Institute for Employment Research

The Research Institute of the Federal Employment Agency

IAB-Discussion Paper 2/2013

Articles on labour market issues

Patterns of unemployment dynamics in Germany

Daniela Nordmeier
Enzo Weber

ISSN 2195-2663

Patterns of Unemployment Dynamics in Germany

Daniela Nordmeier (IAB, University of Erlangen-Nuremberg)
Enzo Weber (IAB, University of Regensburg)

Contents

Abstract

This paper studies the patterns of unemployment dynamics in Germany. To provide a deeper insight into the margins of unemployment adjustment, we employ a structural VAR model and identify the effects of a technology shock as well as two policy shocks. We find that the worker reallocation process varies substantially with the identified shocks. The job finding rate plays a larger role following a technology shock and a monetary policy shock, while the separation rate appears as the dominant margin after a fiscal policy shock. Technology shocks are relatively important for variations in the transition rates, though they do not seem to trigger the high volatilities of German labor market variables. Considering policy shocks, our results point towards fiscal interventions as a promising instrument, but with several limitations.

Zusammenfassung

Die vorliegende Arbeit untersucht die Dynamik der Arbeitslosigkeit in Deutschland. Um einen tieferen Einblick in die Bestimmungsgründe der Schwankungen der Stromgrößen am Arbeitsmarkt zu gewinnen, verwenden wir ein strukturelles VAR-Modell und identifizieren die Effekte eines Technologieschocks sowie zweier Politikschocks. Unsere Ergebnisse zeigen, dass der Fluktuationsprozess mit den identifizierten Schocks variiert. Infolge eines Technologieschocks und eines geldpolitischen Schocks spielt die Einstellungsrate eine größere Rolle, während die Entlassungsrate nach einem fiskalpolitischen Schock als dominanter Faktor fungiert. Technologieschocks sind relativ bedeutend für die Schwankungen der Übergangsraten, wenngleich sie nicht die Ursache der hohen Volatilität von deutschen Arbeitsmarktvariablen zu sein scheinen. Die Analyse von Politikschocks deutet auf fiskalische Interventionen als vielversprechendes Instrument hin, jedoch mit diversen Einschränkungen.

JEL classification: J63, E24, E32

Keywords: Unemployment dynamics, transition rates, structural VAR, policy shocks

Acknowledgements: We would like to thank Shigeru Fujita, Hermann Gartner, Christian Merkl, Hans-Jörg Schmerer, Juuso Vanhala, and participants of the econometric seminar at the University of Regensburg for helpful comments.

1 Introduction

Unemployment dynamics receive substantial attention in business cycle research. Their net changes shape the adjustment of unemployment and are an important indicator of the economic situation. Thereby, a high magnitude of unemployment dynamics on the one hand implies labor market flexibility, but on the other hand creates considerable uncertainty.

The objective of this paper is to investigate the patterns of unemployment dynamics in Germany. The German case is attractive due to the availability of high-quality data and its labor market development, which is significantly different from the U.S. The primary aim is to provide a deeper insight into the worker reallocation process, i.e. the flows in and out of unemployment. For this purpose, we employ a structural VAR model and specify different shocks that are considered to play an important role for labor market fluctuations. These include a technology shock, a monetary policy shock and a fiscal policy shock.[1]

In Germany, the number of unemployed workers fluctuates by around 30.000 each month.[2] The underlying worker flows are about 20 times larger and do not only challenge policy-makers, but also theoretical approaches. Labeled as the Shimer (2005) puzzle, it is well-known that the empirical evidence on labor market fluctuations cannot be replicated by the canonical search and matching model. Consequently, a number of studies have stated shortcomings of the standard model, most prominently the assumption of an exogenous separation rate.

Several studies demonstrate the relevance of both the job finding rate and the separation rate to account for country-specific unemployment fluctuations. However, those studies are mainly based on unconditional analyses which provide only an overall picture regarding the prevalent margin of unemployment changes. Therefore, more recent studies emphasize the importance of switching to conditional analyses on shocks (see, e.g., Canova/Lopez-Salido/Michelacci, forthcoming; Balleer, 2012).

We disentangle different structural shocks in order to inspect whether the worker reallocation process depends on the underlying shock or is constant across shocks. In addition, some studies criticize the focus on productivity shocks in the search and matching literature (see, e.g., Barnichon, 2007). Accordingly, we overcome the single-shock assumption and enrich the discussion on the sources of unemployment dynamics by specifying demand-side impulses. However, we do not model the whole demand side of the economy, but we evaluate the role of technology shocks under the consideration of two specific demand shocks, i.e. a monetary policy shock and a fiscal policy shock.

The analysis of a technology shock corresponds to the standard search and matching model where changes in productivity are seen as the central source of unemployment dynamics. The empirical evidence on unemployment responses, however, is ambiguous.

[1] The choice of structural shocks is in line with Ravn/Simonelli (2008) who analyze the effects on labor market stock variables in the U.S. In contrast to Ravn/Simonelli (2008), however, we do not distinguish between neutral and investment-specific technology shocks as we focus on the extensive margin of labor adjustment. Investment-specific technology shocks have been proven to explain a major part of the dynamics of the intensive margin, i.e. hours worked (see also Fisher, 2006).

[2] Average change after seasonal adjustment over the time period 1991-2012.

For example, Canova/Lopez-Salido/Michelacci (forthcoming) find Schumpeterian features of neutral technology shocks in the U.S., i.e. unemployment increases after a positive technology shock. This observation clearly counters the traditional view in the search and matching literature where positive technology shocks are assumed to reduce unemployment.

The analysis of policy shocks, on the other hand, addresses the question of the usefulness of discretionary policy interventions for controlling unemployment dynamics. While the focus has often been on the effects of monetary policy, the interest in fiscal policy shocks has revived. Especially the recent financial crisis has shown that the use of monetary policy measures is limited when interest rates are low. Despite wide skepticism about the effects of fiscal policy, it is argued that governments would have been better able to fight the crisis if they had been able to adopt a more expansionary fiscal stance (see Blanchard/Dell'Aricca/Mauro, 2010). In addition, for Germany as a member state of the European Economic and Monetary Union (EMU), decisions on monetary policy are made on a supranational level. As those decisions may not necessarily reflect the domestic situation, fiscal policy may be more relevant for stabilizing national unemployment fluctuations.

Taking into account two specific demand shocks, our paper extends the study of Bachmann/Balleer (2011) who compare the effects of technology shocks for the U.S. and Germany. Interestingly, the authors find significant cross-country differences in responses to a positive technology shock. In Germany, unemployment increases due to a rise in the separation rate, and in the U.S., unemployment increases due to a fall in the job finding rate. Accordingly, Bachmann/Balleer (2011) conclude that non-technology shocks, such as demand shocks, are necessary to understand the overall dynamics of unemployment.

Moreover, our analysis is related to several studies on the worker reallocation process in the U.S. For example, Braun/Bock/DiCecio (2009) analyze the responses of labor market variables to different types of shocks. They find qualitatively similar results across shocks, where the responses of the job finding rate determine unemployment changes. Demand shocks induce less persistent effects compared to supply shocks, but seem to be more important. When they directly compare technology and monetary policy shocks, Braun/Bock/DiCecio (2009) identify a higher contribution of monetary policy shocks. Also related to our study is Fujita (2011) who shows that quick responses of the separation rate and a hump-shaped behavior of the job finding rate are robust features with respect to several specifications.

While the worker reallocation process in the U.S. seems to be independent from the underlying type of shock, our results show interesting differences for Germany. Most notably, the job finding rate is the prevalent margin after a technology shock and a monetary policy shock, while the separation rate appears as the driving force after a fiscal policy shock. In addition, technology shocks are relatively important for variations in the transition rates, though they cannot explain the high volatilities on the German labor market. The consideration of policy shocks points towards fiscal interventions as a promising instrument for controlling unemployment dynamics. However, our analysis identifies several limitations as well, such as a short-lived influence of government spending shocks. We argue that the persistence of shocks seems to be relevant to account for unemployment dynamics.

The paper is structured as follows: Section 2 describes our data on German worker flows. Section 3 outlines the empirical approach including the model specification and the estimation procedure. The benchmark results are presented in Section 4. Section 5 provides several robustness checks regarding data issues and model assumptions. In Section 6, we investigate the subsample stability. The conclusion follows in Section 7.

2 Data Description

While we use official data to obtain the structural shocks of interest, we generate worker flows from the Sample of Integrated Labor Market Biographies (SIAB). The SIAB is a 2% random sample of all German residents who are registered by the Federal Employment Agency (*Bundesagentur für Arbeit*) due to the administration of the unemployment insurance and benefit systems. In contrast to survey data, the administrative data faces neither sample attrition nor sample rotation problems and provides the individuals' labor market status on a daily basis, which is important to measure worker flows without a time aggregation bias.[3] This yields a considerable advantage over commonly used U.S. data.

