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The effects of wage flexibility on activity and employment in the Spanish economy

The effects of wage flexibility on activity and employment in the Spanish economy*

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Abstract

In this paper we estimate the macroeconomic effects of the greater wage and firms' internal flexibility promoted by various changes in Spanish labour regulations approved since 2012. To do so, we propose a structural VAR that allows us to break down the changes in the main macroeconomic variables into different structural shocks. The simulation of two counterfactual scenarios allows us to conclude that the effects of smaller rigidities in the labour market from 2012 onwards have been significant. In the first scenario, we describe how the economy would have evolved since 2012 if the observed wage flexibility were absent. In the second scenario, we estimate the effects of greater wage flexibility since the onset of the crisis in 2008.

Keywords: labour market, reforms, wage flexibility, structural VAR

JEL classification: C32, E24, J08.

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1. Introduction

Aside from Greece, Spain was the European country with the highest unemployment increase during the recent recession, experiencing a fall in GDP similar to that of other economies, while working hours per worker barely changed and real wages grew, partly due to a composition effect. This evidence, as shown by Andrés and Doménech (2015), suggests that job destruction between 2008 and 2013 was due among other things to rigidities in the labour market that reduced employment instead of wages and hours per worker.

This abnormal labour market adjustment also occurred in the two previous recessions that have affected the Spanish economy since the early 1980s[1].

In this context of inefficient labour market regulations, the reforms undertaken in 2010 and, particularly, from 2012 onwards were necessary, as well as other additional measures (see Doménech et al., 2016, for further details), although they have not been enough to solve all structural problems of the Spanish labour market. As a result of these reforms, greater flexibility helped first to avoid greater job destruction and, subsequently, to promote a stronger and a more balanced employment recovery.

The purpose of this article is to quantify the effects of the changes made in the labour market since 2012. To do so, we estimate the macroeconomic effect of the greater wage and firms' internal flexibility partially favoured by various changes in employment laws. We propose a labour market model that extends previous contributions in the literature (particularly, Fabiani et al., 2001) and incorporates non-stationary wage and mark-up shocks. Using zero long-run and sign identification restrictions, the estimation of the structural VAR obtained from this model allows us to break down the changes in the main macroeconomic aggregates into different types of structural shocks that affected employment, unemployment, GDP, prices, productivity and the labour share. The estimation of the structural shocks allows us to simulate two counterfactual scenarios, whereby we conclude that the effects of less rigid labour market are positive and significant. In the first scenario, we describe how the economy would have evolved since 2012 with the wage rigidity observed from 2009 to 2011. In the second scenario, we estimate the effects from 2008 onwards of the wage flexibility observed from 2012 to 2015.

This article also contributes to the debate on the effects of the structural reforms in countries with no monetary policy sovereignty and in a context of interest rates close to or at zero. During the recession, there was much debate on the possible negative short-term effects of the structural reforms in peripheral European countries, which have been deleveraging in a context in which real interest rates have been positive, despite the ECB reducing official rates to zero. Given the combination of a high risk premium and negative inflation, some pundits have contended that in these circumstances the structural reforms designed to regain competitiveness by reducing costs and prices push interest rates and real debt up and aggregate demand down, intensifying the fall in prices and production, and the destruction of jobs in the short term. As Krugman (2014) points out, in a deflationary economy "the usual rules of economic policy no longer apply: virtue becomes vice, caution is risky and prudence is folly ... Structural reform, which usually means making it

[1] The Spanish labour market has been the subject of many studies, an overview of which goes beyond the objectives of this paper. See, for example, the references included in Chapter 2 of Andrés and Doménech (2015) as a starting point for readers interested in pursuing this subject further.

easier to cut wages, is more likely to destroy jobs than create them."

According to this view, in a two-country model with monopolistic competition in products and labour markets, Eggertsson, Ferrero and Raffo (2014) show that structural reforms can be contractionary when the central bank's nominal interest rate is close to its lower limit, fuelling expectations of protracted deflation. Similarly, using a neo-Keynesian closed economy model with price and wage rigidities, Galí (2013) shows that both in monetary unions in which central bank interest rates do not respond to the fall in inflation in one particular country and in economies at the zero lower bound (ZLB), wage flexibility can have contractionary effects on aggregate demand and employment if negative inflation rates and higher real interest rates are expected. Galí and Monacelli (2016) extended this result to open economies and found that wage adjustments have very limited effects on employment when the exchange rate is fixed, as it is the case in a monetary union.

Although these theoretical results have questioned the desirability of structural reforms such as those carried out in Spain in the labour market during the last few years, other studies have found results more favourable to these reforms. Using the QUEST model for the Eurozone in its multi-country version, Vogel (2014) finds that, when economies are at the ZLB, the short-term negative effects of structural reforms are slight and very short-lived (generally one quarter), which does not justify delaying structural reforms and foregoing their future benefits. For their part, Andrés, Arce and Thomas (2014) show that structural reforms can stimulate production and employment, even in the short term and in a deflationary environment in which households and firms are looking to reduce their debt, because they increase the future value of assets and collateral, favouring the recovery and accelerating the deleveraging process.

Our results show that the effects of the labour reforms on production and employment have been positive, despite their potentially deflationary consequences. Moreover, these effects may have been reinforced by the reduction in risk premiums and interest rates, helped by the interactions and positive externalities between structural reforms, gradual and credible fiscal consolidation, the process of banking union and the restructuring of the financial system, as well as a more expansionary monetary policy. In contrast with some previous results that propose the convenience of postponing structural reforms to periods of greater inflation, our results suggest that, if implemented at the beginning of the crisis, they could have avoided a significant part of the falls in GDP and employment. Nevertheless, as this was not the case, better latter than never.

The structure of this article is as follows. In section 2 we analyse the behaviour of the labour market during the crisis and the recovery, and highlight the behaviour of employment and of certain significant macroeconomic variables that followed the economic policies adopted since 2012. This helps to understand the peculiarities of this episode

compared with others observed in the last few decades. In section 3 we describe the main characteristics of our theoretical and econometric model. The results of the two counterfactual scenarios are detailed in section 4, as well as some robustness exercises. Lastly, section 5 summarises the main conclusions of this paper.

2. The crisis and recovery of the Spanish labour market

The response of the labour market to macroeconomic shocks has represented a huge problem for the Spanish economy over the past forty years. The institutional configuration of the labour market has led to inadequate adjustment mechanisms, both in booms (increase in labour market duality, lacklustre productivity and weak growth in real wages) and in recessions (countercyclical changes in working hours, downward wage rigidity and massive job losses). Consequently, the cyclical component of employment is more volatile in Spain, and the structural unemployment rate higher than in other developed countries[2].

Given its endemic deficiencies, the labour market behaved as expected during the last recession. The decline in domestic demand (consumption and investment) since the beginning of 2008 led to a cumulative reduction of 9.3% in GDP up to mid-2013. The contraction in economic activity was accompanied by a fall of 19% in employment (Figure 1). The causes of this exceptionally high elasticity are to be found in the lack of response from the intensive margin (hours per employee)[3] and, above all, from wages. As shown in Figure 2, nominal remuneration per employee increased by 9.2% between the first quarter of 2008 and the fourth quarter of 2011, while real remuneration increased by 8.2%.[4] This upturn in labour costs, along with a limited competition in the market for products[5], the tax changes and the rise in regulated tariffs made it difficult for prices in the economy as a whole to adjust, despite the fall in domestic demand, which in turn, led to a reduced demand for workers. Moreover, the increase in compensation per employee also pushed up unit labour costs (ULC) during 2008 and 2009, in spite of the notable increase in apparent labour productivity (Figure 3). Given that the ULC of the Eurozone as a whole grew by

[2] Andrés and Doménech (2015) estimate that the structural unemployment rate has fluctuated around 15% since the mid-eighties. In contrast, in the eight most advanced economies of the EU, the average unemployment during the same period was just 6.8%.

[3] After falling by around 4% since 2002, hours worked per employed person increased during 2008 and 2009 by about 1% and then stabilised until the beginning of 2012.

[4] Part of the growth in remuneration was the result of a composition effect caused by the concentration of job destruction in groups with below-average wages. However, real wage increases included in collective bargaining agreements reached 3.6% in 2008 and 2.3% in 2009.

[5] According to Koske et al. (2015), Spain's indicator of barriers to competition is similar to that of the average of Germany, France, Italy, the UK and Portugal, but those for regulatory complexity, barriers to entry for firms and to private initiative are more restrictive. The analysis of the effects of competition in the markets for goods and services on the labour market can be found in Blanchard and Giavazzi (2003).

nearly four points less during the same period, the price competitiveness of the Spanish economy suffered.

The fall in employment and the counter-cyclical changes in the labour force during the initial stages of the crisis[6] turned into an unemployment rate increase of 18 percentage points (pp) to 26.3% in 1Q2013 (Figure 4). The magnitude of the unemployment rate reached is worrying, but the possibility of remaining high for an extended period of time is even worst. This difficulty in reversing the growth in unemployment, known as hysteresis, which has its origin in deficiencies in price and wage formation (among other things), has been widely documented for the Spanish economy after the previous recessions (Dolado and López-Salido, 1996, and Dolado and Jimeno, 1997).

With the aim of halting the deterioration of the labour market, successive governments have approved several reforms since 2010, which mainly sought to rebalance the adjustment by facilitating a correction through wages, internal flexibility and the intensive margin (hours per worker), at the expense of moderating the response of the extensive margin (employment). The reform of the labour market, passed in February 2012 as Royal Decree-Law and in July as Law, stands out[7]. Among the numerous changes introduced by this reform, it is worth mentioning the following three:

- The decentralisation and modernisation of the collective bargaining system, by giving greater priority to agreements at the firm level and eliminating the indefinite extension of collective bargaining agreements where new ones cannot be agreed (ultra-activity).
- A significant reduction in the cost of dismissal, whether unfair (the special *express* dismissal was abolished and the severance payment of 33 days per year worked with a maximum of 24 month was applied across the board) or for fair causes (economic reasons for fair dismissal were simplified and wages during the dismissal procedural period were abolished except for reinstatement cases).
- The promotion of internal flexibility mechanisms[8]. Firstly, the reform facilitates the adoption of substantial amendments to the terms of employment contracts (particularly the amount of wages or salary) and removes the requirement for a prior administrative authorisation for suspending the contract or reducing the working day for economic,

[6] As shown in Box 1 of BBVA Research (2008), the labour force growth during the early part of the crisis was explained by an added worker effect characterised by an increased propensity to participate in the labour market on the part of groups with traditionally limited prospects of obtaining employment (women, young people, people with few or no qualifications etc.).

