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Labour market adjustments during the Great Recession

An international comparison

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1 Introduction

The Great Recession has led to lower profits, lower employment, and lower wage growth. The response to the aggregate demand shocks differed substantially between countries. The depth and duration of the economic recession to a large extent determines the subsequent labour market response. It matters whether cumulated loss of gross domestic product (GDP) in most recent crisis is roughly 3%, as was the case in the United States, or cumulatively almost 30%, as was the case in Greece. Second, the adjustment process in the economy is also driven by the institutional setting. This paper provides some background with the analysis presented in Chapter 3 of the Policy Brief 'Langdurige werkloosheid: afwachten én hervormen'.

The main question we address in this document is: what was the impact of recent financial crisis on wages, unemployment and profits within different economies? In other words: who paid the price of the Great Recession?

In order to provide an answer, we look at the development of the main components of GDP (compensation of employees and operating surplus). To address the impact of adjustments on the labour market, we perform a further decomposition of changes in the compensation of employees into changes of real wages, unemployment, hours worked, and participation. Note that this method is mainly based on accounting rules and that it does not account for the underlying economic and institutional structures which differ between economies.

We conclude that the Great Recession was almost immediately reflected in a drop in the profits in most countries. In a similar way, profits increased immediately during the recovery from the crisis. In most economies, labour market adjustments occur with some delay. Regarding these adjustments economies differ in their responses in real wage rate and long-term unemployment during the Great Recession. This leads to three categories of countries. The Netherlands belongs to a group of countries with a limited change in the real wage and a relatively limited increase in long-term unemployment. A second group, containing, for instance, the UK and US shows a relatively large downward adjustment in the real wages and a relatively small increase in long-term unemployment; while the third group, including for instance Spain and Italy, shows a relatively large increase in long-term unemployment combined with an increase in real wages.

In the next section, we describe the theoretical perspective, as well as empirical literature, on adjustment mechanisms on the labour market in response to a drop in aggregate demand. Section 3 explains the decomposition methodology of changes in GDP and the data we use to conduct our empirical analysis. In Section 4 we present the result of the empirical analysis for a group of OECD countries.

2 Economic adjustment mechanisms and institutions

2.1 Introduction

The literature on labour market resilience often examines the response of aggregate wages to economic shocks. However, it is the *combined* effect of changes in employment, hours worked per employee and wage costs per hour that exerts influence on the labour market/has the welfare effects. Moreover, we further add into the analysis by examining the effects of shocks on other mixed income, being the income of self-employed, income from capital provision and profits. By addressing all these posts, we are able to paint a complete picture to what extent GDP shocks affect wages, unemployment, and profits. Or to put differently: who pays the price of the economic bust?

In the next section we focus on the effect of shocks in GDP on the prices (i.e. the wages) and the quantities in the labour market (i.e. employment, unemployment). In Section 2.3 we assess the impact of institutions on the way labour markets react to a shock. Some policies cause labour market rigidities, constrain labour market dynamics and can consequently prolong the duration and increase the depth of a recession. However, labour flexibility is not a panacea for the labour market in order to cope with negative shocks. Rigidities can also smooth individual consumption when the households are dealing with credit constraints and stabilize aggregate demand (Bertola, 2014). As far as this argument is concerned, some policies have an additional effect of enhancing resilience and helping to mitigate economic shocks.

2.2 Adjustments after an economic shock

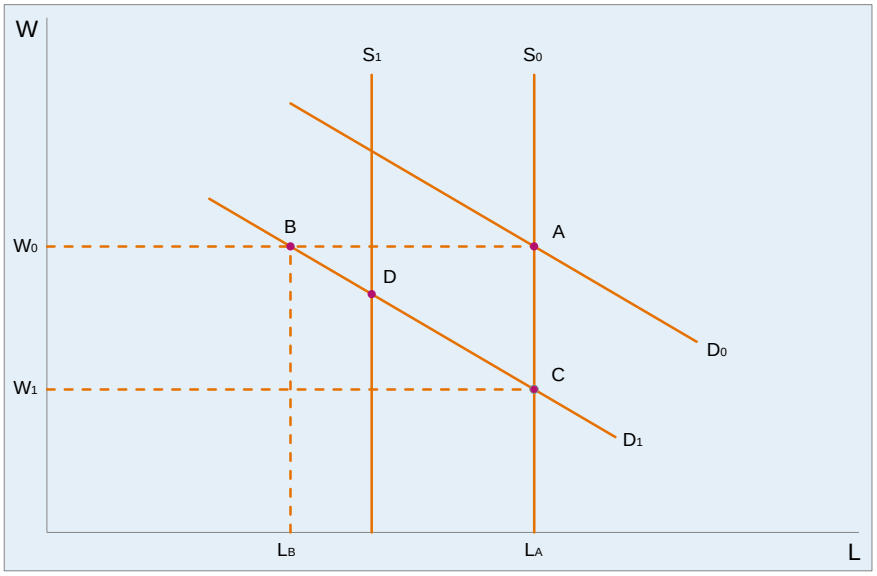
We adopt a simple framework of labour demand and supply to illustrate the trade-off between different adjustment responses if an economic shock hits an economy. In Figure 1, the supply and demand of labour in persons are illustrated by S_0 and D_0, respectively. For sake of simplicity, the supply curve of labour is inelastic. The demand curve depends on the real wage rate W, real production, the production technology (labour intensity) and hours worked per person. Production is determined by demand factors such as income, prices, interest rates and wealth.

Suppose the economy is initially in full equilibrium at point A in Figure 2.1.[2] This equilibrium is characterized by full employment (L_A) and real wage rate W_0. Next, a recession hits the economy and borrowing conditions deteriorate due to credit rationing and liquidity constraints. That implies that the interest rate rises and the demand for goods and services falls. The labour demand curve shifts inwards, for example to D_1, resulting in an unemployment of $L_A - L_B$ at wage rate W_0 (shift to point B).

[2] Full equilibrium refers to the situation in which all markets for goods and services, the labour market and all financial markets are in equilibrium.

