The Cyclicality of Effective Wages within Employer-Employee Matches – Evidence from German Panel Data

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May 2007

ABSTRACT:

Using individual based micro-data from the German Socio-Economic Panel Study (SOEP), I analyze the cyclicality of real wages for male workers within employer-employee matches over the period 1984–2004, and compare different wage measures: the standard hourly wage rate, hourly wage earnings including overtime and bonus payments, and the effective wage, which takes into account not only paid overtime, but also unpaid working hours. None of the hourly wage measures is shown to exhibit cyclicality except for the group of salaried workers with unpaid overtime. Their effective wages react strongly to changes in unemployment in a procyclical way. Despite acyclical wage rates, salaried workers without unpaid hours but with income from extra payments, such as bonuses, experienced procyclical earnings movements. Monthly earnings were also procyclical for hourly paid workers who received overtime payments. The procyclicality of earnings revealed for Germany is of comparable size with the one in the U.S..

JEL: E32, J31

Keywords: Wage cyclicality, effective wages, unpaid overtime, bonus payments, firm stayers

Acknowledgements: I am grateful to Bob Hart for his indispensable suggestions, and to Bernd Fitzenberger for providing a fruitful discussion. I also would like to thank Michael Kvasnicka for his valuable remarks, Elizabeth Roberts and Anita Kottwitz for their help in processing the data, and an anonymous referee, participants of the ECB/CEPR Labour Market Workshop, the SOEP Brownbag seminar and the Berlin Network of Labor Market Researchers for their helpful comments. All remaining errors are my own.

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1. Introduction

Up to the early 1990s, real wages in the U.S. and in Europe were considered to be almost noncyclical by macroeconomists who derived this evidence from analyses of aggregate time series. However, the use of longitudinal microdata allows researchers to follow the same workers over time, and more recent micro-based studies showed that wages in fact react to recessions and expansions in a procyclical way. Solon, Barsky, and Parker (1994) attribute the phenomenon that real wages at an aggregate level barely show any cyclicality to composition effects. They demonstrate that the movement of real wages with the cycle is not visible due to a composition bias, which arises from a higher share of low-skilled workers being employed during peaks. A number of studies found wage procyclicality particularly for workers who change employers, but more recently also for workers who stay with the same firm. Recent work by Devereux (2001) and others reveals that the cyclicality of real wages differs strongly between salaried and hourly paid workers, and between different wage measures, depending on whether overtime and bonus payments are taken into account.

This paper contributes to the literature on the cyclicality of real wages in two ways. Most important, it provides first evidence for Germany, using individual based micro-data from the German Socio-Economic Panel Study (SOEP) for the period 1984 to 2004. While the previous studies concentrate on the U.S. and the U.K. labor market, which are acknowledged to be quite flexible in terms of wage setting and job mobility, the objective of this study is to reveal whether previous findings can be validated for a labor market that is known as being relatively inflexible. It is quite possible that labor market rigidities, which may stem from the presence of unions or from employment protection legislation, affect the sensitivity of the real wage to the business cycle. Therefore, it will be investigated whether findings of previous studies on Anglo-American economies can be transmitted to more regulated economies. Second, further evidence on real wage cyclicality is produced by comparing the cyclicality of different wage measures. In addition to the standard hourly wage rate and hourly wage earnings including overtime and bonus payments, a new wage measure is examined, which takes into account not only paid overtime, but also unpaid working hours. Effective wages are calculated by averaging total earnings over all working hours, i.e. standard hours, paid

overtime and unpaid overtime. The effective wage is therefore the real compensation of the total work done, and has not been examined in the wage cyclicality literature before.[1]

The cyclicality of effective wages is an important issue to get a more accurate picture of real wages and to achieve a better understanding of the determination of wages, extra payments, and working hours, and their adjustment over the business cycle. By decomposing overall wage cyclicality by different worker groups and identifying the main contributors of overall wage variability, one can derive predictions on how real wages adjustments evolve over future business cycles. Moreover, the understanding of the cyclical behavior of both wages and working hours are crucial for the development of macroeconomic models. This study provides micro-based evidence on whether sticky wages are prevailing in a relatively inflexible economy, and whether wage cyclicality should be a property in macroeconomic models, when modeling regulated labor markets.

2. The Cyclicality of Real Wages

For a long time, macroeconomists agreed that real wages are quite stable over the business cycle.[2] This belief was based on evidence from aggregate time series and considered as a stylized fact. Hence, theoretical macroeconomic models, such as efficiency wage theory or the theory of implicit contracts, evolved in order to explain the non-cyclicality of wages in the presence of a large variability in employment. However, disaggregating data has revealed that the weak cyclicality of wages arises from the changing composition of the workforce over the business cycle. Higher shares of low-skilled workers during peaks cause wages to be averaged over workers with lower earnings potential than in low employment times. The use of longitudinal microdata allows researchers to follow the same workers over time, and more recent micro-based studies showed that wages in fact react to recessions and expansions in a procyclical way. Solon, Barsky, and Parker (1994) were the first who stressed the importance of this effect, and showed that the countercyclical composition bias causes the movement of real wages with the cycle to be non-visible. The concensus in the literature, using U.S. micro

[1] However, effective wages have been analyzed in a different context by Bell and Hart (1999) and Bell, Hart, Hübler, and Schwerdt (2000).
[2] See Solon, Barsky and Parker (1994) for an overview.

data was that a year-to-year increase in unemployment by 10 percent reduces wages of male workers by almost one percent (Bils, 1985; Rayack, 1987; Blank, 1990; Solon et al., 1994).

A number of studies differentiate between workers who stay with their jobs and those who change jobs. Some of them reveal wage procyclicality particularly for workers who change employers. Bils (1985) finds that wages of firm stayers are only slightly procyclical, while those of firm changers are very procyclical.[3] The stronger cyclicality of wages for between-company movers is confirmed by Shin (1994) who yet finds substantial wage procyclicality even for company stayers.[4] Likewise, Solon et al. (1994) and a more recent study by Shin and Shin (2003) also reveal procyclicality of real wages for workers who stay with the same firm.[5] In contrast, Devereux (2001) finds weak evidence of wage procyclicality within employer-employee matches using data on male job stayers from the Panel Study of Income Dynamics (PSID). However, he investigates different sources of payments, and reveals that hourly paid workers experience procyclical earnings movements despite acyclical wage rates, i.e. that adjustments over the business cycle are realized through working hours at stable wages. Moreover, salaried workers are found to earn acyclical salaries, but procyclical earnings if they receive bonuses or overtime payments. In their attempt to replicate the findings of Devereux with data from the National Longitudinal Survey of Youth (NLSY), Shin and Solon (2006) do not find supporting evidence for the noncyclicality of real wages among salaried job stayers. However, they confirm the finding that overtime pay contributes to the discrepancy between the cyclicality of the standard hourly wage rate and average hourly earnings.