Worker flows are calculated as the number of transitions between employment and unemployment within a month. Employment is measured as employment subject to social security, and thus excludes, e.g., self-employment, apprenticeships or marginal jobs. Unemployment is measured by benefit receipt. According to Fitzenberger/Wilke (2010), we also correct for specific periods without benefit receipt that are likely to constitute times of sanctions or may result from the expiration of entitlements.[4]

The worker flows are defined by their underlying transition hazard rates as these are interpreted as the driving forces of unemployment dynamics. Accordingly, the monthly job finding rate (f) and separation rate (s) satisfy

$$f_t = \frac{(\sum_{s=1}^{S} UE_s)_t}{U_{t-1}} \qquad \text{and} \qquad s_t = \frac{(\sum_{s=1}^{S} EU_s)_t}{E_{t-1}} \tag{1}$$

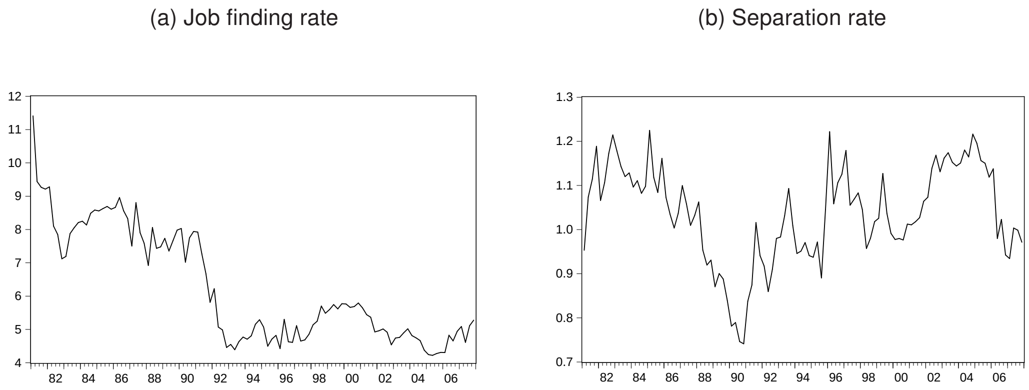
where t denotes the 10th day of a month and S denotes the number of days since the 10th day of the previous month. To account for a structural break due to the German reunification, the time series are backward adjusted in 1993. Then, the transition rates are adjusted for seasonality and represented by their quarterly averages. The latter is necessary to obtain data at the same frequency as the official data that we use to specify the structural shocks.

Figure 1 shows the transition rates during the sample period 1981-2007. The job finding rate declines from over 10% to around 5%. In other words, the average unemployment duration between two socially secured jobs has increased from under 1 year to almost 2

3 Nordmeier (2012) analyzes monthly reversed worker flows in Germany and finds that point-in-time measurements do underestimate not only the level of total worker flows but also their cyclical movements.

4 More details on data selection and measurement are given in Nordmeier (2012).

Figure 1: Transition rates



Note: Quarterly averages of monthly data.

years. This, in turn, implies a substantial increase of long-term unemployment. According to our definition, the share of long-term unemployed accounts for around 50% after the reunification.[5] The separation rate fluctuates around 1% throughout the sample period. Hence, a job that is subject to social security lasts on average about 8 years. In addition, the transition rates display different movements on business cycle frequency. While the job finding rate adjusts quite gradually, the separation rate depicts relatively sharp variations. The latter holds, for example, for the drop in the late 1980s (which does not result from the statistical break at the German reunification).

3 Empirical Model

We employ a structural VAR model to analyze macroeconomic fluctuations in a framework that requires a minimum of theoretical assumptions. Hence, this tool enables us to address several ongoing discussions concerning the sources and patterns of unemployment dynamics.

Our empirical approach proceeds as follows. First, we specify the VAR model and identify different structural shocks that are considered to play an important role for labor market dynamics. These include a technology shock, a monetary policy shock and a fiscal policy shock. Then, we describe our estimation procedure and derive the conditional unemployment response.

[5] Obviously, this number is higher than official numbers on long-term unemployment because our unemployment definition also includes workers who are marginally attached to the labor force. See Jones/Riddell (1999) for a classification of nonemployment. Accordingly, our unemployment measure corresponds rather to the “desire of work” criterion than the typical “job search” criterion.

3.1 VAR Specification

We consider the following reduced-form VAR model:

$$y_t = \mu + A(L)y_{t-1} + \nu_t, \tag{2}$$

where y_t is a vector of the endogenous variables, μ denotes a vector of constants, $A(L)$ is a lag polynomial of order p, and ν_t captures the residuals. In our benchmark specification, the included variables are changes in government spending (Δg_t), changes in labor productivity (Δa_t), the separation rate (s_t), the job finding rate (f_t) and the interest rate (r_t). For exact definitions of the included variables see Table A.1. The ordering of the variables may support the identifying restrictions towards a nearly triangular identification scheme.

The use of first differences follows from unit root tests which are presented in Table A.2. The augmented Dickey-Fuller (ADF) test indicates a nonstationary behavior of government spending and productivity. However, we do not impose the nonstationarity assumption on the job finding and separation rates but leave it to the system estimation to identify a unit root or not. This has the advantage of allowing a flexible decision. In case of nonstationarity, the VAR model would still be consistently estimated (see, e.g. Sims/Stock/Watson, 1990).

3.2 Identification of Shocks

As the innovations ν_t from a reduced-form VAR are typically correlated, interpreting them as structural shocks would be misleading. Therefore, we need to impose identifying restrictions on the reduced-form residuals which allow us to disentangle structural shocks in the variables. To do so, we include a matrix B that relates the structural shocks to the reduced-form innovations

$$\nu_t = B\epsilon_t, \tag{3}$$

where $\epsilon_t \sim (0, \Sigma_\epsilon)$ summarizes the structural shocks and B describes the immediate effects of the shocks on the variables y_t. The structural shocks are assumed to be orthogonal with unit variance, i.e. $\Sigma_\epsilon = E(\epsilon_t, \epsilon_t') = I$, following the convention in the literature.

Our aim is to provide evidence on unemployment dynamics in response to economically well-founded shocks. Therefore, we base our analysis on standard identifying restrictions. In doing so, we distinguish between long-run restrictions for the technology shock and short-run restrictions for the two policy shocks. Short-run restrictions contain assumptions about contemporaneous relations between shocks and variables, and thus are imposed on matrix B. In contrast, long-run restrictions are imposed on the impulse responses (see Appendix B).

The technology shock ϵ^a is identified as a neutral technology shock. According to Gali (1999), we allow only technology shocks to have a permanent impact on productivity. In other words, we assume that the unit root in productivity exclusively results from technology shocks and the long-run effects of all other shocks are zero. However, other shocks can affect productivity temporarily through its interdependency with policy and labor market variables. Such transitory impacts can be quite substantial.

The identification of the monetary shock ϵ^r follows Christiano/Eichenbaum/Evans (1996). Accordingly, the monetary authority can react to other structural shocks immediately, but the intervention works only with a one-period time lag. Hence, the monetary shock cannot influence other variables within the same period. We further assume that the monetary authority has a direct influence on the interbank money market rate.

The fiscal policy shock describes a shock in government spending. Following Blanchard/Perotti (2002), we identify the government spending shock ϵ^g by assuming that the government reacts to other shocks only with a one-quarter implementation lag. Hence, government spending depends on its own history and on lagged values of other variables, but not on unexpected movements in any other variable. Put differently, government spending is predetermined.

3.3 Estimation

The combination of short-run and long-run restrictions leads to a non-recursive structure in our structural VAR model, and thus prevents an ordinary least square estimation. Therefore, we estimate our model with the maximum likelihood (ML) method by making use of the Newton algorithm.

Once we obtain the results of the ML estimation, we apply a residual-based bootstrap procedure and run 1000 replications to compute confidence intervals for the impulse response functions. We also adopt the median from the empirical bootstrap distribution as the point estimates may be biased in small samples (compare also Canova/Lopez-Salido/Michelacci, forthcoming).

Given the bootstrapped impulse responses of the transition rates, we follow Fujita (2011) and trace the unemployment response based on the law of motion. In general, a change in unemployment is given by the sum of its in- and outflows. In our two-state environment, the unemployment response satisfies

$$\Delta u_t = -\tilde{f}_t u_{t-1} + \tilde{s}_t e_{t-1}, \tag{4}$$

where $\tilde{f}_t, \tilde{s}_t$ denote the conditional transition rates and $e_t = (1 - u_t)$.

The starting point of the law of motion is the steady state unemployment rate

$$u_0 = u^* = \frac{\bar{s}}{\bar{f} + \bar{s}}, \tag{5}$$

where $\bar{f}, \bar{s}$ indicate the sample average of the transition rates.

The conditional development of the job finding and separation rates are received by transforming their impulse responses into levels

$$\tilde{f}_t = \bar{f} + \psi^f_{e,t} \qquad \text{and} \qquad \tilde{s}_t = \bar{s} + \psi^s_{e,t}, \tag{6}$$

where the sample averages $\bar{f}, \bar{s}$ again represent the baseline value and $e \in [\epsilon^a, \epsilon^g, \epsilon^i]$ describes the structural shock of interest.

It is worth noting that this procedure neglects any flows in and out of the labor force, and thus provides the *pure* response of the unemployment rate arising from the worker reallocation process within the labor force.

4 Results

Our benchmark results are based on a lag order of p=2. The choice of the lag order follows different selection criteria (see Table A.3). Considering the variation along with the maximum number of lags, the chosen lag structure satisfies most criteria.

In what follows, we present the conditional worker reallocation process and the corresponding unemployment adjustment as obtained by the impulse responses. Afterwards, we decompose the variance of the forecast error and discuss the importance of the different shocks for the transition rates.

4.1 Impulse Responses

Impulse responses illustrate the dynamic reaction of a variable to a structural shock. The impulses are normalized to a unit increase in the underlying variable. The responses of the labor market variables are presented in percentage points; Table A.4 gives the steady state values.