If wages are fully flexible, full employment would be restored by a drop in nominal wages, point *C* with real wage rate W_1. However, there is a huge body of literature showing that nominal wages are rigid downwards (e.g. Gottschalk, 2005; Schmitt-Grohé and Uribe, 2013). Fehr and Goette (2005) argue that wage sweep-ups caused by nominal rigidity correlate strongly to unemployment, suggesting that downward nominal wage rigidity fuels unemployment. For an average OECD country, Abbritti and Fahr (2013) demonstrate that wages increase relatively fast, thereby limiting vacancy posting and employment creation, but they decline more slowly, leading to a strong reduction in vacancies and employment. Hence, there appears to be a strong asymmetry between wage rigidity and employment fluctuations during the different phases of the business cycle.

Figure 2.1. Labour market adjustments and economic shocks



Another (price) mechanism to restore full employment is currency devaluation or inflation to obtain real wage cuts.[3] However, there are signs that real wages too are downward rigid (Babecký et al., 2010) and the EMU restricts currency devaluations. Furthermore, in particular producers of tradable goods (exposed sectors) experience a limited influence on the price level due to international competition.

Some countries have dealt with the economic shock by hoarding labour, introducing work sharing or cutting labour supply which are all examples of the quantity mechanism to restore equilibrium on the labour market. *Labour hoarding* means that firms do not proportionally lay-off workers, given the drop in demand for their products and services. Stated differently: many workers were not fully occupied. In case of labour hoarding, firms switch to a more labour intensive production technology. The increased labour intensity leads to a rise in demand for labour. In the extreme case, the labour demand returns to D_0, resulting in full employment at real wage W_0. Firms will adopt labour hoarding if several conditions are met (e.g. Van den Berge et al., 2014). First, firms need substantial financial

[3] Currency devaluation improves competitiveness of sectors and thus production rises and the labour demand curve shifts outwards. To obtain a real wage cut the economy needs inflation caused by devaluation or an increased money supply. The latter will initially have a wealth effect on demand.

buffers to finance labour hoarding. It is costly, as employees who do not fully produce have to be paid their wage. Labour hoarding thus leads to lower profits and a lower mixed income in the economy. Second, labour hoarding is often induced to avoid transaction costs. In particular if firms expect a quick recovery of the economy, it is cost-optimal behaviour to hold on to redundant workers and avoid the high transaction costs of lay-off procedures and subsequently re-hires (when demand recovers again).

In the case of *work sharing*, the decrease in labour demand (in terms of hours worked), resulting from a drop in aggregate demand, is spread more equally among employees. Theoretically, it helps in avoiding lay-offs in the short run. Similar to labour hoarding, this mechanism leads to an outward shift of the labour demand curve. In the extreme case where the decrease in labour demand is fully spread over all employees, the demand curve returns to D_0 none of the employees loses their jobs and all adjustments take place through less hours worked per person employed. In this case the economy returns to point *A.*

Cuts in labour supply also help to limit short-run unemployment effects of economic shocks. This drop in labour supply is often the result of a "discouraged worker effect" (e.g. Clark and Summers, 1981; Cahuc and Zylberberg; 2004; Deloach and Kurt, 2012) which can be further propagated by policies (such as unemployment insurance).[4] The reduction in the labour supply causes the supply curve S_0 in Figure 1 to shifts inwards to S_1 and point D becomes the new long-run equilibrium with employment between L_A and L_B and a real wage between W_1 and W_0.

In short, a fall in aggregate demand (GDP) is ultimately reflected by less employment, lower real wages and/or less profits. The distribution of the shock among these components depends on the flexibility of real wages, the flexibility of labour demand, the flexibility of labour supply and financial buffers of firms. In many cases, this flexibility is related to particular institutions. This topic is elaborated on in the next section.

2.3 Role of institutions

Research suggests policy settings and institutional arrangements are important factors which amplify or mitigate macroeconomic shocks (Blanchard and Wolfers, 2000; Bassanini, 2012). Many of these studies particularly focus on labour market resilience, i.e. the situation where labour markets are more or less affected by economic shocks in terms of labour income, unemployment, and depth and duration of the crisis (e.g. OECD, 2012). Institutions that amplify effects of shocks on gross labour income (i.e. the product of hourly wages and hours worked) affect government revenues and/or profits of firms, which might make them extremely costly. On the other hand, these institutions can also smooth individual consumption when individual households are dealing with credit constraints and can stabilize aggregate demand (Bertola, 2014). In this sense, some policies also add to resilience and help mitigate economic shocks. Next, we focus on some standard institutional

[4] When labour market prospects deteriorate (i.e. the number of vacancies declines and unemployment rises), job finding opportunities become slim and search costs (monetary and psychological costs) are increasing, which consequently discourages people to actively search for work.

variables that have been used in previous literature examining labour market responses (e.g. Bassanini and Duval, 2006; Blanchard and Wolfers, 2000; Nickell et al., 2005; Eichhorst et al., 2010).

Wage adjustment

Institutions such as employment protection legislation and (organization of) wage bargaining affect the extent of wage rigidity (Babecký et al., 2010; Clar et al., 2007). Holden and Wulfsberg (2009) use industry-level data of 19 OECD countries and show that real wage cuts are less prevalent in countries with strict employment protection legislation and high union density. Concerning bargaining power of employment organizations, we expect that higher bargaining coverage leads to less flexible wages, due to a lower competition on working conditions. Eichhorst et al. (2010) show that countries that have higher wage flexibility also tend to have lower collective bargaining coverage. The degree of centralization and coordination of bargaining is also important, but the literature is inconclusive on the exact effects. Calmfors and Driffill (1988) postulate an inverted U-shape between coordination of wage bargaining and wage adjustments. This means that either a highly centralized system (e.g. Austria) or highly decentralized system with bargaining at the firm level (e.g. US) works best for wage moderations.

