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What explains changes in full-time and part-time employment in Western Germany?

A new method on an old question

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Abstract

From 1992 to 2005, part-time employment in Western Germany has grown by 82 percent, whereas full-time employment has shrunk by 14 percent. Behind these general figures there is substantial variation of employment schemes across industries. Beside this, the share of the service industries in gross value added has grown, whereas the importance of manufacturing and construction has decreased considerably. We analyse the extent to which the changes in part-time and full-time employment can be explained by changes in the sectoral composition of the economy or by other factors.

Using West German yearly data from 1992-2005, we estimate a regression analogue shift-share model. It allows us to divide the overall development of employment into the business cycle effect, the sector effect and the employment status effect. Moreover, we control for sectoral gross value added, unit labour costs and working time.

As a methodological contribution we extend the shift-share approach into a dynamic panel model. We use a bias-corrected least squares dummy variable (LSDVc) estimator which is appropriate for our data structure. As a second step, we decompose the fixed effects of the LSDVc estimation into parameters for part-time, full-time, and self-employment as well as six sectors.

Our results confirm previous deterministic shift-share analyses: Characteristics inherent in full-time or part-time employment dominantly explain changes in employment patterns in Western Germany. The sectoral composition of the economy plays a significant but minor role. The model extensions reveal that much of the status and sector effects in the simple shift-share analysis can be captured by determinants of labour demand.

1 Introduction

Between 1991 and 2005, Western Germany experienced similar changes of the employment structure with respect to working time as well as of the sectoral composition of the economy, as other developed countries did. First, part-time employment experienced a striking boom. Since the beginning of the 1990s, it has risen by 82 percent, whereas full-time employment has shrunk by 14 percent until 2005. Only in periods of economic upswing the downward trend of full-time employment slowed down slightly, as around the year 2000. Second, economic sectors developed differently, making the dominance of the service sectors more and more obvious. For instance, the share of Manufacturing/energy in total gross value added fell from 32 to 27 percent, whereas the share of Banking/insurance/business services in total gross value added rose from 24 to 30 percent. Third, employment schemes differ across economic sectors. Private/social/public services is the sector with the highest part-time ratio. It even grew from 25 to 40 percent. In contrast, Agriculture/fishery had a part-time ratio of only 15 in 2005, which had grown from 6 percent in 1991, however.

In the tradition of earlier studies on the development of part-time employment (for instance Leppel/Clain 1988), we ask whether the three empirical findings are related to each other. Is the change in the sectoral composition of the economy towards service sectors which are undoubtedly part-time friendly the main reason for the immense incline of part-time employment? The other way round: To what extent has the tremendous loss of importance in Construction or Manufacturing influenced the downward trend of full-time employment?

Our paper superimposes on the existing literature in three respects. First, in augmentation of previous papers (e. g. Euwals/Hogerbrugge 2006, Friesen 1997) that explain the development of part-time employment alone, we propose an integrated approach that views several kinds of employment as parts of the whole economy. Therefore, self-employment, which has increased rather moderately, is included. This allows us to interpret our empirical results as deviations from a national average. Second, we use a regression analogue shift-share model that refines formerly used deterministic shift-share approaches such as by Walwei/Werner (1995), Smith/Fagan/Rubery (1998) or Wolf (1999). And third, as a methodological contribution, we provide an application of the bias-corrected least squares dummy variable (LSDVc) estimator for a dynamic macro panel structure.

The paper is organized as follows: As an overview of the previous literature the next section discusses heterogenous labour demand and sectoral change as the two starting points for our analysis. In the third section, we present our data and some descriptive details. Afterwards, the analytical model is described. We formulate a simple regression analogue shift-share model. It disentangles employment growth into effects caused by incidents that concern the whole economy such as business cycle fluctuations and into effects caused by special developments within the economic sectors and/or kinds of employment. Further on, this cross section effect is decomposed into a sector effect and a status effect which is inherent in full-time, part-time, or self-employment. The simple shift-share model is extended by metric variables.

Since theory suggests the dependence of current labour market decisions from the observed development in the pre-period, we include lagged endogenous employment growth. This specification transforms our model into a dynamic panel model. Then the bias-corrected least squares dummy variable (LSDVc) estimator is appropriate for our data structure with T approximately equalling N.

The fifth section presents the estimation results. They reveal a significant positive impact of the status part-time employment as well as of the sector Banking/insurance/business services. Moreover, the full-time status and Manufacturing/energy have a significant negative effect. Determinants of labour demand, expressed as metric variables, explain a lot of the status and sector effects, especially unit labour costs and the lagged endogenous variable. All in all, there seems not to be a monocausal explanation for the employment schemes developing differently but an interaction of status- and sector-specific determinants as well as habit persistence or slow adjustment on the labour market. The final section summarizes the paper and draws some conclusions.

2 Literature overview: The determinants of full-time and part-time employment

Why do agents prefer either full-time or part-time employment? Numerous contributions to the literature refer to the success of part-time employment as such. We derive the rationale of employing part-time from them, whereas the opposite implies the rationale of employing full-time. As Leppel/Clain (1988) point out, (involuntary) part-time in the United States rose for two main reasons: first, downturns in the business cycle that require the adjustment of labour and second, the shift of the sectoral composition of the economy towards services. We use this starting point to separate the rationale for different employment strategies into two directions: heterogenous labour demand, here with respect to working hours not qualification and derived characteristics, and sectoral change with its impact for employment (for a summary: Knottenbauer 2000, Klodt/Maurer/Schimmelpfennig 1997).

2.1 Heterogeneous labour demand

Characteristics inherent in full-time or part-time employment may explain the success or failure of employment schemes. We focus on factors of labour demand here, whereas some studies contributed to supply side explanations as well (Euwals/Hogerbrugge 2006, Buddelmeyer/ Mourre/ Ward 2004). The determinants refer to economic reasons or to labour market institutions.[1]

Why is part-time so attractive to employers? Among the economic reasons for part-time employment having become more and more important, Zeytinoglu (1992) describes higher flexibility as the most outstanding. Following Osterman (1987), flexibility is one of three goals that companies pay attention to when choosing their employment system (roughly speaking, this is

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[1] For differently structured comprehensive overviews see Smith/Fagan/Rubery (1998) and Delson (1998).

how to recruit, contract, train and supervise staff). During the past decades, flexibility has become a necessary feature of firms to react on ever rising competition and uncertainty. Companies are urged to find flexible organisational forms, reducing buffers also with respect to labour (Marsden 1999).

This partly explains the moderate rise in self-employment (also subsidized self-employment) and in other flexible kinds of labour that form the boundary between employment and self-employment. Among them, part-time is certainly not the most flexible status a firm could use. Compared on the one hand with other flexible kinds of employment such as fixed term contracts or temporary work agencies, however, part-time might induce higher firm loyalty and motivation. In comparison to full-time employment, on the other hand, part-time raises more flexibility to adjust, first, to the business cycle and, second, to market shocks in general.

First, companies need to adapt flexibly to the business cycle. By reducing working hours, they can easily adjust labour to the necessary volume of work – without the costs of dismissal and re-hiring or recruiting in the next upswing. This strategy would actually mean that in economic downturns full-time jobs are reduced into part-time jobs. Wanger (2006) asked German firms in 2004 how their part-time jobs had evolved during the past 12 months. Half of the firms said that they had transformed full-time jobs often or sometimes. Among the shrinking firms this share was three quarters.

