Explaining the German Employment Miracle in the Great Recession – The Crucial Role of Temporary Working Time Reductions

By ALEXANDER HERZOG-STEIN♦, FABIAN LINDNER♦, SIMON STURN♠

We investigate the reasons for the robust performance of the German labor market in the Great Recession. We analyze to what extent cyclical reductions in productivity and working time cushioned employment losses in previous recessions, and investigate the importance of these mechanisms in the Great Recession by applying time-series techniques to estimate counterfactual developments. We find cyclical working time reductions to be extraordinarily pronounced, whereas reductions in productivity are in line with historical evidence. While short-time work plays a significant role in the adjustment of working time, equally important are working time accounts and discretionary variations in regular working time. (*JEL: E24, E32, E37, J20, J50*)

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

♦ 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; also affiliated with Vienna University of Economics and Business.
We thank Michael Ash, Deepankar Basu, Peter Hohlfeld, Camille Logeay, Robert Pollin, Christian Proaño, Katja Rietzler, Sven Schreiber, Sabine Stephan, Thomas Theobald, and Till van Treeck for helpful comments and discussions. Any remaining errors are ours.

I. Introduction

In 2008 to 2009 Germany experienced the deepest recession in its post-war history. GDP dropped by more than 6% from its cyclical peak in the first quarter of 2008 to its trough in the third quarter of 2009 (Figure 1). This output shock is also large compared to the experiences in other countries in the Great Recession; US output declined by 4.2% from peak to trough, the Euro Area as a whole by 5.5%.[1] But unlike in previous recessions or other countries, this sharp decline in output triggered no significant job losses. In fact, employment was even higher in the trough of the recession than at the pre-recession peak, while unemployment was lower. The remarkable stability of the German labor market has been termed 'labor market miracle' (e.g. Krugman, 2009; Möller, 2010).

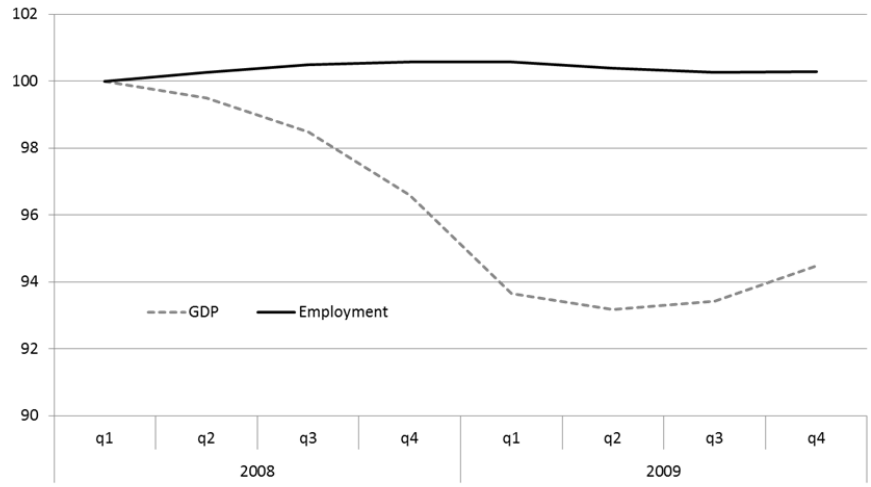


FIGURE 1: GDP AND EMPLOYMENT IN THE GREAT RECESSION, 2008Q1=100

Source: Federal Statistical Office (Statistisches Bundesamt), own calculations

[1] Own calculations with GDP data from the OECD and business cycle dates from the NBER's Business Cycle Dating Committee and the CEPR Euro Area Business Cycle Dating Committee.

So far, surprisingly little evidence on the causes of this miracle exists, and no consensus on its determinants has been reached. The German labor market in the decade or so before the Great Recession has been characterized by significant changes along several dimensions (for a recent survey see Dustmann et al., 2014), which might explain why different authors come up with different explanations for the 'employment miracle'. A sequence of labor market reforms, especially focusing on the rearrangement of unemployment and welfare benefits, long-term unemployment activation policies, and a modest liberalization of employment protection legislation have been introduced in 2002 to 2005. In about the same time period social partners, employer federations and unions, agreed on very moderate wage increases (Sturn and van Treeck, 2010; Dustmann et al., 2014), and negotiated several new institutional arrangements allowing for flexible working time adjustments in response to output fluctuations (Bispinck, 2009; Herzog-Stein and Seifert, 2010; Herzog-Stein and Zapf, 2014). All this happened against the background of a long-lasting recession and high unemployment.

In an early attempt to explain the stability of the labor market in the Great Recession, Möller (2010) stresses the role of working time accounts and the behavior of social partners, which allowed firms to buffer the demand shock by reducing working hours. Further, Möller (2010) 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. Employees in the export sector often possess extensive firm-specific know-how, which makes it difficult and expensive to replace them. Others highlight the crucial role of short-time work in the crisis (e.g. Boeri and Bruecker, 2011; Brenke et al., 2013; Balleer et al., 2013).

Some authors suggest that labor hoarding in the form of pro-cyclical changes in productivity is primarily behind the 'employment miracle', which in turn was enabled by wage moderation in the upswing before the crisis (e.g. Boysen-

Hogrefe and Groll, 2010). Boysen-Hogrefe and Groll (2010) apply time-series methods to investigate if the decline in productivity per working-hour was exceptionally strong in the Great Recession. This, however, is not confirmed by their econometric estimates. This argument is also partially refuted by Schaz and Spitznagel (2010), who compare the development of productivity per hour in Germany and the US from 1991 to 2009. They show that Germany's hourly productivity is strongly pro-cyclical for the whole period while productivity and growth in the US are hardly correlated. Schaz and Spitznagel (2010) conclude that US employers tend to lay off their workers when production decreases, while German employers tend to hoard labor in downturns.

In a very influential article, Burda and Hunt (2011) argue, based on time-series evidence, that employment has hardly fallen in the Great Recession because employment growth was very low in the upswing before due to employers' lack of confidence in its durability. According to them, this explains about 40 per cent of the missing employment decline in the Great Recession. They further show that temporary working time reductions did not contribute in a relevant way to save jobs in the Great Recession, while the exceptionally strong reduction in productivity did.

This paper contributes to the existing literature by presenting stylized facts, econometric evidence, and a discussion of the institutional instruments responsible for this development. We compare the Great Recession to other major recessions in Germany since 1970, and analyze to what extent changes in hourly productivity and working time cushion their impact on employment. Cyclical reductions in hourly productivity are found to play a significant role in safeguarding employment in all recessions. Working time reductions are less pronounced and occur irregularly. However, in the Great Recession, this instrument was amply used to stabilize employment. We further present time-series evidence that the development of cyclical hourly productivity before,

during, and after the Great Recession is well predictable using historical data, while the increase in working time before the recession and its reduction at the beginning of the recession are much stronger than forecasted. Our findings suggest that both pro-cyclical variations in hourly productivity and working time strongly contributed to safeguarding jobs in the Great Recession. However, only the latter was extraordinarily pronounced compared to earlier business cycles, preventing an additional 650.000 job losses, amounting to 1.6% of total employment. Using detailed information on instruments for the adjustment of working time, we uncover the institutional mechanisms behind this strong reduction. While short-time work played a significant role, equally important are working time accounts and discretionary variations in regular working time, two new instruments which have been established in the decade before the Great Recession. We argue that the development and application of these new instruments was supported by corporatist industrial relations and strict employment protection legislation, and is thus not easily adoptable in countries with different institutional backgrounds. We conclude that the roots of this miracle lie mainly in recently revived corporatist labor market structures, resulting in institutional arrangements between employer federations and unions which enabled firms to flexibly adjust working time when it was most needed.