Minimum wages impose a threshold preventing downward wage adjustment at the bottom of the distribution. Hence, statutory minimum wages can be expected to negatively affect adjustments of wages to shocks. The effect of minimum wages on wage adjustments as a result of economic shocks is not undisputed. Bassanini (2012) does not find a significant effect of minimum wages on the transmission of GDP shocks on total earnings or fluctuations of value added.

Unemployment benefit schemes

A vast amount of literature argues that generous unemployment benefit schemes contribute negatively to labour market resilience. 'Generosity' is defined to depend on the level and the duration of the benefits. Rothstein (2011) and Nickell et al. (2003) argue that unemployment benefits negatively affect the readiness of the unemployed to search for jobs. This lengthens the duration of unemployment spells. Katz and Meyer (1990) find that, the duration plays a more important role in fueling unemployment than the level of the benefit does. Tatsiramos and Van Ours (2014) show that an extension of benefits duration leads to an increase in unemployment duration by 20% of the benefits extension. Regarding the level of the benefit, Scarpetta (1996) and Blanchard and Wolfers (2000) argue that higher benefits increase the equilibrium unemployment rate due to lower search intensity. On the other hand, unemployment benefits could stimulate consumption smoothing, which dampens the decrease in aggregate demand in a recession.

Employment protection legislation

Employment protection legislation (EPL) is an important element of transaction costs during an economic bust, e.g. by imposing severance payments. It makes firms reluctant to

adjust their work force immediately in response to changes in product demand.[5] Strict EPL in continental-Europe (Siebert, 1997) could therefore explain why labour hoarding behaviour seems to be more of a continental-European phenomenon than it is an Anglo-Saxon one (e.g. US, UK).

EPL seems to mitigate the loss of labour income in downturns by reducing the risk of being laid-off. However, the downside is that these policies prolonged the effect of the shock, as adjustment process towards an efficient labour allocation is hampered. Bassanini (2012) finds that, ceteris paribus, OECD-countries with more stringent employment protection show less output fluctuations when an economic shock occurs. Blanchard and Wolfers also discuss the trade-off between lower labour market dynamics and higher persistence of unemployment and conclude that the effect of EPL on equilibrium unemployment is ambiguous.

Work sharing

Work sharing, increases the so-called *internal numerical flexibility* (Atkinson, 1984), i.e. the flexibility in the amount of hours worked per person. It is observed more often in countries that lack *external numerical flexibility*, defined as adaptations in the number of employees, due to strict employment protection legislation. Although work sharing may seem attractive as an adjustment mechanism to mitigate the negative effects of economic shocks, the evidence supporting this conclusion is disputed. Kapteyn et al. (2004) argues that work sharing does have an positive effect on employment in the short run, but the long-run effect becomes small and insignificant if the indirect upward effect on wages are taken into account. Secondly, the success of work sharing initiatives by European governments is marginal at best (e.g. Freeman, 1998). Crépon and Kramarz (2002) conclude that the 1982 mandatory reduction of working hours in France had a negative impact on employment, while Hunt (1999) finds an adverse effect of work-sharing on employment in Germany. Overall, there seems to be ambiguity on the sign and size of the effect, both in the theories and the empirics (Taylor, 2009).

One specific way of implementing work sharing is through short-time working schemes. The benefit of short-time working schemes is that short-term transaction costs (in terms of hire and fire costs) can be avoided if the economy recovers quickly. The downside of short-time working schemes is that economic restructuring can be hampered (inefficient firms are supported with general means), which becomes especially problematic in case of a severe and prolonged recession. Furthermore, if work sharing is implemented without adjustments in wages, substantial short-time working schemes are expensive and often involve large deadweight loss (Boeri and Bruecker, 2011). In this case work sharing becomes equivalent to labour hoarding.

[5] EPL also makes firms more reluctant to immediately hire new workers when product demand increases. As a result, EPL lowers the volatility of employment over the business cycle (e.g. Nickell, 1978; Bentolila and Bertola, 1990; Blanchard and Wolfers, 2000; Bassanini, 2012).

Entitlement age of early retirement schemes

Sometimes, a cut in labour supply is propagated by policies. The literature is quite unambiguous that early-retirement schemes do not result in additional employment for the young (e.g. Barr en Diamond, 2009; Gruber en Wise, 2010; Kalwij et al., 2010; Jousten et al., 2008). Furthermore, early retirement schemes will ultimately cause negative effects on output in the long run due to negative labour supply effects (measured in full-time equivalents) (e.g. Layard et al., 1991; Vestad, 2013; Erosa et al., 2012; Staubli and Zweimüller, 2013).

3 Decomposition methodology and data

3.1 Introduction

This section focuses on the decomposition methodology of GDP growth and the sources of the data. After a review of the literature on decompositions (Section 3.2), Section 3.3 provides information on the mechanics of GDP growth decomposition into various components. Section 3.4 briefly describes the data used for the empirical analysis in this study.

3.2 Literature on decompositions

The literature contains multiple approaches to decompose the growth of a country. The first source of variation is the number of separate components that are distinguished. A second source of variation is the specification of the decomposition equation. Specification in terms of differences in the natural logarithms of GDP is quite common, while other decompositions focus on the level of GDP per capita rather than its growth rate. Below we cover some of these different approaches and show the similarities and differences with our approach.

A very basic example of a decomposition can be found in Kohler (2006), who finds that productivity and hours worked per worker are two important components in explaining output growth differences between Europe and the US in the recent years. Üngör and Kalafatcilar (2014) decompose economic growth in Turkey and find that, next to labour productivity, participation effects play a significant role. The role of labour force participation in economic growth is confirmed in Bloom and Canning (2003) and Bloom et al. (2010). They use a decomposition analysis to show the effect of demographic changes on economic growth in Ireland, China and India. Marattin and Salotti (2009) decomposes GDP per capita into several ratios, such as GDP per hour, hours worked per employee, the employment rate, the participation rate and demographics variables. They argue that these components are too often 'forgotten' in the discussion on long run growth dynamics.

