Sectoral Transformation, Turbulence, and Labour Market Dynamics in Germany

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Abstract

The secular rise of European unemployment since the 1960s is hard to explain without reference to structural change. This is especially true in Germany, which has lost more than 7% of its industrial employment in the period 1975-2001, while service sector employment has risen by more than 10%. Has this development been an even one, or has there been an increase in turbulence over the past quarter-century? This paper documents the extent of structural change in German employment over the past three decades. Employing a variety of measures, we document the marked increase in turbulence, especially since 1990. However, this increase is not due to an increase in gross flows, but an increase in the net "yield" given gross worker turnover. This turnover is cyclically sensitive and strongly procyclial. Net reallocation, on the other hand, is countercyclical, which means that recessions speed up sectoral reallocation. German reunification and Eastern enlargement are the most obvious factors contributing to the long-run trends observed.

Key words: Gross worker flows; sectoral and occupational mobility; turbulence.

JEL classification: J63; J64; J62

1 Introduction

Modern market economies are constantly subject to structural change. Some sectors shrink, while others grow. As a result, there is pervasive movement of workers between the different sectors of the economy. This happens as a reaction both to long-run trends, and to short-run, cyclical, variations. The most important long-run trend for developed economies is the shift of employment from the production sector to services. This is the case for virtually all OECD countries and is especially true in Germany, a heavily industrialized country which has lost more than 7% of its industrial employment, while service sector employment has risen by more than 10% between 1975 and 2001. During the same period, unemployment has risen from below 2% of the workforce to over 10%.

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Earlier influential analyses of the European unemployment problem such as Bruno and Sachs (1985) stressed the impact of the supply shocks of the 1970s, while Blanchard and Summers (1986), Burda (1988), Lindbeck and Snower (1986) and Layard, Nickell, and Jackman (2005) stressed inappropriate constellations of labor market institutions, such as unemployment compensation, job protection or powerful unions which protected the power of insiders. The secular rise of European unemployment since the 1970s is however difficult to account for without reference to structural change. Structural shifts have therefore received more attention recently.

In this paper, we analyse both the extent and the dynamics of structural change in western Germany for the time period 1975-2001. We do this by computing gross and net worker flows from a large panel data set which covers 2% of the German social security workforce. We are thus able to point precisely to where structural change is most prevalent in the economy, which workers are most affected, and which worker flows contribute most to it. Furthermore, we show which role the business cycle plays for sectoral and occupational worker reallocation. Before doing so, however, we briefly summarise the empirical and theoretical literature on structural change and its impact on the labour market.

There are two broad explanations for the long-run changes in the sectoral structure of developed economies, namely the rise of the service sector and the decline of the productive sector, one utility-based and one technology-based.[1] The utility-based explanation posits that as real incomes rise, demand for services rises faster than demand for goods. This leads to a shift of final demand away from goods towards services. The technology-based explanation argues that labour productivity has increased faster in the goods-producing sector than in the service sector. Ngai and Pissarides (2005) analyse the effect of this evolution in a multi-sector model of growth with differences in TFP growth rates between sectors and derive the conditions for balanced growth. Employment flows to the sector with the lowest growth rate, and in the limit converges to the two sectors featuring the slowest growth and the fastest growth, respectively. With respect to the evolution of employment, this technology-based explanation is thus in line with Baumol's "cost disease" process (Baumol, 1967). As for empirical studies, Marimon and Zilibotti (1998) decompose sectoral employment and labour cost in 11 European countries into country, industry, and temporal effects. According to their analysis, 80% of the long-run differentials across countries and industries in employment growth can be accounted for by sectoral effects. They also argue that Spain's very high unemployment in the 1990s was mainly due to the difficulties this economy had with reallocating workers from agriculture to industry. van Riet, Ernst, Madaschi, Orlandi, Rivera, and Benoît (2004) review the main stylised facts concerning sectoral specialisation in the European Union, as well as the changes that have taken place over time. One of their findings is that some countries (notably Finland, Germany, and Sweden) experienced above-average rates of sectoral reallocation in the early 1990s. D'Agostino, Serafini, and Ward-Warmedinger (2006) analyse the determinants of the service sector employment share in the EU-15. They conclude that an efficient sectoral reallocation of labour has been hindered by the institutional framework affecting flexility in the labour market and by the mismatch between workers' skills and job vacancies. Lee and Wolpin (2006) investigate the importance of the costs workers face when switching their sector of employment, as well as the role of labour supply and demand factors in the growth of the service sector. In order to do so, they estimate a two-sector growth model with aggregate and idiosyncratic shocks for the US economy. They find that these mobility costs are large, and that demand side factors, namely technical change and movements in product and capital prices, were responsible for the growth of the service sector.

Another strand of the literature is concerned with the effects of cyclical factors affecting the structure of the economy. In his seminal contribution, Lilien (1982) argues that sectoral shocks require the reallocation of workers between sectors. Because of the time-consuming nature of the matching process, this leads to frictional unemployment, which raises the overall unemployment rate. This hypothesis has not held up to subsequent analyses. Abraham and Katz (1986) and Blanchard and Diamond (1989) show that the evolution of vacancies is not consistent with the sectoral-shocks explanation. In particular, they argue that vacancy data do not show large differences in labour demand between sectors. Therefore, sectoral

[1] See Schettkat and Yocarini (2006) for a summary of the literature.

shocks cannot be seen as a cause of higher unemployment. Rather, sectors differ in their sensitivity to aggregate shocks. However, Layard, Nickell, and Jackman (2005) argue that the development of worker mobility should be considered as a factor influencing unemployment at least over the long run. According to Groshen and Potter (2003), the cyclical sensitivity of different sectors in the US economy has changed over time. They attribute the "jobless recovery" of the years 2001-2003 to the fact that more job losses during the preceding recession were permanent than had usually been the case in previous recessions. This means that structural transformation seems to have impeded certain industries from re-employing workers they had previously shed. Formal analyses of the cyclical aspects of sectoral reallocation are provided by Rogerson (1987), who constructs a two-period, two-sector model with permanent sectoral shocks, Rogerson (2005), who proposes a variant of the Lucas-Prescott model (Lucas and Prescott, 1974) which allows for infinitely lived agents and sector-specific human capital. Jovanovic and Moffitt (1990) estimate a structural model with both idiosyncratic and sectoral productivity shocks. They find that, for the US between 1966-1980, while having a lower impact than idiosyncratic factors, sectoral shocks play an important role for gross worker mobility.

While this paper is mainly concerned with sectoral flows, the more general literature on mobility in the labour market is clearly important. There is in fact a large literature analysing the consequences of worker mobility for individual workers and for the economy as a whole. Voluntary job mobility by individual workers has been extensively analysed in the job search literature (for an overview of job search, see Rogerson, Shimer, and Wright, 2005). One of the conclusions related to our investigation is that young workers follow a two-stage search strategy: they first try to find a job in a suitable occupation, and only afterwards decide on which sector they want to work in (cf. Neal, 1999). Involuntary job mobility, on the other hand, is dealt with in the displaced workers literature (cf. Burda and Mertens (2001), Kuhn, 2002). Displacement has implications both for future wages and for the subsequent labour market history of workers. These consequences are likely to be more negative when a worker has to change sector or occupation, as this implies the loss of sector- or occupation- specific human capital. Worker mobility thus plays a role for the evolution of the wage structure. As Kambourov and Manovskii (2004) point out, the increase of occupational mobility has lead to a spreading out of the wage distribution in the US. The reason for this is the fact that a change of occupation implies a loss of human capital, and hence a wage loss. Finally, worker mobility is also important for the allocation of workers to their most productive use in the economy.

Much has recently been made of the issue of *turbulence* in the labour market. In order to clarify how this is related to structural change in the economy, we briefly discuss this issue. There are several different notions of the concept of turbulence. First, following Lilien (1982), one can define turbulence as increased *net* reallocation of workers between sectors. Second, the stability of employment relationships (cf. Farber, 1999) is often viewed as a measure of turbulence. Third, one can define turbulence as an increase in mismatch on the labour market. Layard, Nickell, and Jackman (2005) look at the mismatch between labour demand and labour supply across economic sectors. This can be measured by examining either sectoral market tightness or sectoral unemployment rates. Finally, Ljungqvist and Sargent (2004) definte turbulence as the increased loss of human capital when unemployed. They argue that the loss of human capital during unemployment reduces the incentive for the unemployed to take up a new job, especially when unemployment benefits are high.

While there is thus a large literature on the causes and the effects of sectoral change, there seems to be a lock of analyses which specifically look at the dynamics of this change. The paper closest to our approach is Greenaway, Upward, and Wright (2000). They examine the behaviour of net and gross worker flows in the UK for the time period 1950-2000. Their key findings are, first, that gross worker flows do not display a secular trend, and second, that net worker flows, i.e. sectoral reallocation, was higher in the 1970s and 1980s than in any other post-war decade. They also argue that gross worker flows they are not indicative of the amount of sectoral reallocation occurring. Instead, they are best seen as an indication of the cost of sectoral reallocation.