Besides, part-timers can be offered a full-time job after they have proved suited (Buddelmeyer/ Mourre/Ward 2004, Houseman 2001). This kind of tenure might be used more often in recession periods when companies hire with caution anyway. As a consequence, part-time reacts less or even countercyclically through the business cycle (Buddelmeyer/Mourre/Ward 2004, Lester 1999). Thus much of the response of labour demand to the cycle is due to the changed composition of full-timers and part-timers within total employment.

Second, the adaptation of labour might become urgent with any kind of market shock. Be it additional orders that cannot be served by the core staff in regular shifts. Or be it an extension of opening hours, as in Germany. Throughout the 1990s, the German law governing the hours of trading has been eased several times.[2] Opening hours have been prolonged from 7-18.30 to 6-20 o`clock, the more conservative treatment of Saturdays has ceased, and trade has become allowed on four Sundays per year.[3] As Friesen (1997) points out, part-timers have weaker preferences to work according to a regular schedule. They are more willing to work at unusual times or bundle working hours and have another day off when less labour is needed. Part-time employment is less costly to vary. Therefore, it makes it easier for companies to react on fluctuations of economic activity or on organisational necessities.

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[2] This example combines economic and institutional determinants. A law clearly is part of the institutional framework. However, longer opening hours also reflect a market-based development because companies may choose whether or not they take the chance.

[3] Even more liberal opening hours can nowadays be negotiated by the German Länder. But this most current law came into force off our period of consideration.

In the United States, part-time employment is mostly used to support the team in peak-time hours of the day or week and to provide assistance during hours not fully covered by full-time shifts (Houseman 2001). For Germany, the business survey in Wanger (2006) confirms flexibility as the most important advantage of part-time employment. This is consistent with the most commonly given information that the company's current part-time ratio corresponds to its current labour requirements.

Another major economic reason for part-time might be labour cost differentials. Owen (1979) and Montgomery (1988a, empirically: 1988b) derive the rationale for hiring part-timers when fixed labour costs are low and variable labour costs are high.[4] Lower hourly wages for part-timers are a necessary assumption in labour demand theory to make this status attractive to employers at all. According to the OECD (1999), median hourly earnings of part-timers were just 83 percent of the full-time equivalent in Germany in 1995. The share was higher for women (87 percent). Houseman (2001) confirms the argument for the United States, although large differentials between full-timers' and part-timers' compensations especially occur when additional benefits are taken into account.

In addition to economic reasons, part-time might be preferred to full-time employment because of labour market institutions. Again, we focus on labour demand. Houseman/Abraham (1995) compare the impact of labour market institutions, such as employment protection, on labour adjustment in Germany and the United States. On the German relatively regulated manufacturing labour market, working time is easier and cheaper to adjust than employment. As a conclusion, labour market regulations seem to enhance part-time employment.

The German law on the support of part-time employment came into force in 2001. In companies with at least 15 employees, employers must agree to employees' wishes to reduce working time if the employee has been working in the company for at least six months and if there are no reasonable operational counter-arguments. Thus, the agreement on shorter working time between employers and employees is not always voluntary. Nonetheless, since part-time often meets employees' preferences (Wanger 2006, Zeytinoglu 1992), it improves motivation and productivity of part-time workers.

Another German law has supported part-time since 1988. Although modified several times, the main idea has always been to ease the transition of older employees from working life into retirement. Under certain circumstances, more than 55-year old workers could decide to work part-time or bundle their working time in the first half of the contract period and get earlier retired in the second half (semi-retirement). The Federal Employment Agency subsidizes this employment-retirement transition scheme.

Other institutional conditions refer to different burdens that social security legislation puts on the kinds of employment. Rice (1990) found that part-timers in Great Britain had become a

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[4]   For the interaction of full-time and part-time employment see Bonlier/Fon/Goldfarb (1990).

more powerful substitute for full-timers, especially young ones, because average hourly wage costs tremendously changed among the kinds of employment after social contribution legislation had been modified. High social contributions might have been a reason for the substantial increase in part-time employment in Germany as well. Our data contains not only employment covered by social security but marginal employment, too. The latter has developed vividly during the period of consideration. New laws changed the registering modalities and eased the prerequisites for marginal employment in 1999 and 2003. While net wages after the deduction of social contributions and wage tax was 53 percent of compensation of employees (according to the European System of Accounts 1995), the net wages in marginal employment were 80 percent in 2003 to 2005 and 77 percent meanwhile. Moreover, the decision to hire marginal employees is supported by arguments such as flexibility again and less bureaucracy (Ehler 2005).

However, part-time employment has disadvantages that might prevent employers from demanding part-timers, hiring full-time employees instead. One economic reason is that part-timers must compensate fixed labour costs such as set-up times in shorter working hours. This calls for a higher productivity per hour. Companies in Germany had at least answered that productivity had grown through part-time employment (Wanger 2006). Nonetheless, they name higher costs for the workplace, equipment, and administration as well as higher effort for communication among the team members as the most important disadvantages of part-time in comparison to full-time employment.

Moreover, companies tend to spend less on firm- and job-specific training of part-timers (Euwals/Hogerbrugge 2006, OECD 1999). Although training investment would be the same for full-timers and part-timers, the latter leave less time for the training to bear fruits for the employer. In addition, part-timers tend to have less job tenure, also making training investments more risky. As a consequence, employers might prefer full-timers when firm- and job-specific knowledge is essential. Furthermore, production of a certain capital intensity (which is sector-specific) can imply fixed hours of operation which may require full-time employees that are well informed about the machines rather than part-timers (Euwals/Hogerbrugge 2006).

Decisions for one or the other employment strategy are usually made under uncertainty and bounded rationality. In a complex environment, agents might prefer to decide according to routines instead of having to update rational calculations permanently. In addition, contractual relations on the labour market and labour market regulations slow down the speed of adjustment to changed circumstances on the factor or goods markets. Both arguments motivate a lagged endogenous variable when explaining employment growth by status and sector.

2.2 Sectoral change

The status inherent determinants of different employment patterns may be reinforced or offset by the change of the sectoral composition of the economy. The development of economic sectors within the economy is heterogeneous. Throughout the process of sectoral change some sectors´ value added and employment grow faster than others´, and the importance of sectors

in terms of their share in total gross value added or total employment shifts from the secondary to the tertiary sectors. Theories of sectoral change mostly deal with the macroeconomic employment effect. This is not the aim of that paper. Instead we focus on changing employment schemes in the economy that result from the combination of sector-specific employment growth and sector-specific employment preferences.

Different employment growth across sectors can occur because of sectoral deviations in production and productivity (Knottenbauer 2000, 353-357), that is different sectoral employment thresholds. Production in the service sectors must have risen more sharply than productivity and/or productivity gains must have been distributed among more employees via reducing working hours, that is more part-time work.

Once the sectoral economic development deviates from the national average, it may cause specific employment schemes. If a sector with traditionally high representation of full-time employment, for example, shrinks, the growth of full-time employment will be affected above average. Of course, the sectoral restructuring of the economy has been taking place for longer than just 15 years. It can account for only part of the observed change in the employment structure in our analysis. Moreover, as Franke (2005) points out, the growth of the tertiary sector was based on the growth of industrial production, too, and on productivity gains due to modern technology that requires appropriate staff.