Micro-based panel studies on the U.K. confirm the procyclicality of real wages. Hart (2006a) focuses on worker-job matches instead of worker-firm matches, and differentiates between full-time job stayers and job movers who move either within or between firms.[6] Using the British New Earnings Survey Panel Data (NESPD) he finds that real wages are strongly procyclical for both job stayers and movers, with an even stronger wage responsiveness than previously found for the U.S.. The procyclicality of the wage rate is more pronounced among job movers and manual workers, and not significantly different from the cyclicality of hourly

[3] When taking into account overtime earnings, he finds procyclicality of wages even when aggregating the data.
[4] This higher procyclicality of job changers has been attributed to the existence of implicit contracts (Beaudry and DiNardo, 1991; McDonald and Worswick, 1999; Grant, 2003, Devereux and Hart, 2005), or to compensating differentials (Barlevy, 2001).
[5] They show that wage adjustments occur particularly in high employment times, which is evidence against the spot market model, where wage adjustments take place during both expansions and recessions.
[6] See Hart (2006b) for an analysis of real wage cyclicality for female workers in part-time and full-time jobs.

wage earnings, including overtime pay. A more detailed analysis by differentiating between within-company job movers, between-company job movers and job stayers is provided by Devereux and Hart (2006).[7] Using also the British NESPD on fulltime workers, they find wages of job stayers to be strongly procyclical, although the procyclicality is more pronounced among internal movers, and strongest among external movers. Moreover, they show that the wage cyclicality of job movers is much higher than that of job stayers in the private sector and among workers uncovered by collective bargaining.

One strand of research closely related to real wage cyclicality is the literature on the wage curve (Blanchflower and Oswald, 1994), which describes the negative relationship between the *level* of local unemployment and the *level* of wages. The estimated equation resembles much the one of the studies on the cyclicality of real wages, but this link is barely ever mentioned in the wage curve literature. Blanchflower and Oswald (1994) find evidence of a negative relationship between real wages and local unemployment for Great Britain and the US, and present three alternative models more or less consistent with their findings (Card, 1995): an implicit contract model, an efficiency wage model, and a bargaining model. Empirical evidence of the wage curve has been found for numerous other countries, including Australia, Canada, and the Netherlands. Blanchflower and Oswald (1996) also estimate the relationship between the levels of wages and unemployment for Germany, and find an effect of unemployment on wages for gender- and age-specific unemployment rates. Several other studies show the existence of a wage curve also for general unemployment rates in Germany (Wagner, 1994; Baltagi and Blien, 1998; Pannenberg and Schwarze, 1989, 2000; Bellmann and Blien, 2001 Baltagi, Blien, and Wolf, 2000). However, many of the existing wage curve studies merely use repeated cross-sections rather than panel data, and are therefore not able to control for unobserved individual characteristics. Furthermore, most of the studies on the German wage curve are only based on a few years of observations. The wage curve aims at explaining regional wage differentials of workers in labor markets with different levels of local unemployment at one point in time, and therefore tracks a static problem. In contrast, the issue of wage cyclicality is a dynamic matter, asking how real wages evolve over time with the variability in unemployment or other cyclical variables. Empirical studies on the wage curve therefore generally lack of the dynamic aspect of the variability of wages. Moreover,

[7] Wage cyclicality analyses that distinguish between external and internal mobility were first provided by case studies on U.S. companies. Solon, Whatley, and Stevens (1997) use data from the interwar period and find wages of intra-firm job movers to be more procyclical than of job stayers. Wilson (1997) uses more recent data and finds wage cyclicality to be more pronounced among workers who remain in the same job and not among switchers.

they do not distinguish between wages at firm-entry and those of firm stayers. As most wage curve studies for Germany consider only few years of observations, they are not able to properly identify business cycles.

3. Data

The data used in this study were made available by the German Socio-Economic Panel Study (SOEP). The SOEP is a representative longitudinal micro-database that provides a wide range of socio-economic information on private households and their individuals in Germany. The yearly data were first collected from about 12,200 randomly selected adult respondents (in 6,000 families) in West Germany in 1984. After German reunification in 1990, the SOEP was extended by about 4,500 persons (in 2,200 families) from East Germany, and supplemented by expansion samples in 1998, 2000, and 2002. In the most recent wave, in 2005, about 21,000 respondents were participating in the panel study.[8] I use data from 1984 to 2005 for West German male workers aged between 20 and 60, excluding Berlin. To ensure comparability of the results with those of previous studies, attention is restricted to full-time employees within employer-employee matches holding single jobs. The sample contains only full-time workers with monthly earnings of at least 500€ in order to exclude observations with implausibly low incomes. Short-time workers and those working less than 30 hours per week were excluded from the study. Respondents with missing information on earnings, working hours or other variables included in the estimations were also dropped from the sample. In the unbalanced panel, only respondents who participated in at least two waves of the survey are included in order to be able to observe changes in their real wages. When an employment spell is interrupted by unemployment or economic inactivity, an individual drops out of the sample, but is picked up in later years in case he is re-employed. In total, the sub-sample consists of about 38,000 person-year-observations.

The SOEP provides not only information on monthly gross earnings including overtime payments, but also on extra payments, such as Christmas bonus, holiday pay, income from profit sharing, and other bonuses. Extra payments have become increasingly important in

[8] The SOEP data is available as a public-use file containing 95% of the SOEP sample, with some variables omitted for reasons of data protection (see Wagner, Burkhauser, and Behringer, 1993, or for more detailed information, Haisken-DeNew and Frick, 2005).

recent years, and have been shown to significantly contribute to the procyclicality of earnings in the U.S. (Devereux, 2001). In the SOEP, information on extra payments are revealed on an annual basis in the subsequent wave of a respective year. These bonuses can be converted into monthly payments and added to the monthly gross earnings for those workers who have not changed their job during the year.[9] Moreover, labor income including extra payments is only available for workers who participate in the survey for two consecutive years, and observations in 2005 cannot be used except for the information on extra payments. Hence, workers have to participate for at least three waves in the survey to ensure that changes in their real wages *including extra payments* can be observed. As a result, the inclusion of extra payments in this study leads to a considerable reduction in the sample size. However, since these additional payments are considered to be substantial for the analysis of real wage cyclicality, observations without this information are nevertheless dropped. Figure 1 shows that the importance of bonus payments has been increasing in Germany, as not only the proportion of workers with bonus payments but also the average share of bonus payments in monthly base earnings has risen sharply since the mid 1980s.

- Figure 1 about here –

All earnings are deflated using the West German Consumer Price Index (the base year used in this study is 1984). The SOEP asks survey respondents for detailed information on their working hours. Workers provide information on their contractual hours and on their actual working time, i.e. the weekly hours they usually work *on average*, including overtime.[10] Moreover, if a worker indicates that he works overtime, he is asked for the compensation of these extra hours, which may be overtime pay, leisure compensation, or no compensation at all.[11] This allows to differentiate between contractual hours, paid overtime hours, and unpaid overtime hours in the analysis.

[9] Since extra payments are declared on an annual basis, they are not dependent on the month of the interview and therefore unaffected by seasonal variations.
[10] The SOEP also provides information on the number of overtime hours worked during the last month before the interview. However, since these working hours might not be representative of the average over the whole year due to seasonality, overtime hours in this study are calculated as the difference between the *usually* worked actual hours and the contracted working time of a worker.
[11] However, the responses with respect to the compensation of overtime are mutually exclusive in the SOEP questionnaire, e.g. a worker cannot work paid and unpaid overtime hours at the same time.