[7] Royal Decree-Law 3/2012 of 10 February on urgent measures for the reform of the labour market (https://goo.gl/utNImY) and Law 3/2012 of 6 July on urgent measures for the reform of the labour market (https://goo.gl/ty3ul7).

[8] The Second Agreement on Employment and Collective Bargaining for 2012-2014 also contributed to promoting the use of internal flexibility mechanisms as an alternative to job destruction (see http://goo.gl/4zKgss).

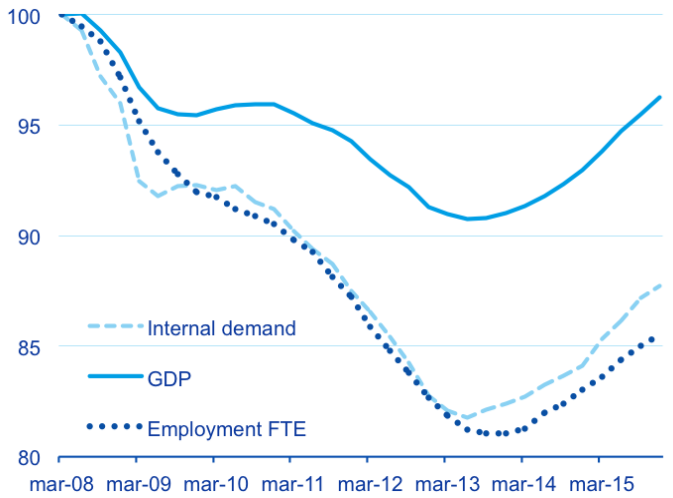

Figure 1: *GDP, internal demand and employment, seasonally adjusted, 1Q2008=100). Source: BBVA Research based on INE.*

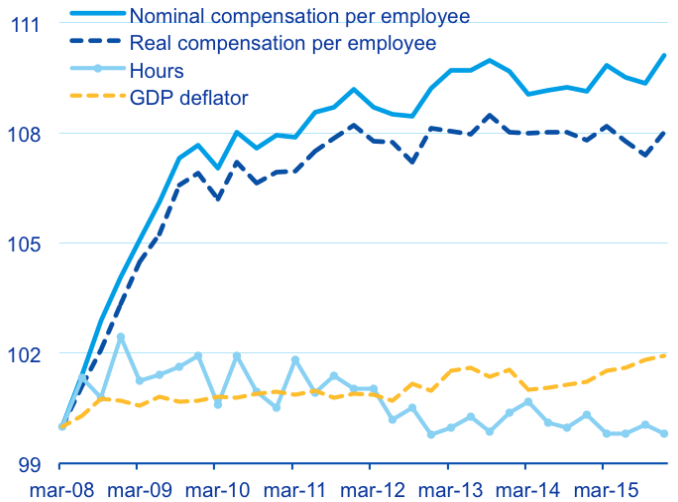

Figure 2: *Compensation per employee, hours worked and prices (seasonally adjusted, Q1 2008 = 100). Source: BBVA Research based on INE.*

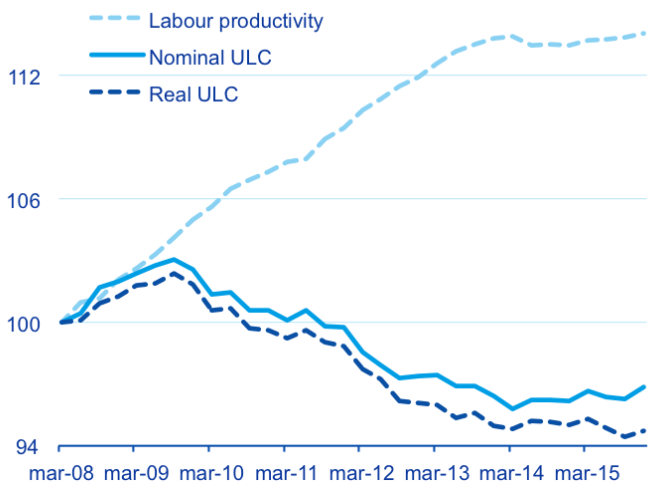

Figure 3: *Labour productivity and unit labour cost (seasonally adjusted, Q1 2008 = 100). Source: BBVA Research based on INE.*

Figure 4: *Labour force and unemployment rate (seasonally adjusted, Q1 2008 = 100). Source: BBVA Research based on INE.*

technical, organisational or production-related reasons. Secondly, it reduces the uncertainty regarding the economic causes that enable a collective bargaining agreement opting-out and extends the fields in which the employer can deviate from it (workday, work hours, workflows, tasks, etc.). Lastly, the reform allows functional mobility among occupational groups, not only between categories[9].

The labour reform of 2012 represented, therefore, a significant advance from the previous legislation and mitigated some of the dysfunctions of the Spanish labour market. However, despite its scope, the reform was complemented by further additional measures implemented later, as described in more detail by Doménech et al. (2016).

The Second Agreement on Employment and Collective Bargaining (AENC by its Spanish acronym) 2012-2014 and the enforcement of the labour reform in March 2012 marked the beginning of a new stage in the labour market, characterised by a greater wage and internal flexibility, among other things[10]. The preliminary evidence of what has happened since then can be summarised as follows:

- Both hours worked per employee and the labour costs slowed down or decreased, as shown in Figures 2 and 3, facilitating the adjustment of the labour market.
- The empirical elasticity of employment to GDP between 1Q2012 and 1Q2014 was 1.9, 0.3pp less than that registered between 1Q2008 and 1Q2012. This implied a less severe job destruction, even though the upsurge and persistence of financial stresses were greater in the European debt crisis of that period than in the international financial crisis of late 2008 and the first half of 2009 and, in particular, despite the substantial difference in fiscal policy stance between the two periods. In 2008 and 2009, fiscal policy was clearly expansionary, with an increase in the structural deficit equivalent to 7 pp of GDP, half of which was reversed in 2010 and 2011. The balance of those four years was a net fiscal expansion of around 3.5 points of GDP that, regardless the value of the fiscal multiplier, served to avoid a greater job destruction. In contrast, from 2012 to 2014 there was a fiscal contraction of around 5 points of GDP. The fact that during 2012 and 2013 the employment destruction -in more adverse financial and fiscal circumstances- was lower than during the first part of the crisis is consistent with the hypothesis that reforms and changes to collective bargaining increased the flexibility of the labour market.
- The Second AENC and the labour reform of 2012 contributed to breaking the vicious cycle of increasing real wages and job destruction in which the Spanish economy found

[9] A summary of the changes introduced by the reform of the labour market can be seen in BBVA Research (2012).

[10] On the possible effects of the labour reform of 2012, see BBVA Research (2013), Bank of Spain (2013), OECD (2014), García-Pérez and Jansen (2015) and García-Pérez (2016).

itself from the first quarter of 2008 until the fourth quarter of 2011, as shown in Figure 5. This rigidity of the Spanish labour market until 2012 contrasts with the flexibility of real wages in Ireland since the beginning of the crisis (Figure 6).[11] The comparison with this economy is very interesting, since Ireland suffered a more intense housing bubble and burst and also a more generalized collapse of its financial system. Nevertheless the performance of its labour market was much better, both in terms of smaller job destruction and more rapid employment growth. This was also the case of the US. While in Spain in the first quarter of 2009 employment fell by 2.7% and real wages increased by 1.2%, in the US employment fell by 1.8% and wages fell by 2.3%. This divergence between the dynamics of Spain and the US widened during the first three years of crisis, such that cumulative job destruction (especially of temporary jobs) in Spain in 4Q2011 was 13.2% and the increase in wages 5.3%, while in the US employment and wages, which had already started to recover, were respectively just 3.0% below and 1.2% above their 4Q2008 levels. In Spain growth in employment from the fourth quarter of 2013 started earlier and more strongly than the consensus had expected at the beginning of that same year.

- As shown by Boscá et al. (2016) and in Figure 7, job creation following the labour market reforms has been accompanied by a shift of the Beveridge curve (the relationship between the unemployment and the vacancy rates) towards the origin.

- In contrast with what happened in the period of expansion prior to the economic crisis, in 2014 and 2015 jobs were created without a positive inflation, GDP growth deflator or ULC differential with EMU. On the contrary, the increase in employment came about with gains in price competitiveness. Whereas in the years prior to the crisis employment growth was accompanied by a positive differential of ULC (which grew at an average of 3.5% in Spain between 2003 and 2007, compared with 1.5% for the EMU), in the current recovery the differential is negative (-0.2% in Spain as against 0.9% for the EMU in 2014 and 2015).
- As it is shown in Figure 8, for the first time in the past few decades, from the second half of 2013 onwards jobs have been created with no deficits in the current account. From 3Q1997 to 2Q2008 the unemployment rate fell 7.8 points but the current account balance deteriorated in 9.7 pp. Admittedly, the behaviour of oil prices since the summer of 2014 has helped in this process. In fact, from the end of 2013 to the end of 2015, the decline in the energy deficit of 1.5 pp of GDP has partly offset the 2.3 points reduction in the non-energy trade surplus. However, it is appropriate to recall that at other times

[11] Draghi (2014) also made a similar comparison, pointing out the differences in the flexibility of Spanish and Irish labour markets.

