 was not detected (White's test for heteroskedasticity, p=0.233216).

In the case of Model 2 authors have also selected to conduct the pooled OLS estimation because of high p-values for Breusch-Pagan test (p=0.137956) and Hausman test (p=0.20013). The model was corrected because of detected heteroskedasticity (White's test, p=2.89816e-005). The same situation is in the case of Model 3: pooled OLS estimation, Breusch-Pagan test (p=0.130081), Hausman test (p=0.221135) and correction for detected heteroskedasticity (White's test, p=6.61673e-005).

In the case of the Model 1, where authors regressed outflow rate by Elsby et al. (2013) on sectoral employment shares, the conclusion is that employment growth in different sectors has different impact on the probability of unemployed person to find a job. For example, the employment growth of 1% in sector A (agriculture, forestry and fishing) will on average increase the outflow rate for 0.009%. Beside sector A, positive influence on employment probability is also in the case of sectors B, C, F, G, J, L, M, O, and Q. It is interesting that sector K (financial and insurance activities) has negative sign, and it is probably because of different variations in that sector during economic crisis. The largest impact on the growth of unemployment-to-employment transitional probability is in the case of sectors J (information and communication) and L (real estate activities), where 1% of growth will generate approximately 0.06% of outflow probability growth. Overall, the Model 1 is explaining 70.2% of variations in outflow rate across European countries through variations of sectoral employment.

Table 1. Regression estimates for influence of cross-sectoral employment shares on outflow rate across European countries. Source: Author's own calculations.

	Model 1		Model 2		Model 3	
Dependent variable	OutE (Outflow rate (Elsby et al., 2013))		OutSd12 (Outflow rate, d< 12 months)		OutWeighted (Outflow rate, weighted)	
Independent variables	*Coefficient*		*Coefficient*		*Coefficient*	
const	-0.902	***	-0.182	**	-0.139	*
A Agriculture, forestry and fishing	0.009	***	0.003	***	0.002	**
B Mining and quarrying	0.036	**	0.023	***	0.031	***
C Manufacturing	0.006	**	0.003	***	0.002	**
D Electricity, gas, steam and air conditioning supply	-0.036		-0.057	***	-0.055	***
E Water supply; sewerage, waste management and remediation act.	0.026		-0.024	***	-0.019	**
F Construction	0.021	***	0.007	***	0.007	***
G Wholesale and retail trade; repair of motor vehicles and motorcycles	0.020	***	0.010	***	0.009	***
H Transportation and storage	-0.014		-0.001		-0.003	
I Accommodation and food service activities	-0.009		-0.008	***	-0.008	***
J Information and communication	0.061	***	0.018	***	0.019	***
K Financial and insurance activities	-0.014	*	-0.003		-0.005	*
L Real estate activities	0.064	***	0.017	***	0.019	***
M Professional, scientific and technical activities	0.025	***	0.006		0.005	
N Administrative and support service activities	-0.003		-0.003		-0.003	
O Public administration and defense; compulsory social security	0.012	**	-0.002		-0.001	
P Education	0.007		-0.000		-0.002	
Q Human health and social work activities	0.012	***	0.003	**	0.002	
R Arts, entertainment and recreation	-0.019		0.007		0.009	
S Other service activities	0.005		0.000		0.006	
R-squared	0.702		0.814		0.838	
S.E. of regression	0.048		1.779		1.638	
P-value(F)	5.81e-24		5.62e-36		1.57e-39	

Source: authors' calculations based on data from KILM database.
* indicates significance at the 10 percent level
** indicates significance at the 5 percent level
*** indicates significance at the 1 percent level

In the Model 2 authors regressed estimates of outflow rates calculated on the basis of unemployment spells less than twelve months on sectoral employment. Overall, the Model 2 is explaining 81.4% of variations in outflow rate across European countries through variations of sectoral employment.

In the Model 3 there is regression of weighted outflow rate estimates based on the methodology proposed by Elsby et al (2013). This model is very similar to the previous one and there are only two major differences, in the case of two sectors: K (Financial and insurance activities – significant only in Model 3) and Q (Human health and social work activities – significant only in Model 2). The Model 3 is explaining 83.8% of variations in outflow rate across European countries through variations of sectoral employment.

