Employment Growth within BSR Countries: Some Predictive Aspects of Shift-share Analysis

Barbara Batóg, Jacek Batóg
Department of Statistics and Econometrics
Faculty of Economics and Management
University of Szczecin
Mickiewicza Street 64, 71-101 Szczecin
phone: +48 91 444 1973, fax: +48 91 444 2130
e-mail: **batog@uoo.univ.szczecin.pl**
website: http://www.us.szc.pl/batog

Abstract

Economic transition in the countries such as Estonia, Latvia, Lithuania and Poland is connected with changes of the sectoral structure of the employment in the economy. One part of this process consists of a shift of resources, including labour, from the public to the private sector. Another part has been the movements of labour across industries. In the paper the growth of total and sectoral employment within countries of the Baltic Sea Region will be analyzed using the shift-share approach. This will allow comparing employment tendencies in economies in transition with those in developed countries from that region. Shift-share analysis assesses the links between the sectoral structure of employment and international differences in employment growth. The difference between the total growth of employment in country *i* and average growth for the whole sample could be divided into three effects: sectoral-mix effect, competitive effect and residual effect. The data will come from Eurostat Database and will cover period 1999–2005. The research has been conducted according to industry classification ISIC Rev. 3. Apart from the main analysis of components of the employment growth the authors have also tried to verify the hypothesis that the shift-share approach has some predictive power[1]. It turned out that the largest part of variation in relative employment growth is explained by the competitive effect and only small part is explained by the sectoral-mix effect.

JEL classification: J21.

Key words: employment growth, sectoral structure, shift-share analysis.

Introduction

The distinct changes during last decades are noticeable as far as the sectoral structure of economies is concerned. This phenomenon occurs with reference to both produced value added and employment. The changes of the sectoral structure of the employment occur dynamically especially within countries in transition. Economic transition has been associated with the reallocation of labour and jobs across economic sectors. This process includes a shift of labour from the public to the private sector, as well as the movements of labour across industries. In the case of economies in transition in the Baltic Sea Region i.e. Estonia, Latvia, Lithuania and Poland, one could expect, assuming pattern of employment changes similar to more developed countries, the faster decrease of agriculture employment, the acceleration of emplo y-

[1] The extensive review of literature related to applications of shift-share method as forecasting tool can be found in (Stevens, Moore, 1980).

ment growth in market services, the slowdown of employment growth in non-market services and further decrease of employment in processing industry (Karpinski, Paradysz, Ziemiecki, 1999; Batóg, Batóg, 2001). These transformations determine the economy's competitive power and growth potential. It is also worth to mention that jobs that are created in expanding sectors usually require different skills and are located in different regions than jobs in declining sectors (Rutkowski, 2006). The intensity of structural changes in the economy depends mainly on individual's labour mobility, which is driven not only by economic determinants but also by demographic ones (Merkle, Zimmermann, 1994). In the paper the dynamics of total and sectoral employment in BSR countries will be analyzed through identification of two main components: sectoral-mix effect and competitive effect. The theoretical framework will be based on shift-share approach with changing length of sample period. Such approach allows formulating some forecasts for national and aggregate factors of employment growth.

Methodology

The shift-share analysis provides a more comprehensive assessment of international differences in employment growth. This approach was firstly used by Creamer (*U.S. National Resources …*, 1942) and was expounded by Dunn (Dunn, 1960, Harvey, Perloff, Dunn, Lampard, Muth, 1960) as a method for the determination of the components explaining the variations in economic magnitudes, mainly the employment. The basic model proposed by Dunn shows the relationship between the change in GDP for the *i*-th industry in region *j* from the base to the end period ΔE_{ij} and growth rate of GDP for the country R_k, GDP growth for the *i*-th industry of the country R_{ik}, and GDP growth for the *i*-th industry of the region *j* R_{ij}:

$$DE_{ij} = E_{ij0}R_k + E_{ij0}(R_{ik} - R_k) + E_{ij0}(R_{ij} - R_{ik}). \qquad (1)$$

The three factors of the right hand side are called respectively the national component (the national growth effect, the base growth effect), the structural component (the industry mix effect, the composition effect) and the competitive component (the relative share effect). The first component shows the effect on the industry of the regional economy, assuming that this sector follows the national rate of growth. The second component calculates the change in the sector that can be connected with the regional industry structure. The third component points out regions with industries growing faster than the national average.

