

Euro-area labour markets: Different reaction to shocks?

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Received: 13 May 2014 / Revised: 15 July 2014 / Accepted: 27 October 2014 / Published online: 19 November 2014

ABSTRACT

A small labour market model for the six largest euro-area countries (Germany, France, Italy, Spain, the Netherlands and Belgium) is estimated in a state space framework. The model entails, in the long run, four driving forces: trend labour force, trend labour productivity, long-run inflation rate and trend hours worked. The short run dynamics is governed by a VAR model including six shocks. The state-space framework is convenient for the decomposition of endogenous variables in trends and cycles, for shock decomposition, for incorporating external judgment, and for running conditional projections. The forecast performance of the model is rather satisfactory.

The model is used to carry out a policy experiment with the objective of investigating whether euro-area labour markets react differently to a reduction in labour costs. Results suggest that, following the 2008–2009 recession, moderate wage growth would significantly help delivering a more job-intense recovery.

JEL classification: C51; C53; E17; J21

Keywords: Labour market, Forecasting, Kalman Filter

1. INTRODUCTION

The main objective of this paper is to illustrate some key features of the euro-area labour markets, in particular how euro-area labour market differ when they are affected by the same type of shocks. This question is relevant both for monitoring labour market developments in the euro-area and for policy analysis, i.e. which reform fits better one country vis-à-vis another.

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For this purpose a small labour market model for the six largest euro-area countries – Germany, France, Italy, Spain, the Netherlands and Belgium – is estimated in a state space framework. The model consists of a set of labour market equations (labour force, labour demand, wage curve, production function, relative prices, hours worked) which are jointly estimated.

On the quantity side the model distinguishes between the intensive (hours worked per persons) and the extensive (persons employed) margins. On the price side it distinguishes between GDP and consumer price deflators. The model entails long-run dynamics and short-run fluctuations. The long-run dynamics is derived from strong theoretical restrictions which determine the pattern of trends (labour force, labour productivity, inflation rate and hours worked). The short-run fluctuations are driven by a homoscedastic vector autoregressive process.

In addition, the model presents a number of features which in our view makes it appealing in comparison with similar studies. Firstly, the same specification is estimated for all countries, which allows for a straightforward cross-country comparison of the different reactions to shocks. Secondly, the estimation technique used allows the joint estimation of long and short run dynamics, where both the trend and the cyclical component have theoretical underpinnings. Therefore, there is no need of detrending data by purely statistical methods prior the model estimation.² Thirdly, on the data front, the paper makes use of recently available hours worked series at a quarterly frequency compatible with national accounts.

While the model is primarily empirical, the long-run restrictions are consistent with a frictionless economy where a Cobb-Douglas production function is used to derive the desired level of employment by firms. On the labour-supply side, the long-run wage curve is consistent with a bargaining model where the real consumption wage depends on productivity and on the prevailing labour market conditions, which are captured by the rate of unemployment.

The model is cast in a state-space framework, which is very convenient for the decomposition of endogenous variables in trends and cycles, for the shock decomposition, for incorporating external judgments and for running conditional projections.

Focusing on developments during the past 10 years, this paper shows how the euro-area countries differ in terms of contribution of the long-term driving forces and the short-term shocks to key labour market developments.

Finally, the paper presents a policy experiment with the objective of investigating the different reactions of the euro-area labour markets to a reduction in labour costs. This question, which has been already addressed by a number of previous empirical papers, is still very relevant in light of the ongoing debate on the need for regaining cost competitiveness in the euro-area for two key reasons. Firstly, given current uncertain situation regarding the employment prospects after the 2009 recession, it is important to shed light on the employment implications of a change in labour cost. Secondly, the 2009 recession implied very different labour market reactions across countries in terms of employment and hours worked, partly due to nominal-wage inertia. Thus it is important to understand the implications of a labour moderation strategy on the two margins of adjustment. Given that the estimation horizon used in this paper is relatively up-to-date, i.e. from 1992 to 2009, and the model is able to distinguish between intensive and extensive margins of labour utilisation, the answers provided by the paper to the above policy questions represent a new feature.

The model does not contain features of typical long-term growth models (e.g. population growth) because its main purpose is to give a realistic representation of the current labour market developments rather than focusing on long-term trends.

² Canova and Ferroni (2009), who adopted a non-structural approach to detrending using a parsimonious econometric specification, recently confirmed by simulations that an incorrect specification of trends distorts the estimation of parameters of the cyclical part of macroeconomic models.

The paper is organized as follows. Section 2 is devoted to a survey of related papers. Section 3 presents the model. The dataset and the estimation are discussed in Section 4, while the results of a policy experiment are present in Section 5. Section 6 concludes.

It should be noted at the outset upfront that, given the empirical nature of the model and the absence of ‘deep’ parameters in the sense of structural models, the word ‘shock’ is used through the paper in the spirit of the traditional macro-modelling environment.

2. THE LINK WITH RELATED LITERATURE

On the modelling side, the literature on small-scale labour market models is considerable. Small-scale labour market models or the supply-side block of large macro-models usually involve a production function equation, a labour supply relationship, a labour demand derived from the first order conditions of profit-maximizing or equivalently a cost-minimizing representative firm and a wage setting relation determined by a bargaining process between firms and labour unions (Layard et al., 1991). On the empirical side, one of the critical problems is the identification of labour demand and supply relationships.

Following Morgan and Mourougane (2005), the labour demand equation is identified by using the value added deflator at factor costs to compute real wages, which is the relevant deflator for firms. By contrast, the wage curve is identified by using the consumption deflator to compute real wages, which is instead the relevant deflator for households. Moreover, labour demand conditions, i.e. the unemployment rate, enter in the wage curve. Following Hansen and Warne (2001) our model entails also a short-term equation for relative prices, that is the consumer/producer price wedge. Such a wedge reflects, in particular, the impact of indirect taxes, terms of trade effects and relative bargaining powers. In the short run, the dynamics of producer prices and of nominal wages is based on a VAR form with identification restrictions.

A similar approach has been followed by Duarte and Marques (2009), where an empirical SVECM involving nominal wages, prices, the unemployment rate, productivity and import prices is estimated for the euro area and the US. The main finding of the paper is that wage dynamics are mainly determined by unemployment shocks in both economies but a significant role is also played by technology shocks in the US and by import price shocks in the euro area. This last result is particularly important as it suggests that in the euro area economies wages tend to be ‘de facto’ indexed to imported inflation.

On the data side, due to limited availability of reliable time series for hours worked, so far most of the existing studies on euro-area countries labour markets measure employment as the number of persons employed (see Mourre, 2006). In this respect, the fact that our model is able to distinguish empirically between the intensive margin (hours worked) and the extensive margin (jobs) represents an important innovation with respect to standard labour market models.

On the estimation side, our econometric approach follows very closely the analysis in Proietti and Musso (2007), where a multivariate structural time-series model is used for the estimation of potential output and output gap. As in Proietti and Musso (2007), the decomposition of time series to trend and cyclical component in this paper is model-based and hence does not depend on purely ad hoc statistical techniques. The difference between these two papers lies in the specification of the model used to separate trend and cycle.³ Brůha (2011) presents a similar model for the Czech economy.

Finally, regarding the policy content of the paper, a large number of empirical and theoretical works have covered the issue of the relative gains/costs of wage moderation. In particular, partial equilibrium approaches indicate that labour cost moderation generally help employment

³ Hjelm and Jönsson (2010) provide an overview of various approaches to filter the trend component from economic time series, including multivariate model-based approaches.

creation (Pierluigi and Roma, 2008) and growth (Estevao, 2005), the same applies to simulations conducted with large macroeconomic models (Angelini et al, 2013), where the key mechanism at work is the competitiveness channel which leads to higher growth and employment. While this last study looks at the implication of nominal wage moderation, the two studies previously quoted refer to real-wage moderation. In our simulation the focus is on nominal wages, this is because for countries belonging to a monetary union the ability to achieve nominal-wage moderation is very important, especially in an environment characterized by moderate price developments.

3. MODEL

The dynamics of the model is basically composed of two parts: the long-run dynamics and short-run fluctuations. The long-run dynamics is derived from strong theoretical restrictions and it provides a discipline on trends in modelling variables. The short-run dynamics then enriches the structure of the model and makes it possible to use the model for forecasting and shock decomposition exercises.

In general terms, any model variable x_t is given as a sum of the trend component and the cyclical component⁴

$$x_t = \bar{x}_t + \tilde{x}_t$$

where \bar{x}_t is the trend component, and \tilde{x}_t is the cyclical component.

3.1. The long-run dynamics

The equations describing the long-run dynamics are given as follows, where all variables are in logs:

$$\bar{y}_t = \bar{e}_t + \bar{h}_t + \varpi_t^z \quad (1)$$

$$\bar{e}_t + \bar{h}_t = \bar{y}_t - (\bar{w}_t - \bar{p}_t) \quad (2)$$

$$\bar{w}_t - \bar{q}_t = -\gamma_1 (\bar{l}_t - \bar{e}_t) + \gamma_2 (\bar{y}_t - \bar{e}_t - \bar{h}_t) + \alpha_2 \bar{m}_t \quad (3)$$

$$\bar{p}_t = \varpi_t^p \quad (4)$$

$$\bar{l}_t = \varpi_t^l + \alpha_1 \bar{m}_t \quad (5)$$

$$\bar{h}_t = \varpi_t^h \quad (6)$$

In Eq. (1), (2) and (3) \bar{y}_t is the trend output, \bar{e}_t is the trend number of persons employed. In Eq. (1), (2), (3) and (6) \bar{h}_t is the trend number of hours worked per employee. In Eq. (2) and (3) \bar{w}_t is the trend in the nominal compensation per total hours worked. In Eq. (2) and (4) \bar{p}_t is the trend GDP deflator at factor costs; in Eq. (3) \bar{q}_t is the private consumption deflator (which is assumed to follow the same trend as \bar{p}_t), \bar{l}_t is the labour force, which is the sum of employed and unemployed, and \bar{m}_t is the trend in the net immigration flows, which affects the labour force. In Eq. (1), (4), (5) and (6) ϖ_t^k with $k = z, p, l, h$ denote trends in productivity, price level, labour force, and hours worked.

⁴ All variables in this paper are considered in logs unless otherwise stated. All variables are also seasonally adjusted.

The long run specification of the model is stylised. In particular, Eq. (1) suggests that the production function is formulated as a relation describing average labour productivity which follows, in the long run, the productivity trend ϖ_t^z . Eq. (2) is derived from the first order conditions of the Cobb-Douglas production function and expresses the desired total amount of hours worked $(\bar{e}_t + \bar{h}_t)$ as a function of the level of output and the real product wage $(\bar{w}_t + \bar{p}_t)$. The consumer real wage $((\bar{w}_t + \bar{q}_t))$ is determined by a bargaining process between firms and labour unions. The outcome of this process is described as a relationship between the consumer real wage, average real productivity and unemployment in Eq. (3). It is assumed that net immigration is able to affect the consumer real wage by reducing the bargaining power of unions.

The trend price level (ϖ_t^p) is assumed to be the same for the GDP and consumption deflators (Eq. (4)). Eq. (5) says that trend domestic labour force ϖ_t^l is affected by immigration. The long-run dynamics of hours worked is determined by its trend ϖ_t^h , which reflects slowly-moving institutional features of the economy; see Eq. (6). The structural form implies the following long run elasticities:

	ϖ_t^l	ϖ_t^z	ϖ_t^p	ϖ_t^h
\bar{l}_t	1	0	0	0
\bar{y}_t	1	$1 + \frac{1 - \gamma_2}{\gamma_1}$	0	1
\bar{e}_t	1	$\frac{1 - \gamma_2}{\gamma_1}$	0	0
\bar{w}_t	0	1	1	0
\bar{p}_t	0	0	1	0
\bar{q}_t	0	0	1	0
\bar{h}_t	0	0	0	1

(7)

Given that the parameters γ_1 and γ_2 are not separately identified, only their non-linear combination $\frac{1 - \gamma_2}{\gamma_1}$ could be estimated.

