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Alexander Herzog-Stein[1], Fabian Lindner[1],
Simon Sturn[2],

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JEL ref.: E24, E32, E37, J20, J50.

Keywords: Germany, Great Recession, employment miracle, working time reduction, labour hoarding, internal labour market flexibility, working time accounts, short time work.

[1] Macroeconomic Policy Institute (IMK), Düsseldorf, E-mail: alexander-herzog-stein@ boeckler.de and fabian-lindner@boeckler.de
[2] Department of Economics, University of Massachusetts, Amherst, E-mail: s.sturn@econs.umass.edu

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This paper investigates the reasons for the exceptionally robust performance of the German labour market during the Great Recession. While GDP dropped by more than five per cent in 2009, employment remained constant and started to increase soon after. We compare this recession to other major recessions in Germany and analyse to what extent changes in hourly productivity and working time cushioned their impact on employment. We find that reductions in hourly productivity played a significant role in all recessions while working time reductions helped to safeguard jobs only occasionally. However, in the Great Recession, temporary working time reductions were amply used to stabilise employment. Using a time series model, we show that the reduction in hourly productivity during the Great Recession is predictable with historical data, while the reduction in working time was unexpectedly pronounced. Using detailed information on instruments for the adjustment of working hours, we show that new instruments which have been established in the decade before the Great Recession have been heavily used to reduce working time in the Great Recession. We argue that the development of these instruments was only possible within the framework of corporatist industrial relations.

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♦ Macroeconomic Policy Institute (IMK), Düsseldorf, E-mail: alexander-herzog-stein@boeckler.de and fabian-lindner@boeckler.de

♠ Department of Economics, University of Massachusetts, Amherst, E-mail: s.sturn@econs.umass.edu

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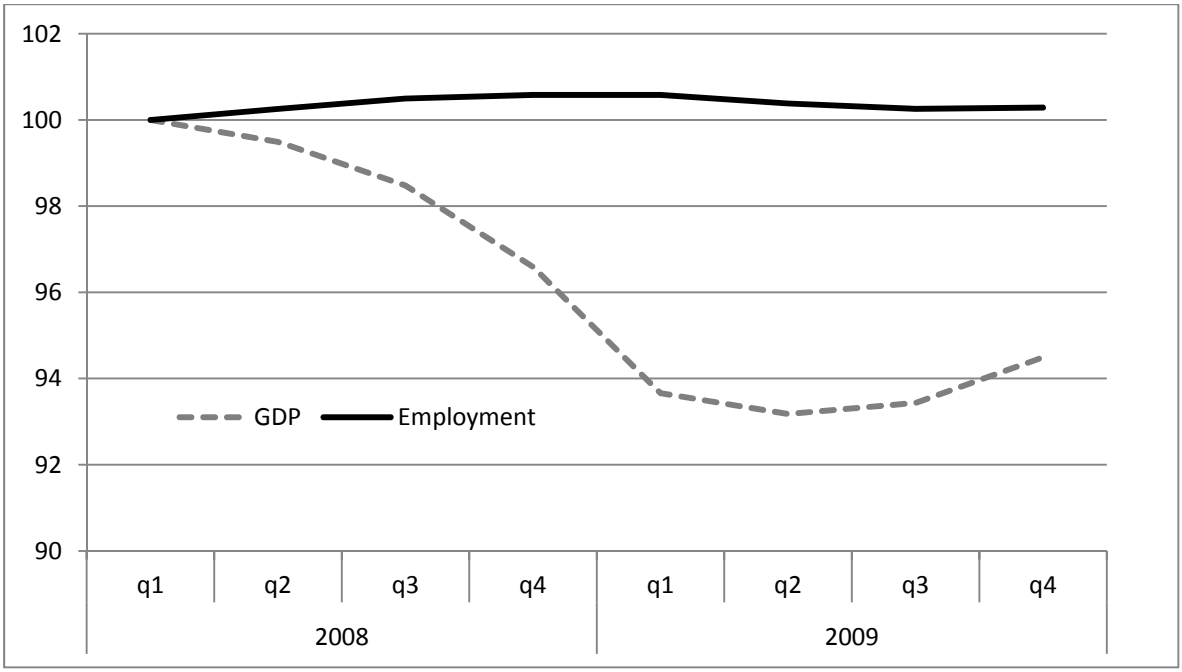
1. Introduction

In 2008 to 2009 Germany experienced the deepest recession in its post-war history. GDP dropped by 6.6% from its cyclical peak in the first quarter 2008 to its trough in the third quarter of 2009. This is an extremely deep fall compared to earlier recessions and across countries. However, the sharp decline in output was not followed by significant job losses and rising unemployment. In fact, employment was even higher after the recession than before (Figure 1), while unemployment was lower. This remarkable stability of the German labour market has been called a 'labour market miracle' by some commentators (Krugman 2009; Möller 2010). But until now surprisingly little effort has been undertaken to explain it. This paper aims to contribute to the existing literature by presenting stylized facts, econometric evidence and a discussion of the instruments used to cushion the recession's effect on employment in order to better understand the foundations of these developments.

Figure 1: GDP and employment in the Great Recession, 2008q1=100



Source: Destatis, own calculations

The paper is structured as follows. Section 2 provides a survey of the existing literature on the reasons for the German employment miracle in the Great Recession. Section 3 compares the development of GDP, employment, productivity per hour and hours worked per employee in post-war downturn-periods in Germany. Section 4 provides econometric evidence of the importance of cyclical reductions in productivity and working hours to safeguard employment in the Great Recession. Section 5 discusses in more detail the institutional foundations of this labour market miracle. Section 6 concludes.

2. A Survey of the Empirical Literature

Möller (2010) summarises and explores several different arguments which were put forward in the policy debate as explanatory factors for the German labour market development in the Great Recession. He stresses the role of working time accounts and the behaviour of social partners which allowed firms to buffer the shock in demand. Further, he shows that the crisis mainly affected export-oriented manufacturing firms which strongly profited from the upswing before the crisis and suffered from a shortage of qualified workers. Their employees possess high firm-specific know-how which makes it difficult and expensive to replace them. Together with the expanded toolkit of instruments to adjust working time at the firm level, these factors increased the willingness of firms to hoard labour.

Boysen-Hogrefe and Groll (2010) argue that the decline in productivity per working-hour was exceptionally strong in this recession in relation to the strong drop in output, although this conclusion is not confirmed by their econometric estimates. They claim that this decline in productivity was only acceptable for firms because of the wage restraint before the crisis. Therefore they argue that wage moderation before the crisis lies at the heart of the miracle.

Schaz and Spitznagel (2010) compare the development of productivity per hour in Germany and the US from 1991 to 2009 and find that Germany's hourly productivity is strongly pro-cyclical for the whole period while productivity and growth in the US are hardly correlated. This means that US employers tend to lay off their workers when production decreases while German employers tend to hoard labour. As pro-cyclical productivity buffers the effects of changes in GDP on employment, it reduces the cyclicality of employment both in upswings and downturns. Schaz and Spitznagel (2010) explain their findings – comparable to Abraham and Houseman (1993) – with the effects of strict employment protection and product market regulation. The former reduces the ability of firms to lay off workers and thus force them to find other ways to adjust to demand shocks. The latter creates market entry barriers and less

competition, and allows firms to reduce lay-offs in a downturn and to keep qualified workers with company-specific skills.

Burda and Hunt (2011) published the most extensive investigation of the German labour market reaction in the Great Recession so far. Their main line of argument is that employment has hardly fallen in the recession because employment growth was very low in the upswing before due to employers' lack of confidence in its durability. According to their estimates, this explains about 40 per cent of the missing employment decline in the Great Recession. Another 20 per cent of the miracle can be explained by wage moderation. The remaining 40 per cent are unexplained.

To sum up, in the debate on the causes of the German employment miracle three main clusters of arguments can be extracted.[1] First, the cyclical decline of productivity (due either to the preceding wage moderation or as a regular feature of the German labour market) is behind the employment miracle. Second, strong temporary working-time reductions, which were possible because of new instruments and institutions, allowed to avoid firings. Third, hiring restraints in the last upswing did not make it necessary to decrease employment in the crisis. Until now surprisingly little effort has been undertaken to quantify the role of these different mechanisms. This will be the focus of sections 3 and 4.

