The Cyclicality of Effective Wages within Employer-Employee Matches in a Rigid Labor Market

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February 2011

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ABSTRACT

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This study analyzes real wage cyclicality for male full-time workers within employer-employee matches in Germany over the period 1984-2004. Five different wage measures are compared: the standard hourly wage rate; hourly wage earnings including overtime and bonus pay; the effective wage, which takes into account unpaid overtime; and monthly earnings, with and without additional pay. None of the hourly wage measures exhibits cyclicality except for the group of salaried workers with unpaid overtime. Their effective wages show a strongly procyclical reaction to changes in unemployment. Despite acyclical wage rates, salaried workers without unpaid overtime experienced procyclical earnings movements if they had income from extra pay. Monthly earnings were also procyclical for hourly paid workers with overtime pay. These findings suggest that cyclical earnings movements are generated by variable pay components, such as bonuses and overtime, and by flexible working hours. The degree of earnings procyclicality revealed for the German labor market is comparable to the United States.

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Up to the early 1990s, macroeconomists considered real wages in the US and Europe to be almost noncyclical, an idea based largely on evidence from aggregate time series analysis. However, the use of longitudinal micro-data allows researchers to follow the same workers over time, and more recent micro-based studies have shown that wages do in fact react to recessions and expansions in a procyclical way. Solon et al. (1994) attribute the phenomenon that aggregate-level wages show barely any cyclicality to composition effects. They demonstrate that the movement of real wages with the cycle is not visible due to composition bias, which arises from a higher share of low-skilled workers being employed during peaks. A number of studies have 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 workers, as well as among different wage measures, depending on whether overtime and bonus pay are taken into account.

This study analyzes the cyclicality of real hourly wages and monthly earnings for full-time employed male workers who stayed in the same firm in Germany over the period 1984-2004. It contributes to the literature on real wage cyclicality in several ways. Most important, it offers a variety of different hourly wage measures and provides the first analysis that explicitly takes into account unpaid overtime.[1] In addition to the standard hourly wage rate and hourly wage earnings including overtime and bonus pay, the present study examines a third hourly wage measure, which takes into account not only paid overtime, but also unpaid working hours. To distinguish this wage measure from hourly wage earnings, which are only based on *paid* working hours (standard hours and paid overtime), it is called "effective wage" and 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. Previous studies on real wage cyclicality have typically used the base wage rate and a wage measure, where per-period earnings are divided by working hours. However, the literature seems to be largely unaware of the

fact that studies differ in their inclusion of unpaid overtime hours, depending on the data source at hand. Individual-based micro datasets that are widely used in US studies (e.g., PSID) provide information on actual hours worked, including all (paid and unpaid) working hours reported by workers, which enables one to calculate the effective wage. In contrast, studies that are based on employer data (e.g., NESPD in the UK) do not contain information on unpaid hours, since this is usually not recorded by employers, and their measure of average hourly earnings is calculated by merely using standard working hours and paid overtime. Given that a considerable percentage of workers report unpaid working hours (24 percent of full-time salaried male workers in the sample used in this study), it is essential to distinguish between average hourly earnings and effective wages. Especially in relatively rigid labor markets with the presence of strong unions, unpaid overtime may be a way to get around collective bargaining to ensure wage flexibility. Since the authors of most studies refer to "average hourly earnings" independent of whether they include or exclude unpaid overtime, Table 1 provides an overview of the detailed wage measures used in recent studies on the US and Europe. While the UK studies (Hart, 2006; Devereux and Hart, 2006) rely on contractual or actual working hours *excluding* unpaid overtime, i.e., average hourly earnings, the US studies (e.g., Devereux, 2001) use contractual or actual hours *including* unpaid overtime, i.e., effective wage rates. However, studies that are based on different wage measures may be difficult to compare. Hence, this paper analyzes the cyclicality of different hourly wage measures and contributes to the literature by revealing whether differences in previous estimates for the UK and the US have arisen due to discrepancies in the hourly wage measures used.

– Table 1 about here –

Second, this study uncovers potential sources of real wage cyclicality by comparing the cyclicality of the different hourly wage measures described above and of two additional monthly wage measures: basic monthly earnings and total earnings (including overtime pay and bonuses).

Hence, possible sources of wage variation at both margins—working hours and pay components—are taken into account. The cyclicality of hourly wages may be generated by cyclical movements of 1. standard working hours, paid overtime hours, unpaid overtime hours and/or 2. standard wages, overtime pay, bonuses. Again, it is evident that distinguishing between hourly wage measures with and without including unpaid overtime is crucial, since unpaid extra hours allow the effective wage a potentially greater flexibility. By comparing five different wage measures, this study complements previous analyses that made first attempts to compare the cyclicality of different hourly and monthly wages (e.g., Devereux, 2001). At the same time, it provides evidence on differences in the cyclical behavior of paid and unpaid hours. Moreover, this paper may help to reconcile some of the apparently contradictory previous findings and explain differences in wage cyclicality across countries, since past studies on this issue have relied on different measures of hourly and monthly wages.

Third, this study provides first evidence for Germany, using individual based micro-data from the German Socio-Economic Panel Study (SOEP) for the period 1984 to 2004.[2] Previous papers mainly concentrate on the US and the UK 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 to be 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 real wages to the business cycle. Hence, this study complements recent research on Portugal (e.g., Martins, 2007) and Italy (Peng and Siebert, 2008) by investigating whether findings of previous studies on Anglo-American economies can be transmitted to more regulated economies.

The analysis of effective wage cyclicality is important to obtain a more accurate picture of real wages and a better understanding of the determination of wages, bonuses, 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 of how real wage adjustments might evolve over future business cycles. Moreover, understanding the cyclical behavior of both wages and working hours is crucial for the development of macroeconomic models. The present study provides micro-based evidence on whether sticky wages are prevalent in a relatively inflexible economy, and whether wage cyclicality should be considered in macroeconomic models when modeling regulated labor markets.

Although recent developments in US and European labor markets have led researchers to stress the importance of worker flows and to focus increasingly on the wages of newly hired workers, the present study concentrates on wages within employer-employee matches. The main reason is its focus on the comparison of different wage measures and on the cyclicality of various hours and pay components. Bonuses have become increasingly important in recent years and are a core component of this analysis. However, as will be described in the data section below, data restrictions in the SOEP (as in other datasets) do not allow the use of reliable job-specific information on bonuses for newly hired workers. The cyclicality of wages within employer-employee matches should hence be seen as a lower bound for the cyclicality of firm movers, since wage cyclicality is known to be stronger among job changers (e.g., Devereux and Hart, 2006). However, the present analysis allows direct comparison of the results with findings on firm stayers from previous research (e.g., Devereux, 2001) and provides a useful starting point for complex analyses on job stayers and movers based on appropriate data.