To model trends ϖ_t^k we modify the approach by Harvey and Jaegger (1993). Harvey and Jaegger (1993) propose an I(2) process for filtering trends from economic time series, which is defined as follows:

$$\theta_{1t} = \theta_{1t-1} + \theta_{2t-1} + \sigma_1 \eta_{1t}$$

$$\theta_{2t} = \theta_{2t-1} + \sigma_2 \eta_{2t}$$

where η_{it} $i = 1, 2$ are independent i.i.d. white-noise processes. Standard errors σ_1, σ_2 determine the smoothness of the filtered trend. In particular, if σ_1 is small, the trend θ_{1t} is relatively smooth.

It is interesting to note that the Leser (1961) filter (later ‘rediscovered’ in economics as the HP filter) is optimal for processes $x_t = \theta_{1t} + v_t$, provided that $\sigma_1 = 0$ and v_t is an i.i.d. white noise sequence. Although, the Harvey-Jaegger model can be used to filter out smooth trends, it is not suitable for forecasting.⁵

We therefore opt for an I(1) process to model ϖ_t^k , since this would imply that the long-run growth rate in the variables is a stationary process. This is a rather plausible feature especially for productivity and the price level.⁶ In more details, we assume the following ARIMA (3,1,0) process, which can produce smoothed growth trends slowly varying around a long-run value:

$$\varpi_t^h - \varpi_{t-1}^h = \theta_{1t}^k, \quad (8)$$

where θ_{1t}^k follows a stationary process:

$$\begin{aligned} \theta_{1t}^k &= \rho_1 \theta_{1t-1}^k + \theta_{2t-1}^k \\ (\theta_{2t}^k - \mu^k) &= \rho_2 (\theta_{2t-1}^k - \mu^k) + \theta_{3t-1}^k \\ \theta_{3t}^k &= \rho_3 \theta_{3t-1}^k + \varepsilon_t^k \end{aligned}$$

with ε_t^k being an i.i.d. white noise sequence, and $0 \leq \rho_i < 1$ for $i \in \{1,2,3\}$. The fact that stochastic innovations enter directly only into the third equation implies that θ_{1t}^k follows a slowly varying smooth process.

The interpretation of model (8) is the following: θ_{1t}^k can be considered as the trend growth rate of the variable ϖ_t^k , which moves around a target θ_{3t}^k . This target grows in a steady state by μ^k and is shocked by an invertible MA(1) process, represented by θ_{3t}^k . Note that the process is similar to the one used in Carabenciov et al. (2008) (and in related IMF-based models) to filter low-frequency movements in output and unemployment. The difference with respect to Carabenciov et al. (2008) is that we add a process θ_{3t}^k , which adds an additional flexibility to the spectral properties of the low-frequency component.

3.2. Formulation of the state-space model

The short run dynamics of the model is governed by a VAR(1) process. Both short and long term components are then combined in a single state-space model, which is then used for model estimation and simulation. The observation variables are transformed to annualised quarterly growth rates.⁷

Hence the observed growth rate of the labour force is given by:

$$l_t - l_{t-1} = (\bar{l}_t - \bar{l}_{t-1}) + (\hat{l}_t - \hat{l}_{t-1}) + \theta_{1t-1}^l + (\hat{l}_t - \hat{l}_{t-1})$$

⁵ The problem may occur when the filter identifies a sign change in θ_{2t} . Such a change is then permanent on forecast. As an example, this may happen for trend productivity during a huge recession. If a model identifies in the last period that $\theta_{2t} < 0$, it will then predict an indefinite decline in productivity, which would mean that the model would not be able to forecast any growth recovery no matter how far in the future. Unless one believes in such a doomsday scenario, this is clearly an implausible feature for forecasting.

⁶ At least in the case of a well anchored monetary policy.

⁷ Here, we assume that we measure and filter only growth rates. In models where additional restrictions (in the form of e.g. accounting identities or equilibrium conditions) were imposed, it would be beneficial to measure also the level of variables directly. However, we do not have additional restrictions here and thus no efficiency is lost by measuring the growth rates only.

The observed growth rate of output is given by:

$$y_t - y_{t-1} = (\bar{y}_t - \bar{y}_{t-1}) + (\hat{y}_t - \hat{y}_{t-1}) + \theta_{1t}^l + \left(1 + \frac{1 - \gamma_2}{\gamma_1}\right) \theta_{1t}^z + (\hat{y}_t - \hat{y}_{t-1})$$

where the second equality follows by virtue of long-run elasticities⁸. Similarly, the observed employment is given by:

$$e_t - e_{t-1} = (\bar{e}_t - \bar{e}_{t-1}) + (\hat{e}_t - \hat{e}_{t-1}) + \theta_{1t}^l + \left(1 + \frac{1 - \gamma_2}{\gamma_1}\right) \theta_{1t}^z + (\hat{e}_t - \hat{e}_{t-1})$$

The observed nominal wage inflation $\pi_t^w = w_t - w_{t-1}$ is given by:

$$\pi_t^w = \bar{w}_t - \bar{w}_{t-1} + \hat{\pi}_t^w = \theta_{1t}^p + \theta_{1t}^z + \hat{\pi}_t^w$$

Analogous formulae apply for changes in the GDP and consumption deflators:

$$\pi_t^y = \theta_{1t}^p + \hat{\pi}_t^y$$

$$\pi_t^c = \theta_{1t}^p + \hat{\pi}_t^c$$

Measurement noise has been not included in the system.

4. DATA AND ESTIMATION OF THE MODEL

As compared to previous empirical work on labour market models, the dataset used is very up-to-date. Data have quarterly frequency and span from 1992Q1 to 2009Q4 for Belgium, Germany, Spain, France, Italy and the Netherlands. The choice of this sample period has been dictated both on the basis of statistical and economic grounds. On the statistical side, this sample period excludes the data problem related to German unification and to a number of missing back data for some countries, in particular hours worked. On the economics side, this period excludes the strong cost and price disinflationary process undergone during the 1980s by most euro-area countries. While this implies reducing the volatility of the series and thus limiting their explanatory power, the choice of limiting the estimation to this relatively recent sample period is more economically founded, as it excludes the disinflationary period of the period of the previous decade. All data used are adjusted for seasonality.

Unit wages are measured as gross compensation (including social security contributions) per hours worked and labour productivity is measured as real GDP per total hours worked. Given that the unemployment rate features also the model, which is typically measured as number of individuals, a distinction is made between the intensive and extensive margins. Real GDP and its deflator are measured at factor costs. The private consumption deflator is used as a measure for consumer prices. The wedge between the consumption and GDP deflators captures the effect of taxes and administered prices, as well as those of relative import prices on wage bargaining. In this regards external shocks are feeding throughout the model via this wedge. As typically handled in the empirical literature the identification problem of the labour demand and supply equations is

⁸ Results in Table 7 imply that $\bar{y}_t = \varpi_t^l + \left(1 + \frac{1 - \gamma_2}{\gamma_1}\right) \varpi_t^k$.

resolved by assuming that real product wages is what matters for firms (labour demand) and real consumer wage is what matters for employees or unions (wage curve).

Regarding some properties of the data, it is worth mentioning that quarterly series of hours worked have been only very recently made available for the euro-area countries by the national statistical offices. These data, while new, confirm the long term downward trend in the estimated data available for the annual frequency. As is evident from Figure 1, the employment gains across the euro-area countries were mainly determined by the creation of new jobs, while the working time per person has declined substantially during the past 20 years. As reported in Leiner-Killinger et al. (2005), the decline in hours worked is attributable to the increased use of part-time working arrangements, which is often related to the greater number of women entering the labour market, to institutional factors such as tax wedges which create disincentive to work, or to specific policy measures including changes in working time regulations, such as the introduction of the 35-hour week in France in 2000. During the 2009 recession, in some euro-area countries the reduction in total hours was a temporary phenomenon, primarily driven by the introduction of government-sponsored short-time work measures and flexible working time arrangements (such as working-time accounts).

Labour market reforms pursued in the early and mid-2000s in the largest euro-area countries aimed at increasing the flexibility for new hires to enter and leave new occupations have provided strong incentives for part-time jobs at the expense of the total number of hours worked. Given this decoupling between hours worked per person and employment it appears very relevant also for policy purposes to measure the unit wage as compensation per total hours worked rather than as per person employed, which is instead the typical approach in earlier empirical work on labour demand and supply (see for example Mourre, 2006). In particular, during the 2009 recession the dynamics of hourly compensation remained rather strong, while that of compensation per employee has moderated significantly.

The model described in Section 3 can be rewritten according to the following state- space form:

$$x_t = Ax_{t-1} + M + \sum_x \epsilon_t \quad (9)$$

$$y_t = Cx_t \quad (10)$$

where the state vector contains the vectors of the long-run growth rates θ_{1t}^k , their drivers θ_{2t}^k , θ_{3t}^k , cyclical parts of the model; the matrix A contains the long-run block based on the process (8) and the VAR block, which drives the short-run dynamics; the matrix M contains μ_t^x in the appropriate locations; $\sum_x \epsilon_t$ maps structural innovations to θ_{3t}^k , and to the cyclical part; and finally the matrix C adds the two components to the vector of the observable variables y_t . The part of this matrix, which corresponds to the long-run dynamics, is based on the long-run elasticities reported in (7).

The Kalman filter is used for state filtering and smoothing, forecasting, likelihood evaluation and shock decomposition. The formulae for filtering, smoothing, and likelihood evaluation are fairly standard (e.g. Harvey, 1989). Given the smoothed estimate of the state $x_{T|T}$ and its covariance matrix $P_{T|T}^x$ (T denotes the last observation), the h -step (unconditional) prediction of $y_{T+h|T}$ can be computed as:

$$y_{T+h|T} = C \left[A^h x_{T|T} + \left(\sum_{g=0}^{h-1} A^g \right) M \right]$$

and its covariance matrix can be derived as follows:

$$P_{T+h|T}^y = CP_{T+h|T}^x C'$$

where the state prediction covariance matrices $P_{T+h|T}^x$ satisfy the recursion:

$$P_{T+h+1|T}^x = AP_{T+h|T}^x A' + \Sigma_x \Sigma_x'$$

with the initial condition given by the Kalman filter output $P_{T|T}^x$.

The conditional forecast can be also easily derived. To condition the forecast on a set of variables, it is sufficient to run the filter on the model with a suitably redefined observation matrix C . The approach used for implementing conditional forecast maintains trends fixed on the unconditional projection. In this way, we can attribute the difference between conditional and unconditional forecast to the cyclical part of the model. Also, following Koopman and Harvey (2003), the Kalman filter can be ‘inverted’ to inquire how observations in each series translate to the model assessment of trends and cycles. Finally, the model is used to perform shock decomposition, which is computed as follows: based on the smoothed states $x_{t|T}$, we can recover the smoothed residuals $\epsilon_{t|T}$. The shock contribution to the i th observable variable from the j th shock is defined as $\sum_{s \geq 0} i_s^{ij} \epsilon_{t-s|T}^j$ where $\epsilon_{t-s|T}^j$ is the j th element of $\epsilon_{t-s|T}$ and i_s^{ij} is the (i, j) element of the impulse response $i_s = CA^s \Sigma_x$. Note that our definition of the shock decomposition cumulates the effects of current and past shocks (the alternative decomposition could be defined in terms of current shocks plus the effect of the initial conditions).

We estimate the model using a pseudo-Bayesian approach (as in Hong and Chernozhukov, 2003): we maximize the likelihood with some prior imposed on long-run growth rates⁹ and on selected signs of impulse responses for the short-run dynamics. It is interesting to mention, that only for Italy does the prior affect the estimation results. For other countries, the mode of the posterior distribution would be almost equal to the maximum likelihood estimator.¹⁰ The prior on standard errors of innovations are flat (uninformative) and hence the same for all countries.

Figures from 2 to 7 show recursive point forecasts for the six euro-area countries since 2004. All the charts show annualized quarterly changes. Recursive point forecasts show that in all cases the model can track the short-term dynamics rather well, with the exception of the labour force in Germany, France, Italy, and the Netherlands. This may be due to the fact that in these countries the labour force has shown very little procyclicality in the recent past, due to structural factors, such as population aging. Figures 9 to 14 compare the relative accuracy of the model forecasts (denoted as the BPS model, based on the first letters of authors’ names) with forecasts generated by the ‘random walk’ model, by unrestricted VAR(1) and unrestricted VAR(2) processes¹¹ at forecast horizons from 1 to 8 quarters. The figures display the root mean square errors (RMSE) relative to BPS; the RMSE of the model presented being normalized to one. Typically, for most countries, BPS does a better job for nominal wages and inflations, while for the labour force the unrestricted VARs seem to be better. The ordering for the rest of variables is inconclusive.