This paper is structured as follows: Section 2 compares the development of GDP, employment, productivity per hour, and hours worked per employee in post-war downturn-periods in Germany. Section 3 provides econometric evidence of the importance of cyclical reductions in productivity and working time to safeguard employment in the Great Recession. Section 4 discusses in more detail the institutional foundations of this labor market miracle. Section 5 relates our findings to the international literature on labor hoarding and business cycle dynamics, and speculates on the generalizability of the German labor market miracle. Specifically, we ask what countries with different institutional labor

market arrangements can learn from the recent German experience. Section 6 concludes.

II. Safeguarding employment in downturns: a historical comparison

In his classic article, Arthur Okun (1962) established what would subsequently be known as 'Okun's law': the relation between changes in GDP and changes in unemployment. In a recent investigation, Ball et al. (2013) show for Germany that a 1 percentage point reduction in the output gap goes along with a cyclical increase in unemployment of about 0.3 percentage points. Since there is no one-to-one relation between output and unemployment, other factors must buffer the output losses. As can be easily shown by a simple national accounts identity, which is implicit in Okun's work (e.g. Gordon, 1993), these buffers are average hours worked per employee and hourly labor productivity.

GDP (Y) is defined as the number of employees (E), multiplied by their average working time, i.e the number of effective hours worked per employee (WT), and labor productivity per hour (LP). Expressed in growth rates (g) and solved for employment, this gives:[2]

$$g_E \approx g_Y - g_{WT} - g_{LP} \tag{1}$$

In a mechanical sense, therefore, a strong drop in output with employment remaining constant, as in Germany during the Great Recession, implies that either working time or labor productivity, or both, decreased strongly.

In a first assessment of the extent and causes of labor hoarding in the Great Recession, we start out with this accounting identity and compare the development of GDP, hourly productivity, working hours per employee, and employment in major German recessions for which quarterly data are available.

[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.

The comparison with earlier periods sheds light on the question as to whether employment, working time and/or hourly productivity reacted in an exceptional way in the Great Recession compared to previous downturns.

It is crucial to take account of trend growth in such an assessment (see e.g. Ball et al., 2013; Merkl and Wesselbaum, 2011; Ohanian and Raffo, 2012), otherwise recessions in a period of high trend growth would seem much less severe than recessions in an environment of low growth in potential output. The stabilizing impact of productivity would also be understated for recessions during times of strong trend productivity increases, while the opposite is true for working time in recessions with strong trend declines in average working hours. We thus reformulate Equation (1) in cyclical deviations of the respective trend growth ($\bar{g}$). The cyclical rate of change in employment, $\hat{g}_E$, is given by the following expression:

$$(2)\ \hat{g}_E = \left(g_E - \bar{g}_E\right) \approx \hat{g}_Y - \hat{g}_{WT} - \hat{g}_{LP} = \left(g_Y - \bar{g}_Y\right) - \left(g_{WT} - \bar{g}_{WT}\right) - \left(g_{LP} - \bar{g}_{LP}\right)$$

Equation (2) shows that the cyclical growth in employment, $\hat{g}_E$, equals the deviation of actual employment growth from its trend growth. This in turn can be decomposed into trend-deviations of GDP growth, working time growth, and hourly labor productivity growth.

For our assessment of German recessions, we apply seasonally adjusted quarterly data, which are available from 1970q1 onwards.[3] The trend of all variables is calculated by applying the Hodrick-Prescott filter with the standard smoothing parameter of $\lambda=1600$ (e.g. Ohanian and Raffo, 2012).[4] In order to

[3] Information on working hours is provided by the Institut für Arbeitsmarkt- und Berufsforschung (IAB) based on various sources and is part of the German national accounts (for a detailed account see Wanger, 2013). Note that unpaid overtime work is not recorded. To the extent that unpaid overtime work is pro-cyclical, like paid overtime work, this overstates the pro-cyclicality of hourly labor productivity, and understates the pro-cyclicality of working time.

[4] The results remain reasonably robust when higher values for the smoothing parameter are used.

allow for breaks in the data because of German reunification, a different trend is allowed for starting with 1991q1.[5] Economic downturns are determined by applying the business cycle dating procedure developed by the German Council of Economic Experts.[6] Using this procedure, six economic downturns can be identified since 1970. However, we do not consider the downturn beginning in 1985, since it was not recognized by the German Council of Economic Experts as a "pronounced economic downturn".[7] The downturn beginning in 1991 is omitted as there are data problems because of German reunification.

TABLE 1: ECONOMIC DOWNTURNS

	Peak	Trough	GDP change	Output gap change
Downturn I	1973q2	1975q2	-0,5	-5,6
Downturn II	1979q4	1982q4	-0,9	-5,0
Downturn III	2001q1	2005q2	0,8	-4,0
Downturn IV	2008q1	2009q3	-6,1	-7,4

Source: Federal Statistical Office (Statistisches Bundesamt), own calculations

Thus, our sample contains four recessions (Table 1), 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 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

[5] For pre-reunification Germany the sample lasts from 1970q1 to 1991q4, while for post-reunification Germany it starts with 1990q1. This reduces the end-value problem of univariate filter methods for the period of the reunification.

[6] The method is described in detail in German Council of Economic Experts (2007), and is applied in Herzog-Stein and Seifert (2010) and Sturn and van Treeck (2010). The output gap is 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, we use the average of four filter procedures (Hodrick-Prescott, Baxter-King, Bandpass, and Lowpass) to compute trend GDP (German Council of Economic Experts, 2007, 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 German Council of Economic Experts in defining an upturn (German Council of Economic Experts, 2007, p. 325ff.). 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).

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

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.

Table 2 applies the decomposition of GDP according to equation 2) to the four downturn episodes. We are interested in learning to what extent cyclical reductions in productivity and working time buffered the drop in the output gap, and thus contributed to preventing job losses in the recessions. For completeness, we also present the actual and trend development of employment, GDP, hourly productivity, and working time in the four recessions.

TABLE 2: CONTRIBUTIONS TO SAFEGUARDING EMPLOYMENT IN DOWNTURNS

		Downturn I 1973q1 - 1975q2		Downturn II 1979q4 - 1982q4		Downturn III 2001q1 - 2005q2		Downturn IV 2008q1 - 2009q3	
		rate of change	Persons in 1000	rate of change	Persons in 1000	rate of change	Persons in 1000	rate of change	Persons in 1000
E	Actual	-3.3%	-901	-0.3%	-78	-1.4%	-567	0.3%	113
	Trend	-0.8%	-230	1.2%	323	0.5%	192	1.3%	508
	Cycle	-2.5%	-671	-1.5%	-401	-1.9%	-759	-1.0%	-395
Y	Actual	-0.5%	-131	-0.9%	-240	0.8%	304	-6.1%	-2451
	Trend	5.2%	1401	4.2%	1132	4.7%	1875	1.3%	534
	Cycle	-5.6%	-1532	-5.0%	-1372	-4.0%	-1570	-7.4%	-2984
LP	Actual	7.0%	1911	3.3%	895	4.6%	1822	-2.6%	-1047
	Trend	8.9%	2417	5.8%	1579	6.8%	2687	0.8%	303
	Cycle	-1.9%	-507	-2.5%	-685	-2.2%	-865	-3.4%	-1350
WT	Actual	-3.8%	-1041	-3.8%	-1024	-2.3%	-897	-3.9%	-1549
	Trend	-2.7%	-722	-2.6%	-715	-2.4%	-959	-0.7%	-274
	Cycle	-1.2%	-319	-1.1%	-308	0.2%	62	-3.2%	-1275

Notes: The deviations in the numbers presented in the table from the accounting identity in equation 2) are due to the following points: the individual trend of each time series is calculated without taking into account equation 3); the fact that each time series in the German national accounts is individually seasonally adjusted which in practice causes deviations from the accounting identity 1); and rounding differences.