There exists some work on occupational and sectoral mobility in Germany. The dynamics of the German labour market were analysed by Bachmann (2005) for the time period 1975-2001 using the IAB Regional File 1975-2001. This data set consists of registry data provided by the Institute for Employment

Research (IAB) of the German Federal Employment Agency. He finds that worker flows do not display a marked trend over the time period considered. This is consistent with the evidence presented by Winkelmann and Zimmermann (1998), who show that there is no evidence for increased job stability in Germany during the last decades. Farber (1999) argues that the same is true for the US. As for the cyclical features of worker flows, Bachmann (2005) shows that separations are relatively flat over the business cycle, while accessions are strongly procyclical. This points to the fact that hirings play a key role for the dynamics of the labour market.

Velling and Bender (1994) analyse the cross-sectional properties of occupational mobility for employment covered by social security legislation for the year 1989. They also use registry data provided by the IAB. Their main findings are as follows: occupational mobility depends strongly on worker characteristics such as age, education, and sex. Furthermore, the labour market history of a worker, in terms of both wages and previous transitions, has an important impact on the probability of a change of occupation. Bender, Haas, and Klose (1999b) provide descriptive evidence on both types of mobility for the time period 1985-1995 using the same data set. From this, they conclude that the influence of the business cycle on both series is strong. Furthermore, unemployed workers are found to have become more mobile over the time period considered. Isaoglu (2006) explicitly analyses occupational mobility of male employed workers in Germany for the time period 1985-2003 using the German Socioeconomic Panel (GSOEP). She estimates probit transition models and concludes that occupational mobility is strongly procyclical and strongly dependent upon individual characteristics.

The key differences between the above studies and this one are as follows. First, as opposed to Isaoglu (2006), we use the IAB employment sample (IABS) for the time period 1975-2001. The main advantages of the data set, which is described in detail below, are that the information is very accurate, and that the sample size is very large. Second, we consider occupational and sectoral mobility for workers experiencing different labour market transitions, namely those who switch to a new job without intervening spell of non-employment, those who were unemployed beforehand, and those who were not covered by the system of social security beforehand. Third, we consider men and women separately.

The plan of the paper is as follows: the next section gives a detailed description of the data set used. The third section presents evidence on the evolution of the sectoral structure of the economy. In particular, we show that Lilien-type indices indicate an increase in the pace of sectoral reallocation from the early 1990s. The fourth section analyses the dynamics of structural change by looking at gross and net worker flows across sectors. We find that while gross flows have hardly changed over the time period considered, net flows have increased considerably. We also show that the business cycle plays an important role for the extent of sectoral reallocation in the economy. The final section summarises the main results and concludes the discussion.

2 The data and measurement issues

2.1 The data set

The data set used is the IAB Regional File 1975-2001, which is provided by the Institute for Employment Research (IAB) of the German Federal Employment Agency. The data base covers 2% of all the persons who, between the 1st January 1975 (for western German employees) or the 1st January 1992 (for eastern German employees) and the 31st December 2001, worked in an employment covered by social security. The data source consists of notifications made by employers to the social security agencies, which include health insurances, statutory pension schemes, and the unemployment insurance agencies.[2] These notifications are made on the behalf of workers, employees and trainees who pay contributions to the social insurance system. This means that, for example, civil servants and self-employed are not included. Overall, the subsample includes over 1.29 million people, of which 1.1 million are from western Germany. For 1995, the employment statistics, from which the IAB Regional File is drawn, cover nearly 79.4%

[2]For a complete description of the data set, see Bender, Haas, and Klose (2000).

of the employed persons in western Germany, and 86.2% of all employed persons in eastern Germany. As for the unemployed, only those entitled to unemployment benefits are covered. This means that the unemployment stock is about one third lower compared to offical labour statistics.[3] Notifications are made at the beginning and at the end of an employment or unemployment spell. Furthermore, there is an annual report which updates some of the information. The information provided is the following: sex, year of birth, and degree of education/training. Also, information on the occupation and the gross earnings of workers, an establishment number, and the economic sector is available on a daily basis. It should be noted here that our notion of a job is establishment (not firm) based. This means that a change of establishment within the same firm will also be recorded as a job change.

For the purpose at hand, it is important to note that information on the economic sector or the occupation of an employee is not mandatory in the following sense: if *only* the sector or the occupation of an employee changes, the employer does not have to notify the social security agency. However, this information has to be included in every mandatory notification, i.e. the notification at the beginning of an employment spell and the annual notifications. As a change of sector always involves a new employment relationship, and thus a new notification, every such change is recorded. This is not true for changes of occupation, as this might well change for an employee while he remains in the same establishment. Therefore, a change of occupation on the same job will only be recorded at the end of the year. This means that some occupational mobility is not recorded, for example when an employee changes his occupation and then the match is destroyed before the end of the year (and the next annual notification). Thus, we have exact information on sectoral mobility, and a lower (and in all likelihood quite exact) bound on occupational mobility. Up to now, the empirical analysis considers 16 broad economic sectors. The information on the occupation of an employee is much more detailed: 128 different occupations are recorded.

Two states of the labour market can be directly derived from the data set: employment covered by social security, and unemployment, if the worker is receiving some form of unemployment compensation. The third state considered, "non-participation", is not directly recorded but can be inferred. It is defined as: not paying social security contributions while full-time employed, and not receiving unemployment benefits. This means that non-participation can coincide with the state "out-of-the-labour-force". However, it can also mean self-employment, civil service employment, retirement, or marginal employment. Thus, for those ever registered with the social security system, "non-participation" provides an upper bound for "out-of-the-labour force".[4]

The advantages of the data set are thus as follows: first, it does not suffer from the problems inherent in most panel data sets, e.g. there is no sample attrition, and it follows workers over a long period of time because there is no need for rotation as in the CPS. Given the length of our times series, the evidence here is likely to be more conclusive than the US studies cited above, which observe only one episode of labour market tightening (1994-2000) and loosening (2000-2003). Our data set covers two decades and two full business cycle swings. Second, it offers observations at a very high frequency, which means that every actual transition is observed. Again, this is a distinct advantage over survey data like the CPS or the GSOEP, which does not record multiple transitions that take place between two interview dates and, in the case of the GSOEP, uses retrospective data. There are two disadvantages to the data set. On the one hand, it is representative for the working population covered by social security legislation, and not the entire working population. It should be pointed out here that the share of workers covered by social security relative to total employment is large and relatively stable, at around 80 %. On the other hand, it only covers the unemployed who receive unemployment benefits. Therefore, this special structure of the data set has to be taken into account when interpreting the different flows however, especially the ones going to and from non-participation.

[3] See Bender, Haas, and Klose (1999a).

[4] Cf. Fitzenberger and Wilke (2005) for an in-depth analysis of this issue.

2.2 Measurement

Given the data on the employment state of workers, it is possible to calculate worker flows. There are two basic options. First, one can use point-in-time comparisons. This implies checking the labour force state of each individual at two given dates (e.g. at the beginning of two consecutive months), and infer the ensuing flow from this comparison. Second, one can calculate flows cumulatively, i.e. take into account every change of state that takes place, even if there are several flows within a certain time period (e.g. a month). As our data record every single move with daily accuracy, we opt for the latter approach. Thus, we take into account short spells as well, which are usually not recorded in other data sets[5].

As it is possible to track the employment and unemployment history of every person in the data set, we can compute the flows to new job matches from different origins. We do so for employer-to-employer (EE) transitions, unemployment to employment (UE) transitions, and transitions from non-participation to a new employment (NE).

We have to take into account that there might be measurement errors in the data because of the way the data are collected. In particular, workers' notifications of leaving the state of unemployment might not always correspond exactly to the actual change of labour market state. We correct for this latter potential measurement error in the following way: If the time interval between an unemployment and an employment record is smaller than 30 days, we count it as a direct transition between the two states recorded.[6] If the gap between two notifications is larger than 30 days, we count this as an intervening spell of non-participation. As for job-to-job flows, records that are from the same person and the same establishment are counted as one single spell as long as the time between two consecutive employment notifications does not exceed 7 days.

As we are interested in consistent time series that go back as far as possible, the empirical analysis only considers workers from western Germany. As there is no information on the place of residence in the data set, we discard observations on employees that at some point have worked in eastern Germany. We also discard some worker groups, such as artists, who feature an implausibly high number of spells. As these observations are due to administrative rules, they are not interesting from an economic point of view. We therefore drop these observations from the data set by eliminating all observations for any person who features more than 200 employment spells over the time period considered. We also do not consider apprentices. The number of people receiving unemployment benefits is unreliably measured before 1980. Therefore, the stock of those people, as well as the flows from that state, cannot be used for our analysis before 1980. As employment is correctly measured, we obtain reliable estimates for direct job-to-job transitions for the entire time period 1975 to 2001.