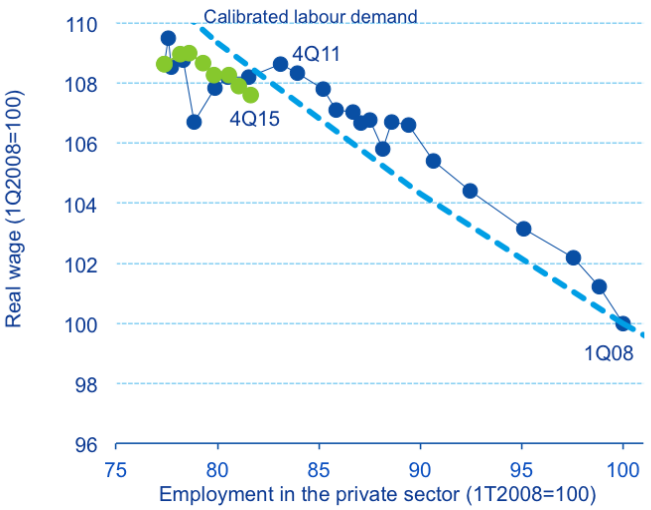

Figure 5: *Spain: real wages and employment in the private sector (1Q2008 = 100). Source: BBVA Research based on INE.*

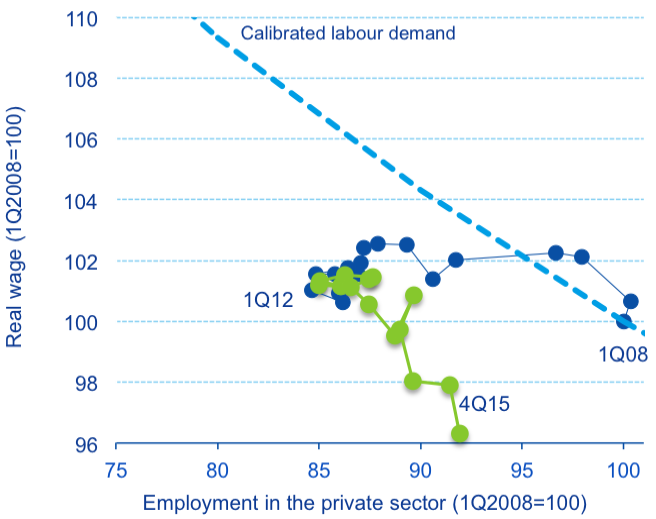

Figure 6: *Ireland: real wages and employment in the private sector (1Q2008 = 100). Source: BBVA Research based on Haver.*

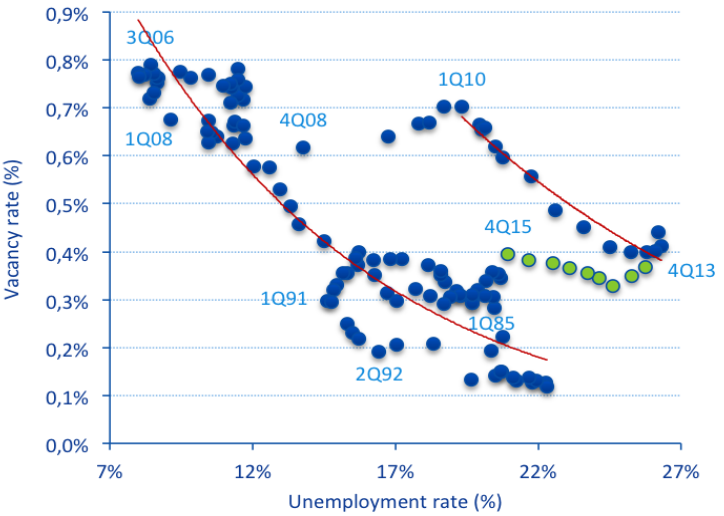

Figure 7: *Beveridge curve (1985-2015). Source: Boscá et al. (2016).*

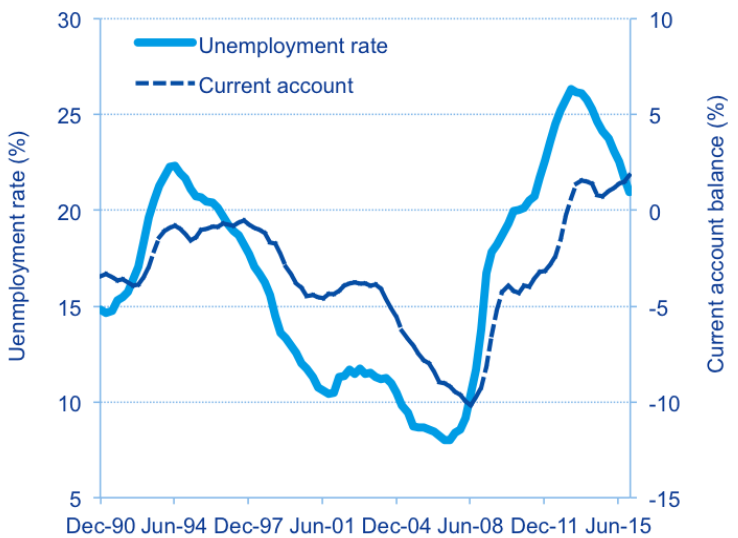

Figure 8: *Unemployment rate and current account balance (%). Source: BBVA Research based on INE.*

when oil prices in real terms were at similar levels or even lower than in 2015, this did not prevent job creation giving rise to a sharp deterioration in the current account balance.

In summary, the preliminary evidence appears to indicate that the changes in the labour market have had positive effects on the adjustment and recovery of the Spanish economy. Nevertheless, many of the structural weaknesses of its labour market, such as the high proportion of temporary employment contracts, long-term unemployment, the mismatch between labour supply and demand, and a still very high structural unemployment rate, continue to require additional measures.

However, the structural effects of the changes in labour legislation on employment and the unemployment rate are difficult to estimate, since these variables are affected by other shocks happening at the same time. To quantify these effects with more precision, we propose and estimate the model detailed in the following section.

3. Theoretical model

The model proposed to identify the structural shocks affecting the labour market is based on Layard et al. (1991), used by Andrés (1993) to explain the persistence of unemployment in Spain. In particular, we extend the model proposed by Fabiani et al. (2001) to account for shocks in firms' prices, in order to be able to distinguish appropriately changes in the market power of firms and the bargaining power of workers. As shown later, our results justify the inclusion of price shocks as a source of hysteresis in the Spanish unemployment rate. In order to identify the structural shocks, we impose a set of zero long-run restrictions a la Blanchard and Quah (1989) and sign restrictions, following Arias, Rubio-Ramírez and Waggoner (2013).

The stylised form of the model, with variables in logarithms, is given by:

$$y_t = \phi(z_t^d - p_t) + az_t^s \tag{1}$$

$$y_t = n_t + z_t^s \tag{2}$$

$$p_t = z_t^p + w_t - z_t^s - \beta u_t \tag{3}$$

$$l_t = \alpha E_{t-1}(w_t - p_t - z_t^s) + z_t^l \tag{4}$$

$$w_t = E_{t-1}(p_t + z_t^s) + z_t^w - \sigma E_{t-1} u_t \tag{5}$$

$$u_t \equiv l_t - n_t \tag{6}$$

$$z_t^d = z_{t-1}^d + \varepsilon_t^d \tag{7}$$

$$z_t^s = z_{t-1}^s + \varepsilon_t^s \tag{8}$$

$$z_t^l = z_{t-1}^l + \varepsilon_t^l \tag{9}$$

$$z_t^p = \lambda z_t^p + \varepsilon_t^p \tag{10}$$

$$z_t^w = \rho z_{t-1}^w + \varepsilon_t^w \tag{11}$$

where y_t, p_t, w_t, n_t, l_t and u_t denote respectively GDP, prices, nominal wages, employment, labour supply and the unemployment rate.

Equation (1) implies that aggregate demand (y_t) depends on the stance of economic policy in real terms ($z_t^d - p_t$) and on permanent income, approximated by productivity (z_t^s). Equation (2) is the production function with constant returns to scale, omitting capital under the assumption that in the long term it is a constant fraction of GDP. Equation (3) is the price setting rule, which implies the existence of a non-competitive supply in the product market and, consequently, a non-competitive labour demand: prices depend on the unemployment rate in the economy (u_t) and represent a fraction (z_t^p) of the unit labour costs ($w_t - z_t^s$). Equation (4) is the competitive supply of labour (l_t), which depends on demographic factors (z_t^l), and on the difference between real wages ($w_t - p_t$) and productivity.[12] Equation (5) describes the nominal wage function. Wage bargaining takes place at the beginning of the period and implies a non-competitive supply of labour: wages are set such that in real terms they increase according to the expected productivity and a wage shock (z_t^w, representing the bargaining power of workers) but decrease with the unemployment rate. Equation (6) is the identity that defines the unemployment rate.

Equations (7) to (11) describe the dynamic of the (independent, identically distributed and uncorrelated) structural shocks in the model: demand (ε_t^d), productivity (ε_t^s), participation in the labour force (ε_t^l) and rigidities in price and wage formation (ε_t^p and ε_t^w), which we call from now on price and wage shocks.

As shown in the Appendix, solving the system of equations for the unemployment

[12] Intertemporal substitution models of labour (e.g., Lucas and Rapping, 1969) explain the long-term evidence that permanent real wage increases due to increased productivity do not affect the supply of labour.

rate and the share of wages in national income, we obtain:

$$u_t = \frac{1}{\sigma-\beta}\rho z_{t-1}^w + \frac{1}{\sigma-\beta}\lambda z_{t-1}^p + \frac{1}{\sigma-\beta}\varepsilon_t^w + \frac{1}{1-\phi\beta}\left[\phi\varepsilon_t^p - (a+\phi-1)\,\varepsilon_t^s + \varepsilon_t^l - \phi\varepsilon_t^d\right] \tag{12}$$

$$\begin{aligned}[(w_t+n_t)-(p_t+y_t)] \quad &= \quad -\frac{\beta}{\sigma-\beta}\rho z_{t-1}^w - \frac{\sigma}{\sigma-\beta}\lambda z_{t-1}^p - \frac{\beta}{\sigma-\beta}\varepsilon_t^w - \frac{1}{1-\phi\beta}\varepsilon_t^p \\ &\quad + \frac{\beta}{1-\phi\beta}\left[(a+\phi-1)\,\varepsilon_t^s - \varepsilon_t^l + \phi\varepsilon_t^d\right] \end{aligned} \tag{13}$$

which, together with (10) and (11), imply that both variables respond exclusively to price and wage shocks in the medium and long term (i.e., the degree of hysteresis depends on the values of ρ and λ).

