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## Structural change, Services and Employment - an econometric comparison of two North Rhine- Westphalian regions

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## **Structural Change, Services, and Employment**

**A comparison of two North Rhine-Westphalian regions**

1. Introduction
2. Structure and Development of Employment
3. An Input-Output Interpretation
4. A Regional View
5. Conclusion

## **Abstract**

Structural change often is characterised by a win-loose-situation. As service employment grows while industrial employment declines in the long run, this explanation seems to be intuitive. Nevertheless, it ignores the division of labour by industries. A large extent of tertiarisation depends on gaining importance of service industries as a supplier of manufacturing. This paper analyses structural employment change for two largely different, but neighboured North Rhine-Westphalian regions: Emscher-Lippe as a part of the northern Ruhrgebiet is faced with most of the “rust belt” problems - including lagging employment of service industries. On the other hand, Münsterland is a more rural landscape with considerable employment successes in manufacturing as well as in services. These facts obviously conflict with a substitution pattern favouring services and burdening manufacturing. This requires a closer examination by means of an input-output approach. The results suggest that a competitive industrial base is one of the key factors of employment growth in service industries.

## **1. Introduction**

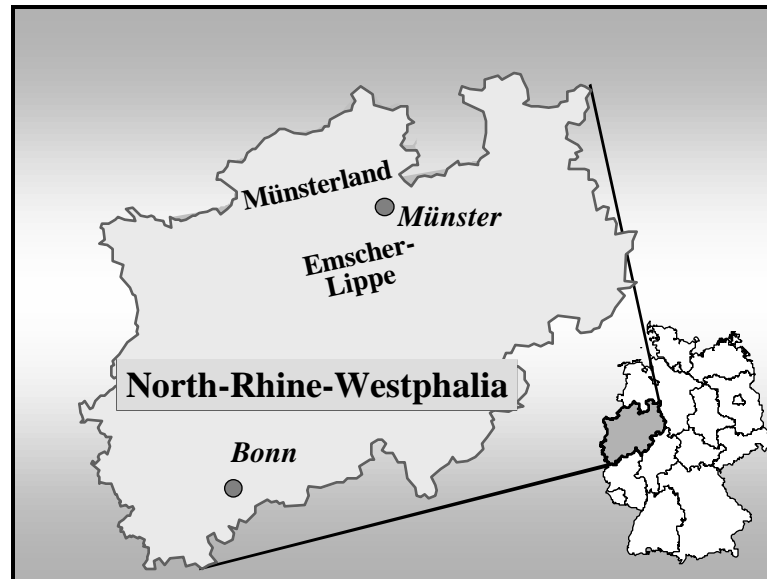
Service industries are assigned to a major role for solving employment problems because some of these activities used to have a huge expansion in production and employment (i.e. Bullinger 1997). In Germany, and also in the EU, enterprise based services like consulting and maintenance are striking examples (Löbke et. al. 1997). For well-known reasons, tertiarisation will not reduce the persisting labour market problems markedly: a large part of unemployment is based on mismatch (Padoa Schioppa 1991, Franz 1996). Service enterprises despairingly are seeking well-educated people, while the qualification of a majority of long-term unemployed is inferior. Structural change is not expected to support the lower end of labour market. Other broadly accepted reasons for European unemployment are labour market regulation and sticky wages (Bean 1994, Fitoussi/Phelps 1988). These sources of unemployment surely will not be got over by tertiarisation, too.

Moreover it is questionable, to what extent service industries are determining overall employment. Studies which suppose that services dominate employment dynamics mostly neglect the relations between manufacturing and services: First of all, industrial commodities tend to get more and more service-intensive. Outsourcing is the second important trend of “de-industrialisation”. Both trends are mainly driven by manufacturing (Lichtblau, Meyer, Ewerhart 1996) – this is the reason why manufacturing has become the most important customer of service industries. Taking different characteristics of service branches into account, one has to look for intermediate relationships. Therefore, an appropriate analysis has to distinguish several industries.