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

The output gap decreases strongly in all economic downturns. In the first downturn, the cyclical decline of GDP from peak to trough is 5.6%, in the second downturn 5.0%, in the third 4.0%, and in the fourth – the Great Recession – 7.4%. The cyclical decline in hourly productivity strongly mitigates the effects of the downturn on employment in all recessions. Between one third and more than half of the output shocks are buffered by pro-cyclical productivity (Table 3). Its relative contribution to safeguarding employment was highest in Downturns II and III, and not exceptionally strong in Downturn IV. Cyclical reductions in hours worked are more infrequent. They buffer about one fifth of the output shock in Downturns I and II, and are even slightly pro-cyclical in Downturn III. In the Great Recession, however, cyclical working time reductions cushion more than two fifth of the shock, contributing much more strongly to safeguarding employment than in previous downturns.

TABLE 3: RELATIVE CONTRIBUTION OF CYCLICAL PRODUCTIVITY AND WORKING TIME TO SAFEGUARDING EMPLOYMENT IN DOWNTURNS

	Downturn I	Downturn II	Downturn III	Downturn IV
Jobs destroyed due to cyclical decline in output				
	46.1%	27.6%	48.9%	12.0%
Share of jobs saved due to				
LP	33.1%	49.9%	55.1%	45.2%
WT	20.8%	22.5%	-3.9%	42.7%
Sum	53.9%	72.4%	51.1%	88.0%

Source: own calculations.

These findings are in stark contrast to those of Burda and Hunt (2011), who argue that temporary working time reductions did not contribute in an extraordinary way to saving 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). However, as shown in Table 2, both of their conclusions only hold if trend growth rates of working time and productivity are neglected.

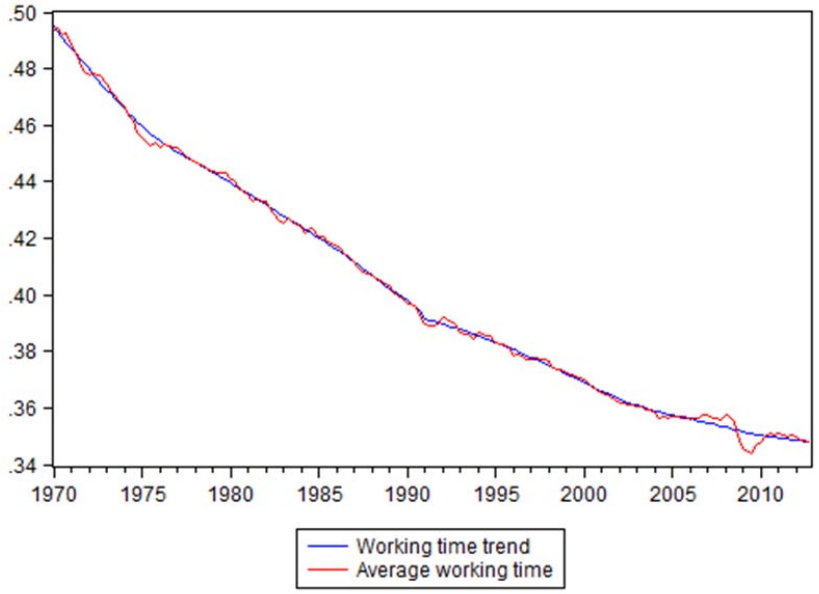


FIGURE 2: TOTAL WORKING TIME, 1970Q1-2013Q4

Source: Federal Statistical Office (Statistisches Bundesamt), Institute for Employment Research (IAB)

Notes: 1970q1-1990q4 West Germany, 1991q1-2013q4 Germany; Working time trend: HP trend with λ=1600

Burda and Hunt (2011) further present econometric evidence that working time did not decrease strongly in the Great Recession. They explain working time in a single equation from 1970 to 2003, using the levels of GDP, labor costs, and a lagged dependent variable as explaining variables. Building on these results they forecast working time in the following years. 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). However, a look at the plain variable plot is sufficient to cast serious doubt about their estimation results and conclusion. Figure 2 shows actual and trend working time from 1970q1 to 2013q4. Clearly, and in line with the findings of Table 2, cyclical changes in working time in the Great Recession of 2008 to 2009 were very substantial (see also Table 1 in Boeri and Bruecker, 2011, for a similar conclusion).

Our preliminary conclusion is that the cyclical reduction in hours worked per employee played a significant role in safeguarding the labor market during the Great Recession. The same is true for labor productivity, but with the important difference that the relative magnitude of the cyclical variation is in line with the developments in earlier downturns.

III. Econometric evidence on labor hoarding in the Great Recession

In this section we pursue the analysis from Section 2 more systematically by presenting time-series evidence on the contributing factors to labor hoarding in the Great Recession. Our identification strategy relies on the following steps. Firstly, we regress relative trend-deviations for both hourly productivity and working time on the output gap. Thus, we explain cyclical reactions of productivity and working time by output fluctuations. These specifications are estimated until the second quarter of 2005, which marked the beginning of the upswing before the Great Recession. This allows us to test for Burda and Hunt's (2011) finding that in the upswing before the Great Recession employment growth was exceptionally weak. 2005 is further the year where substantial institutional changes in the labor market were implemented (see Section 1). Secondly, these estimates are used to construct forecasts over the period 2005q3 to 2012q4, given the actual development of the output gap. To allow for a causal interpretation of our results, we instrument the German output gap with the world

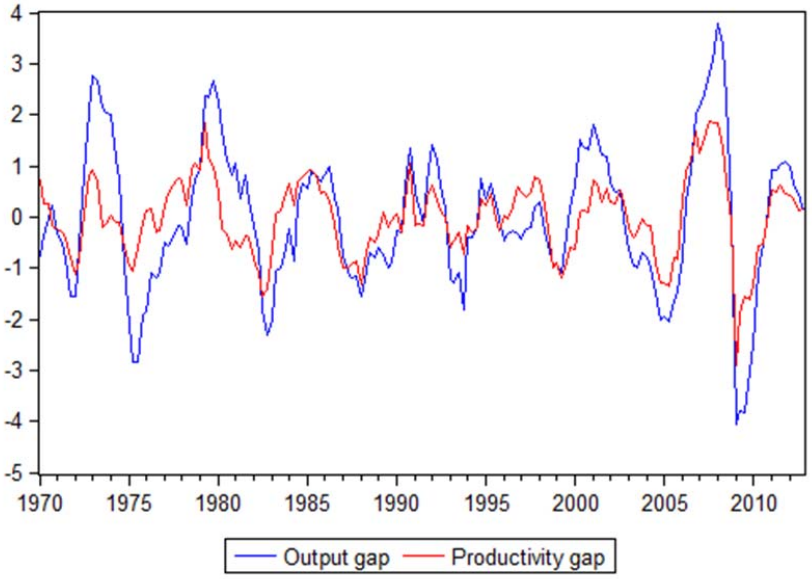
output gap. Thirdly, we compare the forecasted with the actual development of the cyclical component of hourly productivity and working time. This uncovers the extent to which hourly productivity and working time changes in the crisis are consistent with historical developments, or if they reacted unusually strongly to the output shock in the recent crisis. Comparison of actual and predicted paths of hourly productivity and working time also allows us to calculate the number of jobs saved by each.