In the case of the Spanish economy, unit roots tests do not allow to reject the null hypothesis that both the unemployment rate and the share of wages in national income are $I(1)$ process. Additionally, cointegration tests allow to reject the hypothesis that these variables are $C(1)$. Therefore, the data observed over the past forty years justify the existence of total hysteresis caused by rigidities in the price and wage setting mechanisms ($\rho = \lambda = 1$)[13].

After solving for the remaining variables and checking their degree of integration, we arrive at one of the model's possible structural MA representations:

$$\begin{bmatrix} \Delta\,(w_t+n_t)-(p_t+y_t) \\ \Delta u_t \\ \Delta\,(w_t-p_t) \\ \Delta y_t \\ \Delta p_t \end{bmatrix} = C(L)_{5\times 5} \begin{bmatrix} \varepsilon_t^w \\ \varepsilon_t^p \\ \varepsilon_t^s \\ \varepsilon_t^l \\ \varepsilon_t^d \end{bmatrix}$$

with the following long-term solution (L=1):

$$C(1) = \begin{bmatrix} \frac{\beta}{\sigma+\beta} & -\frac{\sigma}{\sigma+\beta} & 0 & 0 & 0 \\ \frac{1}{\sigma+\beta} & \frac{1}{\sigma+\beta} & 0 & 0 & 0 \\ \frac{\beta}{\sigma+\beta} & -\frac{\sigma}{\sigma+\beta} & 1 & 0 & 0 \\ -\frac{1-\alpha\beta}{\sigma+\beta} & -\frac{1+\alpha\sigma}{\sigma+\beta} & 1 & 1 & 0 \\ \frac{1-\alpha\beta}{\phi(\sigma+\beta)} & \frac{1+\alpha\sigma}{\phi(\sigma+\beta)} & \frac{a-1}{\phi} & -\frac{1}{\phi} & 1 \end{bmatrix}$$

The later provides the necessary and sufficient restrictions for the correct identification

[13] According to Stock and Watson (1988) and Gonzalo and Granger (1995), if k variables are $I(1)$ and the cointegration rank is $r < p$, then there are only $(p-r)$ common factors $I(1)$ plus some $I(0)$ which explain the changes in the p variables. Consequently, in our case, there are at least two $I(1)$ factors that explain the changes in these two variables.

of the model[14], where the five variables included in the VAR are the share of wages and salaries in GDP, the unemployment rate, and the rates of growth of real wages, GDP and GDP deflator. In particular, we imposed the following long-run restrictions:

- $C(1)(1,3) = C(1)(1,4) = C(1)(1,5) = C(1)(2,3) = C(1)(2,4) = C(1)(2,5) = 0$: only price and wage shocks have permanent effects on the share of wages in national income and on the unemployment rate.
- $C(1)(3,4) = C(1)(3,5) = 0$: neither labour supply shocks nor nominal demand shocks have permanent effects on real wages.
- $C(1)(4,5) = 0$: nominal demand shocks have no permanent effects on GDP.
- $C(1)(1,1) > 0$: wage shocks have a positive and permanent effect on the share of wages in national income and on the unemployment rate..
- $C(1)(1,2) < 0$: price shocks have a negative and permanent effect on the share of wages in national income but positive and permanent on the unemployment rate.[15]

Figure 9 shows the workings of the labour market over the long term under the hypotheses of the model. The intersection between non-competitive labour demand and supply functions determines the equilibrium level of employment and real wages (point I). The difference between this level of employment and the (competitive) supply of labour, given the equilibrium real wage, determines the volume of unemployment. Permanent increases in productivity (e.g., economic growth due to technical progress) allow demand and supply to shift upwards, increasing real wages for a constant employment level. Conversely, increases in the labour force (shocks in the supply of labour) in the long term give rise to horizontal shifts in the demand and supply of labour, such that employment increases and real wages remain unchanged. Shocks in demand have only short-term effects on real wages and employment, under the assumption that over a sufficiently long period there is no full hysteresis, so that in the very long term the economy returns to point I. A price shock caused by an increase in margins or by tax distortions gives rise to a downward and leftward shift in the demand for labour function (point P), such that both employment and real wages fall. Lastly, a wage shock gives rise to an increase in real wages and a decline in employment (point W).

[14] The assumed orthonormality of the structural shocks imposes 15 restrictions. Therefore 10 additional restrictions are needed to identify the 25 elements of $C(L)$. These restrictions must be arranged so that the jth column of $C(L)$, which corresponds to the reactions of the economy to the jth shock contains $j-1$ restrictions. Fernández-Villaverde et al (2007) discuss the conditions under which the restrictions implied by an infinite VAR are satisfied by an emprirical finite order VAR.

[15] The results are robust to the zero and sign restrictions bias induced by the penalty function method of Mountford and Uhlig (2009). Following Arias, Rubio-Ramírez and Waggoner (2013), we first verify the zero long-run restrictions (*a la* Blanchard and Quah, 1989) and, subject to them, we verify the sign restriction.

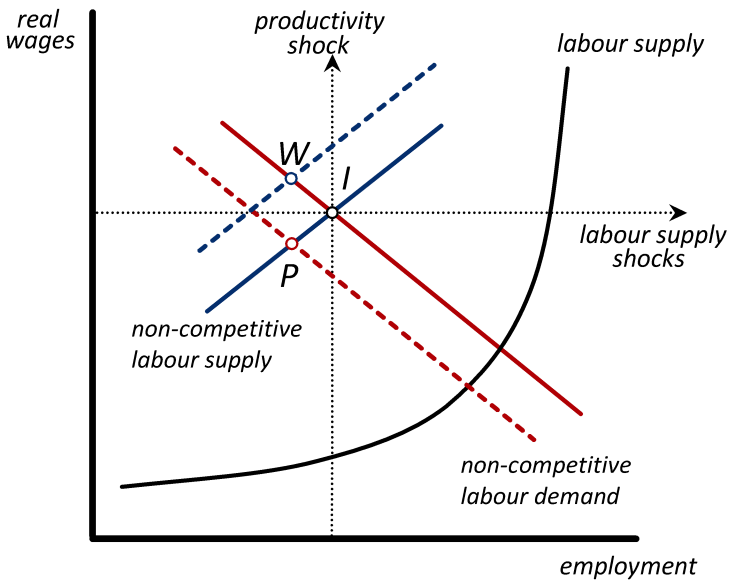

Figure 9: *Long-run effects of shocks on real wages and employment in the model.*

4. Results

In order to analyse how rigidities in price and wage formation affect job creation and the level and persistence of the unemployment rate, we have estimated our SVAR model using data from Spain's official quarterly statistics from 1Q11980 to 4Q2015.[16] One of the advantages of the SVAR estimate is that the causality goes in a single direction: the estimated structural shocks explain the present and future trends in the variables analysed and are exogenous to past values of these variables, which are already taken into account by the model's own dynamic. This characteristic allows us to be sure that the wage shocks are discretionary and are explained by other causes such as changes in labour legislation and not by an automatic and endogenous reaction to, for example, the unemployment rate.

The estimated impulse response functions to positive wage and price shocks in Figures 10 and 11 confirm the predictions of the theoretical model. Firstly, we see that both shocks have a negative, permanent and statistically significant effect on activity and em-

[16] All the variables included in the estimate, except the unemployment rate, correspond to the aggregates of the official Spanish quarterly statistics (CNTR). Before estimating the model, we corrected the atypical positive terms and transitory changes with the TSW program; we would note in particular the elimination of civil servants' extra payment in December 2012. We included a deterministic trend and some statistically significant dummies in the estimate.

ployment. Secondly, we see that wage shocks have a positive and permanent effect on real wages and their share in GDP, while the response of these variables to a price shock is negative and permanent. Lastly, both shocks push apparent labour productivity upward and the labour force downwards, which implies greater deterioration in employment than in activity and in the unemployment rate, as we have seen during the recent crisis. In view of these effects, a wage shock giving rise to a 1% increase in real wages in the long term would lead to the destruction of 1.9% of jobs, such that the total real payroll (that is, the real wage times employment) would fall by 0.9%.

As an exercise of robustness we have estimated the model using two alternative sample periods: the first until the onset of the recession (1980-2007) and the second until the labour market reform in 2012 (1980-2011). The results of the exercise in Figure 12 show that the response of the Spanish economy to wage shocks does not change the sign or lose significance as a result of the adjustments seen during the recession. On the contrary, we see an increase in the sensitivity of employment and the unemployment rate to changes in real wages when the latest economic cycle is included in the sample[17], which is consistent with the assumption that structural reforms that increase wage flexibility stimulate production and employment, even in the short term and in a deflationary setting. Therefore, and contrary to the proposals of some economists and opinion leaders, this result does not support the delay of labour markets reforms to periods of higher interest and inflation rates.

Figure 13 shows the contributions of the structural shocks to the unemployment rate dynamics seen over the past forty years. The greatest part of the increase in the unemployment rate between 2008 and 2011 is explained by rigidities in price and wage formation (11.5 pp of 14.1 pp), with greater intensity than in the economic crisis of the early nineties. Productivity and aggregate demand shocks for their part, together with shocks in participation in the labour force, explain only 3.5 pp.[18]

At this point it is useful to distinguish between the different behaviour of wage and price shocks between 2008 and 2012. In the first three years of the crisis, unemployment increased basically because of the upward pressures in real wages: instead of remuneration being adjusted downwards, jobs were destroyed. In 2011 and 2012, the biggest contribution to the growth in unemployment came from price shocks, as firms tried to restore profitability. The extent to which this was in reaction to the wage shocks of previous years or to the financial crisis, which gave rise to a significant increase in risk premia and lend-

[17] This result is in line with the estimates made by Izquierdo and Puente (2015) based on micro-data from the continuous sample of working histories.

