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The Cyclicalty of Effective Wages within Employer-Employee Matches— Evidence from German Panel Data

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- F I R S T D R A F T -

ABSTRACT:

This paper contributes to the literature on the cyclicalities of real wages, as it provides first micro-based evidence on Germany, and hence on a labor market known as being relatively inflexible compared to Anglo-American economies. Using individual based micro-data from the German Socio-Economic Panel Study (SOEP), I analyze the wage cyclicalities 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 cyclicalities 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 procyclicalities of earnings revealed for Germany is of comparable size with the one in the U.S..

JEL: E32, J31

Keywords: Wage cyclicalities, effective wages, overtime, bonus payments, firm stayers

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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 cyclicity 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 cyclicity 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 cyclicity 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 cyclicity is produced by comparing the cyclicity 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 cyclicity literature before.¹

¹ However, effective wages have been analyzed in a different context by Bell and Hart (1999) and Bell, Hart, Hübler, and Schwerdt (2000).

The cyclical behavior 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 Cyclicity 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-cyclicity of wages in the presence of a large variability in employment. However, disaggregating data has revealed that the weak cyclicity of wages arises from the changing composition of the workforce over the business cycle. A higher share of low-skilled workers during peaks causes 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 consensus in the literature, using U.S. micro 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 procyclicity 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 cyclicity of wages for between-company movers is confirmed by Shin (1994) who yet finds substantial wage procyclicity even for company stayers.⁴ Likewise, Solon et al. (1994) and a more recent study by Shin and Shin (2003) also reveal procyclicity of real wages for workers who stay with the same firm.⁵ In contrast, Devereux (2001) finds weak evidence of wage procyclicity 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

² See Solon, Barsky and Parker (1994) for an overview.

³ When taking into account overtime earnings, he finds procyclicity of wages even when aggregating the data.

⁴ This higher procyclicity 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.

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 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 for general unemployment rates in

⁶ See Hart (2006b) for an analysis of real wage cyclicality for female workers in part-time and full-time jobs.

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.

Germany. Wagner (1994) was the first providing evidence of a wage curve in West Germany, which however was only evident for the first half of the 1980s. Support for the wage curve in Germany is also found by Baltagi and Blien (1998) for the period 1981–1990. They use data from the IAB employment panel and find an unemployment elasticity of around -0.07 , which is shown to be higher for younger workers, less qualified workers and men. Pannenberg and Schwarze (2000) exploit regional panel data for West Germany for the years 1985–1994. However, they only find evidence of a German wage curve for the years 1990–94. Data from a German establishment panel for the years 1993 to 1995 is used by Bellmann and Blien (2001). They show that wages at the establishment level react to variations in regional unemployment with an elasticity of about -0.1 . In their analysis of the East German wage curve for the period 1992–1994, Pannenberg and Schwarze (1998) suggest an extended wage curve in countries with active labor market policies. They adjust the local unemployment rates by taking into account participants in labour market training programs, and demonstrate that this approach is crucial for the existence of a wage curve in East Germany in their study. Baltagi, Blien, and Wolf (2000) examine the East German wage curve for the period 1993–1998 using a much bigger dataset, which is the employment statistics of the Federal Employment Services. They find evidence for the East German wage curve, the wages being more responsive for female workers.

To sum up, the wage curve rather explains 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. Empirical studies on the wage curve therefore generally lack of the dynamic aspect of the variability of wages. Moreover, they are based on the implicit assumption that all wages are determined at the spot market, and do not distinguish between wages at firm-entry and those of firm stayers. Another issue is that most wage curve studies consider only few years and are therefore 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 holding single jobs. Respondents with missing information on earnings, working hours or other variables included in the estimations were 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 recent years, and have been shown to significantly contribute to the procyclicality of earnings (Devereux, 2001). In the SOEP, information on extra payments are only revealed in the subsequent wave of a respective year. Therefore, labor income including extra payments is only revealed 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.⁹ 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 cyclicity, observations without this information are nevertheless dropped. 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

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).