A range of studies focuses not on the decomposition per se, but on a component that forms a proxy for the growth of productivity. For example, Kaitila (2006) finds a positive correlation between the investment shares of GDP and productivity. Alho (2008) uses a similar decomposition to study the relationship between taxes, productivity and other

employment components. Blanchard (2004) shows how the total number of hours worked can be decomposed to include the unemployment rate and the average hours worked per worker. He shows how the gap in GDP per capita between the EU and the US can be attributed to (voluntary) reductions in hours worked per person in Europe. Burda and Hunt (2011) decomposes GDP growth during the Great Recession for the US and Germany and concludes that differences in institutions mainly explains differences within each component. Restuccia (2008) adds to the literature by using a decomposition framework to compare economic performance between a number of countries, instead of a single country over time.

In our decomposition analysis, we make no attempt to specify an underlying production function. Doing so enables the estimation of contribution of different factors to GDP growth. Hayashi and Prescott (2002), for example, calculate the contribution of capital intensity, and Garrido (2013) uses a Cobb-Douglas production function as the starting point for his decomposition aimed at the contribution of calculate human capital. The drawback of this method is that it requires assumptions on the underlying economic relations that need to be estimated.

Chapter 2 of the OECD (2012) provides an extensive decomposition of unemployment. The document decomposes the change in the unemployment rate into five components, including hourly labour productivity, average wage rate, average hours worked, changes in the labour force and changes in GDP. Despite the different focus, the study is similar to the decomposition made in this paper. The OECD identifies the (real) wage bill as a separate component and shows that in almost all countries the average wage costs increase during the economic downturn. The OECD provides evidence that this could be due to a concentration of the reduction in employment in the low end of the wage distribution. As more low-paid workers become unemployed, the average wage rate tends to increase. This effect should be taken into account when interpreting our results.

3.3 Derivation of the GDP decomposition

In the national accounts, GDP (in market prices) is equal to:

$$p_y y = w\overline{L} + T + Z \tag{1}$$

where p_y represents the market price of real production y, in which w is the nominal compensation for every hour of labour input $\overline{L}$, T represents the total nominal value of taxes and subsidies and Z measures the total nominal operating surplus and mixed income. [6]

Equation (1) can be decomposed, by applying the following definitions:

A. Total hours of labour input $\overline{L}$ is the result of hours per employee h and labour demand
   L^d in persons:

[6] Taxes and subsidies refer to charges on production and import like the value added tax, import tax and excises. Direct taxes like corporate tax and income tax are not part of this term.

$$\overline{L} = h\ L^d \tag{2}$$

B. Labour demand is the product of the labour supply L^s (in persons) and the employment rate $1 - u$, where u is the unemployment rate:
$L^d = (1 - u)L^s$ (3)

C. The unemployment rate can be split into the rates of short-term unemployment and long-term unemployment:
$u = u^S + u^L$ (4)

D. Labour supply is the product of the total working age population N and the participation rate q. This participation rate measures the ratio of people in the labour supply to the total working age population.
$L^S = qN$ (5)

Applying these definitions and rewriting in terms of growth rates leads to (consult Appendix A for further details):

$$\overset{\circ}{y} \approx \omega_{l,-1}\left\{\frac{\overset{\circ}{w}}{p_y}\right\} + \omega_{l,-1}\overset{\circ}{l} + \omega_{T,-1}\left\{\frac{\overset{\circ}{T}}{p_y}\right\} + \omega_{Z,-1}\left\{\frac{\overset{\circ}{Z}}{p_y}\right\} \tag{6}$$

$$\overset{\circ}{l} \approx \overset{\circ}{h} + \overset{\circ}{q} + \overset{\circ}{N} - \left\{\frac{\Delta u^S}{1 - u_{-1}} + \frac{\Delta u^L}{1 - u_{-1}}\right\} \tag{7}$$

in which $\omega_{l,-1}$, $\omega_{T,-1}$ and $\omega_{Z,-1}$ are the respective shares in GDP of labour income, taxes and subsidies and operating surplus, as measured in the previous period.

Equation (6) describes the growth rate of real GDP as a weighted average of:
1. the growth in real wages (first term RHS),
2. the growth in employment in hours (second term RHS)
3. the growth rate of real taxes and subsidies on products and production (third term RHS)
4. the growth rate of real operation surplus and mixed income (fourth term RHS)

Equation (7) describes the change in employment as the sum of:
1. the growth of hours worked per employee (first term RHS)
2. the growth of the participation rate (second term RHS)
3. the working-age population growth (third term RHS)
4. the change in the short-term and long-term employment relative to the employment rate (fourth term RHS).

Note that his decomposition is entirely based on a simple set of (accounting) definitions. The underlying economic and institutional structures, which differ between economies, are

not explicitly described by this method. Therefore, we are not able to direct any results to particular economic structures or institutions.

3.4 Data

The results presented in this study are mainly based on the data from the OECD National Accounts. The main advantage of using the national accounts data as a base is the international comparability. We utilize the main aggregates computed under the income approach. From this source we obtain the Gross Domestic Product, the total compensation of employees, the value of taxes minus subsidies, the operating surplus and gross mixed income, the Purchasing Power Parity (PPP) series, the total employment and the self-employment series.

Using these series allows us to generate time series for the price index of GDP and labour demand (employees). By comparing the GDP at current and at constant prices, we generate a price index of GDP (with 2005 as base), which is applied to transform nominal values into real values. The PPP series allows us to express all values in common currency (US dollars). Labour demand (employees) is generated by subtracting self-employment from total employment.

Sometime, data from the national accounts are incomplete, which make it necessary to use alternative sources. Another important source is the OECD Labour Force Survey (LFS). Other sources were also used to cross check and complement the OECD data, including the EUKLEMS database, OECD Structural Analysis (STAN) database, Total Economy Database (TED), Annual Macro-Economic Database of the European Commission (AMECO), Eurostat database and the OECD Economic Outlook Databases. For a complete overview of all the data sources used, we refer to Appendix B. Annual data was gathered for the period 1970 up till 2013 (2014 in the case of Germany and the Netherlands) at annual frequency.