In the first step, 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:

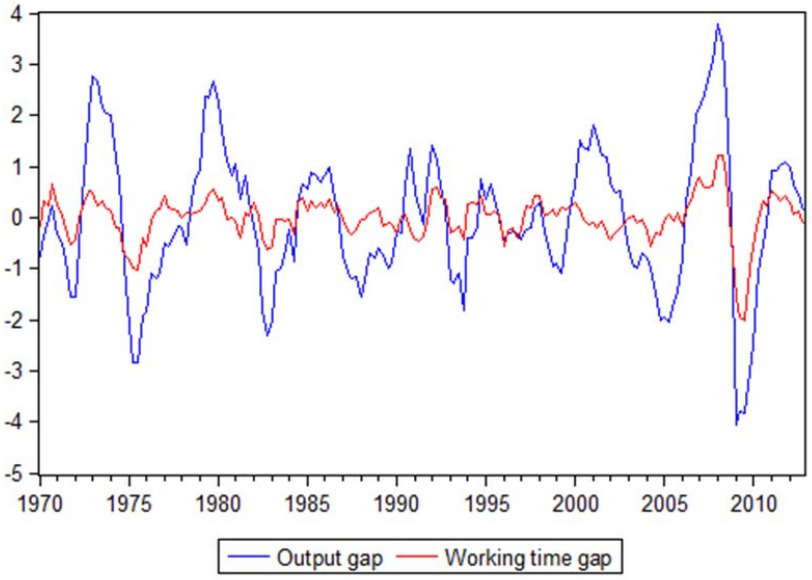
$$x_t^{gap} = \frac{x_t - \bar{x}_t}{\bar{x}_t}, \tag{3}$$

where x_t is the respective variable in time period t, and $\bar{x}_t$ is its trend value. The trend of all variables is calculated by applying the Hodrick-Prescott filter with the standard smoothing parameter of $\lambda=1600$ for quarterly observations.[8] Figure 3 presents these measures over the whole sample period. The output gap is strongly correlated with both the productivity gap and the working time gap, with correlation coefficients of 0.78 and 0.74 respectively.

[8] The results are robust to variations in the smoothing parameters. Especially higher values for λ tend to strengthen our findings.



A) WORKING TIME GAP AND OUTPUT GAP



B) WORKING TIME GAP AND OUTPUT GAP

FIGURE 3 A) AND B): RELATIVE PRODUCTIVITY PER HOUR GAP AND OUTPUT GAP, 1970Q1-2012Q4

Source: Federal Statistical Office (Statistisches Bundesamt), own calculations

Next we estimate two Autoregressive Distributed Lag (ADL) models. In the first model, the hourly productivity gap, LP^{gap}, is explained by current and lagged values of the output gap, Y^{gap}, and lagged values of the dependent variable (Equation 4). In the second model, a corresponding specification explains the working time gap, WT^{gap}, with current and lagged values of the output gap and lagged dependent variables (Equation 5).[9]

$$LP_t^{gap} = \sum_{k=1}^{n} \alpha_{1,k} LP_{t-k}^{gap} + \sum_{j=0}^{n} \alpha_{2,j} Y_{t-j}^{gap} + u_t^{LP} \quad (4)$$

and

$$WT_t^{gap} = \sum_{k=1}^{n} \beta_{1,k} WT_{t-k}^{gap} + \sum_{j=0}^{n} \beta_{2,j} Y_{t-j}^{gap} + u_t^{WT} \quad (5)$$

The α's and β's are coefficients and u^{LP} and u^{WT} are error terms for the productivity and the working time estimations respectively.

To allow for a causal interpretation of our findings we apply a two-stage least squares approach and instrument the contemporaneous German output gap by the world output gap. Due to its strong export orientation, German economic performance heavily depends on global economic activity, while changes in German working time or hourly productivity can be expected to have no relevant impact on the global business cycle. The world output gap and the German output gap are highly correlated with a correlation coefficient of 0.72.[10] Lag length has been determined following a general-to-specific approach, starting with 8 lags. Lags with the highest p-values have been dropped until only those significant at the ten per cent level or less remain (the results are presented in Table A1 in the

[9] Reunification dummies for the year 1991 are found to be insignificant and are therefore not included.

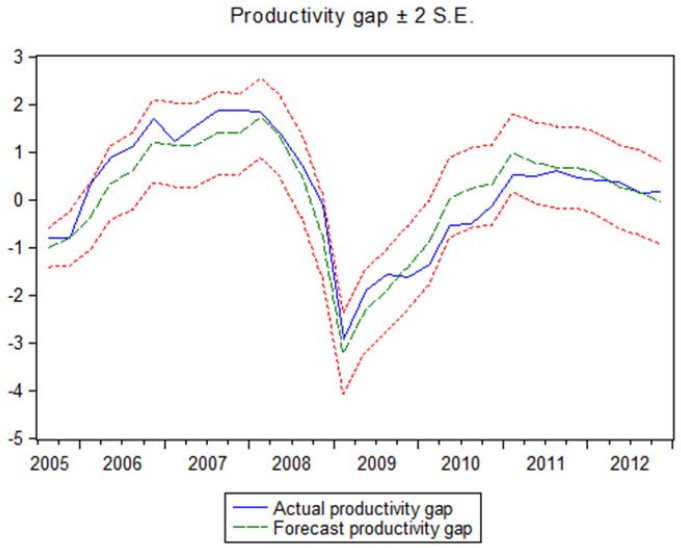
[10] To construct the world output gap, we use quarterly world GDP as estimated by the IMF and made a seasonal adjustment with the BV4.1 procedure of the German Federal Statistical Office. The results are robust to other estimation approaches, like ordinary least squares (OLS) or generalized method of moments (GMM) without instrumenting the output gap.

Appendix). According to the R-squared, both models are able to explain a high share of the variation in the dependent variable. No evidence for serial correlation in the residuals is present at conventional levels of significance.[11]

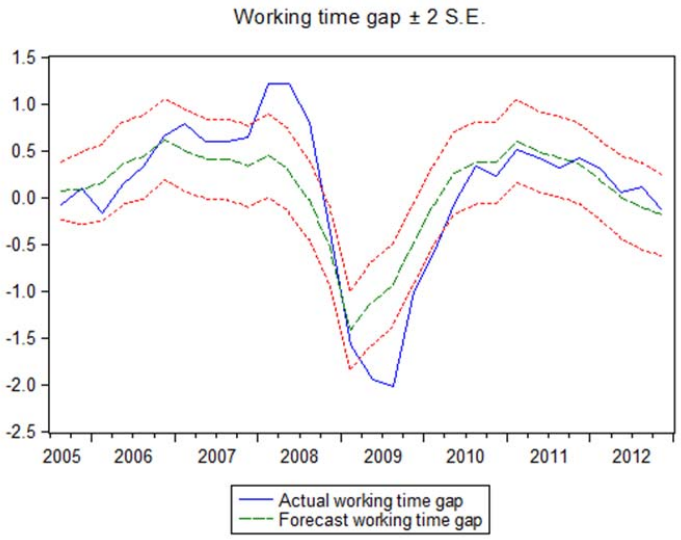
The estimation results are used to generate forecasts of the productivity and working time gap based on the actual output gap for the period 2005q3 to 2012q4. The beginning of the sample period is the beginning of the upswing before the Great Recession. The results are presented in Figure 4.

With respect to the productivity per hour gap, the forecast tracks the actual development very closely over the whole forecast period (Figure 4a). The actual development is always within the confidence band of two standard errors. This suggests that the size of the output shock is sufficient to explain the cyclical response of productivity. Put differently, the cyclical reaction of productivity in the Great Recession is not significantly different from the 1970 to 2005 period. Thus, cyclical reductions in productivity contributed strongly to safeguarding jobs in the Great Recession, but the magnitude was in line with historical evidence and is thus unlikely to have been the key mechanism behind the labor market miracle.

[11] Both in the productivity gap model and in the working time model Wald tests reject that the coefficients of the output gap and its lags sum to zero at the 5% significance level. To assess the predictive power of these specifications, we estimated them until 1982q4, the beginning of a trough, and forecasted them until 1990q4. Further, we estimate them until 1999q1, the beginning of an upswing, and forecasted them until 2005q1. In both cases our models perform reasonably well in explaining actual developments, where the latter never leave the 95% confidence intervals.



