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What accounts for the German Labor Market Miracle? A Macroeconomic Investigation

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What accounts for the German Labor Market Miracle? A Macroeconomic Investigation

by *Mathias Klein*^{*} and *Stefan Schiman*[†]

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Abstract

We study the driving forces of the so-called “German labor market miracle”, the trend-shift and steady decline of German unemployment over the last two decades that persisted beyond the Great Recession. Our structural VAR approach encompasses various factors within a single comprehensive framework based on robust sign restrictions. We find that wage bargaining shocks account for most of the observed unemployment decline. Wage moderation was most pronounced right after the implementation of Hartz IV, but it persisted far beyond that. Moreover, the real effects of wage bargaining shocks were stronger post-1999, i.e. within the monetary union. In contrast, the muted response of unemployment to the Great Recession was not significantly different to the experience in previous business cycle downturns. The results are robust to several modifications of the model and changes in the sample.

Keywords: German labor market miracle, structural VAR, sign restrictions.

JEL classification: C32, E24, E32.

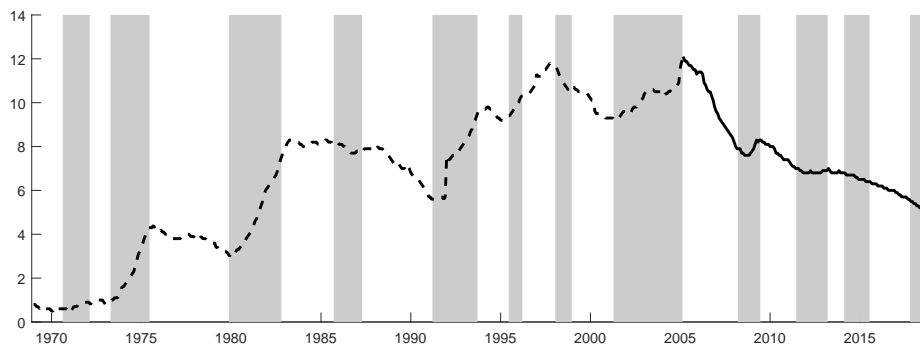
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1 Introduction

In the early 2000s, the unemployment rate in Germany underwent a historic trend shift (Figure 1). A peak at around 12 percent in 2005 was followed by a persistent and steady decline that brought unemployment down to 5 percent in 2018. What makes this downward trend so remarkable is that it persisted beyond the Great Recession, the deepest economic downturn in German post-WWII history. This economic turmoil caused unemployment to rise sharply and more persistently in most other industrialized countries. The fall of German unemployment is also outstanding because it is unprecedented in the country’s modern history. Unemployment had risen during several economic downturns (gray shaded areas in Figure 1), and the increase was never fully offset, so that structural unemployment seemed to trend upward (illustrated by the dashed segment of the time series).

Figure 1: Unemployment rate and economic downturns¹ in Germany



The persistent decline in unemployment and its perceived decoupling from real economic activity during the Great Recession is known as “German (labor market) miracle” (Bauer and King 2018; Hartung, Jung, and Kuhn 2018; Burda and Hunt 2011; Boysen-Hogrefe and Groll 2010). Over the last years, a hot debate about its causes emerged among researchers and policy makers. The literature has proposed different explanations ranging from standard business cycle effects (supply and demand shocks) to demographic

¹OECD based recession indicator for Germany from the period following the peak through the trough, compiled by the Federal Reserve Bank of St. Louis, retrieved from FRED; <https://fred.stlouisfed.org/series/DEUREC>, February 1, 2019

changes (labor supply) and structural transformation in the labor market (wage moderation and improvements in matching efficiency). Intriguingly, the trend shift was preceded by significant labor market reforms, the so-called “Hartz reforms”, which, hence, were an obvious candidate cause.

These labor market reforms play an important role in explaining the German miracle. [Hartung, Jung, and Kuhn \(2018\)](#) conclude that the unemployment rate would be 50% higher today if there would have been no Hartz reforms and that these reforms mainly worked via lowering separation rates. According to [Krebs and Scheffel \(2013\)](#), Hartz I-III reduced the noncyclical unemployment rate by 1.5 percentage points, Hartz IV by a further 1.4 percentage points. [Krause and Uhlig \(2012\)](#) also find a large reduction in German unemployment and its duration due to Hartz IV. [Launov and Wälde \(2016\)](#) find that Hartz III, i.e. the enhanced effectiveness of the public employment agencies, explains about 20% of the observed post-reform unemployment drop. But the role of unemployment benefit reduction due to Hartz IV explains just about 5% - a minuscule effect, which echoes the authors’ earlier results ([Launov and Wälde 2013](#)). [Bradley and Kügler \(2019\)](#) conclude that while the Hartz reforms shortened the typical duration of unemployment, they did not reduce unemployment as a whole.

[Bauer and King \(2018\)](#) consider the labor market reforms in conjuncture with the Great Recession and they argue that there might have been offsetting effects. [Burda and Hunt \(2011\)](#) focus on the “missing” increase of unemployment during the Great Recession in Germany and they find that this was mainly a compensation for firms’ reticence to hire new staff during the preceding expansion, but that wage moderation and the widespread adoption of working time accounts also played a role. Recently, [Gehrke, Lechthaler, and Merkl \(2018\)](#) find that the labor market reforms were most likely the key drivers of a series of positive labor market performance shocks that hit the German economy prior to the Great Recession and prevented unemployment to increase by more during the recession. [Boysen-Hogrefe and Groll \(2010\)](#) emphasize the role of wage moderation for the small response of unemployment during the Great Recession, and they acknowledge that the preceding labor market reforms had a certain stake in it.