3. Safeguarding Employment in Downturns: a Historical Comparison

As a first approximation to the labour market development in the Great Recession, we compare the development of GDP, hourly productivity, working hours per employee and employment in major German recessions for which quarterly data are available. The comparison with earlier periods sheds light on the question if working time and/or hourly productivity reacted in an exceptional way in the Great Recession.

In order to compare the actual importance of the reactions of GDP, employment, average working time, and hourly productivity with earlier downturns, we take account of trend growth in these periods and then compare the cyclical variations (see Herzog-Stein and

[1] Further explanations were put forward in the policy debate. For example, it is argued by some that labour hoarding was fueled by a feared lack of skilled work in the near future. Klinger et al. (2011) present empirical evidence against this argument in a survey of enterprises. They look at the factors that led enterprises to hoard labour and conclude that labour shortage in 2008 did not have an influence on enterprises propensity to hoard.

Seifert (2010)). Not considering trend growth rates in the analysis would drastically mislead the interpretations. For example, in the recession of 1973q2 to 1975q2, real GDP dropped by 0.5 per cent, which might be seen as a moderate decrease. The output gap, however, dropped by 5.6 percent (Table 1). Since we are mainly interested in cyclical patterns a decomposition into trend and cycle is necessary.

The starting point for the examination is a decomposition of employment. GDP is defined as the number of employees (*EMP*), multiplied by their average working time, i.e the number of effective hours worked per employee (*WT*), and labour productivity per hour (*LP*). If one expresses this relation in growth rates (*g*) and solves for employment, this identity can be expressed as:[2]

1) $$g_{EMP} \approx g_{GDP} - g_{WT} - g_{LP}$$

In a mechanical sense, an increase in GDP growth increases employment if the other factors are kept constant. Similarly, a decrease in the growth of working time or labour productivity per hour increases employment growth. The relationship from 1) also holds for changes in trend growth, $\bar{g}$:

2) $$\bar{g}_{EMP} \approx \bar{g}_{GDP} - \bar{g}_{WT} - \bar{g}_{LP}$$

The cyclical rate of change in employment, $\hat{g}_{EMP}$, that is actual employment growth less trend growth, can be expressed in terms of equations 1) and 2), as follows:

3) $$\hat{g}_{EMP} = (g_{EMP} - \bar{g}_{EMP}) \approx \hat{g}_{GDP} - \hat{g}_{WT} - \hat{g}_{LP} = (g_{GDP} - \bar{g}_{GDP}) - (g_{WT} - \bar{g}_{WT}) - (g_{LP} - \bar{g}_{LP})$$

Equation 3) shows that a deviation of employment growth from its long term trend can be decomposed into trend-deviations in GDP growth, working time growth, and hourly labour productivity growth. The trend of all variables is calculated by applying a Hodrick-Prescott filter with the standard smoothing parameter of λ=1600. Quarterly data are used, which are available from 1970q1 onwards. For the period until 1990 a different trend is used than for the period starting in 1991 in order to distinguish pre- and after-unification Germany.

[2] For continuous growth rates, the relation presented in the following equation holds with equality. However, for discrete growth rates, it only holds approximately. The approximate case is chosen because quarterly growth rates are used.

In a second step, the downturn periods to which this decomposition is applied have to be identified. Economic downturns are determined with the help of the business cycle dating procedure developed by the German Council of Economic Experts (SVR).[3] Using this procedure, six economic downturns can be identified since 1970. However, in what follows, we will only analyse four cycles. Although there was a downswing beginning in 1985, we do not consider this downturn period since it was not recognised by the German Council of Economic Experts as a "pronounced economic downturn".[4] The downturn beginning in 1991 bears data problems because it is the period of German unification: before 1991, data is only available for West Germany while after 1991 it is all of Germany that is covered.

Table 1: Economic downturns

	Peak	**Trough**	**Change in GDP**	**Change in output gap**
Downturn I	1973q2	1975q2	-0.5	-5.6
Downturn II	1979q4	1982q4	-0.7	-3.2
Downturn III	2001q1	2005q2	0.9	-3.9
Downturn IV	2008q1	2009q3	-6.8	-7.8

Source: Destatis, own calculations

Thus, four recessions are covered, among them those due to the oil price shocks in the 1970s, as well as the long economic downswing of the first half of the 2000s decade and the downswing due to the Great Recession. The recession of the early 1970s is of special interest for comparison, as it was the most severe economic decline in Germany's post-war history up to 2008. The period from the first quarter of 2001 to the second quarter of 2005 is the most recent downturn period available for comparison. Overall, two West German slumps and two slumps of the unified German economy are included in the analysis. The dating of the four cycles analysed in the paper is shown in Table 1.

[3] The method is described in detail in SVR (2007/08), and is applied in Herzog-Stein and Seifert (2010), Sturn and van Treeck (2010) and Herzog-Stein et al. (2010). The output gap is generally defined as the percentage deviation of actual GDP from its long-term trend. A downturn ends and an upturn starts when the output gap reaches its local minimum, after which it closes and has to be positive for four quarters. This potential output is estimated using various statistical filtering techniques. Like the German Council of Economic Experts (SVR) we use the average of four filter procedures (Hodrick-Prescott, Baxter-King, Bandpass and Lowpass) to compute trend GDP (SVR 2007/08, p. 326). This evens out the variations produced by each of the filter procedures used. The starting point of the downturn is defined as the quarter in which the value of the output gap reaches a local maximum, after which the output gap closes, to be followed by four quarters where it is negative. This is an analogous process to that used by the SVR in defining an upturn (SVR 2007/08, p. 325 ff.). The length of the economic cycle is defined as the period between two maxima in the cycle with only one minimum between them (Herzog-Stein and Seifert 2010).

[4] For details see Herzog-Stein and Seifert (2010) and the references mentioned there.

Table 2 applies the decomposition of GDP according to equation 3) to the downturn episodes that have been identified. The table shows that GDP fell sharply in relation to trend in all economic downturns. In the first downturn, the cyclical decline of GDP from its peak to its trough was 5.6 %, in the second downturn 3.2 %, in the third 3.9, and in the fourth – the Great Recession – 7,8 %. Without cyclical adjustments in working time or labour productivity, this would have led to an equally sharp fall in employment. However, labour productivity, and in three out of four recessions also working time, fell relative to its trend development, so that the negative impact on employment was cushioned.

The cyclical decline in hourly productivity strongly mitigated the effects of the downturn on employment in all recessions. Its contribution to safeguarding employment was highest in Downturn IV, where productivity declined by 4.2 %. In relation to the size of the cyclical drop in output, cyclical productivity buffered about one third of the shock in Downturn I and II, about two thirds in Downturn III, and more than half in Downturn IV.

Cyclical reductions in hours worked were more infrequent. They contributed to safeguarding employment in Downturn I, II and IV, but not in Downturn III, where cyclical working time even increased. Relative to the size of the output gap, temporary working time reductions buffered about one fifth in the first two recessions, and more than two fifths in Downturn IV. Cyclical working time therefore played by far the biggest role in the most recent downturn.

In contrast to our findings, Burda and Hunt (2011) argue that temporary working time reductions did not contribute in an extraordinary way to save jobs in the Great Recession. According to them “hours per worker fell rapidly in the Great Recession”, but “their path is roughly comparable to that in the shallower 1973–75 recession”, while “the 4 percent reduction in productivity in the 2008–09 recession contrasts with strong increases in productivity in the four previous recessions” (Burda and Hunt 2011, p. 280). But as shown in Table 2, both conclusions only hold if one does not correct for trend growth rates of working time and productivity.