Although in the case of some variables the forecast performance of our model is as good as VARs models, the advantage of the state-space framework used should be stressed. The state-space formulation allows one easily to make conditional forecasts or to incorporate external

⁹ All simulations reported in this paper are taken with respect to the mode of the posterior distribution.

¹⁰ For Italy, the maximum likelihood estimator would result in extremely low standard errors of innovations in the process (8). This would mean that the long-run growth rates would be almost constant, which is a feature we do not like. Such a feature is especially counterfactual when the model is used for forecasting during a crisis for it would predict a rapid recovery.

¹¹ A reader may ask why we have chosen the VAR order of the maximum lag 2. The reason is that VARs with higher lags are better at the very short forecast horizons (1 quarter), but their forecasting ability deteriorates rapidly for longer forecast horizons (for horizons greater than 3, they are much worse than any of the four models considered). This effect is likely due to over-parametrization of higher-order VARs. The reader may want to consider the lucid discussion by Tiao and Xu (1993) for intuition why some models can be ‘good’ at short forecast horizons, but fail completely at longer horizons.

judgements. For example, if the forecaster has an extra piece of information (say from sectoral experts) about the likely evolution of only some of the model variables, then they can run conditional forecasts based on this piece of information. It is sufficient to redefine the matrix C from Eq. (10), as it just means to delete rows of the matrix C corresponding to variables for which the information is not available. The same approach can be used if some variables are measured with a lag or lead comparing to the other variables.

Similarly, if the forecaster doubts regarding the real time release of some observations (for example, the national-account wages are too different from the census-based wages) and fears that the figure may be subject to significant revisions, they could add a measurement noise to Eq. (10) and run the filter and forecast with the last observation subject to the measurement noise.

Furthermore, the state-space framework can incorporate the ‘expert-information’ about unobserved trends. For example, if the model yields the implausible decomposition of a series to trend and cyclical components, it is possible to force the model to a more plausible decomposition by a suitable expansion of the observation matrix C for a given period. By this, the expert can impose their preferred decomposition for one or more series.

Finally, there is a notorious issue of the end-point bias, i.e. excessive trend revisions due to new data. Our model applied to the data exhibits lower revisions comparing to the mechanical application of the HP filter. In the literature, this is often explained as the virtue of the state-space formulation and the Kalman filtering¹², but this is incorrect. As shown by Andrle (2013), the ‘end-point bias’ of a filter (i.e., the excessiveness of trend revisions) depends on how well the assumed model can forecast future observations rather than on the filtering technique (Kalman filter versus least squares). It turns out that the trend formulation chosen in this paper can produce more reasonable forecasts than the I(2) Harvey-Jaegger process implicitly assumed by the HP filter (see Footnote 5 above), and this is the reason for alleviating excessive trend revisions.

Figures 15 to 20 show the historical shock decomposition for four variables. The left column displays the decomposition to the model trends and to the cyclical component, while the right column shows the decomposition of the cyclical part of the variable. Also in this case the charts show annualized quarterly changes.

Focusing on the left column of the figures 15–20, from a cross-country perspective it is interesting to note that the model reading of the 2009 crisis is that of an almost entirely cyclical episode, i.e. trend developments have not been affected by the crisis. The only exception is Spain, where a clear downward movement in employment and an upward movement in hours worked can be observed. As regards trend wages the countries can be divided in two groups: in the first group – Germany, France and the Netherlands – trend wages are equally explained by trend inflation and productivity; in the second group – Italy, Spain and Belgium trend wages are predominantly explained by trend inflation.

As to the evolution of the cyclical component during the past 10 years, Germany is the only country which appears characterized by an opposite movement of employment and labour participation shocks in explaining the dynamics of employment and hours worked. Indeed, across the euro-area countries, Germany is the country which witnessed the smallest employment creation between 1999 and 2008 and a sharp downward trend in the labour force. In other words the chart suggests that in Germany, employment creation was demand- and not supply-driven. As to the shock decomposition of the cyclical component of German GDP, this has been mainly dominated by a productivity shock. Indeed, a key issue for the German economy is that many years of productivity gains were translated only very marginally and very late into employment creation. As to the shock decomposition of the cyclical component of nominal wages in Germany, this has been mainly driven by participation and wage shocks.

¹² E.g. Proietti and Musso (2007) claim that the state-space model can alleviate the bias *because of the adaptation property of the Kalman smoother at the end of the sample*. Our working paper version also contains a similarly incorrect statement.

As regards, the evolution of the cyclical components in France, all shocks appear to have contributed to the downward adjustment of employment during the recession. In Italy, according to the model, relatively favourable internal terms of trade could explain the benign employment movements in the early 2000s and could offset a larger fall of employment in the 2009 crisis, which was driven by productivity and employment shocks.

Finally in the case of Spain, the fall in employment between 2008 and 2009 is explained by a decline of trend labour force. In the case of trend output growth such a decline is compensated for by an increase in trend productivity growth. This result, which of course entails a high degree of uncertainty, would suggest that a rebalancing of the supply-side determinants of growth is taking place in Spain. Such a rebalancing might deliver, if persistent, a more sustainable growth model for the Spanish economy.

5. A POLICY EXPERIMENT: THE EFFECT OF WAGE MODERATION ON THE JOB-RICHNESS OF THE ECONOMIC RECOVERY

The 2009 recession, which is covered in the dataset used for the estimation, has led to very different employment responses across the euro-area countries. In particular, Germany and to a lesser extent Italy, Belgium and the Netherlands have witnessed a significant degree of labour hoarding, stronger than in previous recessions, while Spain saw exceptionally strong labour shedding. While labour hoarding is a common characteristic across the euro-area countries, the particularly strong resilience of the labour market to the sharp economic downturn was mainly due, in the first group of countries, to the extensive use of special measures to support employment. By contrast, the employment losses observed chiefly in Spain were related to the sharp downward correction of a strongly labour-intensive sector, i.e. construction, in an environment characterized by very loose firing conditions (due to a high rate of temporary contracts). In light of this heterogeneity in labour market adjustments across euro-area countries, the employment prospects in a recovery scenario appear highly uncertain, as it might be the case that firms would downwardly adjust employment once special schemes to keep jobs are expired or that they would gradually return to higher levels of hours worked per person, waiting for long before new job opportunities are created. On the other hand, it might also be the case that in those countries witnessing strong labour shedding, the recovery may provide a relatively stronger impulse to employment.

This section tries to answer the following policy question: to what extent could a stronger degree of hourly wage moderation than that recently witnessed strengthen the job-richness of the economic recovery after the 2009 recession?

The simulation exercise consists of quantifying the different elasticities of a 1% drop in the unit wage level across euro-area countries. These elasticities are derived by taking the difference between the unconditional forecasts delivered by the our model in a two-year horizon and the conditional forecasts, where a 1% drop in the wage level in the course of the first year (2010) has been assumed. Such a drop is obtained by reducing the wage rate in each quarter of 2010 by a proportional amount leading to a 1% fall with respect to the baseline level for the year as a whole. The drop in the level of wages is permanent, i.e. no unwinding has been implemented in the subsequent year. The simulation results are reported in Figure 8.

In general, this empirical model confirms the gains in terms of higher employment which could be achieved via wage moderation even in the short-run. However, the reaction of such a wage shock entails different implications in terms of margins of adjustment. It appears, in particular, that gains both in hours worked and persons employed could take place in such a scenario in Germany, France, the Netherlands and, after two-years, in Belgium. By contrast the same shock would induce, as in the case of Spain, very strong employment creation, especially in the second

year after the shock, at the expense of hours per person, leading in any case to an overall gain in terms of total hours worked.

In the case of Spain, the finding of a trade-off between the evolutions of the two margins of adjustment can be explained by looking at past behaviour of the two variables. The Spanish unemployment rate has shot up by almost 10 percentage points since the beginning of the 2009 recession, while compensation has remained almost unaffected by the sharp change in labour market conditions. This feature has been found also in other empirical cross-country works (see Pierluigi and Roma, 2008). Such a huge employment correction has been partially driven by the burst of the housing bubble and partially by the strong bias towards fixed-term contracts. The model reading of such a situation is that even a small decline in the wage rate would strongly impact on employment and would also lead to a strong fall in the labour force. An important caveat is that this rather stylised model cannot capture sectorial adjustments and therefore tends to over-weigh the possibility for the unemployment rate to swiftly return to pre-crisis levels.

In the case of Italy the wage shock leads to a rather small reaction of hours worked and a small and negative reaction of employment in persons. The sum of the two margins imply an overall almost nil impact of the negative wage shock. The result is related to the very weak empirical link between wage dynamics and hour developments in Italy, as it emerges from the very small reaction of the labour demand to labour costs developments (see Pierluigi and Roma, 2008 and European Commission, 2006).

All in all, looking at the aggregate variable (EA6), one can conclude from this exercise that wage moderation would certainly help employment creation and – to a lesser extent – an upward adjustment in hours. In the case of Spain, the results suggest that a moderation in the dynamics of the wage rate would be highly beneficial for preventing further employment losses. Results are in line with other studies, based on larger scale models, where a negative wage mark-up shock is used to replicate an increase of labour market flexibility (see Gomes et al. 2011 and Angelini et al., 2013).

6. CONCLUSIONS

This paper presents a new macro tool for monitoring and forecasting labour market developments across the six largest euro-area countries. The model is primarily empirical but relies on theoretical underpinning in the derivation of the trends. The forecasting properties of the estimated model are satisfactory as they generally improve on first and second order VAR models and random walk processes.

The paper also shows that labour market adjustments differ substantially across euro-area countries, as it emerges from the contributions of the long-term drivers and short-term shocks to key labour market developments.

Finally, the model is used to assess the employment impact of reduction in the nominal hourly wage rate. The results of this policy experiment would suggest that in an environment characterized by significant labour hoarding, achieving moderate wage growth significantly helps delivering a more job-intense recovery. The simulations also show that countries tend to differ in their adjustment of hours worked versus job creation in response to a nominal wage cut, most likely in relation to the different institutional settings. In Spain, wage moderation appears particularly beneficial for preventing further employment losses after the sharp labour shedding witnessed in 2009. By contrast, in France, Italy and Belgium a lower nominal wage rate triggers a higher response of hours worked rather than jobs. In Germany and the Netherlands both margins of adjustment are equally positively affected by a nominal wage reduction.

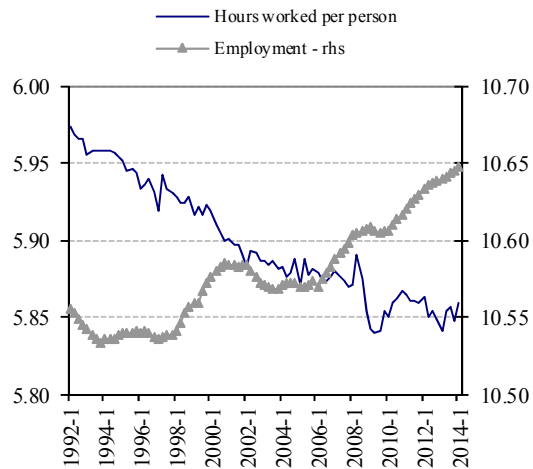
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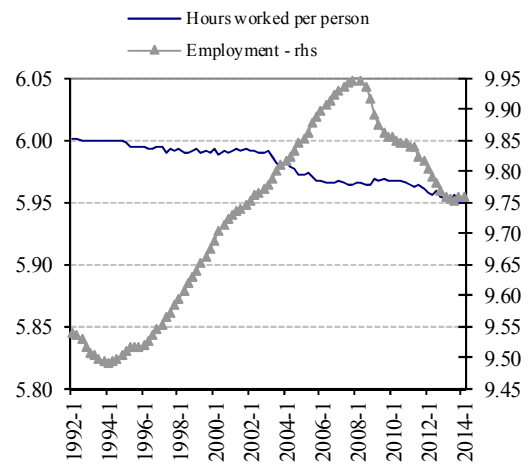
APPENDIX