In short, a consensus on the causes of the German labor market miracle is not reached yet; not least because the methodological approaches differ; because some authors focus on specific aspects ignoring others; and because labor market reforms were not homogeneous but diverse with respect to their effects. Our approach is a comprehensive one that strives to encompass the potential driving forces and identify them within a single consistent framework. We estimate vector autoregressions where demand, technology, labor supply, wage bargaining, and matching efficiency shocks are identified through robust sign restrictions as proposed by [Foroni, Furlanetto, and Lepetit \(2018\)](#). The distinction between business cycle (demand and technology) and labor market shocks enables us to carve out the effects of the Great Recession and whether unemployment reacted differently to it than to previous recessions. Moreover, the identified labor market shocks are particularly well-suited to capture potential effects of labor market reforms. For instance, some of the early Hartz reforms aimed at improving matching efficiency while Hartz IV, the notorious capstone of the reforms, essentially lowered wage replacement benefits.

Our estimation sample covers quarterly data ranging from 1970 to 2018. We find that negative wage bargaining shocks account for most of the observed decline of the German unemployment rate, that they were most pronounced right after the implementation of Hartz IV and that the monetary union might have emphasized the unemployment dampening effect of wage moderation. In contrast, the remaining business cycle and labor market shocks explain only a minor part of the observed unemployment decline. Moreover, according to our analysis the response of unemployment during the Great Recession was not significantly different to previous economic downturns. Our findings imply that absent wage bargaining shocks over the last two decades, the unemployment rate in 2018 would be up to 2 percentage points higher than the observed one. The results are robust to several modifications of the model and changes in the sample.

The paper is structured as follows. In Section 2, we describe the empirical approach and the identifying assumptions. Section 3 gives an overview of the properties of the model, focusing on impulse responses and forecast error variance decompositions. In Section 4, we study the underlying causes responsible for the significant fall in unemploy-

ment based on our empirical model. Section 5 takes a closer look at the unique period surrounding the Great Recession and section 6 concludes.

2 Empirical Framework

Let

$$\mathbf{y}_t = \mathbf{c} + \sum_{i=1}^l \mathbf{A}_i \mathbf{y}_{t-i} + \mathbf{u}_t \quad (1)$$

be the reduced-form model, where \mathbf{y}_t is a vector of endogenous variables, \mathbf{c} is a vector of constants, \mathbf{A}_i are matrices of reduced-form coefficients and $\mathbf{u}_t \sim \mathcal{N}(\mathbf{0}, \Sigma_{\mathbf{u}})$ is a vector of reduced-form residuals.

To recover orthogonal innovations \mathbf{w}_t (i.e. $\mathbf{w}_t = \mathbf{B}\mathbf{u}_t$, such that $\Sigma_{\mathbf{w}}$ is diagonal) we resort to a method that has become standard in the literature ([Rubio-Ramírez, Waggoner, and Zha 2010](#)). The structural impact multiplier matrices \mathbf{B}^{-1} are chosen as the product of the Cholesky factor of $\Sigma_{\mathbf{u}}$, $chol(\Sigma_{\mathbf{u}})$, and orthogonal matrices \mathbf{Q} obtained via a QR decomposition of matrices sampled from a standard Normal distribution. From the infinite set of \mathbf{Q} 's we choose those that lead to appropriate structural models, i.e. models with structural shocks satisfying the impact sign restrictions given in Table 1. Our baseline model implies five different shocks: demand, technology, labor supply, wage bargaining, and matching efficiency. We stop sampling when one thousand appropriate models are drawn. The sign restrictions in Table 1 have been proposed by [Forni, Furlanetto, and Lepetit \(2018\)](#).

Table 1: Impact sign restrictions

	GDP	Inflation	Real wages	Unemployment	Vacancies
Demand	+	+		−	
Technology	+	−	+		
Labor supply	+	−	−	+	
Wage bargaining	+	−	−	−	+
Matching efficiency	+	−	−	−	−

A demand shock moves output and prices in the same direction, and output and unemployment in opposite directions. These dynamics are consistent with the effects induced by monetary policy, government spending, marginal efficiency of investment, discount

factor, and most financial shocks. A productivity (technology) shock, on the other hand, moves output and prices in opposite directions and elicits a positive comovement of output and real wages. The effect on unemployment is unrestricted. An exogenous variation of labor supply may occur at the extensive margin (employment) or at the intensive margin (hours worked per capita). In either case it affects the number of job seekers and, hence, the ability of firms to fill vacancies. This, in turn, affects hiring costs, wages and prices. A wage bargaining shock constitutes an exogenous variation in real wages originating from the wage bargaining process of employees (trade unions) and employers (firms). Similar to labor supply shocks, this affects firms' marginal costs and, hence, prices and output. A matching efficiency shock is associated with similar dynamics but it moves unemployment and vacancies in the same direction.

The identified demand and technology shocks represent traditional drivers of the business cycle in standard New Keynesian models. These innovations should be interpreted as shocks which induce fluctuations in real and labor market variables but do not originate from changes in the labor market. The labor supply shock captures innovations in the labor force due to demographic changes and migration flows. Moreover, because the Hartz reforms also increased the pool of unemployed officially registered, the labor supply shock might also cover parts of the labor market reforms. Wage bargaining shocks represent wage moderation by trade unions but also exogenous variations in unemployment benefits, which constitute the workers' outside option in the negotiation process. Over the last years, trade unions focused more strongly on other aspects than just wages and salaries (e.g., part-time work, flexible working hours, child care) which implies that the wage bargaining shock also represents more structural changes in negotiation processes. The matching efficiency shock represents variations in the ability of labor market institutions to match workers searching for a job and available vacancies. Improvements in matching efficiency might capture better matching technologies in the private job market and public employment agencies.