I.   THE CYCLICALITY OF REAL WAGES

Macroeconomists long agreed that real wages are stable over the business cycle. 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 to explain the non-cyclicality of wages in the presence of a large variability in employment. However, disaggregated data has revealed that the weak cyclicality of wages arises from the changing composition of the workforce over the business cycle. The higher percentages of low-skilled workers employed during peaks cause wages to be averaged over larger shares of workers with lower earnings potential than is the case in periods of low employment. Through the use of longitudinal micro-data, however, researchers can follow the same workers over time, and more recent micro-based studies have shown that wages in fact react to recessions and expansions in a procyclical way. Solon et al. (1994) were the first to stress the importance of this effect, showing that the countercyclical composition bias conceals the movement of real wages with the cycle. The consensus in the literature using US micro-data was hat a year-to-year increase in unemployment by ten percent reduces wages of male workers by almost one percent (Bils, 1985; Rayack, 1987; Blank, 1990; Solon et al., 1994).[3]

A number of studies have differentiated between workers who stay with their jobs and those who change jobs. Some of these reveal especially strong wage procyclicality for workers who change employers. Bils (1985) finds that wages of firm stayers are only slightly procyclical, while those of firm movers are highly procyclical.[4] The stronger cyclicality of wages for firm movers is confirmed by Shin (1994), who yet finds substantial wage procyclicality even for stayers.[5] Likewise, Solon et al. (1994) and a more recent study by Shin and Shin (2008) reveal procyclicality of real wages for workers who stay with the same firm.[6] 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 pay, and reveals that hourly paid workers experience procyclical earnings movements despite acyclical wage rates—in other words, that adjustments over the business cycle are achieved through working hours at stable wages. Moreover, salaried workers are found to earn acyclical salaries, but procyclical earnings if they receive bonuses or overtime pay. In an attempt to replicate the findings of Devereux with data from the National Longitudinal Survey of Youth

(NLSY), Shin and Solon (2007) 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. Swanson (2007) does not differentiate between job movers and job stayers, but confirms Devereux's (2001) finding of acyclical straight-time hourly wages using the Panel Study of Income Dynamics (PSID). He concludes that the procyclicality of average wages is generated by more variable pay margins such as bonuses.

Micro-based panel studies on the UK confirm the procyclicality of real wages. Hart (2006) 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. 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 US. The procyclicality of the base wage rate is more pronounced among job movers and manual workers, and not significantly different from the cyclicality of hourly 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] Also using the British NESPD on full-time 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 not covered by collective bargaining agreements. Recent studies on Southern Europe confirm these findings. Using matched employer-employee data from the Portuguese "Quadros de Pessoal" (QP), Martins (2007) shows that external movers display higher cyclicality than firm stayers. Moreover, he finds the procyclicality of wages to be stronger during recessions and for younger workers.[8] Peng and Siebert (2008) find a considerable procyclicality of real wages for stayers in Northern Italy, which they report to be even higher than in the US and the UK.[9]

As can be seen in Table 1, the wage measures used by most existing studies are base wage rates and per-period earnings divided by working hours. While the UK studies use firm-based data to calculate average hourly earnings (total earnings divided by total paid working hours), existing US studies use individual-based micro-data and rely on effective wages (total earnings divided by total paid and unpaid working hours). As is evident, none of the studies explicitly differentiates between paid and unpaid overtime hours. This, however, could be important if there are worker groups for whom unpaid hours noticeably decrease the effective hourly wage. As summarized in Table 1, some of the studies have identified overtime and bonus pay as a source of real wage cyclicality. In addition to these two components of total worker compensation, unpaid working hours could be a way to adjust hourly wages and could hence affect the movement of wages over the business cycle.

II.   DATA

The data used in this study were made available by the German Socio-Economic Panel Study (SOEP).[10] I use data from 1984 to 2005 on workers aged 20 to 60 from West Germany, excluding Berlin.[11] To ensure comparability of the results with those from previous studies, the focus is on male full-time employees within employer-employee matches holding single jobs.[12] The sample contains only full-time workers with declared monthly earnings of at least 500 euros in order to exclude observations with implausibly low incomes. Short-time workers and those working less than 30 hours per week are also excluded from the study.[13] Respondents with missing information on earnings, working hours, or other variables included in the estimations are 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 again in later years if re-employed. In total, the sub-sample consists of 37,999 person-year observations.

The SOEP provides not only information on monthly gross earnings including overtime, but also on bonuses such as Christmas bonuses, holiday pay, income from profit-sharing, and other bonuses. Bonuses have become increasingly important in recent years, and have been shown to significantly contribute to the procyclicality of earnings in the US (Devereux, 2001). In the SOEP, information on bonuses is collected retrospectively on the year prior to the interview. Hence, observations in 2005 are only used to retrieve information on bonuses in 2004. Data on bonuses is collected on an annual basis and can be converted into monthly pay.[14] However, since the retrospective information on bonuses can only be attributed to the specific jobs of workers who have not changed their employer (during the year), bonuses cannot be identified for movers within the SOEP. This is the main reason why this study concentrates on firm stayers, for whom this condition is met. As a result of the survey design, information on monthly earnings *and* bonuses is only available for workers who have participated in the survey for two consecutive years. Hence, workers have to participate in the survey for at least three waves to ensure that changes in their real wages *including bonuses* can be observed. As a result, the inclusion of bonuses in this study leads to a sizeable reduction of about ten percent in the sample size.[15] However, since additional pay is considered to play an important role in the analysis of real wage cyclicality, observations lacking this information are dropped. Figure 1 shows that the importance of bonus pay has been increasing in Germany: not only the proportion of workers with bonus pay but also the average share of bonus pay 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 *average* number of hours they usually work per week, including overtime.[16] If workers indicate that they work overtime, they are asked for the form of compensation for these extra hours, whether overtime pay, time off in compensation for overtime, or no pay at all.[17] This makes it possible to distinguish among contractual hours, paid overtime hours, and unpaid overtime hours in the analysis.

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 pay per contractual working hour. Hence, monthly gross earnings have to be calculated net of overtime pay.[18] Dividing these adjusted monthly gross earnings by contractual working hours then yields the standard hourly wage. Second, average hourly earnings including overtime and bonus pay are calculated by dividing total earnings, i.e., monthly earnings including overtime pay and monthly bonuses, by all *paid* hours, i.e., contractual hours and paid overtime, but not unpaid working hours.[19] Third, a 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.[20] 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.[21]

Depending on the cyclicality of overtime and bonuses, the average and the effective wage could be more cyclical or less cyclical than the standard wage rate. Since economic reasoning and evidence from previous studies gives us grounds to assume that bonuses and paid overtime are procyclical, average earnings are expected to be more sensitive to the business cycle than the

standard wage rate. The expectation with respect to the cyclicality of the effective wage is not as straightforward. On the one hand, overtime hours are generally expected to increase during or at the beginning of phases of expansion, 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. In the latter case, the effective wage is expected to be even more procyclical than average wage 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 periods of expansion, and not in recessions. This would imply that merely the compensation form of extra work adjusts to current business cycle conditions.[22]

In addition to the three different wage measures, the cyclicality of monthly earnings, of both basic earnings and those including overtime and bonuses, 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.[23]

In the literature on real wage cyclicality, national unemployment has been used widely as a 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 West German unemployment rate, which 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.[24] While the cyclicality of unemployment is clearly visible, the real wage averaged over all workers in the sample described above shows barely 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. Weighted summary statistics are provided in Table 2, which separates the sample according to the types of pay workers receive. It is obvious that the remuneration differs strongly between hourly paid and salaried workers. Whereas 40 percent of the hourly paid workers in the sample received overtime payments, only 10 percent of salaried workers received financial compensation for their extra work. The percentage of employees with bonuses is only slightly higher among salaried workers, but a comparison of monthly earnings reveals that salaried workers receive clearly higher bonus pay, which leads to a higher discrepancy between basic earnings and overall earnings.