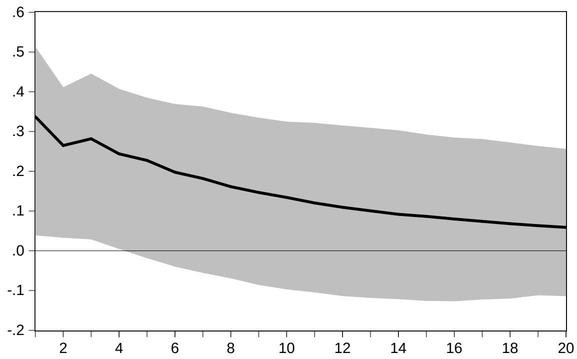
Technology shock. Figure 2 shows the dynamic responses to a technology shock. A positive technology shock leads to an increase in the job finding rate and a decline in the separation rate. Accordingly, the unemployment rate goes down. The response of the job finding rate is significant for 4 quarters, while the response of the separation rate is borderline significant. Hence, the technology shock seems to work primarily along the job finding margin. This observation corresponds to the standard set-up of the search and matching model, where the transmission mechanism of a productivity change is modeled by a matching function.[6] Nevertheless, the separation rate does demonstrate a reaction which supports the postulation of an endogenous separation margin in theoretical approaches.

The reduction in the unemployment rate is in line with the traditional view of the Real Business Cycle (RBC) theory that has strongly influenced the search and matching model.[7] A positive productivity shock raises the expected profits from a match so that firms will post more vacancies. As unemployment is predetermined, the rise in vacancies leads to a

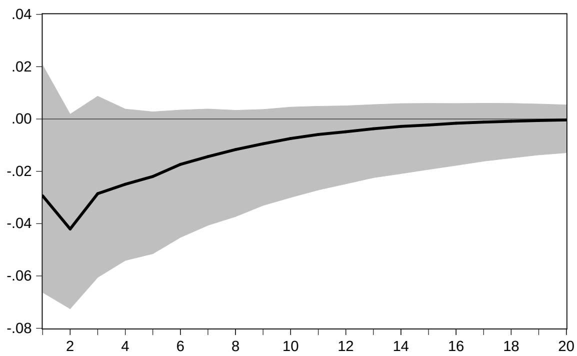
[6] Under standard assumptions, the job finding rate is a function of labor market tightness.
[7] See, e.g., Merz (1995) for an integration of the search and matching approach in an RBC model.

Figure 2: Responses to a technology shock

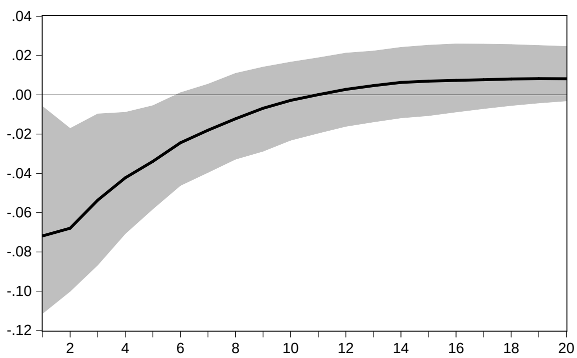
(a) Job finding rate



(b) Separation rate



(c) Unemployment rate



Notes: Impulse responses to a one-off increase in productivity. The abscissa accounts for the quarters after an impulse. The black line shows the median from bootstrapping and the grey area demonstrates the 90% confidence interval. Benchmark sample 1981-2007.

higher market tightness and, according to the matching function, to a higher job finding rate. This, in turn, will reduce unemployment. The fall in unemployment will then counter the increased job finding rate via the matching function in subsequent periods. In general, the variables adjust gradually to the steady state after a one-off increase in productivity.

In terms of magnitude, the unemployment rate shows a relatively resilient response. A one percent increase in productivity leads to a 0.07 percentage point reduction of unemployment, which is 0.5% of the baseline value. In contrast, the transition rates react more sensitively to a technology shock. The impact effects amount 5.4% in case of the job finding rate and 2.8% in case of the separation rate.[8] Considering that a one percent increase in productivity is of plausible magnitude,[9] the technology shock fails to account for the unconditional volatilities on the German labor market. This, in turn, reinforces the critique on the single-shock assumption when analyzing unemployment dynamics.

Monetary policy shock. Figure 3 presents the dynamic adjustment process after a contractionary monetary policy shock. The monetary impulse triggers hump-shaped responses in the job finding rate and the unemployment rate. The job finding rate decreases significantly after 4-9 quarters in response to a rise in the interest rate and then adjusts gradually to the steady state. The behavior of the unemployment rate mirrors the response of the job finding rate, though it is slightly smoothed by the reaction of the separation rate. The separation rate responds with a temporary drop and increases after 6 quarters according to the contractionary impulse. The influence on the separation rate, however, is low and insignificant. Consequently, a monetary policy shock appears to be transmitted to unemployment through its impact on the job finding rate.

A hump-shaped pattern after a monetary policy shock has been documented by several studies. Interestingly, the velocity of the adjustment process seems to depend on the underlying labor market structure. For example, Islas-Camargo/Cortez (2011) observe a maximum effect of monetary policy shocks on Mexican unemployment after only 3 quarters. They explain this result by the existence of a large informal sector and schemes that have led to more employment flexibility. In contrast, Ravn/Simonelli (2008) find a peak effect on U.S. unemployment after 6 quarters and Alexius/Holmlund (2008) report a maximum increase in Swedish unemployment after 9 quarters. Our results for Germany show a peak effect on unemployment after 7 quarters. Accordingly, the degree of labor market regulation tends to increase the persistence of responses to monetary policy shocks.

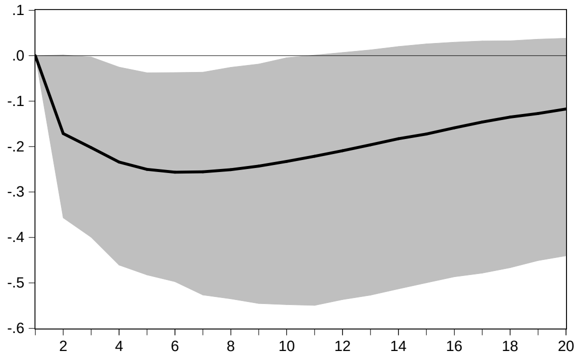
The effects of a monetary policy shock are smaller than those of a productivity shock. A unit increase in the interest rate leads to a maximum reduction in the job finding rate by around 0.26 percentage points, which corresponds to 4.2% of its baseline value. The

8 Gartner/Merkl/Rothe (2012) explain the high volatility of German worker flows by large hiring costs and low quit rates. Using a labor-selection model with worker-firm specific productivity shocks, they demonstrate that those factors depress the level of the transition rates and thereby increase their sensitivity to aggregate shocks.

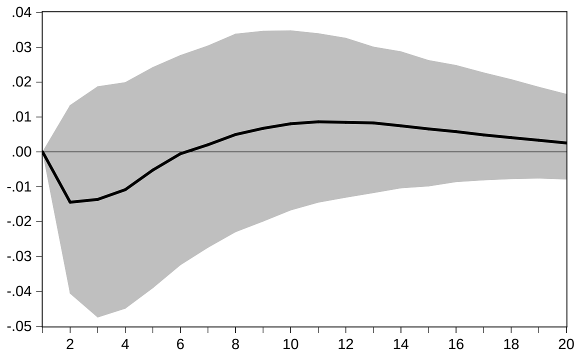
9 A one percent increase in productivity resembles the standard deviation of its cyclical component. For example, Gartner/Merkl/Rothe (2012) report a standard deviation of 1.3% by computing the log deviation from the HP-trend with $\lambda = 10^5$. Using the standard smoothing parameter of $\lambda = 1600$, we observe a standard deviation of 0.7%.

Figure 3: Responses to a monetary policy shock

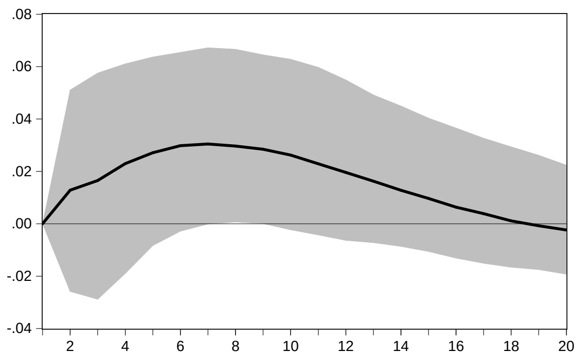
(a) Job finding rate



(b) Separation rate



(c) Unemployment rate



Notes: Impulse responses to a one-off increase in the interest rate. The abscissa accounts for the quarters after an impulse. The black line shows the median from bootstrapping and the grey area demonstrates the 90% confidence interval. Benchmark sample 1981-2007.

maximum increase in the unemployment rate amounts to 0.03 percentage points, which is half the impact effect of the technology shock. Taking into account that the changes in key interest rates are around 0.25-0.5 percentage points, the effects appear even smaller.

Fiscal policy shock. The effects of a fiscal policy shock are plotted in Figure 4. In the impact period, the variables show the expected reactions to a rise in government spending. The job finding rate goes up, the separation rate goes down and, as a result, the unemployment rate shrinks. Interestingly, the job finding rate decreases after the positive impact effect, and then returns sluggishly to its baseline value. At first glance, the negative side-effect might indicate a Ricardian behavior, and thus the general skepticism about the effects of fiscal policy. Based on Ricardian equivalence arguments, the increase in government spending is likely to lead to a future rise in distorting taxes, and thereby to lower profits. In turn, firms will reduce their labor demand and the job finding rate will decrease. However, the negative effect on the job finding rate is rather borderline insignificant and should not be overstated.