In addition to sectoral disaggregation, a regional emphasis may be useful in this context. Several German regions exhibit employment trends which clearly conflict with usual notions on structural change. Some of them are concentrated in North Rhine-Westphalia (NRW):

- the Münsterland – i.e. the region surrounding the city of Münster – is marked by manufacturing. It increased employment in manufacturing against the recent German trend and was successful in service industries, too.
- Emscher-Lippe is an older industrial area with massive employment problems.
- Both regions form a district with Münster as an administrative centre. However, this service oriented city does not burst with employment dynamics.

**Figure 1: The Region**



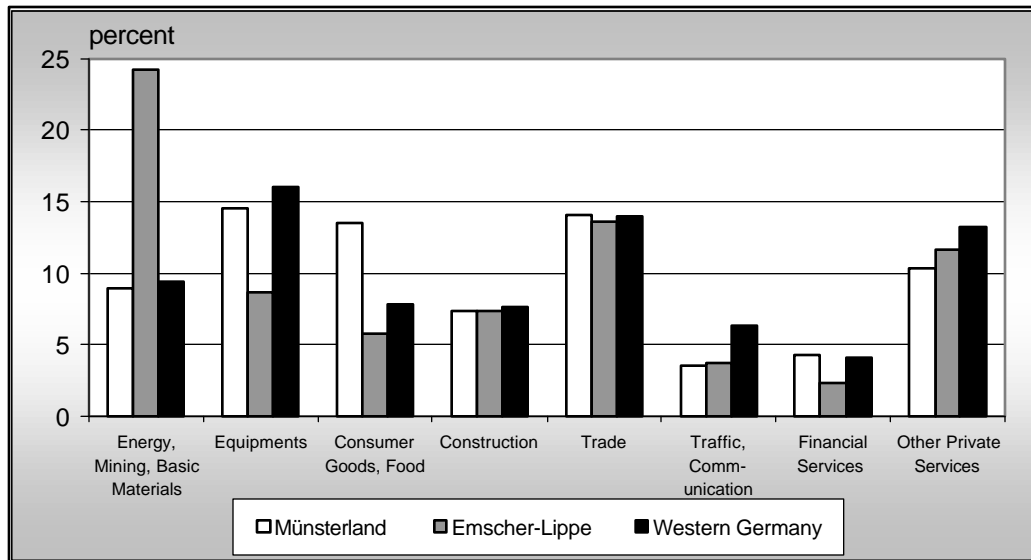
This paper analyses the relevance of the manufacturing sector in structural change of employment for this area. More precisely it is questionable whether manufacturing is still a “metronome” with respect to regional employment. The plan of the paper is as follows: the second section surveys the structure and the development of employment in the analysed area and introduces results of causality tests. Section 3 employs an input-output framework and gives a structural interpretation of the reduced form results. Finally, the fourth section introduces a transfer at the regional level.

## 2. Structure and Development of Employment

Typical for the Ruhrgebiet, large scaled heavy industries continue to play an important part in Emscher-Lippe. Unemployment rates are high – nearly 16 percent compared to 11 percent in Western Germany at the end of 1998. Recently, 270 000 employed persons were counted – 6 000 less than ten years before. The Münsterland is dominated by medium-sized enterprises. Including the city of Münster, the region managed a rapid growth of 18 percent up to nearly 470 000 employees the last ten years.

A part of deviating employment records may be based on employment structure. Indeed, the proportion of employees in manufacturing is unusually high for both regions (see figure 2):

**Figure 2: Sectoral Composition of Employment (1995)**



Source: Statistical Office of NRW (LDS).

- While coal mining and heavy industries are over-represented in Emscher-Lippe, the employment share of industries producing equipment and other higher tech commodities is modest. Therefore, severe structural risks tend to continue.
- In Münsterland, “high tech”-industries are represented in a “normal” extent. The employment share in consumer goods and food attracts attention, but not unusual for a rural landscape: beside the processing of agricultural products, wood processing and furniture as well as textiles and apparels have large employment shares. Obviously, another set of risky branches is over-represented in Münsterland.

- Wholesale and retail trade have quite normal proportions, but most other private services are under-represented in both regions. Due to its regional focus in Münster, this is not valid for banking and insurance in Münsterland. Primarily enterprise based other private services are still underdeveloped in both regions. Either Münsterland nor Emscher-Lippe are catching up: growth in emerging branches like consulting and information services did not exceed the German development.