-        Table 2 about here –

The relatively high share of salaried employees with unpaid overtime (24 percent) 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 working hours. In contrast, the average wage and effective wage rate are identical for hourly paid workers, among whom the percentage of unpaid overtime workers is only 2 percent. 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 comparable, regardless of whether overtime pay, bonuses, 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 increases 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

percent as in Devereux and Hart (2006), 55 percent of salaried workers in the sample experienced an increase in their standard hourly real wage, whereas 35 percent experienced a wage cut. Among hourly paid workers, 41 percent suffered a reduction in real wages, whereas 52 percent enjoyed a wage increase.[25] These numbers compare to 51 percent of male (53 percent of female) job stayers in the UK who experienced a wage increase in 1997, and to 29 percent (males) and 27 percent (females) who suffered a reduction in their real wages (Devereux and Hart, 2006).

III.   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:

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

where $\Delta ln\ w_{it}$ is the change in the natural logarithm of worker i's real wages 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. 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—as done by 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 ways. First, by restricting the sample to a balanced panel. This 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. Second, in line with Devereux (2001) and other previous studies, an unbalanced panel design can be 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) may lead to the underestimation of the standard errors if common group errors are not accounted for (Moulton, 1990). 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 estimating 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:

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

where D_t represents the vector of year dummies which equals one if the observation is from year t, and zero otherwise.[26] 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:

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

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The second-step equation is estimated using WLS, with the weights being derived from the number of individual observations in each year. The change of the log wages is multiplied by 100. This enables one 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.

IV.   RESULTS

Table 3 shows the real earnings and hourly wage cyclicality for all employer-employee matches (first row), and for those workers employed in the private sector (second row).[27] While basic monthly earnings of all firm stayers exhibit procyclical movements, earnings react more strongly to the cycle when overtime pay and bonuses are taken into account. Both average hourly earnings 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 significantly different from zero. In the following, the earnings and hourly 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 3 about here –

Hourly Paid Workers

The earnings and hourly wage cyclicality for hourly paid workers who do not change employers is shown in Table 4. Compared to the estimates for all workers in Table 3, the procyclicality of both earnings and hourly wages is slightly more pronounced among employees who are paid on an hourly basis. In the full sample (first row), the estimates are again very noisy and not statistically significant. However, when only workers with overtime pay 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 percent and with a decrease in overall earnings including overtime pay by about 1.2 percent for workers in this sample. Paid overtime hence exhibits 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 percent and 5 percent levels. The size of these earnings effects is comparable with an earnings procyclicality of about 1.9 percent for job stayers in the US with no extra job (Devereux, 2001). All measures of the hourly wage rate exhibit procyclical signs, but the estimates are not statistically different from zero. Although the hourly wage of all 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 4 about here –

- Figure 3 about here –

Salaried Workers

Table 5 displays results for workers that are remunerated with a monthly salary. The earnings and hourly wage effects are shown for the full sample of salaried workers (first row), for those who receive bonuses (second row), for workers with bonuses in the private sector (third row), and for those with bonuses 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 neither of economic nor of statistical significance. Likewise, workers in the full sample of salaried workers and in the sample of workers with bonuses 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 bonuses. 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 percent in reaction to a one point increase in the unemployment rate. As for hourly paid workers, paid overtime of salaried workers is found to exhibit procyclical behavior. The size of this earnings effect is comparable to the procyclicality of earnings found by Devereux (2001) for US job stayers with a single job and with non-salary income (coefficient of –0.95, significant at the 5 percent level). The finding of Devereux (2001) that salaried workers in the US earn acyclical salaries but procyclical earnings if they receive bonuses or overtime pay is hence confirmed for the West German labor market.

- Table 5 about here –

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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 for total work done is reduced with every additional unpaid hour worked.[28] The hourly wage and earnings cyclicality for the group of salaried workers with unpaid overtime is presented in Table 6, which shows results for the full sample (first row), for those workers with bonuses (second row), and for those with bonuses, excluding public-sector workers (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 percent, and by slightly more for those workers with bonuses.

-        Table 6 about here –

The strongest real wage procyclicality is observed among workers with bonuses in the private sector, whose effective wage decreased by 1.7 percent in reaction to a one point increase in unemployment. The size of this wage effect is even stronger than that found in the US for salaried job stayers (coefficient of –1.5 in Shin and Solon, 2007) and for salaried job stayers with non-salary income (–0.8 in Devereux, 2001). These findings hold when estimating weighted regressions using population weights, as shown by way of example in Table A1 of the Appendix. Although the coefficients are slightly larger in absolute terms and less precisely estimated, the results are qualitatively the same. The strong procyclicality of effective wages for unpaid

overtime workers refutes the hypothesis that unpaid overtime is prevalent during phases of expansion.[29] Unpaid hours show behavior that is exactly the opposite of the movement of paid overtime, which has been shown to increase during upswings, when the demand for (paid) labor increases. The effective compensation of workers who regularly do unpaid overtime may decrease during recessions, either because they increase their unpaid overtime hours in the face of rising unemployment, or because their compensation for ongoing overtime work has been adjusted to current business cycle conditions.

Acyclical Wage Rates and Procyclical Earnings

The finding that earnings exhibit procyclical movements over the business cycle despite acyclical hourly wage rates for most hourly paid and salaried workers might be attributed to different causes. 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 in the hourly wage measures. Devereux (2001) addresses the measurement error in working hours. He hypothesizes that the clumping of reported working hours at a certain hour levels implies that the procyclicality of the average hourly wage is *over*stated. Shin and Solon (2007) 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 in contrast to findings for the UK and to some extent for the US is related to the problem of selectivity. When workers leave a job, 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 will understate the true overall wage cyclicality. Therefore, the composition bias might be a problem not only when observing aggregate wage data, but also in micro-data analyses. It is possible that the problem of sample selection bias is more severe in the present study than in the studies on Anglo-American labor markets, where unemployment has not been as high as in Germany since the 1990s. In Germany, there may be a higher probability that those workers whose wages are strongly affected by the cycle are not in the sample due to unemployment or economic inactivity.[30] 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 the worker's wages. 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.[31]

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 us 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 the 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, γ_1 and γ_2, with a negative current unemployment effect and a positive lagged unemployment effect on the change in wages. This supports the specification of the present model. Table A2 in the Appendix presents results of this specification test for the group of salaried workers with unpaid overtime.

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 the regions of 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 Germany's regions differ widely, a disaggregated cyclical variable might be a more suitable measure.[32] 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 makes it possible to differentiate the time influence by means of year dummies rather than imposing a linear time trend on the model

(Hart, 2008). However, regardless of whether a linear time trend or year fixed effects are included, 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.[33] This confirms the findings using state unemployment rates for the US reported by Devereux (2001), who presumes that these results may be attributed to larger measurement error in state-level unemployment rates. He also points out that "when year effects are included, the 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."