⁹ Therefore, 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.

working time, i.e. the weekly hours they work on average, including overtime. 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. This allows to use contractual hours, paid overtime hours, and unpaid overtime hours separately 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 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.¹⁰ 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.¹¹ 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.¹² 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.¹³ Depending on the cyclicity 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 cyclicity of the effective wage is not as straightforward. On the one hand, overtime hours in general can be expected to increase during or at the beginning of expansions, when labor demand is high or starts to rise. This points to the procyclicality of unpaid overtime and causes effective wages to be less procyclical than average wage earnings. On the other hand, paid overtime might be

¹⁰ This overtime premium corresponds to the premium put down in most collective agreements in Germany.

¹¹ 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.

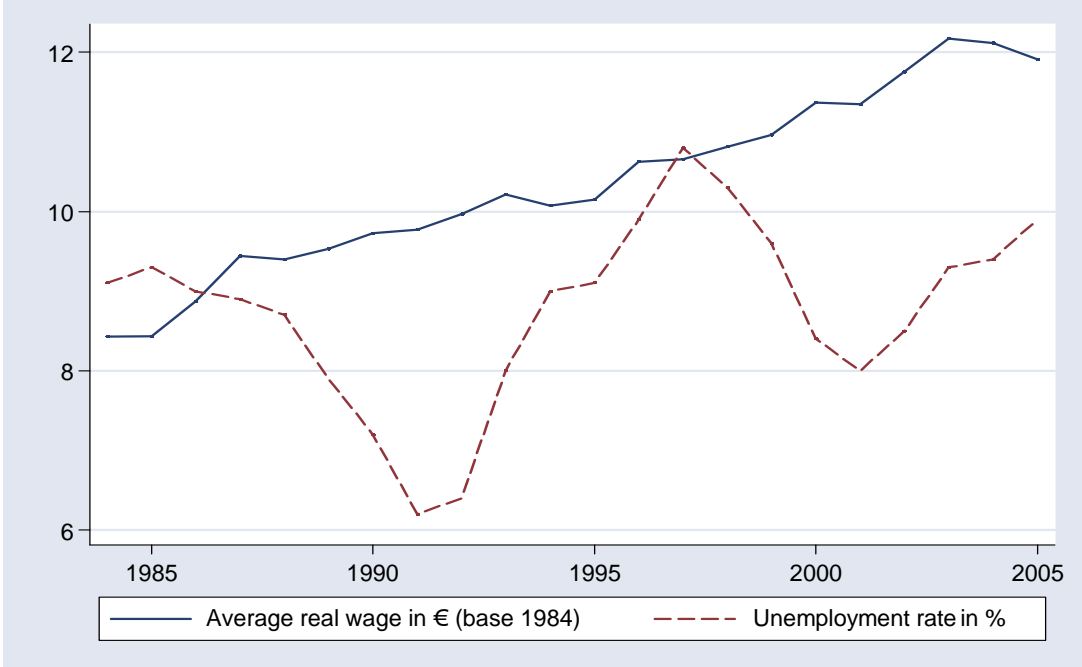
¹² Since leisure-compensated overtime hours are ought to be taken as time-off at a later point in time, these extra hours should in theory not be part of the average working time usually worked. There is no reliable information but only speculation on how many leisure-compensated overtime hours are not 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.

¹³ 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.

substituted for unpaid hours during recessions, and replace unpaid work during expansions. This implies that the total amount of overtime stays relatively constant over the cycle, and that merely the compensation form of extra work adjusts to current business cycle conditions.¹⁴ In the latter case, the effective wage is expected to be even more procyclical than average wage earnings. In addition to the three different wage measures, the cyclicity 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.¹⁵

In line with previous studies, the wage cyclicity 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 1 shows the standard hourly real wage for the years 1984 to 2005 and the West German unemployment rate.¹⁶ While the cyclicity 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 1: Real Wage and Unemployment Rate (West Germany)



Source: Federal Statistical Office, SOEP (Full-time male employees)

¹⁴ Evidence for a relatively stable amount of total overtime with changing compensation over the cycle is found by Bauer and Zimmermann (1999).