The mutual characteristic of these three models is that employment growth in five sectors does not have any significant influence on the outflow rate: H (transportation and storage), N (administrative and support service activities), P (education), R (arts, entertainment and recreation), and S (other service activities).

According to the values information criteria (Log-likelihood and Akaike criterion), the conclusion is that Model 1 is the best among three models and it describes in the best way relations of sectoral employment shares with outflow rates.

CONCLUSION

Authors have developed econometrical models for evaluation of relationship between outflow rate and cross-sectoral employment. Aggregate fluctuations of unemployment-to-employment transition probability are well captured by empirical specifications about significant cross-sectoral link between worker flows and job flows. Authors showed that cross-sectoral employment contains information that substantially improves our ability to understand the movements in aggregate labor market flows.

Empirical data proved a strong positive correlation between dispersion of employment growth across sectors and outflow rate in Europe. It implies that shifts in demand from some sectors to the others are responsible for significant fraction of unemployment-to-employment transition probability. In the best model (Model 1) variations of sectoral employment shares is explaining 70.2% of variations in outflow rate across European countries.

Econometric analysis in this research actually started from implementation of fixed effects model, which takes into account specific characteristics of every unit of observation, in this case every country. In other words, the focus is on “within” variation inside every country, but the Breusch-Pagan test showed that although every country has its own characteristics, these characteristics are not correlated with coefficients in the model, so the key lies in the overall variations, and not in “within” variations when it comes to the outflow rates.

Authors have concluded that reallocation shocks accounted for about 70 to 80 percent variability of outflow rates across Europe, during the five year period (2008-2012). This results suggests that reallocation of employment has substantial economic importance and significant contribution to fluctuations in unemployment. The largest impact on the growth of unemployment-to-employment transitional probability authors have found in the case of sectors J (information and communication) and L (real estate activities).

Obtained econometrical models are significantly informative in the context of analyzing economic cycles for better understanding of labor market variations and creation of efficient labor market policies.

Further research in the area will be oriented towards cross-cluster analysis and modeling of outflow rates on the cluster level.

This paper represents the contribution in the area of relations between labor market flows and industrial aspect of cyclicality. The added value of this paper lies in the explanation of behavior of different industrial sectors in condition of economic crisis and it is based on the latest available data from country-level KILM comprehensive database. The new information should help policy makers and experts in the area to better understand the phenomena in question.

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APPENDIX

Figure 3. Variation of outflow rate (unemployment spells less than 12 months) during five year period (2008-2012)