The rising weight of services involves more jobs that are typically done by women (Smith/Fagan/Rubery 1998), as in health or gastronomy branches. Women, however, usually have to or want to combine market and family responsibilities. That is why they often prefer part-time employment. Thus, the sectoral change and the increase in part-time employment are linked via the labour supply decisions of women. Companies themselves might provide flexible working time patterns deliberately in order to attract (qualified) women. Here, employment preferences of labour demand and supply seem to meet.

Other sector-specific factors might account for different employment schemes. For instance, sectors differ with respect to their degree of unionisation (Houseman 2001). Manufacturing and Construction with a high degree of unionisation and declining importance are usually employing full-time. On the opposite, service sectors gain weight and are less unionized – but employ more part-time workers. Thus the degree of unionisation seems to be an indicator for a higher or lower fraction of part-time employees. However, it cannot be ruled out whether this interrelation is due to higher flexibility in less unionized sectors or due to the difficulties to get part-timers unionized.

Beyond the long term sectoral change, sectoral developments apart from the national average can occur in the short run due to different positions through the business cycle or different cyclical dependence (Lester 1999).

Does either status itself or the sectoral change explain the rise of part-time employment and the decline of full-time employment? A new empirical analysis will help answer that question.

3   Data and descriptive statistics

We use yearly data from 1991 to 2005. Sources are the system of national accounts of the German federal statistics office (DESTATIS) and the working time computation of the Institute for Employment Research (IAB). We focus on Western Germany because in the early 1990s the transition of eastern Germany towards a market economy caused structural breaks in the variables referring to the sectoral change as well as to other economic variables such as the growth of wages and therefore labour unit costs. For the question we have in mind here, data of Germany as a whole would distort the expressiveness of our estimations and conclusions.

As the first cross section identifier, we separate employed into full-time employees, part-time employees and self-employed. For these categories, the computations of the German system of national accounts and working time are consistent. Although the focus of our paper is on the development of full-time and part-time employment, the inclusion of self-employment allows us to use shift-share analysis with the macro-economy as reference area. We refer to these three categories as kinds of employment or employment status.

The definition of part-time employment is not connected to a certain number of working hours per week, but to information given by the employers or employees themselves in their declarations to social security or in the Mikrozensus, a yearly survey among 1 percent of the German population about their living and working conditions. Part-time covers everything below the working time customary in the establishment. In 2005, full-time employees worked on average 1681 hours, part-timers worked on average 626 hours. Although for some people 35 hours per week is already part-time, the quite low proportion of only 37 percent of a full-time equivalent is due to the number of marginal employees with very low working hours per week.

The second cross section identifier are six economic sectors (see table 1). Eventually, we define 18 cross sections (3*6) that we observe over 15 years, calculating 14 growth rates. Our panel data set therefore contains 18*14=252 observations.

As can be seen from table 1, total employment in Western Germany rose by 0.4 percent per year between 1991 and 2005. Part-time employment increased in all sectors and contributed with a yearly growth rate of 4.6 percent considerably to the overall development. In marked contrast, full-time employment only grew in the sector of Banking/insurance/business services and suffered sharp losses in the two sectors with the highest full-time ratios, Construction and Manufacturing/energy. Self-employment changed scarcely on average. On the sectoral level, however, very different growth rates can be observed in the growing sectors Private/social/public services and Banking/insurance/business services on the one hand and Agriculture/fishery on the other hand. Since self-employment is the typical employment status in Agriculture/fishery, this substantial decline might be a normalisation of the employment structure towards the average.

Table 1
Average yearly employment growth and average employment ratios,
1992–2005, percent

		growth	ratio*
Self	Construction	2,6	0,9
Self	Private, social, public services	4,3	1,9
Self	Banking, insurance, business services	4,8	1,9
Self	Trade, hotel & catering, transport	0,2	3,3
Self	Agriculture, fishery	-4,5	1,6
Self	Manufacturing, energy	-0,4	0,9
Self		1,1	10,5
Part-time	Construction	4,0	0,6
Part-time	Private, social, public services	4,9	9,2
Part-time	Banking, insurance, business services	7,0	3,7
Part-time	Trade, hotel & catering, transport	4,2	7,2
Part-time	Agriculture, fishery	4,5	0,3
Part-time	Manufacturing, energy	2,1	2,6
Part-time		4,6	23,6
Full-time	Construction	-2,8	4,7
Full-time	Private, social, public services	-0,7	16,5
Full-time	Banking, insurance, business services	2,3	8,3
Full-time	Trade, hotel & catering, transport	-1,0	14,9
Full-time	Agriculture, fishery	-1,5	0,7
Full-time	Manufacturing, energy	-2,5	21,0
Full-time		-1,2	66,0
	Construction	-1,4	6,1
	Private, social, public services	1,4	27,6
	Banking, insurance, business services	3,8	13,9
	Trade, hotel & catering, transport	0,5	25,4
	Agriculture, fishery	-2,9	2,5
	Manufacturing, energy	-2,0	24,5
All		0,4	100,0

Remarks: *share in total employment.

Source: DESTATIS, IAB (FB 4), own calculations.

Figure 1 gives an impression of the shares of full-time, part-time, and self-employment in total employment. Already in the beginning of the 1990s, part-time employment was more common in the sectors Private/social/public services, Banking/insurance/business services and Trade/hotel & catering/transport with one fifth to one quarter of all employees working part-time. By the year 2005, this proportion had even increased up to 30 to 40 percent. Although part-time had become more important in all sectors, Construction and Manufacturing/energy still had significantly lower shares and still were sectors that first and foremost employed full-time workers. Self-employment was the typical employment status in Agriculture/fishery throughout the period under consideration.

Figure 2 provides an overview of the sectoral shares in total gross value added. The two most important sectors by that measure are Manufacturing/energy and Banking/insurance/business services with almost 30 percent each. They seem to have exchanged shares in total gross value added and thus their ranks. The increasing shares of Private/social/public services and Ban-

king/insurance/business services at the one extreme and the decreasing shares of Construction and Manufacturing/energy as well as the diminishing importance of Agriculture/fishery on the other extreme underline the structural change towards tertiary sectors.