The empirical results are in the next section.

3 Sectoral employment and structural change

3.1 The sectoral structure of the economy

We first analyse how social security employment is allocated over the six main sectors of the economy. In order to do so, we compute the stock of social security employment for the 30th of June of every year in our sample (1975-2001)[7]. The results are in Figure 1 and Table 1. This gives an impression of the quantitative importance of the different sectors, as well as of the structural change that has taken place over the time period considered. For the time period considered, most workers are employed in production, in the service sector, and in trade and transport. The construction sector, agriculture, energy, and mining, and the public sector (''state'') are quantitatively much less important. The three latter sectors, as well as trade and transport, are relatively stable over time and do not show a pronounced trend. The most striking evolution in the graph is the reduction of the employment share in the production sector, and

[5] Note however the qualification mentioned above with respect to occupational mobility.

[6] We did the calculation for smaller intervals as well. This does not change the results significantly.

[7] Ideally, we would like to take beginning or end of year figures. However, because of the special notification procedure that generates our data, we are unable to do so.

the strong increase of the service sector. The employment share of the latter rises by more than 10%, and nearly the entire rise is at the expense of the production sector.

Sectoral employment shares for a finer breakdown into 16 sectors are presented in Table 2 for full-time and part-time employment. This table shows, among other things, where the growth in service employment is coming from. While household-related services have remained relatively stable over the time period considered, the employment share of social services has increased by between 50% and 80%, and the share of business related services by 75%. As for shrinking sectors, the decline in the employment share is strongest for the production of basic goods (-30%), consumption goods (-35%), and construction 1 (-35%).

The main message from this analysis is clear: over the entire time period 1975-2001, there has been an ongoing process of structural change in the economy, reallocating workers from the production sector to the service sector. Within the service sector, business-related services have increased most, while household-related services have remained relatively constant. One question that arises is whether the reallocation of workers from shrinking to expanding sectors has been smooth, or whether the pace at which this process has been taking place has changed over time. This is the topic of the next section.

3.2 Structural change and turbulence

The empirical evidence presented in the previous section has given an impression of the importance of different industrial sectors and its evolution over time. However, from this it is not straightforward to see the overall extent of structural change. One way of quantifying the latter is to follow Layard, Nickell, and Jackman (2005) in calculating a Lilien (1982)-type turbulence index. The index used takes the form[8]

$$\lambda_{d,t} = \frac{1}{2} \sum_{j=1}^{J} \left| \Delta_d \frac{E_{j,t}}{E_t} \right|.$$

Here, J denotes the number of economic sectors considered, $E_{j,t}$ is employment in sector j in period t, E_t is total employment in period t, Δ is the difference operator, and d indicates the number of years over which the difference is taken. Thus, for example, $\lambda_{1,t}$ measures the turbulence at time t as half the sum of changes in sectoral shares from year t to year $t-1$. The division by two is performed in order to avoid double counting. The evolution of the turbulence index is depicted in Figure 2 for six main economic sectors and three differences, namely 1-, 5-, and 8-year differences. As one can see, the indices rise with the amount of difference considered, i.e. the λ_5-index is larger than the λ_1-index, and the λ_8-index is larger than the λ_5-index. This could have been expected as the λ_1-index captures short-run changes (from one year to the next), while the other indices capture more long-run trends. What is striking however, is that all three measures indicate a marked increase in turbulence in the 1990s. Especially the early 1990s seem to have been a particularly turbulent period. This is in all likelihood due to the impact German reunification had on the labour market of the entire country. But even in the second half of the 1990s, the indices do not return to the previous, lower levels of the 1980s. Neglecting the jump in the early 1990s and comparing the time periods 1985-89 and 1995-99, the means of the three indices increase by at least 85%. This means that this Lilien-type turbulence did not abate even more than five years after German reunification. We analyse this issue further by looking at a more detailed sectoral division. The result is in Table 3 and in Figure 3. As one can see, the result is robust to considering a larger number of sectors: the Lilien index computed for 16 economic sectors also strongly rises in the early 1990s, goes back in the second half of the 1990s. However, in the latter period it still remains above the levels of the 1980s. The results for turbulence with respect to occupations are in the same table. Similarly to the results for sectors, the Lilien index rises strongly in the early 1990s. Thereafter, however, it returns to levels which are similar to the ones seen in the 1980s.

[8] The original Lilien (1982) index is defined as $\sigma = \left[\sum_{j=1}^{J} (\frac{E_{jt}}{E_t})(\Delta \log E_{jt} - \Delta \log E_t)\right]^{1/2}$. The reason for calculating a modified index is that it provides a more natural point of comparison for the flow analysis we are conducting. The two indices yield very similar results.

The question then is why the sectoral Lilien indices have increased in the early 1990s, and why they have remained high thereafter. In order to answer this question, we rewrite modified Lilien index in the following way:

$$\begin{aligned}
\lambda_t &= \frac{1}{2}\sum_{j=1}^{J}\left|\Delta\frac{E_{j,t}}{E_t}\right| \\
&= \frac{1}{2}\sum_{j=1}^{J}\left|\frac{E_{j,t}}{E_t}-\frac{E_{j,t-1}}{E_{t-1}}\right| \\
&\approx \frac{1}{2}\sum_{j=1}^{J}\left|\frac{E_{j,t}-E_{j,t-1}}{E_t}\right| \\
&= \frac{1}{2}\sum_{j=1}^{J}\left|\frac{i_{j,t}-x_{j,t}}{E_t}\right|
\end{aligned}$$

where the approximation in the third line holds if the changes in the employment stocks are not too large from one year to the next. Then, it is easy to see that the Lilien index will increase if inflows and outflows diverge. This can happen for two reasons: first, if the short-run variations of inflows and/or outflows increase, and, second, if long-run trends accelerate. In order to examine the second possibility, we run regressions of the form

$$\frac{E_{j,t}}{E_t} = c + at + \epsilon_t,$$

where c is a constant, t a time trend, and ϵ_t an error term. We do this for the sectors which show the largest changes in employment shares, namely the production and the service sector. This yields regressions with a good fit (R^2 of 0.86 and 0.97 for the production and service sector, respectively) and a coefficient on the time trend which is significant at the 1% level. We then conduct Chow-type breakpoint tests for both regressions for the year 1990. This rejects the null hypothesis of no structural change in both regression equations at the 1% level of significance. We conclude that the year 1990 marks a watershed for the West German labour market: After reunification, the structural change in the economy, i.e. the reallocation of workers from the production sector to the service sector, accelerated significantly. In the next section, we examine in which way this has changed the dynamics of the German labour market.

4 The Dynamics of Structural Change

In order to analyse the dynamics of structural change, we look at both gross and net worker flows. A gross flow can occur for several reasons. One is a change in labour demand of one economic sector relative to the others. This will lead to flows from one sector to another, i.e. net sectoral reallocation. Any other factors leading to match dissolution (e.g. a change in idiosyncratic productivity of a match) will result in a worker flow, which can happen to lead to a match in a different economic sector. If the relative demand between sectors has not changed though, a worker flow in the reverse direction is likely. These two worker movements thus lead to gross reallocation while leaving net reallocation - and thus the distribution of workers across sectors - unchanged.

Our analysis proceeds in several steps. First, we have a look at the cross-sectional and long-run trends in gross worker flows in Section 4.1. A detailed analysis of net worker flows is in Section 4.2, where we investigate the evolution of the components of net flows, as well as the contribution of sectoral inflow and outflow rates to structural change. Finally, in Section 4.3, we examine the role of the business cycle for the dynamics of structural change.

4.1 Gross sectoral and occupational mobility

Our analysis of gross occupational and sectoral mobility proceeds in two steps. First, we look at the cross-sectional properties of the worker flows on the labour market which involve a change of sector and/or occupation. The aim of this exercise is to get a general picture of the magnitude of those flows, as well as of the differences between worker groups. Second, we examine the long-run trends of gross worker flows. This will give an indication of whether labour market dynamics have changed over time.

In order to keep the analysis tractable, we first concentrate on employment inflows only. We thus analyse new employment relationships involving a change of sector and/or occupation, and we distinguish between three different states of origin: employment, unemployment, and non-participation. In other words, we look at the flows entailing a change of sector/occupation which go from one employer to another (EE flow), from unemployment to employment (UE flow), and from non-registration to employment (NE flow). Furthermore, the analysis is conducted separately for men and women, and for three age categories.

Specifically, we compute the following time series:

1. the hazard of a worker experiencing both a sectoral change and
   (a) an EE-transition
   (b) an UE-transition
   (c) an NE-transition
2. the hazard of a worker experiencing a sectoral change conditional on having made
   (a) an EE-transition
   (b) an UE-transition
   (c) an NE-transition
3. the hazard of a worker experiencing both an occupational change and
   (a) an EE-transition
   (b) an UE-transition
   (c) an NE-transition
4. the hazard of a worker experiencing an occupational change conditional on having made
   (a) an EE-transition
   (b) an UE-transition
   (c) an NE-transition

All time series are calculated for men and women separately. Furthermore, we divide workers into three different age groups, 16-29, 30-49 and 50-65.