Equation (1) can be rearranged in the following way:

$$DE_{ij} - E_{ij0}R_k = E_{ij0}(R_{ik} \quad R_k) + E_{ij0}(R_{ij} \quad R_{ik}). \qquad (2)$$

The left hand side is called the net relative change (NRC) and determines the difference between the actual change and the national component (informs about the difference between the growth of *i*-th industry in region *j* and the national average growth independently of industrial structure).

The classical shift-share model has some limitations. Among the most important ones are: the lack of reference to the theoretical explanation of reasons of occurring changes in the examined variables, an inadequate assumption about strict separation of regional and national effects (Holden, Nairn, Swales, 1989), the interrelation of reference of sectoral and competitive effects with regional concentration of employment (Herzog, Olsen, 1977), not taking into account the level of unemployment and shifts attributed to the process of migration (Tervo, Okko, 1983) and different results coming from the different levels of disaggregation of industries.

There have been many extensions, modifications and new applications of

shift-share approach. Among them it is worth to mention:

- an observation that regional shift (competitive effect) is affected also by the specialization of the regional employment (Rosenfeld, 1959),
- introducing the concept of homothetic employment, leading to the identification of an additional allocation effect (Esteban-Marquillas, 1972),
- some econometric advancements (Arcelus, 1984, Haynes, Dinc, 1997),
- probabilistic approaches (Berzeg, 1984, Patterson, 1991),
- taking into account the influence of change in productivity and output on change in the employment (Rigby, Anderson, 1993).

The shift-share analysis can also provide an assessment of the links between the sectoral mix of employment and international differences in employment growth (Ray, Harvey, 1995). Therefore the necessary condition is that the examined variable could be divided into subgroups and expressed as a weighted mean of its values in those subgroups. The change in the variable between two periods may be explained in terms of variation in the weights of the different groups or in terms of the modification of its values[2].

The variant of shift-share analysis applied in the research assumes that the difference between the total growth of employment in country i and average growth for the whole sample can be divided into three effects:

- *sectoral-mix effect*: measures the impact of differences between the initial sectoral structure of employment in country i and the structure of overall sample,
- *competitive effect*: measures the impact of differences between the sector specific growth rates in country i and the sector specific rates averaged for all countries,
- *residual effect*[3]: measures if the employment growth of country i tends to be higher, relative to all countries, in the sectors in which the country i is specialized.

All the above effects can be calculated using the following measures[4]:

- annualized employment growth (EG_i) in country i:

$$EG_i = \sum_{j=1}^{s} (N_{ijT} - N_{ij0}) / (T \cdot \sum_{j=1}^{s} N_{ij0}), \tag{3}$$

where:

s – number of sectors,

N_{ijt} – employment in country i, sector j and time t,

- sectoral contribution (SC_{ji}) to annualized employment growth of sector j in country i:

$$SC_{ji} = EG_{ij} \cdot w_{ij0}, \tag{4}$$

where:

EG_{ij} – employment growth in country i and sector j:

$$EG_{ij} = (N_{ijT} - N_{ij0}) / (T \cdot \sum_{j=1}^{s} N_{ij0}), \tag{5}$$

w_{ij0} – share of sector j in total employment in country i at time 0:

$$w_{ij0} = N_{ij0} / \sum_{j=1}^{s} N_{ij0}, \tag{6}$$

---

[2] Murillo, Núñez, Usabiaga, 2005.

[3] This term is sometimes interpreted as a measure of the extent to which a country is specialized in those sectors in which it has a competitive advantage (Ray, Harvey, 1995).

[4] OECD Employment Outlook 2000.