Furthermore, Münster as the administrative centre and location of one of the greatest German universities has a remarkable speciality: 40 percent of the employees are occupied in public services, health services, and sciences. In the short run, this fraction does not react too much on aggregate employment fluctuations. But in a longer perspective, public financial situation will limit the development.

This structural snapshot leads to the question, if there are any relationships between job growth in manufacturing and in services. From a theoretical viewpoint, the answer is quite clear: each of the depicted branches take part in the inter-industrial division of labour. Intermediate deliveries do not work in sense of a one way. Even at a low regional level, service industries are customers as well as supplier of manufacturing. This establishes mutual relationships between employment in manufacturing and service industries. In a technical sense, the connections between manufacturing and service branches are simultaneous. Nevertheless, it is questionable, whether employment in manufacturing primarily causes service employment (industry push). Conversely, a competitive service sector might be necessary for a successful industrial development (service pull).

Both hypothesis are tested following the standard Granger (1969) procedure: in a first step, the test measures the additional influence of job growth in manufacturing in an auto-regression for job growth in service industries. A second regression does exactly the opposite – testing the partial influence of job growth in service industries in an auto-regressive process on job growth in manufacturing. The partial F-statistics allow to check these cross-influences. If they improve the prediction significantly, the null hypothesis ("X does not cause Y") has to be rejected.

**Table 1: Industry push vs. Service Pull – Results of Causality Tests**

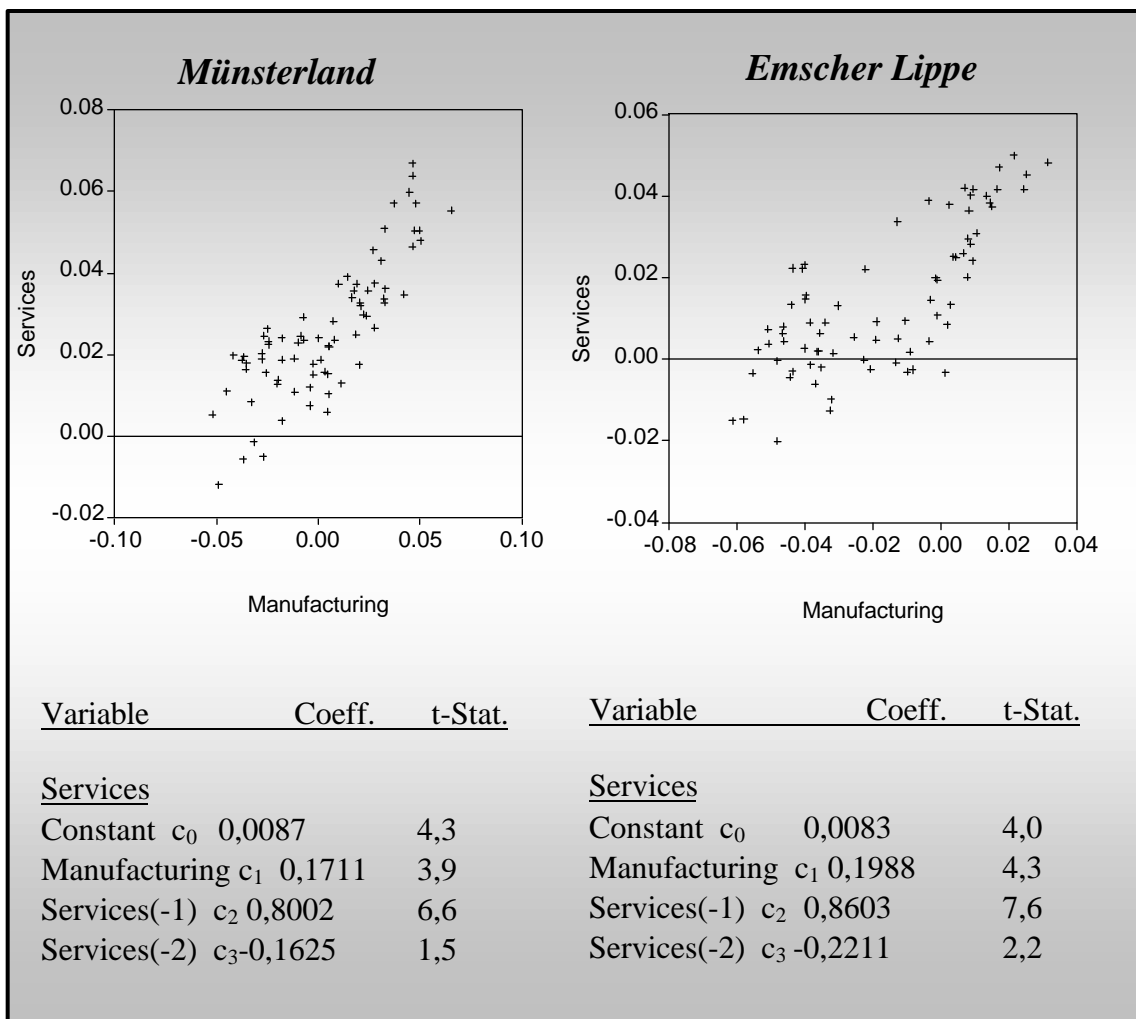
<b>Null-Hypothesis</b>	<b>Münsterland</b>	<b>Emscher-Lippe</b>
No Service Pull	5,2	2,8
No Industry Push	2,1	2,7