The time series we get for (1.) and (3.) are meant to capture the overall extent of sectoral and occupational mobility, respectively. As both types of mobility are likely to depend on the type of transition a worker experiences at the same time, we jointly analyse a given labour market flow and a switch of sector and/or occupation. The time series generated for (2.) and (4.) are meant to capture the sectoral and occupational mobility *over and above* the movements in worker flows. This is why in (2.) and (4.) we condition on having made a certain transition.

4.1.1 Cross-sectional results

The cross-sectional evidence on worker mobility presented in this section will shed some light on the following questions: first, which labour market transitions are most prevalent on average, and which transitions play the biggest role for structural change in the economy? And, second, which groups of workers are most mobile, or, put differently, who is affected by/plays an important role for structural change?

In order to answer these questions, we start by presenting average results for the different time series for the time period 1980 to 2000. Table 4 shows the hazard of changing sector and making a certain transition at the same time (flows 1.a-1.c), while the hazard of changing sector *conditional on* making a certain transition (flows 2.a-2.c) is in Table 5. Table 6 presents those averages for the flows (3.a)-(3.c), i.e. the hazard of changing occupation and, at the same time, making one of the three transitions considered, for men and women separately. Table 7 displays the average hazard of changing occupation conditional on making a certain transition. The hazards are very similar with respect to sectors and occupations. Looking at the differences between age cohorts, one can see that the hazards are all strongly falling with age. This finding can be rationalised by the fact that young workers, who have only relatively recently entered the labour market, are engaging in job shopping in order to look for the sector and the occupation that suits them best (cf. Neal, 1999). For older workers, this effect is of less importance. Also, older workers have accumulated more sector/occupation-specific human capital. Changing sector or occupation therefore entails a larger loss of human capital for older workers than for younger workers. Hence, the propensity to change sector and occupation is falling with age. Note, however, that the definition of sectors is much broader than the definition of occupations, and that therefore the hazards of changing sector are generally lower.

As for differences between male and female workers, women in general display lower hazards of changing sector and occupation. This finding is in line with the evidence presented in Fitzenberger and Kunze (2005). There, the authors argue that female workers are often locked in low wage careers, which are characterised by low mobility and therefore job changes only lead to small wage gains. Finally, the fraction of new employment relationships involving an occupational change for the workers is relatively low if the worker has been unemployed previously. As shown below, the reason for this is that exit rates from unemployment are generally low over the time period considered.

These results show that the hazard of a worker changing his sector and occupation is highest when he has been outside the social security labour force before, and is lowest for direct job-to-job transitions. This implies that direct job-to-job transitions generally take place between jobs involving the same sector and occupation. As for women, the results are quite similar, with two exceptions: first, for women at a young age, direct job-to-job transitions are much less likely to involve a change of occupation than for men. Second, NE flows at an older age are also less likely to go together with a change of occupation than this is the case for men.

We conclude from the results in this section that all three labour market flows play an important role for structural change in the economy. Furthermore, there are important differences between worker flows, with men and young workers being most mobile.

4.1.2 Long-run trends

We now turn to the analysis of long-run trends. As a first step, we compute gross worker flows normalised by the employment stock as follows:

$$gross_t/e_t = \left[\sum_{j=1}^{J} ee_{j,t} + 0.5 \cdot (eei_{j,t} + eex_{j,t}) + ue_{j,t} + eu_{j,t} + en_{j,t} + ne_{j,t} \right] \cdot \frac{1}{e_t}$$

where $ee_{j,t}$ denotes direct job-to-job transitions within an economic sector. $eei_{j,t}$ are inflows into, $eex_{j,t}$ outflows from a sector. ue, eu, en, and ne are the transitions between the states of employment e, unemployment u, and non-registration n. Subscripts j and t denote an economic sector and time period

$[t, t+1]$, respectively. This measure of gross flows gives an impression of the overall amount of worker reallocation in the economy. The resulting time series is in Figure 4, and averages for different time periods are in Table 8. The emerging picture is clear: apart from business cycle fluctuations, the series is quite stable. No clear long-run trend is discernible. There is thus no evidence for an increase in turbulence in the sense that worker turnover has remained relatively stable over the time period considered.

Next, we analyse the evolution over time of the hazards introduced in the previous section. While doing so, we are interested in whether a certain type of transition displays a clear trend. This will cast further light on the questions of whether one can see more turbulence in the labour market. The analysis is now more detailed in the sense that we can examine whether employment relationships have become less stable, whether the unemployed have become more or less mobile over time (which might be an indication of Ljunqqvist-Sargent type turbulence), or whether there have been more or less direct job-to-job transitions involving a change of sector and/or occupation.

The evolution of the hazard of experiencing an occupational change together with a certain labour market flow is in Figure 5 for EE flows. The left panel displays the hazards for different age groups of male workers, while the right panel shows the same hazards for female workers. It becomes apparent that there is no clear trend in the data. On the other hand, the series react strongly, and positively, to the business cycle, i.e. they are strongly procyclical. Furthermore, the cylicality is falling with age. In order to keep the analysis tractable, in the remainder of this section, we only discuss the results for men aged between 25 and 55.[9]

Figure 6 depicts different measures of flows between sectors, while Figure 7 does the same for occupations. The left panel shows the fraction of new employment relationships which involve a worker who has changed sector, and who has made either a direct job-to-job transition, or who has been previously unemployed, or not in the data set. The right panel displays the fraction of new employment relationships which involve a worker who has changed occupation *conditional on* a certain labour market transition. The latter transition thus abstracts from movements in the number of labour market transitions, and focuses on the fraction of labour market transitions which lead to a change of sector in the total number of a certain labour market transition. As for trend behaviour, none of the series features a strong long-run trend, with one exception: The conditional hazards of changing sector and of changing occupation after an unemployment spell has been strongly rising since the early 1980s. Thus, the unemployed seem to have become occupationally more mobile during the last two decades. This might be an indication for Ljungqvist-Sargent type turbulence: If the skills of the unemployed started depreciating more quickly from the early 1980s, then it is likely that the unemployed will have a lower propensity to return to their sector and/or occupation in later periods.

4.2 Net flows

Having examined gross flows and sectoral inflows and outflows, we now turn to the analysis of net flows. We calculate net reallocation between sectors as follows:

$$net_t/e_t = \left[\sum_{j=1}^{J} |eei_{j,t} - eex_{j,t} + ue_{j,t} - eu_{j,t} + ne_{j,t} - en_{j,t}| \right] \cdot \frac{1}{e_t}$$

We use this formula in order to calculate two different measures of net reallocation. First, we compute reallocation which has a net effect on a monthly basis (this is called "Net flows monthly" in the tables). This measure thus takes into account those flows which have a net effect on sectoral employment stocks from one month to the next. Second, we calculate worker reallocation which has a net effect on a yearly basis ("Net flows yearly"). Note that these two measures can move independently from each other: on the one hand, one can imagine a situation where there is a great amount of short-run turbulence, which however cancels out over the year. This would lead to high net flows on a monthly bases and low net flows on a yearly basis. On the other hand, little short-run variation can lead to large changes over the

[9] The results for all age groups, and men and women, are very similar with respect to long-run trends and cyclicality. They are available from the authors upon request.

year, if the monthly movements, instead of cancelling out, sum up over the year. This would lead to the reverse result.

Both time series are in Table 8 and in the left panel of Figure 4. The results show a marked difference between the two time series computed. Net flows on an monthly basis display a relatively small, but clear downward trend. This implies that the short-run variation in net changes has declined over time. Net flows on a yearly basis, on the other hand, more than doubled over the same time period. Given the results obtained for the modified Lilien index in Section 3.2, the latter result is not surprising. However, the fact that at the same time short-run variations declined is striking.

4.2.1 Accounting for Changes in Net Flows: The Role of Different Labour Market Transitions

Having found that the behaviour of net flows changed significantly from the beginning of the 1990s, we now want to analyse in more detail where these changes come from. In order to do so, we examine the components of net flows. We calculate both the differences $EEI - EEX$, $NE - EN$, $UE - EU$, and the individual flows. We do this for the economy as a whole, and for two sectors, the one with the highest growth in employment share (business-related services), and the one with the strongest decline in its employment share (consumer goods). The results for the economy as a whole are in Tables 9 and 10. Several features are noteworthy. First, direct job-to-job transitions only play a minor role for structural adjustment. Not only is their level low relative to the other flows, but their net impact, measured by the difference between EEI and EEX, is low as well. Furthermore, their net effect over the time period considered is relatively stable. Second, both according to their level and their net effect, the flows between employment and unemployment are much more important. While the level of these flows seems to feature a slight downward trend, their net effect on sectoral employment stocks was stable when comparing the average of the 1980s and the 1990s. Finally third, the flows between employment and non-registration play the most important role. This is both true for the level of the gross flows, and for the net effect, which peaked in the second half of the 1990s.