– employment growth (CID_i) in country i assuming a common initial distribution of sectors:

$$CID_i = \sum_{j=1}^{s} EG_{ij} \cdot \overline{w}_{j0}\,, \tag{7}$$

where:

$\overline{w}_{j0}$ – employment share of sector j in total sample at time 0:

$$\overline{w}_{j0} = \sum_{i=1}^{n} N_{ij0} \,/\, \sum_{i=1}^{n}\sum_{j=1}^{s} N_{ij0}\,, \tag{8}$$

n – number of countries,

– employment growth (CSG_i) in country i assuming common sectoral growth rates:

$$CSG_i = \sum_{j=1}^{s} \overline{EG}_j \cdot w_{ij0}\,, \tag{9}$$

where:

$\overline{EG}_j$ – annualized employment growth of sector j in total sample:

$$\overline{EG}_j = \left(\sum_{i=1}^{n} N_{ijT} - \sum_{i=1}^{n} N_{ij0} \right) / \left(T \cdot \sum_{i=1}^{n} N_{ij0} \right), \tag{10}$$

and finally we can derive:

competitive effect (CE_i) in country i: $CE_i = CID_i - \overline{EG}$,

sectoral-mix effect (SE_i) in country i: $SE_i = CSG_i - \overline{EG}$,

residual effect (R_i) in country i: $R_i = REG_i - CE_i - SE_i$,

where:

REG_i – relative annualized employment growth in county i: $REG_i = EG_i - \overline{EG}$.

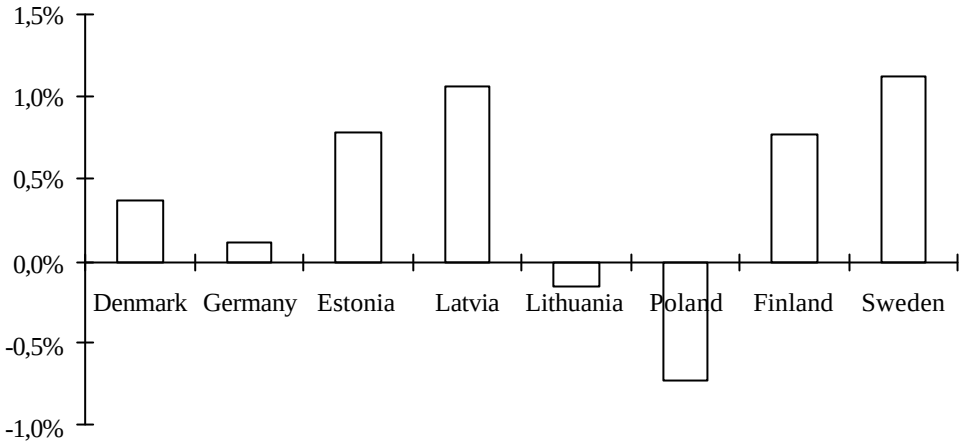
Data

The sample consists of 8 BSR countries. The data comes from Eurostat Database and covers period 1999–2005. The research was conducted in the following sectors and subsectors according to ISIC Rev. 3:

1. Agriculture, hunting, forestry and fishing (A+B).
2. Total industry, excluding construction (C+D+E).
3. Construction (F).
4. Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods; hotels and restaurants; transport, storage and communication (G+H+I).
5. Financial intermediation; real estate, renting and business activities (J+K).
6. Public administration and defence, compulsory social security; education; health and social work; other community, social and personal service activities; private households with employed persons; extra-territorial organizations and bodies (L+M+N+O+P+Q).

Figure 1 represents annualized total employment growth during 1999-2005 for all examined BSR countries. The greatest growth was observed in Sweden and Latvia. For Poland and Lithuania the growth rates were negative. For all countries employment growth was mostly due to increase in service employment. At the same time employment in agriculture decreased for all countries. The above results point to the service sector as the main source of future employment growth in BSR economies.

Figure 1. The annualized total employment growth in BSR countries in 1999-2005



Source: own calculations.

Empirical results

Table 1 presents the shift-share decomposition of relative employment growth. Countries are listed in descending order of their relative annualized employment growth. The largest increase in the total employment occurred in Sweden and Latvia, whereas in Lithuania and Poland the employment decreased. The competitive effect explains the largest part of cross-country variation in employment growth – the greatest values were noticed for Latvia and Estonia. The sectoral-mix effect as well as the residual effect is relatively small for almost all countries, apart from Lithuania. It means that initial sectoral structure in 1999 had rather little meaning for international differences in employment growth pattern over the analyzed period (it was probably caused by the quite short period of analysis).