Except for the negative side-effect on the job finding rate, the government spending shock tends to have a short-lived influence only. Nevertheless, a rapid adjustment process after a fiscal policy shock seems to be characteristic for Germany. For example, Bode/Gerke/Schellhorn (2006), Tenhofen/Wolff/Heppke-Falk (2010) and Baum/Koester (2001) show short-run effects of both government spending and revenue shocks on German GDP. Instead, Ravn/Simonelli (2008) document rather hump-shaped effects of a fiscal policy shock on U.S. output and labor market variables, with peak effects after 3 years.

Since the positive impact effect on the job finding rate is insignificant, the fall in the unemployment rate can be mainly ascribed to the separation margin. This observation, however, challenges the conclusion of Turrini (2012). For highly regulated labor markets in OECD countries, Turrini (2012) reports a dominant role of the job finding rate after a fiscal policy shock.[10] In other words, the result of Turrini (2012) implies that a fiscal policy shock tends to influence the average unemployment duration. Our result implies an impact on job stability, though Germany has a relatively strict employment protection. However, when firms are aware of the vanishing character of fiscal stimulus, search frictions may hinder a temporarily capacity extension along the job finding margin and fixed-term contracts may help to overcome employment protection after a negative impulse.

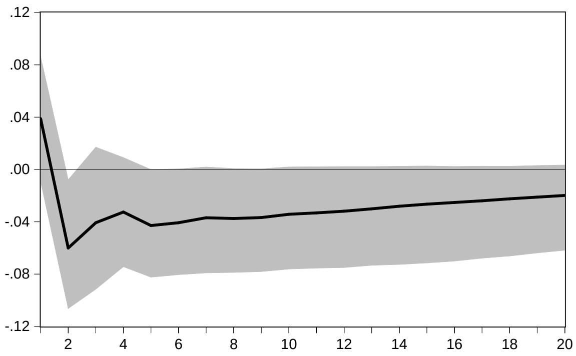
The size of the responses underpins the dominant role of the separation rate. On impact, a one percent increase in government spending reduces the separation rate by 0.013 percentage points and 1.2% of its baseline value, respectively. In contrast, the government spending shock raises the job finding rate by 0.4 percentage points, which corresponds to 0.6% of the sample average. The government spending shock, thus, can generate a small amplification effect on the separation rate, but not on the job finding rate. The impact multiplier with respect to unemployment is only 0.1.[11]

[10] Note that Turrini (2012) uses an action-based variable on fiscal consolidation. As this measure does not include cyclical movements, it can be seen as exogenous.

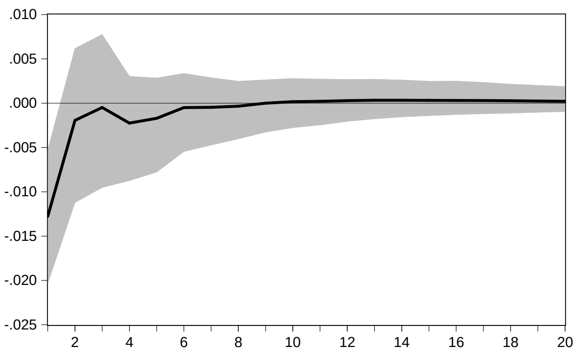
[11] In fact, the returned interest in fiscal policy has also revived the debate on fiscal multipliers. Monacelli/Perotti/Trigari (2010) analyze fiscal multipliers with respect to labor market variables and demonstrate that wage rigidity may dampen the size of unemployment multipliers.

Figure 4: Responses to a fiscal policy shock

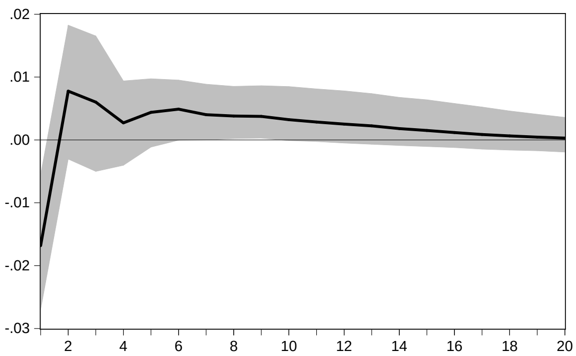
(a) Job finding rate



(b) Separation rate



(c) Unemployment rate



Notes: Impulse responses to a one-off increase in government spending. The abscissa accounts for the quarters after an impulse. The black line shows the median from bootstrapping and the grey area demonstrates the 90% confidence interval. Benchmark sample 1981-2007.

To sum up, the transmission channel to unemployment responses varies significantly with the identified shocks. The job finding rate turns out to be the driving force of unemployment responses after a technology shock and a monetary policy shock, whereas the separation rate seems to be the dominant margin in case of a fiscal policy shock. Differences occur also in the timing and the velocity of the adjustment process. The effects of the technology shock emerge on impact and remain significant for over 1 year. In contrast, the monetary policy shock reaches its peak effect after 1,5 years, while the influence of a fiscal policy shock vanishes rapidly. These patterns indeed can be reconciled with the stylized fact that fluctuations of the job finding rate are more persistent than those of the separation rate.

4.2 Forecast Error Variance Decomposition

The variance decomposition of the forecast errors reveals the relevance of the shocks for movements in the different variables. This provides information over and above impulse responses, which display dynamic reactions to hypothetical shocks. Notice that the interpretation of the variance decomposition is restricted to the *relative* importance of the identified shocks as the forecast errors depend substantially on the underlying VAR system.

Table 1 gives the proportions of variations in the transition rates due to the different structural shocks. It can be seen that the three shocks account for about 40% of the forecast error variance in the job finding rate and about 30% of the forecast error variance in the separation rate. Thereby, the technology shock plays a prevailing role.[12] However, the relative contribution of the technology shock compared to the two policy shocks diverges over time.

In case of the job finding rate, the technology shock shows a maximum contribution of 41% after 4 periods and then decreases to 32% over the 5-year forecast horizon. At the same time, the contributions of both policy shocks increase. In particular, the monetary policy shock explains up to 8%. The different developments can be related to the different shapes of the impulse responses. While the technology shock has its maximum effect on impact, the monetary policy shock reaches its peak effect on the job finding rate only after around 1,5 years. Accordingly, the cumulative effect of the monetary policy shock arises at longer forecast horizons. The fiscal policy shock accounts for about 6% in the long-run.

In contrast, the importance of the technology shock for movements in the separation rate increases steadily at shorter forecast horizons and then remains nearly unchanged. The monetary policy shock does hardly contribute to fluctuations in the separation rate, while the fiscal policy shock matters in the short-run due to its sharp impact effect. In the first forecast period, the fiscal policy shock is nearly as important as the technology shock.

[12] Note that the difference to unity captures the contributions of exogenous disturbances in the transition rates themselves.

Table 1: Forecast error variance decomposition

	Job finding rate			Separation rate		
Forecast horizon	Techn. shock	Monet. shock	Fiscal shock	Techn. shock	Monet. shock	Fiscal shock
1	0.365	0.000	0.022	0.120	0.000	0.103
2	0.388	0.012	0.048	0.227	0.003	0.065
3	0.403	0.020	0.047	0.239	0.005	0.052
4	0.406	0.030	0.044	0.251	0.006	0.048
5	0.402	0.038	0.047	0.260	0.006	0.045
6	0.394	0.046	0.048	0.266	0.006	0.043
7	0.386	0.053	0.049	0.269	0.006	0.042
8	0.377	0.058	0.051	0.271	0.006	0.041
9	0.369	0.063	0.052	0.273	0.006	0.041
10	0.361	0.066	0.053	0.274	0.007	0.041
11	0.354	0.070	0.054	0.275	0.007	0.040
12	0.347	0.072	0.054	0.275	0.008	0.040
13	0.342	0.074	0.055	0.275	0.009	0.040
14	0.336	0.076	0.055	0.275	0.009	0.040
15	0.332	0.077	0.056	0.275	0.010	0.040
16	0.328	0.078	0.056	0.275	0.010	0.040
17	0.324	0.079	0.056	0.275	0.010	0.040
18	0.321	0.079	0.057	0.275	0.010	0.040
19	0.319	0.080	0.057	0.275	0.010	0.040
20	0.316	0.080	0.057	0.275	0.010	0.040

Note: Based on medians from bootstrapping.

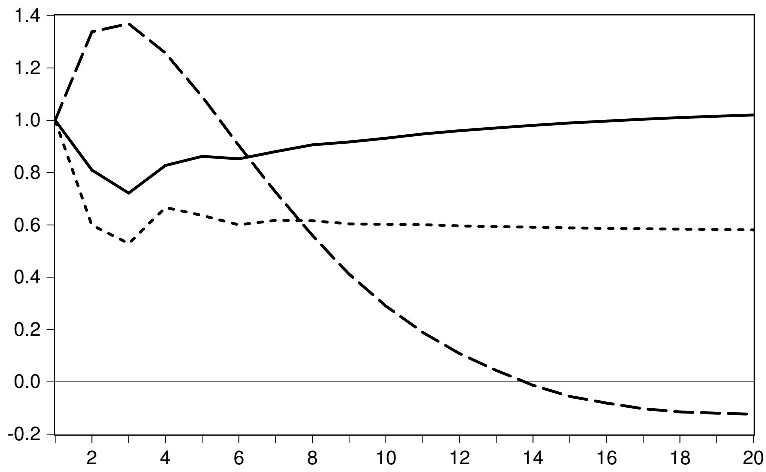
4.3 Discussion

Our results show that the worker reallocation process in Germany does not proceed independently from the underlying type of shock. In particular, the impulse responses indicate that the significance of the transition rates varies with the identified innovations. The forecast error variance decomposition exhibits the different adjustment processes by a changing relevance of the structural shocks over time. This might suggest a role for the persistence of shocks to understand the conditional patterns of unemployment dynamics.