Figure 1
Hours worked and employment developments across euro-area countries

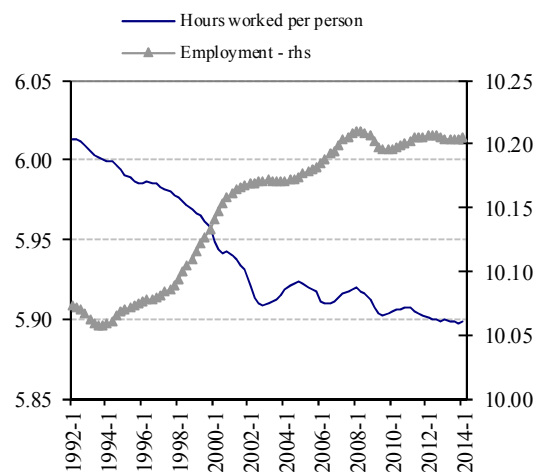
Germany



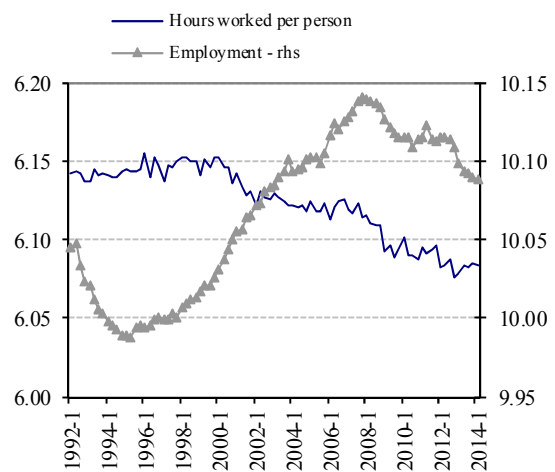
Spain



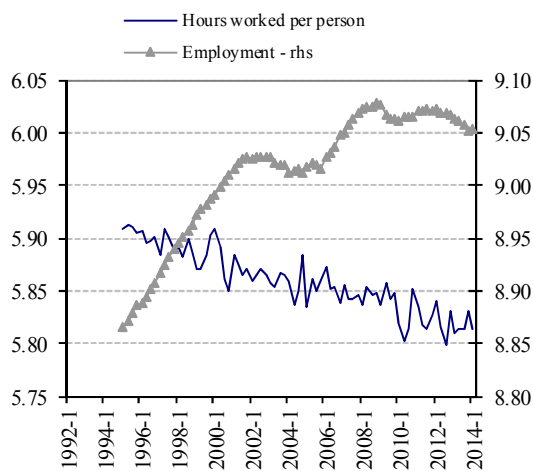
France



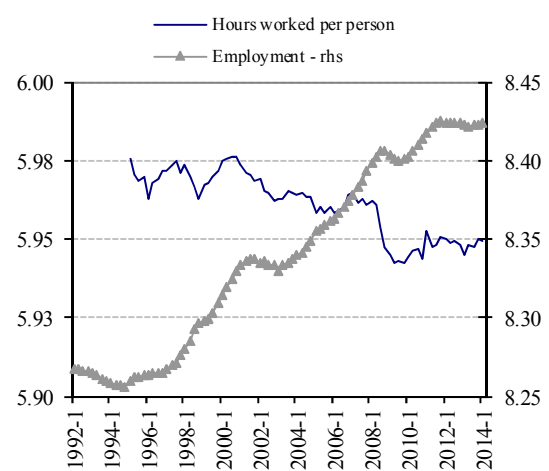
Italy



Netherlands



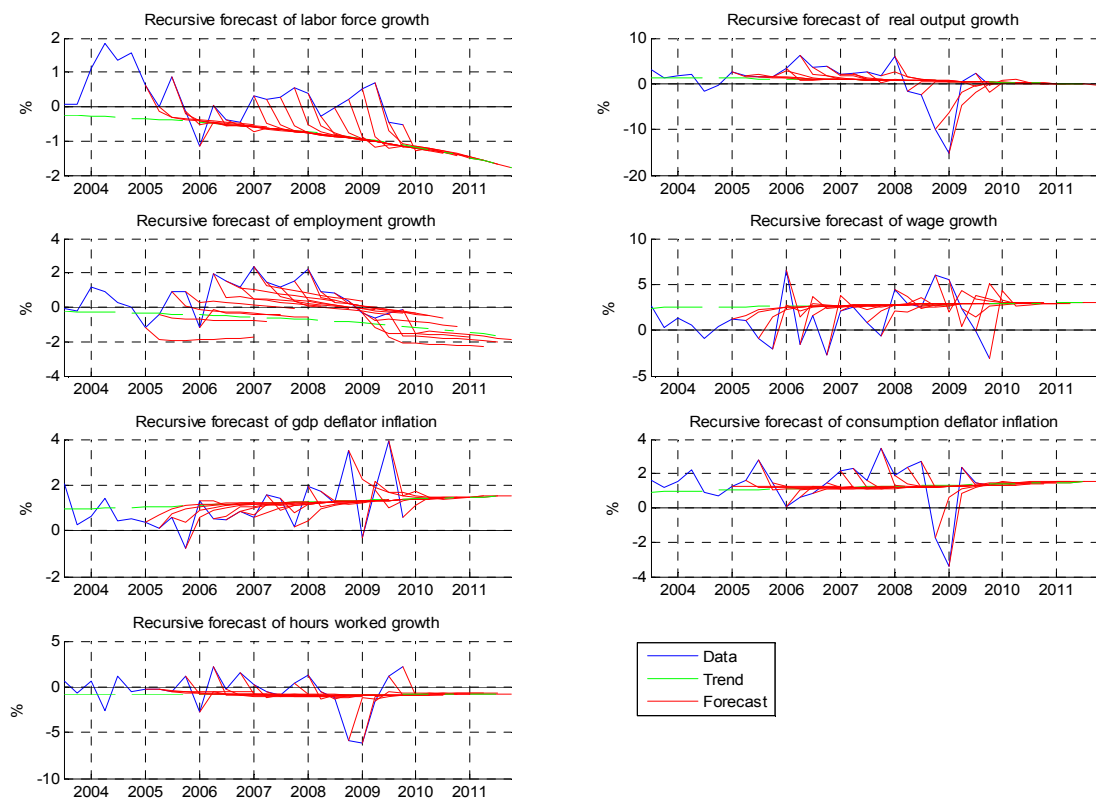
Belgium



Note: data shown in logs. In the case of NL and BE data for hours worked start in 1995Q1.

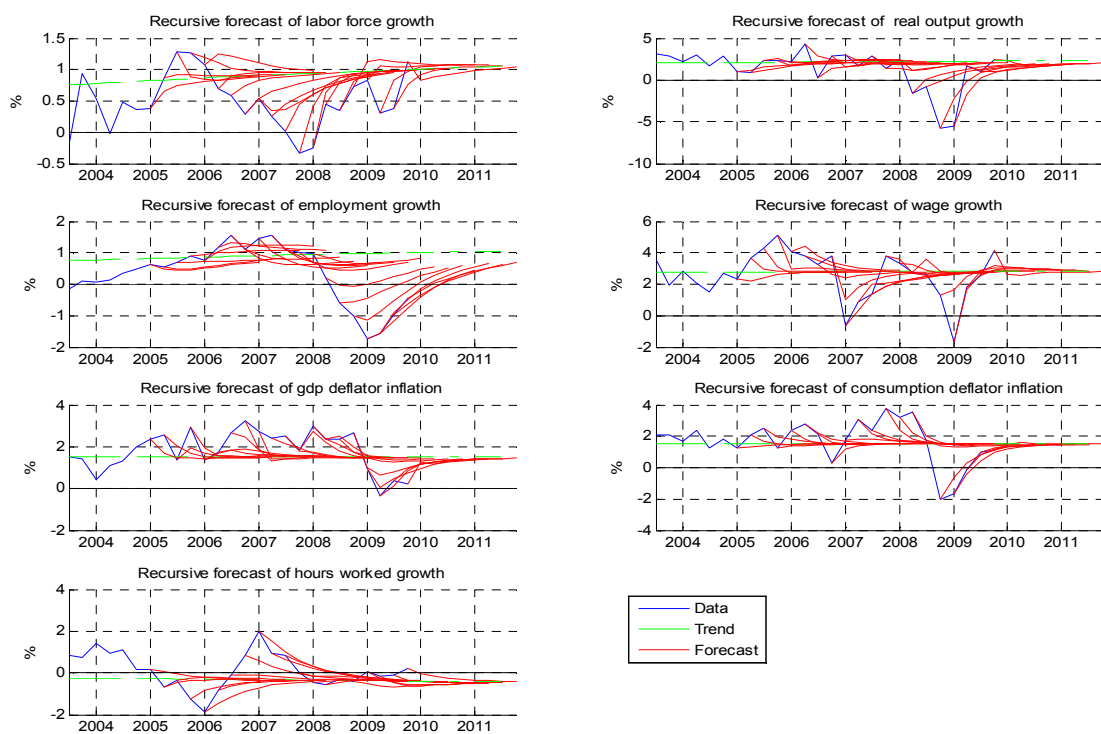
Source: Authors' calculation on Eurostat data.

Figure 2
Germany – recursive forecast



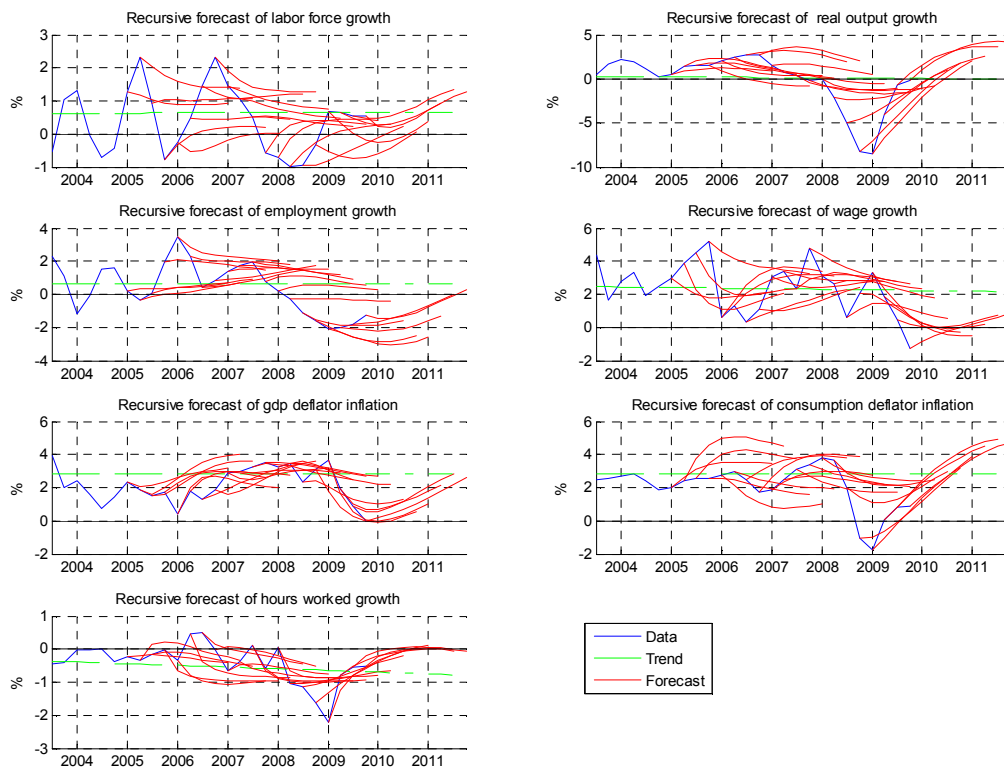
Source: Authors' calculation.