V.   CONCLUSION

Previous studies on the cyclicality of real wages have focused on the US and the UK, which are known to have extremely flexible labor markets. One of the aims of this study was therefore to reveal whether previous findings of procyclical estimates for job stayers can be validated for Germany, whose labor market is known to be relatively inflexible in terms of wage setting and employment protection. A further objective of this study was to examine potential sources of real wage cyclicality. This was achieved by comparing different hourly and monthly wage measures that have not been examined together in any other single study to date. In addition to the standard hourly wage rate and average hourly earnings including overtime and bonus pay, effective wages were analyzed. These take unpaid overtime into account and are calculated by averaging total earnings over all working hours. The effective wage is therefore the real compensation for the total work done and corresponds to the hourly wage measure previously used in US studies. 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. To estimate the reaction of each wage measure to changes in the West German unemployment rate, I used the two-step estimation technique and the method of weighted least squares as used by Devereux (2001) and others.

Despite the unique nature of the German labor market, the findings were similar to previous results for the US. In spite of acyclical hourly real wages, hourly paid workers with additional income from overtime pay showed procyclical movements in their monthly earnings. Hence, it seems that adjustments over the business cycle are achieved through working hours of hourly paid workers at relatively stable hourly wages. For salaried workers, no cyclicality of the hourly wage rates was found either. However, salaried workers in the private sector who receive additional income from bonuses or overtime had procyclical earnings, which are of similar size to the US (estimates of –0.7 to –1.0). Hence, acyclical base salaries are compatible with procyclical overall earnings in the West German labor market as well. The overall compensation of salaried workers seems to be adjusted over the cycle through different forms of extra pay 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 bonuses in the private sector. This implies that the effective wage for these workers decreased by 1.7 percent in reaction to a one point increase in the unemployment rate. Since the effective wage measure is identical to the wage measure used in US studies, it is reasonable to conclude that the West German labor market displays comparable wage flexibility for this worker group. This suggests that higher flexibility results for workers with wages above the union wage or not covered by collective bargaining agreements, since salaried workers with unpaid overtime receive higher earnings on average and are less likely to be covered by union wage setting agreements. This result provides indirect support for the findings of Devereux and Hart (2006) for the UK, where wage cyclicality is much higher among workers not covered by collective bargaining agreements. Moreover, the strong procyclicality of effective wages for

salaried unpaid overtime workers supports the notion that unpaid overtime is prevalent during recessions, when unemployment is rising, and hence decreases the real hourly compensation of the total work done. This might be explained by an increase in unpaid overtime worked during downturns, when workers' bargaining positions worsen due to a higher risk of losing the jobs. This is also consistent with the idea that overtime pay rather than the total amount of overtime hours adjusts over the business cycle.

In terms of explaining the higher wage cyclicality in the UK than in the US, as reported by previous research, the findings for Germany do not support the hypothesis that different wage measures are responsible for the discrepancies between the two countries. For salaried workers in Germany, including unpaid overtime (as in US studies) leads to higher and not to lower procyclicality than when excluding unpaid overtime (as in UK studies). The stronger procyclicality of average hourly earnings in the UK, as compared to effective wages in the US, can only be explained by procyclical unpaid hours. Unless the cyclicality of unpaid overtime goes in opposite directions on the German labor market than on the Anglo-American labor markets, the use of different wage measures in US and UK studies cannot explain the differences in wage cyclicality.

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

Building on the findings presented in this paper, future research should answer the question of how real wage cyclicality changes *over time*. The finding that real wage cyclicality differs strongly among worker groups has helped to identify main contributors to overall wage variability, and raises the question of how the changing importance of these contributors since the mid-1980s has affected wage cyclicality since then. Future research should therefore be directed at the analysis of how the cyclicality of wages has varied over time and over the business cycle, and should identify the factors that may have contributed to eventual changes. The finding that per-period earnings were cyclical for hourly paid workers only if they received overtime pay may give rise to speculations on how the earnings cyclicality developed as a result of current trends in changing overtime compensation.[34] The decline in the percentage 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 weakened the earnings cyclicality for hourly paid workers within matches. On the other hand, the declining prevalence of traditional hourly and salaried methods of pay and the increasing prevalence of bonuses with the implementation of new pay schemes such as incentive pay may have increased the procyclicality of both hourly and salaried workers. The higher reliance on incentive-based pay systems has given firms more options for adjusting wages to the business cycle, and may have increased wage cyclicality overall. Finally, the decline in paid overtime and the trend towards more unpaid overtime in the German economy may have led to an increasing procyclicality of effective wages, particularly among salaried workers. Additional research on the cyclicality of wages over time is hence crucial to derive predictions on how real wages adjust over future business cycles. Variable pay components, such as bonuses and overtime pay, as well as flexible working hours are likely candidates for generating cyclical movements of real wages.

ACKNOWLEDGEMENTS

REFERENCES

Anger, S. (2006): *Overtime Work in Germany – The Investment Character of Unpaid Hours*, Aachen: Shaker.

Barlevy, G. (2001): *Why Are the Wages of Job Changers So Procyclical?* Journal of Labor Economics, 19 (4), 837-878.

Bauer, T., K.F. Zimmermann (1999): *Overtime Work and Overtime Compensation in Germany*, Scottish Journal of Political Economy, 46, 419-436.

Beaudry, P., J. DiNardo (1991): *The Effect of Implicit Contracts on the Movement of Wages over the Business Cycle: Evidence from Micro Data*, Journal of Political Economy, 99 (4), 665-688.

Bell, D.N.F., R.A. Hart (1999): *Unpaid work*, Economica, 66, 271-290.

Bell, D.N.F., R.A. Hart, O. Hübler, W. Schwerdt (2000): *Unpaid Work in the Workplace: A Comparison of Germany and the U.K.*, London: Anglo-German Foundation for the Study of Industrial Society.

Bils, M. J. (1985): *Real Wages over the Business Cycle: Evidence from Panel Data*, Journal of Political Economy, 93 (4), 666-689.

Blanchflower, D. G., A. J. Oswald (1994): *The Wage Curve*. Cambridge, Massachusetts and London, MIT Press.

Blank, R. (1990): *Why Are Wages Cyclical in the 1970s?* Journal of Labor Economics, 8 (1), 16-47.

Card, D. (1995): *The Wage Curve: A Review*, Journal of Economic Literature, 33 (2), 285-299.

Carneiro, A., P. Guimarães, P. Portugal (2009): *Real Wages and the Business Cycle: Accounting for Worker and Firm Heterogeneity*, IZA Discussion Paper No. 4174.

Chambers, R. L., C. J. Skinner, eds.(2003): Analysis of Survey Data, Wiley, New York.

Devereux, P. J. (2001): *The Cyclicality of Real Wages within Employer-Employee Matches*, Industrial and Labor Relations Review, 54 (4), 835-850.

Devereux, P. J. (2004): "*Cyclical Quality Adjustment in the Labor Market*, Southern Economic Journal, 70(3), 600-615.

Devereux, P. J., R. A. Hart (2006): *Real Wage Cyclicality of Job Stayers, within-Company Job Movers, and between-Company Job Movers*, Industrial and Labor Relations Review, 60, 105-119.

Devereux, P. J., R. A. Hart (2007): *The Spot Market Matters: Evidence on Implicit Contracts from Britain*, Scottish Journal of Political Economy, 54(5), 661-683.

Grant, D. (2003): *The Effect of Implicit Contracts on the Movement of Wages over the Business Cycle: Evidence for the National Longitudinal Surveys*, Industrial and Labor Relations Review, 56, 393-408.

Haisken-DeNew, J. P., J. R. Frick (2005): *Desktop Companion to the German Socio-Economic Panel Study*, German Institute for Economic Research (DIW): Berlin.