*Partial F-statistics, 76 Observations (1979:1 - 1997:4), 2 lags included*

The test results for Münsterland and Emscher-Lippe are shown in table 1. The Granger test does not lead to uniform results: In Münsterland, the partial F-statistics are favouring “industry push”: the influence on service employment on manufacturing employment has to be rejected at a 5 percent significance level. Conversely, this is not possible in the reversed case. There seems to be an influence of manufacturing employment on service employment. On the other hand, the test statistics for Emscher-Lippe indicate a “patt” and, moreover, both null hypothesis can not be rejected at a 5 percent level. This unsatisfactory result requires further examinations.

Figure 3 shows scatterplots of job growth in manufacturing and private services. Both plots suggest that job growth in service industries and severe employment losses in manufacturing as well as the reverse situation are not very likely. In both cases, the correlation is about 0,80. The positive connection of job growth in manufacturing and service industries illustrates that a win-loose situation is untypical for recent structural change in employment.

**Figure 3: Sectoral Employment Growth**



Sample: 1979:1 - 1997:4 (76 Obs.).

The scatterplots suggest a more structural interpretation of the relationship between manufacturing and services. Employing the industry push hypothesis, simple regressions indicate that one percent job growth in manufacturing causes about a half percent job growth in service industries. The regression results shown in figure 3 make sure that these relations are stable even if endogenous lags are introduced: The long-term elasticities  $c_1 / (1 - c_2 - c_3)$  are 0,47 in Münsterland and 0,55 for Emscher-Lippe. The estimated elasticity for Western Germany is similar, but the inference is not so close.

The estimated parameters are more plausible if the industry push is employed: following the service pull hypothesis would imply elasticities exceeding one - one percent of job growth in services industries induces more than one percent employment growth in manufacturing. Even if autonomous job growth is significantly negative allowing for deviating business cycles sensitivities, this result is hard to explain in the long run.

The last argument again is a technical one: Additionally to the standard causality test, one may have a look at the t-values of the cross terms. As shown in figure 3, the t-statistics of coefficient  $c_1$  are about 4 in both regions. The corresponding t-statistics in the reversed regressions - i.e.  $\% manu = d_0 + d_1 * \% services + d_2 * \% manu(-1) + d_3 * \% manu(-2)$  - also are indicating significance, but the influence of the cross terms  $d_1$  are weaker (t statistics 2,2 for Münsterland and 2,3 for Emscher-Lippe). This may be a final hint in favour of the industry push hypothesis.