4 Empirical results

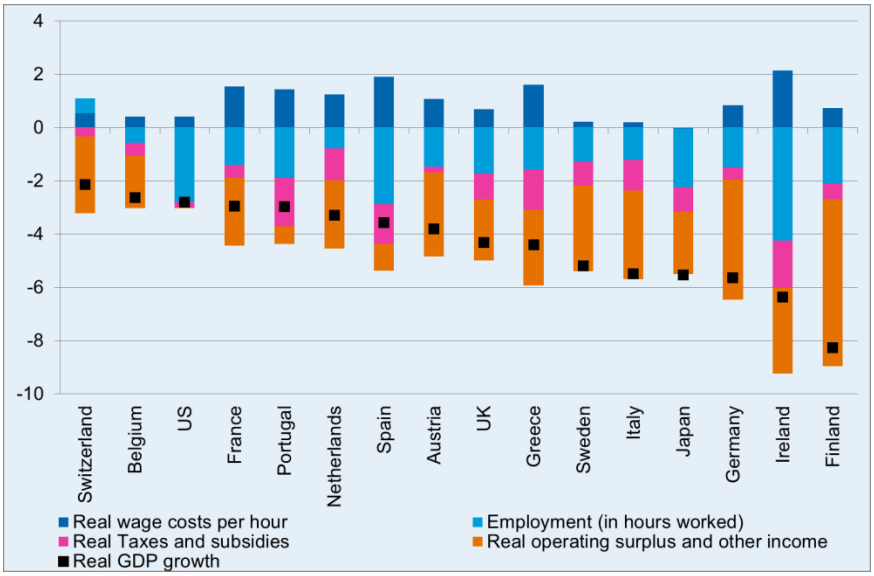
In this section we discuss the results of our decomposition analysis aimed at answering the question: how are the costs of the Great Recession mitigated across different actors in the economy? Based on these results, a second step is to derive a typology of countries that show similar patterns. In Section 4.1 we start with a decomposition of real GDP growth into wage costs, employment, operating surplus and taxes and subsidies. Next, we dig further into the mechanics behind the employment response. These decompositions are based on equations (6) and (7) of Section 3.3. Afterwards, we take a deeper look at the role of wages in Section 4.2. Section 4.3 discusses the contribution of the adjustment mechanisms over time by separately comparing the development of key variables in our decomposition from an international perspective and derives the typology of countries that show similar patterns.

4.1 Cross section analysis

Decomposition of GDP

Figure 4.1 displays a basic decomposition of changes in real GDP growth from an international perspective at the start of the Great Recession (i.e. the year 2009).[7]

Figure 4.1 Basic decomposition of GDP growth in 2009



GDP losses in 2009 were large across the board, with Finland and Ireland experiencing the largest declines in GDP (black squares) while, at the other end of the spectrum, New Zealand and Australia show no GDP losses.[8]

The decompositions of the GDP decline show much heterogeneity. Spain, Ireland and the US show especially large immediate declines in employment as a response to the crisis (light blue bars). In contrast, in the Netherlands, France, Belgium, Sweden, Italy and Germany, the contribution of the employment decrease was relatively mild. Labour hoarding seems to be prominent in these countries. At the start of the crisis, real wage costs per hour still increased in the majority of the countries showed in Figure 4.1 (dark blue bars). In the next section we will have a closer look at the development of real wage costs. The limited drop in employment and small increase in real wage costs imply that the largest part of the fall in GDP is found in a reduction of operating surplus (orange bars).[9] This could possibly point to labour hoarding and a drop in income of self-employed (mixed income). The decline in operating surplus at the start of the recession could imply that firms sacrifice profit in order to avoid lay-offs and subsequent re-hires in the short-run. As we have some unanswered questions about the mixed income data provided by the National Accounts (see Box 1),

[7] This decomposition is based on equation (6) of Section 3.3.
[8] To improve readability of the figures, we have only included a selection of countries in the figures. The full dataset also contains Australia, New Zealand, Canada, Czech Rep., Denmark, Korea, New Zealand and Norway.
[9] As the weight of taxes and subsidies in GDP is rather small, the term $\omega_{T,t-1}\frac{\dot{T}}{p_y}$ is not discussed.

we refrain from decomposing the change in operational surplus to income of self-employed and firm profits.