Three different wage measures are generated by dividing earnings from various sources by the respective working hours. First, the standard hourly wage rate is defined as hourly compensation for a contractual working hour. Hence, monthly gross earnings have to be calculated net of overtime payments, for which a premium of 25% is assumed.[12] Dividing these adjusted monthly gross earnings by contractual working hours then yields the standard hourly wage. Second, the average hourly wage including overtime and bonus payments is calculated by dividing total earnings, i.e. monthly earnings including overtime payments and monthly extra payments, by all *paid* hours, i.e. contractual hours and paid overtime, but not unpaid working hours.[13] Third, a new wage measure is introduced, which takes into account not only paid overtime, but also unpaid working hours. Hence, effective wages are calculated by averaging total earnings over all working hours, i.e. standard hours, paid overtime and unpaid overtime.[14] Taking into account all working hours is particularly important for those workers with excessive unpaid working time, for whom the standard or average wage overstates the actual hourly compensation. It has already been shown that unpaid hours may lead to a substantial wage drift for some worker groups.[15] Depending on the cyclicality of overtime and extra payments, the average and the effective wage can be more or less cyclical than the standard wage rate. Since economic reasoning and evidence from previous studies gives us grounds to assume that extra payments and paid overtime are procyclical, average wage earnings are expected to be more sensitive to the business cycle than the standard wage rate. The anticipation with respect to the cyclicality of the effective wage is not as straightforward. On the one hand, overtime hours in general are expected to increase during or at the beginning of expansions, when labor demand is high or starts to rise. If unpaid hours behave similarly to paid extra hours, this points to the procyclicality of unpaid overtime and causes effective wages to be less procyclical than average wage earnings. On the other hand, workers could increase their overtime hours in terms of unpaid work during recessions, when their bargaining position worsens and their risk of job loss is higher (Anger, 2005). In the latter case, the effective wage is expected to be even more procyclical than average wage

[12] This overtime premium corresponds to the premium put down in most collective agreements in Germany.
[13] Some workers indicate that they work partially paid/partly leisure compensated overtime. Here, it is assumed that 40% of these overtime hours were actually paid. This number is derived from the question in the SOEP available since 2002, where respondents reveal how many overtime hours during the last month were paid.
[14] Since leisure-compensated overtime hours are ought to be taken as time-off at a later point in time, these extra hours should in theory not be part of the average working time usually worked. There is no reliable information but only speculation on how many leisure-compensated overtime hours are not claimed and therefore become forfeited. Consequently, this study does not take into account leisure-compensated overtime hours. The effective wage can therefore be considered as a conservative measure.
[15] Bell and Hart (1999) show for managers and professionals in the U.K. that their high levels of unpaid hours lead to actual hourly earnings of about 90% of their paid-for earnings. Bell, Hart, Hübler, and Schwerdt (2000) find similar evidence for Germany.

earnings. The same impact on the cyclicality of the effective wage is obtained if the amount of overtime hours worked was stable over the business cycle, but overtime was compensated for in expansions, and not in recessions. This would imply that merely the compensation form of extra work adjusts to current business cycle conditions.[16]

In addition to the three different wage measures, the cyclicality of monthly earnings, of both basic earnings and those including overtime and extra payments, will be analyzed below. Monthly earnings have the advantage of avoiding any potential bias from measurement error in hours worked, if these are inaccurately quantified.[17] In the literature on real wage cyclicality, national unemployment has been widely used as measure of the business cycle. In line with previous studies, wage cyclicality is measured as the reaction of the workers' wages to changes in the unemployment rate. The yearly average of the West German unemployment rate is provided by the Federal Statistical Office and refers to registered unemployment. Figure 2 shows the standard hourly real wage for the years 1984 to 2005 and the West German unemployment rate.[18] While the cyclicality of unemployment is clearly visible, the real wage averaged over all workers in the sample described above barely shows any cyclical behavior, but a fairly steady upward trend.

- Figure 2 about here –

Again, to ensure comparability with the results from previous research, the control variables included are work experience, its square term, and its cubic term. Summary statistics are provided in Table 1, which separates the sample according to the workers' methods of payments. The population weights provided by the SOEP are used to weight the descriptives.[19] It is obvious that the remuneration differs strongly between hourly paid and salaried workers. Whereas 40% of the hourly paid workers in the sample received overtime payments, only 10% of salaried workers received financial compensation for their extra work. The percentage of employees with extra payments is only slightly higher among salaried workers, but a comparison of the monthly earnings reveals that workers with a salary receive

[16] Evidence for a relatively stable amount of total overtime with changing compensation over the cycle is found by Bauer and Zimmermann (1999).
[17] See Devereux (2001) for a discussion on the measurement error in working hours.
[18] Using the other wage measures described above produces very similar graphs.
[19] Sample weights are not used for the later part of the analysis for efficiency reasons.

clearly higher bonus payments which leads to a higher discrepancy of basic earnings and overall earnings.

- Table 1 about here –

The relatively high share of employees with unpaid overtime among salaried workers (24%) indicates that the effective wage measure may be relevant particularly for this worker group. A comparison of the wage measures of salaried workers shows that taking into account unpaid working hours leads to a significant drop in the effective wage compared to the average wage rate, which only considers paid hours. In contrast, average wage and effective wage rate are identical for hourly paid workers, among whom the percentage of unpaid overtime workers is only 2%. Furthermore, the table displays mean changes in real earnings and in real wages, which are both expressed in logarithms as they are used in the later analysis. The changes in earnings and wages are of comparable size, regardless of whether overtime pay, extra payments or unpaid working hours are taken into account, but they are significantly larger for the group of salaried workers. The high standard deviations indicate a wide distribution in earnings and wage changes. Both pay cuts and pay rises were observed in the sample. With "no wage change" being defined as a change in real hourly wage between two years within the bounds of +/- 1% as in Devereux and Hart (2006), 55% of salaried workers in the sample experienced an increase in their standard hourly real wage, whereas 35% experienced a wage cut. Among hourly paid workers, 41% suffered a real wage reduction, whereas 52% gained from a wage rise.[20] These numbers compare to 51% of male (53% of female) job stayers in the U.K. who experienced a wage increase in 1997, and to 29% (males) and 27% females who suffered a reduction in their real wage (Devereux and Hart, 2006).

[20] Taking into account adjustments of working hours revealed very similar numbers: 53% (54%) of salaried workers experienced an increase in their real monthly earnings (including overtime and extra payments), whereas 34% (35%) experienced an earnings cut. Among hourly paid workers, 42% (42%) suffered a real earnings reduction, whereas 49% (50%) gained from rise in their monthly earnings.

4. Estimation Methods

As in most micro-based studies on real wage cyclicality, the estimation of the wage cyclicality in the present study follows Bils (1985), and is based on the following wage change equation:

$$(1) \qquad \Delta \ln w_{it} = \alpha_1 + \alpha_2 \Delta U_t + \alpha_3 X_{it} + \alpha_4 t + \varepsilon_{it}$$

where $\Delta ln\ w_{it}$ is the change in the natural logarithm of worker *i*'s real wage in year *t* compared to year *t-1*. ΔU_t represents the year-to year change in the national (West German) unemployment rate, X_{it} is a vector of worker characteristics which contains a cubic in work experience, *t* is a linear time trend, and ε_{it} is the error term. α_1 is the individual specific effect, and α_2, α_3, and α_4 are parameters to be estimated. The parameter of main interest is α_2, which is negative if wages react to changes in unemployment in a procyclical way. The regression model is kept deliberately parsimonious to ensure comparability with other studies which likewise include polynomials of experience as only exogenous variables. The inclusion of a cubic in tenure as additional worker characteristics like in the estimates of Devereux (2001) for job stayers and in some of the other previous studies did not seriously affect the results. Nor did the inclusion of additional controls for worker characteristics. According to Solon et al. (1994), the problem of composition bias can be avoided in two different ways: First, restricting the sample to a balanced panel would imply the assignment of fixed weights to the same workers over time. However, the requirement that one must have a wage observation for every worker in each year from 1984 to 2004, would shrink the sample substantially. Therefore, in line with Devereux (2001) and other previous studies, an unbalanced panel design is used. Equation (1) controls implicitly for wage effects of time-invariant worker characteristics, as these are netted out in the measurement of year-to-year changes.