Figure 5 shows the impulse responses of productivity, interest rate and government spending to their own shocks. The impulse responses are equivalent to the movements of the variables conditional on the individual shocks. Indeed, these movements differ substantially in the degree of persistence. Thereby, we call a process persistent if it takes a long time until it reaches a new steady state. Clearly, this process is finished quite quickly for government spending. Compared to that, productivity adjusts with moderate persistence. The adjustment of the interest rate is most long-lasting. The impression of a differing persistence in the adjustment mechanisms is supported by the coefficients for the first-order autocorrelation of the conditional movements (see Table A.5).

Moreover, Table A.5 provides the correlations between those variables and the transition

Figure 5: Adjustment mechanisms



Note: The solid line shows the adjustment of productivity, the dashed line the adjustment of the interest rate and the dotted line the adjustment of government spending.

rates based on the different shocks. Interestingly, the separation rate shows constantly higher cross-correlations in absolute values than the job finding rate, indicating that the separation margin is more sensitive to contemporaneous changes. Nevertheless, those contemporaneous relations have turned out to be less significant in case of a technology shock and a monetary policy shock, which induce more persistent patterns.

In fact, several authors emphasize the role of persistence for the dynamic responses of labor market variables. For example, Mayer/Moyen/Stähler (2010) and Kato/Miyamoto (2013) demonstrate that the degree of persistence of government spending shocks strongly influence the response of unemployment. Mayer/Moyen/Stähler (2010) find that the sign of the unemployment response changes once they assume a serially uncorrelated shock. Kato/Miyamoto (2013) explicitly incorporate an endogenous role of the separation margin and show higher impact multipliers than with assuming an exogenous separation rate, but they also find that the magnitude of labor market responses decreases the less persistent government spending shocks are. Moreover, a lower persistence of government spending shocks accelerate a negative side-effect on the job finding rate.

Recall that the worker reallocation process in the U.S. has been found to be similar across shocks. Here, the hump-shaped behavior of the job finding rate dominates the sharp responses of the separation rate, which, in turn, explains the conditional patterns of labor market stock variables (see Braun/Bock/DiCecio, 2009; Fujita, 2011; Ravn/Simonelli, 2008). Accordingly, our results may suggest that shocks in the U.S. tend to trigger more persistent adjustment mechanisms than in Germany and that differences in the reactions to specific shocks are less pronounced.

5 Robustness Analysis

This section reconsiders the foregoing results along the following dimensions. First, we address some data issues such as the indicated nonstationarity of the transition rates and their trending behavior. Then, we proceed by modifying the lag length and inspect the identifying assumptions. Afterwards, we examine technology shocks in a small VAR as done by previous studies.

Unit Roots. When variables appear to be integrated, it is not necessary to impose the unit root, as the estimation of a nonstationary VAR yields consistent parameters. In case of an incorrect restriction the model would be misspecified and the estimation results are likely to be biased. However, if the restriction is correct, the estimation would gain in more efficient parameters.

As the ADF test cannot reject the null hypothesis of nonstationary for the job finding rate, we check our results by including the job finding rate in first differences. In addition, we also assume a unit root in the separation rate, though the null hypothesis can be rejected at the 5% significance level. Nevertheless, redoing the unit root test by allowing for a higher lag structure, as assumed in the VAR model, points more to an integrated separation rate.[13]

The results show only slight changes. After a technology shock, the responses of the job finding rate and unemployment rate are less significant. The response of the separation rate to a contractionary monetary policy shock turns out strictly positive, though still insignificant. Accordingly, the unemployment response becomes more significant after the monetary policy shock. These changes, however, do not affect the implications of our benchmark estimation.

Structural Break. Although the transition rates have been adjusted for the German reunification, the striking movement in the early 1990s suggests an investigation of their trend behavior. A closer look on the development of the German Beveridge curve reveals a substantial right shift in 1991 since many workers became unemployed when Eastern Germany was transformed towards a market economy (see Klinger/Weber, 2012). If a significant number of those workers moved to the Western part to enhance their re-employment probability, the registration at Western German employment agencies would indeed trigger a downward shift in the Western German job finding rate.

A Chow test indicates a structural break in the job finding rate in 1991Q3. Once we include a shift dummy for the job finding rate, we obtain lower and less persistent impulse responses. However, the signs and shapes of the benchmark results appear to be robust. In addition, the changes are countered if we also consider a shift dummy for the separation rate as suggested by the Chow test.

Cyclical Components. An alternative procedure to treat low-frequency movements is to use a detrending method. In particular, Fernald (2007) demonstrates that VARs with long-run restrictions are sensitive to low-frequencies. Even if low-frequency movements do not

[13] Further evidence may come from Klinger/Weber (2012).

reflect a unit root, they can be problematic. Therefore, Fernald (2007) recommends to check the results by using alternative detrending methods.

Especially the job finding rate displays a notable trend behavior. In the first part of our sample period, the job finding rate exhibits a reduction of more than one half of its initial value in 1981. In general, declining labor market dynamics may have several reasons. For example, changes in the composition of the labor force, such as aging, is a prominent explanation.[14] Other explanations include a fall in outside wage offers or a rise in mobility costs.

Against the background of the debate initiated by Shimer (2005), we use the Hodrick-Prescott (HP) filter to remove the trending behavior in the transition rates.[15] This specification of the transition rates may be interpreted as the underlying business cycle component.[16] The general pattern of our benchmark results is unchanged. Interestingly, the responses to a technology shock become insignificant, whereas the positive impact effect of the government spending shock on the job finding rate turns out to be significant. This might indicate that technology shocks are more important for low-frequency movements and that government spending shocks rather affect high-frequency variations, which could be a valuable path for future research. Moreover, the negative side-effect of the fiscal policy shock on the job finding rate nearly disappears.

Lag Length. We also re-estimate our benchmark model with a higher lag length of p=4 as suggested by three selection criteria.

Allowing for a more complex adjustment process leads to more persistent responses with slightly lower impact effects. In general, the responses are less significant (which is not surprising in view of the higher number of parameters) and the negative response of the job finding rate to a government spending shock again turns out less pronounced. Nevertheless, the key results remain unchanged.

Identifying Assumptions. So far, we have assumed that government spending does not react contemporaneously to unexpected changes in any other variable. This assumption is convincing as long as the government spending measure does not include transfer payments such as unemployment benefits. Nevertheless, the government spending measure may capture some other unemployment-related subsidies that are counted as public consumption.

In 2011, for example, the unemployment-related government consumption amounts 4.39 billion Euro, i.e. around 0.9% of overall government consumption.[17] Therefore, we relax our assumption and allow for non-zero effects of exogenous disturbances in the transition

[14] However, Fujita (2012) shows for the U.S. separation rate that aging cannot account for the whole decline that has been observed for over three decades.

[15] We use the standard smoothing parameter of $\lambda = 1600$.

[16] See Cogley/Nason (1995) for a critical view on the HP-filter. These authors argue that the HP-filter can generate a spurious cycle when a time series is integrated.

[17] See Statistisches Bundesamt (2012).

rates. Accordingly, innovations in government spending result as

$$\nu_t^g = b_{11}\epsilon_t^g + b_{13}\epsilon_t^s + b_{14}\epsilon_t^f, \tag{7}$$

where b_{13} and b_{14} denote the automatic responses to shocks in the transition rates. At the same time, this modification leads to an exact identification of our VAR model, and thus reconsiders the overidentification issue in our benchmark specification. However, the responses of our benchmark estimation are unchanged as the modified assumption primarily affects the shocks in the transition rates.

Small VAR. To relate our results to previous evidence, we also re-estimate our VAR model by identifying a productivity shock only, i.e. $y_t = [a_t, s_t, f_t]'$. Accordingly, we have to impose two long-run restrictions to identify the technology shock and one short-run restriction to disentangle the innovations in the transition rates. Hence, this specification satisfies an exact identification as well.

The results show that our benchmark estimation is robust with respect to the technology shock. In particular, the signs and magnitude of the impulse responses do not change once we exclude other variables. However, the full specification gives a more comprehensive picture of the sources of unemployment dynamics.

6 Subsample Analysis

In this section we investigate the subsample stability of the preceding results. We follow the natural break along with the German reunification. Our data is complete for whole Germany since 1993, so we consider the time period 1993-2007. The impulse responses are plotted in Figures A.1-A.3.

It can be seen that the responses change notably. In particular, the responses to a technology shock change their sign. The job finding rate shows a negative response to a positive technology shock. Interestingly, this effect has also been found for the U.S. labor market. Balleer (2012) explains the "job finding puzzle" by skill-biased technological change. As a positive technology shock may increase the relative productivity of high-skilled to low-skilled workers, low-skilled workers will be substituted out of employment. Accordingly, the job finding rate of low-skilled workers goes down, while the job finding rate of high-skilled workers may increase. Then, if the negative effect outweighs the positive effect, the aggregate job finding rate will decrease.