Figure 3
France – recursive forecast



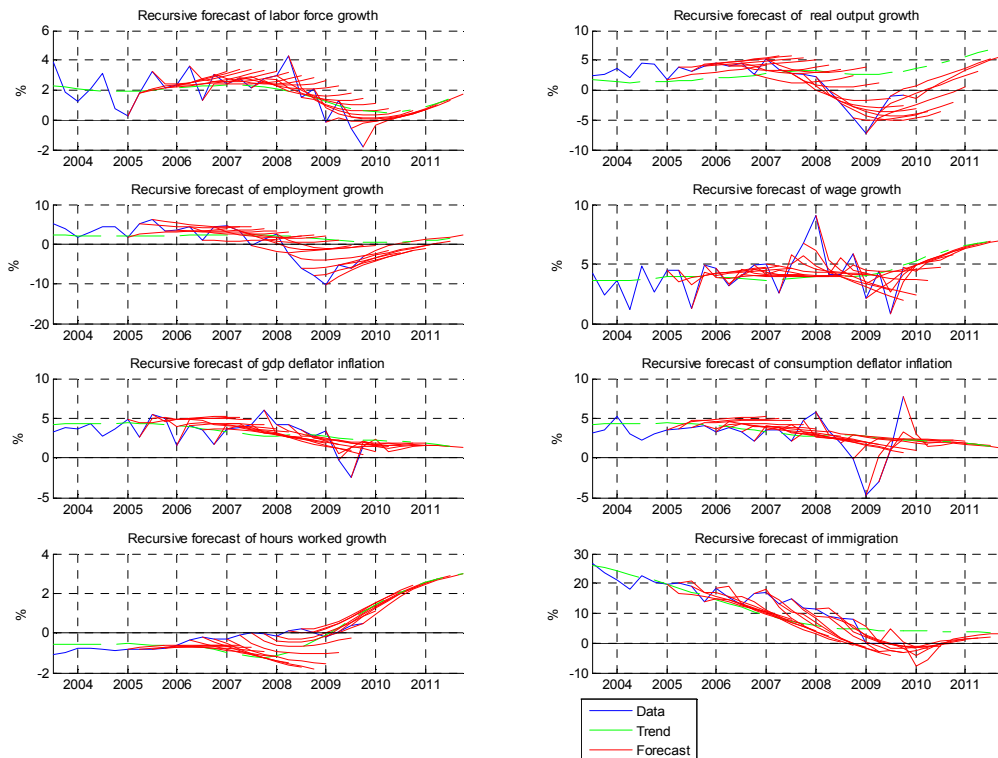
Source: Authors' calculation.

Figure 4
Italy – recursive forecast



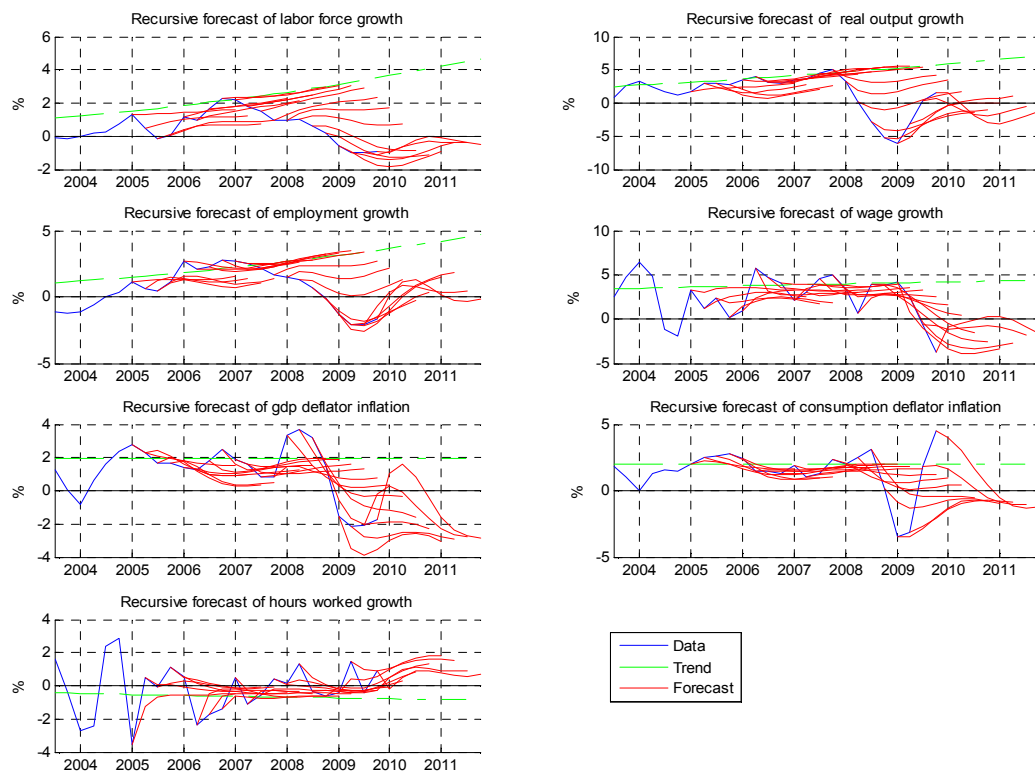
Source: Authors' calculation.

Figure 5
Spain – recursive forecast



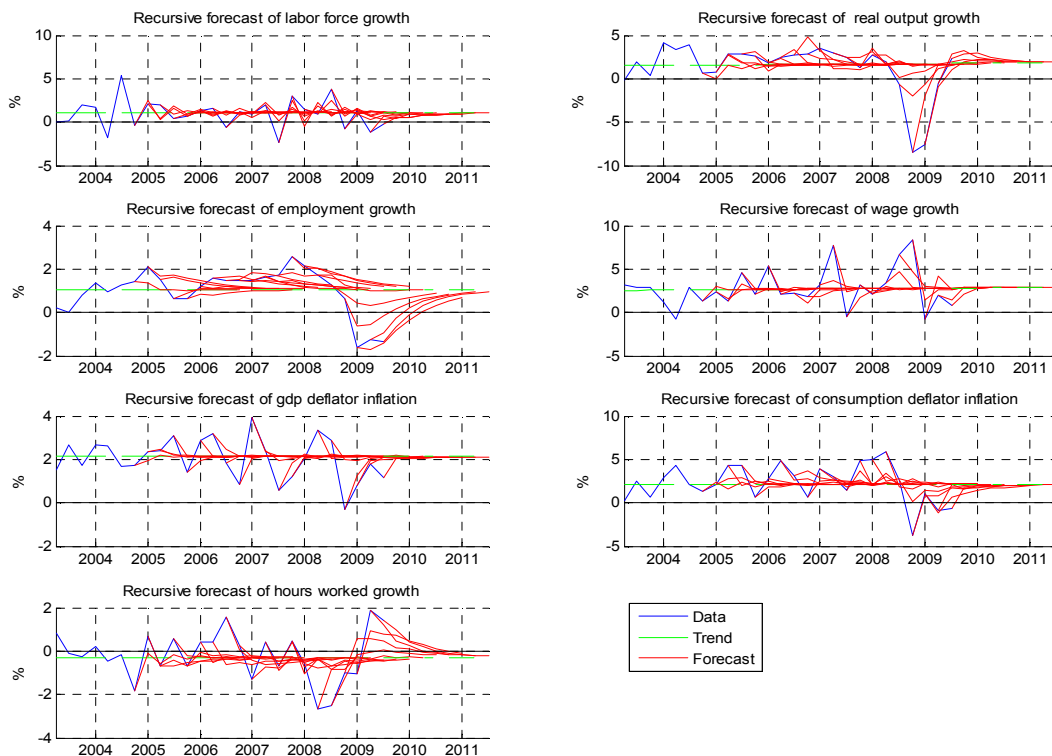
Source: Authors' calculation.

Figure 6
The Netherlands – recursive forecast



Source: Authors' calculation.

Figure 7
Belgium – recursive forecast

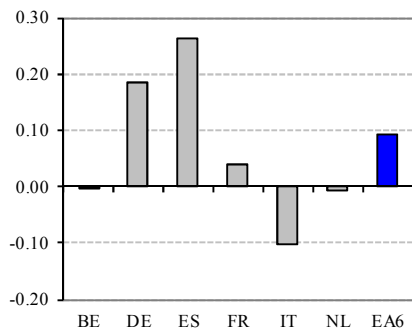


Source: Authors' calculation.

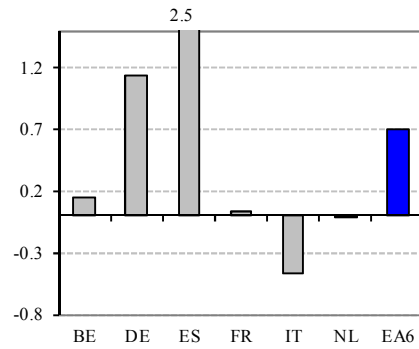
Figure 8
Impact of a 1% drop in hourly compensation

Employment in persons

(a) 2010

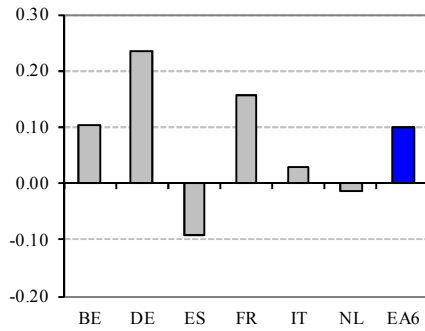


(b) 2011 (cumulated)

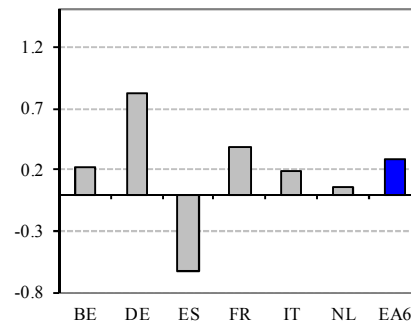


Hours worked per person

(a) 2010

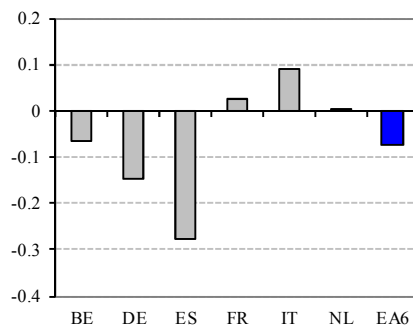


(b) 2011 (cumulated)

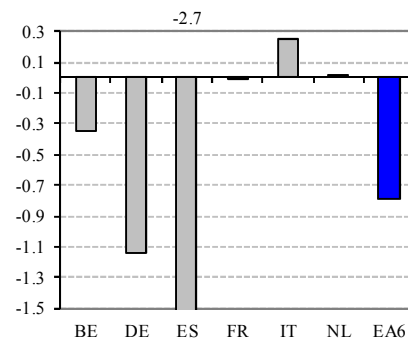


Unemployment rate

(a) 2010



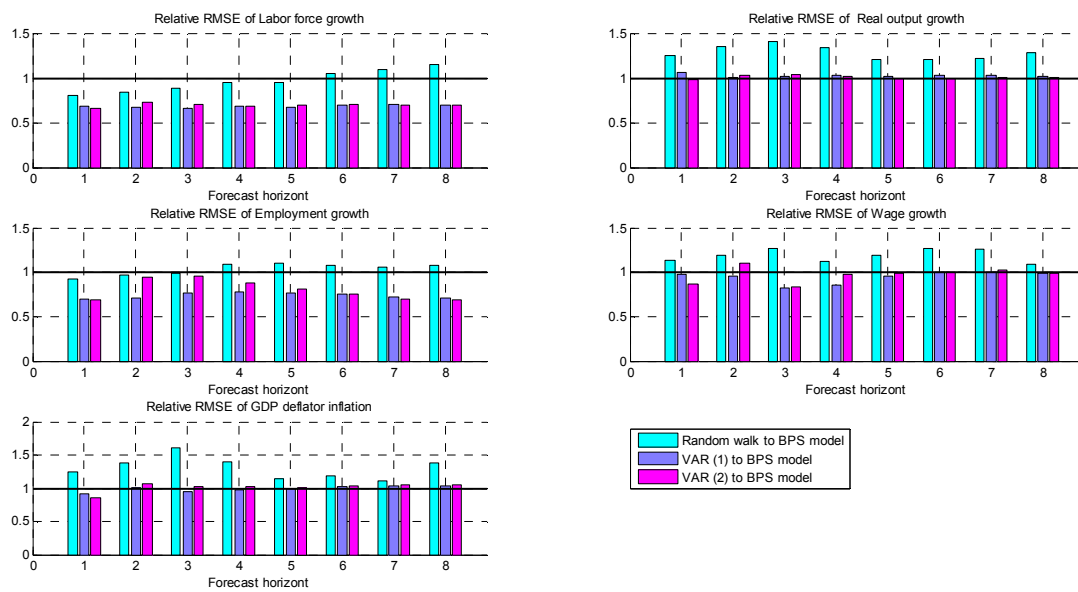
(b) 2011 (cumulated)



Note: EA6 is the weighted average of the six euro-area countries.