Table 2: Contributions to safeguarding employment in downturns

		Downturn I (1973q2 to 1975q2)		Downturn II (1979q4 to 1982q4)		Downturn III (2001q1 to 2005q2)		Downturn IV (2008q1 to 2009q3)	
		rate of change in %	number of employed persons in thousand	rate of change in %	number of employed persons in thousand	rate of change in %	number of employed persons in thousand	rate of change in %	number of employed persons in thousand
Employment	Actual development (1)	-3.3	-901	-1.2	-338	-1.4	-567	0.3	110
	Trend (2)	-0.8	-227	0.6	164	0.5	198	1.2	493
	Cycle (1 - 2) = (3)	-2.5	-674	-1.8	-502	-1.9	-765	-1.0	-383
Real GDP	Actual development (4)	-0.5	-131	-0.7	-196	0.9	348	-6.6	-2641
	Trend (5)	5.2	1378	2.5	681	4.7	1854	1.2	472
	Cycle (4 - 5) = (6)	-5.6	-1510	-3.2	-877	-3.9	-1505	-7.8	-3114
Labour productivity	Actual development (7)	6.9	-1878	2.7	-734	4.3	-1679	-3.7	1475
	Trend (8)	8.9	-2384	3.8	-1031	6.8	-2643	0.5	-209
	Cycle (7 - 8) = (9)	-2.0	505	-1.1	297	-2.5	964	-4.2	1683
Working time	Actual development (10)	-3.8	1043	-2.4	654	-2.2	886	-3.7	1508
	Trend (11)	-2.7	711	-1.8	483	-2.4	953	-0.6	238
	Cycle (11 - 10) = (12)	-1.2	332	-0.6	171	0.2	-66	-3.2	1269
sum (9) + (12)		-3.2	837	-1.7	468	-2.3	897	-7.3	2953

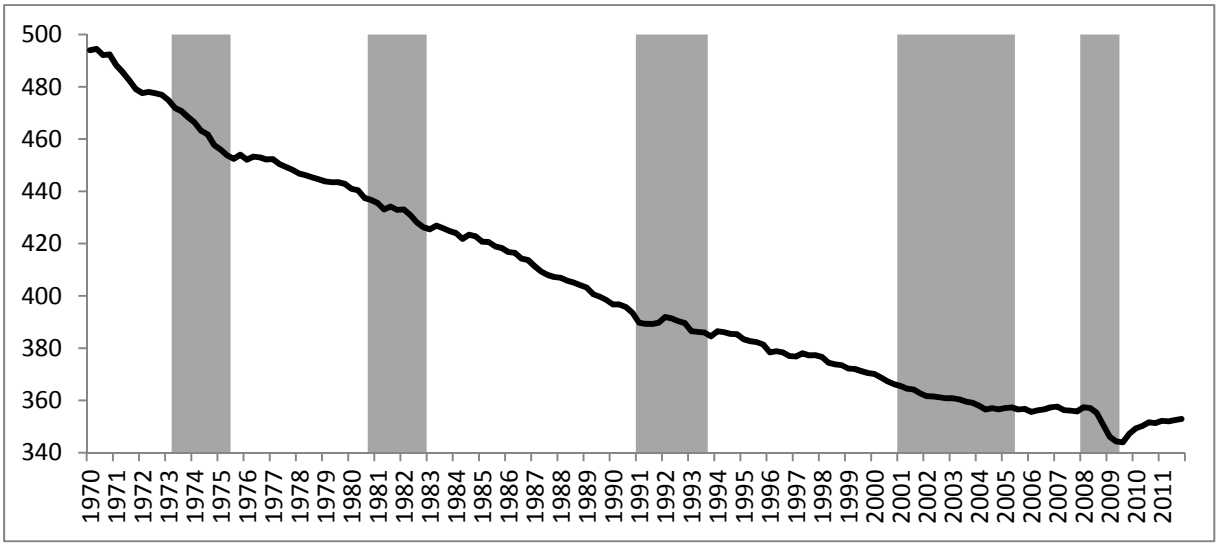
Remarks: The employment effects in Downturn I are lower in numerical terms as they relate only to the former West Germany (FRG). The trend of each series is calculated on the basis of the seasonally adjusted quarterly figures using the Hodrick-Prescott (HP) Filter. The deviations of the numbers presented in the table from the accounting identity presented in equation (4) is partly due to the individual trend calculation of each time series without taking into accounting equation (3), the fact that each time series in the German national accounts is individually seasonally adjusted which causes in practice deviations from the accounting identity (1), and rounding differences.

Source: Federal Statistical Office (Statistisches Bundesamt); own calculations.

Burda and Hunt (2011) also present econometric evidence that working time did not decrease strongly in the Great Recession. They estimate a single equation from 1970 to 2003, using the levels of GDP, labour costs and a lagged dependent variable as exogenous variables, and make forecasts for the following years. Not very surprisingly, they find that their forecasts extrapolate the secular decline of total working time since 1970 (see Figure 2). They conclude from this evidence that "the overall cuts in hours per worker were consistent with the severity of the Great Recession" (Burda and Hunt 2011, p. 273).

The problem with this approach is that they do not control for variables explaining the trend development of working time, like e.g. unions and employer federations bargaining power, female labour market participation, sectorial change, labour market policy, and preferences of workers and employers. Therefore they unrealistically assume in this framework that the working time trend should continue to fall according to its pre-2004 trend. Looking at Figure 2, however, it seems that the trend decline in working time moderated significantly after 2003.

Figure 2: Total working time, 1970q1-2011q4



Source: Destatis, Institute for Employment Research (IAB); Note: 1970q1-1990q4 West Germany, 1991q1-2011q4 Germany; Shaded areas: Recessions

We conclude that it is important to account for trend-developments, if one is interested in cyclical contributions of working time and productivity in stabilizing employment in a recession. According to the results presented in Table 2, the cyclical reduction in hours worked per employee played a significant role in safeguarding the labour market in Downturn IV. The same is true for labour productivity, but here the magnitude of the cyclical variation is in line with the developments in earlier downturns and therefore unlikely to explain the

unusual stability of employment during the Great Recession. In the next chapter we specify single equations to address the impact of productivity and working time in economic downturns more systematically.

4. Econometric evidence on labour hoarding in the Great Recession

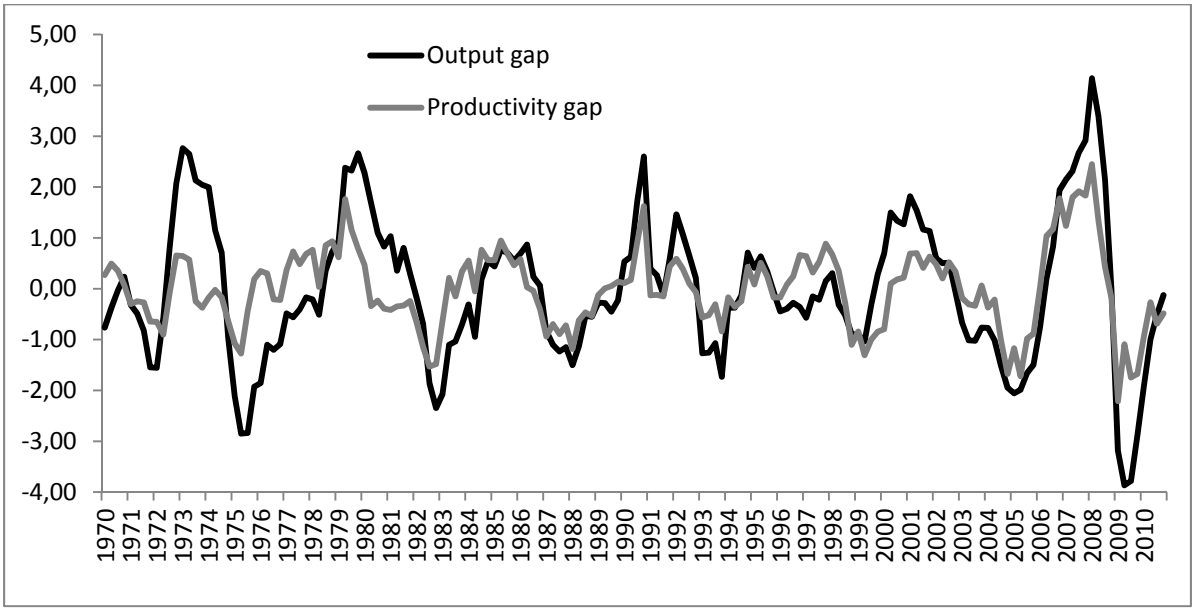
We estimate econometric specifications in which relative deviations from trend of hourly productivity and working time are explained by the output gap and various lags of the dependent variable. After estimating single equations until the beginning of the upswing in the second quarter 2005 before the Great Recession, hourly productivity and working time are forecasted until the fourth quarter of 2010. The comparison of the forecasts and the actual developments of both time series will provide evidence whether their changes in the crisis are consistent with previous patterns. This allows us to address the question as to what extent cyclical reductions in productivity and working time can explain the German labour market miracle.