Hart, R. A. (2006): *Worker-Job Matches, Job Mobility and Real Wage Cyclicality*, Economica, 73, 287-298.

Hart, R. A. (2008): *Piece work pay and hourly pay over the cycle*, Labour Economics, 15(5), 1006-1022.

Martins, P. (2007): *Heterogeneity in Real Wage Cyclicality*, Scottish Journal of Political Economy, 54 (5), 684-698.

McDonald, J. T., C. Worswick (1999): *Wages, Implicit Contracts, and the Business Cycle: Evidence from Canadian Micro Data*, The Journal of Political Economy, 107 (4), 884-892.

Moulton, B. R. (1990): *An Illustration of a Pitfall in Estimating the Effects of Aggregate Variables on Micro Units*, The Review of Economics and Statistics, 72 (2), 334-338.

Peng, F., W.S. Siebert (2008): *Real Wage Cyclicality in Italy*, Labour, 22 (4), 569-591.

Peng, F., W.S. Siebert (2007): *Real Wage Cyclicality in Germany and the UK: New Results Using Panel Data*, IZA Discussion Paper No. 2688.

Rayack, W. (1987): *Sources and Centers of Cyclical Movement in Real Wages: Evidence from Panel Data*, Journal of Post-Keynesian Economics, 10 (1), 3-21.

Shin, D. (1994): *Cyclicality of Real Wages among Young Men*, Economics Letters, 46 (2), 137-142.

Shin, D., K. Shin (2008): *Why Are the Wages of Job Stayers Procyclical?* Macroeconomic Dynamics, 12(1), 1-21.

Shin, D., G. Solon (2007): *New Evidene on Real Wage Cyclicality within Employer-Employee Matches*, Scottish Journal of Political Economy, 54 (5), 648-660.

Solon, G., R. Barsky, J. A. Parker (1994): *Measuring the Cyclicality of Real Wages: How Important Is Composition Bias?* The Quarterly Journal of Economics, 109 (1), 1-26.

Solon, G., W. Whatley, A. H. Stevens (1997): *Wage Changes and Intrafirm Job Mobility over the Business Cycle: Two Case Studies*, Industrial and Labor Relations Review, 50 (3), 402-415.

Swanson, E.T. (2007): *Real Wage Cyclicality in the Panel Study of Income Dynamics*, Scottish Journal of Political Economy, 54 (5), 617-647.

Wagner, G. G., R. V. Burkhauser, F. Behringer (1993): *The English Language Public Use File of the German Socio-Economic Panel Study*, The Journal of Human Resources, 28 (2), 429-433.

Wilson, B. A. (1997): *Movements of Wages over the Business Cycle: An Intra-Firm View*, Working Paper, Board of Governors of the Federal Reserve System (U.S.).
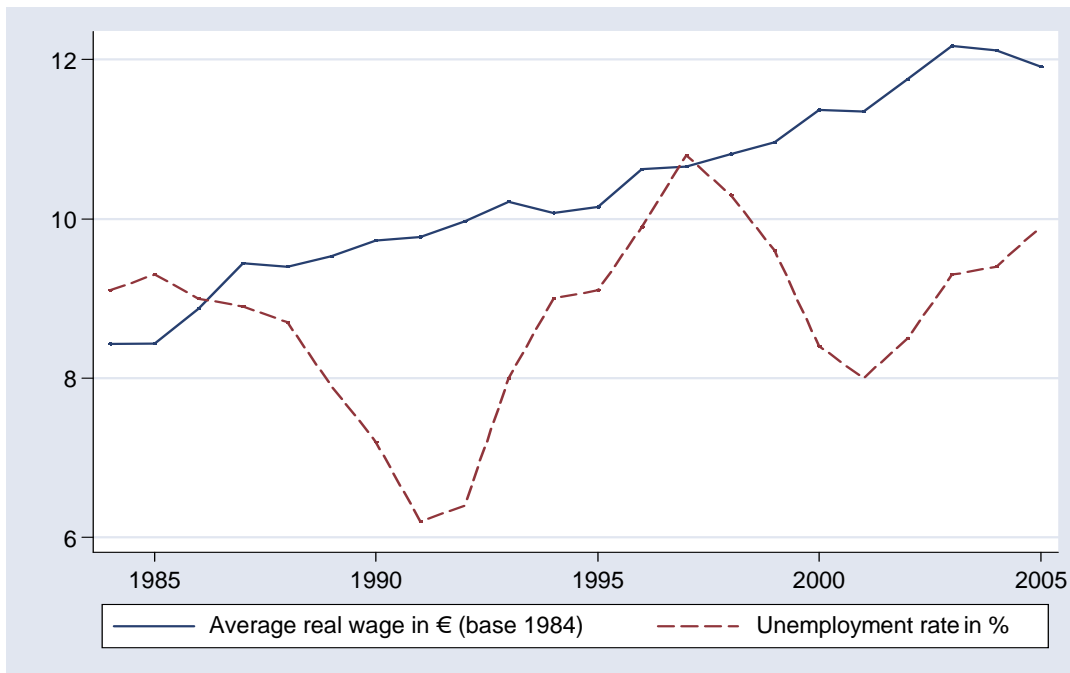
FIGURES AND TABLES

Figure 1:   Proportion of Workers with Bonus Pay and the Percentage of Bonus Pay in Monthly Base Earnings (West Germany)
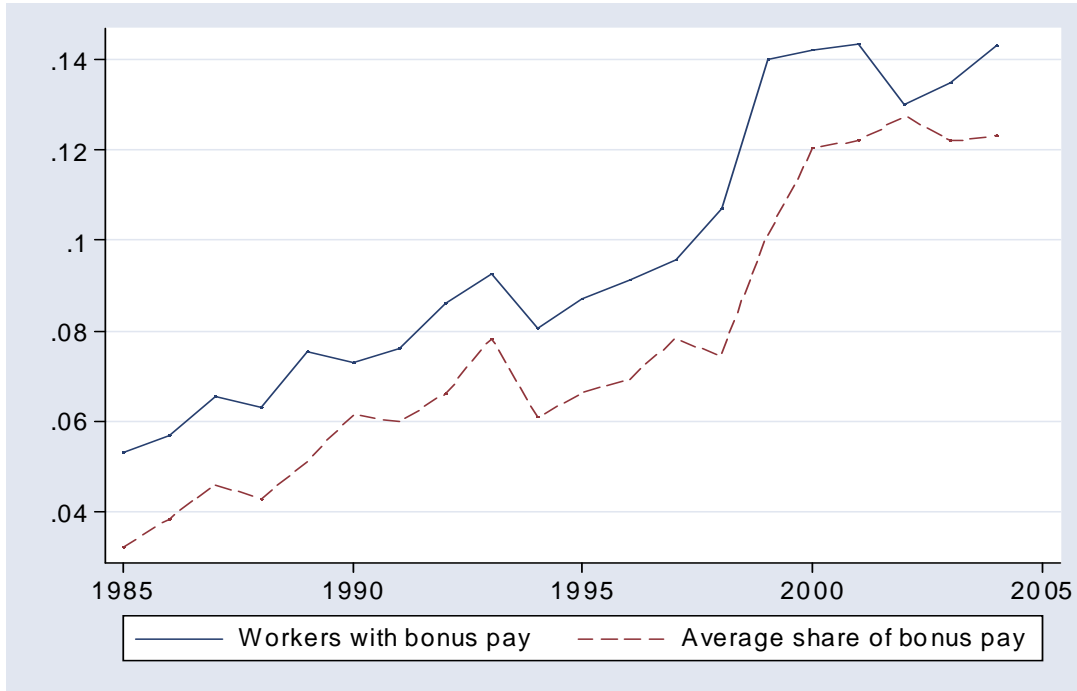
Source: SOEP, 1984-2005
Sample: Full-time male employees, aged 20-60.