The analysis in this section up to now was for the economy as a whole. However, given the divergence in the evolution of employment between sectors, one would presume that there are also important differences in the way these net changes come about. In order to investigate this matter further, we again look at the differences between flows analysed above, as well as at individual flows. This time, however, we do so for two sectors: first, the consumption goods sector, which lost 35% of its employment between 1975 and 2001, and second, the business-related service sector, whose employment share grew by 75% during the same period. The results for the consumption goods sector are in Tables 11 and 12, and those for the business-related service sector are in Tables 13 and 14. Looking at direct job-to-job transitions first, one can see that the levels are higher for the growing sector. The net contribution of these transitions to employment change ($|EEI - EEX|$) is very small in both sectors though. There is however a strong discrepancy in the net contribution of the flows between employment and unemployment. For the shrinking sector, these flows are relatively high, and they play the most important role for net sectoral employment changes. This is not the case for the business-related service sector: here, unemployment flows only play a minor role. Furthermore, and surprisingly, the inflow into this sector from unemployment is also relatively low. Finally, the transitions between non-registration and employment are relatively low for the declining sector, and are not important for its net employment changes. For the growing sector, the opposite is true: these transitions are high, and they are by far the most important contributor to changes in the employment share. We conclude from this that direct job-to-job transitions only play a minor role for net worker reallocation in both sectors, flows between unemployment and employment are most important for this purpose in the shrinking sector, which is the case for transitions between non-registration and employment in the growing sector.

4.2.2 Accounting for Changes in Net Flows: Sectoral Inflow and Outflow rates

In the previous section, we analysed which labour market transitions are most important for net changes in sectoral employment. Now, we want to examine which sectors were mainly responsible for the rise in

the Lilien index documented above. In order to do so, we calculate inflow and outflow rates both for a six sector- and a sixteen-sector breakdown of the economy. Inflow rates are calculated as the number of workers employed in a sector who were not employed in the same sector one year before - i.e. they can have been employed in a different sector, unemployed, or not in the sample - divided by the employment stock of that sector. Conversely, outflow rates are the number of workers leaving a sector (to employment in a different sector, to unemployment, or to out of the sample) divided by the employment stock. The results for six sectors are in Table 15 and Figure 8. As one can see, the inflow rates into the different sectors behave very similarly: there is no discernible long-run trend, and the rates are clearly procyclical. The same is true for the outflow rates, although the volatility of the outflows rates is generally lower, with the construction sector being an obvious exception.

Tables 16 and 17 contain the inflow and outflow rates for 16 sectors. We use these figures in order to determine which sectors played the most important role for the increase in worker reallocation recorded above. [RESULTS: TO BE COMPLETED]

4.3 Worker reallocation over the business cycle

The effect of the business cycle on the economy as a whole and on the labour market in particular has been a contentious issue at least since the times of Schumpeter (1942). On the one hand, recessions can be seen as being "cleansing", because they are times when outdated techniques and products are squeezed out of the market (Caballero and Hammour, 1994). On the other hand, recessions go together with a strong decline in job-to-job transitions, which are often productivity-enhancing because they often lead to an improvement of the quality of worker-firm matches (Barlevy, 2002, Krause and Lubik, 2006). Thus, recessions can lead to a reduction in the average quality of newly created matches, i.e. they can have a "sullying" impact. We add a new dimension to this debate by looking at the cyclicality of sectoral and occupational changes.

The cylicality of gross flows and sectoral mobility and occupation mobility can be seen in Figures 6 and 7, respectively. As in section 4.1, we look at both transitions going together with a change of sector or occupation (left panel in the figures), and changes of sector or occupation conditional on a certain transition (right panel in the figures). It becomes apparent that the state of origin clearly matters. In a recession, there are less workers entering a new employment involving a different occupation directly from another job or from non-participation. Furthermore, given a transition from those two states of origin, the probability of changing sector or occupation goes down in a recession as well. This suggests that workers take advantage of favourable business cycle conditions in order to engage in on-the-job search, which then often results in a change of sector or occupation. On the contrary, in a recession, workers workers search less on-the-job, and even if they make a direct transition to a new job, this transition is less likely to involve an occupational change than in a cyclical upswing. The picture looks different for workers coming from unemployment. In a business cycle downturn, the number of workers making a transition from unemployment to employment and switching occupation is *rising*. However, the probability of changing occupation conditional on having made a transition from unemployment to employment is going down. In other words, flows from unemployment to employment are generally going up in a recession. This also raises the number of UE transitions which go together with a new occupation, but the share of UE transitions involving an occupational switch is falling. Therefore, in a recession, the probability of an unemployed worker finding a new job in the sector he was previously working in is going up. This is in all likelihood due to the fact that, in a recession, the proportion of workers who have only very recently joined the pool of the unemployed, is going up. These workers usually dispose of a large amount of sector- or occupation-specific human capital and will therefore be rehired relatively quickly in their sector (occupation) of origin.

It is also instructive to analyse the behaviour of net and gross sectoral mobility, which is in Figure 4. In a recession, gross flows fall, which is mainly due to a reduction in the number of job-to-job transitions (cf. Bachmann, 2005). This is the "sullying" part of a recession. On the other hand, net flows go *up* in a downturn. This means that sectoral reallocation increases in bad times, i.e. recessions are then indeed times of economic restructuring, which could play a cleansing role. We interpret these two mechanisms as

follows: in an upswing, the labour market is relatively tight, which leads workers to engage in on-the-job search. Direct job-to-job transitions are a consequence. However, workers are reluctant to change sector or occupation as this involves the loss of at least some sector- or occupation-specific human capital. Therefore, net employment changes are relatively low. In a downturn, the reverse is true. Firms' hiring activity is low, and more workers have to change sector in order to find a job at all, even if this involves the loss of some specific human capital. Thus, gross worker flows go down, but net worker flows go up in a recession.

5 Conclusion

In this paper, we have analysed the dynamics of structural change in Germany during the time period 1975-2001. We started by documenting that the reallocation of employment from industry to services accelerated after 1990, and that "turbulence" as measured by Lilien-type indices increased sharply. Interestingly, however, this is only true when looking a net differences on a yearly basis. When looking at monthly net differences, turbulence actually declined. Thus, short-run variation declined, while long-run structural change accelerated. We then investigated this change in more detail by looking at net worker flows, as well as their components, i.e. gross flows. We found that job-to-job flows only play a minor role for net employment changes, with transitions between employment and unemployment coming second, and flows between employment and non-registration playing the most important role. Comparing a strongly shrinking sector (consumer goods) with a fast growing sector (business-related services), we documented that for the former net employment adjustment came about by unemployment flows, while for the latter the flows involving non-registration were most important. Finally, we investigated the behaviour of net and gross flows over the business cycle. Net reallocation was found to be counter-cyclical, and gross reallocation to be pro-cyclical. We interpret this as an indication of both a sullying and cleansing effect of recessions: job-to-job transitions involving a change of sector go down sharply; at the same time, workers have to change sector, which leads to rising net reallocation.

We believe that structural change, and especially the acceleration of sectoral reallocation after 1990, should be considered as an important determinant of the performance of the German labour market. This paper is a step in that direction.

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Appendix A Results

A.1 Tables

Table 1: Employment shares for 6 sectors. Averages for different time periods, in per cent. Yearly panel.

	1976-2000	1976-80	1981-85	1985-90	1991-95	1996-2000
Agr., En., Min.	3.0	3.3	3.3	3.1	2.7	2.5
Production	39.9	42.7	41.2	41.3	38.6	35.7
Construction	7.4	8.1	7.8	6.9	7.1	6.8
Trade, Transp.	18.2	18.4	18.2	17.7	18.4	18.5
Services	25.1	20.6	22.7	24.4	27.1	30.8
State	6.4	6.9	6.8	6.6	6.1	5.7

Table 2: Employment shares for 16 sectors. Averages for different time periods, in per cent. Monthly panel, full-time and part-time employment.