Indeed, the argumentation along with a substitution of low-skilled workers can be reconciled with the initial rise in the separation rate. In terms of the Schumpeterian paradigm, new technologies can cause a wave of creative destruction when existing jobs do not satisfy the new standards. The positive impact effect on the separation rate is also in line with recent evidence for the U.S. In particular, Canova/Lopez-Salido/Michelacci (forthcoming) discuss the Schumpeterian creative destruction hypothesis for neutral technology shocks and argue that search frictions can trigger a temporarily rise in unemployment. This explanation seems to match our results. After the impact period, however, the responses of the transition rates offset each other and the unemployment rate adjusts to the steady state.[18]

The insignificance of the responses may result not only from less observations but also from different features of a technology shock, i.e. traditional and Schumpeterian responses offset each other. In addition, the forecast error variance decomposition indicates that technology shocks per se have become less important after the reunification (see Table A.6). Compared to our benchmark period, the relative importance of the technology shock shrinks for fluctuations in both transition rates. At short forecast horizons, the relative contribution accounts for up to 30% in case of the job finding rate and 19% in case of the separation rate. At longer forecast horizons, the contributions decrease to 26% and 16%, respectively. In relation to the policy shocks, however, the technology shock still plays a prevailing role, especially for the job finding rate.

The monetary policy shock contributes only about 1% to the variation in the transition rates. Moreover, the responses to a monetary policy shock are low and insignificant. Especially the impact on the unemployment rate is close to zero as both transition rates respond negatively. The disappearing relevance of monetary policy shocks for German unemployment dynamics might be traced back to the implementation of the EMU. It seems that the national labor market has become more resilient to monetary policy shocks. At the same time, monetary policy shocks have become less important to control unemployment dynamics.

In turn, the fiscal policy shock gains in importance. The contributions to the forecast errors increase by a factor of about 2-3. The shock again shows a significant impact effect on the unemployment rate through the separation margin. The response of the job finding rate, however, turns out strictly positive, indicating that the negative side-effect of preceding results is not stable. In addition, the impact multipliers with respect to both transition rates increase. Considering the baseline values for the subsample, a one percent increase in government spending raises the job finding rate by 1.1% and reduces the separation rate by 1.8%. The fiscal multiplier with respect to unemployment is again around 0.1%.

7 Conclusion

Using a structural VAR approach, this paper has analyzed the conditional patterns of unemployment dynamics in Germany. For this purpose, we have specified a technology shock, a monetary policy shock and a fiscal policy shock.

Our analysis reveals various patterns of unemployment dynamics, i.e. the worker reallocation process is not constant across the identified shocks. In particular, the significance of the transition rates varies with the different types of shocks. The impulse responses indicate a larger role of the job finding rate after a technology shock and a monetary policy shock, while the separation rate appears as the dominant margin after a fiscal policy shock. In line with the unconditional movements of the transition rates, the transmission

[18] In particular, these patterns seem to mirror the economic development in the 1990s. See also Smolny (2012) who describes the macroeconomic adjustment after the reunification.

mechanism through the job finding margin is relatively persistent, while the effects along the separation margin are sharp and short-lived. Several robustness checks reinforce this clear-cut pattern.

The forecast error variance decomposition demonstrates that the identified shocks account for 40% of the variations in the job finding rate and 30% of the variations in the separation rate. Thereby, the technology shock plays a substantial role. In our benchmark sample, the technology shock shows traditional features, i.e. an increase in productivity reduces unemployment. Once we restrict our time period to reunified Germany, we also observe Schumpeterian features, i.e. an increase in productivity leads to higher separations. In addition, the relative importance of technology shocks shrinks over time.

Monetary policy shocks seem to have become less important for unemployment dynamics in Germany. Especially after the reunification, changes in the interest rate account for just 1% of the variations in the transition rates. The loss of importance can be reconciled with the implementation of the EMU. Nevertheless, it should be noted that those results do not concern the functioning of rule-based monetary interventions. Accordingly, the results may also indicate that the monetary authority does rarely deviate from its policy rule or that discretionary policy interventions are anticipated due to a transparent strategy.

Instead, fiscal policy shocks may be a more promising instrument to account for unemployment dynamics. The effects of the government spending shock are significant for different specifications and the fiscal multipliers of the transition rates have increased over time. However, our analysis points to several limitations as well. First, the effects of a government spending shock turn out to be very short-lived. Second, there are indications of a Ricardian equivalence behavior, though this observation is not stable. Third, the fiscal multipliers are of a moderate magnitude which might fuel concerns about fiscal debt levels. Forth, the transmission of a government spending shock works primarily through the separation rate, and thus fiscal policy may be less suitable to control rises in long-term unemployment triggered by other factors.

Hence, further evidence on the sources and mechanisms of labor market dynamics seems to be crucial for determining an optimal policy instrument. A key result from our study is that those analyses should not neglect the separation margin, especially when shocks tend to be less persistent.

References

Alexius, Annika; Holmlund, Bertil (2008): Monetary Policy and Swedish Unemployment Fluctuations. In: Economics - The Open-Access, Open-Assessment E-Journal, Vol. 2, p. 1–25.

Bachmann, Ronald; Balleer, Almut (2011): What Drives Labor Market Dynamics in Germany?, mimeo.

Balleer, Almut (2012): New Evidence, Old Puzzles: Technology Shocks and Labor Market Dynamics. In: Quantitative Economics, Vol. 3, No. 3, p. 363–392.

Barnichon, Régis (2007): The Shimer Puzzle and the Correct Identification of Productivity Shocks. CEP Discussion Papers 0823, Centre for Economic Performance, LSE.

Baum, Anja; Koester, Gerrit B. (2001): The Impact of Fiscal Policy on Economic Activity over the Business Cycle - Evidence from a Threshold VAR Analysis. Discussion Paper Series 1: Economic Studies 03/2011, Deutsche Bundesbank.

Blanchard, O.; Dell'Aricca, G.; Mauro, P. (2010): Rethinking Macroeconomic Policy. In: Journal of Money, Credit and Banking, Vol. 42, No. SPN/10/03, p. 199–215.

Blanchard, Olivier; Perotti, Roberto (2002): An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output. In: The Quarterly Journal of Economics, Vol. 117, No. 4, p. 1329–1368.

Bode, Oliver; Gerke, Rafael; Schellhorn, Hannes (2006): Die Wirkungen fiskalpolitischer Schocks auf das Bruttoinlandsprodukt. Arbeitspapier 01/2006, Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung.

Braun, Helge; Bock, Reinout De; DiCecio, Riccardo (2009): Supply Shocks, Demand Shocks, and Labor Market Fluctuations. In: Federal Reserve Bank of St. Louis Review, Vol. 91, No. 3, p. 155–178.

Canova, Fabio; Lopez-Salido, David; Michelacci, Claudio (forthcoming): The Ins and Outs of Unemployment: An Analysis Conditional on Technology Shocks. In: The Economic Journal.

Christiano, Lawrence J; Eichenbaum, Martin; Evans, Charles (1996): The Effects of Monetary Policy Shocks: Evidence from the Flow of Funds. In: The Review of Economics and Statistics, Vol. 78, No. 1, p. 16–34.

Cogley, Timothy; Nason, James M. (1995): Effects of the Hodrick-Prescott Filter on Trend and Difference Stationary Time Series - Implications for Business Cycle Research. In: Journal of Economic Dynamics and Control, Vol. 19, No. 1-2, p. 253–278.

Dorner, Matthias; Heining, Jörg; Jacobebbinghaus, Peter; Seth, Stefan (2010): Sample of Integrated Labour Market Biographies (SIAB) 1975-2008. FDZ Datenreport 01/2010, Institute for Employment Research (IAB), Nürnberg.

Fernald, John G. (2007): Trend Breaks, Long-run Restrictions, and Contractionary Technology Improvements. In: Journal of Monetary Economics, Vol. 54, No. 8, p. 2467–2485.

Fisher, Jonas D. M. (2006): The Dynamic Effects of Neutral and Investment-Specific Technology Shocks. In: Journal of Political Economy, Vol. 114, No. 3, p. 413–451.

Fitzenberger, Bernd; Wilke, Ralf A. (2010): Unemployment Durations in West Germany Before and After the Reform of the Unemployment Compensation System during the 1980s. In: German Economic Review, Vol. 11, p. 336–366.

Fujita, Shigeru (2012): Declining Labor Turnover and Turbulence. Working Papers 11-44/R, Federal Reserve Bank of Philadelphia.

Fujita, Shigeru (2011): Dynamics of Worker Flows and Vacancies: Evidence from the Sign Restriction Approach. In: Journal of Applied Econometrics, Vol. 26, No. 1, p. 89–121.

Gali, Jordi (1999): Technology, Employment, and the Business Cycle: Do Technology Shocks Explain Aggregate Fluctuations? In: American Economic Review, Vol. 89, No. 1, p. 249–271.

Gartner, Hermann; Merkl, Christian; Rothe, Thomas (2012): Sclerosis and Large Volatilities: Two Sides of the Same Coin. In: Economics Letters, Vol. 117, No. 1, p. 106–109.

Islas-Camargo, Alejandro; Cortez, Willy W. (2011): How Relevant is Monetary Policy to Explain Mexican Unemployment Fuctuations? MPRA Paper No. 30027, Instituto Tecnologico Autonomo de Mexico, Universidad de Guadalajara.

Jones, Stephen R. G.; Riddell, W. Craig (1999): The Measurement of Unemployment: An Empirical Approach. In: Econometrica, Vol. 67, No. 1, p. 147–162.

Kato, Ryuta R.; Miyamoto, Hiroaki (2013): Fiscal Stimulus in an Endogenous Job Separation Model. Economics & Management Series (EMS) 2013-02, International University of Japan.