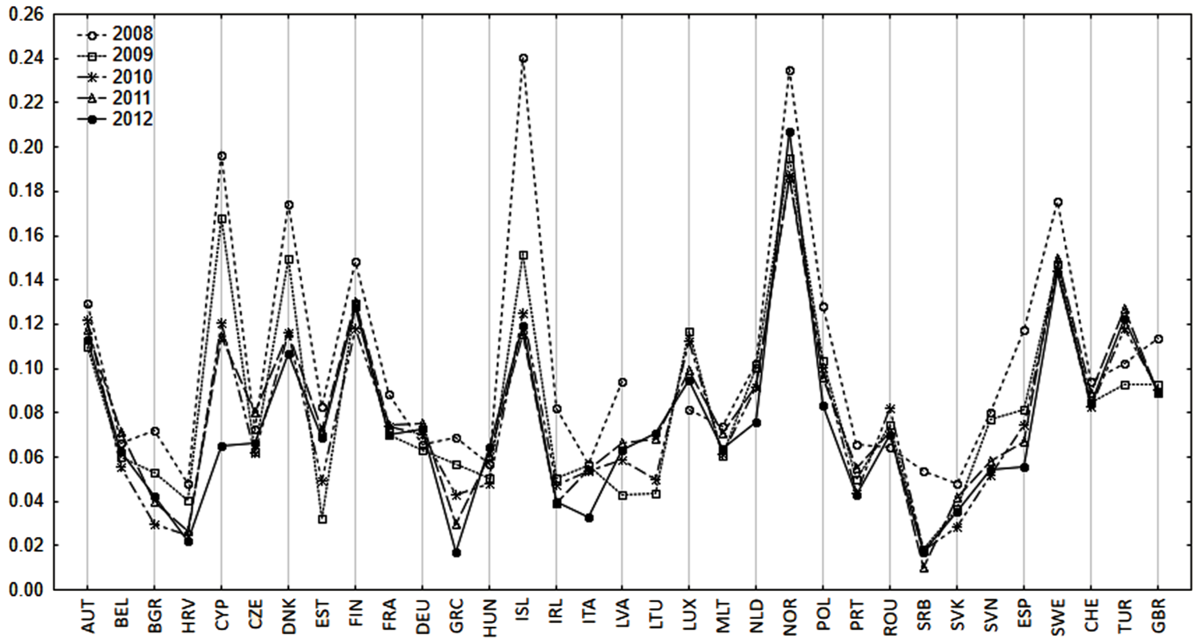

Figure 4. Variation of weighted outflow rate during five year period (2008-2012)

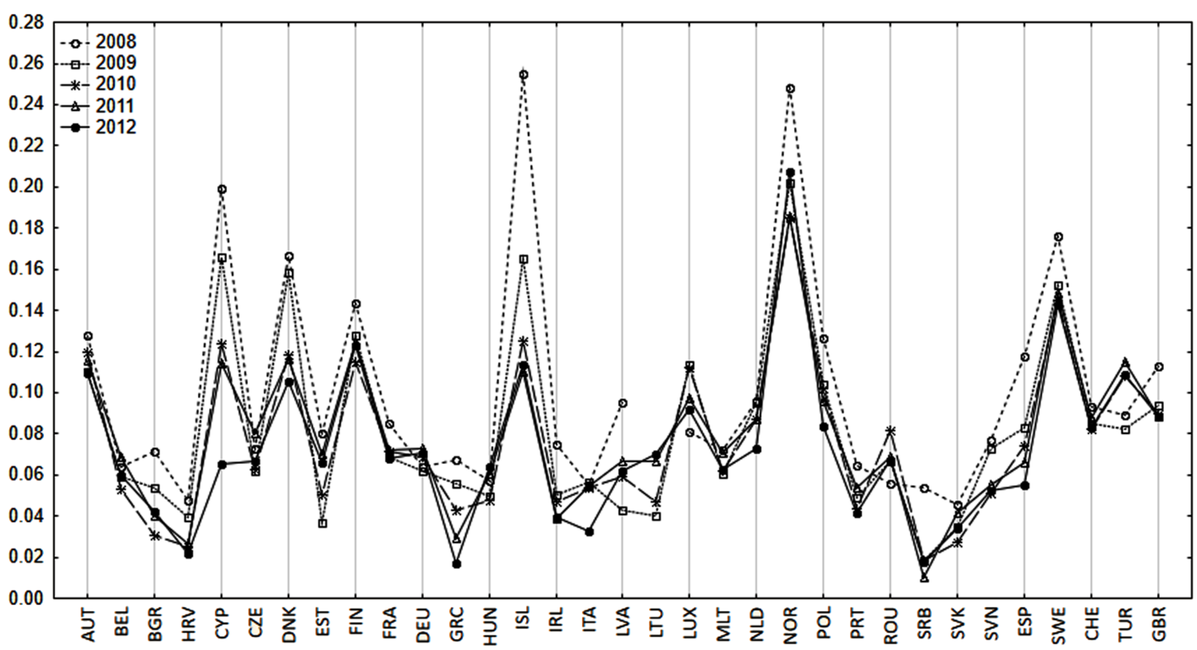

Table 2. Analysis of variance: Testing statistical differences among clusters in the case of employment shares across industrial sectors. Source: Author's own calculations.