	1976-2000	1976-80	1981-85	1985-90	1991-95	1996-2000
Agr., En., Min.	2.7	3.1	3.1	2.9	2.5	2.3
Production: basic materials, goods	7.8	9.1	8.5	7.9	7.1	6.2
Production: investment goods 1	10.1	10.3	10.3	10.7	10.0	9.4
Production: investment goods 2	9.3	9.6	9.4	9.9	9.0	8.4
Consumption goods	7.4	8.9	8.1	7.5	6.8	5.8
Food, beverages, tobacco (Genussmittel)	3.2	3.5	3.4	3.3	3.2	2.9
Construction 1 (Bauhauptgewerbe)	4.2	5.2	4.7	3.9	3.8	3.4
Construction 2 (Ausbaugewerbe)	2.5	2.4	2.5	2.4	2.7	2.7
Distr. services: trade 1, e.g. wholesale trade	6.1	6.1	6.0	6.0	6.2	6.3
Distr. services: trade2, e.g. retail trade	8.7	8.7	8.8	8.5	8.8	8.9
Trade and Communication	4.5	4.6	4.5	4.3	4.4	4.5
Services, business-related	10.3	7.9	8.8	9.8	11.4	13.5
Services, household-related	3.7	3.5	3.7	3.8	3.7	3.9
Services: social 1, e.g. hospitals	8.3	6.8	7.5	8.1	9.1	10.1
Services: social 2, e.g. organisations	4.1	3.0	3.5	4.0	4.6	5.5
Public corporations	6.9	7.1	7.2	7.1	6.7	6.4

Table 3: Lilien index for sectors and occupations, different time periods, in per cent. Yearly panel, full-time employment.

	1976-2000	1976-80	1981-85	1985-90	1991-95	1996-2000
Occupational turbulence, J=10	0.55	0.49	0.56	0.44	0.74	0.57
Sectoral turbulence, J=6	0.67	0.50	0.59	0.55	0.97	0.80
Sectoral turbulence, J=16	0.81	0.64	0.72	0.66	1.07	0.95

Table 4: Hazard rates for transitions involving a change of sector. Averages for 1980-2000, in per cent. All transitions.

	Men			Women		
	EE	NE	UE	EE	NE	UE
Age 16-29	5.87	5.20	4.71	4.49	2.94	2.65
Age 30-49	2.74	0.97	1.65	2.27	1.13	1.56
Age 50-65	1.08	0.31	0.65	0.92	0.32	0.60

Table 5: For a given flow, fraction of transitions involving a change of sector, male workers. Averages for 1980-2000, in per cent. All transitions.

	Men			Women		
	EE	NE	UE	EE	NE	UE
Age 16-29	39.59	39.30	38.12	32.48	34.54	37.18
Age 30-49	33.69	36.52	32.94	31.28	25.28	34.03
Age 50-65	25.66	17.71	22.07	25.24	14.25	23.02

Table 6: Hazard rates for transitions involving a change of occupation. Averages for 1980-2000, in per cent. All transitions.

	Men			Women		
	EE	NE	UE	EE	NE	UE
Age 16-29	7.39	7.76	6.33	5.36	4.70	3.58
Age 30-49	3.03	1.41	2.27	2.48	1.74	2.13
Age 50-65	0.80	0.49	0.86	0.75	0.58	0.84

Table 7: For a given flow, fraction of transitions involving a change of occupation. Averages for 1980-2000, in per cent. All transitions.

	Men			Women		
	EE	NE	UE	EE	NE	UE
Age 16-29	49.62	58.60	51.37	38.62	55.34	50.17
Age 30-49	36.96	52.81	45.40	34.02	38.91	46.25
Age 50-65	19.29	27.60	29.42	20.45	25.43	32.87

Table 8: Net and gross flows as share of employment, and ratio of net to gross flows. All figures in per cent. Monthly panel, full-time and part-time employment.

	1976-2000	1976-80	1981-85	1985-90	1991-95	1996-2000
Gross flows	43.5	45.4	42.1	44.0	40.3	45.7
Net flows, monthly basis	11.7	12.9	11.8	11.9	10.3	11.3
Net flows, yearly basis	2.4	1.6	1.8	2.7	2.5	3.5
Net flows, monthly basis, to gross flows	26.8	28.5	28.1	27.1	25.7	24.8
Net flows, yearly basis, to gross flows	5.6	3.5	4.3	6.1	6.3	7.6

Table 9: Differences as share of employment, in per cent. Monthly panel, full-time and part-time employment.

	1981-2000	1981-85	1985-90	1991-95	1996-2000
0.5*(EEI+EEX)	4.2	3.0	4.3	4.1	4.3
UE+EU	11.9	14.3	13.0	11.2	12.5
NE+EN	23.3	21.5	23.7	20.8	23.8
$\|EEI - EEX\|$	0.5	0.4	0.6	0.5	0.4
$\|UE - EU\|$	1.4	1.9	0.9	1.4	1.5
$\|NE - EN\|$	2.7	1.6	3.0	1.9	4.2

Table 10: Flows as share of employment, all workers, in per cent. Monthly panel, full-time and part-time employment.

	1981-2000	1981-85	1985-90	1991-95	1996-2000
EEI	3.9	3.1	4.3	4.1	4.3
UE	5.8	6.3	6.3	5.0	5.6
NE	12.2	11.2	12.8	11.0	14.0
EEX	3.9	3.1	4.3	4.1	4.3
EU	7.0	8.0	6.6	6.2	7.0
EN	10.0	10.3	9.9	9.8	9.9

Table 11: The consumption goods sector: Sums and differences as share of employment, in per cent. Monthly panel, full-time and part-time employment.

	1981-2000	1981-85	1985-90	1991-95	1996-2000
0.5*(EEI+EEX)	3.5	2.5	4.0	3.7	3.8
UE+EU	13.0	14.1	12.9	12.5	12.6
NE+EN	18.5	18.3	19.9	17.2	18.6
$\|EEI - EEX\|$	0.3	0.4	0.2	0.5	0.2
$\|UE - EU\|$	2.3	3.0	1.1	2.6	2.5
$\|NE - EN\|$	1.6	0.9	2.3	0.7	2.4

Table 12: The consumption goods sector: Flows as share of employment, in per cent. Monthly panel, full-time and part-time employment.

	1981-2000	1981-85	1985-90	1991-95	1996-2000
EEI	3.4	2.3	2.0	3.5	3.8
UE	5.4	5.5	6.0	4.9	5.1
NE	9.9	9.5	11.1	8.5	10.5
EEX	3.6	2.7	4.1	4.0	3.8
EU	7.6	8.5	6.9	7.5	7.6
EN	8.6	8.9	8.8	8.6	8.1

Table 13: The business-related service sector: Sums and differences as share of employment, in per cent. Monthly panel, full-time and part-time employment.

	1981-2000	1981-85	1985-90	1991-95	1996-2000
0.5*(EEI+EEX)	4.8	3.5	5.0	5.0	5.5
UE+EU	10.1	9.9	9.7	9.1	11.9
NE+EN	27.7	24.6	27.3	26.1	32.8
$\|EEI - EEX\|$	0.3	0.4	0.2	0.4	0.3
$\|UE - EU\|$	0.7	1.1	0.7	0.4	0.6
$\|NE - EN\|$	4.2	1.8	4.5	3.2	7.2

Table 14: The business-related service sector: Flows as share of employment, in per cent. Monthly panel, full-time and part-time employment.

	1981-2000	1981-85	1985-90	1991-95	1996-2000
EEI	4.8	3.7	4.9	5.1	5.4
UE	5.0	4.4	5.1	4.5	6.0
NE	15.9	13.2	15.9	14.7	20.0
EEX	4.7	3.4	4.1	4.8	5.6
EU	5.1	5.5	11.6	4.6	5.7
EN	11.8	11.4	11.4	11.5	12.8

Table 15: Sectoral inflow and outflow rates. Averages for different time periods, in per cent. Yearly panel.

	1976-2000	1976-80	1981-85	1985-90	1991-95	1996-2000
Inflow rate						
Agr., En., Min.	9.93	10.45	9.74	9.62	8.56	11.24
Production	9.69	10.59	9.06	10.69	8.41	9.66
Construction	14.28	15.05	12.92	14.70	13.57	14.59
Trade, Transp.	15.37	17.15	13.68	15.11	14.83	15.63
Services	16.49	17.57	15.01	16.13	15.74	17.76
State	10.97	11.97	10.62	11.59	10.07	10.41
Outflow rate						
Agr., En., Min.	13.53	12.84	13.02	12.63	12.74	16.46
Production	11.13	11.18	11.05	10.30	11.82	11.35
Construction	21.14	19.17	25.07	21.72	18.05	22.68
Trade, Transp.	15.94	17.18	15.79	15.06	15.50	16.27
Services	15.50	15.91	15.14	14.90	14.75	16.79
State	11.99	12.56	11.54	11.86	11.60	12.41

Table 16: Sectoral inflow rates. Averages for different time periods, in per cent. Yearly panel.