Figure 1
Shares of full-time, part-time, and self-employment in total employment, 1991 and 2005, percent
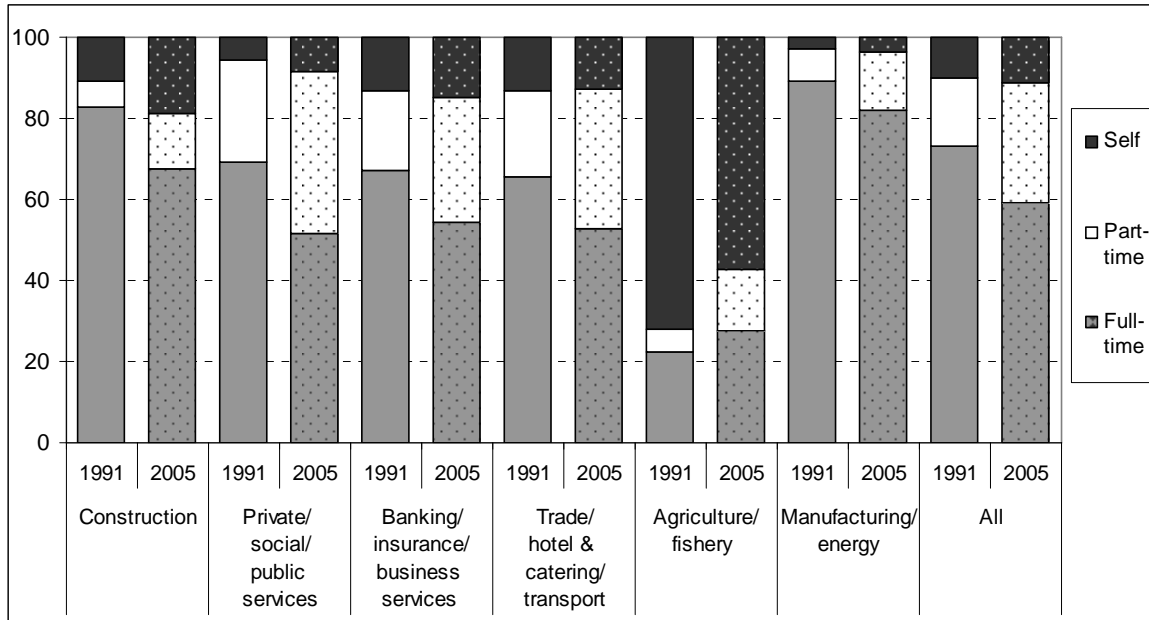
Source: DESTATIS, IAB (FB 4), own calculations.

Figure 2
Share of sectoral gross value added in total gross value added, 1991 and 2005, percent
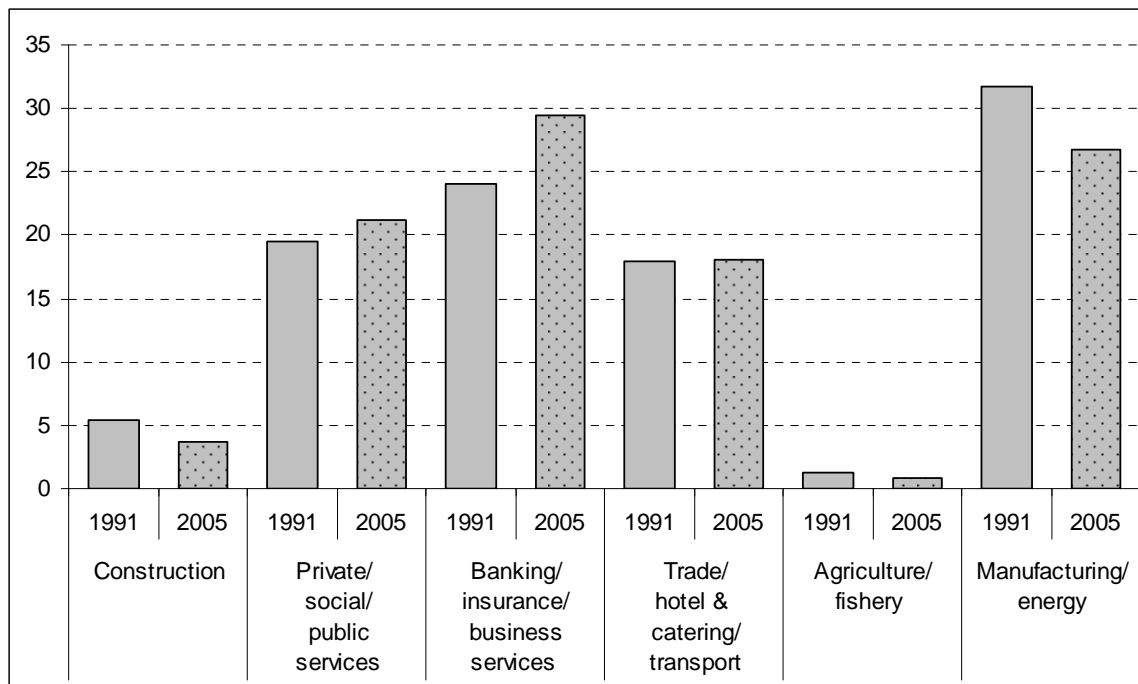
Source: DESTATIS, own calculations.

Combining figures 1 and 2 makes it obvious that the vividly growing part-time employment was typical of prospering sectors, whereas declining full-time employment was rather present in shrinking sectors. The following shift-share analysis tries to find out to what extent these phenomena are correlated. Does the economic development of sectors explain the development of employment status?

4 The shift-share model

The traditional shift-share analysis was established by Dunn (1960). Its main purpose was to separate components of an overall development, mostly in regional economics to find out regional or sectoral specialties that might have influenced the overall development. Von Wachter (2001), for instance, uses the deterministic approach to filter the impact of sectoral growth rates and changes in the sectoral composition on aggregate growth of labour productivity in France, Germany, and the United States. The studies of Walwei/Werner (1995), Smith/Fagan/Rubery (1998), and Wolf (1999) explicitly contain preparatory work for our analysis. According to their deterministic shift-share models the status effect clearly outperforms the sector effect – or as in Wolf (1999) the occupation effect[5] – in Western Germany.

Being deterministic, the traditional shift-share analysis faced much criticism (Knudsen/Barff 1991). As a consequence, it was transformed into a regression analogue shift-share approach by Patterson (1991).[6] Using standard econometric instruments one could combine the idea of the traditional shift-share analysis and the opportunity to extend it by metric variables and find out about significance levels. This modern kind of shift-share analysis has been the methodological basis of various studies (Blien/Haas 2005, Möller/Tassinopoulos 2000).

Our dependent variable is yearly employment growth by status and sector. The sum of sector and status specific growth rates shall equal the average of the Western German economy. This is why we weight the variables with the previous year´s share of employment in a specific status and sector in total employment. Thereby, we avoid heteroscedasticity, too. Since OLS estimation has a quadratic structure, we use the square root of this sector and status specific employment shares. For later fixed effect estimation, we specify time-invariant, that is averaged, weights.

(W1) $\qquad w_{ij} = \sqrt{\dfrac{\displaystyle\sum_{t=1}^{T} \dfrac{e_{ij,t-1}}{e_{t-1}}}{T}}$

Following Patterson (1991), the simple shift-share model is written as:

(M1a) $\qquad w_{ij} g e_{ijt} = \alpha_t w_{ij} D_t + \alpha_{ij} w_{ij} D_{ij} + w_{ij} \varepsilon_{ijt}$

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[5] Wolf (1999) uses the dominating occupation of an employee instead of economic sectors. She argues that occupations are more closely related to working time patterns than are sectors.

[6] For an overview of the development of shift-share analysis and an application see Wolf (2002).

ge_{ijt} is the growth of employment by status i and sector j in year t. At first, we stick to our panel data structure, just separating the time and the cross section effects by dummies D_t and D_{ij}. The time effect reflects the overall development of the economy in that year that is caused by trend or cycle. As we have learned from the literature section, part-time is supposed to react less on cyclical fluctuations. Such specialties are then captured by the cross section effects. They reflect time-invariant influences of employment status and sector in common on the growth of employment in that cross section. Therefore, we allow for interaction terms between employment status and sectors. ε_{ijt} is the residual.

The model is plagued by perfect collinearity. That is why we usually have to exclude one cross section dummy as a reference category. However, since the dummy variables refer to deviations from the average development, we rather restrict the sum of cross section effects to be zero. In the restrictions, the weights also have to be time-invariant but must add up to one to form the usual "national" (that is here Western German) average (Kennedy 1986). We write the first restriction as

(R1) $$\sum_{i=1}^{I}\sum_{j=1}^{J} w_{ij}^2 \alpha_{ij} \overset{!}{=} 0$$

with i=status and j=sectors.