Klinger, Sabine; Weber, Enzo (2012): Decomposing Beveridge Curve Dynamics by Correlated Unobserved Components. IAB Discussion Paper 28/2012, Institute for Employment Research (IAB), Nuremberg.

Mayer, Eric; Moyen, Stéphane; Stähler, Nikolai (2010): Government Expenditures and Unemployment: A DSGE Perspective. Discussion Paper Series 1: Economic Studies 18/2010, Deutsche Bundesbank.

Merz, Monika (1995): Search in the Labor Market and the Real Business Cycle. In: Journal of Monetary Economics, Vol. 36, No. 2, p. 269–300.

Monacelli, Tommaso; Perotti, Roberto; Trigari, Antonella (2010): Unemployment Fiscal Multipliers. In: Journal of Monetary Economics, Vol. 57, No. 5, p. 531–553.

Nordmeier, Daniela (2012): Worker Flows in Germany: Inspecting the Time Aggregation Bias. IAB Discussion Paper 12/2012, Institute for Employment Research (IAB), Nürnberg.

Ravn, Morten O.; Simonelli, Saverio (2008): Labor Market Dynamics and the Business Cycle: Structural Evidence for the United States. In: Scandinavian Journal of Economics, Vol. 109, No. 4, p. 743–777.

Shimer, Robert (2005): The Cyclical Behavior of Equilibrium Unemployment and Vacancies. In: American Economic Review, Vol. 95, No. 1, p. 25–49.

Sims, Christopher A.; Stock, James H.; Watson, Mark W. (1990): Inference in Linear Time Series Models with Some Unit Roots. In: Econometrica, Vol. 58, No. 1, p. 113–144.

Smolny, Werner (2012): Cyclical Adjustment, Capital-labor Substitution and Total Factor Productivity Convergence - East Germany After Unification. In: Jahrbücher für Nationalökonomie und Statistik, Vol. 232, No. 4, p. 445–459.

Statistisches Bundesamt (2012): Volkswirtschaftliche Gesamtrechnungen. Inlandsproduktberechnung, Detaillierte Jahresergebnisse, Fachserie 18, Reihe 1.4, Statistisches Bundesamt, Wiesbaden.

Tenhofen, Jörn; Wolff, Guntram B.; Heppke-Falk, Kirsten H. (2010): The Macroeconomic Effects of Exogenous Fiscal Policy Shocks in Germany: A Disaggregated SVAR Analysis. In: Journal of Economics and Statistics (Jahrbücher für Nationalökonomie und Statistik), Vol. 230, No. 3, p. 328–355.

Turrini, Alessandro (2012): Fiscal Consolidation in Reformed and Unreformed Labour Markets: A Look at EU Countries. European Economy - Economic Papers 462, Directorate General Economic and Monetary Affairs (DG ECFIN), European Commission.

A Further Tables and Figures

Table A.1: Sources and definitions of data

Time series	Definition	Source
Government spending	Sum of government consumption and government gross fixed capital formation divided by output deflator (2000=100), logged	National accounts
Labor productivity	Real gross domestic product (GDP) divided by total hours worked (2000=100), logged	National accounts
Job finding rate	Transition rate from unemployment to employment (average of monthly rates based on daily transitions)	SIAB
Separation rate	Transition rate from employment to unemployment (average of monthly rates based on daily transitions)	SIAB
Interest rate	Nominal interbank money market rate (average of daily rates)	Deutsche Bundesbank

Notes: All series are seasonally adjusted, quarterly data. Western German data are linked to reunified German data in 1993.

Table A.2: Augmented Dickey-Fuller (ADF) tests

	Level		First Difference	
	Model specification	Test statistic	Model specification	Test statistic
Government spending	t, c, L=4	-1.707	c, L=3	-4.201***
Productivity	t, c, L=4	-2.293	c, L=3	-4.452***
Separation rate	c, L=0	-3.031**	L=0	-12.062***
Job finding rate	c, L=1	-2.157	L=0	-13.688***
Interest rate	c, L=1	-3.771***	L=0	-5.277***

Notes: The ADF regressions cover a number of lags (L) according to the Schwarz and Hannan-Quinn information criteria. Regressions may include a trend (t) and/or a constant (c). ***, ** and * indicate significance on the 1%, 5% and 10% level.

Table A.3: VAR lag order selection

Maximum lag length	LR	FPE	AIC	SIC	HQ
	Selection criteria				
2	2	2	2	1	1
4	4	4	4	1	1
6	4	2	4	1	2
8	4	2	2	1	1
10	4	2	2	1	1
12	4	2	12	1	1

Notes: LR = Likelihood ratio test statistic, FPE = Final prediction error, AIC = Akaike information criterion, SIC = Schwarz information criterion, HQ = Hannan-Quinn information criterion.

Table A.4: Steady state values

	Benchmark sample (1981-2007)	Subsample (1993-2007)
Job finding rate	6.247	4.960
Separation rate	1.036	1.056
Unemployment rate	14.225	17.553

Note: Values are based on the sample averages of the transition rates.

Table A.5: Conditional correlations

		Productivity	Interest rate	Gov. spending
Autocorrelation		0.718	0.917	-0.005
Correlation	f	-0.705	-0.291	0.823
matrix	s	0.796	-0.862	-0.966

Notes: Based on medians from bootstrapping. The first column refers to the technology shock, the second column to the monetary policy shock and the last column to the fiscal policy shock.

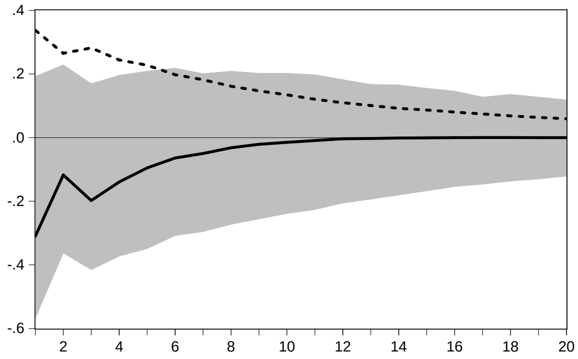
Table A.6: Forecast error variance decomposition in the subsample (1993-2007)

	Job finding rate			Separation rate		
Forecast horizon	Techn. shock	Monet. shock	Fiscal shock	Techn. shock	Monet. shock	Fiscal shock
1	0.300	0.000	0.076	0.192	0.000	0.210
2	0.265	0.004	0.071	0.142	0.001	0.171
3	0.294	0.005	0.087	0.147	0.004	0.143
4	0.294	0.007	0.099	0.149	0.009	0.142
5	0.289	0.007	0.100	0.149	0.011	0.141
6	0.281	0.007	0.103	0.152	0.012	0.138
7	0.276	0.007	0.106	0.154	0.013	0.137
8	0.272	0.007	0.106	0.154	0.014	0.137
9	0.269	0.007	0.107	0.155	0.014	0.136
10	0.267	0.007	0.107	0.156	0.014	0.136
11	0.265	0.007	0.107	0.156	0.014	0.136
12	0.264	0.007	0.107	0.156	0.014	0.136
13	0.263	0.007	0.107	0.156	0.014	0.136
14	0.263	0.007	0.107	0.156	0.014	0.136
15	0.262	0.007	0.107	0.156	0.014	0.136
16	0.262	0.007	0.107	0.156	0.014	0.136
17	0.262	0.007	0.107	0.156	0.014	0.136
18	0.262	0.007	0.107	0.156	0.014	0.136
19	0.262	0.007	0.107	0.156	0.014	0.136
20	0.262	0.007	0.107	0.156	0.014	0.136

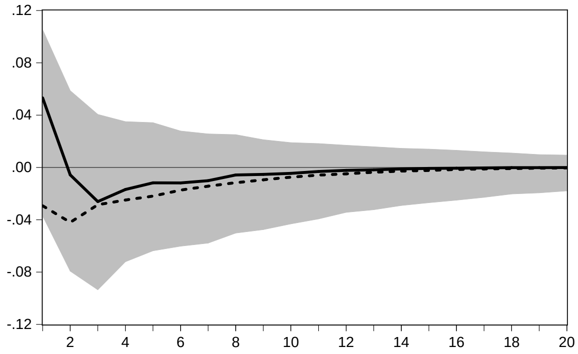
Note: Based on medians from bootstrapping.

Figure A.1: Responses to a technology shock in the subsample (1993-2007)

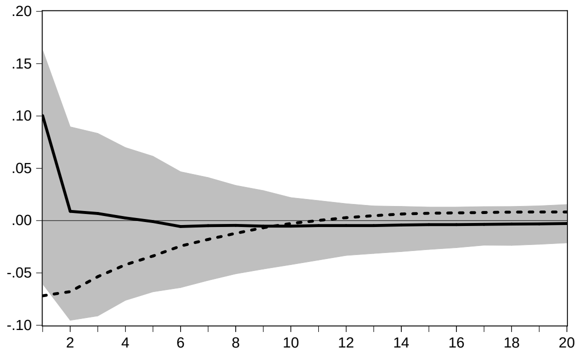
(a) Job finding rate



(b) Separation rate



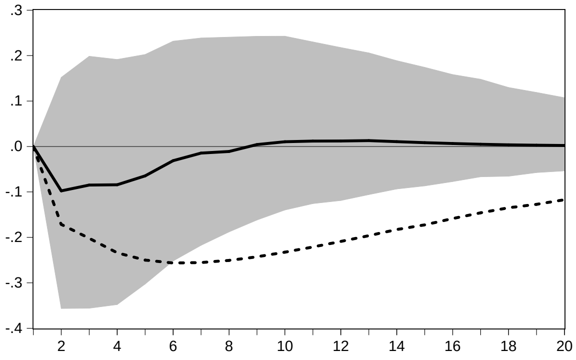
(c) Unemployment rate



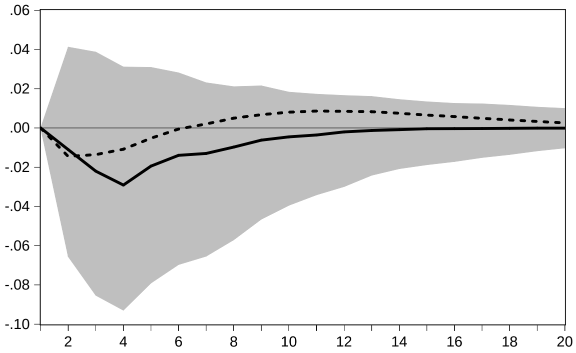
Notes: Impulse responses to a one-off increase in productivity. Dotted lines refer to the benchmark period.