The estimation of the model above by conventional ordinary least squares (OLS) involves a potential problem, which arises from matching data on the individual level with aggregated data. Moulton (1990) demonstrates that estimating models with mixtures of individual and grouped data can lead to a substantial underestimation of the standard errors if common group errors are not accounted for. This arises because individuals within the same cluster who share this observable characteristic might also share unobservable characteristics, which might cause the error terms to be correlated across workers within the same year. Using the same value of the explanatory variable for all persons in the same year might therefore lead to

a downward bias in the estimated standard errors of the year-to year change in unemployment, leading to spurious inference.

To avoid this problem, Solon et al. (1994), Shin (1994), Solon et al. (1997), and Devereux (2001) used a two-step estimation technique. The first stage estimates the change in log wages on the vector of worker characteristics and on year dummies using OLS. In the second stage, the coefficients on the year dummies obtained in the first step are regressed on the change in unemployment and on a linear time trend. Devereux (2001) suggests to estimate the second stage by using weighted least squares (WLS), where the weight for each year's observation is derived from the number of individual observations in that given year. As mentioned in Devereux (2001), consistent estimates are also obtained by using Generalized Least Squares (GLS), which has been shown to yield similar results. For the sake of comparability with previous studies, the two-step technique of Devereux (2001) will be applied in the present study.

In the first step, the following equation is estimated by OLS:

$$\Delta \ln w_{it} = \beta_1 + \beta_2 X_{it} + \sum_{t=1}^{T} \phi_t D_t + \varepsilon_{it} \tag{2}$$

where D_t represents the vector of year dummies which equal one if the observation is from year *t*, and zero otherwise. In the second step, the estimates of the time dummy variables $\hat{\phi}_t$ from (2) are picked up and regressed on the change in unemployment and the linear time trend:

$$\hat{\phi}_t = \delta_1 + \delta_2 \Delta U_t + \delta_3 t + \upsilon_t \tag{3}$$

The second-step equation is estimated using WLS, with the weights being derived from the number of individual observations in each year. Robust standard errors are computed to control for correlation of the error terms. In order to facilitate the interpretation of the results, the change of the log wages is multiplied by 100. This enables us to interpret the estimated coefficients on the change in unemployment as percentage change in the wage as reaction to a one point increase in the unemployment rate.

5. Results

In the following, the results of equation (3) are presented for different samples of West German male workers using different wage and earnings measures. The tables below display the coefficients on the change in unemployment over the full 21-year period. As explained above, movements of monthly earnings over the business cycle will be analyzed in addition to the real wage cyclicality, as per-period earnings allow an analysis of the cyclicality of workers' remuneration independently of hours worked. Before employees are analyzed separately according to their methods of payments, the cyclicality of earnings and wages of all firm stayers, hourly paid and salaried workers, will be considered. Table 2 shows the real earnings and wage cyclicality for all employer-employee matches (first row), and for those workers being employed in the private sector (second row). While basic monthly earnings of all firm stayers exhibit procyclical movements, monthly earnings react stronger to the cycle when overtime pay and extra payments are taken into account. Both the average wage rate and the effective wage display a modest procyclicality, where the cyclicality of the effective wage is more pronounced. This may be a first indication of unpaid overtime being countercyclical, and hence decrease the effective wage particularly during recessions. However, all estimates are very noisy and not statistically significant. Excluding public sector workers leads to a slightly higher procyclicality of both monthly earnings and hourly wage rates, but again the estimates are not statistically significant from zero. In the following, the earnings and wage cyclicality will be estimated separately for hourly paid and salaried workers. Figure 3 shows plots of the estimated coefficients on the year dummies against the change in unemployment for some of the sub-samples analyzed below.

- Table 2 about here –

Hourly Paid Workers

The earnings and wage cyclicality for hourly paid workers who do not change employers is shown in Table 3. Compared to the estimates for all workers in Table 2, the procyclicality of both earnings and wages is slightly more pronounced among employees who are hourly paid. In the full sample (first row), the estimates are again very noisy and not statistically

significant. However, when only workers with overtime payments are considered (second row), the coefficients on the change in unemployment are not only higher than in the full sample, but also statistically significant in the estimates of monthly earnings. A one point increase in the West German unemployment rate is associated with a reduction in basic earnings by 1% and with a decrease in overall earnings including overtime pay by about 1.2% for workers in this sample. Paid overtime hence exhibits a procyclical behavior, being higher during upswings when labor demand is rising. The procyclicality of earnings is only slightly higher for hourly paid workers in the private sector (third row), and still significant at the 10% and the 5% level. The size of these earnings effects compares with an earnings procyclicality of about 1.9% for job stayers with no extra job for the U.S. (Devereux, 2001). All measures of the hourly wage rate exhibit procyclical signs, but the estimates are not statistically different from zero. Although the hourly real wage of hourly paid workers shows no significant cyclicality, regardless of the wage measures considered, hourly paid workers with overtime pay experience procyclical per-period earnings movements. This may indicate that adjustments over the business cycle are realized through working hours at relatively stable hourly wages.

- Table 3 about here –

- Figure 3 about here –

Salaried Workers

Table 4 displays results for workers that are remunerated with a monthly salary. The earnings and wage effects are shown for the full sample of salaried workers (first row), for those who receive extra payments (second row), for workers with extra payments in the private sector (third row), and for those with extra payments and overtime pay in the private sector (fourth row). As in the sample of hourly paid workers above, none of the hourly wage measures seems to react to the business cycle in any of the four sub-samples. The coefficients on the change in unemployment are of neither economic nor statistical significance. Likewise, workers in the full sample of salaried workers and in the sample of workers with extra

payments did not have procyclical earnings. However, when workers employed in the public sector are omitted, a statistically significant procyclical effect is found for monthly earnings including overtime and extra payments. This procyclicality is even more pronounced when the estimates are restricted to employees in the private sector who received overtime payments. Their overall earnings were reduced by about 1% as reaction to a one point increase in the unemployment rate. As for hourly paid workers, paid overtime of salaried workers is found to exhibit a procyclical behavior. The size of this earnings effect is comparable to the procyclicality of earnings found by Devereux (2001) for U.S. job stayers with a single job and with non-salary income (coefficient of –0.95, significant at the 5% level). The finding of Devereux (2001) that salaried workers in the U.S. earn acyclical salaries, but procyclical earnings if they receive bonuses or overtime payments, can hence be confirmed for the West German labor market.