### 3. An Input-Output Interpretation

Input-output-tables give a more detailed picture of intermediate relations between manufacturing and service industries. The core matrix reflects the division of labour by industries. Information on interindustry linkages allows a rough picture of recent structural change. Not surprisingly, service inputs gained importance during the eighties and nineties. In addition to increasing deliveries within service industries, manufacturing has intensified its service inputs. This is particularly remarkable for “other private services”. They are mainly enterprise based and contain a vast variety of activities like consulting, advertising, training, and maintenance in data processing, cleaning services, travelling and catering. The reason for its extraordinary growth are rising service components of industrial products as well as modern organisational concepts advocating outsourcing and concentration on core competence (Siebe 1996).

According to the static open input-output-model with fixed input coefficients  $a_{ij}$ , production of an industry  $j$  depends on final demand for all commodities. In matrix notation

$$(1) \quad \mathbf{y} = (\mathbf{I} - \mathbf{A})^{-1} \mathbf{f}$$

where  $\mathbf{y}$  is the vector of production,  $\mathbf{I}$  is the identity matrix,  $\mathbf{A}$  consists of elements  $a_{ij}$ , and  $\mathbf{f}$  is the vector of domestic final demand. The Leontief multipliers  $(\mathbf{I} - \mathbf{A})^{-1}$  depict the impulse of final demand on production by industries. For given input coefficients they show the necessary additional production by industries if final demand component  $f_i$  rises by one unit. If the commodity demand changes, all service industries delivering manufacturing are touched. According to the decomposition  $(\mathbf{I} - \mathbf{A})^{-1} = \mathbf{I} + \mathbf{A} + \mathbf{A}^2 + \dots$



+  $A^n$  the direct effect  $I f$  is followed by first round intermediate demand of the affected manufacturing branches. An interindustry multiplier process starts, because  $A f$  and all subsequent impulses cover service production.

The following calculations are based on last West German input-output-table for 1990 (Statistisches Bundesamt 1994) – this year lies in the middle of the observation period in section 2. The disaggregation follows the standard German classification distinguishing 58 industries, of which 13 are supplying services. The dominance of manufacturing is not so favourable for analysing services, but at the moment a deeper distinction of services is impossible. All matrix algebra is done for all 58 industries. For reasons of clarity, the results are aggregated.

Calculations of Leontief multipliers show that industrial production to a larger extent needs services. Primarily, this is true for the above mentioned “other private services” and for wholesale and retail trade. The remaining service activities – transport, communication, and financial services - do not depend on manufacturing output so close, but their importance tends to grow. Table 2 shows the additional production by industries if the demand for manufactured commodities is raised by 1 percent. In the simple Leontief framework, aggregate final demand and aggregate production rise for slightly less than a half percent. The composition of additional production by industries reveals a concentration on manufacturing – the io-stability constraint says that the direct effect dominates all subsequent adjustments. Nevertheless, the influence of an “industrial boom” on service sectors is anything but negligible. The relative differences are lying between 0,10 percent (financial services) and 0,36 percent (other private services).

The static open io-model treats no income/expenditure-effects. If induced intermediate demand is considered and additional value added is not, the underlying model will generate somewhat strange results. Therefore, a semi-closed model with income generation and induced consumer demand is considered. The simple io-model is augmented by a Keynesian multiplier (Schumann 1975). In this context, additional production causes income generation and – via consumer expenditures – a rising final demand. The subsequent process is described above.

Self evidently, the impulses are larger in the semi-closed model. The second column of table 2 shows the structural employment adjustments. As to be expected, production effects in manufacturing continue to exceed the relative changes of service industries. The difference between both columns shows that the additional Keynes multiplier predominately promotes industries producing consumer goods and related services.

These differences also shed some light on the mobilisation of enterprise based and consumer based services. “Other private services” - as a prominent example of the first group - benefit most from manufacturing growth. But more than a half of the relative gain is achieved without income generation. This is the highest share among all service industries. The weaker dependency on induced consumer demand indicates that other private services chiefly depend on enterprise development – and therefore on manufacturing, too. The same applies for wholesale trade. But as production in retail trade mainly depends on consumer demand, both effects are very similar. The situation of transport and communication is quite the same. Contrary, banking and insurance are stimulated for the most part by income-expenditure effects.