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

Source: Federal Statistical Office, SOEP (West German male full-time employees, aged 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
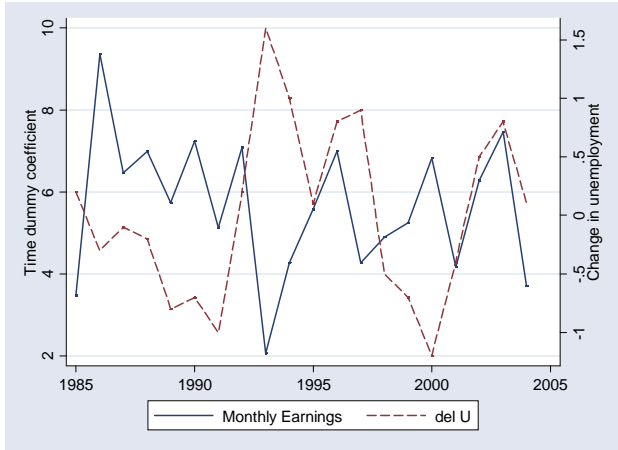
Hourly paid workers: with paid
overtime in the private sector, monthly
earnings
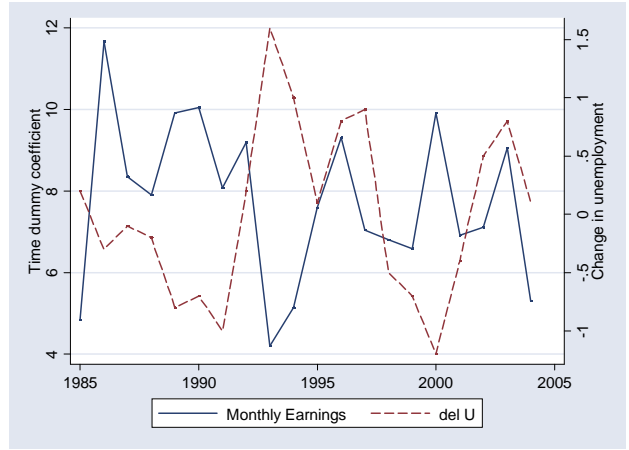
Salaried workers: with extra payment in the private sector

Base salary

Monthly earnings

Salaried workers: with unpaid overtime, effective wage

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

Table 1: Recent Studies on Real Wage Cyclicality

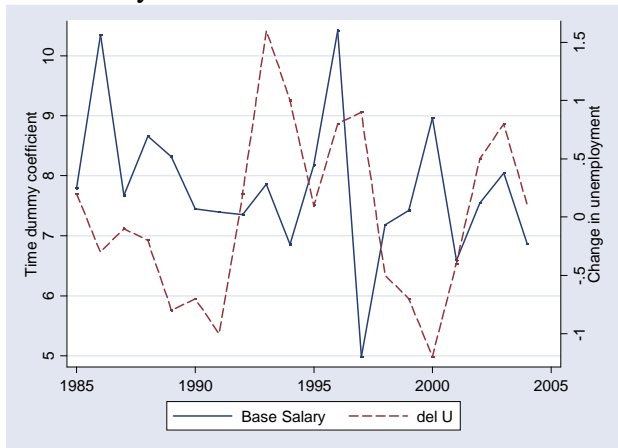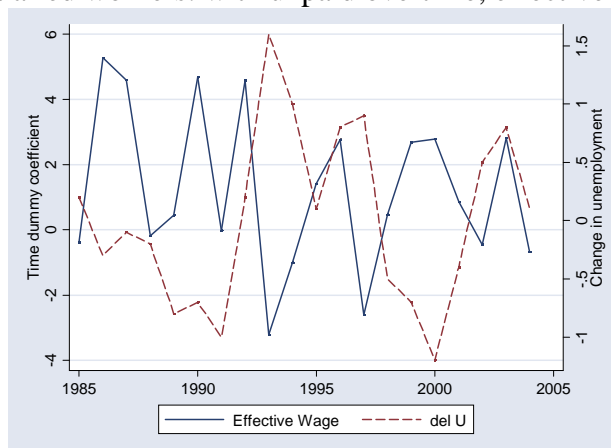| Authors (Date) (Journal)	Country (Dataset)	Period	Wage Measures	Sample	Summary of Findings
Shin and Shin (2008) (Macroecon Dynam)	U.S. (PSID)	1974-1991	-Effective wage rate	Firm stayers	-Procyclical wages
Devereux (2001) (ILRR)	U.S. (PSID)	1970-1992	-Base wage rate -Effective wage rate -Annual total earnings	Firm stayers	-Procyclical average hourly earnings of hourly paid workers despite acyclical wage rates -Procyclical average hourly earnings of salaried workers with bonuses and overtime pay despite acyclical wages. -Procyclicality of annual earnings stronger than of average hourly earnings
Shin and Solon (2007) (SJPE)	U.S. (NLSY)	1979-1993	-Base wage rate -Effective wage rate	Job stayers	-Procylical wages and average hourly earnings among salaried job stayers -Stronger procyclicality of average hourly earnings compared to standard wages among hourly job stayers is explained by additional payments, e.g., overtime pay.
Swanson (2007) (SJPE)	U.S. (PSID)	1967-1991	-Base wage rate -Effective wage rate	Job stayers Job movers	-Acyclical straight-time hourly wage -Procyclical average hourly earnings, stronger procyclicality among young, low-income, and low-educated workers -Procyclicality is generated by variable pay margins, e.g., bonuses and overtime pay
Hart (2006) (Economica)	U.K. (NESPD)	1975-2001	-Base wage rate -Average hourly earnings	Job stayers Job movers	-Strong wage procyclicality among job stayers and movers (stronger than in the US) -Stronger procyclicality among manual workers and job movers -No difference in cyclicality between standard wage rates and wage earnings including overtime.
Devereux and Hart (2006) (ILRR)	U.K. (NESPD)	1975-2001	-Base wage rate	Job stayers Internal movers External movers	-Strong wage procyclicality among job stayers and movers -Procyclicality strongest among external job movers -Procyclicality stronger in the private sector and among non-covered workers
Martins (2007) (SJPE)	Portugal (QP)	1986-2004	-Average hourly earnings	Job stayers Internal movers External movers	-Moderate overall wage cyclicality -Stronger wage cyclicality among young workers and during recessions. -Newly hired workers have more cyclical wages than stayers and internal movers.
Peng and Siebert (2008) (Labour)	Italy (ECHP)	1994-2001	-Effective wage rate	Job stayers Internal movers External movers	-Procyclical wages among job stayers in Northern Italy (stronger than in US and UK) -Procyclicality stronger in the private sector and in small firms

Note: Average hourly earnings refer to total earnings including overtime pay and bonuses, and are based on total paid working hours including paid overtime. The effective wage rate is calculated using total earnings and total working hours including paid and unpaid overtime.
The table only reports studies published in the 2000s. Additional discussion papers are summarized in the text.