As we are interested in the cyclical behaviour of productivity and working time, we de-trend all time series, and construct relative deviations from their trend which we call “gaps”. The hourly productivity gap, working time gap and output gap have been computed as:

4) $$x_{gap} = \frac{x_t - \bar{x}_t}{\bar{x}_t}$$

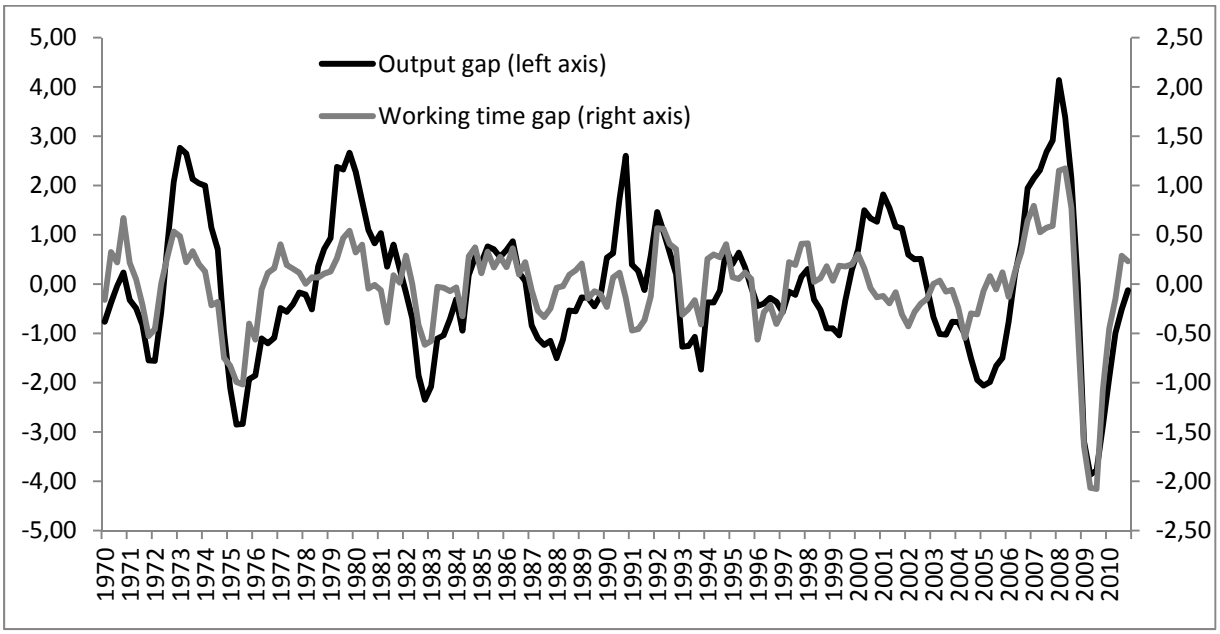
where x_t is the respective variable, and $\bar{x}_t$ is its trend value. The trend of all variables is calculated by applying a Hodrick-Prescott filter with the standard smoothing parameter of λ=1600. Quarterly data are used, which are available from 1970q1 onwards.

Figure 3: Relative productivity per hour-gap and output-gap, 1970q1-2010q4



Source: Destatis, own calculations

Figure 4: Relative working time-gap and output-gap, 1970q1-2010q4



Source: Destatis, Institute for Employment Research (IAB), own calculations

Note that we do not seek to explain the level of employment, productivity and working time. Levels are driven by various factors like labour market institutions and unions and employer federations bargaining power, changes in labour market policy, and preferences of workers and employers. We are only interested in the cyclical fluctuations of these variables, which are primarily driven by business-cycle fluctuations. Figures 3 and 4 present the productivity

per hour-gap and working time-gap plotted against the output-gap for the whole sample period.

We estimate two equations, one in which the hourly productivity gap, *PG*, is explained by various lags of the output gap, *OG*, and lagged dependent variables, as well as a similar equation for the working time gap, *WT*:

$$5) \quad PG_t = \beta_1 \begin{pmatrix} OG_t \\ \vdots \\ OG_{t-n} \end{pmatrix} + \beta_2 \begin{pmatrix} PG_{t-1} \\ \vdots \\ PG_{t-n-1} \end{pmatrix} + \varepsilon$$

and

$$6) \quad WT_t = \beta_3 \begin{pmatrix} OG_t \\ \vdots \\ OG_{t-n} \end{pmatrix} + \beta_4 \begin{pmatrix} WT_{t-1} \\ \vdots \\ WT_{t-n-1} \end{pmatrix} + \varepsilon$$

$\beta_1, \beta_2, \beta_3$ and β_4 are coefficient vectors and ε is an error vector.

The German output gap and all its lags are instrumented by the world output gap and its lags to avoid endogeneity bias. Because of its strong export orientation, the German economic performance heavily depends on global economic activity. However, Germany's economy is not large enough to determine world economic growth itself. This is why it makes sense to assume that the world output gap is independent of Germany's output gap but not vice versa. Further, the world output gap is not likely to be influenced by changes in German working time or hourly productivity. This is why the world output gap constitutes a suitable instrument.

To construct the world output gap, we used quarterly world GDP as estimated by the IMF and made a seasonal adjustment with the BV4.1 procedure of the German Federal Statistical Office. The world output gap and the German output gap are highly correlated with a correlation coefficient of 0.73. We estimate equation 5) and 6) with a two stage least squares estimator and the world output gap as instrument.

In order to select the lag length, serial correlation tests have been used and insignificant lags have been left out of the equation. The approach followed in the estimation process is general-to-specific so that the lags with the highest p-values have been dropped until only those with a

significance level of ten per cent or less remain (the results are presented in Table A1 and A2 in the Appendix). The productivity gap model has slight problems with autocorrelation, which is present at the ten percent level (Table A3 in the Appendix). This is why we have estimated the model with robust standard errors. However, the standard errors hardly change compared to an estimation with non-robust standard errors. The results are robust against using different time periods for the estimation and different estimation methods; simple ordinary least squares (OLS), generalized method of moments (GMM) with and without instrumental variables, and a near vector autoregression (VAR) approach using seemingly unrelated regressions (SUR), have been performed as alternatives. Also various impulse and step dummies were included in different specifications, to control for potential effects of reunification. However, they were never significant and have no impact on the results.