Table 1. Components of employment growth in BSR countries, 1999-2005

Country	**REG_i**	**CE_i**	**SE_i**	**R_i**
Sweden	1,09%	0,64%	0,40%	0,05%
Latvia	1,03%	1,86%	-0,29%	-0,55%
Estonia	0,75%	0,90%	-0,08%	-0,08%
Finland	0,74%	0,58%	0,18%	-0,02%
Denmark	0,33%	0,15%	0,31%	-0,12%
Germany	0,09%	-0,04%	0,11%	0,02%
Lithuania	-0,19%	0,74%	-0,41%	-0,52%
Poland	-0,77%	-0,51%	-0,40%	0,15%

Source: own calculation.

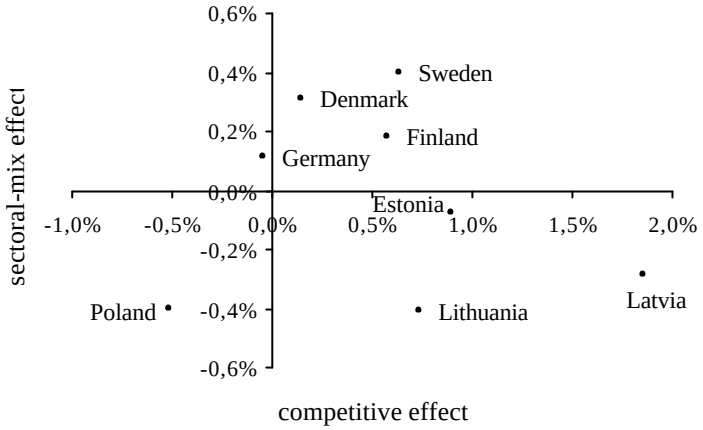
Figure 2 illustrate competitive and sectoral-mix effects for all analyzed countries in 1999-2005. In case of Latvia competitive effect accounted for high of the international difference in employment growth. The largest negative values of sectoral-mix and competitive effects refer to Poland.

According to positive and negative values of sectoral-mix and competitive effects all countries could be divided into four clusters:

I – Denmark, Finland and Sweden,

II – Germany,
III – Poland,
IV – Estonia, Latvia and Lithuania.

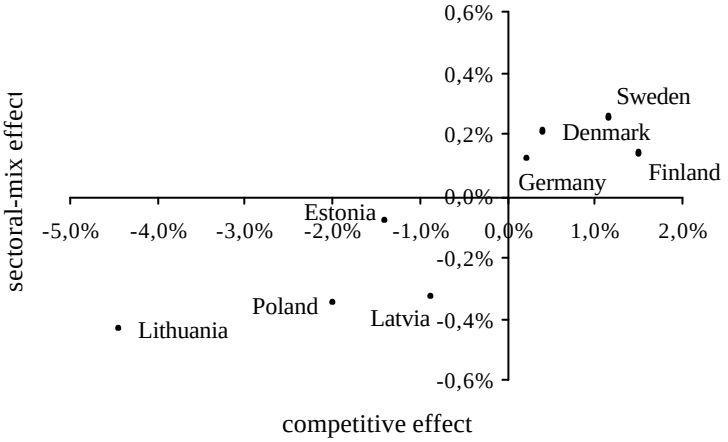
Figure 2. Competitive and sectoral-mix effects in BSR countries, 1999-2005



Source: own calculations.

To analyze the transformation path of main employment growth effects, the shift-share analysis was also consecutively conducted with changing time range (see Figure 2 for 1999-2005 and Figure 3 for 1999-2000 and Table 2 for all subperiods).

Figure 3. Competitive and sectoral-mix effects in BSR countries, 1999-2000



Source: own calculations.