- Table 4 about here –

Next, the sample is restricted to salaried employees who work unpaid extra hours. For these workers, monthly earnings are unaffected by longer working hours, as they receive no financial compensation for their extra work. At the same time, the hourly real compensation of the total work done is reduced with every additional unpaid hour worked. The wage and earnings cyclicality for the group of salaried workers with unpaid overtime is presented in Table 5, which shows results for the full sample (first row), for those workers with extra payments (second row), and for those with extra payments excluding the public sector (third row). In contrast to the results for all salaried workers, the unemployment coefficients in the monthly earnings estimates are not statistically significant for any of the sub-samples. However, the effective hourly wage is clearly more procyclical than the standard wage and the average wage rate in all of the specifications, and most strikingly, the procyclicality of the effective wage is statistically different from zero. Hence, for the sample of unpaid overtime workers, the effective wage procyclicality is of both economic and statistical significance. A one point increase in the unemployment rate reduces the effective wage of salaried workers with unpaid overtime by 1.2%, and by slightly more for those workers with extra payments.

- Table 5 about here –

The strongest real wage procyclicality is observed among workers with extra payments in the private sector, whose effective wage decreased by 1.7% as reaction to a one point increase in unemployment. The size of this wage effect is even stronger than that found in the U.S. for salaried job stayers (coefficient of –1.5 in Shin and Solon, 2006) and for salaried job stayers with non-salary income (–0.8 in Devereux, 2001). However, the wage measure in these studies are earnings divided by hours, i.e. the average wage, which makes the comparison of the results for the U.S. and the West German labor market difficult. The strong procyclicality of effective wages for unpaid overtime workers rejects the hypothesis that unpaid overtime is prevailing during expansions. Unpaid hours show a behavior which is exactly the opposite of the movement of paid overtime, which has been shown to increase during upswings, when labor demand is increasing. The effective compensation of unpaid overtime workers may be decreasing during recessions either because they increase their overall overtime hours in terms of unpaid work in the face of rising unemployment, or because the compensation of their normally worked overtime hours is adjusted to current business cycle conditions.

Acyclical Wage Rates and Procyclical Earnings

The finding that earnings exhibit procyclical movements over the cycle despite acyclical hourly wage rates for most hourly paid and salaried workers might be attributed to different reasons. One explanation for the discrepancy between the cyclicality of hourly and per-period compensation was already mentioned above, and refers to the adjustment of working hours over the business cycle, which might lead to earnings cyclicality in the presence of stable hourly wages. Second, the finding that hourly wages exhibit no cyclicality might be attributed to a measurement error in the reporting of working hours. This requires that the misrepresentation of working hours leads to a countercyclical bias, and therefore to an understated cyclicality of the hourly wage measures. Devereux (2001) addresses the measurement error in working hours, but supposes that the clumping of reported working hours at a certain hours level implies that the procyclicality of the average hourly wage is *over*stated. Shin and Solon (2006) investigate the issue of misreported working hours and find no evidence of a procyclical bias. They conclude that there is indeed a tendency to

*under*estimate the cyclicality of average hourly wages, which could hence explain the non-cyclicality of the wage measures in the estimates above.

Another possible reason why no wage cyclicality is found for most firm stayers in Germany as opposed to findings for the U.K. and to some extent for the U.S. is related to the problem of selectivity. When workers leave employment, their wages become unobservable and they drop out of the sample. If these workers are the ones with a particularly strong (hypothetical) wage procyclicality, the estimated cyclicality of real wages for the remaining workforce understates the true overall wage cyclicality. Therefore, the composition bias might not only be a problem when observing aggregate wage data, but also in micro-data analyses. It is quite possible that the problem of sample selection bias is not as severe in studies on Anglo-American labor markets, where unemployment was not as high as it has been in Germany since the 1990s. In Germany, there is a much higher probability that those workers whose wages are strongly affected by the cycle are not in the sample due to unemployment or economic inactivity. Hence, the high unemployment rate among particular worker groups in Germany might lead to an underestimation of the wage cyclicality, and even to the finding that wages are not cyclical at all. As pointed out by Devereux (2001), solving the problem of selectivity requires variables that affect the worker's likelihood of being within an employer-employee match, but not his wage. Such variables are extremely difficult if not impossible to find. Devereux (2001) refers to unsatisfactory attempts to solve the issue of sample selection in the wage cyclicality literature.

The Phillips Curve

The specification in equation (1) is competing with the specification of the Phillips curve, which establishes a negative relationship between the rate of *change* in wages and the *level* of the unemployment rate. However, a simple test suggested by Card (1995) allows to check the Phillips curve specification by decomposing the change in the unemployment rate ΔU_t into the level of current unemployment U_t and the lag of unemployment U_{t-1}:

$$\alpha_2 \Delta U_t = \gamma_1 U_t + \gamma_2 U_{t-1} \tag{4}$$

If both current and lagged unemployment included in the wage change equation, γ_1 and γ_2, are significant, of the same size, and of opposite signs, the present model is the preferred

specification. The finding of a significant coefficient on current unemployment γ_1, but an insignificant coefficient on lag of unemployment γ_2 would support the Phillips curve specification. Applying this test to the samples above reveals approximately equal magnitudes of the two unemployment coefficients with a negative current unemployment effect and a positive lagged unemployment effect on the change in wages. This supports the specification in the wage change equation (1). Showing wage and earnings effects of current and lagged unemployment, Table 6 presents exemplary results of this specification test for the group of salaried workers with unpaid overtime.

- Table 6 about here –

State Unemployment Rates

The finding that none of the hourly wage measures exhibits cyclicality apart from effective wages for the group of salaried workers with unpaid overtime may be traced back to the use of the national unemployment rate as cyclical variable. If regions within a country are sufficiently heterogeneous, the change in the unemployment rate at the national level might be too aggregated and hence be inappropriate to represent cyclical shocks that affect wages in various regions. Since regions in Germany exhibit great heterogeneity, a disaggregated cyclical variable might be a more suitable measure.[21] Therefore, an alternative specification uses state unemployment rates instead of unemployment at the national level. The use of state unemployment rates introduces more degrees of freedom into the second stage equation, and allows to differentiate the time influence by means of year dummies rather than imposing a linear time trend on the model (Hart 2006c). However, the specification with the state unemployment rates as cyclical variable reveals even less evidence for the procyclical movement of real wages, and also leads to insignificant effects of the change in unemployment on monthly earnings.[22] This confirms the findings of Devereux (2001) for the U.S. using state unemployment rates. He points out that "when year effects are included, the

[21] Both unemployment and changes in unemployment varied quite strongly between the West German states in the observed time period. The biggest difference occurred between the state of Baden-Württemberg with an unemployment rate of 5.4% and Bremen with 15.2% in 1985 (7.8% and 18.3% in 2005), their changes in unemployment in 1985 amounting to -0.2 and +1.4 (+0.9 and +3.9 in 2005) respectively.
[22] The coefficients are not reported here, but are available from the author on request.

state unemployment rate captures the differences in the cycle across states. Thus, it is not surprising that the inclusion of year effects reduces the estimated cyclicality."