Although we use overall cross section effects in model (M1a), we actually want to isolate the influence of either employment status or sector. We therefore further divide the estimated cross section effect $\hat{\alpha}_{ij}$:

(M1b) $$\hat{\alpha}_{ij} w_{ij} = \beta_0 w_{ij} + \beta_i w_{ij} D_i + \beta_j w_{ij} D_j + w_{ij} \varepsilon'_{ij}$$

We do not include D_i and D_j in the first-step model since we allow for more flexibility in the estimation. We estimate 18 parameters that reflect time-invariant influence, otherwise it would be only 3 parameters for employment status and 6 parameters for sectors. As long as we omit metric variables, the parameters do not deviate between the two step procedure and the direct estimation. As soon as we extend the shift-share model by metric variables, the estimates won´t be the same. Then we expect better explanatory power when we allow for more flexibility by 18 parameters in the first step. However, significance levels differ already in the simple model because in the second step we estimate 10 parameters out of only 18 observations.

Again, we eliminate perfect collinearity in model (M1b) by constraints that restrict the sum of properly weighted status-specific coefficients β_i and properly weighted sector-specific coefficients β_j to be zero for the macro-economy.

(W2) $\quad w_i = \dfrac{\sum\limits_{t=1}^{T} \dfrac{e_{i,t-1}}{e_{t-1}}}{T}$

(R2) $\quad \sum\limits_{i=1}^{I} w_i \beta_i \overset{!}{=} 0$

(W3) $\quad w_j = \dfrac{\sum\limits_{t=1}^{T} \dfrac{e_{j,t-1}}{e_{t-1}}}{T}$

(R3) $\quad \sum\limits_{j=1}^{J} w_j \beta_j \overset{!}{=} 0$

What is behind the explanatory power of the status and sector dummies D_i and D_j? To put their influence into concrete terms, we extend the simple model by metric variables. The idea is to detract as much information out of the dummy variables as possible. Variable selection is based on the determinants of labour demand and sectoral change as described in section 2.

The sector effect shows the change in the sectoral composition of the economy, in general the shift from the secondary towards the tertiary sectors. It is reflected by the shares of sectoral gross value added gva_{jt} in total gross value added gva_t. We include the growth rate $ggva_{jt}$ of that share:

$$ggva_{jt} = \frac{\left(gva_{jt} / gva_t\right) - \left(gva_{j,t-1} / gva_{t-1}\right)}{\left(gva_{j,t-1} / gva_{t-1}\right)} \cdot 100$$

The related coefficient is expected to have a positive sign. The more a sector grows above average, the faster employment in that sector increases.

Capital-intensive production and economical operating hours may influence the demand for full-time and part-time employment. Capital intensity, however, distorts the estimations because it is extraordinarily high in Banking/insurance/business services. In this sector, immovables add to the capital stock but require almost no employees. We choose the growth rate of asset investment gin_{jt} instead. Data on this variable is only available by sector, not status. Therefore, we capture only an average impact on employment growth. The sign of that impact can be either positive or negative depending on whether the income effect or the substitution effect of investment prevails.

Moreover, sectors differ by unit labour costs. This variable portrays the dependence of labour demand on costs and productivity. It measures labour costs including social contributions per employee in relation to real labour productivity. Unit labour costs are given as an index. We use the first lag $ulc_{j,t-1}$. The coefficient is expected to be negative: The higher unit labour

costs by sector, the higher are labour costs related to productivity, the less labour will be demanded, and growth of employment in that sector will decline.

Working time wt_{ijt} in our equation shall test to what extent employers choose between employment and hours worked. We use data by status and sector, thereby controlling for the obvious correlation between the decline in average yearly working hours per capita and the increase in part-time employment. We include working time by status and sector as growth rate gwt_{ijt} :

$$gwt_{ijt} = \frac{\left(wt_{ijt} - wt_{ij,t-1}\right)}{wt_{ij,t-1}} \cdot 100$$

Although the literature on substitution between employment and working time has not come to a clear result (Marti 2001, Wanger/Spitznagel 2004), we expect the coefficient to have a negative sign. One explanation is in the institutional framework. Since our data contains marginal employment and marginal employment was nerved by law, employment shall rise faster if working times grows at a lower rate. This means that working time and employees are substitutes in the short run. There is a restriction to that interpretation for self-employed, of course. They usually work many more hours than employees, however, labour demand theory does not hold for this decision.

As a fifth variable we include a structural deviation effect. What impact does it have on employment growth in a certain status and sector whether an employment status was established above or below average in that certain sector? In order not to distort the average by the sector in question, we have excluded that sector when calculating the average. e_{ijt} is total employment in status i and sector j at time t.

$$sd_{ij't} = \frac{e_{ij't}}{e_{j't}} - \frac{\displaystyle\sum_{\substack{j=1 \\ j \neq j'}}^{J} e_{ijt}}{\displaystyle\sum_{i=1}^{I} \sum_{\substack{j=1 \\ j \neq j'}}^{J} e_{ijt}}$$

The sign of that deviation effect can be either positive or negative. A positive sign indicates divergence: If part-time employment in the finance sector, for example, is already above average, the growth rate of part-time employment in the finance sector will rise, further enlarging the difference from the average. Thus, different kinds of employment probably meet sector-specific needs (flexibility, divisibility of work, opening hours). This is why sectors tend to focus on kinds of employment that are advantageous and therefore typical of them anyway.

A negative sign indicates convergence: If part-time employment in the finance sector is already above average, the growth rate of part-time employment in the finance sector will decrea-

se, making the difference from the average smaller. Then the sector specific needs obviously do not exist or are completely met already (saturation).

The extended model is written as

(M2a)
$$
\begin{aligned}
w_{ij}ge_{ijt} = \quad & \alpha_t w_{ij}D_t \\
& + \alpha_{ij}w_{ij}D_{ij} \\
& + \gamma w_{ij}ggva_{jt} \\
& + \eta w_{ij}gin_{jt} \\
& + \delta w_{ij}ulc_{j,t-1} \\
& + \lambda w_{ij}gwt_{ijt} \\
& + \mu w_{ij}sd_{ijt} \\
& + w_{ij}\varepsilon_{ijt}
\end{aligned}
$$

and is estimated under restriction (R1).

Again, we decompose the remaining cross section effect under restrictions (R2) and (R3):

(M2b) $\quad \hat{\alpha}_{ij}w_{ij} = \beta_0 w_{ij} + \beta_i w_{ij}D_i + \beta_j w_{ij}D_j + w_{ij}\varepsilon'_{ij}$

For all models so far we apply restricted weighted least squares dummy variable estimation. The disentangling models (M1b, M2b) are estimated from just 18 observations. Because of this small number of observations the central limit theorem cannot be applied. We use a bootstrap approach for statistical inference. Doing 10,000 replications we apply the widely used percentile method (Efron/Tibshirani 1986) to derive the bootstrapped confidence intervals. For example, the 95% confidence interval goes from the 2.5[th] to the 97.5[th] percentile of the resample distribution.

Moreover, the Wooldridge test (Wooldridge 2002, pp. 274 ff., Drukker 2003) detects serial correlation of first order after estimating model (M2a). According to theory and in order to eliminate serial correlation we include the lagged endogenous variable in our model.