Comparing results presented in Figures 2 and 3 we can observe that at the beginning the BSR countries were divided into two distinctly separated groups. The first group contained more developed countries characterized by positive values both competitive and sectoral-mix effects. In case of the second group both considered effects were negative. After five years the situation has changed – mainly due to the shift in competitive effect. Countries from the first group have moved to the left decreasing their competitive advantage. Three countries from the second group (Estonia, Latvia and Lithuania) moved to the right gaining in competitiveness. Poland still has negative competitive effect but its absolute value has decreased.

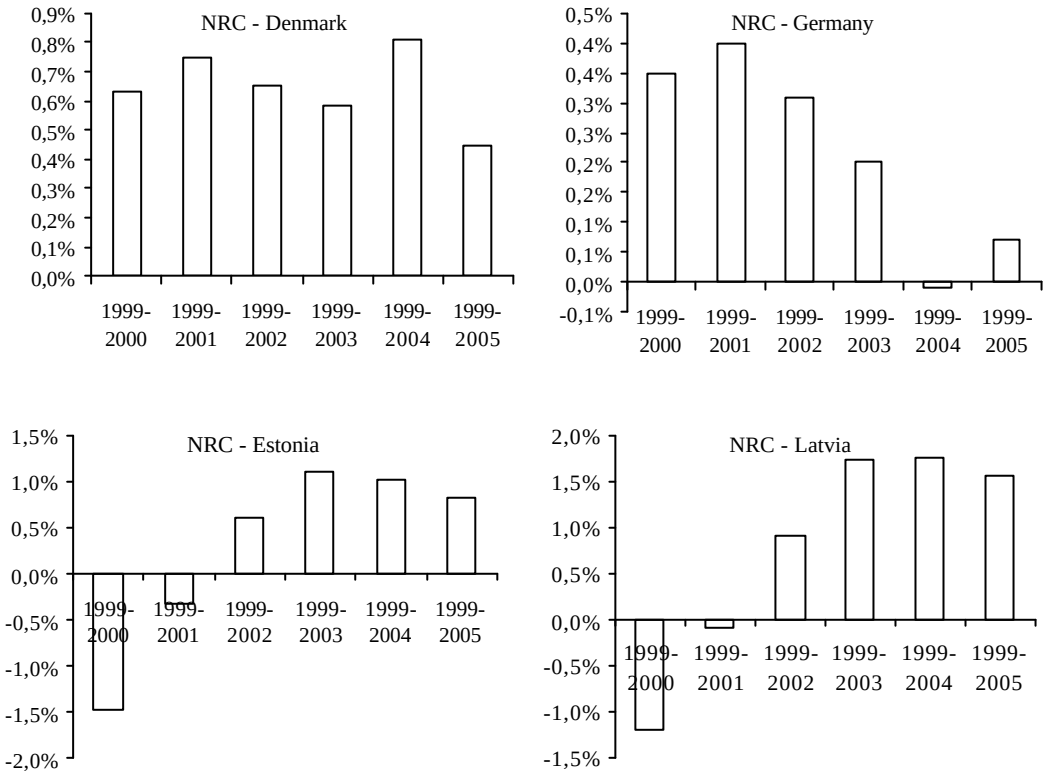
Table 2. Components of employment growth in BSR countries, 1999-2004