Figure 4.2 Basic decomposition of GDP growth in 2010/2013

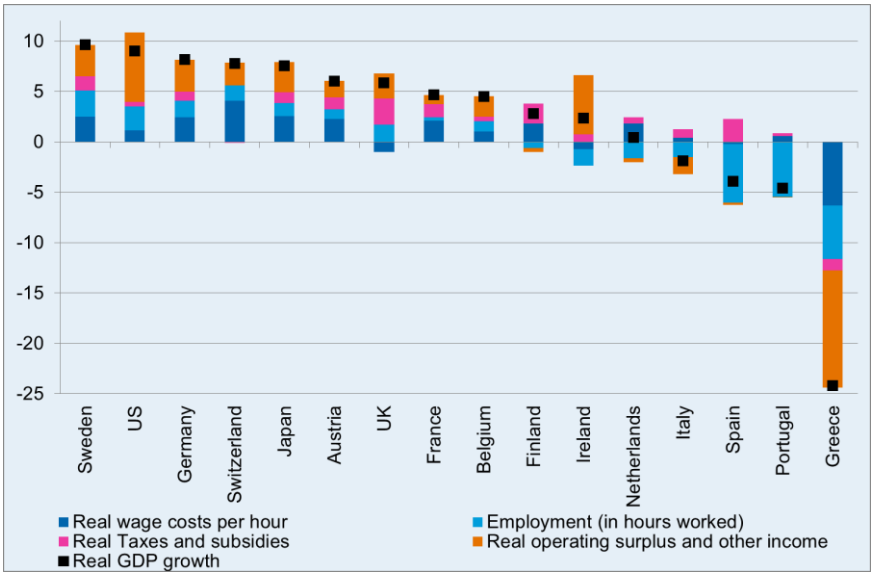
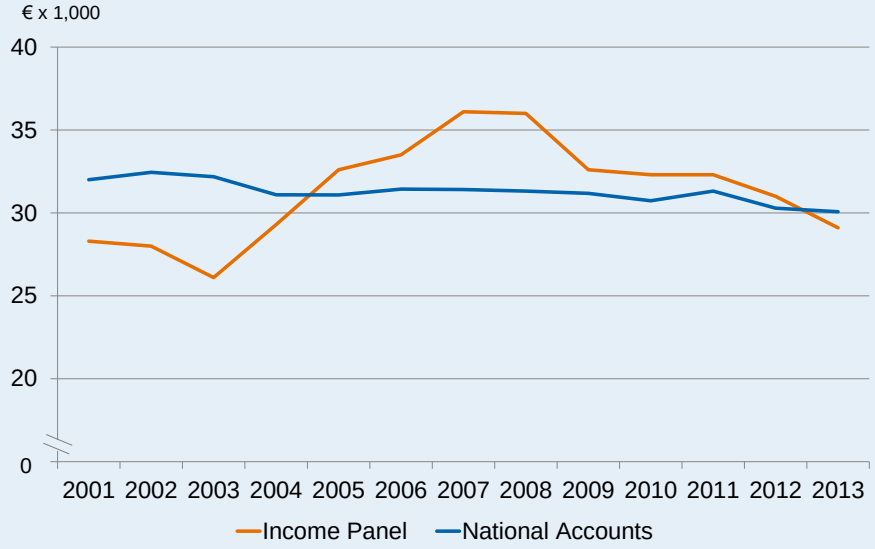


Figure 4.2 shows a similar decomposition of the GDP growth in the period 2010-2013. In contrast to the uniform GDP decreases in 2009, we observe an increase in GDP for almost every country after 2009. Exceptions are Southern countries, namely Greece, Italy, Portugal and Spain. In comparison to the other OECD countries, it is clear that Greece constitutes an outlier, with a continued large decline in output. Although the entire period shows a net growth of GDP for most countries, the dynamics of GDP growth differs considerably between the countries. For example, the US and Switzerland show a steady recovery, while the other countries (e.g. the Netherlands and Finland) experience a double dip. Most of the recovery translated into a sharp resurgence of real operating surplus (orange bars). Within the group that experienced a net recovery, only Finland, Ireland and the Netherlands show a drop in employment (in hours worked, light-blue bars). This employment drop might be related to the double dip in GDP that all three countries have experienced. Large falls in employment take place in Greece, Spain, Portugal and Italy due to the continued recession. In most countries, the growth in real wage costs stagnated or turned into a decline (Greece, Ireland, UK; dark-blue bars).

Box 1. Income self-employed in the Netherlands according to two approaches

Income of self-employed according to two data sources



Source: Statistics Netherlands.

In many OECD-countries, self-employment is a significant part of employment (in many countries about 15%). Therefore, focussing solely on changes in the compensation of employees provides only a partial description of the effects of the financial crisis on price and quantity adjustments on the labour market. In our analysis, the income of self-employed is the mixed income within the operating surplus. For a more complete picture of the impact of the crisis, a separate description of changes in the income of self-employed is necessary. However, internationally comparable statistics on the income of this category is hardly available and/or raises questions on reliability. For example, in the Netherlands, there has been a large increase in the number of self-employed since 1978. The National Accounts and the Income Panel show different developments in income of self-employed. It seems that the calculation method currently applied in the National Accounts to determine this income (mixed income) only partly takes into account the information provided by other data sources such as interviews. Further research seems necessary to obtain a proper description of the income of self-employed in the national accounts.

Employment changes disentangled

To shed light on the economic mechanisms on the labour market as described in Section 2, we further decompose the employment effects at the start of the Great Recession.[10] In Figure 4.3 we illustrate the negative employment effect for a number of countries that show different adjustment patterns.

The figure shows large reductions in hours worked per employee (green bars) for Germany and Japan. The average amount of hours worked for these countries was far below the OECD-average, and it absorbed most of the hit in total employment in 2009.[11]

[10] This decomposition is based on equation (7) of Section 3.3.
[11] See also Hijzen and Venn (2011).

In the majority of countries, the working-age population still grows at the start of the crisis (blue bars). The development of this demographic factor seems country-dependent: we do not distinguish a common pattern throughout the crisis.

Although the short-term employment response to changes in GDP is small overall, some countries (Finland, the US) show a distinct fall in the participation (orange bars). This could be evidence of the discouraged worker effect, as described in Section 2.

Early into the recession, a distinct unemployment pattern is noticeable. While the long-term unemployment (red patterned bars) takes more time to manifest, short-term unemployment (red bars) is already increasing, as is clear from the negative bars. For example, the US and UK show a large rise in unemployment, with an emphasis on short-term unemployment. In the Netherlands and Germany, the red patterned bars are positive, indicating that there was a (limited) decrease in long-term unemployment in 2009. Spain and Ireland show a sharp increase in unemployment in 2009, but in these countries, the role of long-term unemployment is already quite prominent in 2009. This is explained by a strong growth in short-term unemployment preceding the recession in both countries. As the aggregate demand began to stagnate around the year 2008, the unemployment rate started to increase. Workers who became unemployed shortly before 2009 belonged to the group of short-term unemployed in 2008. If they did not succeed at finding a job within that year, they were automatically categorized as being part of the long-term unemployed in 2009. The growth in long-term unemployed in Spain and Ireland is therefore partly due to an earlier economic stagnation.