Figure A.2: Responses to a monetary policy shock in the subsample (1993-2007)

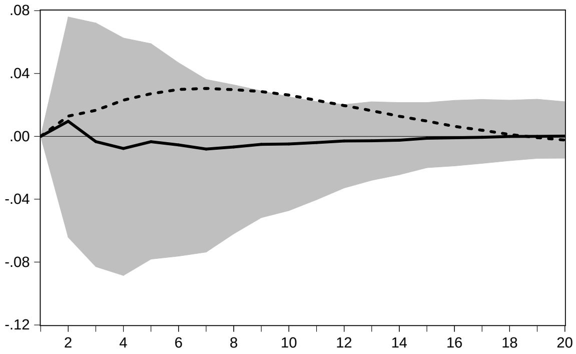
(a) Job finding rate



(b) Separation rate



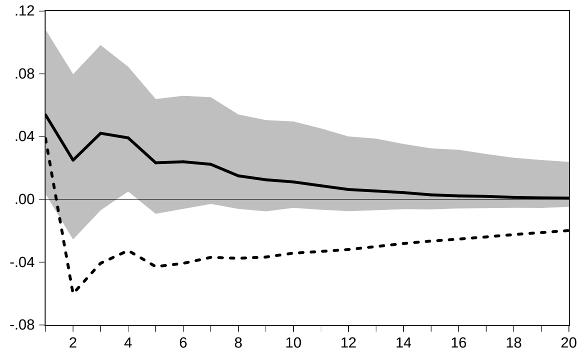
(c) Unemployment rate



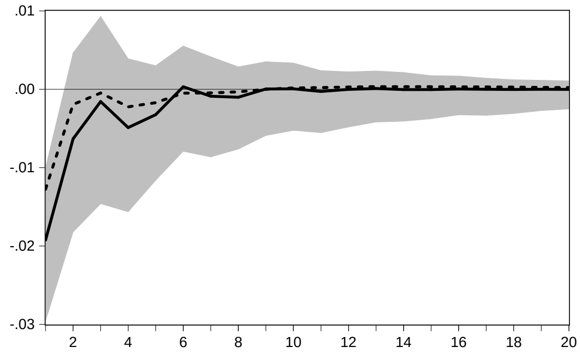
Notes: Impulse responses to a one-off increase in the interest rate. Dotted lines refer to the benchmark period.

Figure A.3: Responses to a fiscal policy shocks in the subsample (1993-2007)

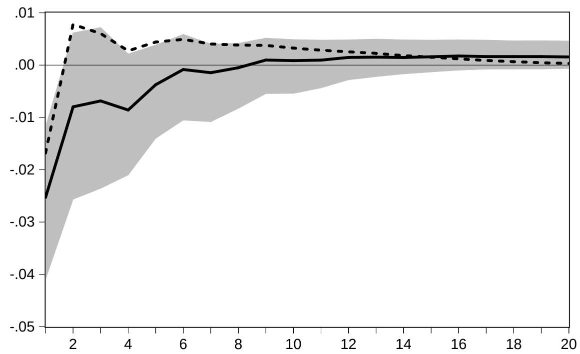
(a) Job finding rate



(b) Separation rate



(c) Unemployment rate



Notes: Impulse responses to a one-off increase in government spending. Dotted lines refer to the benchmark period.

B Imposing Identifying Restrictions

One way to demonstrate the relation between the endogenous variables y_t and the residuals ν_t is the Wold moving average (WMA) representation

$$y_t = \sum_{i=0}^{p} \Psi_i \nu_{t-i}, \tag{8}$$

where the Ψ_i´s capture the responses to an impulse i periods ago. Substituting Equation (3) gives the link to the structural shocks ϵ_t

$$y_t = \sum_{i=0}^{p} \Psi_i B \epsilon_{t-i}. \tag{9}$$

The sum of the impulse responses Ψ_i derives as follows

$$\sum_{i=0}^{\infty} \Psi_i = (I_K - A_1 - A_2 - ... - A_p)^{-1} = (I_K - \sum_{i=1}^{p} A_i)^{-1}. \tag{10}$$

Then, the accumulated long-run effect of a structural shock equals to

$$\Phi = (I_K - \sum_{i=1}^{p} A_i)^{-1} B. \tag{11}$$

The latter expression demonstrates the interdependence of the matrices B and Φ, and thus the link of short-run and long-run restrictions.

Given our identifying assumptions, the matrices B and Φ take the form

$$B = \begin{pmatrix} b_g^g & 0 & 0 & 0 & 0 \\ b_g^a & b_a^a & b_s^a & b_f^a & 0 \\ b_g^s & b_a^s & b_s^s & 0 & 0 \\ b_g^f & b_a^f & b_s^f & b_f^f & 0 \\ b_g^r & b_a^r & b_s^r & b_f^r & b_r^r \end{pmatrix} \tag{12}$$

and

$$\Phi = \begin{pmatrix} \phi_g^g & \phi_a^g & \phi_s^g & \phi_f^g & \phi_r^g \\ 0 & \phi_a^a & 0 & 0 & 0 \\ \phi_g^s & \phi_a^s & \phi_s^s & \phi_f^s & \phi_r^s \\ \phi_g^f & \phi_a^f & \phi_s^f & \phi_f^f & \phi_r^f \\ \phi_g^r & \phi_a^r & \phi_s^r & \phi_f^r & \phi_r^r \end{pmatrix}. \tag{13}$$

Recently published

No.	Author(s)	Title	Date
15/2012	Poeschel, F.	Assortative matching through signals	6/12
16/2012	Dauth, W. Findeisen, S. Suedekum, J.	The rise of the East and the Far East: German labor markets and trade integration	7/12
17/2012	Münich, D. Srholec, M. Moritz, M. Schäffler, J.	Mothers and Daughters: Hereogeneity of German direct investments in the Czech Republic: Evidence from the IAB-ReLOC survey published als: CERGE-EI Working paper : 467	7/12
18/2012	Scholz, Th.	Employers' selection behavior during short-time work	8/12
19/2012	Osiander, Ch.	Selektivität beim Zugang in Weiterbildungsmaßnahmen: Die Bedeutung individueller und struktureller Faktoren am Beispiel der „Initiative zur Flankierung des Strukturwandels"	8/12
20/2012	Dauth, W. Südekum, J.	Profiles of local growth and industrial change: Facts and an explanation	9/12
21/2012	Antoni, M. Heineck, G.	Do literacy and numeracy pay off? On the relationship between basic skills and earnings	9/12
22/2012	Blien, U. Messmann, S. Trappmann, M.	Do reservation wages react to regional unemployment?	9/12
23/2012	Kubis, A. Schneider, L.	Human capital mobility and convergence: A spatial dynamic panel model of the German regions	9/12
24/2012	Schmerer, H.-J.	Skill-biased labor market reforms and international competitiveness	10/12
25/2012	Schanne, N.	The formation of experts' expectations on labour markets: Do they run with the pack?	10/12
26/2012	Heining, J. Card, D. Kline, P.	Workplace heterogeneity and the rise of West German wage inequality published in: The Quarterly Journal of Economics, (2013)	11/12
27/2012	Stops, M.	Job matching across occupational labour markets	11/12
28/2012	Klinger, S. Weber, W.	Decomposing Beveridge curve dynamics by correlated unobserved components	12/12
29/2012	Osiander, Ch.	Determinanten der Weiterbildungsbereitschaft gering qualifizierter Arbeitsloser	12/12
1/2013	Fuchs, J. Weber, E.	A new look at the discouragement and the added worker hypotheses: Applying a trend-cycle decomposition to unemployment	1/13

As per: 26.03.2013

For a full list, consult the IAB website
http://www.iab.de/de/publikationen/discussionpaper.aspx

Imprint

IAB-Discussion Paper 2/2013

Editorial address
Institute for Employment Research
of the Federal Employment Agency
Regensburger Str. 104
D-90478 Nuremberg

Editorial staff
Regina Stoll, Jutta Palm-Nowak

Technical completion
Jutta Sebald

Website
http://www.iab.de

Download of this Discussion Paper
http://doku.iab.de/discussionpapers/2013/dp0213.pdf

ISSN 2195-2663

For further inquiries contact the authors:

Daniela Nordmeier
Phone +49.911.179 6504
E-mail daniela.nordmeier@iab.de

Enzo Weber
Phone +49.911.179 7643
E-mail enzo.weber@iab.de