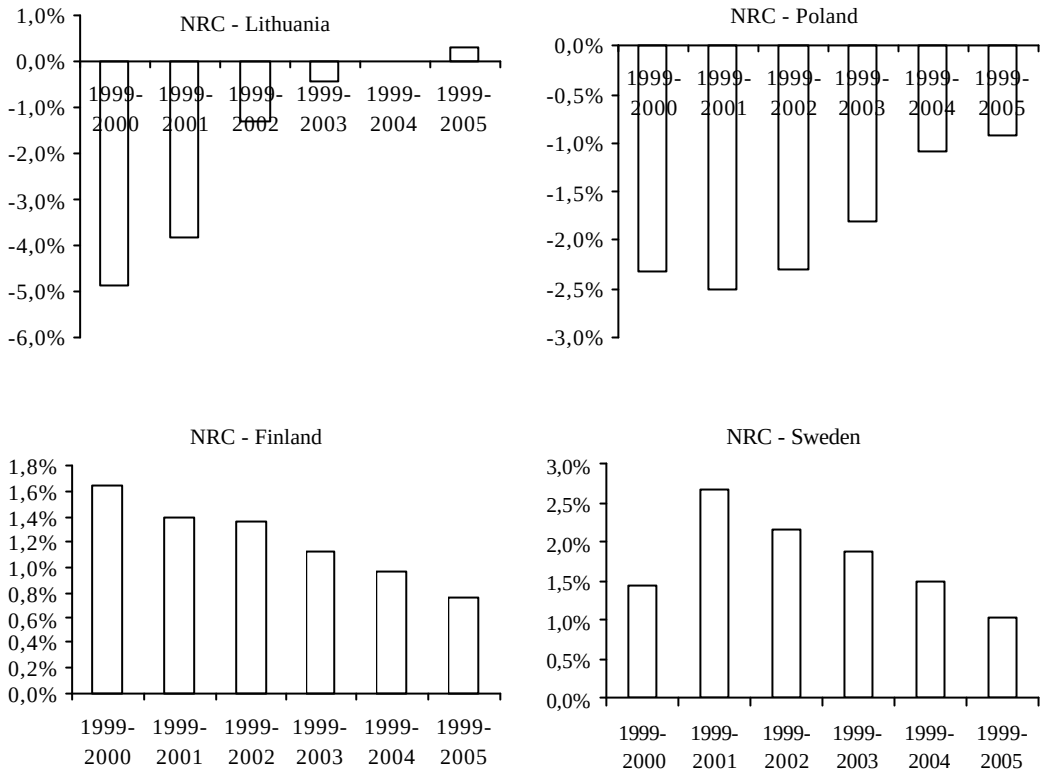
Country	1999-2000		1999-2001		1999-2002		1999-2003		1999-2004	
	CE_i	SE_i	CE_i	SE_i	CE_i	SE_i	CE_i	SE_i	CE_i	SE_i
Denmark	0,42	0,21	0,51	0,25	0,36	0,29	0,25	0,33	0,52	0,28
Germany	0,23	0,12	0,31	0,09	0,23	0,08	0,10	0,11	-0,11	0,10
Estonia	-1,38	-0,08	-0,27	-0,06	0,68	-0,07	1,18	-0,08	1,08	-0,07
Latvia	-0,86	-0,33	0,17	-0,25	1,15	-0,24	2,03	-0,29	2,03	-0,27
Lithuania	-4,44	-0,44	-3,45	-0,37	-0,96	-0,35	0,01	-0,41	0,38	-0,38
Poland	-1,97	-0,35	-2,19	-0,32	-1,98	-0,34	-1,41	-0,41	-0,71	-0,37
Finland	1,52	0,13	1,22	0,17	1,17	0,19	0,93	0,20	0,80	0,17
Sweden	1,18	0,25	2,36	0,32	1,76	0,39	1,44	0,43	1,12	0,37

Source: own calculations.

When we try to draw some conclusions about prospective tendencies in the employment growth we could consider dynamics of net relative changes (NRC) in researched countries (see Figure 4). The NRC is equal to the sum of the competitive and sectoral-mix effects.

Figure 4. Net relative changes ($CE_i + SE_i$) in BSR countries, 1999-2005





Source: own calculations.

The new EU members (Estonia, Latvia, Lithuania and Poland) were characterized by significantly growing NRC, while for the rest of countries a stable small decrease was noticed.

Conclusions

The research provides an example of application of shift-share analysis in order to compare the employment growth in old and new members of European Union in Baltic Sea Region. The cross-country comparisons demonstrate that employment growth rates differ significantly within the BSR countries. When we decompose the total employment growth we can observe that the competitive effect explains the largest part of cross-country variation in employment growth. It means that in the countries with higher rates of employment growth there were visible above-average growth rates across all sectors. The sectoral-mix effect is rather small for all countries. It means that initial structure of employment in BSR countries had almost no influence on relative growth rates of overall employment.

Observed tendencies in net relative changes for all countries allow us to formulate a hypothesis that in the close future we will notice equalization in the level of competitiveness of industries in BSR countries according to employment growth. The main reason of that phenomenon is the process of globalization and convergence of European labour markets.