Figure 4.3 Decomposition of employment growth in 2009

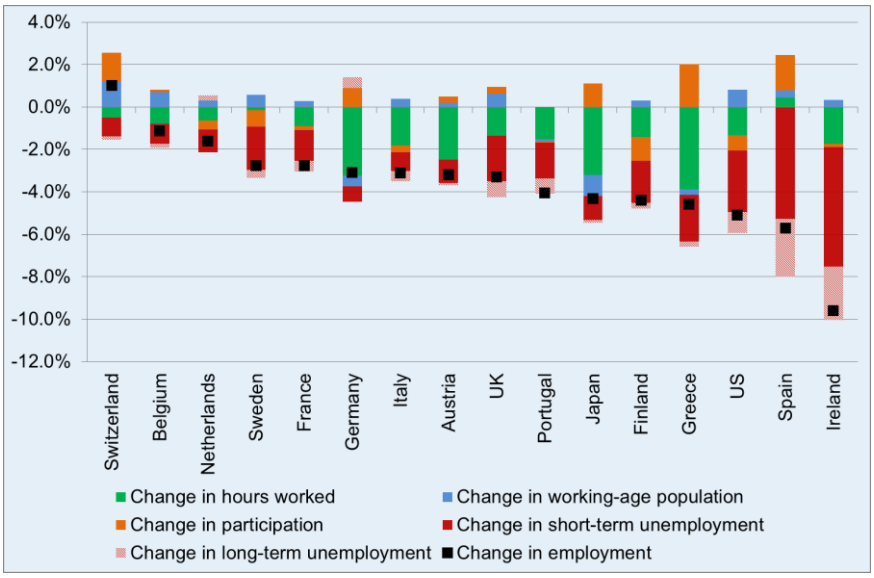


Figure 4.4 shows the decomposition of employment growth during the period 2010-2013. To a large extent, the reactions are a mirror image of Figure 4.3, as economic recovery takes place in a range of countries. The main differences compared to 2009 are the development of long-term unemployment (red patterned bars), short-term unemployment (red bars), hours worked (green bars) and the participation (indicated by orange bars).

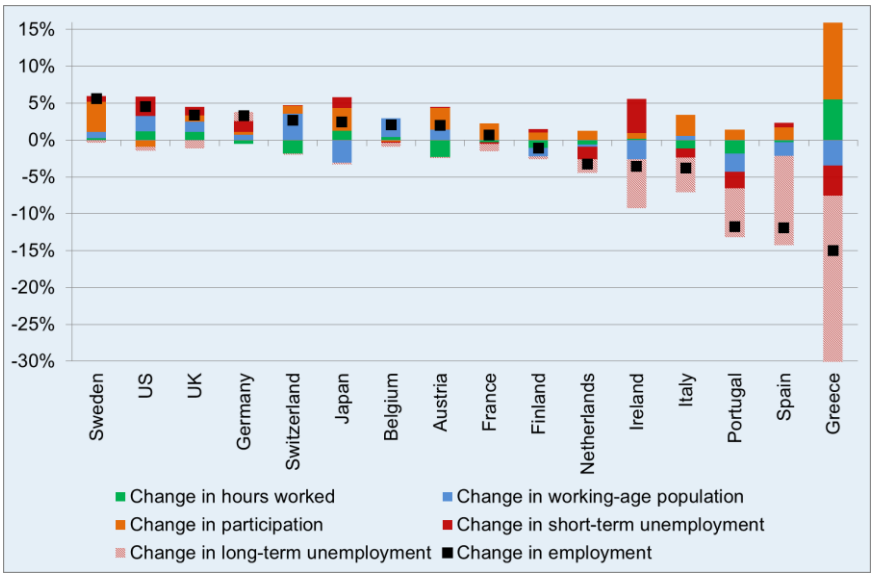
Cumulated over the years 2010-2013, the increase in long-term unemployment seems limited in most countries (except the Southern-European countries and Ireland and the Netherlands). Although long-term unemployment did increase for every country (except Germany) in 2010, this increase was countered by a decrease in the subsequent years of recovery. The net-negative effect of long-term unemployment in the total change in employment is stronger in countries that suffered a double dip (for example, the Netherlands and France).

In some countries (UK, US, Japan, Germany and Ireland) the short-term unemployment already falls in 2010/2013. In Spain, Greece, Portugal and Italy the increase in short-term unemployment is smaller than in 2009. However, in this latter group of countries, the smaller increase of short-term unemployment is not a result of economic recovery, but rather the result of continued recession, implying that people who lost their jobs in 2009 remain - to a large extent - unemployment thereafter. This explanation seems in accordance with the strong increase in long-term unemployment.

After a fall in the hours worked per person in 2009, the countries that had a recovery of employment in 2010 typically also showed a recovery in hours worked. In the period following 2010, there is no pattern to be distinguished in the hours worked .

In many countries, the GDP growth improves labour market opportunities for employees and the participation rate rises (opposite discouraged worker effect). A similar increase in participation occurs in Greece, Spain, Portugal and Italy. In these countries the rise cannot be explained by the opposite discouraged worker effect.

Figure 4.4 **Decomposition of cumulated employment growth in the period 2010/2013**



Given the above information, it is difficult to make groupings based on the differences and similarities in adjustment patterns between countries. One could arguably distinguish one separate group, containing Southern-European countries and Ireland. These countries all display a large fall in GDP in 2009, no net recovery in the subsequent years and a relatively large loss of employment throughout the recession.

4.2 The role of real wage costs

In response to a drop in aggregate demand, real wages should decrease and/or unemployment should rise and/or labour supply should drop, with the size and speed of the effect depending on the local institutions. Because discouragement takes time to materialize (Duval et al., 2011), changes in aggregate demand often lead to changes in wages and unemployment. However, based on our empirical results, the decline in GDP generally did not translate into a negative contribution of real wage costs in 2009 or the subsequent years (see Figures 4.1 and 4.2). At first sight this observation seems in line with insights from the literature that wages are downward rigid, perhaps even in real terms. Furthermore, this observation might lead to the conclusion that wages are not an important adjustment mechanism.