(M3a)
$$
\begin{aligned}
w_{ij}ge_{ijt} = \quad & \rho w_{ij}ge_{ij,t-1} \\
& + \alpha_t w_{ij}D_t \\
& + \alpha_{ij}w_{ij}D_{ij} \\
& + \gamma w_{ij}ggva_{jt} \\
& + \eta w_{ij}gin_{jt} \\
& + \delta w_{ij}ulc_{j,t-1} \\
& + \lambda w_{ij}gwt_{ijt} \\
& + \mu w_{ij}sd_{ijt} \\
& + w_{ij}\varepsilon_{ijt}
\end{aligned}
$$

The standard LSDV estimator of this dynamic panel model provides biased and inconsistent estimates for finite time horizon T (Nickell 1981). Several alternative estimators, which are consistent, have been discussed in the literature. Most of them are based on internal instrumental variables (Anderson/Hsiao 1982, Arellano/Bond 1991, Blundell/Bond 1998). These estimators need a large number of cross sectional units N, as it is typical of micro panel data sets. In our case with just small N=18 but T=14 the various IV/GMM-type estimators can be severely biased and imprecise. This was shown for example by Judson/Owen (1999) in their Monte-Carlo study. For macro panel data sets they favour the bias corrected least squares dummy variable (LSDVc) estimator (Kiviet 1995, 1999, Bun/Kiviet 2003, Bun/Carree 2006) as the appropriate estimation strategy. The idea here is to correct for the bias of the LSDV estimator by an approximation which is based on a consistent estimator like the Arrelano/Bond GMM estimator. A Stata routine xtlsdvc for this estimator is provided by Bruno (2004, 2005). Furthermore, the routine uses a bootstrap approach to estimating the variance-covariance matrix of the estimated coefficients, which explicitly takes into account the autoregressive data generation process.

As a drawback, xtlsdvc is not computable with properly weighted restrictions. However, the restriction as such does not influence the decomposition results because one can transform restricted and unrestricted estimates into each other (Suits 1984, Kennedy 1986). We only have to correct for the weights subsequently. However, since we use weighted cross section effects as endogenous variable in the second step, we can use the cross section effects just as they are calculated by xtlsdvc. The remaining constant deviation between coefficients after transformation will only enlarge the constant term in the decomposition estimation and therefore does not affect the estimation of the dummy coefficients (see appendix). The following disentangling model again is estimated under restrictions (R2) and (R3) with 10,000 bootstrap replications.

(M3b) $\quad fe_{ij} = \beta_0 w_{ij} + \beta_i w_{ij} D_i + \beta_j w_{ij} D_j + w_{ij} \varepsilon'_{ij}$

5 Estimation results

Estimation results of all three models can be seen in table 2.

Table 2
Estimation results

			1 LSDV (simple) coeff.	sign.	2 LSDV (extended) coeff.	sign.	3 LSDVc coeff.	sign.
	dependent variable:							
	yearly percentage change of employment by sector and status							
1	lagged endogenous						0,4856	***
2	year	1992	1,6322	***	8,7762	***		
3		1993	-0,4903		7,9710	***	-0,8683	
4		1994	-0,1079		8,5907	***	0,4462	
5		1995	0,2919		8,7052	***	0,3920	
6		1996	0,1985		8,6358	***	0,0229	
7		1997	0,4119		8,7754	***	0,1792	
8		1998	1,5372	***	9,5354	***	0,8392	*
9		1999	1,5945	***	9,1980	***		
10		2000	2,2639	***	10,0799	***	0,8898	*
11		2001	0,7077	*	9,0292	***	-0,4465	
12		2002	-0,5188		8,0095	***	-0,7203	
13		2003	-1,2062	***	7,4706	***	-0,7380	
14		2004	-0,0455		8,6616	***	0,6500	
15		2005	-0,3581		7,9087	***	-0,5285	
16	cross section Self	Construction	2,2371	**	2,4088	**		
17	Self	Private / social / public services	3,8571	***	4,8138	***		
18	Self	Banking / insurance / business services	4,4478	***	3,7324	***		
19	Self	Trade / hotel & catering / transport	-0,2137		-0,0233			
20	Self	Agriculture / fishery	-4,8394	***	-10,6890	***		
21	Self	Manufacturing / energy	-0,7537		1,2019			
22	Part-time	Construction	3,6135	**	6,1496	***		
23	Part-time	Private / social / public services	4,5321	***	3,2035	***		
24	Part-time	Banking / insurance / business services	6,6478	***	5,6362	***		
25	Part-time	Trade / hotel & catering / transport	3,8171	***	3,5906	***		
26	Part-time	Agriculture / fishery	4,1878	*	7,6331	***		
27	Part-time	Manufacturing / energy	1,7063	***	4,3349	***		
28	Full-time	Construction	-3,1787	***	-3,6842	***		
29	Full-time	Private / social / public services	-1,1201	***	0,5603			
30	Full-time	Banking / insurance / business services	1,9185	***	3,1862	***		
31	Full-time	Trade / hotel & catering / transport	-1,4451	***	0,9687			
32	Full-time	Agriculture / fishery	-1,8922		5,3536	*		
33	Full-time	Manufacturing / energy	-2,9294	***	-5,8058	***		
34	growth of share of gross value added				0,0728	***	0,0588	*
35	growth of asset investment				0,0789	***	0,0864	***
36	unit labour costs				-0,0888	***	-0,0521	**
37	growth of working time				-0,2765	***	-0,2120	**
38	structural deviation				0,1368	**	0,0914	

Decomposition: Restricted WLS

			coeff.	sign.	coeff.	sign.	coeff.	sign.
	dependent variable: cross section effects							
39	sector	Construction	-1,1688		-1,4369		-0,7611	
40		Private / social / public services	0,6180	**	1,3551		0,8164	
41		Banking / insurance / business services	3,2352	***	3,7310	*	2,0486	
42		Trade / hotel & catering / transport	-0,1586		1,3437		0,8546	
43		Agriculture / fishery	-3,8446		-4,8374		-2,6560	
44		Manufacturing / energy	-1,5548	**	-3,9706		-2,3838	
45	status	Self	0,9669		-0,0201		-0,0002	
46		Part-time	3,8471	***	2,9674	***	1,3149	***
47		Full-time	-1,4502	***	-0,9999	*	-0,4444	
48	w		-0,0002		-0,0007		4,9490	***

Remarks: ***(**,*): significant at the 1 (5, 10) percent level.

Source: DESTATIS, IAB (FB 4), own estimations.

5.1 Simple shift-share analysis

The simple shift-share analysis reveals a significant effect of upswing years 1992 and 1998 till 2000. The only negative significant effect is in year 2003, a year of unexpectedly bad economic performance.

All cross sections except for self-employment in Trade/hotel & catering/transport and Manufacturing/energy as well as full-time in Agriculture/fishery differ significantly from the average. With the signs of all part-time cross sections being positive, the estimation results confirm the tremendous upswing in part-time employment. On the other hand, all but one full-time cross sections show negative signs. This highlights the outstanding role of Banking/insurance/business services throughout the period under consideration. It was the only sector with rising full-time employment and it had the most influence on part-time employment as well.