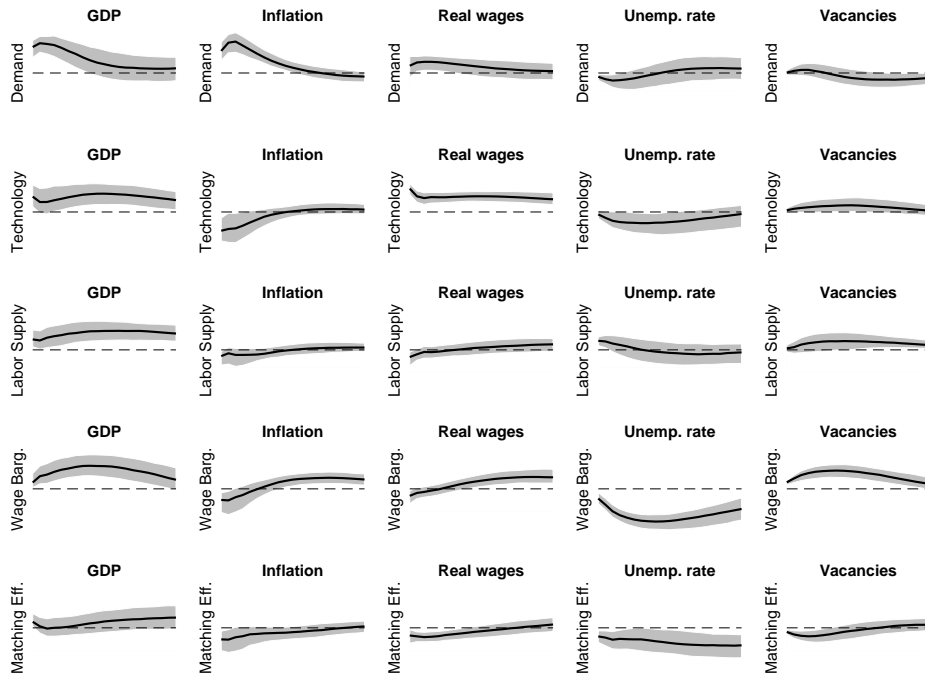
In our estimations we use quarterly data over the period 1970q1 to 2018q1 which provide information on 193 observations. The model is estimated with Bayesian techniques,

employing a Normal-Wishart prior on $\mathbf{a} = \text{vec}([\mathbf{A}_1, \dots, \mathbf{A}_I])$ and $\Sigma_{\mathbf{u}}$. All specifications include 3 lags.

3 Properties of the model

Before quantifying the importance of the different economic shocks for the German labor market miracle, we first gauge the properties of the model by analyzing impulse responses and forecast error variance decompositions. Figure 2 shows average impulse responses (solid lines) together with 68% pointwise credible sets (shaded areas) from impact to five years after the respective shock. Overall, we obtain impulse responses that are very much in line with economic theory. First, we describe the dynamics of demand and supply innovations on the goods market. Then, we turn to shocks originating from the labor market.

Figure 2: Impulse responses over 5 years, baseline model
black: point-wise median, gray: 68% point-wise credible set



The effects of output, inflation and unemployment to a demand shock are transitory and last for about 1-3 years. GDP and inflation increase significantly with peak responses after around a year. Per capita real wages and vacancies, whose impact responses are not restricted, increase in the short run; in the medium run the effects vanish. If real wages are measured in per hour terms (not shown), the effect is ambiguous, indicating that total hours worked might react somewhat stronger to a demand shock than employment and, hence, that both the extensive and the intensive margin of labor increase in response to a demand shock.

The technology shock differs from the demand shock through its divergent response of output and inflation. The shock elicits more persistent effects on several variables than the demand shock. Output and real wages increase significantly and persistently. The impact response of unemployment, which is free of identifying restrictions, is small but negative and most draws indicate a permanent decrease. In turn, vacancies increase somewhat and the increase lasts longer than in demand-fueled booms.

The output effect of labor supply shocks is initially modest, but it strengthens after some time such that in the long run a clear positive effect persists. The assumed price dampening effect is short-lived. Also, the definitional impact increase of unemployment abates quickly and the dampening effect on real wages reverses in the long run. These results are well in line with the findings by [Faroni, Furlanetto, and Lepetit \(2018\)](#) based on US data. The effect of vacancies following labor supply shocks, which is the only unrestricted variable, is small on impact and becomes positive on later horizons. This set of evidence points to the following macroeconomic nexus: An exogenous increase of labor supply and the corresponding reduction of the price of labor incentivize labor demand and, hence, the creation of new vacancies. This demand side reaction acts as an accelerator of growth and, as a result, counteracts the initial wage and price decline. The labor demand effects following the labor supply shock outweigh the reduction of prices and wages and bring unemployment down again.

Wage bargaining shocks respond like labor supply shocks in several ways: with respect to the qualitative response of output (initially modest, then stronger), vacancies (positive and long lasting), inflation and real wages (medium-run compensation of initial decline).

The compensating effect on prices seems to be more pronounced. Correspondingly, the long-term effect of output is more muted. These nuanced differences between the two shocks might follow from the fact that in the case of an exogenous labor supply increase firms draw from a larger pool of workers when growth accelerates such that inflation pressures are deferred. Unemployment, on the other hand, is reduced significantly even in the long run in case of a wage bargaining shock, while it only settles at its pre-shock level in case of an exogenously expanded labor force.