[18] The lack of wage flexibility gave rise to an increase of 7.9 pp in real wages, leading to a shift in the wage equation upwards and to the left in Figure 9.

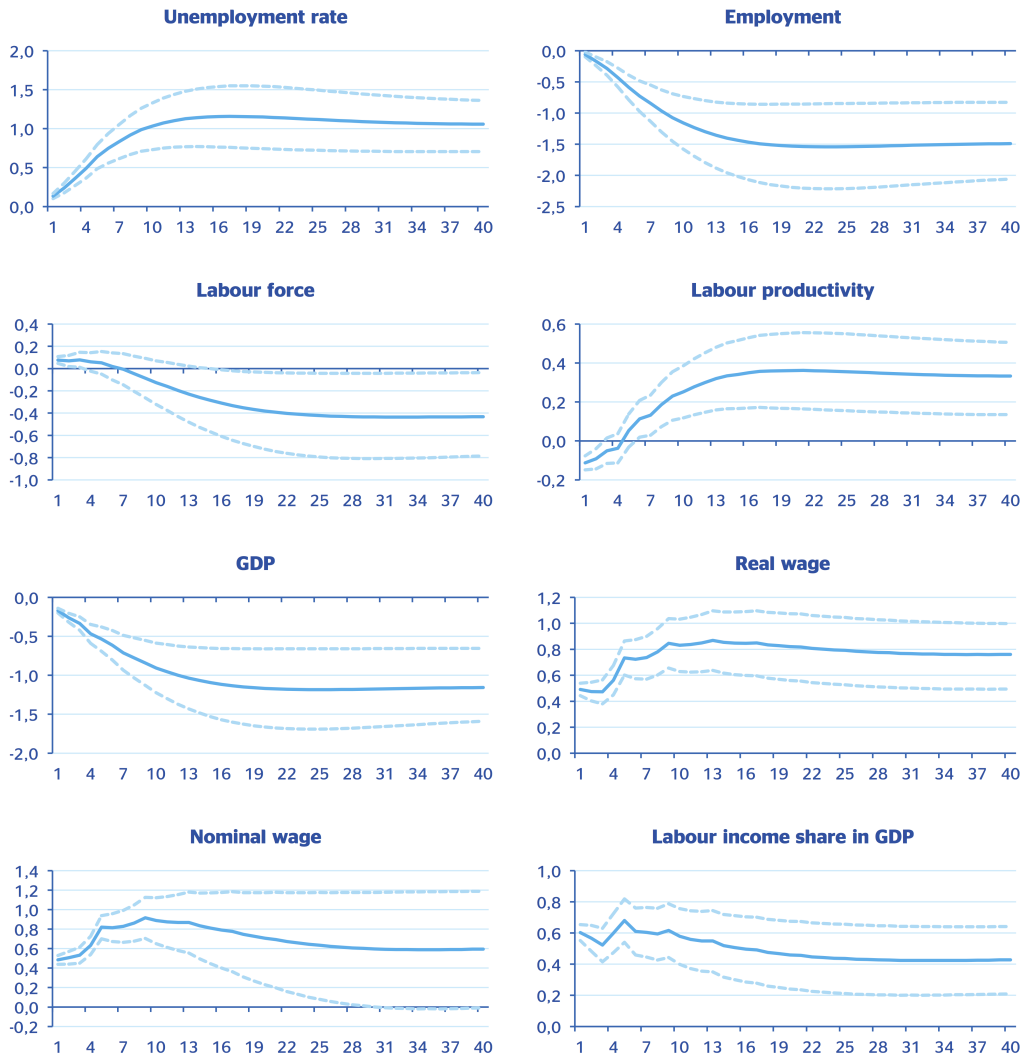

Figure 10: *Impulse response function to a wage shock equivalent to a standard deviation (deviations from the baseline scenario in pp).*

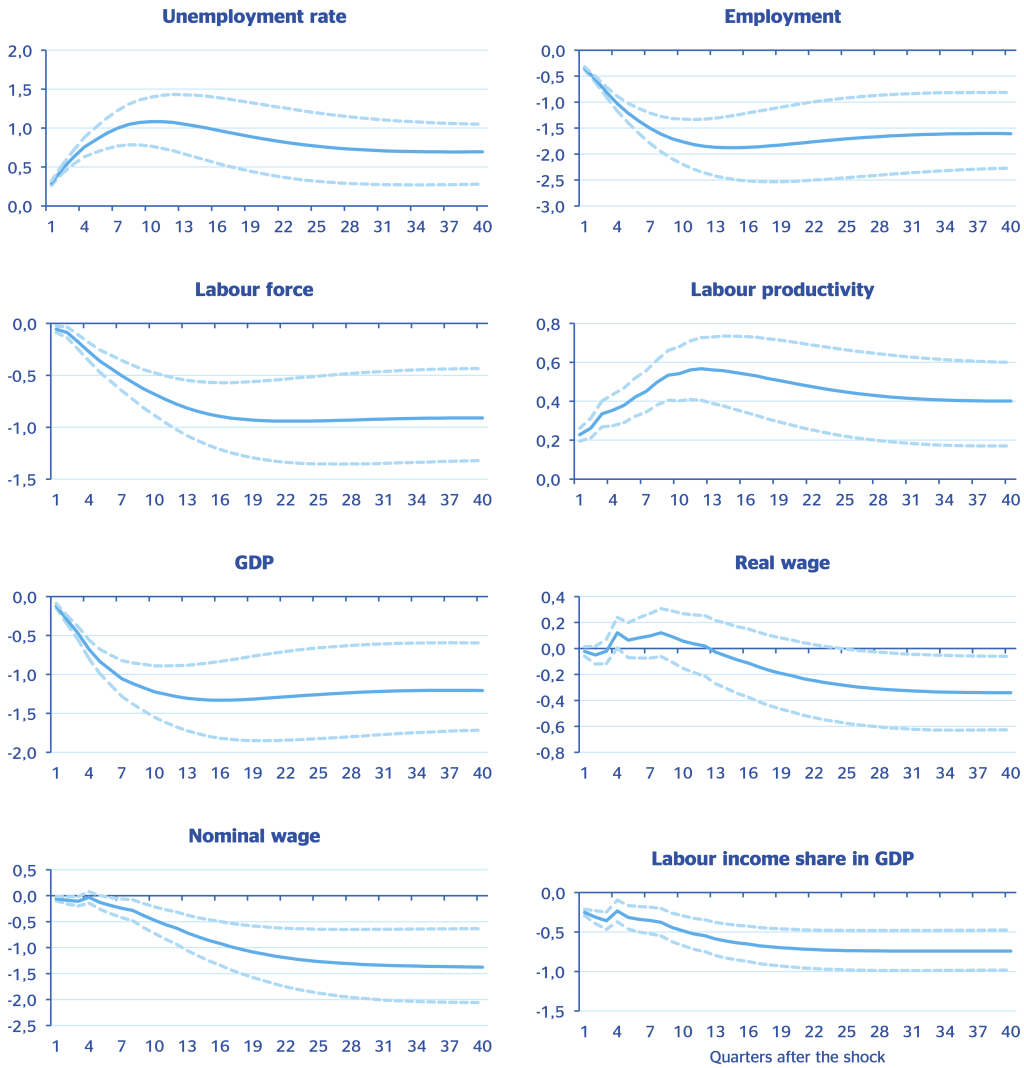

Figure 11: *Impulse response function to a price shock equivalent to a standard deviation (deviations from the baseline scenario in pp).*

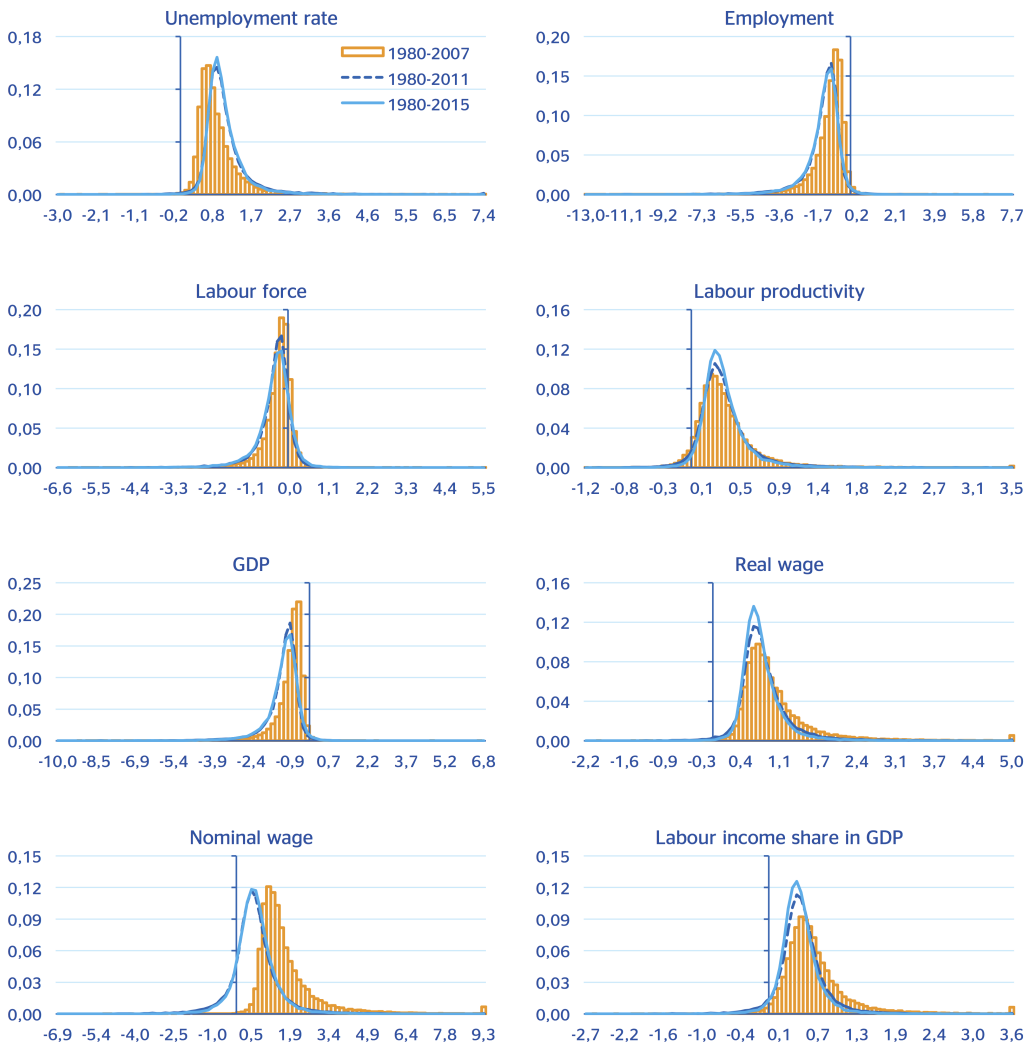

Figure 12: *Probability density functions of long-term responses to a wage shock equivalent to a standard deviation (deviation from the baseline scenario in pp).*

ing restrictions, is a question that the model cannot address[19]. In both cases there would be a shift in the price equation in Figure 9.