	1976-2000	1976-80	1981-85	1985-90	1991-95	1996-2000
Agr., En., Min.	9.9	10.5	9.7	9.6	8.6	11.2
Production: basic materials, goods	9.2	9.7	8.2	10.3	8.4	9.6
Production: investment goods 1	9.8	11.2	9.2	10.9	8.0	9.5
Production: investment goods 2	11.3	11.9	10.6	12.8	9.7	11.6
Consumption goods	12.4	14.0	11.3	13.2	11.3	12.2
Food, beverages, tobacco (Genussmittel)	22.7	29.0	21.5	23.9	19.1	20.0
Construction 1 (Bauhauptgewerbe)	13.4	13.9	11.7	14.0	12.9	14.4
Construction 2 (Ausbaugewerbe)	17.1	19.3	16.6	18.5	15.5	15.9
Distr. services: trade 1, e.g. wholesale trade	17.0	19.3	15.0	17.0	16.9	16.8
Distr. services: trade2, e.g. retail trade	18.1	21.0	16.5	18.2	17.1	17.6
Trade and Communication	14.3	14.4	12.0	14.6	14.2	16.5
Services, business-related	16.2	15.8	13.9	16.1	16.3	19.1
Services, household-related	22.5	24.5	22.4	23.5	19.9	22.2
Services: social 1, e.g. hospitals	16.1	18.4	14.8	15.6	15.3	16.5
Services: social 2, e.g. organisations	18.5	19.8	16.4	17.9	18.5	19.5
Public corporations	10.5	11.5	10.1	11.2	9.7	10.1

Table 17: Sectoral outflow rates. Averages for different time periods, in per cent. Yearly panel.

	1976-2000	1976-80	1981-85	1985-90	1991-95	1996-2000
Agr., En., Min.	11.8	10.9	10.9	10.9	11.2	14.9
Production: basic materials, goods	10.8	10.6	10.2	10.1	11.3	11.9
Production: investment goods 1	10.0	10.4	9.7	9.1	11.0	9.9
Production: investment goods 2	11.7	11.7	11.2	11.1	12.7	12.1
Consumption goods	14.0	14.4	13.7	13.1	14.4	14.2
Food, beverages, tobacco (Genussmittel)	15.6	17.0	14.3	15.7	15.0	16.0
Construction 1 (Bauhauptgewerbe)	15.2	13.9	16.3	14.1	13.9	17.8
Construction 2 (Ausbaugewerbe)	16.7	18.0	17.9	16.0	14.6	16.8
Distr. services: trade 1, e.g. wholesale trade	16.5	18.3	15.8	15.6	16.2	16.8
Distr. services: trade2, e.g. retail trade	18.3	20.2	18.1	17.3	17.4	18.5
Trade and Communication	14.5	14.8	13.5	13.7	14.9	15.6
Services, business-related	14.1	13.8	13.1	13.3	14.2	16.2
Services, household-related	22.1	23.4	22.6	22.4	20.2	21.8
Services: social 1, e.g. hospitals	14.9	15.8	14.3	13.8	14.0	16.4
Services: social 2, e.g. organisations	16.5	16.9	14.7	16.3	16.2	18.5
Public corporations	11.5	11.9	11.0	11.3	11.2	12.1

A.2 Figures

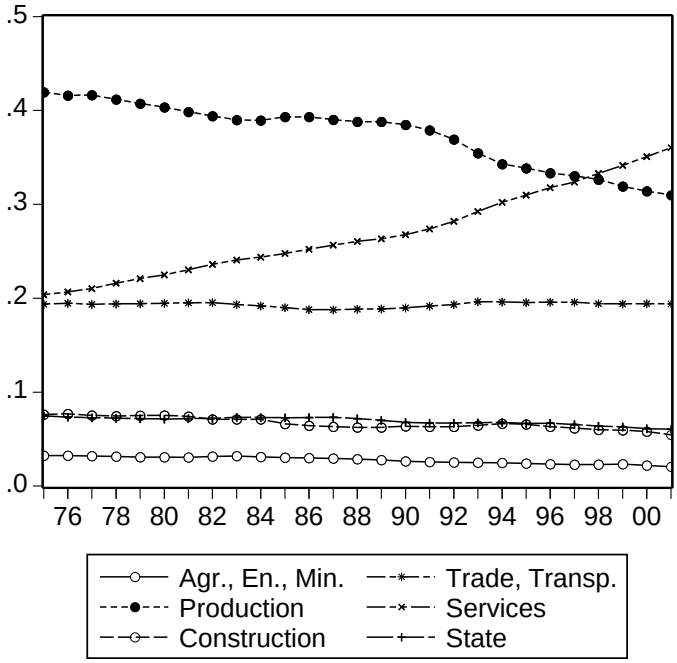

Figure 1: Sectoral employment shares.

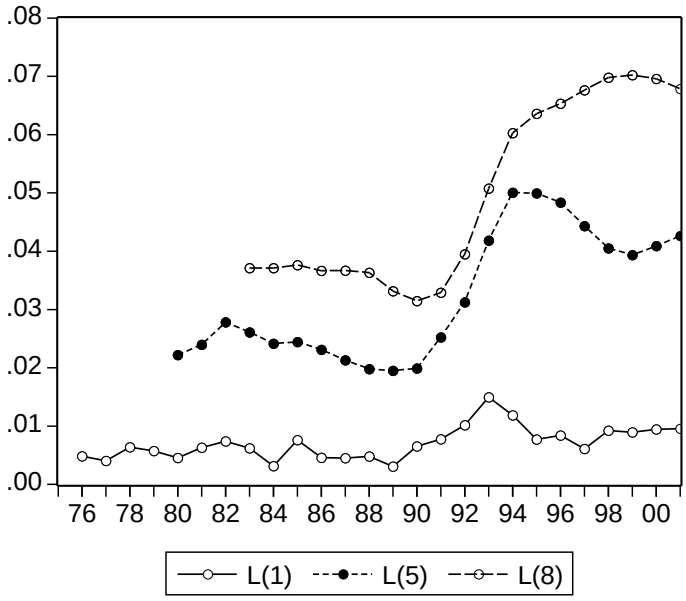

Figure 2: Turbulence indices for sectors, J=6.

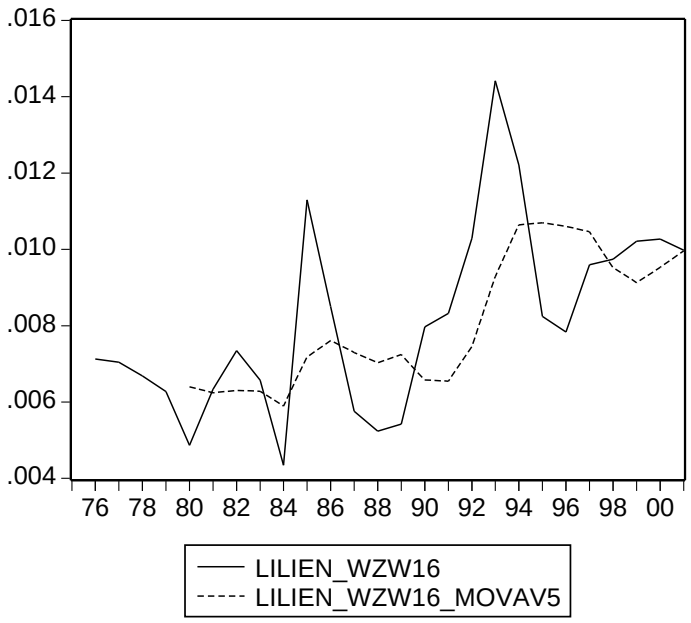

Figure 3: Turbulence index for sectors: raw index and 5-year moving average, J=16.

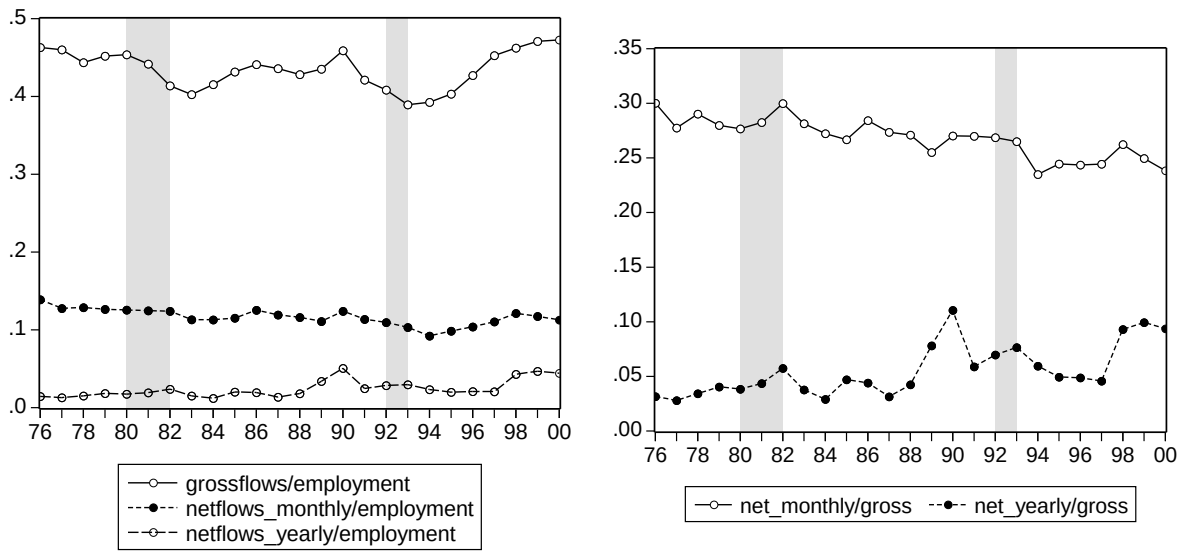

Figure 4: Gross and net flows across sectors; net flows on a monthly and a yearly basis (left panel), and the ratio of net to gross flows (right panel). Monthly panel, full-time and part-time employment.