Variable	Analysis of Variance					
	Between SS	df	Within SS	df	F	Signif. p
A Agriculture, forestry and fishing	4.045	3	10.465	25	3.221	0.040
B Mining and quarrying	0.075	3	0.544	25	1.144	0.351
C Manufacturing	7.351	3	14.791	25	4.142	0.016
D Electricity, gas, steam and air conditioning supply	0.048	3	0.712	25	0.559	0.647
E Water supply; sewerage, waste management and remediation act.	0.236	3	1.494	25	1.317	0.291
F Construction	81.528	3	10.251	25	66.278	0.000
G Wholesale and retail trade; repair of motor vehicles and motorcycles	0.614	3	16.536	25	0.310	0.818
H Transportation and storage	1.588	3	1.864	25	7.098	0.001
I Accommodation and food service activities	0.956	3	2.609	25	3.055	0.047
J Information and communication	0.061	3	1.691	25	0.300	0.825
K Financial and insurance activities	0.702	3	3.706	25	1.579	0.220
L Real estate activities	0.324	3	2.743	25	0.983	0.417
M Professional, scientific and technical activities	1.115	3	2.992	25	3.107	0.045
N Administrative and support service activities	0.823	3	4.470	25	1.535	0.230
O Public administration and defense; compulsory social security	2.865	3	9.989	25	2.391	0.093
P Education	5.288	3	7.378	25	5.973	0.003
Q Human health and social work activities	3.234	3	12.768	25	2.111	0.124
R Arts, entertainment and recreation	0.212	3	0.880	25	2.012	0.138
S Other service activities	0.567	3	1.467	25	3.221	0.040

Source: own calculations based on data from KILM database.

Table 3. Cluster membership. Source: Author's own calculations

Cluster 1	Cluster 2	Cluster 3	Cluster 4
13 Cases Distance AUT 0.498 BEL 0.540 CZE 0.341 FIN 0.229 FRA 0.260 DEU 0.212 ITA 0.302 NOR 0.496 POL 0.350 ROU 0.351 SVK 0.350 SWE 0.318 CHE 0.389	6 Cases Distance BGR 0.746 HRV 0.340 EST 0.314 GRC 0.364 HUN 0.412 LTU 0.370	5 Cases Distance ISL 0.699 IRL 0.489 LVA 0.641 PRT 0.484 ESP 0.519	5 Cases Distance CYP 0.574 DNK 0.361 MLT 0.366 SVN 0.532 GBR 0.375

Source: own calculations based on data from KILM database.

Complete Results of Three Econometric Models for Regression of Outflow Rate on Sectoral Employment Shares

Model 1. Pooled OLS, using 143 observations

Included 33 cross-sectional units Time-series length: minimum 3, maximum 5 Dependent variable: OutE (Outflow rate (Elsby et al., 2013))				
	Coefficient	***Std. Error***	***p-value***	
const	-0.902	0.267	0.001	***
A Agriculture, forestry and fishing	0.009	0.003	0.003	***
B Mining and quarrying	0.036	0.014	0.013	**
C Manufacturing	0.006	0.003	0.024	**
D Electricity, gas, steam and air conditioning supply	-0.036	0.026	0.170	
E Water supply; sewerage, waste management and remediation act.	0.026	0.019	0.178	
F Construction	0.021	0.004	0.000	***
G Wholesale and retail trade; repair of motor vehicles and motorcycles	0.020	0.005	0.000	***
H Transportation and storage	-0.014	0.009	0.118	
I Accommodation and food service activities	-0.009	0.006	0.113	
J Information and communication	0.061	0.017	0.000	***
K Financial and insurance activities	-0.014	0.007	0.053	*
L Real estate activities	0.064	0.018	0.001	***
M Professional, scientific and technical activities	0.025	0.007	0.001	***
N Administrative and support service activities	-0.003	0.008	0.674	
O Public administration and defense; compulsory social security	0.012	0.006	0.037	**
P Education	0.007	0.005	0.150	
Q Human health and social work activities	0.012	0.004	0.002	***
R Arts, entertainment and recreation	-0.019	0.019	0.317	
S Other service activities	0.005	0.015	0.760	

Mean dependent var	0.098	S.D. dependent var	0.082
Sum squared resid	0.281	S.E. of regression	0.048
R-squared	0.702	Adjusted R-squared	0.656
F(19, 123)	15.268	P-value(F)	0.000
Log-likelihood	242.644	Akaike criterion	-445.289
Schwarz criterion	-386.032	Hannan-Quinn	-421.209
rho	0.000	Durbin-Watson	1.651

Source: own calculations based on data from KILM database.
White's test for heteroskedasticity, OLS, using 143 observations
Dependent variable: uhat^2, Test statistic: TR^2 = 43.977, with p-value = P(Chi-square(38) > 43.977430) = 0.233