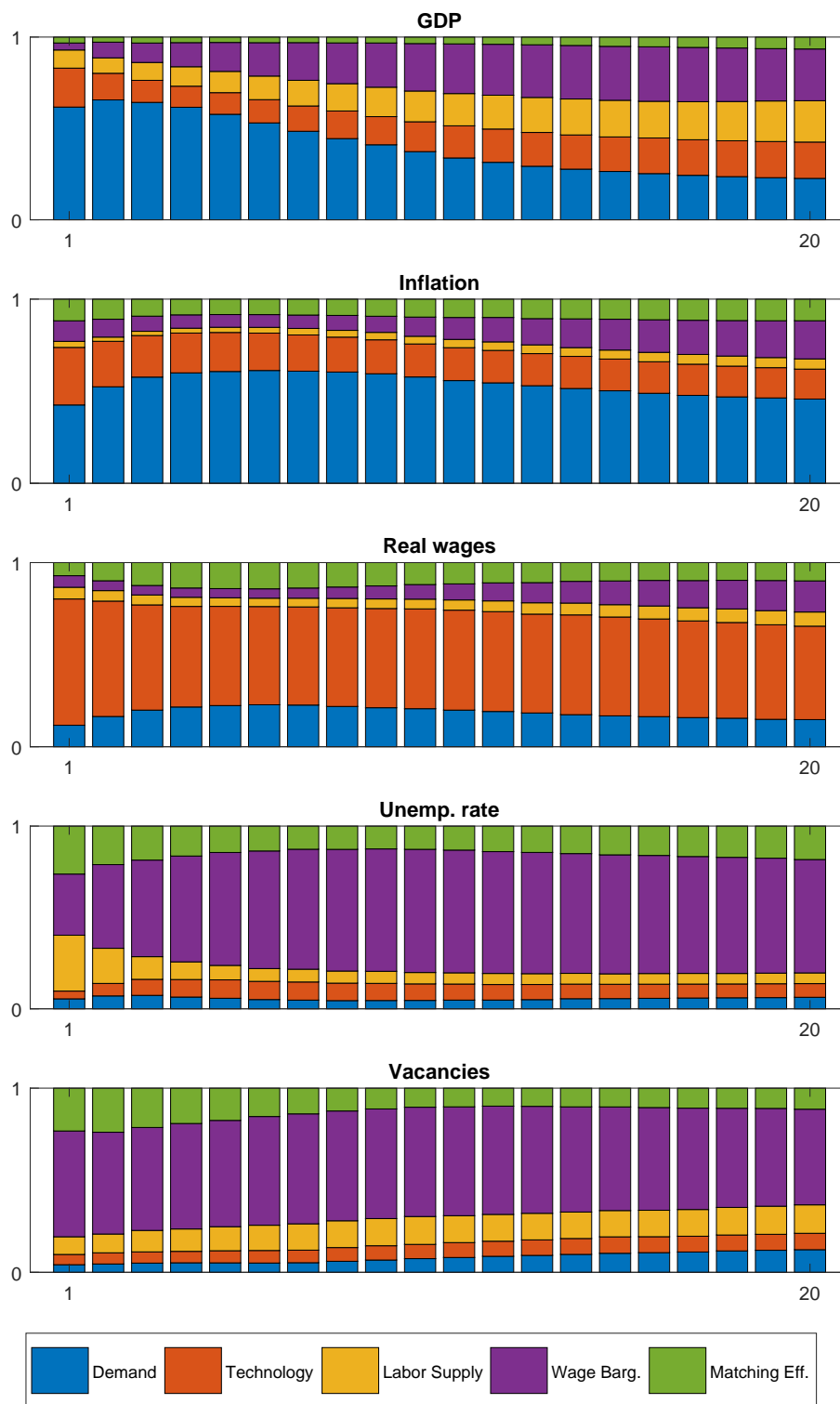
Unemployment also decreases in a persistent manner in response to an improvement of matching efficiency. The response is steadier and less cyclical compared to a wage bargaining shock. In contrast, the impact decrease of vacancies is not permanent. Again, this evidence is well in line with [Faroni, Furlanetto, and Lepetit \(2018\)](#). Another feature of a matching efficiency shock is the rather blurred short and medium run response of output turning unambiguously positive in the long run. The dampening price and wage effects fade out over time.

Figure 3 presents the forecast error variance decomposition and gives a first insight of the quantitative importance of the various structural shocks. There is a single dominant driver, i.e. a factor that accounts for at least half the variation of a variable over almost all horizons, for all variables except output. Inflation is primarily driven by demand shocks, real wages by supply shocks and the unemployment rate and vacancies by wage bargaining shocks, respectively. The dominant driver of output are demand shocks, but only in the short run. In the long run, the sources of output fluctuations are more equally distributed. Another interesting observation is that typical business cycle fluctuations, i.e. demand and technology shocks, play only a minor role for unemployment and vacancies. The dominant contribution of wage bargaining shocks for these variables provides a first hint to their importance for the German labor market miracle.

4 The trend shift

The first aspect of the German labor market miracle is the persistent downward trend following the trend shift in 2005. Germany has never experienced such a large and persis-

Figure 3: Forecast error variance decompositions over 5 years, baseline model medians per quarter, scaled to unity



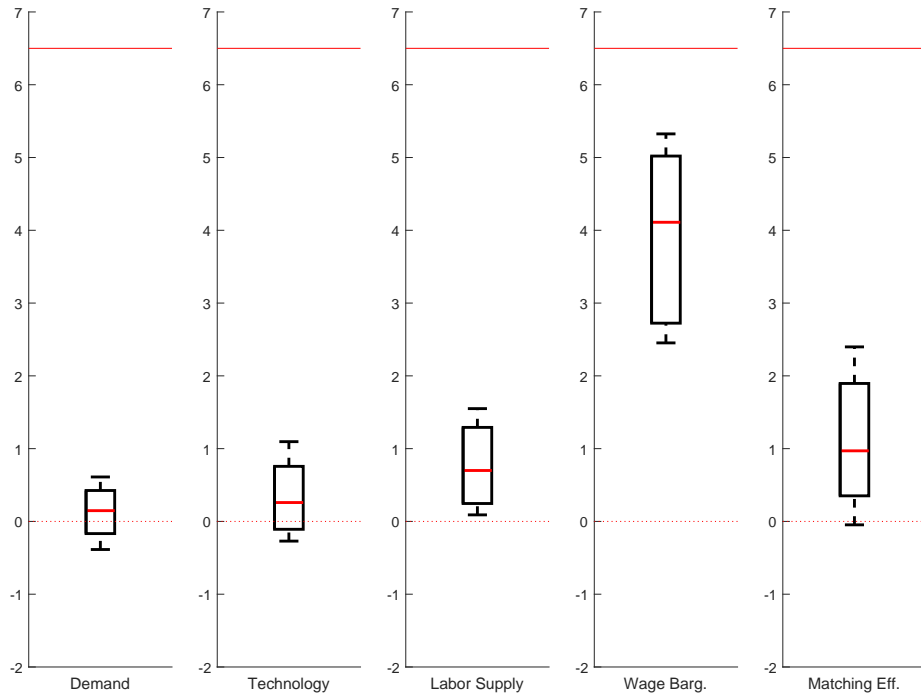
tent drop of unemployment in its modern history. Our approach enables us to conduct a historical decomposition of the unemployment rate and, hence, to analyze which factors contributed to its decline. A favorable statistical prerequisite for this endeavor is that unemployment was almost zero at the start of the sample period, so that the problem of initial values is mitigated and we can write

$$ur_t \approx c + \sum_{i=0}^{t-1} \phi_{k,i} w_{k,t-i}, \quad (2)$$

where ur_t is the unemployment rate at time t , c is a constant, $\phi_{k,t}$ is the response of the unemployment rate to shock k in period t , and w_k are structural innovations.