Table 2: Descriptive Statistics: Sample Means and Standard Deviations, 1984-2004

Variable	All workers	Hourly paid workers	Salaried workers
Work experience (years)	19.61 (10.59)	20.05 (10.83)	19.13 (10.30)
Year of observation	1994.9 (6.0)	1994.3 (6.0)	1995.5 (6.1)
Fraction of workers			
- with paid overtime	0.26	0.40	0.10
- with bonuses	0.81	0.78	0.86
- with unpaid overtime	0.12	0.02	0.24
- in public sector	0.20	0.08	0.34
Monthly earnings (euros)			
Basic earnings	1,998 (918)	1,641 (433)	2,395 (1,128)
Earnings with overtime and bonuses	2,171 (1,042)	1,758 (477)	2,631 (1,281)
Hourly wage (euros)			
Standard wage	11.02 (5.20)	8.96 (2.41)	13.32 (6.38)
Average wage	12.06 (5.92)	9.69 (2.67)	14.70 (7.27)
Effective wage	11.66 (5.32)	9.67 (2.67)	13.89 (6.52)
Earnings Changes (euros)			
Δ log basic earnings	0.022 (0.192)	0.018 (0.186)	0.027 (0.198)
Δ log earnings with overtime and bonuses	0.020 (0.185)	0.016 (0.179)	0.025 (0.191)
Wage Changes (euros)			
Δ log standard wage	0.026 (0.208)	0.022 (0.206)	0.031 (0.211)
Δ log average wage	0.024 (0.198)	0.020 (0.194)	0.029 (0.202)
Δ log effective wage	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 male full-time employees who stay with the same firm, aged 20-60. Data are weighted using population weights.
Note: The standard hourly wage is defined as basic earnings (monthly gross earnings net of overtime and bonus payments) divided by contractual working hours. The average hourly wage is defined as total monthly earnings including overtime and bonuses divided by total paid working hours, including paid overtime. The effective hourly wage is calculated by averaging total earnings over all paid and unpaid working hours. Observations in 2005 are used to retrieve retrospective information on bonuses in 2004

Table 3: Wage and Earnings Cyclicality of Workers within Employer-Employee Matches, 1984-2004

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

Source: SOEP, 1984-2005
Sample: West German male full-time employees who stay with the same firm, aged 20-60.
Note: Robust standard errors in parentheses, * significant at 10%; ** significant at 5%;
         The standard hourly wage is defined as monthly basic earnings (monthly gross earnings net of overtime and bonus payments) divided by contractual working hours. The average hourly wage is defined as total monthly earnings including overtime and bonuses divided by total paid working hours, including paid overtime. The effective hourly wage is calculated by averaging total earnings over all paid and unpaid working hours.

Table 4: Wage and Earnings Cyclicality of Hourly Paid Workers within Employer-Employee Matches, 1984-2004

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

Source: SOEP, 1984-2005
Sample: West German male full-time employees who stay with the same firm, aged 20-60.
Note: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%;
         The standard hourly wage is defined as monthly basic earnings (monthly gross earnings net of overtime and bonus payments) divided by contractual working hours. The average hourly wage is defined as total monthly earnings including overtime and bonuses divided by total paid working hours, including paid overtime. The effective hourly wage is calculated by averaging total earnings over all paid and unpaid working hours.

Table 5: Wage and Earnings Cyclicality of Salaried Workers within Employer-Employee Matches, 1984-2004

Sample (Sample Size)	Monthly earnings		Hourly wage		
	Basic earnings	With overtime and bonuses	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 bonuses (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 bonuses 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 bonuses 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 male full-time employees who stay with the same firm, aged 20-60.
Note: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%;
The standard hourly wage is defined as monthly basic earnings (monthly gross earnings net of overtime and bonus payments) divided by contractual working hours. The average hourly wage is defined as total monthly earnings including overtime and bonuses divided by total paid working hours, including paid overtime. The effective hourly wage is calculated by averaging total earnings over all paid and unpaid working hours.

Table 6: Wage and Earnings Cyclicality of Salaried Workers with Unpaid Overtime within Employer-Employee Matches, 1984-2004

Sample (Sample Size)	Monthly earnings		Hourly wage		
	Basic earnings	With bonuses	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 bonuses (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 bonuses 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 male full-time employees who stay with the same firm, aged 20-60.
Note: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%;
None of these workers receives overtime payments, as they indicated to work unpaid overtime, and the responses with respect to the compensation of overtime are mutually exclusive in the SOEP questionnaire. The standard hourly wage is defined as monthly basic earnings (monthly gross earnings net of overtime and bonus payments) divided by contractual working hours. The average hourly wage is defined as total monthly earnings including overtime and bonuses divided by total paid working hours, including paid overtime. The effective hourly wage is calculated by averaging total earnings over all paid and unpaid working hours.

Table A1: Weighted Estimates: Wage and Earnings Cyclicality of Salaried Workers with Unpaid Overtime within Employer-Employee Matches, 1984-2004

Sample (Sample Size)	Monthly earnings		Hourly wage		
	Basic earnings	With bonuses	Standard wage	Average wage	Effective wage
All workers (N: 3,941)	-0.435 (0.529)	-0.780 (0.477)	0.156 (0.709)	-0.230 (0.603)	-1.476* (0.807)
Workers with bonuses (N: 3,405)	-0.287 (0.566)	-0.583 (0.554)	-0.0848 (0.732)	-0.396 (0.682)	-1.467 (0.864)
Workers with bonuses in the private sector (N: 2,607)	-0.776 (0.767)	-1.107 (0.718)	-0.670 (1.036)	-1.005 (0.919)	-1.963* (1.059)

Source: SOEP, 1984-2005
Sample: West German male full-time employees who stay with the same firm, aged 20-60.
Note: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; Data are weighted using population weights.
None of these workers receives overtime payments, as they indicated to work unpaid overtime, and the responses with respect to the compensation of overtime are mutually exclusive in the SOEP questionnaire. The standard hourly wage is defined as monthly basic earnings (monthly gross earnings net of overtime and bonus payments) divided by contractual working hours. The average hourly wage is defined as total monthly earnings including overtime and bonuses divided by total paid working hours, including paid overtime. The effective hourly wage is calculated by averaging total earnings over all paid and unpaid working hours.

Table A2: Wage and Earnings Effects of Current and Lagged Unemployment of Salaried Workers with Unpaid Overtime within Employer-Employee Matches, 1984-2004

Sample Size: 3,941	Monthly earnings		Hourly wage		
	Basic earnings	With bonuses	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 male full-time employees who stay with the same firm, aged 20-60.
Note: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%;
None of these workers receives overtime payments, as they indicated to work unpaid overtime, and the responses with respect to the compensation of overtime are mutually exclusive in the SOEP questionnaire. The standard hourly wage is defined as monthly basic earnings (monthly gross earnings net of overtime and bonus payments) divided by contractual working hours. The average hourly wage is defined as total monthly earnings including overtime and bonuses divided by total paid working hours, including paid overtime. The effective hourly wage is calculated by averaging total earnings over all paid and unpaid working hours.