¹⁵ See Devereux (2001) for a discussion on the measurement error in working hours.

¹⁶ Using the other wage measures described above produces very similar graphs.

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

**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.

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 $\pm 1\%$ 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.

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:

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

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 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 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 affect the results. 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 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:

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

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:

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

The second-step equation is estimated using WLS, with the weights being derived from the number of individual observations in each year. 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 cyclicity, as per-period earnings allow an analysis of the cyclicity of workers' remuneration independently of hours worked. Before employees are analyzed separately according to their methods of payments, the cyclicity of earnings and wages of all firm stayers, hourly paid and salaried workers, will be considered. Table 2 shows the real earnings and wage cyclicity 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 procyclicity, where the cyclicity 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 procyclicity 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 cyclicity will be estimated separately for hourly paid and salaried workers. Figure 2 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: Wage and Earnings Cyclicity of Workers within Employer-Employee Matches (1984-2004)

| Sample (Sample Size) | Monthly Earnings | | Standard wage | Hourly Wage | |
|--|-------------------|----------------------------------|-------------------|-------------------|-------------------|
| | Basic earnings | With overtime and extra payments | | 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 full-time employees, age 20-60.

Note: Robust standard errors in parentheses.

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. 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: Wage and Earnings Cyclicity of Hourly Paid Workers
(within employer-employee matches, 1984-2004)**

| Sample (Sample Size) | Monthly Earnings | | Standard wage | Hourly Wage | |
|--|--------------------|----------------------------------|-------------------|-------------------|-------------------|
| | Basic earnings | With overtime and extra payments | | 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 full-time employees, age 20-60.

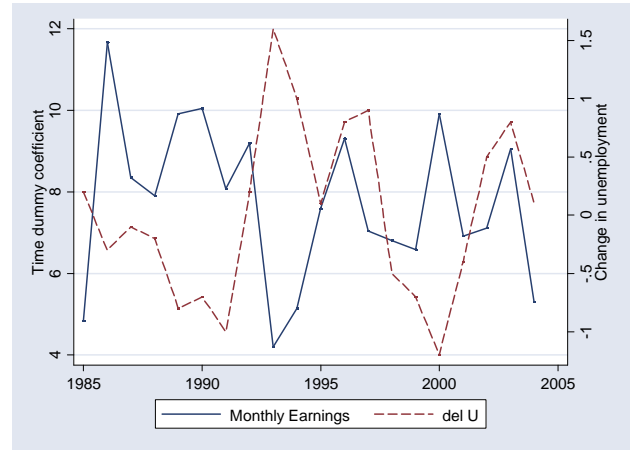
Note: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%;

Figure 2: 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



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. 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).

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

| Sample (Sample Size) | Monthly Earnings | | Hourly Wage | | |
|---|-------------------|----------------------------------|-------------------|-------------------|-------------------|
| | 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%;

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.

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

| Sample (Sample Size) | Monthly Earnings | | Hourly Wage | | |
|--|-------------------|----------------------------------|-------------------|-------------------|---------------------|
| | Basic earnings | With overtime and extra payments | 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%;

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 supports the notion that unpaid overtime is prevailing during recessions, and hence decreasing the effective compensation of workers when unemployment is rising.

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} . If both current and lagged unemployment included in the wage change equation 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, but an insignificant coefficient on lag of unemployment 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).

Monthly Earnings versus Hourly Wage Rates

The finding that earnings exhibit procyclical movements over the cycle despite acyclical hourly wage rates might be attributed to different reasons. One explanation for the discrepancy between the cyclicity 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 cyclicity in the presence of stable hourly wages. Second, the finding that hourly wages exhibit no cyclicity 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

cyclicalities 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 *overstated*. 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 *underestimate* the cyclicalities of average hourly wages, which could hence explain the non-cyclicalities of the wage measures in the estimates above. However, whether the measurement error in working hours in fact leads to a countercyclical bias in the present data is left to future research.