6. Conclusion

Existing studies on the cyclicality of real wage concentrate on the U.S. and the U.K. economies, which are acknowledged to be quite flexible labor markets. The aim of this study was therefore to reveal whether previous findings of procyclical estimates for job stayers can be validated for Germany, a labor market that is known as being relatively inflexible in terms of wage setting and employment protection. A further objective of this study was to investigate the cyclicality of a new wage measure which has not been examined in the wage cyclicality literature before. In addition to the standard hourly wage rate and average hourly wage earnings including overtime and bonus payments, effective wages were analyzed. These take into account unpaid overtime, and are calculated by averaging total earnings over all working hours. The effective wage is therefore the real compensation of the total work done. Using individual based micro-data from the German Socio-Economic Panel Study (SOEP) for the period 1984 to 2004, the cyclicality of these different wage measures, and of two monthly earnings measures was analyzed within employer-employee matches. When estimating the reaction of the according wage measure to changes in the West German unemployment rate, the two-step estimation technique and weighted least squares used by Devereux (2001) and other previous studies were applied.

Despite the different nature of the German labor market, the findings are similar to previous results for the U.S.. In spite of acyclical hourly real wages, hourly paid workers with additional income from overtime pay had procyclical movements in their monthly earnings. Hence, it seems that adjustments over the business cycle are realized through working hours of hourly paid workers at relatively stable hourly wages. For salaried workers who do not change their employer, no cyclicality of the hourly wage rates is found either. However, salaried workers in the private sector who receive additional income from extra payments or overtime had procyclical earnings, which are of similar size as in the U.S. (estimates of –0.7 to –1.0). Hence, acyclical base salaries are compatible with procyclical overall earnings also in the West German labor market. The overall compensation of salaried workers seems to be

adjusted over the cycle through extra payments, such as bonuses. For the sample of salaried workers with unpaid overtime, the effective wage rate turns out to exhibit a strong and statistically significant procyclicality. The wage effect is as strong as –1.7 for employees with extra payments in the private sector. This implies that the effective wage for those workers decreased by 1.7% as reaction to a one point increase in the unemployment rate. Although this effect is difficult to compare with average hourly wage effects found for the U.S., it is reasonable to conclude that the West German labor market displays comparable wage flexibility for this worker group. This suggests that higher flexibility arises for workers with wages above the union wage or not covered by collective bargaining, as salaried workers with unpaid overtime receive higher average earnings, and are supposedly less likely to be covered by union wage setting.[23] Hence, this results provides indirect support for the findings of Devereux and Hart (2006) for the U.K., where wage cyclicality is much higher among workers uncovered by collective bargaining. Moreover, the strong procyclicality of effective wages for salaried unpaid overtime workers supports the notion that unpaid overtime is prevailing during recessions, and hence decreases the real hourly compensation of the total work done, when unemployment is rising. This might be explained by an increase in unpaid overtime worked during downturns, when the workers' bargaining position worsens due to a higher risk of losing the job. In addition, this is consistent with the idea that the compensation of overtime rather than the amount of overtime hours adjusts over the business cycle.

To sum up, for the majority of workers within employer-employee matches, hourly wages do not adjust to the cycle. Therefore, one might conclude that sticky wages are indeed prevailing in a relatively inflexible economy like in the German labor market. This finding is consistent with recent findings on the U.S. (Devereux, 2001), but in stark contrast to studies on the U.K. labor market, where strong wage procyclicality for job stayers was found (Hart, 2006a; Devereux and Hart, 2006). However, while the non-cyclicality of real wage rates should be a property of macroeconomic models for the German economy, it should be kept in mind that both hourly paid and salaried workers with additional income from overtime pay or extra payments experienced procyclical earnings, which were strongly procyclical particularly in the private sector.

In addition to the research presented in this paper, insights should be gained from future work on the cyclicality of real wages *over time*. The finding that real wage cyclicality differs

[23] Unfortunately, this cannot be analyzed using the SOEP, since the information on whether a worker is covered by collective bargaining is not available in the dataset.

strongly between different worker groups has helped to identify main contributors of overall wage variability, and raises the question as to how the changing importance of these contributors since the mid 1980s has affected wage cyclicality since then. Future research should therefore be directed towards the analysis on how the cyclicality of wages varied over time, and which factors may have contributed to these changes. The finding that per-period earnings were cyclical for hourly workers only if they received overtime payments, may give rise to speculations on how the earnings cyclicality developed as a result of the current trend in changing overtime compensation.[24] The decline in the fraction of paid overtime hours in all overtime hours in Germany, which has been accompanied by more flexible working arrangements, such as working-time accounts, may have led to a weaker earnings cyclicality for hourly paid workers within matches. On the other hand, a decline in the prevalence of traditional hourly and salaried methods of payments, and the increasing importance of extra payments due to the implementation of new payment schemes, such as incentive pay, might have increased the procyclicality of both hourly paid and salaried workers. The higher reliance on incentive-based pay, as illustrated in Figure 1, has given firms more scope to adjust workers' compensation to the business cycle, and might have increased overall wage cyclicality. Finally, the fall in the fraction of paid extra hours and the trend towards more unpaid overtime in the German economy might have led to an increasing procyclicality of effective wages, particularly among salaried workers. Future research on the cyclicality of wages over time may hence be crucial to derive predictions on how real wages adjust over future business cycles.

[24] See Anger (2006) for an overview of the trend in overtime hours and their compensation in Germany.