A) PRODUCTIVITY GAP



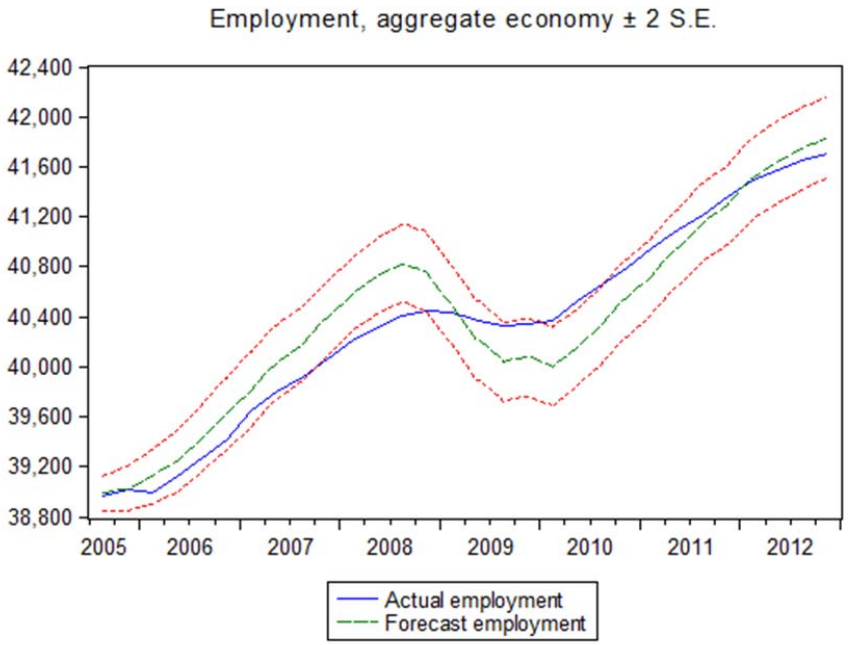
B) WORKING TIME GAP

FIGURE 4: ACTUAL AND FORECASTED PRODUCTIVITY AND WORKING TIME GAP, 2005Q3-2012Q4

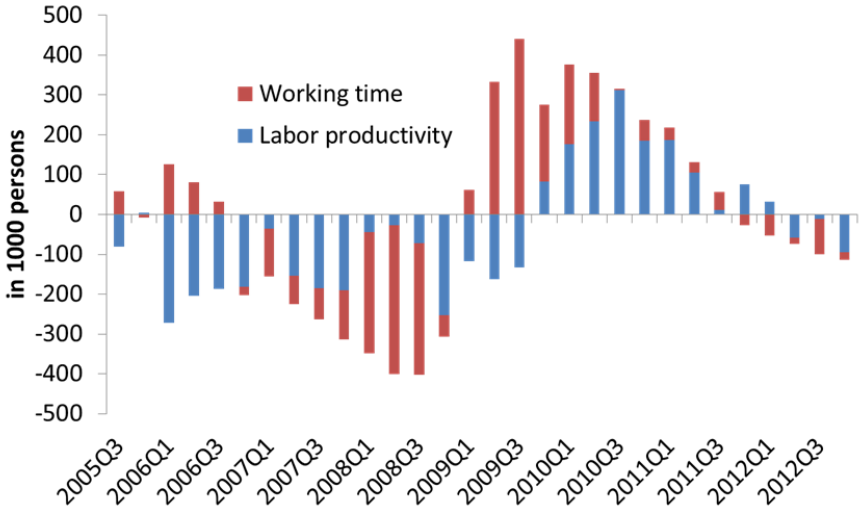
Source: Federal Statistical Office (Statistisches Bundesamt), own calculations

The actual development of working time, on the other hand, departed significantly from the forecasted development (Figure 4b). First, in the upswing before the Great Recession and especially since the end of 2007, cyclical working time was much higher than forecasted. Second, it decreased much more strongly than predicted in the Great Recession. Starting in early 2011, the actual and forecasted working-time gaps are almost identical. These results suggest that working time increased unusually strongly in the upswing before the Great Recession, and decreased massively from early 2008 to mid 2009. These results imply, consistent with Burda and Hunt (2011), that employment growth was weak in the upswing. However, the reason for this might not be the lack in confidence in the durability of the upswing by employers, as argued by Burda and Hunt (2011), but rather because working time was strongly increased instead of new workers being hired. In the recession itself, strong cyclical working time reductions contributed exceptionally strongly to the German employment miracle.[12]

[12] This conclusion is also supported by the results of structural break tests. We estimate the working time specification over the full sample, and perform Andrew-Quandt structural break tests, and find a break in 2006q1.



A) ACTUAL AND PREDICTED EMPLOYMENT



B) DIFFERENCE BETWEEN ACTUAL AND PREDICTED VALUE OF WORKING TIME AND PRODUCTIVITY GAP

FIGURE 5: ACTUAL AND FORECASTED EMPLOYMENT (A), AND THE COMPONENTS OF THIS DIFFERENCE (B), 2005Q3-2012Q4

Source: Federal Statistical Office (Statistisches Bundesamt), own calculations

How many jobs were saved in the recession? The effect on employment can be made explicit by plugging the forecasted values into Equation 2. The results are shown in Figure 5. If hourly productivity and working time had reacted as on average from 1970 to 2005, employment would have been considerably higher before, and lower after the crisis (Figure 5a). According to our estimates, employment would have decreased by 545,000 from its peak in the first quarter of 2008 through to the third quarter of 2009, instead of actually increasing by 113,000. This difference amounts to about 1.6% of total employment. It stems mainly from the strong reduction in cyclical working time, as is made explicit in Figure 5b. Figure 5b shows the contribution of the labor productivity and working time gaps to the difference between actual and predicted employment in 1000s of persons. While both components are strongly pro-cyclical, especially the strong shift in working time from negative to positive at the beginning of the recession safeguarded additionally jobs to a significant extent.[13]

IV. Instruments of working-time flexibility

The evidence presented in Sections 2 and 3 strongly points towards cyclical working time adjustments in the Great Recession being the main cause of the exceptional labor market stability. In this section, we analyze detailed information on the development and composition of working hours collected by the Institute

[13] As a robustness check we repeated this analysis for the manufacturing sector only. Broadly speaking, we are able to forecast both the productivity and working time gap rather accurately, suggesting that especially working time reductions in the non-manufacturing sector drive the results for the aggregate economy. This conclusion is confirmed when conducting our analysis for the non-manufacturing sector separately. However, classification problems associated with the recent boom in temporary agency work do not allow for a definitive conclusion. While temporary agency work was hardly existent until the 1990ies, several legal reforms fuelled a temping boom, especially from 2003 onward. From 2003 to 2008, the number of temporary agency workers skyrocketed from around 300,000 to more than 800,000. The number then dropped below 600,000 during the Great Recession before rebounding to peak at more than 900,000 in 2010 (according to data from the Bundesagentur für Arbeit). Temporary agency workers are officially working in the services sector, but are predominantly contracted to manufacturing firms. Furthermore, the wages earned by temporary agency workers are significantly lower than those of other manufacturing workers, even when they perform equal tasks, while average working hours in the non-manufacturing sector are lower than in the manufacturing sector because of the high share of part-time work. Together, these classification problems potentially lead to an exaggeration of productivity increases in the manufacturing sector in the boom, as well as its reduction in the recession, while the opposite is true for working hours in the non-manufacturing sector.

of Employment Research (IAB).[14] This allows us to pin down the institutional mechanisms behind the strong reduction in working time in 2008 and 2009. The following instruments of internal numerical flexibility are available for work sharing: short-time work, overtime work, temporary reductions in collectively agreed/regular working hours, and working time accounts.