Figure 4: Time series decomposition of the cumulative change of the unemployment rate between 2005 and 2018

Thin red solid lines: total cumulative change (6.5 percentage points)
Boxes: quartiles, whiskers: 16%/84%, Thick red lines: medians



The main results are summarized in Figure 4, which presents historical decompositions of the unemployment rate decline between 2005 and 2018. It shows the quantitative

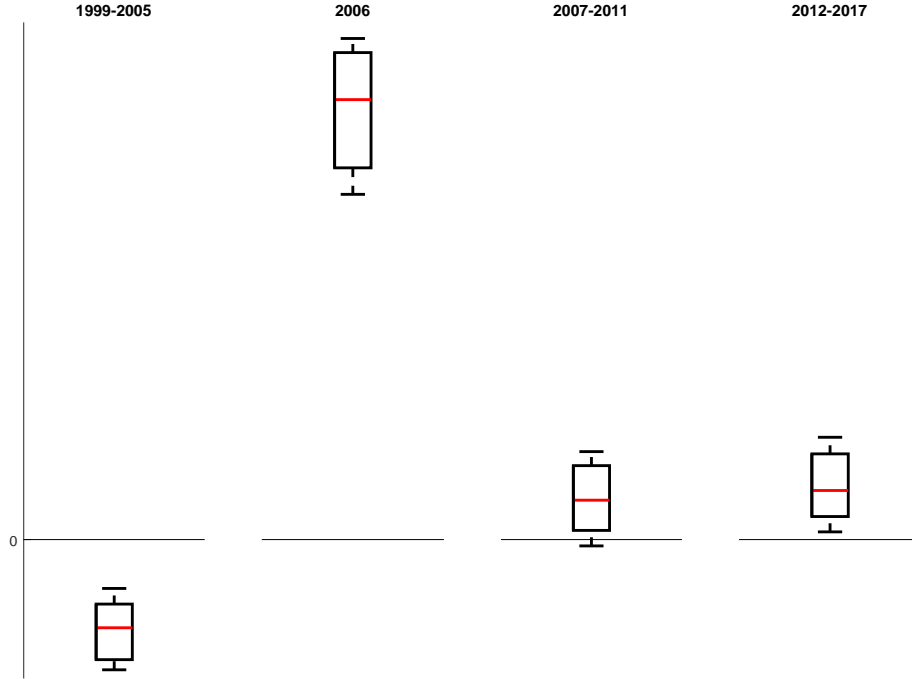
contribution of each of the five structural shocks identified in the VAR. According to this exposition, wage bargaining shocks account for 40 to 80 per cent of the decline of unemployment. The remaining part of the downward trend is explained by matching efficiency shocks (up to 40 per cent), labor supply shocks (up to 25 per cent) and technology shocks (up to 15 per cent). The effects of demand shocks largely cancel out because the adverse shock due to the Great Recession was offset by a cyclical recovery (see below). These results are robust to several modifications of the model. In particular, we find similar results when changing the lag length, when shortening the sample size, when using a Minnesota instead of a Normal-Wishart prior, when using the GDP deflator instead of CPI as a measure for inflation, and when using hourly wages instead of per capita wages (Table 2)². To summarize, this first analysis provides two important results: First, the shift of the unemployment trend is not monocausal. Second, wage bargaining shocks account for most of it.

Table 2: Historical decomposition of the cumulative decline of unemployment between 2005 and 2018 for alternative model specifications, quartiles

	Baseline	$l = 5$	Short sample	Minnesota	Deflator	Hours
Demand	0.4	0.3	1.0	0.3	0.7	0.2
	0.1	0.1	0.5	-0.1	0.2	0.0
	-0.2	-0.2	0.0	-0.7	-0.1	-0.6
Technology	0.8	1.2	0.6	1.3	0.4	0.5
	0.3	0.8	0.1	0.6	0.0	0.1
	-0.1	0.3	-0.2	-0.1	-0.2	-0.4
Labor supply	1.3	1.1	1.0	0.7	1.0	1.2
	0.7	0.5	0.4	0.1	0.5	0.5
	0.2	0.0	0.1	-0.5	0.1	-0.1
Wage bargaining	5.0	4.4	3.2	5.5	5.4	5.8
	4.1	3.3	2.6	4.4	4.4	4.7
	2.7	2.5	1.8	3.2	3.1	3.4
Matching eff.	1.9	2.8	0.7	3.2	1.4	1.9
	1.0	1.6	0.3	2.0	0.9	0.6
	0.4	0.6	0.0	1.1	-0.1	0.0
Trend			3.1			
			2.3			
			1.4			

²The relevance of a deterministic trend when the model is estimated over the shorter, post-reunification sample (1991 – 2018) points to issues with more persistent initial values.