**Table 2: Effects of Production by Industries with respect to a Final Demand Change in Manufacturing (1 Percent)**

	Open static IO-Model	Semi-closed IO-Model
Energy, Mining, Basic Materials	0,69	0,92
Equipment	0,90	1,02
Consumer Goods (incl. Food)	0,81	1,20
Trade	0,22	0,60
Transport, Communication	0,23	0,54
Financial Services	0,10	0,41
Other Private Services	0,36	0,66

Source: Statistisches Bundesamt (1994), own calculations.

Assuming *ceteris paribus* - e.g. given real wages and unchanged productivity - production and employment growth are congruent. Under this restriction, the semi-closed io-model reproduces the results of the simple time series approach in section 2: if employment in manufacturing changes for one percent, an io-framework suggests that employment of service sectors adjusts for about a half percent. This poses the question, whether comparable results have to be expected for the Münsterland and Emscher-Lippe.

#### 4. A Regional View

Comparing Western German and regional employment growth by industries is a simple method to measure nation-wide influence on regional markets. The following elasticity approach is applied for employment changes in Münsterland and Emscher-Lippe. For both regions and eight sectors regional employment growth and the corresponding rates for Western Germany are correlated (annual data between 1979 and 1997,  $g$  are growth rate operators, regional index  $r$ , industry index  $i$ ):

$$(2) \quad ge_{i,r} = \mathbf{b} * ge_i + \mathbf{g}$$

Parameter  $\mathbf{b}$  measures the elasticity of regional employment of an industry and may be interpreted as the dependency of a regional industry from the belonging national market. If the regional employment fluctuate more then its pendant, the employment elasticity is greater than one. Contrary, values below one depict a damped dependence of the region from cycles in the analysed industry.  $\gamma$  seizes the autonomous component of employment growth and shows to what extent the regional employment is able to change inde-

pendently from nation-wide markets. Autonomous employment growth might be positive or negative, depending on locational advantages and/or regional competitiveness.

The results reported in table 3 give further reason for the remarkable economic performance of Münsterland and the unsatisfactory recent development in Emscher-Lippe (Meyer/Ewerhart/Siebe 1998). As expected above, not solely deviating initial employment structures are responsible for the different economic performance. During the last two decades, the Münsterland was faced with locational advantages for manufacturing as well as for transport and trade. Significantly positive autonomous employment gains and corresponding elasticities near unity indicate that employment growth exceeds the West-German development by 1-2 percentage points.

**Table 3: Employment Equations by Regions and Industries**

	Region	Employment Elasticity <b>b</b>	Autonomous Growth <b>g</b>	$R^2_{\text{bar}}$	DW
Energy, Mining,	M	0,79 (4,4)	1,7	0,51	1,42
Basic Materials	E	1,11 <sup>a)</sup> (4,1)	-1,1 <sup>b)</sup>	0,49	1,92
Equipment	M	0,79 (4,9)	2,0	0,56	1,35
	E	0,83 (5,9)	-0,9	0,66	1,58
Consumer Goods	M	1,22 (7,2)	1,0	0,74	1,11
(incl. Food)	E	0,77 (2,8)	-0,5 <sup>b)</sup>	0,27	1,28
Construction	M	1,26 (10,6)	-0,3 <sup>b)</sup>	0,86	1,44
	E	0,85 (7,8)	-0,7	0,77	1,42
Trade	M	0,98 (7,4)	0,9	0,75	1,89
	E	0,96 (6,4)	-0,9	0,69	2,11
Transport,	M	1,32 (4,5)	2,1	0,51	1,09
Communication	E	1,53 (3,9)	0,4 <sup>b)</sup>	0,44	1,53
Financial Services	M	0,67 <sup>a)</sup> (3,3)	0,8 <sup>b)</sup>	0,49	2,41
	E	0,62 (2,6)	-0,4 <sup>b)</sup>	0,58	1,43
Other Private	M	0,61 (6,3)	1,5 <sup>l)</sup>	0,76	2,02
Services	E	0,67 (3,7)	0,2 <sup>b)</sup>	0,45	0,98

Sample: 1979-1997 (19 Observations)

t-Statistics in parenthesis

a) incl. lags b) insignificant influence.