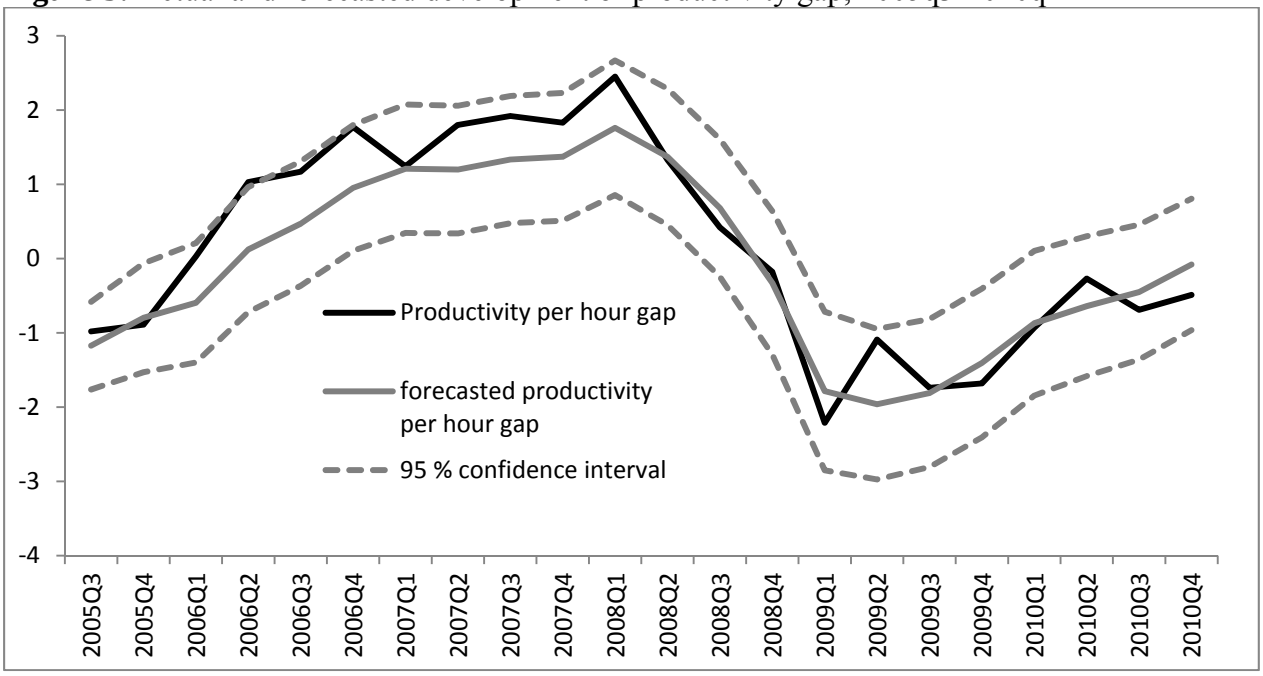
The estimation results are used to create dynamic forecasts for the period 2005q3 to 2010q4. This period covers the upswing before the Great Recession beginning in the third quarter of 2005, the Great Recession and the first six quarters of the subsequent upswing. This forecast can be used to compare the behaviour of hourly productivity and working time before and in the Great Recession. This allows us to quantify to what degree cyclical productivity and cyclical working time reacted differently after 2005 compared to the historical record which is embodied in the estimation. The forecast results are presented in Figures 5 and 6.

With respect to the productivity per hour-gap, shown in Figure 5, the forecasted development tracks the actual development very closely. In fact, the actual development is always within the 95% confidence interval. While productivity growth in the boom before the crisis was slightly stronger than predicted, especially since the beginning of the downturn our forecast tracks the actual development very well. This suggests that the size of the output-shock is sufficient to explain the strong reduction in cyclical productivity in the Great Recession. We therefore conclude that the cyclical reaction of productivity significantly contributed to safe jobs in the downturn. However, the size of this contribution is in line with historical experience and therefore not able to explain the unusual robustness of employment in the Great Recession.

On the other hand, the actual development of working time departed significantly from the forecasted development, especially from 2008q1 to 2010q1 (see Figure 6). While in the first quarters after the peak, cyclical working time was higher than expected, it decreased much stronger in the following quarters. At the end of the forecast horizon, the actual and forecasted

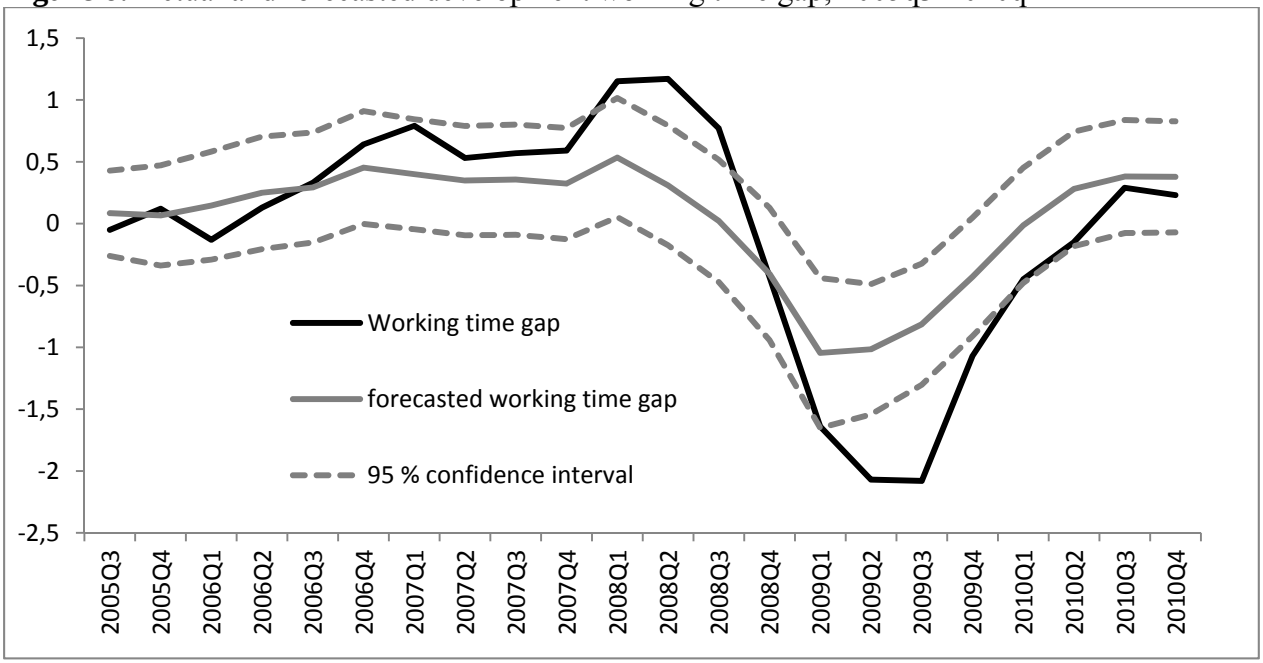
working-time gaps are almost identical. These results suggest that the German employment miracle is mainly caused by unusually strong temporary working time reductions in the recession.

Figure 5: Actual and forecasted development of productivity gap, 2005q3-2010q4



Source: own estimates

Figure 6: Actual and forecasted development working time gap, 2005q3-2010q4



Source: own estimates

Both reductions in hourly productivity and in working hours stabilised employment, because both had a negative gap thereby buffering the effect of the negative output gap on

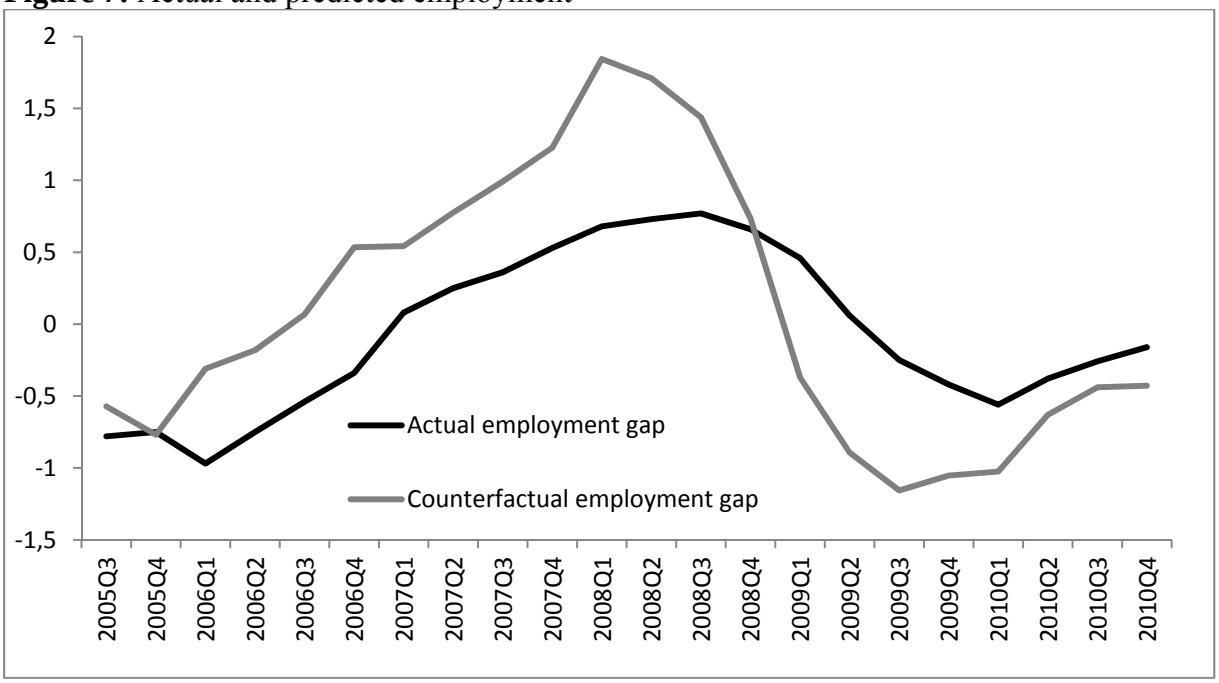
employment. However, working time did so to an extent that could not have been predicted by past information. This confirms our results from Section 2.