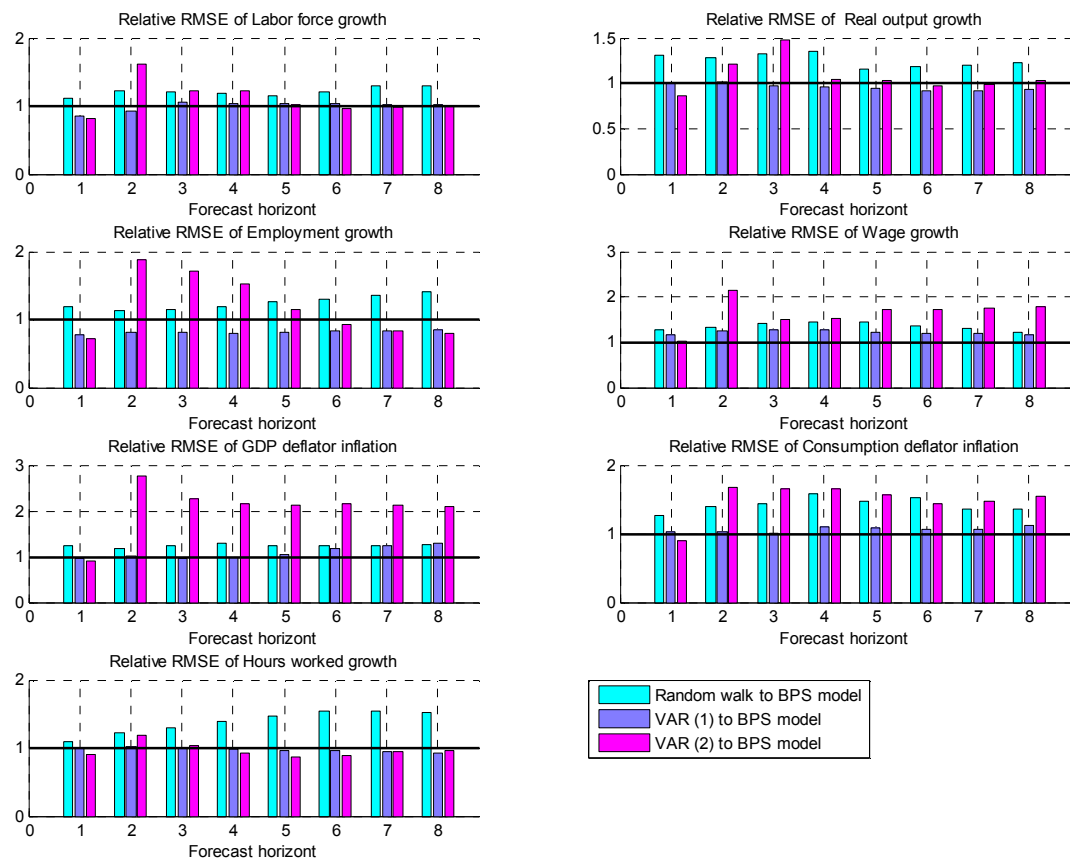
Source: Authors' calculation.

Figure 9
Forecasts' competition: Germany



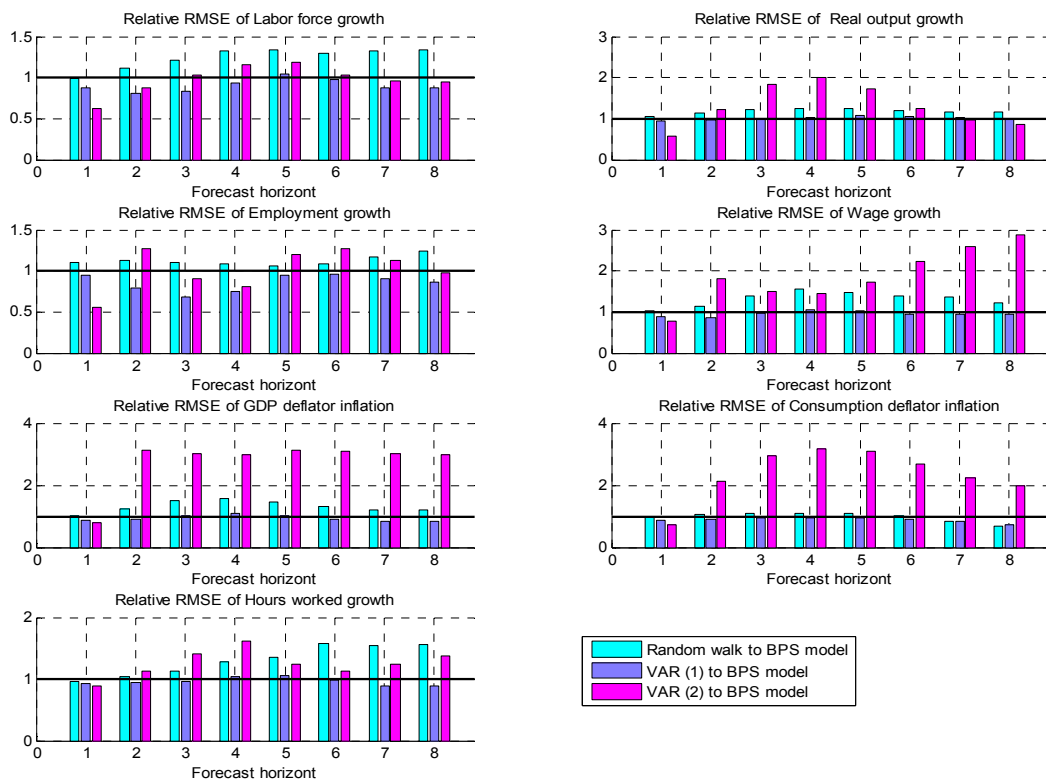
Source: Authors' calculation.

Figure 10
Forecasts' competition: France



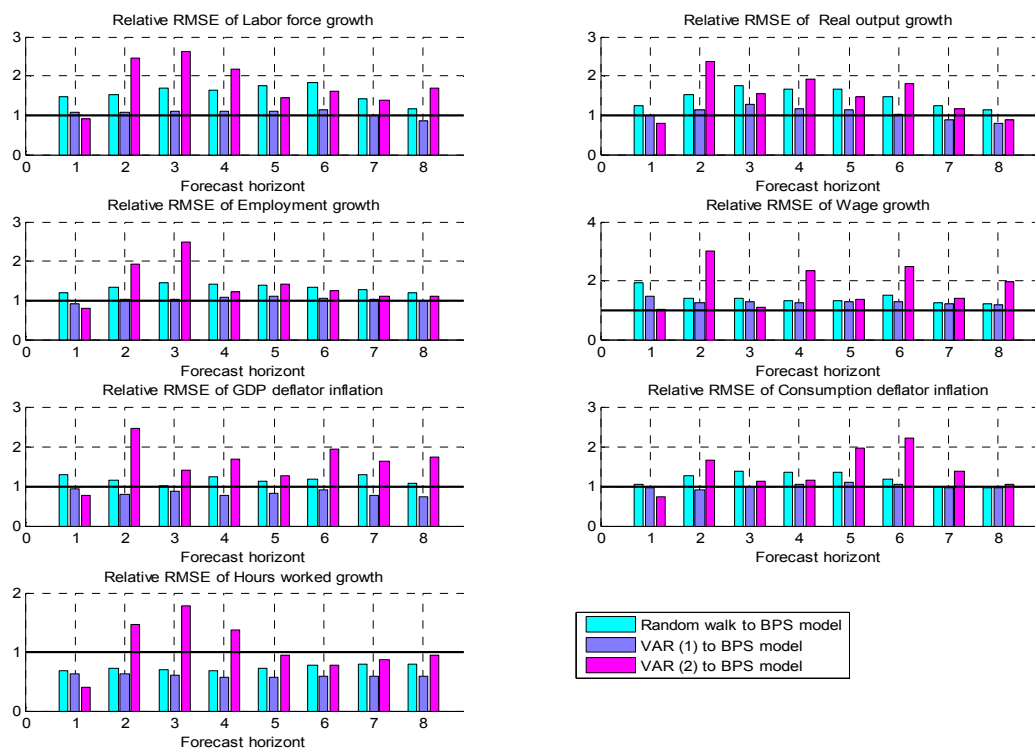
Source: Authors' calculation.

Figure 11
Forecasts' competition: Italy



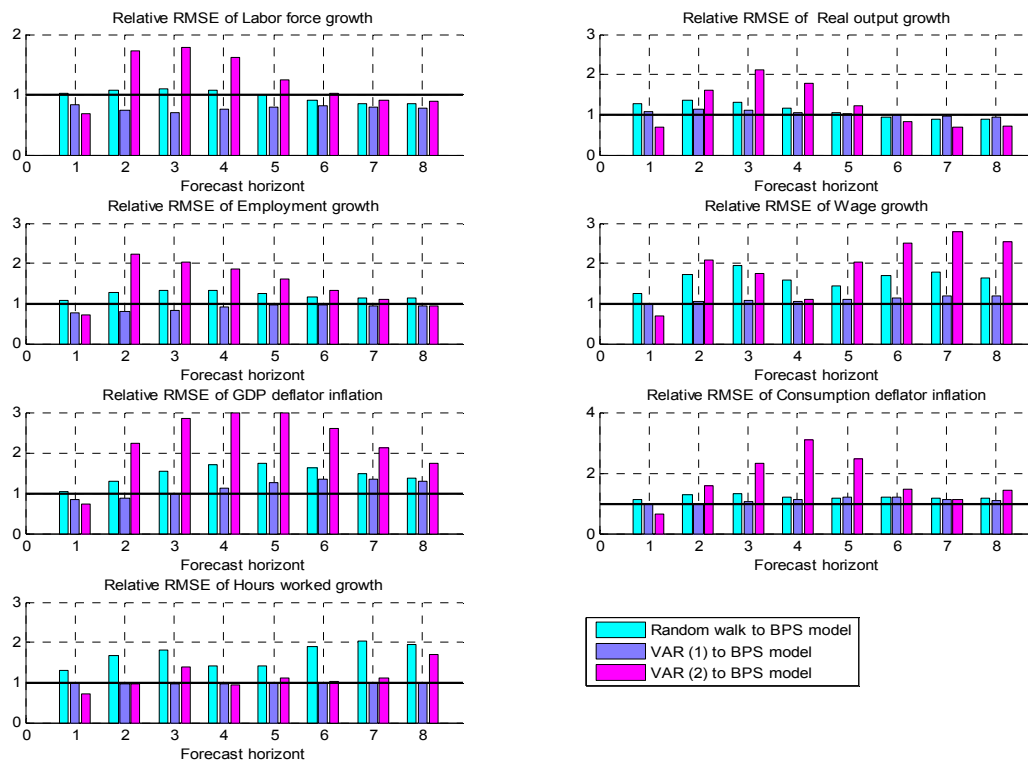
Source: Authors' calculation.

Figure 12
Forecasts' competition: Spain



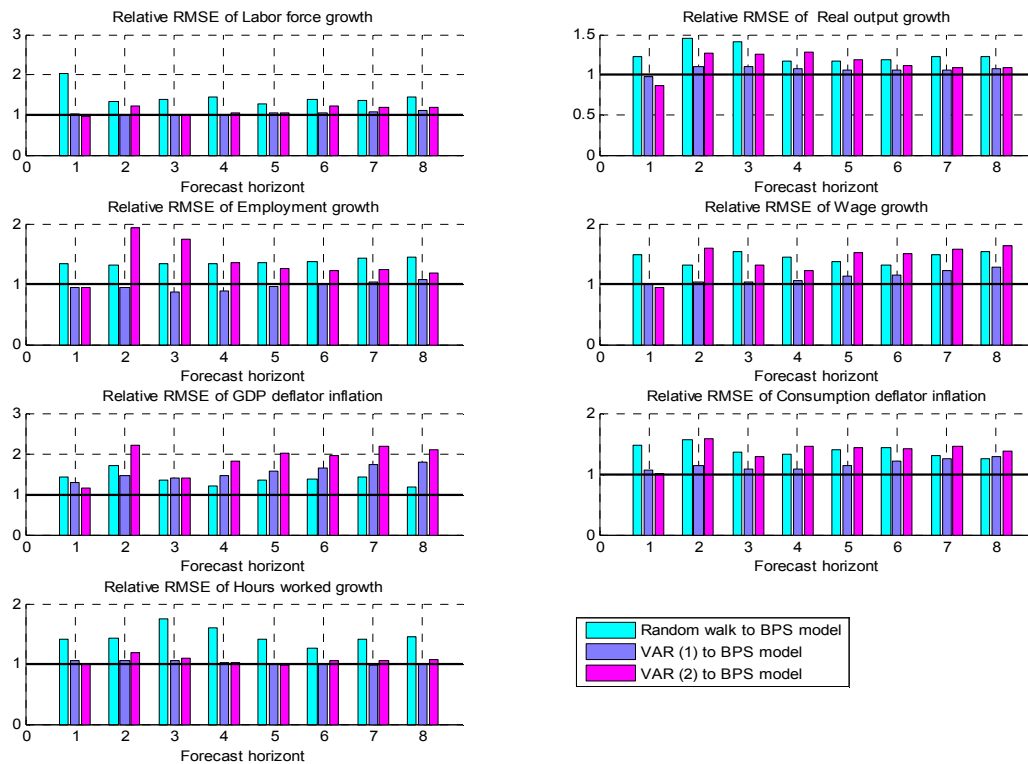
Source: Authors' calculation.