On the other hand, the estimated constants of the equations for Emscher-Lippe do not significantly differ from zero or are even negative. Furthermore, the high elasticity for declining industries like energy, mining, and basic material is clearly a disadvantage – saying that the regional decline moves on faster. In both regions, the employment of transport and communication is fluctuating extremely. The remaining service industries have estimated employment elasticities up to unity. The non-distributive services are not so competitive. To some extent, this reflects a spatial specialisation on manufacturing and comparative disadvantages in services.

The aggregate employment elasticity calculated by weighted averages over industries lies near unity for both regions. But the Münsterland has a distinct locational advantage, while Emscher-Lippe was faced with overall autonomous employment losses.

Coming back to the starting point, elasticities about unity lead to a parallel development of employment by industries in Western Germany and both regions. By pre-multiplying regional employment elasticities with the West-German effects depicted in table 2, one gets fictitious regional effects by service industries. In table 4, this procedure is carried out for Münsterland's service industries. By summing up the last column, overall service employment rises by 788 or 0,52 percent. Obviously, this results meets the long-term elasticity estimated in section 2.

**Table 4: Spill-over from Manufacturing to Services in Münsterland**

	Semi-Closed IO-Model (2)	Regional Elasticity (3)	Percentage Differences (2)*(3)	Absolute Differences
Trade	0,60	0,98	0,59	392
Traffic, Communication	0,54	1,32	0,71	119
Financial Services	0,59	0,67	0,40	80
Other private Services	0,66	0,61	0,40	197
Total			0,52	788

For Emscher-Lippe, the analogous procedure leads to an elasticity of 0,54. This reproduces the result of the time-series model even better. Obviously and not surprising, the employed input-output approach allows a possible and plausible interpretation of recent structural change in some NRW-regions.

## 5. Conclusion

Tertiarisation as the most prominent pattern of structural change seems to be a phenomenon predominately based on developments within service industries. In this interpretation, the prosperity of service industries is a key factor of economic advance. This paper puts some doubts on this simple sight. Its message is twofold: Firstly, it looks for favourable regional conditions apart from initial structure. Secondly and more pronounced, it shows that manufacturing and service industry together are part of the division of labour. In a more complementary context, an emphasis of regional economic policy on services is misleading.

The exemplary empirical analysis of two NRW-regions shows that small employment shares of manufacturing and larger service shares are either necessary nor sufficient for a satisfying economic performance: the industry-based Münsterland might be characterised as an emerging region, the service-intensive city of Münster is not excessively successful, and Emscher-Lippe as an old industrial area is certainly not.

From an European point of view, this is not a unique finding. Recent development on labour markets might be characterised by a regional reallocation of economic activities. Central regions typically do not meet high expectations, while especially surrounding areas are favoured (Molle 1997). A study for south-eastern part of NRW with a focus on metal processing confirms these results (Meyer/Ewerhart/Siebe 1999). The initial industry mix with potential “winners” and “losers” of structural change might limit economic performance, but the approach well-known from shift-share analysis does not tell the whole story:

- industries in special regions are independent from overall market trends to some degree: industries with a high performance might follow a poor development in the region. On the other hand, so called “losers” may outperform their overall markets;
- the regional competitiveness is another key factor for development – among others determined by locational advantages or disadvantages.

As mentioned above, an emphasis on service promoting policies ignores complementary relations between manufacturing and service industries: manufacturing is the most important customer of service industries, and, on the other hand, service industries demand a considerable extent of commodities as inputs. This insight may have been a cause for the recent political discussion on “industrial cores” in Eastern Germany.

Statistical tests for two NRW-regions permit to reject a significant influence of service employment on employment in manufacturing – the inference for a reversed causality is weak. A structural interpretation of the test equations suggests that an input-output framework is well-suited to explain the relationship. Following this idea, employment changes in manufacturing are positively connected with changes in service industries. Therefore, employment gains are unlikely without a competitive industrial basis in some regions.

As a matter of fact, it becomes more and more arbitrary to distinguish services and commodities. Rising service intensities of manufactured products as well as outsourcing, more and more, wipe out the distinction between both. As a consequence, regional economic policy has to make sure that both – manufacturing and service industries – meet a favourable framework.

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