Figure 14 shows the effects of the greater wage flexibility since 2012. The contribution of the wage shock to the change in the unemployment rate fell from 1.1 pp in 2011 to -0.2 pp in 2015. The persistence of the effects of previous wage shocks of course explains the still positive contribution up until 2013.

In order to assess the quantitative significance of the estimated effects of the shocks before and after 2012, we carried out two counterfactual experiments, which respond to the following two questions[20]:

- **Counterfactual 1**: How many additional Full Time Equivalent (FTE) jobs would have been destroyed without the wage flexibility seen since 2012, such that real wages would have increased by 4.5% relative to the base scenario? This is the equivalent of maintaining between 2012 and 2015 the estimated average wage shocks for the period 2010-2011
- **Counterfactual 2**: How many FTE jobs would have been saved if the process of wage flexibilisation had started at the beginning of 2008, such that real remuneration per employee would have increased by only 4.2% instead of the 8.2% observed between the first quarter of 2008 and the last quarter of 2011? This is the equivalent of replacing the wage shocks of 2008-2011 with those estimated for the period 2012-2015.

As regards the first of these questions, the results indicate that; if the wage demands seen on average during 2010 and 2011 (equivalent to 0.9 pp of real wages) had continued between 2012 and 2015, an additional 910,000 jobs would have been lost by the end of the period and the unemployment rate would have been 5.1 pp higher than that currently observed (see Figure 15). In the long term, the number of additional jobs destroyed would reach 1.5 million, and the unemployment rate would rise by 6.3 pp.

As regards to the second question, Figure 16 shows that, if wage demands had been adjusted in 2008 (in other words, if the Spanish labour market had had more flexible worker institutions at the beginning of the crisis), the destruction of nearly two million jobs could have been avoided in the long run and the unemployment rate today would be eight points lower (at 12.9% instead of 20.9% in 4Q2015).

[19] As argued by Andrés and Doménech (2015), when financial stresses increase drastically, the businesses that are most dependent on banking finance can remain in the market only by resorting to self-financing (retaining profits) or supplier financing. Even though competition is tougher, businesses in this situation strive to maintain or even increase their margins (price over costs). Gilchrist, Schoenle, Sim and Zakrajsek (2013) and Montero and Urtasun (2014) found evidence in the US and in Spain showing that the businesses with the worst liquidity problems at the height of the financial crisis were those that increased their prices, whereas those with a sounder financial position reduced them.

[20] Given that the methodology used allows identification of the structural shocks determining the fluctuations on the economy, it is possible to simulate what would have happened (i) in the absence of either of them or (ii) if one of these shocks had had a different sign and/or magnitude.

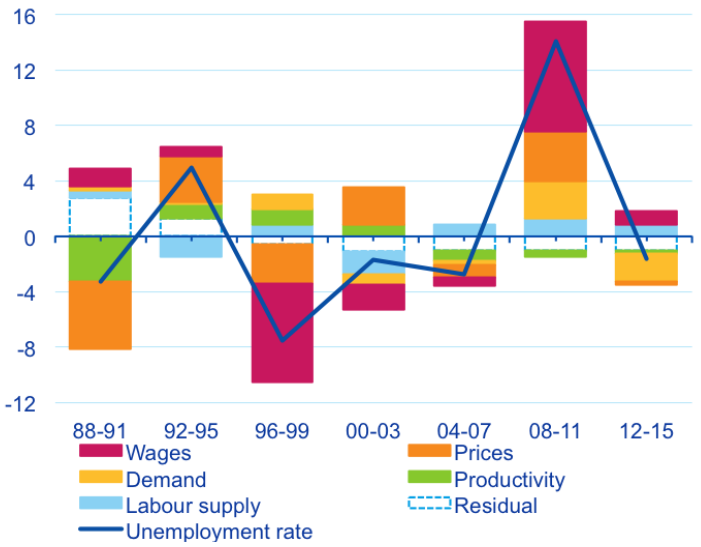

Figure 13: *Historical decomposition of the cumulative change in the unemployment rate (pp).*

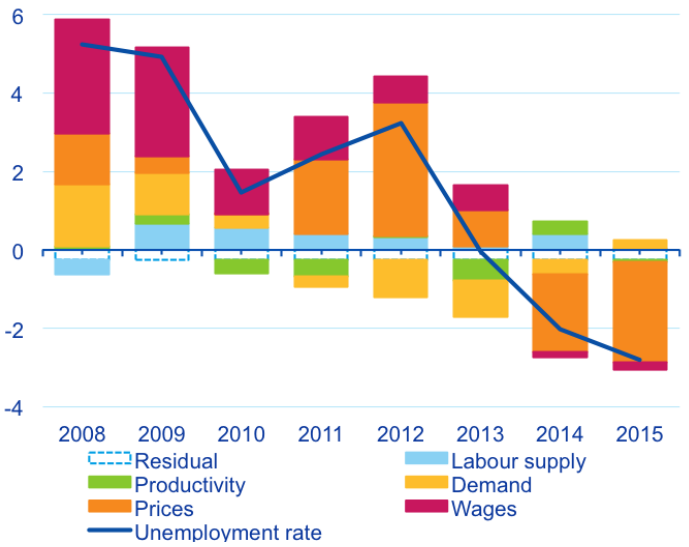

Figure 14: *Historical decomposition of annual changes in the unemployment rate (pp).*

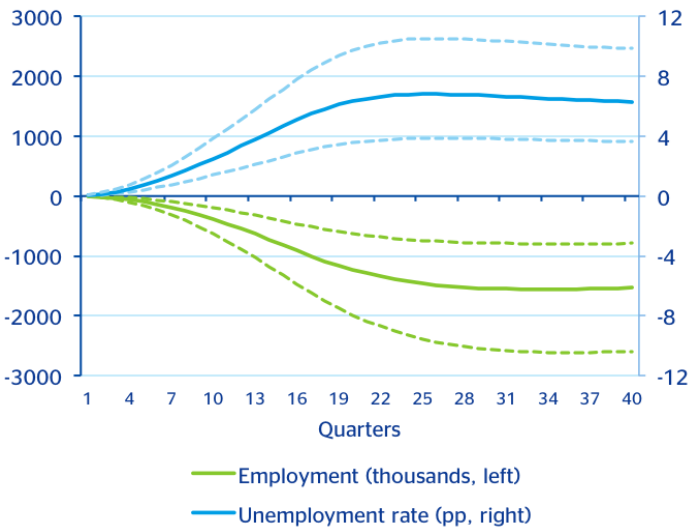

Figure 15: *Results of counterfactual 1 (deviations from baseline scenario). Dotted lines represent the confidence intervals of percentiles 16 and 84.*

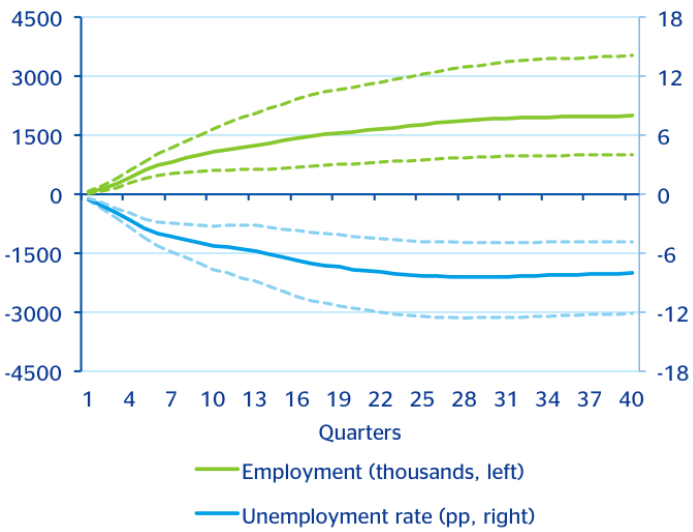

Figure 16: *Results of counterfactual 2 (deviations from baseline scenario). Dotted lines represent the confidence intervals of percentiles 16 and 84.*

Previous results need to be put into context. Firstly, the exercise carried out illustrate the economic importance of wage shocks for employment, but these cannot be attributed solely to labour market reforms. Admittedly the legislative changes undertaken facilitate and incentivise internal and wage flexibility, shifting the non-competitive supply of labour downwards and to the right in Figure 9. But this movement may also be due, at least in part, to the wage moderation fostered by the Second Agreement on Employment and Collective Bargaining. To what extent this agreement was an attempt by the social agents to anticipate the effects of the reforms and how much of the greater wage flexibility seen since 2012 is thanks to this agreement are difficult questions to answer.

Secondly, although the estimated wage shocks are structural, meaning that from a statistical point of view they are exogenous to trends in the labour market, economic agents may discretionally decide to moderate wages when the unemployment rate reaches levels that become intolerable from a social and individual point of view. In terms of Figure 9, it is possible that, as a result of uncoordinated decisions, the non-competitive supply of labour might move upwards for a while and to the left as a result of wage rigidities in the early years of the crisis, until it reached such a high and persistent unemployment rate that, from a certain level, wage demands would start to diminish. In this situation the labour reforms may bring forward, accelerate and intensify this discretional response of wages when a level of tolerance of the unemployment rate is exceeded, which possibly would have happened in any case, but more slowly and with greater economic and social costs.