Figure 13
Forecasts' competition: The Netherlands



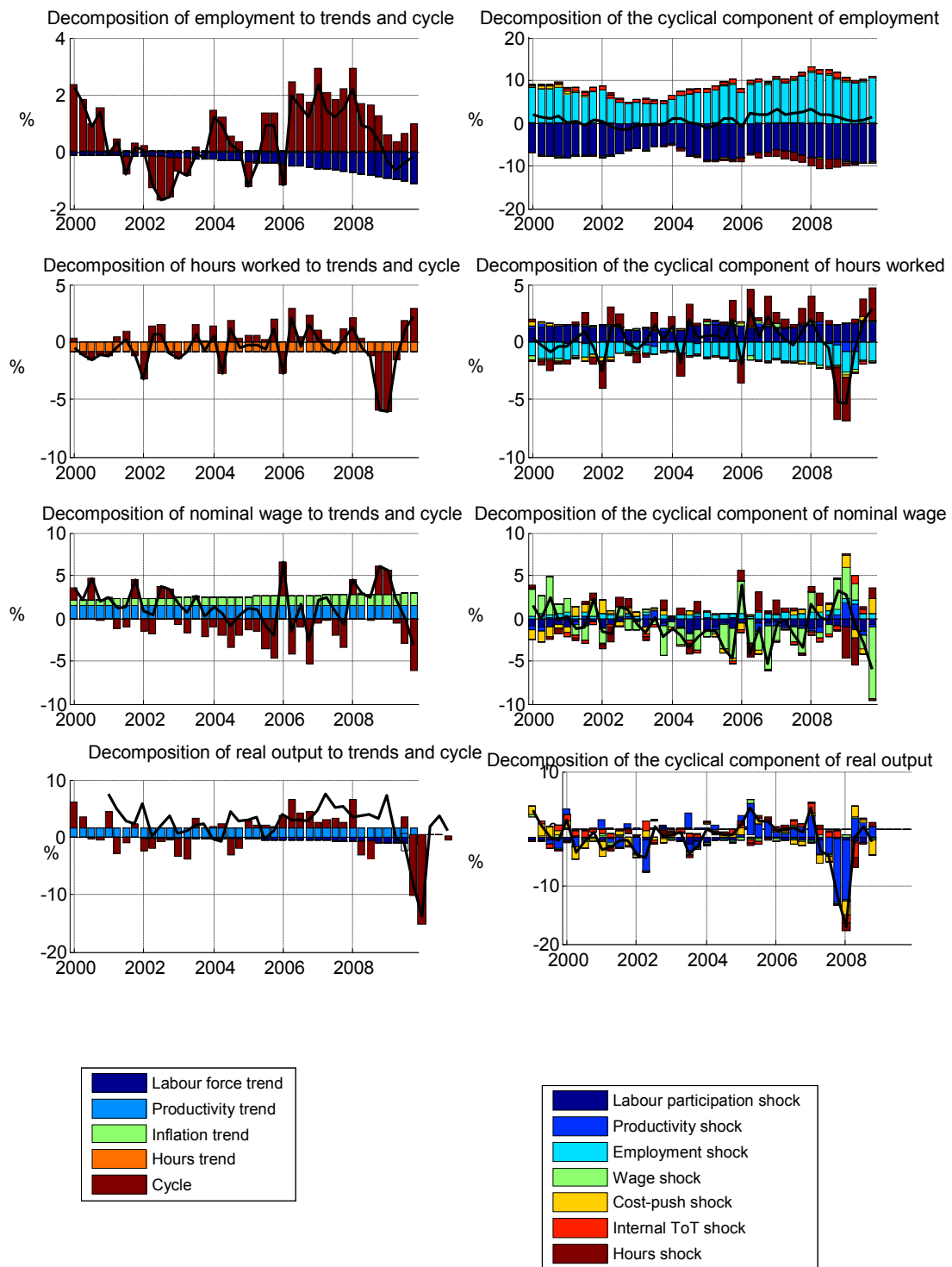
Source: Authors' calculation.

Figure 14
Forecasts' competition: Belgium



Source: Authors' calculation.

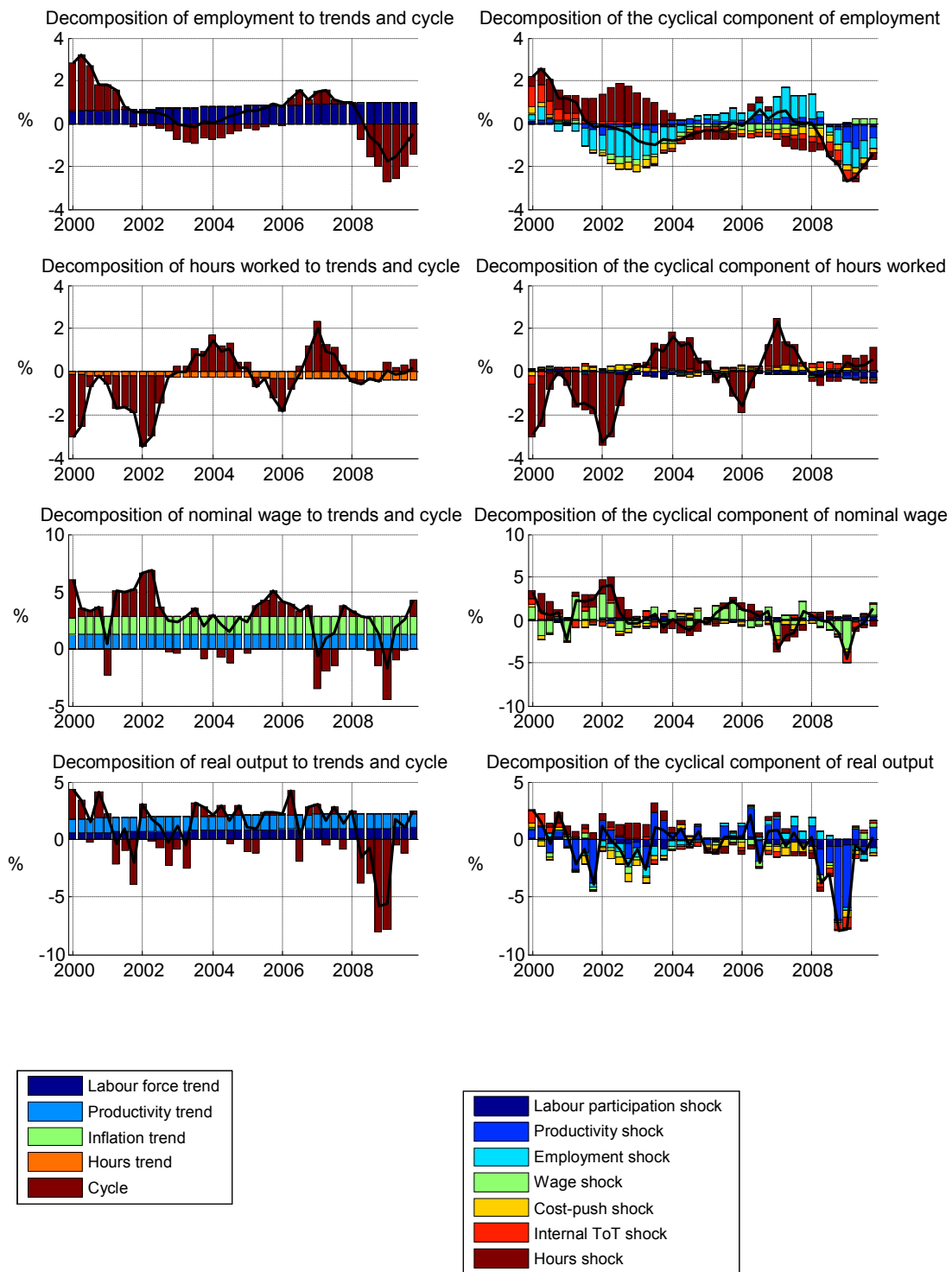
Figure 15
Historical decomposition for Germany



Note: figures reported in annualised growth rates.

Source: Authors' calculation.

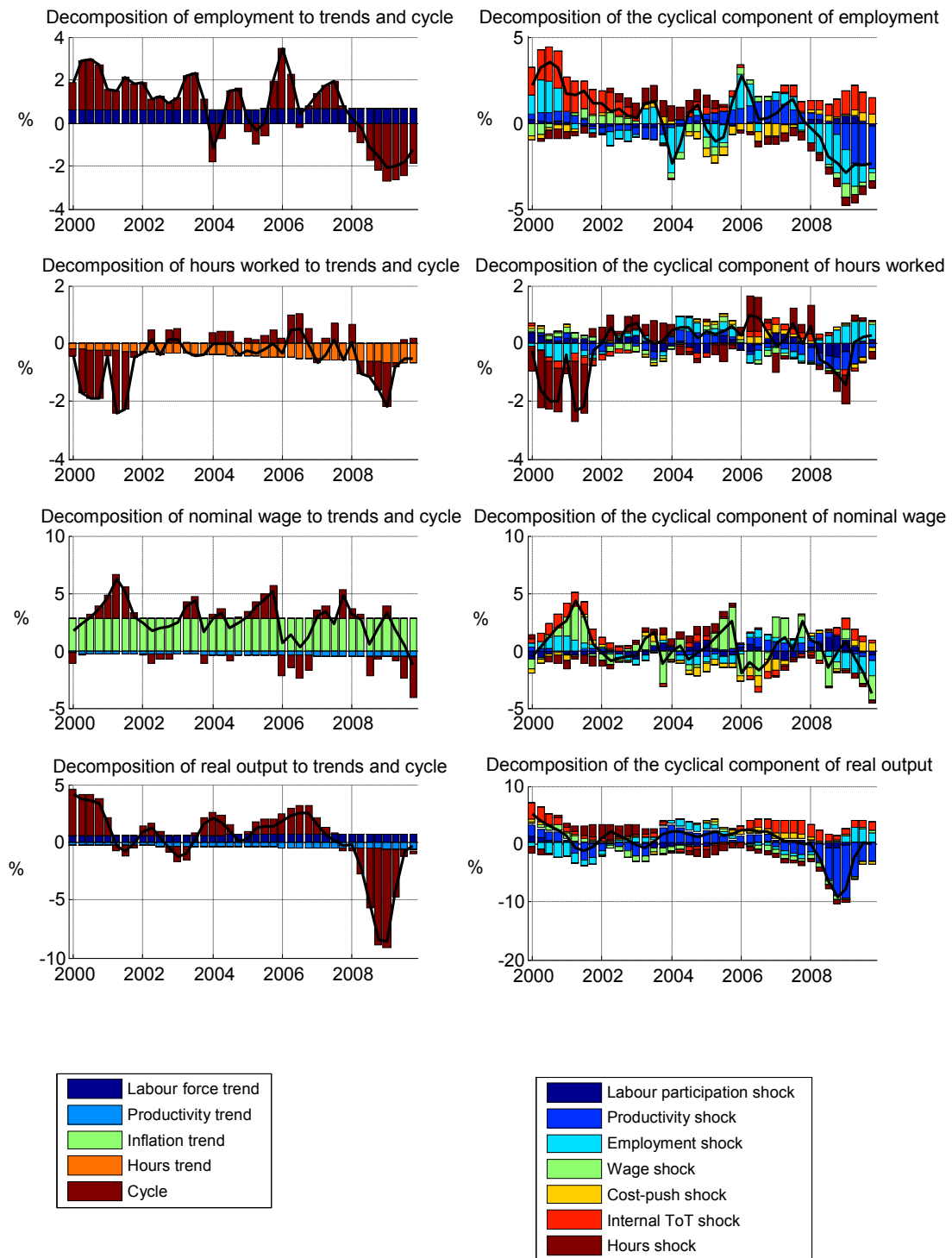
Figure 16
Historical decomposition for France



Note: figures reported in annualised growth rates.