REFERENCES:

Arcelus F. J. (1984). An Extension of Shift-share Analysis. Journal of Growth and Change, 15, 1.
Batóg B., Batóg J. (2001). Analiza zbieznosci struktur zatrudnienia w wybranych krajach wysokorozwinietych. In: J.Hozer, ed. Mikroekonometria w teorii i praktyce, Zeszyty Naukowe, 320, Prace Katedry Ekonometrii i Statystyki, 11. Szczecin: Uniwersytet Szczecinski.

Batóg J. (2000). Sektorowa struktura zatrudnienia a poziom produktu krajowego brutto. Wiadomosci Statystyczne, 9, Warszawa: Glówny Urzad Statystyczny, Polskie Towarzystwo Statystyczne.
Berzeg K. (1984). A Note on Statistical Approaches to Shift-share Analysis. Journal of Regional Science, 24, 2.
Dunn E. S. (1960). A Statistical and Analytical Technique for Regional Analysis. Papers and Proceedings of the Regional Science Association, 6.
Esteban-Marquillas J. M. (1972). Shift-and-share Analysis Revisited. Regional and Urban Economics 2, 3.
Growth and European Labour Markets. Final report. (2002), Project HPSE - CT-1999-00002. Luxembourg: DG Research European Commission.
Haynes K. E., Dinc M. (1997). Productivity Change in Manufacturing Regions: A Multifactor/Shift-Share Approach. Growth and Change, 28.
Herzog H. W., Olsen R. J. (1977). Shift-share Analysis Revisited: The Allocation Effect and the Stability of Regional Structure. Journal of Regional Science 17, 3.
Holden D. R., Nairn A. G. M., Swales J. K. (1989). Shift-Share Analysis of Regional Growth and Policy: a Critique. Oxford Bulletin of Economics and Statistics, 51, 1.
Industrial Location and National Resources (1943). Washington: U.S. National Resources Planning Board, Government Printing Office.
Karpinski A., Paradysz S., Ziemiecki J. (1999). Zmiany struktury gospodarki w Polsce do roku 2010. Polska na tle Unii Europejskiej. Warszawa: Komitet Prognoz „Polska XXI Wieku" przy Prezydium PAN.
Merkle L., Zimmermann K.F. (1994). The Demographics of Labour Turnover, A Comparison of Ordinal Probit and Censored Count Data Models. In K. F. Zimmermann, ed. Output and Employment Fluctuations. Studies in Empirical Economics. Heidelberg: Physica-Verlag.
Murillo I., Núñez F., Usabiaga C. (2005). Differentials and Persistence in Unemployment, an Analysis of the Spanish Regions with the Highest Unemployment Rates. 45th Congress of the European Regional Science Association, European Regional Science Association, ersa05p278.
OECD Employment Outlook June 2000 (2000). OECD.
Patterson M. G. (1991). A Note on the Formulation of a Full-analogue Regression Model of the Shift-share Method. Journal of Regional Science, 31, 2.
Perloff H. S., Dunn E. S., Lampard E. E., Muth R. F. (1960). Regions, Resources, and Economic Growth. Baltimore: Johns Hopkins University Press.
Ray M. A., Harvey J. T. (1995). Employment Changes in the European Economic Community, A Shift-share Analysis. Review of Regional Studies.
Rigby D. L., Anderson W. P. (1993). Employment change, growth and productivity in Canadian manufacturing: An extension and application of shift-share analysis. Canadian Journal of Regional Science 16, 1.
Rosenfeld F. (1959). Commentaire L'exposé de M.Dunn, Economie Appliquée, 4.
Rutkowski J. (2006). Labour Market Developments during Economic Transition, World Bank Policy Research Working Paper, 3894.
Stevens B. H., Moore C. L. (1980). A Critical Review of the Literature on Shift-Share as a Forecasting Technique. Journal of Regional Science, 20, 4.
Tervo H., Okko P. (1983). A Note on Shift-Share Analysis as a Method of Estimating the Employment Effects of Regional Economic Policy. Journal of Regional Science, 23, 1.