In any case, the fact that unemployment increased in 2008 and 2009 and that there was a positive wage shock is what sets Spain apart from other countries, with a rigid and inefficient labour market in which unemployment and real wages both grow at the same time. Other countries do not need their unemployment rate to increase to 20% before starting to make wages more flexible; they do it much earlier, as we discussed before using the examples of Ireland and the US.

The lack of wage flexibility in Spain has also been both cause and effect of the high proportion of temporary jobs. Wages are more rigid if the interests of workers with permanent contracts (insiders) prevail over the unemployed and over workers with temporary contracts (outsiders), in the wage bargaining process .[21] At the same, if wages are more rigid firms have an additional incentive to use temporary employment as a margin of flexibility to face uncertainty and shocks in demand that affect their revenues. Therefore, promoting permanent contracts is a crucial reform to strengthen the effects of changes in labor regulations introduced in recent years.

[21] See Bentolila and Dolado (1994) and Dolado, García Serrano and Jimeno (2002) for a discussion of the effects of temporary contracts on wage negotiations.

5. Conclusions

This paper has analysed the effects of the greater wage flexibility since 2012. Preliminary evidence shows that between 2012 and 2013 job destruction was less severe than in previous years, despite the intense fiscal adjustment and the greater financial stress. The recovery since then has been compatible with a surplus in the current account balance, the improvement in price competitiveness relative to EMU and the inward shift of the Beveridge curve towards the origin.

Using a model that allows us to break down changes in the main macroeconomic aggregates into different types of structural shocks during the crisis and the subsequent recovery, we have estimated two counterfactual scenarios. Their results show that the effects of the greater wage flexibility observed since 2012 are statistically significant and economically relevant.

The results of the first exercise indicate that if the wage shocks seen on average during 2010 and 2011 had continued between 2012 and 2015, close to nine hundred thousand additional jobs would have been lost, practically offsetting the net one million jobs created between 2014 and 2015.

The second exercises allows us to conclude that, if there had been a greater wage flexibility in the labour market in 2008 such as the one observed since 2012, the destruction of close to two million jobs in the long term could have been avoided, as could the increase of eight points in the unemployment rate, almost half the increase seen during the crisis. The results of this paper are thus consistent with the hypothesis that the effects on GDP and employment of the greater flexibility in the labour market have been positive, in spite of their potential deflationary effects.

Although the labour market reform approved in 2012 and the complementary measures adopted since then have contributed towards repairing some of the deficiencies in the labour market, the high levels of unemployment and temporary employment demand new actions. Given the interactions among institutions, the necessary changes should be comprehensive, and should go beyond labour market legislation, for example increasing the size of firms, the competition in product markets, and the efficiency of the public administrations and of the judicial and educational systems.

As for the labour market, it would be advisable to reform the contracts system in order to encourage permanent employment and drastically reduce the proportion of temporary contracts while, at the same time, moving forward in modernising collective bargaining, in line with the proposals of BBVA Research (2014b and 2016) and Andrés and Doménech (2015). It would also be desirable to carry out a fiscal devaluation reducing employers' contributions to social security with an increase in indirect taxes, bringing Spain's tax structure closer to those European countries with lower unemployment rates

and lower inequality. Additional resources for active labour market policies, more efficient public employment services, better public-private partnerships, and more in-depth evaluations of activation policies are all of them necessary reforms.

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Appendix 1: Model solution

It is assumed that wages are set at beginning of the period, before all shocks but ε_t^w are observed. Prices are fixed when all the information is revelead. Using equations (3), (11) and (5) in Section 3 we obtain:

$$E_{t-1}u_t = \frac{1}{\sigma-\beta}\left(z_t^w + \lambda z_{t-1}^p\right) \tag{1.1}$$

which, together with (3), (11) and (4) provides:

$$l_t = -\frac{\alpha\beta}{\sigma-\beta}z_t^w - \frac{\alpha\sigma}{\sigma-\beta}\lambda z_{t-1}^p + z_t^l \tag{1.2}$$

Equating (1) to (2), and replacing (3), one gets:

$$n_t = -\phi\left(\beta u_t + w_t\right) - \phi z_t^p + \left(a+\phi-1\right)z_t^s + \phi z_t^d \tag{1.3}$$

which, together with (13) and (6) yields to:

$$u_t = \frac{1}{1-\phi\beta}\left[\phi w_t - \frac{\alpha\beta}{\sigma-\beta}z_t^w + \phi z_t^p - \frac{\alpha\sigma}{\sigma-\beta}\lambda z_{t-1}^p - \left(a+\phi-1\right)z_t^s + z_t^l - \phi z_t^d\right] \tag{1.4}$$

By substituting (7) to (11) in (1.4), then taking expectations, and finally equating it to (1.1) we obtain:[22]

$$w_t = \frac{1}{\phi}\left[\frac{1-\phi\beta+\alpha\beta}{\sigma-\beta}z_t^w + \frac{1-\phi\sigma+\alpha\sigma}{\sigma-\beta}\lambda z_{t-1}^p + \left(a+\phi-1\right)z_{t-1}^s - z_{t-1}^l + \phi z_{t-1}^d\right] \tag{1.5}$$

which, together with (1.4) and (7) to (11) result in:

$$u_t = \frac{1}{\sigma-\beta}\rho z_{t-1}^w + \frac{1}{\sigma-\beta}\lambda z_{t-1}^p + \frac{1}{\sigma-\beta}\varepsilon_t^w + \frac{1}{1-\phi\beta}\left[\phi\varepsilon_t^p - \left(a+\phi-1\right)\varepsilon_t^s + \varepsilon_t^l - \phi\varepsilon_t^d\right] \tag{1.6}$$

By replacing (1.4), (1.6), (8) and (10) in (3), we get:

$$\begin{aligned} p_t \;=\; & \frac{1+\alpha\beta}{\phi\left(\sigma-\beta\right)}\rho z_{t-1}^w + \frac{1+\alpha\sigma}{\phi\left(\sigma-\beta\right)}\lambda z_{t-1}^p + \frac{a-1}{\phi}z_{t-1}^s - \frac{1}{\phi}z_{t-1}^l + z_{t-1}^d + \frac{1+\alpha\beta}{\phi\left(\sigma-\beta\right)}\varepsilon_t^w \\ & + \frac{1}{1-\phi\beta}\varepsilon_t^p - \frac{a\beta-\beta+1}{1-\phi\beta}\varepsilon_t^s + \frac{\beta}{1-\phi\beta}\varepsilon_t^l - \frac{\phi\beta}{1-\phi\beta}\varepsilon_t^d \end{aligned} \tag{1.7}$$

which can be subtracted from (1.5) to obtain:

[22] Note that $E_{t-1}w_t = w_t$, $E_{t-1}z_t^w = z_t^w$ while $E_{t-1}z_{t-1}^p = z_{t-1}^p$.

$$\begin{aligned} w_t - p_t &= -\frac{\beta}{\sigma-\beta}\rho z_{t-1}^w - \frac{\sigma}{\sigma-\beta}\lambda z_{t-1}^p + z_{t-1}^s - \frac{\beta}{\sigma-\beta}\varepsilon_t^w - \frac{1}{1-\phi\beta}\varepsilon_t^p \\ &\quad + \frac{a\beta-\beta+1}{1-\phi\beta}\varepsilon_t^s - \frac{\beta}{1-\phi\beta}\varepsilon_t^l + \frac{\phi\beta}{1-\phi\beta}\varepsilon_t^d \end{aligned} \tag{1.8}$$

Substituting (1.2), (1.6) and (9) in (6) provides:

$$\begin{aligned} n_t &= -\frac{1+\alpha\beta}{\sigma-\beta}\rho z_{t-1}^w - \frac{1+\alpha\sigma}{\sigma-\beta}\lambda z_{t-1}^p + z_{t-1}^l - \frac{1+\alpha\beta}{\sigma-\beta}\varepsilon_t^w \\ &\quad - \frac{1}{1-\phi\beta}\left[\phi\varepsilon_t^p - (a+\phi-1)\,\varepsilon_t^s + \phi\beta\varepsilon_t^l - \phi\varepsilon_t^d\right] \end{aligned} \tag{1.9}$$

which, together with (8) and (2) imply:

$$\begin{aligned} y_t &= -\frac{1+\alpha\beta}{\sigma-\beta}\rho z_{t-1}^w - \frac{1+\alpha\sigma}{\sigma-\beta}\lambda z_{t-1}^p + z_{t-1}^s + z_{t-1}^l - \frac{1+\alpha\beta}{\sigma-\beta}\varepsilon_t^w \\ &\quad - \frac{1}{1-\phi\beta}\left[\phi\varepsilon_t^p - (a+\phi-\phi\beta)\,\varepsilon_t^s + \phi\beta\varepsilon_t^l - \phi\varepsilon_t^d\right] \end{aligned} \tag{1.10}$$

Finally, using (2), (1.8) and (8) it is possible to obtain:

$$\begin{aligned} [(w_t+n_t)-(p_t+y_t)] &= -\frac{\beta}{\sigma-\beta}\rho z_{t-1}^w - \frac{\sigma}{\sigma-\beta}\lambda z_{t-1}^p - \frac{\beta}{\sigma-\beta}\varepsilon_t^w - \frac{1}{1-\phi\beta}\varepsilon_t^p \\ &\quad + \frac{\beta}{1-\phi\beta}\left[(a+\phi-1)\,\varepsilon_t^s - \varepsilon_t^l + \phi\varepsilon_t^d\right] \end{aligned} \tag{1.11}$$

Thus, it is clear that y_t, n_t, $(y_t - n_t)$,p_t, w_t, $(w_t - p_t)$ and l_t are $I(1)$ processes, while the order of integration of u_t and $[(w_t + n_t) - (p_t + y_t)]$ depends on ρ and λ.