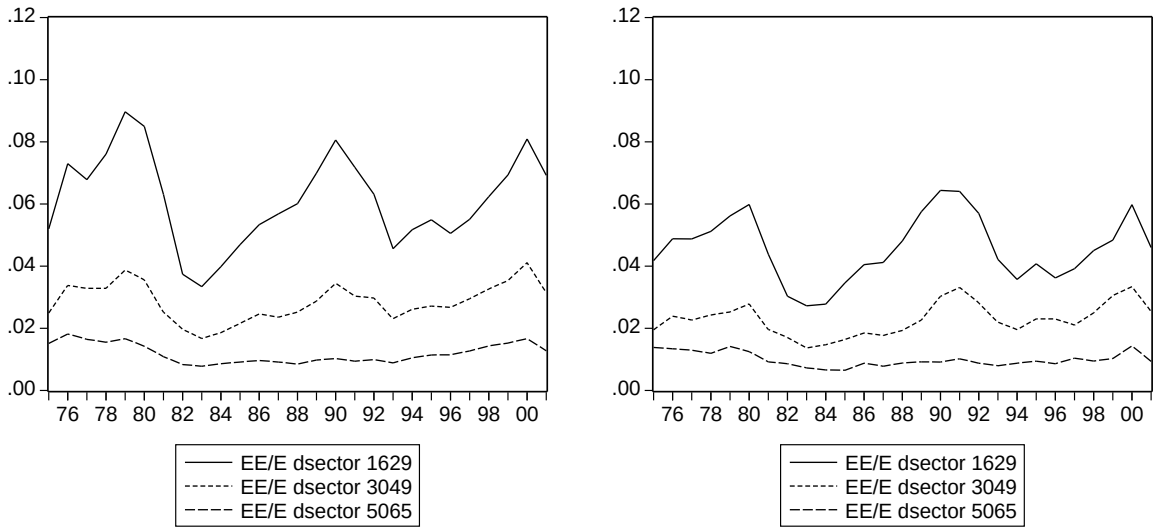

Figure 5: Hazard of an EE transition with a change of sector, male and female workers.

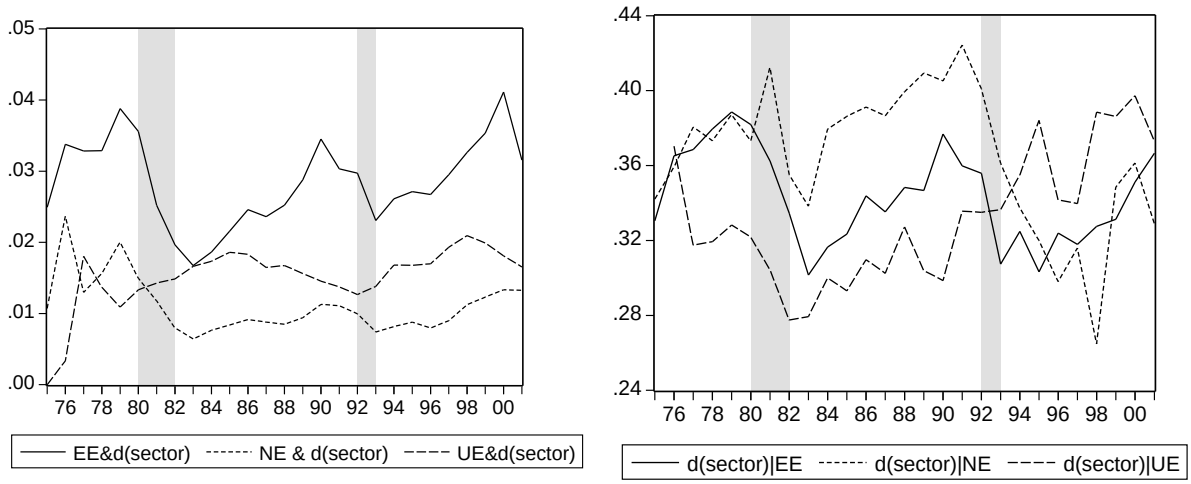

Figure 6: Fraction of new employment relationships involving a change of sector and a certain labour market transition (left panel), and fraction involving a change of sector conditional on a certain labour market transition (right panel). Yearly figures for male employees aged 30-49.

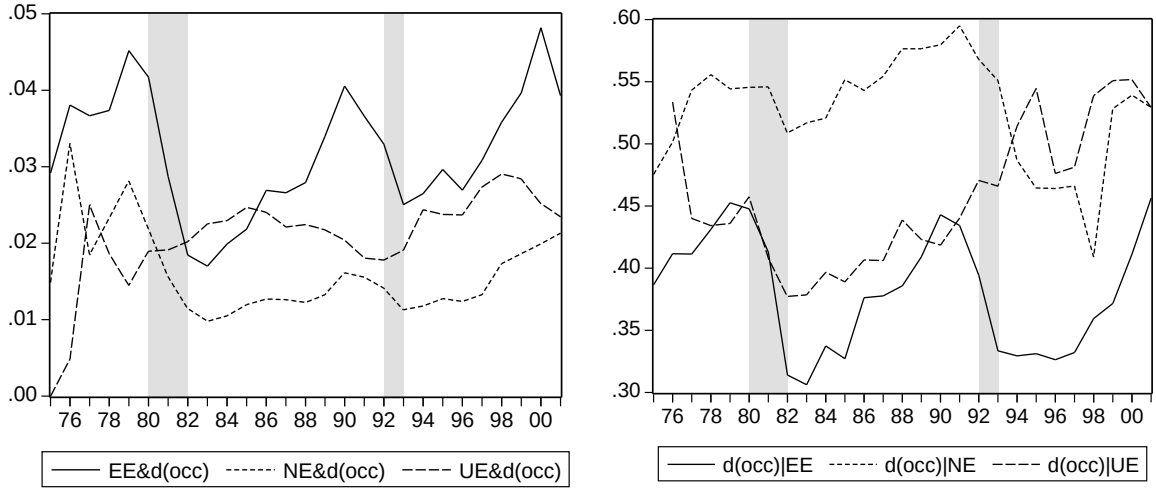

Figure 7: Fraction of new employment relationships involving a change of occupation and a certain labour market transition (left panel), and fraction involving a change of occupation conditional on a certain labour market transition (right panel). Yearly figures for male employees aged 30-49.

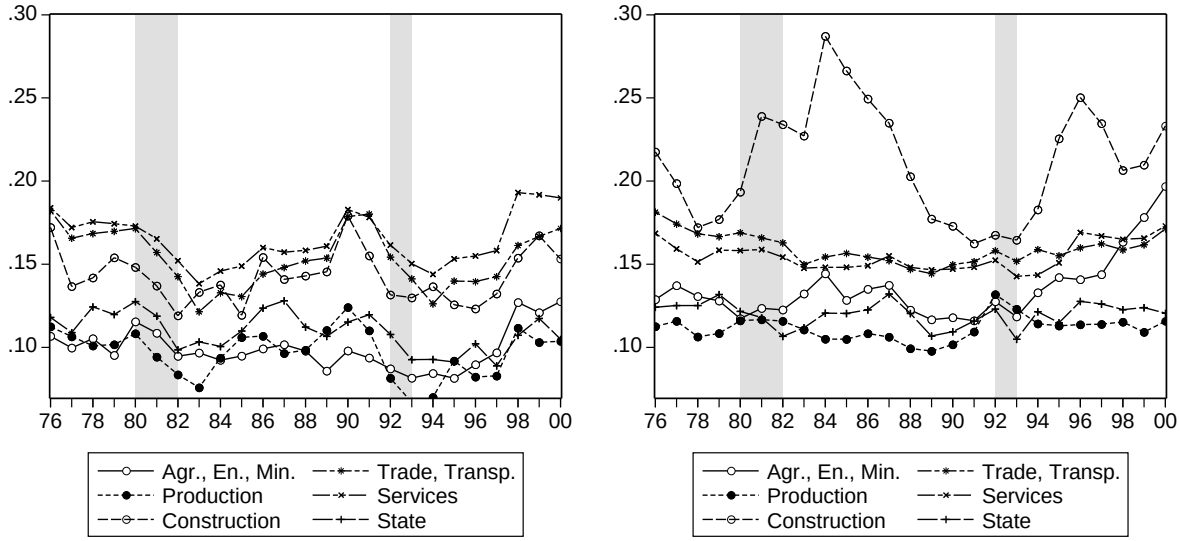

Figure 8: Inflow rates into and outflow rates from different sectors. Yearly figures for all workers.