The effect on employment can be made explicit by computing a counterfactual employment gap that would have been obtained if working time and hourly productivity would have behaved as they did historically according to our estimates. The counterfactual employment gap, $EMPG^c$ is computed by using the actual output gap and subtracting from it the forecasted values of working time (WT^f) and hourly productivity (PG^f) from the third quarter of 2005 onwards:

7) $EMPG^c = OG - WTG^f - PG^f$

The result is shown in figure 7. As can be seen, if hourly productivity and working time would have reacted as predicted based on past data, employment would have been considerably higher before and lower after the crisis.

Figure 7: Actual and predicted employment



Source: own calculations

To sum up, the decline in labour productivity contributed to safeguarding employment but in a predictable way. The new key factor that stabilised employment in the Great Recession was the strong and unprecedented cyclical working-time reduction. This suggests that there might

have been new institutions in place that allowed firms to lower hours worked during the Great Recession. Indeed, many new instruments for flexible working time changes were introduced or expanded before the crisis.

The next section looks in more detail at the most important instruments of working-time flexibility which contributed to the significant temporary reduction in working hours in the Great Recession. In this way we aim to improve our understanding of why the development in the recent crisis differed so strongly from previous experiences.

5. Instruments of Working-time Flexibility

In this section we will analyse which working time instruments have been used to achieve the working time reductions in downswings and why cyclical working time reductions were so pronounced in the Great Recession. Using detailed information on the development and composition of working hours collected by the Institute of Employment Research (IAB),[5] Herzog-Stein and Seifert (2010) identified four instruments of working-time flexibility, also called internal numerical flexibility:[6] short-time work, overtime, temporary reductions in collectively agreed/regular weekly working hours per employee, and working time accounts. Figures 8 a-d present a comparison for the changes in working-time of each of these four working-time components during the four economic downturns that have been identified in section 2. The data is available from the quarterly IAB working-time calculations which have been seasonally adjusted using the BV4.1 procedure of the German Federal Statistical Office. The figure shows the change in working-hours relative to the peak quarter preceding each economic downturn.

The instrument that has been most discussed in the literature on the German working time reduction in the Great Recession is short-time work. Short-time work is not a new instrument. It has existed since the 1920s and is a well-established element in the toolkit of German active labour market policy (Brautzsch and Will 2010; Will 2010; Brenke, Rinne et al. 2011). The instrument was flexibly used in the past. Its legal basis was regularly changed in and between economic-downturn periods (Bogedan 2010).

[5] For details, see Bach and Koch (2003).

[6] For details on the distinction between internal and external flexibility and the various subdivisions see Keller and Seifert (2007).

As can be seen in Figure 8a, short-time work has been used in Downturn I and II, but hardly so in Downturn III. This might be due to the discredit of this instrument because its excessive use in East Germany after reunification to cushion the impact of re-unification (Bogedan 2010). But this changed again in Downturn IV, were legal changes contributed to the wide use of this instrument, combined with governmental media-campaigns motivating employers to use short-time work instead of laying-off workers.

Figure 8: Changes in Hours due to different working time instruments, hours worked per employee, Peak of business cycle = 0