Source: Authors' calculation.

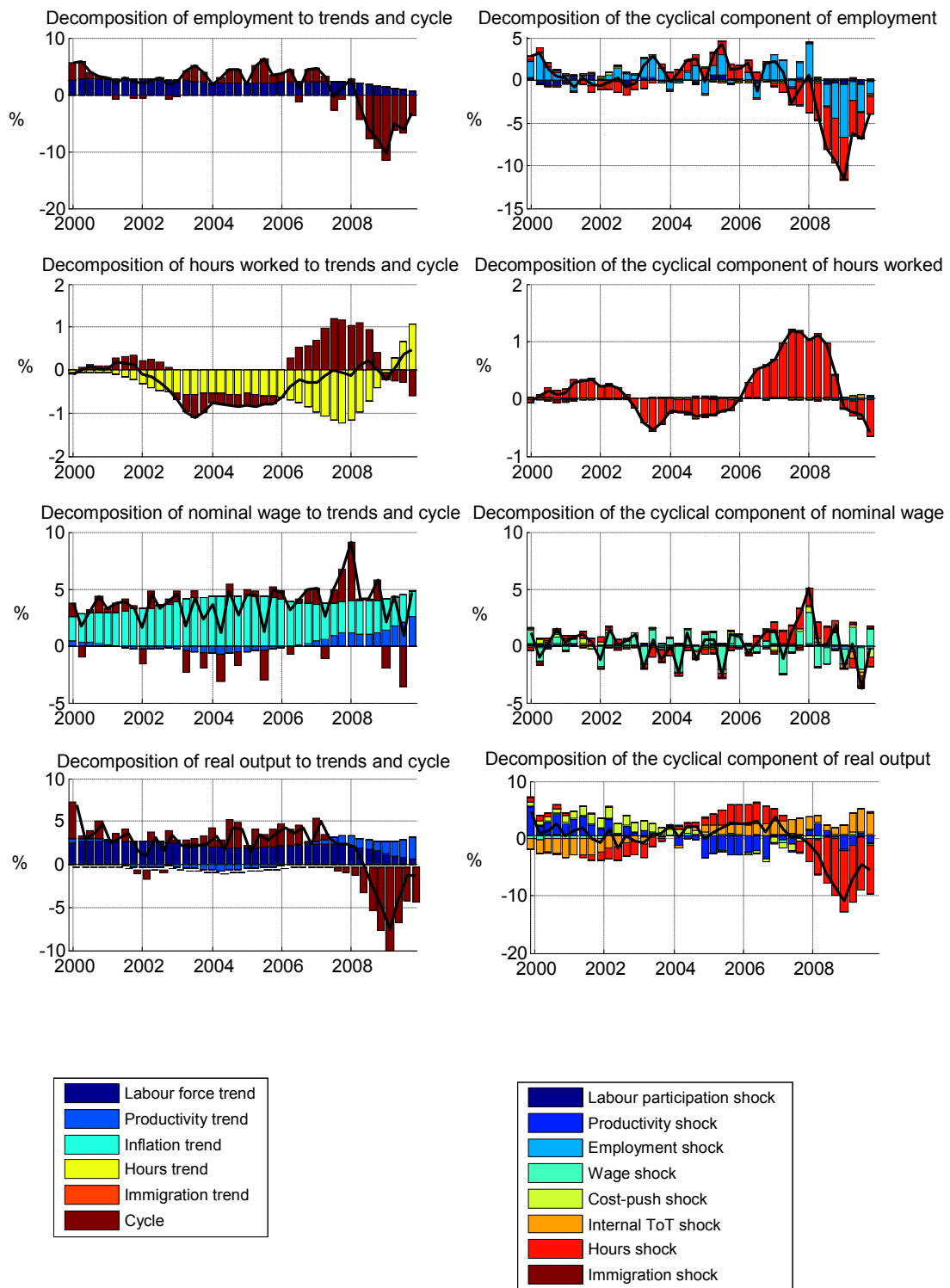
Figure 17
Historical decomposition for Italy



Note: figures reported in annualised growth rates.

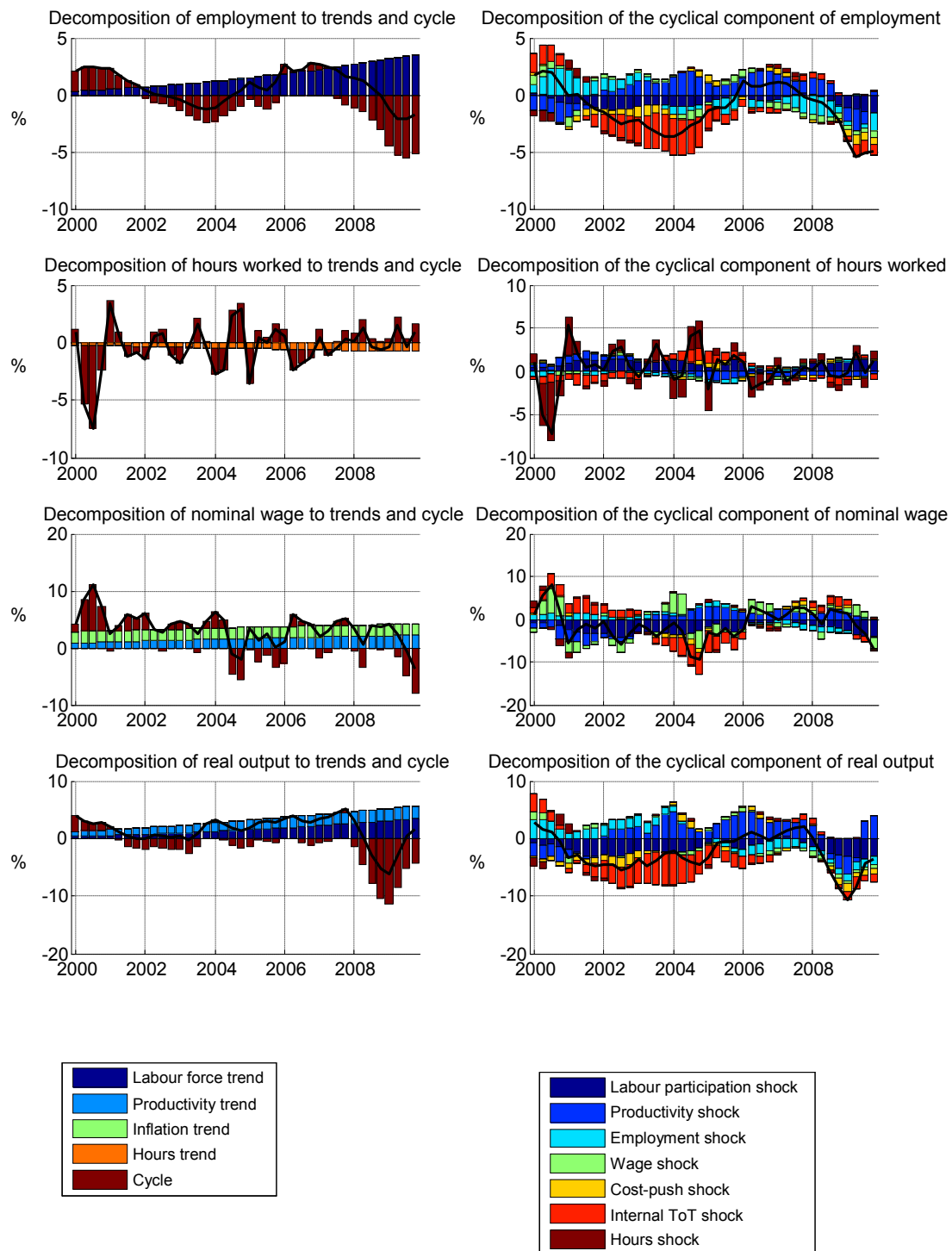
Source: Authors' calculation.

Figure 18
Historical decomposition for Spain



Note: figures reported in annualised growth rates.
Source: Authors' calculation.

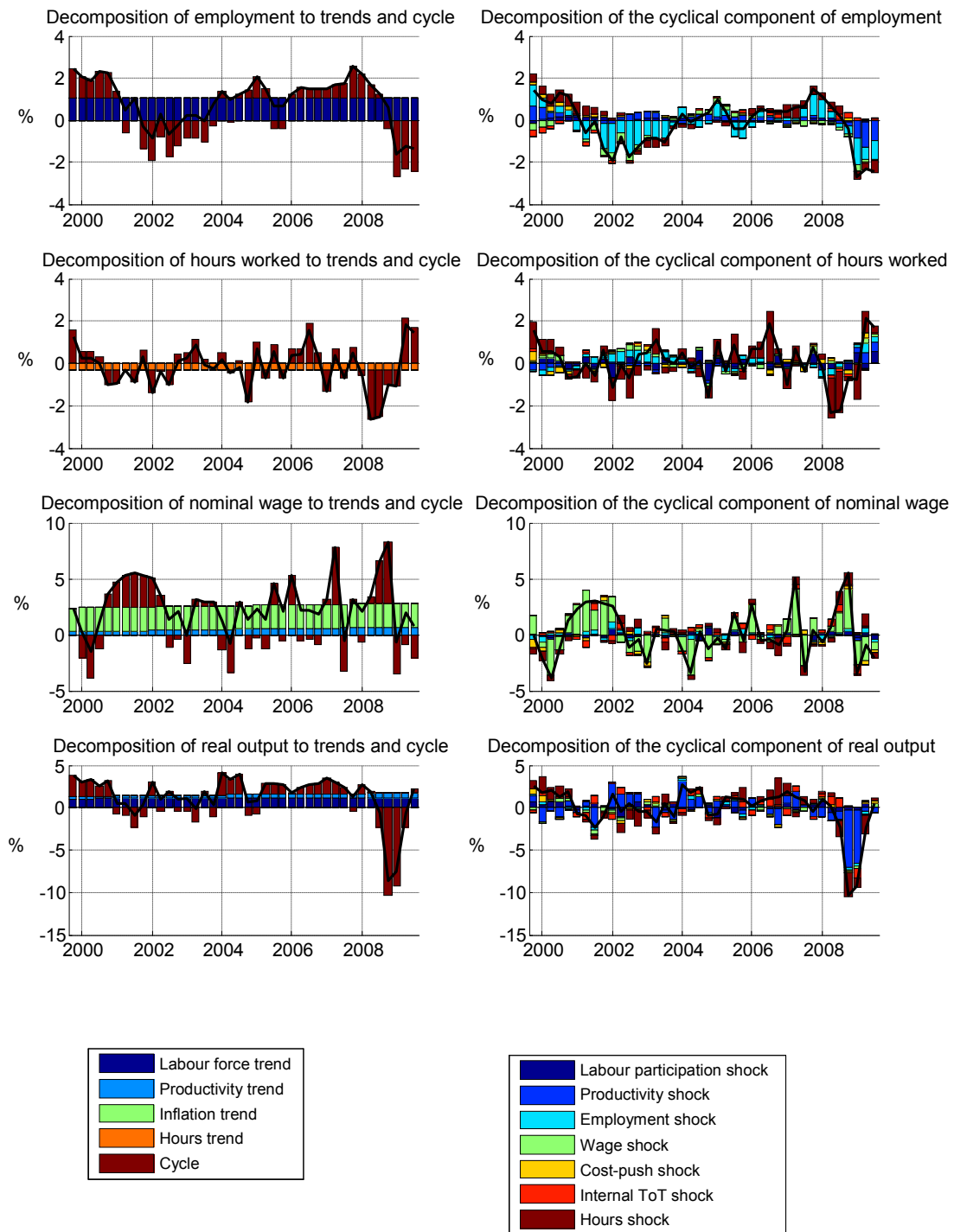
Figure 19
Historical decomposition for the Netherlands



Note: figures reported in annualised growth rates.

Source: Authors' calculation.

Figure 20
Historical decomposition for Belgium



Note: figures reported in annualised growth rates.
Source: Authors' calculation.