The instrument that has been devoted most attention is short-time work (Boeri and Bruecker, 2011; Brenke et al., 2013; Will, 2011). Short-time work exists since the 1920s and is a well-established element in the toolkit of German active labor market policy. It is a publicly subsidized form of work sharing in which employees receive 60% (67% if they have children) of their net-wage from the government for the difference between their regular and actual working hours. The payment of the subsidy is conditional on cyclical economic problems within the firm. The instrument was flexibly used in the past, and its legal basis was regularly changed in and between economic-downturn periods. The attractiveness of short-time work was supported in the Great Recession (e.g. Boeri and Bruecker, 2011). For example, the maximum entitlement period was extended from 6 to 24 months. Furthermore, starting in January 2009, employers were required to pay only half of the standard social security contributions and nothing if the employee participates in certain vocational training programs during that time.

All other working time instruments are not established by law, but negotiated between employers and employees and their representatives. Paid overtime hours, i.e. the possibility to work more hours than the contractually agreed working hours,[15] is the most common instrument of working time flexibility. Overtime

[14] For details, see Bach and Koch (2002) and Wanger (2013).

[15] In practice the remuneration of overtime hours can vary a lot from unpaid overtime to significant overtime premiums. It is even possible that some overtime hours are compensated for by leisure time. The data used here do not include unpaid overtime hours, although there is some indication that on average employees work a significant number of unpaid overtime hours per year (see Brautzsch and Will, 2010; Zapf, 2012).

offers firms the possibility to increase the use of labor and hence output in cyclical upswings. Correspondingly, by reducing overtime, firms can adjust labor, at least to a certain degree, along the intensive margin in an economic slump.

Collective deviations at the firm level from collectively bargained regular weekly working hours are a rather novel instrument for cyclical working time adjustments, and are of importance especially in the core industrial sectors. Many collective agreements in Germany nowadays allow for the possibility of reducing the agreed working time within given limits, or allowing it to be in- or decreased in line with the economic situation within the framework of so-called working-time corridor arrangements (Bispinck, 2009).

Finally, working-time accounts are a relatively new instrument to organize and regulate variable distributions of hours worked over a certain period of time in an establishment (Bauer et al., 2004; Gerner, 2010). Individual deviations from regular or collectively agreed working hours lead to surpluses or deficits on these accounts. Typically, surpluses or deficits have to be rebalanced within a certain predefined time period. They are implemented within the framework of collective and company agreements (Groß 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).[16]

In our initial assessment, we present the changes in hours worked per employee for these four instruments of work sharing in the four German recessions since 1970 (Figure 6). The different working time instruments are seasonally adjusted, and individually computed Hodrick-Prescott trends have been subtracted from

[16] 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 Herzog-Stein and Zapf (2014).

overtime and regular working time.[17] Short time work and working time accounts do not show a trend over time.

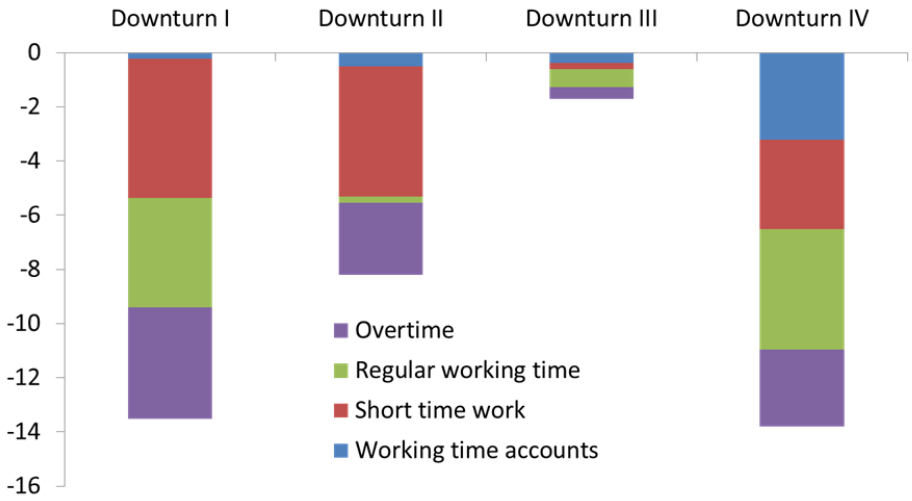


FIGURE 6: COMPONENTS OF CYCLICAL WORKING TIME REDUCTIONS IN RECESSIONS FROM PEAK TO TROUGH, HOURS PER EMPLOYEE

Notes: 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.

As can be seen in Figure 6, short time work has been used to reduce disemployment effects in Downturn I and II, but hardly feature into Downturn III. This might be due to a loss of popularity among policy makers because of its excessive use in East Germany after reunification to cushion the impact of structural adjustments (Bogedan, 2010). But this changed again in Downturn IV, where regulatory changes, combined with governmental media-campaigns motivating employers to use short-time work instead of laying-off workers, contributed to the widespread use of this instrument. Reductions in overtime work also played an important role in most recessions. Surprisingly, we find that

[17] The smoothing parameter is 1600. The change in regular working time is the sum of cyclical changes in full time and part time jobs. Both have been individually de-trended because there is a trend decline in average full time working hours and a trend increase in part time work.

regular working time has been strongly reduced in Downturn I, even though this instrument has only recently become available on a larger scale. This might be mainly the result of a coincidence, however, because independent from the recession, a significant reduction in general working time was implemented in 1974 (Herzog-Stein and Seifert, 2010), which is partially picked up in the data as a cyclical reduction. Thus, the Great Recession is novel in that it is the first time that the change in regular working hours has been deliberately used to adjust labor input along its intensive margin to a temporary fall in demand. Finally, working time accounts are a relatively new tool, which only played a significant role in the Great Recession.

Figure 7 shows the development of these cyclical working time components for the Great Recession and its preceding upswing. During the upswing, from 2005 to early 2008, working time accounts have been filled, regular working hours expanded, and overtime work increased. Given that working time accounts and flexible adjustments from collectively agreed or regular weekly working hours are rather new instruments, this might also explain the unexpectedly strong increase in working time during the upswing, going along with relatively weak employment growth. In the recession, starting with the fourth quarter of 2008, working time account balances and overtime work are reduced strongly, while regular working hours are still increasing. However, starting in 2009, all instruments of working time adjustment strongly contribute to the cyclical decline in working time. While short-time work plays an important role in this, the privately negotiated working time accounts and regular working time adjustments share at least an equally high burden.

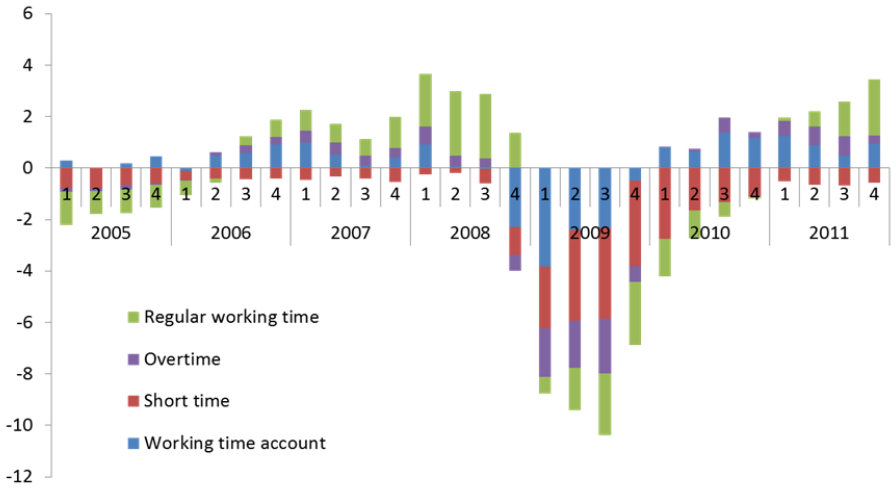


FIGURE 7: COMPONENTS OF CYCLICAL CHANGES IN WORKING TIME, AVERAGE HOURS, 2005Q1–2011Q4

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

Thus, most of the instruments that were used to adjust working hours are negotiated in a framework of corporatist industrial relations, and are not implemented by the government. The existence of working time accounts is an outcome of corporatist negotiations between employers and unions and are implemented within the framework of collective and company agreements (Groß et al., 2000). The reduction of weekly working hours at the company level is further supported by collective agreements that allowed companies, in co-operation with trade unions, to reduce their regular working time substantially in the recession (Bispinck 2009).[18]

[18] 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.