Figure 8a: Short-time Work

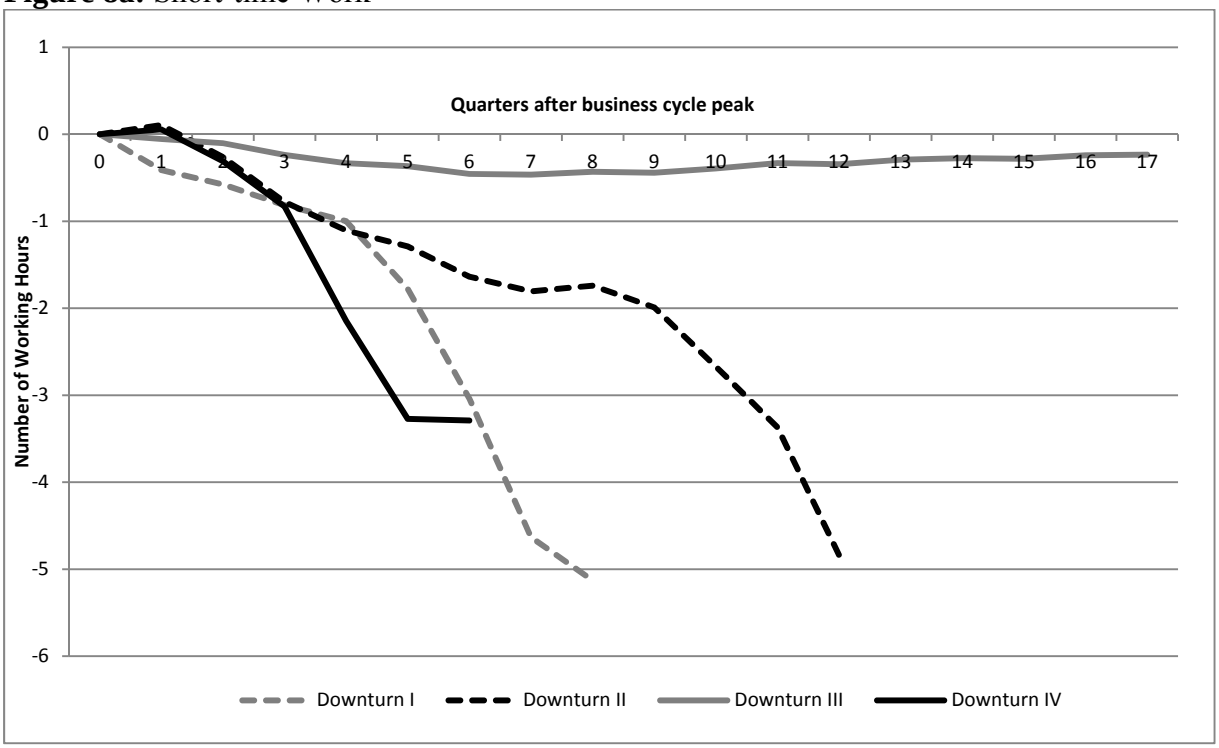


Figure 8b: Working time accounts

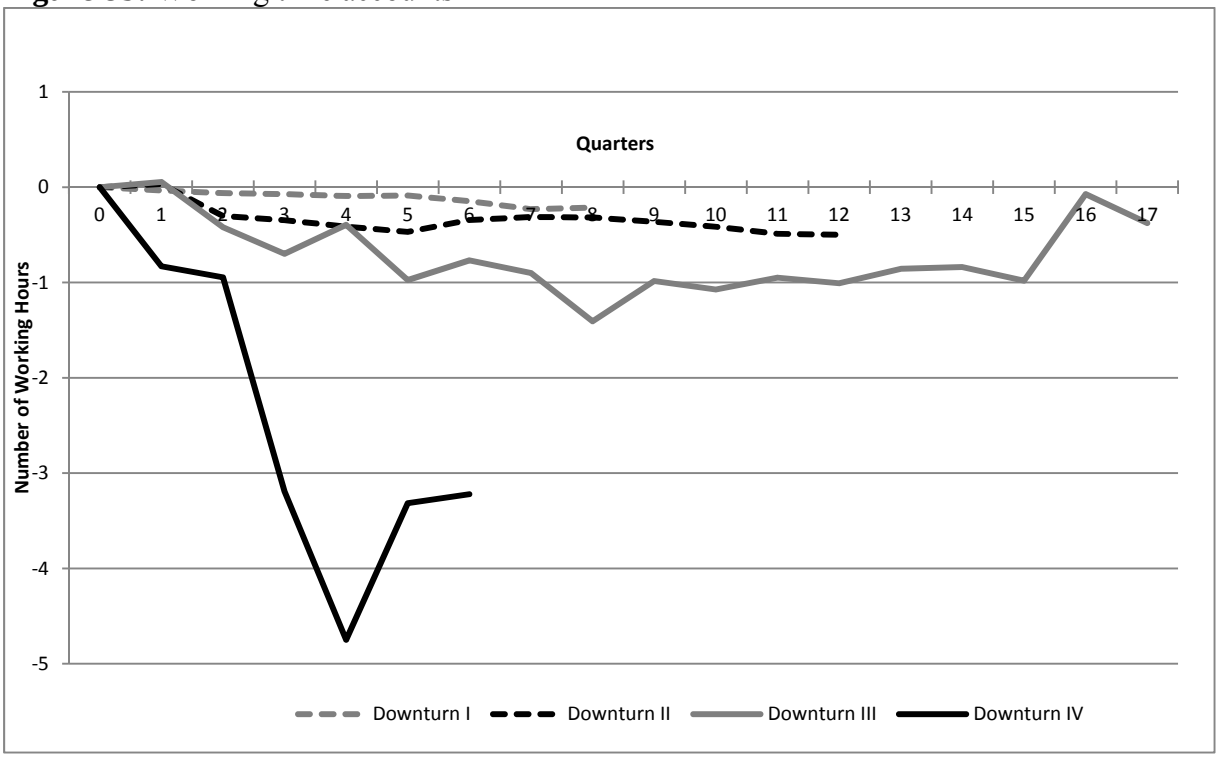


Figure 8c: Overtime

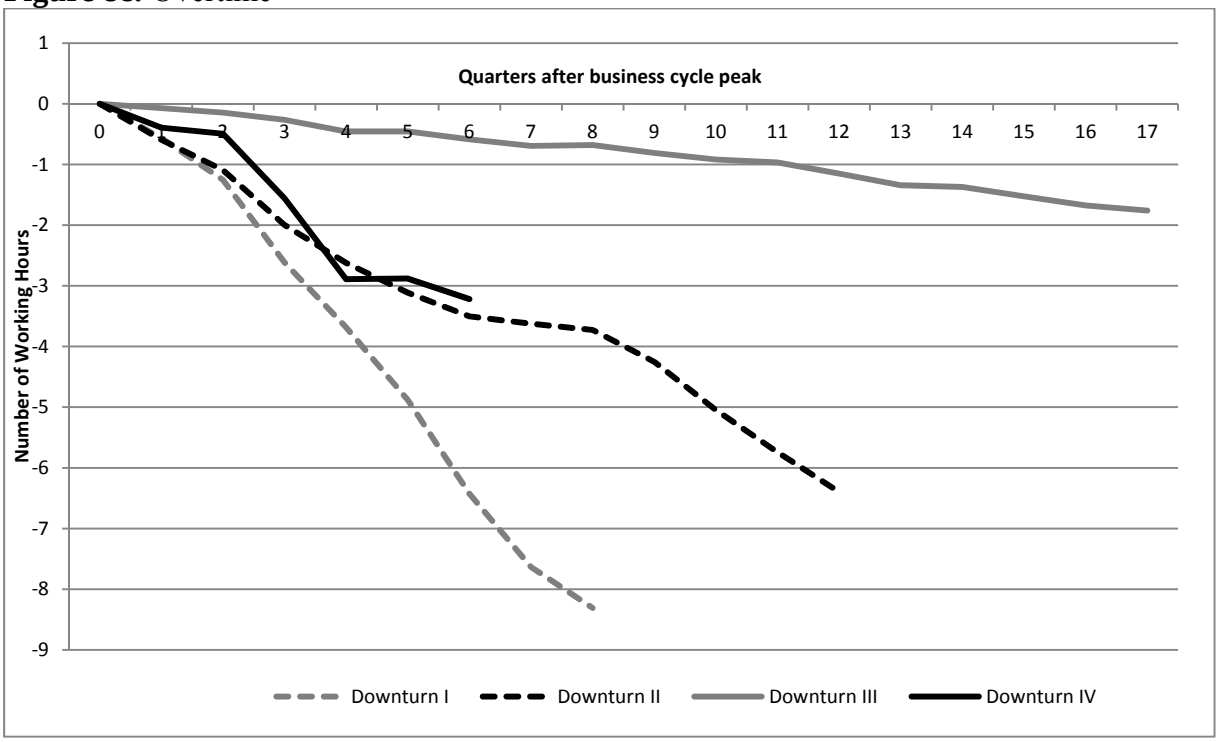
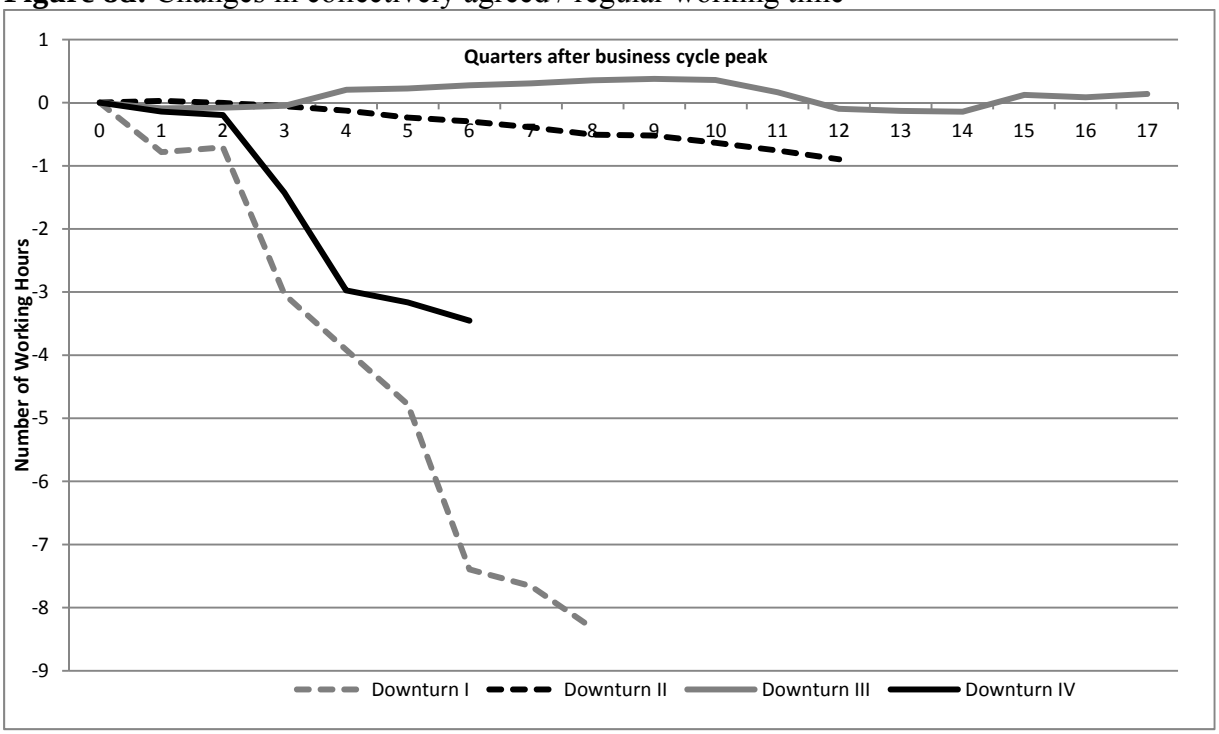


Figure 8d: Changes in collectively agreed / regular working time



Note: Downturn I: 1973q2 to 1975q2, Downturn II: 1979q4 to 1982q4, Downturn III: 2001q1 to 2005q2, Downturn IV: 2008q1 to 2009q3

Source: Institute for Employment Research (IAB) working time calculations; own calculations.

In general, employees are eligible for short-time work if they work in a job that is subject to social security contributions. In the presence of short-time work for economic and business-cycle reasons, employees receive full salary for their actual hours worked and 60% (67 % if they have children) of the net-wage for all regular hours not worked. By law the maximum entitlement period is six months, but it can be extended to a maximum of 24 months by statutory order of the Federal Minister of Labour. This happened in the Great Recession. All social security contributions with respect to lost wages and salary due to short-time work have to be paid by the employer. But starting with January 2009, employers were required to pay only half of the social security contributions (and even nothing if the employee participates in certain vocational training programs during that time). Further, temporary workers, a relatively new phenomena in the German labour market, have been allowed to participate in short-time work programs.