Model 2. Heteroskedasticity-corrected, using 143 observations

Dependent variable: OutSd12 (Outflow rate, d< 12 months (Shimer, 2012))				
	Coefficient	*Std. Error*	*p-value*	
const	-0.182	0.071	0.012	**
A Agriculture, forestry and fishing	0.003	0.001	0.001	***
B Mining and quarrying	0.023	0.006	0.000	***
C Manufacturing	0.003	0.001	0.002	***
D Electricity, gas, steam and air conditioning supply	-0.057	0.01	0.000	***
E Water supply; sewerage, waste management and remediation act.	-0.024	0.008	0.002	***
F Construction	0.007	0.001	0.000	***
G Wholesale and retail trade; repair of motor vehicles and motorcycles	0.010	0.002	0.000	***
H Transportation and storage	-0.001	0.003	0.760	
I Accommodation and food service activities	-0.008	0.002	0.002	***
J Information and communication	0.019	0.006	0.005	***
K Financial and insurance activities	-0.003	0.003	0.208	
L Real estate activities	0.017	0.005	0.002	***
M Professional, scientific and technical activities	0.006	0.004	0.140	
N Administrative and support service activities	-0.003	0.003	0.317	
O Public administration and defense; compulsory social security	-0.002	0.002	0.390	
P Education	-0.001	0.002	0.744	
Q Human health and social work activities	0.003	0.001	0.022	**
R Arts, entertainment and recreation	0.007	0.006	0.260	
S Other service activities	0.000	0.006	0.971	

Source: Author’s own calculations

Table 4. Statistics based on the weighted data

Sum squared resid	389.121	S.E. of regression	1.779
R-squared	0.814	Adjusted R-squared	0.785
F(19, 123)	28.305	P-value(F)	0.000
Log-likelihood	-274.483	Akaike criterion	588.966
Schwarz criterion	648.223	Hannan-Quinn	613.045

Table 5. Statistics based on the original data

Mean dependent var	0.082	S.D. dependent var	0.043
Sum squared resid	0.093	S.E. of regression	0.028

Source: own calculations based on data from KILM database.

Model 3. Heteroskedasticity-corrected, using 143 observations

Dependent variable: OutWeighted (Outflow rate, weighted)				
	Coefficient	*Std. Error*	*p-value*	
const	-0.139	0.076	0.070	*
A Agriculture, forestry and fishing	0.002	0.001	0.027	**
B Mining and quarrying	0.031	0.005	0.000	***
C Manufacturing	0.002	0.001	0.039	**
D Electricity, gas, steam and air conditioning supply	-0.055	0.01	0.000	***
E Water supply; sewerage, waste management and remediation act.	-0.019	0.007	0.012	**
F Construction	0.007	0.001	0.000	***
G Wholesale and retail trade; repair of motor vehicles and motorcycles	0.009	0.002	0.000	***
H Transportation and storage	-0.003	0.003	0.355	
I Accommodation and food service activities	-0.008	0.002	0.001	***
J Information and communication	0.019	0.006	0.003	***
K Financial and insurance activities	-0.005	0.003	0.074	*
L Real estate activities	0.019	0.005	0.000	***
M Professional, scientific and technical activities	0.005	0.003	0.140	
N Administrative and support service activities	-0.003	0.002	0.151	
O Public administration and defense; compulsory social security	-0.001	0.002	0.519	
P Education	-0.002	0.002	0.190	
Q Human health and social work activities	0.002	0.002	0.109	
R Arts, entertainment and recreation	0.009	0.006	0.133	
S Other service activities	0.006	0.006	0.303	

Source: Author's own calculations

Table 6. Statistics based on the weighted data

Sum squared resid	330.217	S.E. of regression	1.639
R-squared	0.838	Adjusted R-squared	0.813
F(19, 123)	33.411	P-value(F)	0.000
Log-likelihood	-262.747	Akaike criterion	565.494
Schwarz criterion	624.751	Hannan-Quinn	589.573

Table 7. Statistics based on the original data

Mean dependent var	0.081	S.D. dependent var	0.043
Sum squared resid	0.092	S.E. of regression	0.027

Source: own calculations based on data from KILM database.