Selection into Employment

Another possible reason why no wage cyclicalities are found for 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 cyclicalities of real wages for the remaining workforce understates the true overall wage cyclicalities. 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 cyclicalities, 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 cyclicalities literature.

6. Conclusion

Existing studies on the cyclicity 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 cyclicity of a new wage measure which has not been examined in the wage cyclicity 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 2005, the cyclicity 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.. Despite 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 cyclicity 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 procyclicity. 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. Moreover, the strong procyclicity 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 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 procyclicality of 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.

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 will evolve over time. 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 lead 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 an increasing importance of extra payments due to the implementation of new payment schemes, such as incentive pay, might increase the procyclicality of both hourly paid and salaried workers. Finally, the fall in the fraction of paid extra hours and the trend towards more unpaid overtime in the German economy may lead to an increasing procyclicality of effective wages, particularly among salaried workers.

References:

- Baltagi, B., U. Blien (1998): *The German Wage Curve: Evidence from the IAB Employment Sample*, Economics Letters (61), 135-142.
- Baltagi, B., U. Blien, K. Wolf (2000): *The East German Wage Curve 1993-1998*, Economics Letters (69) 1, 25-31.
- 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): *Paid and Unpaid Overtime Working in Germany and the UK*, IZA Discussion Papers 133, Institute for the Study of Labor (IZA).
- Bellmann, L., U. Blien (2001): *Wage Curve Analyses of Establishment Data from Western Germany*, Industrial and Labor Relations Review (54) 4, 851-863.
- 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.
- Blanchflower, D. G., A. J. Oswald (1996): *Supervision and the German Wage Curve*, Paper presented at the IAB Workshop on the German Wage Curve, Nuernberg.
- 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.
- Devereux, P. J. (2001): *The Cyclicalities of Real Wages within Employer-Employee Matches*, Industrial and Labor Relations Review (54) 4, 835-850.
- Devereux, P. J., R. A. Hart (2005): *The Spot Market Matters: Evidence on Implicit Contracts from Britain*, IZA Discussion Papers 1497, Institute for the Study of Labor (IZA).
- Devereux, P. J., R. A. Hart (2006): *Real Wage Cyclicalities of Job Stayers, within-Company Job Movers, and between-Company Job Movers*, Industrial and Labor Relations Review (60), 105-119.
- 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 (2000): *Desktop Companion to the German Socio-Economic Panel Study*, German Institute for Economic Research (DIW): Berlin.

- Hart, R. A. (2006a): *Worker-Job Matches, Job Mobility and Real Wage Cyclicity*, *Economica* (73) 290, 287-298.
- Hart, R. A. (2006b): *Real Wage Cyclicity of Female Stayers and Movers in Part-Time and Full-Time Jobs*, IZA Discussion Papers 2364, Institute for the Study of Labor (IZA).
- 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.
- Pannenberg, M., J. Schwarze (1996): *Unemployment, Labor Market Training Programs and Regional Wages: An Extended Wage Curve Approach*, DIW Discussion Paper 139, German Institute for Economic Research (DIW).
- Pannenberg, M., J. Schwarze (1998): *Labor Market Slack and the Wage Curve*, *Economics Letters* (58) 3, 351-354.
- Pannenberg, M., J. Schwarze (2000): *Wage Dynamics and Unemployment in Germany: Evidence from Regional Panel Data*, *Labour* (14) 4, 645-656.
- 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): *Cyclicity of Real Wages among Young Men*, *Economics Letters* (46) 2, 137-142.
- Shin, D., K. Shin (2003): *Why Are the Wages of Job Stayers Procyclical?* ISER Discussion Paper 573, Institute of Social and Economic Research, Osaka University.
- Shin, D., G. Solon (2006): *New Evidence on Real Wage Cyclicity within Employer-Employee Matches*, NBER Working Papers 12262.
- Solon, G., R. Barsky, J. A. Parker (1994): *Measuring the Cyclicity 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.
- 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.
- Wagner, J. (1994): *German Wage Curves, 1979-1990*, *Economics Letters* (44) 4, 307-311.
- 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.).