Short-time work is an instrument that is implemented by the government and established by law. All other working time instruments – overtime work, working time accounts and reductions or regular working time – used in German history and in the Great Recession are

not established by law but negotiated between employers and employees and their representatives, most notably in the core industrial sectors of the German economy.

Working-time accounts are a relatively new instrument and are responsible for a great share of the working time reduction in the downswing (Figure 8b). Working time accounts are an instrument to organise and regulate variable distributions of hours worked over a certain period of time in an establishment. Deviations from regular or collectively agreed working hours lead to surpluses or deficits on these accounts. Working-time accounts are the tools to account for the extra amount or deficit of hours worked during a certain predefined time period (Bauer, Groß et al. 2004; Gerner 2010). They are implemented within the framework of collective and company agreements (Groß, Munz et al. 2000). In 2009 around 50 per cent of all workers in Germany already used them. In the industrial sectors and in large firms this share is even higher (Zapf and Brehmer 2010).[7]

Deviations from collectively agreed or regular weekly working hours have also been extensively used to adjust to cyclical changes in output in the Great Recession (Figure 8c). Many collective agreements in Germany nowadays allow for the possibility of reducing the agreed working time within given limits, or allow it to be in- or decreased in line with the economic situation within the framework of so-called working-time corridor arrangements (Bispinck 2009). Especially in the core industrial sectors, German establishments nowadays have the possibility to cyclically adjust their standard weekly working hours to a certain extent. As far as the reduction in regular working time in the 1970s is concerned, Herzog-Stein and Seifert (2010) have pointed out that its major contribution in 1973 to 1975 was the result of a coincidence, because independent from the economic crisis, the 40-hour week was introduced in 1974, and it continued to apply after the slump had ended. Thus, the Great Recession is special in that it is the first time that the change in regular working hours has been deliberately used to adjust the use of labour input along its intensive margin to a temporary fall in demand.

Paid overtime hours, i.e. the possibility to work more hours than the contractually agreed working hours,[8] is the most common instrument of internal numerical flexibility and has

[7] For more details on working-time accounts and the determinants of its use to safeguard employment at the establishment level in the Great Recession see e.g. the microeconometric study by Herzog-Stein and Zapf (2012).

[8] In practice the remuneration of overtime hours can vary a lot from unpaid overtime to overtime premiums. It is even possible that some overtime hours are compensated by some leisure time later. The data used here do not

always been used in Germany (see Figure 8, Downturn III is an exception). Overtime offers firms the possibility to increase the use of labour and hence output in cyclical upswings. Correspondingly, by reducing overtime, firms can adjust labour at least to a certain degree along the intensive margin in an economic slump.

It is noteworthy that most of the instruments that were used to adjust working hours were negotiated in a framework of corporatist industrial relations, and not implemented by the government. The existence of working time accounts is an outcome of corporatist negotiations between employers and unions and were implemented within the framework of collective and company agreements (Groß et al. 2000).[9] The reduction of weekly working hours at the company level was further supported by collective agreements that allowed companies together with trade unions to reduce their regular working time substantially in the recession (Bispinck 2009).

Overall, the comparison of the four economic-recession periods supports the econometric results presented in the previous chapters in two ways: Firstly, in line with previous experiences during economic downturns, working hours varied pro-cyclically due to the use of internal numerical flexibility over the business cycle and hence safeguarded employment. Secondly, with working-time accounts and variations in standard weekly working hours, two relatively new instruments of internal numerical flexibility played an important role in labour-input adjustment along the intensive margin in the last downturn. This underscores that the adjustment of hours worked and hence the magnitude of the safeguarding of jobs was of a new quality in the Great Recession.

6. Conclusions

The study showed that in all major German recessions a reduction in cyclical productivity per hour played a significant role in buffering the effects of output shocks on employment, while cyclical working time reductions were more infrequent and quantitatively much less important. To quantify the extent to which these reactions of productivity and working time

include unpaid overtime hours, although information indicate that on average employees work a significant number of unpaid overtime hours per year, see Zapf (2012) and Brautzsch and Will (2010).

[9] German industrial relations legislation distinguishes between collective agreements (Tarifverträge) by employers and unions normally signed at the industry level, and company or works agreements (Betriebsvereinbarungen) reached between a single employer and the works council that are based on opening clauses in collective agreements.

were novel, we estimated single equations explaining these two variables from 1970 until 2005. These results were used to create forecasts until 2010. This allowed us to compare the actual development of cyclical productivity per hour, as well as the cyclical working time, with its forecasted values based on historical data.

The results show that the German employment miracle in the Great Recession is mainly explained by temporary working time reductions. While the reduction in cyclical hourly productivity also played an important stabilising role in the recent downturn, it was in line with historical experiences and can thus not explain Germany's employment miracle. The strong und unpredictable temporary working time reductions were mainly due to new instruments of internal-numerical flexibility, i.e. working time accounts and discretionary reductions of regular working hours. Both instruments were not established by law but within the context of corporatist negotiations between employers and employees.

The German experience in the Great Recession shows the importance of internal labour market flexibility in stabilizing employment in a downturn. But internal flexibility might also have positive long-run impacts on the labour market. First, the stabilisation of employment in economic downturns prevents unemployment hysteresis (Røed 1997). Second, internal flexibility might contribute to the overall flexibility of labour markets in some countries, and therefore lowers structural unemployment caused by macroeconomic shocks and rigid labour markets (Sturn 2013).

Further, Eichhorst et al. (2009) find that corporatist countries like Austria, Denmark, Finland, Germany, the Netherlands, and Sweden have much greater overall labour market flexibility when considering internal flexibility than if only external flexibility would be looked at. This suggests that internal flexibility is positively correlated with corporatism and that corporatist industrial relations might be a necessary institutional pre-condition for high degrees of internal flexibility. Also, there seems to be a certain cross-country trade-off between low employment protection regulation and high internal flexibility (OECD 2010). This suggests that a certain external rigidity of the labour market, especially in the form of employment protection legislation which prohibits firms from quickly laying off workers in downturns, might be supportive for the emergence of internal flexibility, if combined with well-functioning corporatist structures.

These arguments are consistent with the German experience, where working time accounts and the reduction of weekly working hours at the company level were an outcome of corporatist bargaining between employers and unions in an environment of strict employment protection legislation

Because of these stabilizing cyclical effects of internal flexibility and its potential positive long-run outcomes, we conclude that there are good reasons for academic researchers to focus more on the quantification, causes and consequences of high internal labour market flexibility, beyond the German experience in the Great Recession. While the impact of external flexibility on unemployment has been heavily researched since the 1990ies (see OECD (2006) for a survey), by now there exists only very few data and literature on internal flexibility.

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8. Appendix

Table A1: TSLS Productivity gap estimation

Variable	Coefficients	Standard errors
OG	0.41	0.10***
OG(-1)	-0.31	0.12**
PG(-1)	0.74	0.07***
PG(-4)	-0.22	0.09**
PG(-5)	0.27	0.09***
PG(-7)	-0.19	0.04***
R^2	0.82	
N	135	

Remarks: Period: 1971Q4 2005Q2, HAC standard errors, Instruments: WOG WOG(-1) PG(-1) PG(-4) PG(-5) PG(-7)

Table A2: TSLS Working time gap estimation

Variable	Coefficients	Standard errors
OG	0.22	0.06***
OG(-1)	-0.17	0.07***
WTG(-1)	0.64	0.07***
WTG(-4)	-0.18	0.06***
R^2	0.73	
N	138	

Remarks: Period: 1971Q4 2005Q2, HAC standard errors, Instruments WOG WOG(-1) WTG(-1) WTG(-4)

Table A3: Tests

	Serial correlation (8 lags), LM-test prob	Heteroscedasticity (Breusch-Pagan-Godfrey) F-test prob	Normality, Jarque-Bera prob
Productivity gap	0,09	0,89	0,39
Working time gap	0,19	0,26	0,44

Publisher: Hans-Böckler-Stiftung, Hans-Böckler-Str. 39, 40476 Düsseldorf, Germany
Phone: +49-211-7778-331, IMK@boeckler.de, http://www.imk-boeckler.de

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