V. Is the German model exportable to other countries?

Early theoretical work on the rationality of labor hoarding emphasizes firm-specific knowledge and skills acquired by on-the-job-training (Becker, 1962; Oi, 1962). Training is an investment by firms and workers into the workers' human capital. To protect their investment and guard against devaluation of skills, long-term contracts are in the interest of both parties.

Recent empirical literature stresses especially the role of labor market institutions as a cause of a high degree of internal labor demand adjustment. In the European context, Estevez-Abe et al. (2001) and Harcourt and Wood (2007) argue that strict employment protection legislation (EPL) increases workers willingness to invest in firm- and industry-specific skills. This might lead to an international comparative advantage for a country's industry in a particular skill-specific production niche, and is thus potentially favorable for firms and workers. Bassanini and Ernst (2002a; 2002b) show for OECD countries that EPL impacts on technological specialization. Their findings suggest that strict EPL in countries with a coordinated system of industrial relations leads to a technological comparative advantage in "routinized" industry-specific innovation regimes (e.g. electronic components and aircraft), whereas the reverse effect of EPL exists for decentralized countries. They conclude that employment protection in coordinated systems of industrial relations align workers' and firms' objectives, and enhance the accumulation of firm-specific competencies while encouraging firm-sponsored training. Relatedly, Sturn (2013) shows for a sample of OECD countries that strict EPL goes along with lower unemployment in corporatist countries, while it increases unemployment in non-corporatist countries. OECD (2010: 63) points out that there seems to be a cross-country trade-off between low EPL and high internal flexibility. Boeri and Bruecker (2011) present cross-country evidence that strict EPL correlates with the use of short-time work in the

Great Recession, and that contractual arrangements which facilitate adjustments at the extensive margin reduce the use of short-time work at the company level, while a larger share of workers with vocational training increase it. Eichhorst et al. (2010) show that internal flexibility seems to be higher in countries characterized by corporatist industrial relations.

Thus, the cross-country industrial relations literature suggests that in countries with strict employment protection and centralized collective bargaining, labor hoarding can be expected to be particularly high (see also Llosa et al., 2014). These arguments are consistent with the German experience. Germany has strict EPL (see stats.OECD), and is typically characterized as a corporatist country with good industrial relations and very low strike incidence. This discussion suggests potential difficulties in exporting such policies of labor demand adjustment along the internal margin to other countries with different institutional settings. Boeri and Bruecker (2011, p. 743) argue that "[t]he low take-up rate of the US STW [short-time work] scheme is also likely to be due to the weak employment protection provided in this country. In order to increase take-up rates significantly in countries with mild employment protection legislation, the state will have to heavily subsidize STW schemes." Similarly, the use of discretionary changes in regular working hours as a mechanism to flexibly adjust working hours to demand shocks seems to require a high degree of unionization and centralization of such decisions, to allow for a timely and flexible implementation at a large scale.

Also the transferability of working-time accounts to other countries has to be approached with some skepticism. To a large extent, working-time accounts are the results of collective agreements and the exact details governing its use at the establishment level are often the result of negotiations between management and works councils. Therefore, working-time accounts are closely connected with the German system of industrial relations. Hence, the German context has to be taken into account when other countries think about introducing working-time accounts

to safeguard employment. Herzog-Stein and Zapf (2014) find evidence that labor-relations factors are important determinants of the use of working-time accounts to safeguard employment within Germany. Furthermore, their empirical results provide some evidence for a trade-off between external-numerical and internal-numerical flexibility: a high degree of internal-numerical flexibility probably requires some restriction of external-numerical flexibility to implement working-time accounts successfully. Their empirical findings also indicate that working-time accounts are not an instrument that can be easily introduced during a severe economic slump, because among other things they come with significant organizational requirements and need a sound basis of mutual trust between management and employees. According to Herzog-Stein and Zapf (2014) they are more comparable to labor market institutions, and they cannot be seen in isolation. A large number of instruments for internal-numerical flexibility exist in German establishments and they are often used in combination. Additionally, it is doubtful whether the introduction of working-time accounts in a legalistic way can provide the same degree of flexibility in the application of working-time accounts as observed under the German system of industrial relations.

Thus, while pro-cyclical variations in working time are an interesting new potential policy variable to moderate output fluctuations in the toolkit of policymakers in countries with a similar institutional background as Germany, our initial assessment suggests that it might not be easily employable in all countries.

VI. Conclusions

We show that in all major German recessions the 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. However, in the Great

Recession temporary working time reductions played a very significant role. To quantify the extent to which the reactions in productivity and working time were novel, we estimate time-series models explaining these two variables from 1970 until 2005. These estimates are used to create forecasts until 2012. This allows us to compare the actual development of cyclical productivity per hour, as well as the cyclical working time, with its counterfactual based on historical data. The results show that the German employment miracle in the Great Recession is mainly explained by strong temporary working time reductions. These strong reductions in working time were mainly the result of new work-sharing instruments, 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. Further, the publicly funded short-time work scheme played a central role.

The German experience in the Great Recession shows the importance of internal labor market flexibility in stabilizing employment in a downturn. But internal flexibility might also have a positive long-run impact on the labor market. First, the stabilization of employment in economic downturns might prevent unemployment hysteresis as well as spending cuts by consumers because of uncertain employment prospects. Second, internal flexibility might contribute to the overall flexibility of labor markets, thereby lowering unemployment caused by macroeconomic shocks and rigid labor markets.

Labor hoarding in the form of lower productivity is relatively costly for firms. Reducing working time is generally a cheaper tool to achieve the same outcome and thus might be expected to be the preferred mechanism from the perspective of the firm. However, while labor hoarding in the form of lower productivity is relatively common across countries and time (see Biddle, 2014), working time reductions in downturns do not seem to play a significant role in most countries (van Rens, 2012). One likely reason is the lack of institutions allowing for flexible

working time arrangements. The German social partners have established such novel and effective institutions. Along with the already established government funded short-time work scheme, these institutional features within the German labor market allow for high flexibility, even though external labor market flexibility is low. In fact, some labor market rigidity in the form of strict employment protection legislation and coordinated wage bargaining mechanisms might even be an institutional precondition for high internal flexibility becoming an attractive alternative to hiring and firing.

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 labor 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, the topic of internal flexibility has received far too little attention to date.

References

Bach, H.-U., and S. Koch. 2002. Working Time and the Volume of Work in Germany: The IAB Concept of Measurement. *IAB Labour Market Research Topics*, *53*, 1–27.

Ball, L. M., Leigh, D., and P. Loungani. 2013. Okun's Law: Fit at Fifty? *NBER Working Papers*, *18668*.

Balleer, A., Gehrke, B., Lechthaler, W., and C. Merkl. 2013. Does Short-Time Work Save Jobs? A Business Cycle Analysis. *IZA Discussion Papers*, *7475*.

Bassanini, A., and E. Ernst. 2002a. Labour Market Institutions, Product Market Regulation, and Innovation: Cross-Country Evidence. *OECD Economics Department Working Papers*, *316*.

Bassanini, A., & E. Ernst. 2002b. Labour market regulation, industrial relations and technological regimes: a tale of comparative advantage. *Industrial and Corporate Change*, *11*(3), 391–426.