NOTES

[1] Unpaid overtime refers to working hours beyond the number of contractually stipulated working hours without direct compensation. This does not mean that those workers provide free working hours out of generosity. For the reasons why workers may choose to work unpaid overtime, see, for example, Bell and Hart (1999) and Anger (2006).

[2] In a contemporaneous discussion paper, Peng and Siebert (2007) analyze real wage cyclicality in Germany and in the UK. They also use the SOEP for Germany but a slightly shorter time series. They impose very strong assumptions on the data and provide a less complex analysis with respect to different wage measures.

[3] 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.

[4] When taking into account overtime earnings, he finds procyclicality of wages even when aggregating the data.

[5] 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, 2007), to compensating differentials (Barlevy, 2001), and to the firm's adjustment of worker quality over the business cycle (Devereux, 2004).

[6] They show that wage adjustments occur particularly in times of high employment, which is evidence against the spot market model, where wage adjustments take place during both expansions and recessions.

[7] The first analyses of wage cyclicality distinguishing between external and internal mobility were case studies of US companies. Solon et al. (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.

[8] The same dataset is used by Carneiro, Guimaraes, and Portugal (2009), who confirm in their discussion paper that wages of newly hired workers are much more procyclical than real wages of stayers. Additional findings are that monthly base wages are more procyclical than hourly base wages, and that the procyclicality of hourly earnings including bonuses is very similar regardless of whether overtime pay is included.

[9] In addition, Peng and Siebert (2007) report in their recent discussion paper that the procyclicality of job stayers' wages in the private sector in West Germany is as strong as in the US and the UK.

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

[11] This study excludes East German workers because their wages were not observed before reunification and were strongly affected by the massive restructuring of the East German labor market during the transition process. In addition, Berlin is excluded from this study due to its isolated geographic and economic position. Being surrounded by GDR states, West Berlin was heavily subsidized by the West German government through direct subsidies, tax incentives, and higher pay schemes in the public sector, which together produced severe labor market distortions. After reunification, the East and West Berlin labor markets became increasingly difficult to distinguish, and starting in 1997, only joint registered unemployment rates are available.

[12] In line with the previous literature, the present study concentrates on male full-time workers, a relatively homogeneous group. In 2004, 69 percent of West German females aged 20 to 60 participated in the labor market, but only 32 percent of all females had a full-time job. A sample of female full-time workers would hence be much smaller. Moreover, since women experience career disruptions more often than men, a clearly higher share of females would be lost by selecting workers with at least two or three consecutive wage observations, which would imply a considerably more severe selection problem.

[13] The term "short-time workers" refers to employees whose actual working hours were temporarily decreased to below their contractually stipulated working hours and who are partially compensated by short-term government benefits. Short-time work was used as an instrument to avoid dismissals during economic crises in Germany.

[14] Since bonuses are declared on an annual basis, they are not dependent on the month of the interview and are therefore unaffected by seasonal variations.

[15] To investigate whether this sample restriction affects the findings presented in this paper, estimates of the cyclicality of the base wage (without bonuses) were compared to estimates using a less restricted sample of workers with wage observations in only two consecutive years. The results were very similar, which suggests that the sample restriction does not bias the results.

[16] 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 *average actual* working hours and the *contractually stipulated* working hours.

[17] The responses with respect to compensation for overtime are mutually exclusive in the SOEP questionnaire, for example, workers cannot work paid and unpaid overtime hours at the same time. However, one option is to indicate that they work both paid overtime and overtime compensated by additional time off.

[18] For paid overtime, a premium of 25 percent is assumed. This corresponds to the premium stipulated in most collective agreements in Germany.

[19] Some workers indicate that they work both paid overtime and overtime compensated by additional time off. Here, it is assumed that 40 percent of these overtime hours were actually paid. This number is derived from the question included in the SOEP survey since 2002, where respondents are asked how many overtime hours were paid during the last month.

[20] Since overtime compensated by additional time off ought to be taken at a later point in time, these extra hours should in theory not be considered part of the usual average working hours. There is no reliable information on this, but only speculation on how much time off in compensation for overtime is not claimed and is therefore forfeited. Consequently, this study does not take into account time off as compensation for overtime. The effective wage can therefore be considered a conservative measure.

[21] Bell and Hart (1999) show for managers and professionals in the UK that high levels of unpaid hours lead to actual hourly earnings of about 90 percent of their paid earnings. Bell et al. (2000) find similar evidence for Germany.

[22] Evidence of a relatively stable amount of total overtime with changing compensation over the cycle is found by Bauer and Zimmermann (1999).

[23] See Devereux (2001) for a discussion of measurement error in working hours.

[24] Using the other wage measures described above produces very similar graphs.

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

[26] Different sampling probabilities of workers may induce bias, which can be reduced by the use of sample weights. However, unweighted regressions are used in the present study to prevent a loss of efficiency, which is increasing in the variation in sample weights (Chambers and Skinner, 2003). Moreover, bias from sampling is already reduced by the analysis of year-to-year changes, which capture the time-invariant sampling probabilities of different worker groups. Results from weighted regressions are presented in Table A1 of the Appendix for the group of salaried workers with unpaid overtime.

[27] Although the variables used in this study to split the sample (such as private sector, pay scheme, and overtime work) may be endogenous, they will nevertheless be used to generate worker subgroups. This allows a more detailed, albeit descriptive, view of differences in wage cyclicality among worker groups and enables direct comparison of the results with findings in the previous literature. Moreover, overtime compensation schemes and bonuses are mostly a characteristic of jobs or firms and may change very slowly over time. Therefore, the focus on firm stayers in this study helps to avoid that many workers move across groups, although I am aware that these characteristics may to some extent be determined by the business cycle. For example, 15 percent of all white-collar and blue-collar workers in my sample changed their worker status between 1984 and 2004.

[28] Although only every fourth salaried worker reports unpaid overtime, the actual number of unpaid overtime workers may be higher. Salaried workers who indicate that their hours are credited to a working time account may also provide free working hours if credited overtime hours are partially forfeited.

[29] The strong procyclicality of effective wages may also be caused by measurement error if respondents overstate their working time, in particular their unpaid working hours during recessions. However, in line with previous US studies (for example, Devereux, 2001), the present study obtains overtime information from the respondents' usual working hours, and not from the specific questions on overtime. Since respondents are asked to indicate their overtime volume and compensation later in the questionnaire, it is rather unlikely that they misreport their actual working hours by factoring in overtime depending on their form of compensation for overtime work. Nevertheless, we should keep in mind that in the present study as well as in previous US studies, over-reporting of unpaid hours may potentially lead to overly strong estimates of the effective wage cyclicality.

[30] On the other hand, workers whose wages are presumably sensitive to the business cycle may be protected by German labor law.

[31] Differences in real wage cyclicality between the German and Anglo-American economies may also be caused by the different roles of nominal wage rigidity in these countries. Results from unreported regressions show a negative association between inflation rates and real wages, which points to nominal rigidity. However, most of the inflation coefficients are small and not statistically significant. At the same time, the estimates show slightly weaker wage cyclicality, but the main results hold. I am grateful to one of the referees for suggesting this robustness check.

[32] 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 percent and Bremen with 15.2 percent in 1985 (7.8 percent and 18.3 percent in 2005), their changes in unemployment in 1985 amounting to -0.2 and +1.4 (+0.9 and +3.9 in 2005) respectively.

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[33] The coefficients are not reported here, but are available from the author upon request.

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