When disentangling the cross section effect into sector and status effects, a lot of significance disappears due to fewer degrees of freedom. We estimate 10 parameters from just 18 observations. Nonetheless, the most influencing sectors keep their significance, with employment in Banking/insurance/business services and Private/social/public services growing significantly above average and employment in Manufacturing/energy growing significantly below average. If Manufacturing/energy had had the same employment structure as all sectors on average, employment in Manufacturing/energy would have grown 1.6 percentage points below average growth. Indeed, declining full-time employment is typical of Manufacturing/energy, and employment there grew even 2.4 percentage points below average. Thereby, employment fell in that sector whereas it increased on average. The negative sector effect was even strengthened by the status effect.

As expected, part-time has a large positive impact and full-time a negative impact. Both are highly significant. If part-time employment had been present in all sectors equally, it would have grown 3.8 percentage points above average. This is a large status effect that might be due to flexibility and other reasons mentioned in the literature overview. However, part-time employment even grew 4.2 percentage points above average – partly because it was over-represented in growing sectors like Banking/insurance/business services. The other way round, if full-time employment had been present in all sectors equally, it would have grown 1.5 percentage points below average. Indeed, it grew 1.6 percentage points below average due to its dominance especially in shrinking sectors as Construction and Manufacturing/energy.

Figure 3 shows the decomposition of employment growth by sector and status effects in 1998 which is the middle of our period of consideration. A positive time effect of that year raises employment growth in all cross sections equally. However, it can hardly compensate for the negative status effect of full-time. Only the positive sector effect of Banking/insurance/business services is large enough to yield an increase in full-time employment. The positive part-time effect, on the other hand, usually more than compensates negative sector effects.

Figure 3
Simple shift-share analysis: decomposition 1998, percent/percentage points
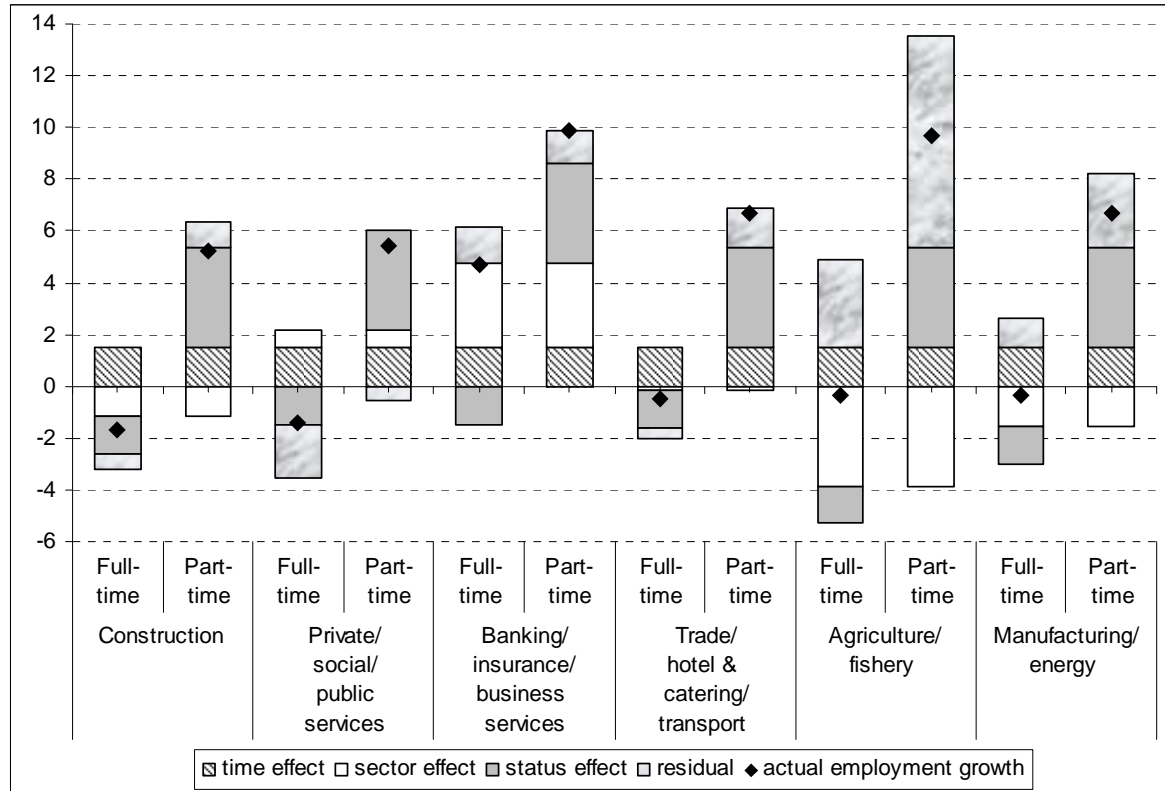
Source: DESTATIS, IAB (FB 4), own estimations.

Obviously, sector as well as status influence employment growth. However, the status effect is often larger and dominates the sector effect. The regression analogue shift-share model confirms the results of previous deterministic ones such as Walwei/Werner (1995).

5.2 Extended shift-share analysis

The model extension by metric variables aims at giving some clue of what is behind the cross section effects. Of course, some explanatory power is then taken out of the dummy variables, making them less significant, especially on the disentangling second stage. Moreover, as column (2) in table 2 shows, the intercept shifts according to the metric variables, heavily enlarging the coefficients of the years and making all of them highly significant. This cannot be interpreted in comparison to the simple shift-share analysis. As should be, economic boom years still have the highest coefficients whereas periods of recession have smaller coefficients.

All metric variables have a significant influence on employment growth. The growth of shares of sectoral gross value added in total gross value added $ggva_{jt}$ explains a rising employment growth rate to some extent. The faster that share had grown, indicating a higher importance of a sector, the faster employment in that sector had grown. This result indicates that the change in the sectoral composition of the economy has a proportional impact on employment. Moreover, the growth of asset investment gin_{jt} positively influences employment growth. The income effect seems to outperform the substitution effect and/or capital and labour are

not perfect substitutes. In addition, unit labour costs are an important factor. If the index of unit labour costs $ulc_{j,t-1}$ had risen by one point in the pre-period, employment growth would have shrunk by 0.1 percentage points.

Growth of working time gwt_{ijt} reveals a significant substitution effect in the short run. Part-timers in Manufacturing/energy, for instance, experienced the largest decrease of working time, whereas working time in full-time cross sections increased a bit. If working time by cross section had grown faster by one percentage point, employment growth in that cross section would have slowed down by 0.3 percentage points.

The structural deviation sd_{ijt} has a positive sign, indicating divergence. To give an example interpretation: Part-time employment is overrepresented in the sector Banking/insurance/business services. This positive deviation from the average is even enhanced slightly because it goes along with a further rising growth rate of part-time employment in Banking/insurance/business services by 0.1 percentage points. Therefore we suppose that part-time work meets specific needs of the sector Banking/insurance/business services, such as flexible working hours. In general, the deviation effect proves that certain employment schemes are more advantageous for some sectors than they are for others.

The metric variables do affect the cross section dummies. For some cross sections, part-time in Construction for example, the metric variables in common had an impact even more negative than on average. This enlarges the coefficient of part-time in Construction. In contrast, the coefficient of part-time in sectors with a high part-time ratio, Private/social/public services and Banking/insurance/business services, becomes smaller. Thus the metric variables in common had a more positive influence here than on average. All part-time cross sections keep their positive sign. The impact of the model extension is especially striking within the full-time cross sections. Some of them loose there significance. However, the most important full-time sectors – the rising sector Banking/insurance/business services and the shrinking sectors Construction and Manufacturing/energy – are significant and show the expected positive and negative sign respectively.