Hysteresis caused by rigidities in the price and wage setting mechanisms $(\rho = 1, \lambda = 1)$

If $\rho = 1$ and $\lambda = 1$, then u_t and $[(w_t + n_t) - (p_t + y_t)]$ are $I(1)$ processes, are affeced in the short run by all shocks, but in the long run only by price and wage shocks ε_t^w and ε_t^p . In this case, the structural MA representation is given by:

$$z_t^w = \frac{1}{1-L}\varepsilon_t^w;\; z_t^p = \frac{1}{1-L}\varepsilon_t^p;\; z_t^s = \frac{1}{1-L}\varepsilon_t^s;\; z_t^l = \frac{1}{1-L}\varepsilon_t^l;\; z_t^d = \frac{1}{1-L}\varepsilon_t^d \tag{1.12}$$

$$\Delta y_t = -\frac{1+\alpha\beta}{\sigma-\beta}\varepsilon_t^w - \frac{1+\alpha\sigma}{\sigma-\beta}L\varepsilon_t^p + L\varepsilon_t^s + L\varepsilon_t^l - \frac{1}{1-\phi\beta}(1-L)\left[\phi\varepsilon_t^p - (a+\phi-\phi\beta)\,\varepsilon_t^s + \phi\beta\varepsilon_t^l - \phi\varepsilon_t^d\right] \tag{1.13}$$

$$\Delta n_t = -\frac{1+\alpha\beta}{\sigma-\beta}\varepsilon_t^w - \frac{1+\alpha\sigma}{\sigma-\beta}L\varepsilon_t^p + L\varepsilon_t^l - \frac{1}{1-\phi\beta}(1-L)\left[\phi\varepsilon_t^p - (a+\phi-1)\varepsilon_t^s + \phi\beta\varepsilon_t^l - \phi\varepsilon_t^d\right] \tag{1.14}$$

$$\Delta(y_t - n_t) = \varepsilon_t^s \tag{1.15}$$

$$\begin{aligned}\Delta p_t &= \frac{1+\alpha\beta}{\phi(\sigma-\beta)}\varepsilon_t^w + \frac{1+\alpha\sigma}{\phi(\sigma-\beta)}L\varepsilon_t^p + \frac{a-1}{\phi}L\varepsilon_t^s - \frac{1}{\phi}L\varepsilon_t^l + L\varepsilon_t^d \\ &\quad + \frac{1}{1-\phi\beta}(1-L)\left[\varepsilon_t^p - (a\beta-\beta+1)\varepsilon_t^s + \beta\varepsilon_t^l - \phi\beta\varepsilon_t^d\right]\end{aligned} \tag{1.16}$$

$$\Delta w_t = \frac{1}{\phi}\left[\frac{1-\phi\beta+\alpha\beta}{\sigma-\beta}\varepsilon_t^w + \frac{1-\phi\sigma+\alpha\sigma}{\sigma-\beta}L\varepsilon_t^p + (a+\phi-1)L\varepsilon_t^s - L\varepsilon_t^l + \phi L\varepsilon_t^d\right] \tag{1.17}$$

$$\begin{aligned}\Delta(w_t - p_t) &= -\frac{\beta}{\sigma-\beta}\varepsilon_t^w - \frac{\sigma}{\sigma-\beta}L\varepsilon_t^p + L\varepsilon_t^s - \frac{1}{1-\phi\beta}(1-L)\varepsilon_t^p + \frac{a\beta-\beta+1}{1-\phi\beta}(1-L)\varepsilon_t^s \\ &\quad - \frac{\beta}{1-\phi\beta}(1-L)\varepsilon_t^l + \frac{\phi\beta}{1-\phi\beta}(1-L)\varepsilon_t^d\end{aligned} \tag{1.18}$$

$$\Delta l_t = -\frac{\alpha\beta}{\sigma-\beta}\varepsilon_t^w - \frac{\alpha\sigma}{\sigma-\beta}L\varepsilon_t^p + \varepsilon_t^l \tag{1.19}$$

$$\Delta u_t = \frac{1}{\sigma-\beta}\varepsilon_t^w + \frac{1}{\sigma-\beta}L\varepsilon_t^p + \frac{1}{1-\phi\beta}(1-L)\left[\phi\varepsilon_t^p - (a+\phi-1)\varepsilon_t^s + \varepsilon_t^l - \phi\varepsilon_t^d\right] \tag{1.20}$$

$$\begin{aligned}\Delta[(w_t + n_t) - (p_t + y_t)] &= -\frac{\beta}{\sigma-\beta}\varepsilon_t^w - \frac{\sigma}{\sigma-\beta}L\varepsilon_t^p - \frac{1}{1-\phi\beta}(1-L)\varepsilon_t^p \\ &\quad + \frac{\beta}{1-\phi\beta}(1-L)\left[(a+\phi-1)\varepsilon_t^s - \varepsilon_t^l + \phi\varepsilon_t^d\right]\end{aligned} \tag{1.21}$$

Long-term solution ($L = 1$):

$$\Delta y_t = -\frac{1+\alpha\beta}{\sigma-\beta}\varepsilon_t^w - \frac{1+\alpha\sigma}{\sigma-\beta}\varepsilon_t^p + \varepsilon_t^s + \varepsilon_t^l$$

$$\Delta n_t = -\frac{1+\alpha\beta}{\sigma-\beta}\varepsilon_t^w - \frac{1+\alpha\sigma}{\sigma-\beta}\varepsilon_t^p + \varepsilon_t^l$$

$$\Delta\left(y_t - n_t\right) = \varepsilon_t^s$$

$$\Delta p_t = \frac{1+\alpha\beta}{\phi\left(\sigma-\beta\right)}\varepsilon_t^w + \frac{1+\alpha\sigma}{\phi\left(\sigma-\beta\right)}\varepsilon_t^p + \frac{a-1}{\phi}\varepsilon_t^s - \frac{1}{\phi}\varepsilon_t^l + \varepsilon_t^d$$

$$\Delta w_t = \frac{1}{\phi}\left[\frac{1-\phi\beta+\alpha\beta}{\sigma-\beta}\varepsilon_t^w + \frac{1-\phi\sigma+\alpha\sigma}{\sigma-\beta}\varepsilon_t^p + \left(a+\phi-1\right)\varepsilon_t^s - \varepsilon_t^l + \phi\varepsilon_t^d\right]$$

$$\Delta\left(w_t - p_t\right) = -\frac{\beta}{\sigma-\beta}\varepsilon_t^w - \frac{\sigma}{\sigma-\beta}\varepsilon_t^p + \varepsilon_t^s$$

$$\Delta l_t = -\frac{\alpha\beta}{\sigma-\beta}\varepsilon_t^w - \frac{\alpha\sigma}{\sigma-\beta}\varepsilon_t^p + \varepsilon_t^l$$

$$\Delta u_t = \frac{1}{\sigma-\beta}\varepsilon_t^w + \frac{1}{\sigma-\beta}\varepsilon_t^p$$

$$\Delta\left[\left(w_t + n_t\right) - \left(p_t + y_t\right)\right] = -\frac{\beta}{\sigma-\beta}\varepsilon_t^w - \frac{\sigma}{\sigma-\beta}\varepsilon_t^p$$

Short-term solution ($L = 0$):

$$\Delta y_t = -\frac{1+\alpha\beta}{\sigma-\beta}\varepsilon_t^w - \frac{\phi}{1-\phi\beta}\varepsilon_t^p + \frac{a+\phi-\phi\beta}{1-\phi\beta}\varepsilon_t^s - \frac{\phi\beta}{1-\phi\beta}\varepsilon_t^l + \frac{\phi}{1-\phi\beta}\varepsilon_t^d$$

$$\Delta n_t = -\frac{1+\alpha\beta}{\sigma-\beta}\varepsilon_t^w - \frac{\phi}{1-\phi\beta}\varepsilon_t^p + \frac{a+\phi-1}{1-\phi\beta}\varepsilon_t^s - \frac{\phi\beta}{1-\phi\beta}\varepsilon_t^l + \frac{\phi}{1-\phi\beta}\varepsilon_t^d$$

$$\Delta\left(y_t - n_t\right) = \varepsilon_t^s$$

$$\Delta p_t = \frac{1+\alpha\beta}{\phi\left(\sigma-\beta\right)}\varepsilon_t^w + \frac{1}{1-\phi\beta}\varepsilon_t^p - \frac{a\beta-\beta+1}{1-\phi\beta}\varepsilon_t^s + \frac{\beta}{1-\phi\beta}\varepsilon_t^l - \frac{\phi\beta}{1-\phi\beta}\varepsilon_t^d$$

$$\Delta w_t = \frac{1-\phi\beta+\alpha\beta}{\phi\left(\sigma-\beta\right)}\varepsilon_t^w$$

$$\Delta\left(w_t - p_t\right) = -\frac{\beta}{\sigma-\beta}\varepsilon_t^w - \frac{1}{1-\phi\beta}\varepsilon_t^p + \frac{a\beta-\beta+1}{1-\phi\beta}\varepsilon_t^s - \frac{\beta}{1-\phi\beta}\varepsilon_t^l + \frac{\phi\beta}{1-\phi\beta}\varepsilon_t^d$$

$$\Delta l_t = -\frac{\alpha\beta}{\sigma-\beta}\varepsilon_t^w + \varepsilon_t^l$$

$$\Delta u_t = \frac{1}{\sigma-\beta}\varepsilon_t^w + \frac{\phi}{1-\phi\beta}\varepsilon_t^p - \frac{a+\phi-1}{1-\phi\beta}\varepsilon_t^s + \frac{1}{1-\phi\beta}\varepsilon_t^l - \frac{\phi}{1-\phi\beta}\varepsilon_t^d$$

$$\Delta\left[\left(w_t + n_t\right) - \left(p_t + y_t\right)\right] = -\frac{\beta}{\sigma-\beta}\varepsilon_t^w - \frac{1}{1-\phi\beta}\varepsilon_t^p + \frac{a\beta+\phi\beta-\beta}{1-\phi\beta}\varepsilon_t^s - \frac{\beta}{1-\phi\beta}\varepsilon_t^l + \frac{\phi\beta}{1-\phi\beta}\varepsilon_t^d$$

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