Bauer, F., Groß, H., Lehmann, C., and E. Munz. 2004. Arbeitszeit 2003. Arbeitszeitgestaltung, Arbeitsorganisation und Tätigkeitsprofile. *Technical Report, Institut Zur Erforschung Sozialer Chancen*.

Becker, G. S. 1962. Investment in Human Capital: A Theoretical Analysis. *Journal of Political Economy*, *70*(5), 9–49.

Biddle, J. E. 2014. Retrospectives: The Cyclical Behavior of Labor Productivity and the Emergence of the Labor Hoarding Concept. *Journal of Economic Perspectives*, *28*(2), 197–212.

Bispinck, R. 2009. Tarifliche Regelungen zur befristeten Arbeitszeitverkürzung. *Elemente Qualitativer Tarifpolitik*, *67*.

Boeri, T., and H. Bruecker. 2011. Short-time work benefits revisited: some lessons from the Great Recession. *Economic Policy*, *26*(68), 697–765.

Bogedan, C. 2010. Arbeitsmarktpolitik aus der "Mottenkiste"? Kurzarbeitergeld im Lichte politischer Interessen. *WSI Mitteilungen*, *11*, 577–583.

Boysen-Hogrefe, J., and D. Groll. 2010. The German Labour Market Miracle. *National Institute Economic Review*, *214*(1).

Brautzsch, H.-U., and H. Will. 2010. Kurzarbeit: Wichtige Stütze des Arbeitsmarktes in der Krise, aber keine Dauerlösung. *Wirtschaft Im Wandel*, *16*(8).

Brenke, K., Rinne, U., and K. F. Zimmermann. 2013. Short-time work: The German answer to the Great Recession. *International Labour Review*, *152*(2), 287–305.

Burda, M. C., and J. Hunt. 2011. What Explains the German Labor Market Miracle in the Great Recession. *Brookings Papers on Economic Activity*, *42*(1 (Spring)), 273–335.

Dustmann, C., Fitzenberger, B., Schönberg, U., and A. Spitz-Oener. 2014. From Sick Man of Europe to Economic Superstar: Germany's Resurgent Economy. *Journal of Economic Perspectives*, *28*(1), 167–188.

Eichhorst, W., Feil, M., and P. Marx. 2010. Crisis, What Crisis? Patterns of Adaptation in European Labor Markets. *Applied Economics Quarterly (formerly: Konjunkturpolitik)*, 29 – 64.

Estevez-Abe, M., Iversen, T., and D. Soskice. 2001. Social Protection and the Formation of Skills: A Reinterpretation of the Welfare State. In P. A. Hall & D. Soskice (Eds.), *Varieties of capitalism – The institutional foundations of comparative advantage* (pp. 145–183). Oxford: Oxford University Press.

German Council of Economic Experts. 2007. *Das Erreichte nicht verspielen*. *Jahresgutachten 2007/08*. Wiesbaden.

Gerner, H.-D. 2010. Arbeitszeitverlängerung, Arbeitszeitkonten und Teilzeitbeschäftigung: Ökonometrische Analysen. *IAB Bibliothek*, *322*.

Gordon, R. J. 1993. The Jobless Recovery: Does It Signal a New Era of Productivity-led Growth? *Brookings Papers on Economic Activity*, *24*(1), 271–316.

Groß, H., Munz, E., and H. Seifert. 2000. Verbreitung und Struktur von Arbeitszeitkonten. *Arbeit. Zeitschrift Für Arbeitszeitforschung, Arbeitsgestaltung Und Arbeitspolitik*, *9*(3), 217–299.

Harcourt, M., and G. Wood. 2007. The Importance of Employment Protection for Skill Development in Coordinated Market Economies. *European Journal of Industrial Relations*, *13*(2), 141–159.

Herzog-Stein, A., and H. Seifert. 2010. Der Arbeitsmarkt in der Großen Rezession – Bewährte Strategien in neuen Formen. *WSI Mitteilungen*, *11*, 551–559.

Herzog-Stein, A., and I. Zapf. 2014. Navigating the Great Recession. *ILR Review*, *67*(3), 891–925.

Krugman, P. 2009. Free to lose. *New York Times*, *November 1*, A31.

Llosa, G., Ohanian, L., Raffo, A., and R. Rogerson. 2014. Firing Costs and Labor Market Fluctuations: A Cross-Country Analysis. *Society for Economic Dynamics 2014 Meeting Papers*, (533).

Merkl, C., and D. Wesselbaum. 2011. Extensive versus intensive margin in Germany and the United States: any differences? *Applied Economics Letters*, *18*(9), 805–808.

Möller, J. 2010. The German labor market response in the world recession: de-mystifying a miracle. *International Labour Review*, *42*(4), 325–336.

Ohanian, L. E., and A. Raffo. 2012. Aggregate hours worked in OECD countries: New measurement and implications for business cycles. *Journal of Monetary Economics*, *59*(1), 40–56.

Oi, W. Y. 1962. Labor as a Quasi-Fixed Factor. *Journal of Political Economy*, *70*(6), 538–555.

Okun, A. M. 1962. Potential GNP: Its Measurement and Significance. *Proceedings of the Business and Economic Statistics Section of the American Statistical Association*, 98–103.

Schaz, P., and E. Spitznagel. 2010. Makroökonomische Dynamik von Arbeitsmärkten - Ein Vergleich interner und externer Flexibilität in den USA und Deutschland. *WSI Mitteilungen*, *12*, 626–635.

Sturn, S. 2013. Are corporatist labour markets different? Labour market regimes and unemployment in OECD countries. *International Labour Review*, *152*(2), 237–254.

Sturn, S., and T. van Treeck. 2010. Arbeitsmarktreformen in Deutschland: Hohe soziale Kosten ohne gesamtwirtschaftlichen Nutzen. *WSI Mitteilungen*, *11*, 592–600.

Van Rens, T. 2012. How important is the intensive margin of labor adjustment? Discussion of "Aggregate hours worked in OECD countries: New measurement and implications for business cycles" by Lee Ohanian and Andrea Raffo. *Journal of Monetary Economics*, *59*(1), 57–63.

Wanger, S. 2013. Arbeitszeit und Arbeitsvolumen in Deutschland – Methodische Grundlagen und Ergebnisse der Arbeitszeitrechnung. *AStA Wirtschafts- Und Sozialstatistisches Archiv*, *7*(1-2), 31–69.

Will, H. 2011. Germany's Short Time Compensation Program: macroeconom(etr)ic insight. *IMK Working Paper*, *1*.

Zapf, I. 2012. Flexibilität am Arbeitsmarkt durch Überstunden und Arbeitszeitkonten - Messkonzepte, Datenquelle und Ergebnisse im Kontext der IAB-Arbeitszeitrechnung. *IAB-Forschungsbericht*, *3*.

Zapf, I., and W. Brehmer. 2010. Flexibilität in der Wirtschaftskrise - Arbeitszeitkonten haben sich bewährt. *IAB-Kurzbericht*, *22*.

Appendix

Table A1: TSLS estimation

(a) Productivity gap, sample: 1971q1-2005q2

Variable	Coefficient	p-value
Y_t^{gap}	0.66***	(0.00)
Y_{t-1}^{gap}	-0.75***	(0.00)
Y_{t-3}^{gap}	0.14***	(0.00)
LP_{t-1}^{gap}	0.94***	(0.00)
LP_{t-4}^{gap}	-0.11***	(0.01)
R^2	0.89	
N	138	

(b) Working time gap, sample: 1972q1-2005q2

Variable	Coefficient	p-value
Y_t^{gap}	0.23	(0.00)
Y_{t-1}^{gap}	-0.19***	(0.01)
WT_{t-1}^{gap}	0.69***	(0.00)
WT_{t-4}^{gap}	-0.27***	(0.01)
WT_{t-5}^{gap}	0.14*	(0.08)
WT_{t-8}^{gap}	-0.10**	(0.04)
R^2	0.74	
N	134	