Figure 5: Wage bargaining shocks, quarterly averages over indicated time horizon
Boxes: quartiles, whiskers: 16%/84%, thick red lines: medians



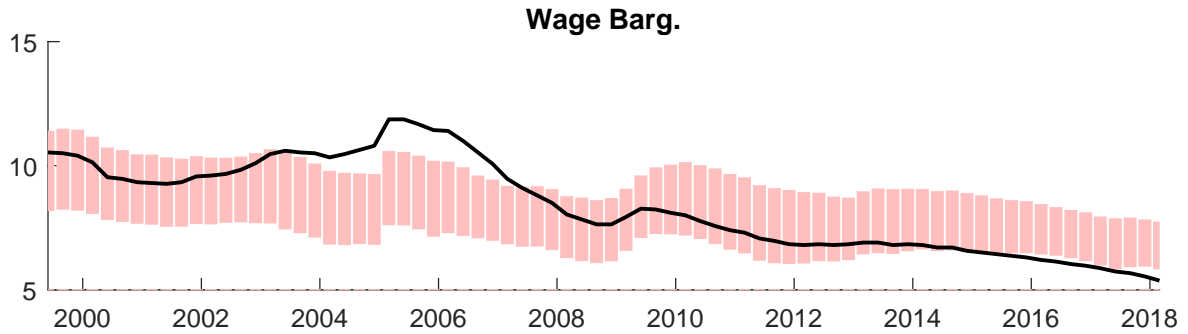
In a next step, we investigate the chronology of wage bargaining shocks to inform our understanding of the mechanisms behind these shocks. It is useful to remember that a wage bargaining shock can be understood as a deviation from the estimated average wage setting relation over the sample period. A prevalence of positive (negative) wage bargaining shocks means that workers get a smaller (larger) share of total income than in similar macroeconomic circumstances in the sample period. “Positive” or “negative” refers to the the shock’s initial impact on output. Figure 5 provides a graphical summary of the prevalence of the identified wage bargaining shocks. The y-axis marks only the zero line, not the absolute size of structural residuals, because only the relative size and directions are meaningful. In the period from the introduction of the Euro in 1999 until and including 2005, negative wage bargaining shocks prevailed, i.e. workers were paid more than in similar macroeconomic circumstances in the sample period. Indeed, between

1998 and 2003 the wage share in the service sector was on the rise and climbed above the Euro area average (Figure A1 in the appendix). Also, for 2004 and 2005 the models do not identify positive wage shocks but the more so for 2006. From then onwards, mainly positive wage bargaining shocks are identified indicating significant and permanent wage moderation by trade unions. Given the chronology of labor market reforms, it seems that Hartz IV, enacted in January 2005, has a certain stake in this development. While earlier reform measures, Hartz I-II in 2003 and Hartz III in 2004, aimed at improving labor market matching, Hartz IV constituted a reduction of wage-replacement benefits (e.g. Krebs and Scheffel 2013). In our reading, this measure affected wage negotiations by depressing reservation wages. It ultimately dampened real wage outcomes in 2006.

Interestingly though, while wage moderation was substantial in 2006, it was not limited to that year. Less dramatic but steady, it persisted from then onwards over the entire remaining sample period. From the analysis of impulse responses we know that the reduction of wages following a wage bargaining shock is not permanent. Instead, it is reversed thanks to rising labor demand. This, in turn, dampens unemployment further. The mechanism seems compelling: pay less, produce more, catch up with earnings, end up with lower unemployment. But to us it also seems unsustainable on a national scale. We conjecture that Euro area mechanisms provide some explanation for that and rerun the model on a smaller sample until 1998, i.e. before the establishment of the monetary union. Impulse responses are qualitatively similar, but there is a remarkable difference (Figure A2 in the appendix): unemployment responds “less persistently” to shocks, and in particular to wage bargaining and matching efficiency shocks. Five years after a wage bargaining shock the unemployment rate is still significantly below its pre-shock level in the entire-sample estimation. But its decline is fully offset when estimation is restricted to the pre-Euro sample. Also for matching efficiency shocks, the unemployment decline is purely transitory in the pre-Euro regime, while it is permanent over the entire sample. Equivalent results hold for output. German firms seem to realize higher gains from wage moderation and improved matching within the monetary union.

Given the importance of wage bargaining shocks for the German labor market miracle, we want to know how it would have evolved in their hypothetical absence. Figure 6

Figure 6: Counterfactual unemployment rate in the absence of wage bargaining shocks
 Red bars: credible set of counterfactual outcomes; black line: realized values



presents realized values and the range of hypothetical counterfactuals. Up to the start of the graph in 1999, the cumulative effect of wage bargaining shocks on unemployment was negative, according to most draws. The gap widened until 2005 because a series of negative wage bargaining shocks hit the economy. Thus, in the first years after the millennium, tight wage negotiation put an upward pressure on salaries which induced subsequent increases in the unemployment rate. In 2006, negative wage bargaining shocks started to materialize and dampened unemployment. At the time of the Great Recession their cumulative effects were largely neutralized. From then onwards, small but steady positive wage bargaining shocks kept dragging unemployment down. In the absence of wage bargaining shocks, the unemployment rate would be up to 2 percentage points higher at the end of the sample.

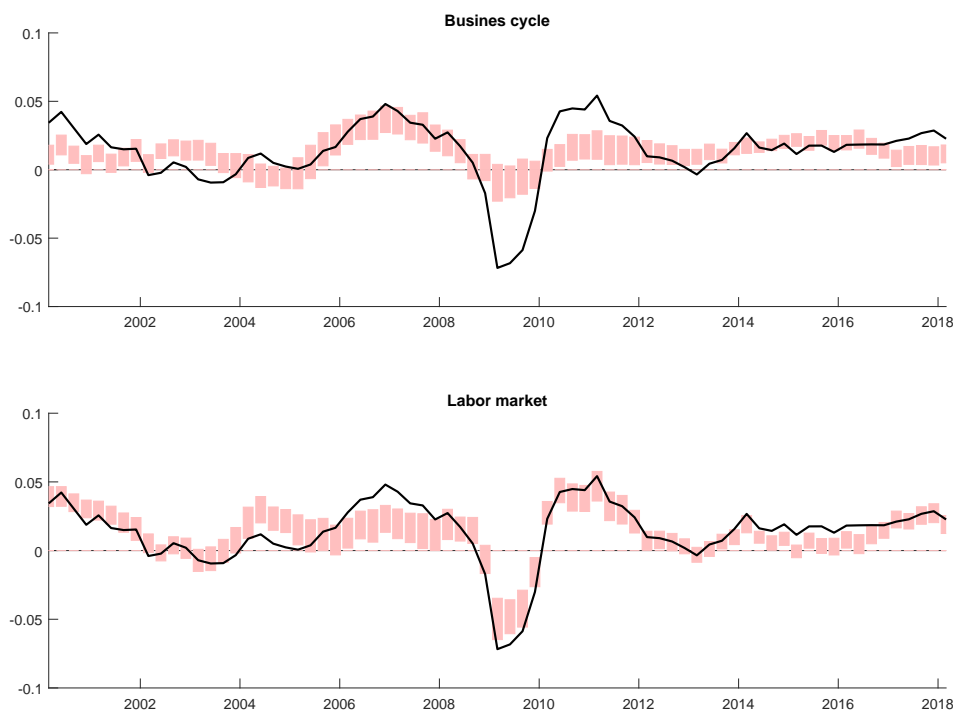
Two other observations are worthwhile to mention: First, the jump in 2005 was not due to wage bargaining shocks. Instead it was largely due to a labor supply shock that was an unintended side-effect of Hartz IV: certain groups of the population, who were not eligible for pre-reform benefits, registered for unemployment under the new regulation because they were eligible for post-reform benefits; these included in particular young adults up to the age of 25. Beyond that, municipalities had a strong interest in declaring as many pre-reform welfare recipients as possible fit for work, because it made them eligible for the post-reform benefits which were financed by the federal government ([Brenke 2010](#)). The second observation worthwhile to mention is that wage bargaining shocks, while accounting for much of the secular decline of unemployment, are not related to its small