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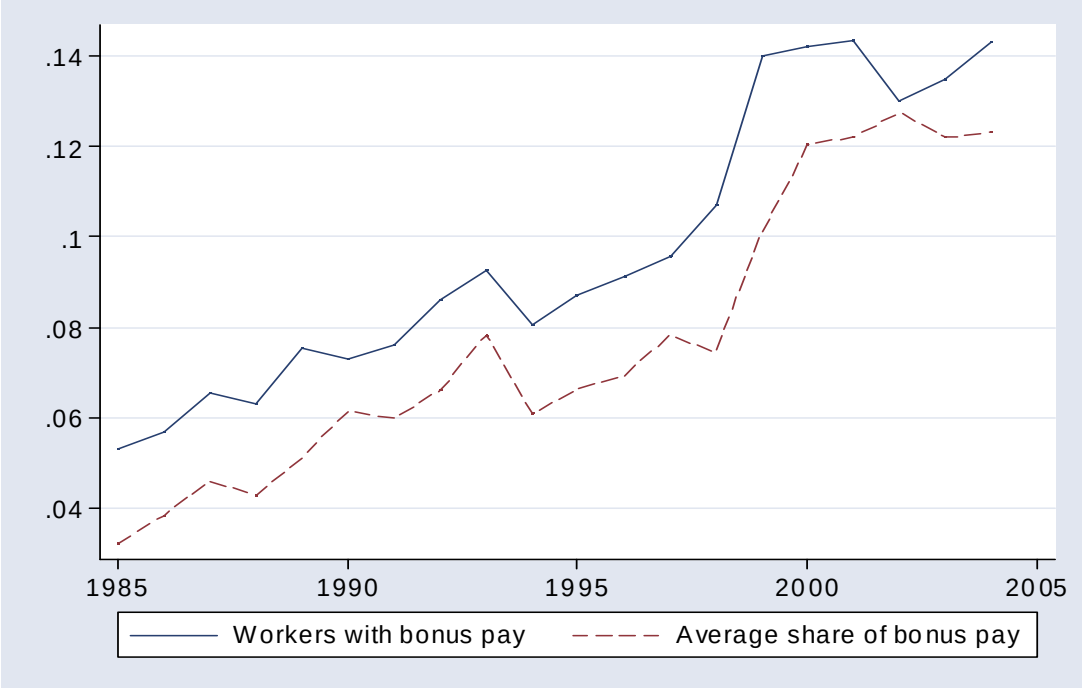
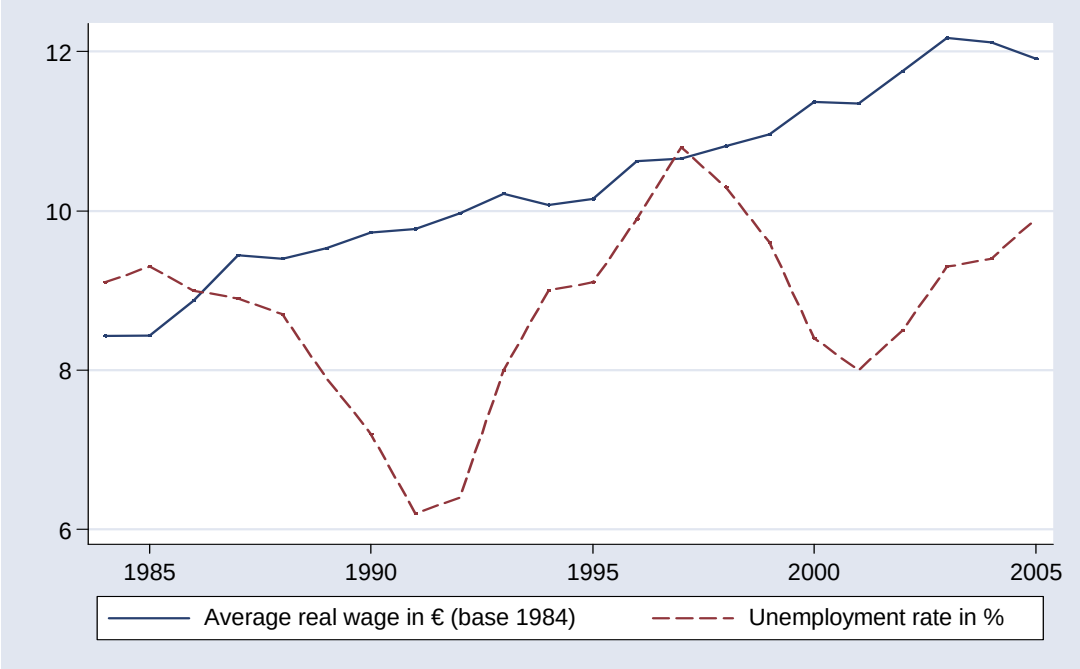
Appendix: Figures and Tables

Figure 1: Proportion of Workers With Bonus Payments and Share of Bonus Payments in Monthly Base Earnings (West Germany)



Source: SOEP, 1984-2005
Sample: Full-time male employees, age 20-60.

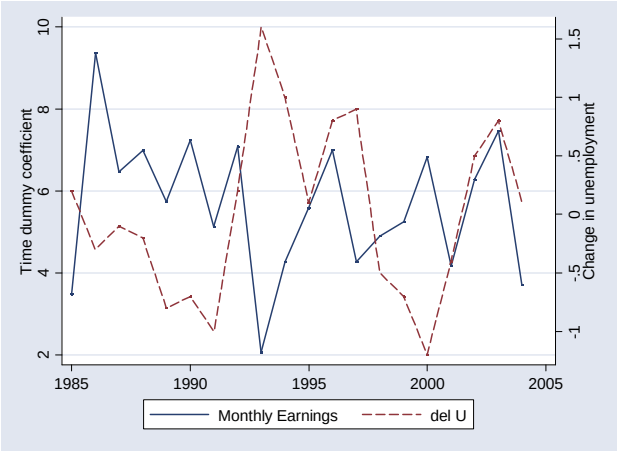
Figure 2: Real Wage and Unemployment Rate (West Germany)



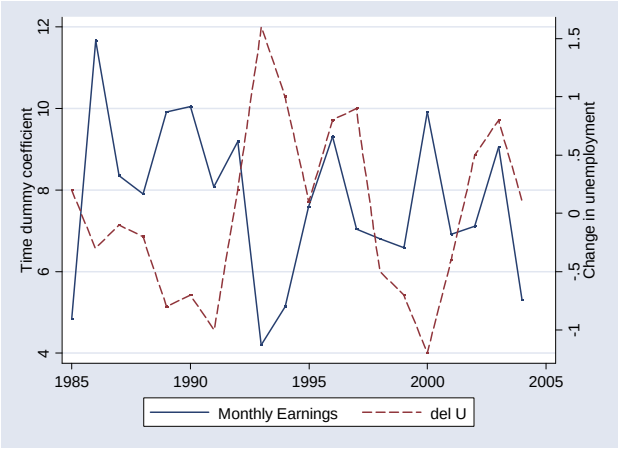
Source: Federal Statistical Office, SOEP (Full-time male employees, age 20-60).

Figure 3: Coefficients on Year Dummies: Hourly Paid and Salaried Workers (within employer-employee matches, 1984-2004)

Hourly paid workers:
Full sample, Monthly Earnings

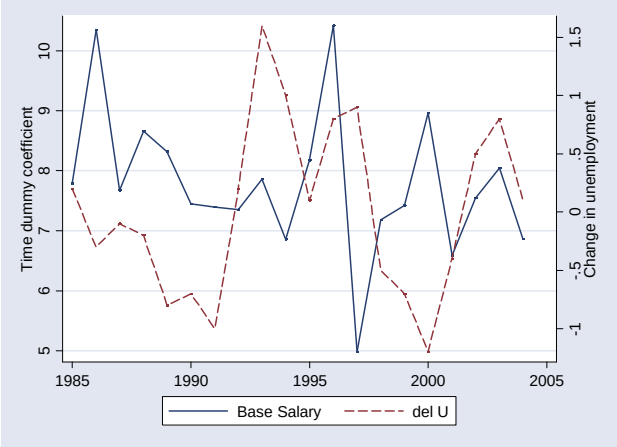


Hourly paid workers: with paid overtime in the private sector, Monthly Earnings

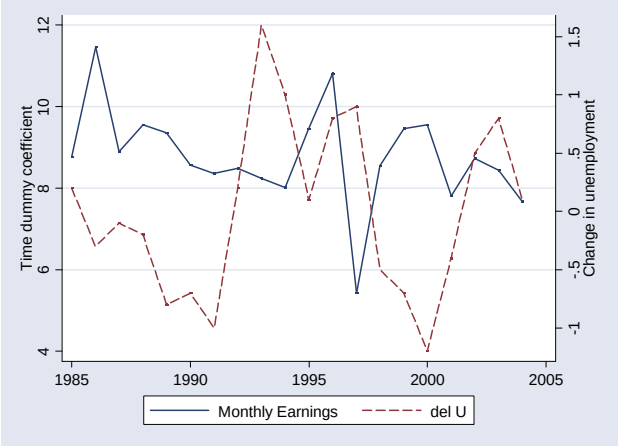


Salaried workers: with extra payment in the private sector

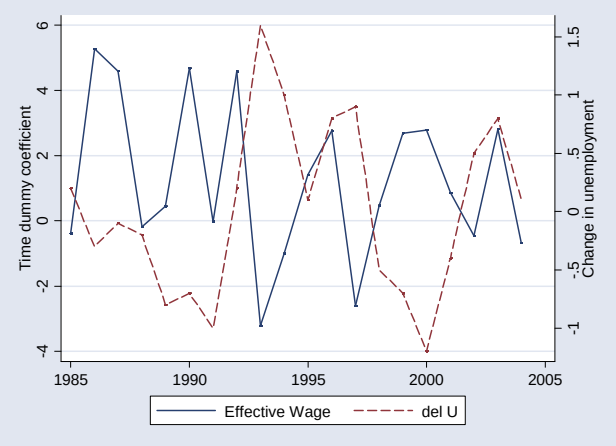
Base Salary



Monthly Earnings



Salaried workers: with unpaid overtime, Effective Wage



Source: SOEP, 1984-2005
Sample: West German male full-time employees, age 20-60.