After the metric variables have explained a lot of the cross section variation, disentangling these effects leaves only a few dummy variables significant. However, the expected signs show up. Since the economic variables mostly vary across sectors, not status, they are able to capture most of the sector effect. Banking/insurance/business services is the only sector that remains significant. This result can be traced to the tremendous increase of the financial sector as well as to other market phenomena during the phase of the New Economy. The importance of business services such as IT engineering and consulting rose sharply. In addition, outsourcing became a widespread strategy which mostly concerned business services, again IT services or facility management, for example. These activities newly showed up as stand-alone services whereas they had been documented with the company's main field of activity before outsourcing. The phenomenon of seemingly self-employment is parallel.

The economic variables explain less of the status effect which the simple shift-share analysis had proved dominant anyway. Although the part-time effect diminished a bit it is still highly significant. Other things being equal, part-time employment grew 3.0 percentage points above average. The same holds for full-time employment – with the expected negative sign and significance at the 10 percent level.

5.3 Extended shift-share analysis with lagged endogenous variable

Roughly half of the employment growth in the pre-period is transferred into the current period. Due to the new metric variable, the constants – the years´ coefficients – shift again. With the exception of the structural deviation, the short term effects of all economic variables are significant. This remains true for the long term effects, too (table 3).

Table 3
Long term effects

dependent variable:	LSDVc	
yearly percentage change of employment by sector and status	long term effect	sign.
growth of share of gross value added	0,1142	*
growth of asset investment	0,1680	***
unit labour costs	-0,1013	***
growth of working time	-0,4122	**
structural deviation	0,1777	

Source: DESTATIS, IAB (FB 4), own estimations.

The parameters of the sector and status effects (table 2) are smaller than they had been without lagged employment growth. All but one do no longer differ significantly from the average. Thus, either much of the employment decision is made according to the experience in the pre-period or labour adjustment just needs time.

The economic variables and the lagged endogenous jointly are not able to capture the part-time effect which is still highly significant. This result justifies two conclusions: First, the growth of part-time employment in Western Germany was extraordinary. Second, this development can be traced neither to the prosperity of sectors with a high part-time ratio nor to economic arguments such as the adjustment process or labour costs. There are still determinants inherent in part-time that were not fully captured, flexibility or institutional advantages, for example. However, these characteristics make the status of part-time deviate positively from the average.

6 Summary and conclusions

In this article, we combined empirical findings of Western Germany on the development of full-time, part-time, and self-employment and on the change of the sectoral composition of the economy. In extension to the previous literature, we conducted a regression analogue shift-share analysis. We included all three kinds of employment which enabled us to interpret

the results as deviation from national average employment growth. To find out about the underlying driving forces we extended the simple model by economic variables and the lagged endogenous. For the dynamic panel model the bias corrected least squares dummy variable estimator was appropriate. The main results are the following.

First, part-time employment rose and full-time employment fell due to status inherent factors such as flexibility needs or adjustment costs. The part-time effect is outstanding. Second, the sectoral composition of the economy and its change towards service sectors supported the vivid increase of part-time and decline of full-time employment. But it did not dominate these tendencies. Third, much of the sector and status effects is accounted for by economic variables such as unit labour costs and a sector´s share in total gross value added. Fourth, the negative impact of the growth of working time on employment growth suggests working hours and employment being substitutes in the short run. Since working hours by sector and status decreased, employment rose. And finally, there seems to be hardly any adjustment process towards an average employment scheme. It rather indicates divergence, further deepening the differences between employment schemes across sectors.

Since our analysis confirmed that status inherent factors determine the development of employment schemes to a large degree, policy makers should be aware of these distinctions. They probably meet employers´ needs better than traditional employment patterns. Moreover, they provide not only employers with flexibility but also parts of the labour force that have to reconcile work and other responsibilities. Therefore it helps increasing the participation rate and employment. However, part-timers face disadvantages in Germany, too (Rubery 1998): On average, they get fewer earnings, less training and receive less claims to the public pension system. From that qualitative point of view, the future task in science and politics shall be how to reconcile the pros and cons of the examined development.

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Appendix: How to transform LSDVc fixed effects

The corrected least square dummy variable (LSDVc) estimation procedure is not computable in STATA with properly weighted cross section dummies and properly weighted restriction (model M3a). However, as we disentangle this effect in the second step (M3b), we need cross section parameters as if we had used both proper weights and properly weighted restriction.

We derive our transformation algorithm from the model without lagged endogenous variable (M2a). It is the only one that can be estimated comparably, first, with the least square dummy variable (LSDV) estimator and, second, with the standard fixed effects estimator (within-transformation, FE). According to the Frisch-Waugh theorem these two strategies are compatible. They provide equal estimators for the parameters and equal predictions of the endogenous variable. Therefore, we set our starting point as

$$\hat{y}_{ijt}^{LSDV} = \hat{y}_{ijt}^{FE}$$

(1)
$$w_{ij}\hat{\alpha}_t^{LSDV} + w_{ij}\hat{\beta}_{ij}^{LSDV} + \sum_{k=1}^{K}\hat{\gamma}_{kjt}^{LSDV}x_{kijt} = \hat{c}^{FE} + w_{ij}\hat{\alpha}_t^{FE} + \hat{\beta}_{ij}^{FE} + \sum_{k=1}^{K}\hat{\gamma}_{kijt}^{FE}x_{kijt}$$.

Because of the Frisch-Waugh theorem $\hat{\gamma}_{kjt}^{LSDV}$ and $\hat{\gamma}_{kjt}^{FE}$ are equal. We cancel them from the equation. This cannot be done with the parameters of the time dummies. Since the standard fixed effects model contains a constant one has to exclude one time dummy variable as the benchmark category. Further transformations therefore contain the constant value of that benchmark category. It is equal to the difference between the time dummies' parameters of the two estimation strategies. The next transformation step can then be written as

(2) $\qquad w_{ij}\hat{\beta}_{ij}^{LSDV} = w_{ij}(\hat{\alpha}_t^{FE} - \hat{\alpha}_t^{LSDV}) + \hat{c}^{FE} + \hat{\beta}_{ij}^{FE}$.

$w_{ij}\hat{\beta}_{ij}^{LSDV}$, the weighted cross section effect, is the endogenous variable in the second step estimation (M2b, M3b). In contrast to the isolated estimation of c^{FE} and β_{ij}^{FE} in the standard fixed effects estimation, LSDVc estimates $c^{FE} + \beta_{ij}^{FE}$ as combined measure. For the estimation of model M3b we do not have to adjust the implicit fixed effects. The remaining term $w_{ij}(\hat{\alpha}_t^{FE} - \hat{\alpha}_t^{LSDV})$ is captured by the constant in model M3b. This is why it gets highly significant only in the LSDVc disentangling procedure.

To be complete, the following equation specifies the final transformation step.

(3) $\qquad \hat{\beta}_{ij}^{LSDV} = (\hat{\alpha}_t^{FE} - \hat{\alpha}_t^{LSDV}) + \dfrac{\hat{c}^{FE}}{w_{ij}} + \dfrac{\hat{\beta}_{ij}^{FE}}{w_{ij}}$

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