hike during the Great Recession. This aspect of the German labor market miracle is discussed in the next section.

5 The Great Recession

The increase of unemployment in Germany during the Great Recession seems to be exceptionally low given the large output loss and compared to other countries like the US. [Gehrke, Lechthaler, and Merkl \(2018, fig. 1\)](#) visualize this phenomenon vividly. While GDP dropped by 5% in Germany in the first quarter of 2009, the maximum quarterly loss in the US was 2%. Meanwhile, unemployment soared from below 5% in the US before the crisis to almost 10% thereafter, while in Germany it increased only temporarily and by less than 1 percentage point.

Figure 7: Counterfactual output growth (yoy) absent the respective shocks
red bars: 16/84-quantiles; black solid line: realized values



To substantiate our argument here, we summarize the five structural shocks to two categories: business cycle shocks made up by demand and technology shocks, and labor market shocks, comprising the remaining shocks. How had GDP growth evolved in the absence of business cycle shocks, how had it evolved absent labor market shocks? According to Figure 7, the Great Recession was obviously a business cycle phenomenon. It was followed and preceded by economic expansions. These expansions, however, were very different in nature. The upswing that followed the recession was indeed a cyclical recovery, without strong positive business cycle impulses it would not have occurred. The growth acceleration before the crisis, however, was much more a labor market phenomenon. Absent business cycle impulses GDP growth had not been much below its realization. Hence, there was no business cycle upturn prior to the recession, which fits the muted development of business sentiment indicators observed by [Burda and Hunt \(2011\)](#). There was not a business cycle surprise contrary to firms' expectations, but rather a business cycle weakness in line with firms' expectations.

Apart from the cyclical recovery, also in recent years GDP growth is to a large extent driven by shocks originating from the labor market. Positive labor market innovations are responsible for a significant part of the long-lasting economic boom that followed the Great Recession. When excluding labor market shocks, GDP growth was barely higher than 1 per cent on a year-on-year basis at the end of the sample. To sum up, labor market shocks affect output growth in Germany to a large extent, but the Great Recession and the subsequent recovery were mainly business cycle phenomena. Going back to forecast error variance decompositions, we know that neither demand nor technology shocks have a large stake in accounting for the variation in unemployment, neither in the short nor in the long run. From these results we would *expect* a small increase of unemployment in response to a business cycle shock. But was it *unusually* low, compared to past experience? To answer this question, we return to the model estimated on the sample up to 1998. The forecast error variance decomposition is presented in Figure A3 in the appendix. In the short to medium run, the contribution of business cycle shocks to the variation of unemployment (~20%) is not substantially altered compared to the model estimated on the entire sample (~15%). From this observation we conclude that the Great Recession

is not driving these results and that the behavior of unemployment during the Great Recession was not substantially different from previous economic downturns. The Great Recession was “great” in the sense that the drop of GDP was substantial; in Germany even more so than in the US. But the relatively modest response of unemployment is in line with that.

We can conclude that the anomaly illustrated by [Gehrke, Lechthaler, and Merkl \(2018\)](#) is not an anomaly due to the Great Recession, but that it is a general difference in the response of unemployment to a business cycle shock in Germany and in the US. According to [Foroni, Furlanetto, and Lepetit \(2018\)](#) unemployment in the US is much more sensitive to business cycle variations: they account for 50-70% of the one-year forecast error variance of unemployment, compared to 15%-20% in Germany according to our results. A plausible explanation for this difference are short-time work arrangements, being much more common in Germany than in the US. Short-time work arrangements encourage firms that must or wish to reduce labor input (depending on whether they face a demand or technology shock, respectively) to do so on the intensive margin rather than on the extensive margin.

6 Conclusion

In this article we study the macroeconomic driving forces of the “German labor market miracle”, which includes the steady downward trend of unemployment since 2005 and the small response of unemployment to the Great Recession. We contribute to the existing literature by gauging the relevance of various factors within a consistent macroeconomic framework. Our results indicate that the decline of unemployment was not monocausal, but that wage moderation was the dominant driver. The effect of wage bargaining shocks was particularly pronounced right after the implementation of Hartz IV, which reduced wage replacement benefits and, hence, the reservation wage. Improved matching efficiency, targeted by other reform measures, in particular Hartz III, also contributed to the decline of unemployment. In addition, we identify shocks that are not related to labor market reforms. In particular, a shortage of labor supply helped to bring unemployment down.