Table 1: Descriptive Statistics: Sample Means and Standard Deviations (within employer-employee matches, 1984-2004)

Variable	All workers	Hourly paid workers	Salaried workers
Work experience	19.61 (10.59)	20.05 (10.83)	19.13 (10.30)
Year	1994.9 (6.0)	1994.3 (6.0)	1995.5 (6.1)
With paid overtime	0.26	0.40	0.10
With extra payments	0.81	0.78	0.86
With unpaid overtime	0.12	0.02	0.24
Public sector	0.20	0.08	0.34
Monthly earnings			
Basic earnings Y_s (in €)	1,998 (918)	1,641 (433)	2,395 (1,128)
Earnings with overtime and extra payments Y_a (in €)	2,171 (1,042)	1,758 (477)	2,631 (1,281)
Hourly wage			
Standard wage W_s (in €)	11.02 (5.20)	8.96 (2.41)	13.32 (6.38)
Average wage W_a (in €)	12.06 (5.92)	9.69 (2.67)	14.70 (7.27)
Effective wage W_e (in €)	11.66 (5.32)	9.67 (2.67)	13.89 (6.52)
Earnings Changes			
$\Delta \ln Y_s$	0.022 (0.192)	0.018 (0.186)	0.027 (0.198)
$\Delta \ln Y_a$	0.020 (0.185)	0.016 (0.179)	0.025 (0.191)
Wage Changes			
$\Delta \ln W_s$	0.026 (0.208)	0.022 (0.206)	0.031 (0.211)
$\Delta \ln W_a$	0.024 (0.198)	0.020 (0.194)	0.029 (0.202)
$\Delta \ln W_e$	0.024 (0.205)	0.020 (0.195)	0.028 (0.215)
Observations	37,999	20,017	17,982

Source: SOEP 1984-2005
Sample: West German full-time employees, age 20-60. Data are weighted using population weights.

Table 2: Wage and Earnings Cyclicality of Workers within Employer-Employee Matches (1984-2004)

	Monthly Earnings		Hourly Wage		
Sample (Sample Size)	Basic earnings	With overtime and extra payments	Standard wage	Average wage	Effective wage
All workers	-0.276	-0.450	0.059	-0.160	-0.265
(N: 37,999)	(0.407)	(0.394)	(0.438)	(0.421)	(0.473)
Workers in the private	-0.502	-0.691	-0.044	-0.291	-0.384
sector (N: 30,251)	(0.438)	(0.429)	(0.449)	(0.435)	(0.491)

Source: SOEP, 1984-2005
Sample: West German full-time employees, age 20-60.
Note: Robust standard errors in parentheses.

Table 3: Wage and Earnings Cyclicality of Hourly Paid Workers (within employer-employee matches, 1984-2004)

	Monthly Earnings		Hourly Wage		
Sample (Sample Size)	Basic earnings	With overtime and extra payments	Standard wage	Average wage	Effective wage
All workers	-0.573	-0.695	-0.107	-0.297	-0.317
(N: 20,017)	(0.593)	(0.592)	(0.590)	(0.592)	(0.602)
Workers with paid	-1.008*	-1.158**	-0.434	-0.676	-0.729
overtime (N: 6,809)	(0.484)	(0.492)	(0.506)	(0.512)	(0.512)
Workers with paid	-1.043*	-1.222**	-0.410	-0.690	-0.740
overtime in the private	(0.525)	(0.526)	(0.533)	(0.534)	(0.531)
sector (N: 6,466)					

Source: SOEP, 1984-2005
Sample: West German full-time employees, age 20-60.
Note: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%;

Table 4: Wage and Earnings Cyclicality of Salaried Workers (within employer-employee matches, 1984-2004)

	Monthly Earnings		Hourly Wage		
Sample (Sample Size)	Basic earnings	With overtime and extra payments	Standard wage	Average wage	Effective wage
All workers (N: 17,982)	0.059 (0.385)	-0.174 (0.339)	0.245 (0.456)	-0.007 (0.403)	-0.207 (0.424)
Workers with extra payments (N: 14,157)	0.084 (0.368)	-0.135 (0.345)	0.213 (0.408)	-0.033 (0.386)	-0.154 (0.389)
Workers with extra payments in the private sector (N: 10,015)	-0.387 (0.396)	-0.671* (0.359)	-0.073 (0.473)	-0.386 (0.428)	-0.474 (0.449)
Workers with extra payments and paid overtime in the private sector (N: 2,611)	-0.732 (0.615)	-0.959* (0.505)	-0.370 (0.607)	-0.647 (0.537)	-0.393 (0.602)

Source: SOEP, 1984-2005
Sample: West German full-time employees, age 20-60.
Note: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%;

Table 5: Wage and Earnings Cyclicality of Salaried Workers with Unpaid Overtime (within employer-employee matches, 1984-2004)

	Monthly Earnings		Hourly Wage		
Sample (Sample Size)	Basic earnings	With overtime and extra payments[1]	Standard wage	Average wage	Effective wage
All workers (N: 3,941)	-0.190 (0.376)	-0.646 (0.399)	0.245 (0.589)	-0.239 (0.552)	-1.244* (0.706)
Workers with extra payments (N: 3,405)	-0.215 (0.366)	-0.638 (0.412)	-0.005 (0.621)	-0.440 (0.599)	-1.332* (0.738)
Workers with extra payments in the private sector (N: 2,607)	-0.273 (0.459)	-0.825 (0.504)	-0.156 (0.762)	-0.713 (0.711)	-1.705** (0.797)

Source: SOEP, 1984-2005
Sample: West German full-time employees, age 20-60.
Note: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%;
[1] Since the responses with respect to the compensation of overtime are mutually exclusive in the SOEP questionnaire, these workers do not receive overtime payments, as they indicated to work unpaid overtime.

Table 6: Wage and Earnings Effects of Current and Lagged Unemployment of Salaried Workers with Unpaid Overtime (with. employer-employee matches,1984-2004)

	Monthly Earnings		Hourly Wage		
Sample Size: 3,941	Basic earnings	With overtime and extra payments[1]	Standard wage	Average wage	Effective wage
Current unemployment U_t	-0.206 (0.428)	-0.628 (0.421)	0.220 (0.470)	-0.218 (0.456)	-1.268 (0.540)**
Lagged Unemployment U_{t-1}	0.174 (0.445)	0.664 (0.427)	-0.270 (0.482)	0.260 (0.455)	1.220 (0.551)**

Source: SOEP, 1984-2005
Sample: West German full-time employees, age 20-60.
Note: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%;
[1] Since the responses with respect to the compensation of overtime are mutually exclusive in the SOEP questionnaire, these workers do not receive overtime payments, as they indicated to work unpaid overtime.