While the Hartz reforms *raised* labor supply, other developments must have pushed it in the opposite direction; mostly likely demography. So far, however, the unemployment effects of the shrinking working-age population in Germany has been studied mostly with a regional focus (e.g. [Fuchs 2016](#)); future research on this is needed. We also find that wage moderation was not limited to the immediate aftermath of Hartz IV, it rather persisted far beyond the reform and the Great Recession. It seems that trade unions perceived wage moderation a worthwhile strategy because of its beneficial medium to long run effect on unemployment *and* wages. The sustainability of this effect is hard to reconcile on a national level and our results shows that the implementation of the monetary union could have indeed enhanced the positive real effects of wage moderation. The analysis on this issue remains, however, tentative. A model-based approach could provide more insights into the mechanisms of wage moderation within a monetary union and should be pursued in future research.

With respect to the Great Recession, we find that German unemployment did not respond significantly different than to previous business cycle downturns. Instead, the small impact of business cycle shocks at the extensive margin of labor is a general characteristic of the German economy and likely related to favorable labor market institutions, such as e.g. short-time work arrangements.

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Appendix

A1 Graphs

Figure A1: Wage shares, source: OECD

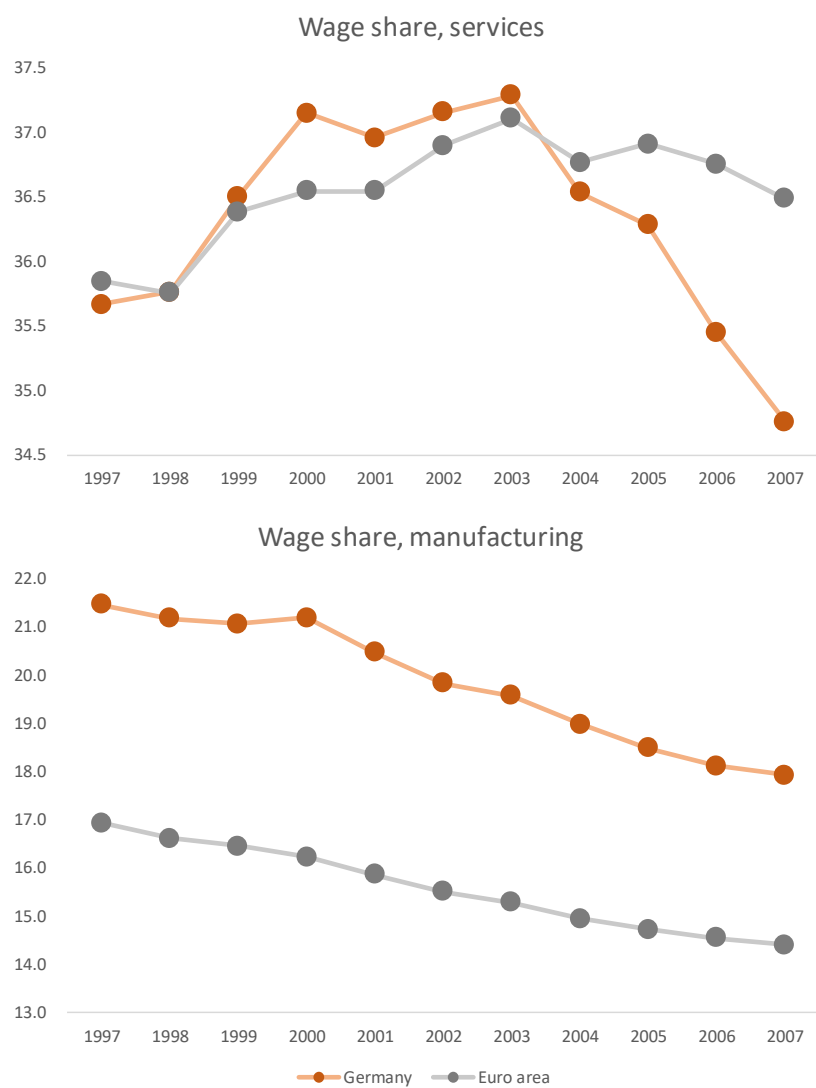


Figure A2: Impulse responses over 5 years, short sample (1970 – 1998)

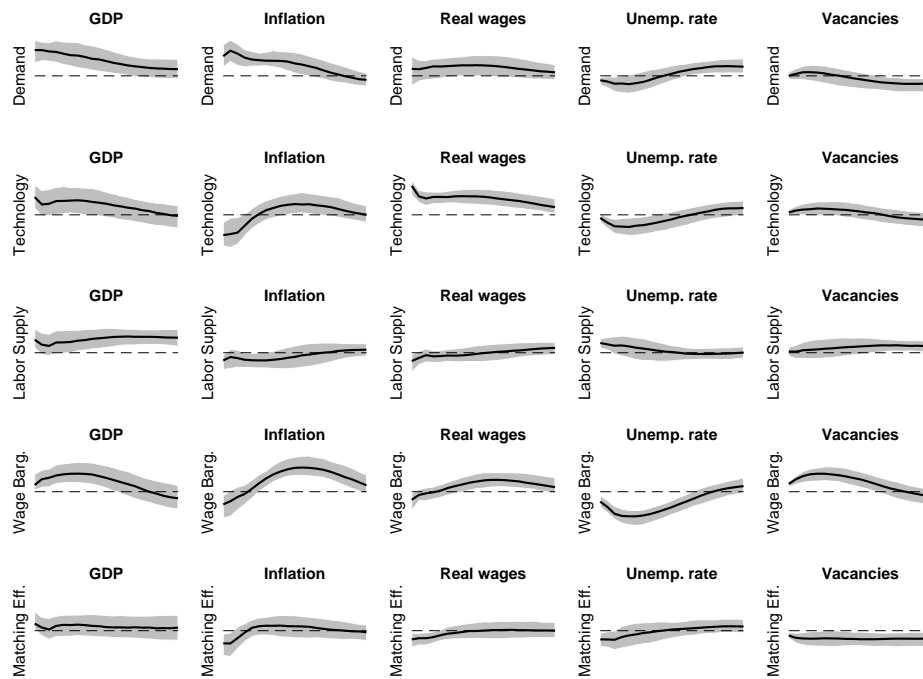


Figure A3: Forecast error variance decompositions over 5 years, short sample (1970 – 1998)