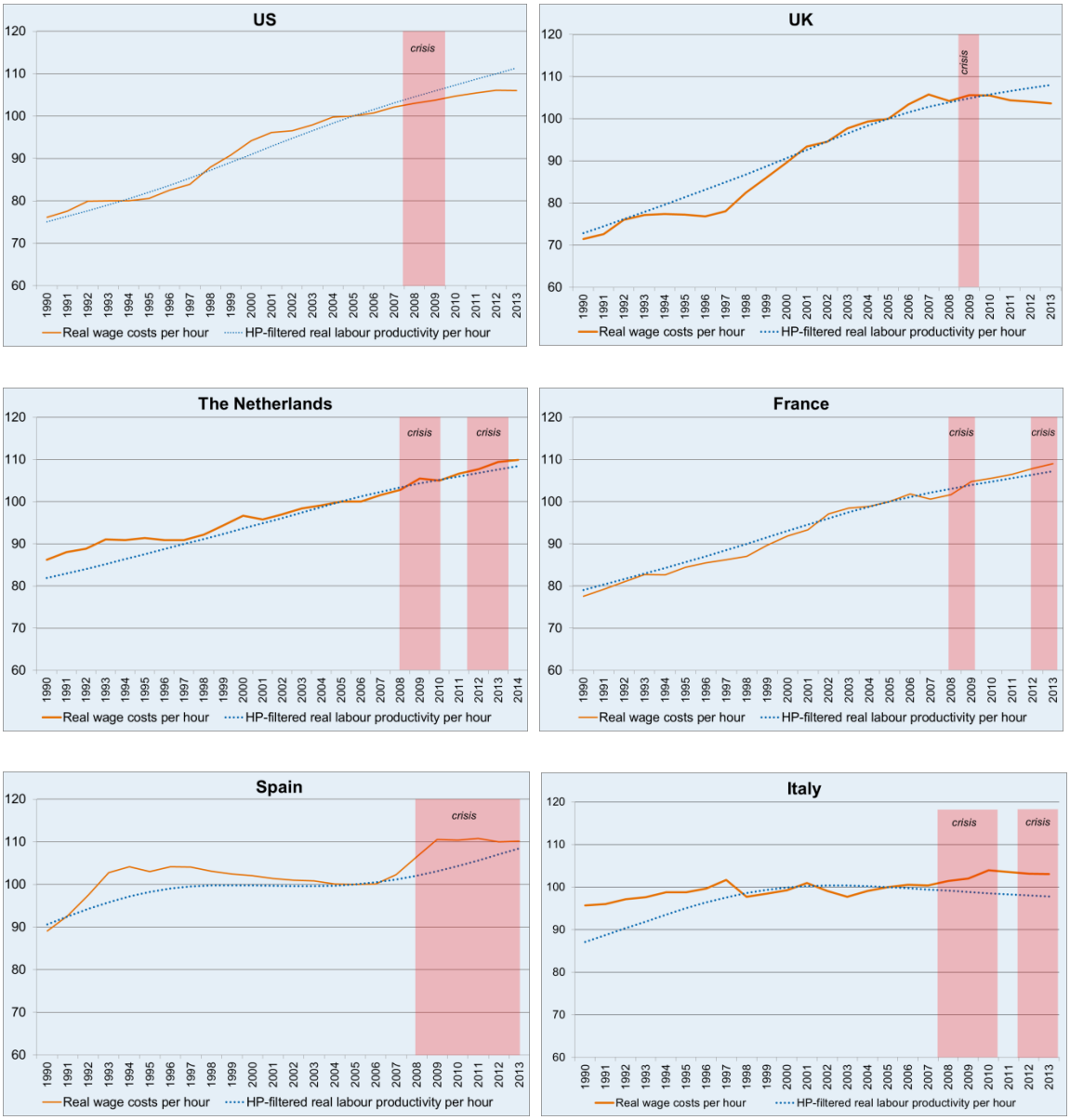
However, in that case, we implicitly assume that the change in real wages is solely determined by changes in labour market conditions, while changes in real wages also depend on the development of labour productivity per worker.[12] Therefore, a proper assessment of the wage rate as an adjustment mechanism should take into account simultaneous changes in labour productivity. The productivity per hours follows an upward trend, due to the technological progress. In general, this implies that real wage costs per hour will show a similar upward trend, so that unit labor costs remain unaltered. Therefore, the growth or decline in the wage rate per hour during the recession, as observed in section 4.1, is the net effect of productivity growth and the downward pressure of increased unemployment. In consequence, to understand the role of real wage adjustments, it is necessary to examine real wage costs deviations from the long-run productivity trend. With a bird's eye view, this leads to three groups.

The first group contains Anglo-Saxon countries, namely the US and the UK, where real wages costs quickly respond to the downfall in aggregate demand. In this group, the institutions allow for a relatively large and fast downward pressure on the real wages, resulting in a significantly lower rate of growth of real wage costs, compared to labour productivity, after the beginning of the recession. Figure 4.5 shows this process for the US and the UK. The figure illustrates the development of real wage costs vis-à-vis the development of productivity per hour, where labour productivity is measured as the HP-filtered real output per hour worked. In this group there is a continued increasing gap of real wage costs (yellow line) relative to the structural productivity (blue line). In these countries real wage costs seem to have responded as a result of the crisis and this finding is in accordance with micro-level evidence by Blundell et al. (2014).

[12] In the empirical analysis we assume that changes in structural Total Factor Productivity (TFP) approximate changes in labour productivity.

In our second group, real wage costs continue to grow along real productivity (see Figure 4.5 for the Netherlands and France). This group consists of the Netherlands, France, Czech Republic, Japan, Korea, Sweden, Canada, Belgium, Austria and Finland. During the crisis, the real wage costs closely tracks the growth of labour productivity. It should be noted that some countries in this group, i.e. Belgium, Finland, Norway and Austria, show a tendency towards a positive rather than negative deviation from structural productivity trend.

Figure 4.5 **Real wage costs per hour vis-à-vis structural labour productivity per hour, 2005 = 100**



Explanation: the length of the recession is determined by negative employment contributions to GDP development. The HP-trend for productivity is based on observations of total factor productivity for the total sample period (i.e. 1970-2013/2014). We use a lambda of 100 to execute the HP filter.

The third group consists of Spain, Italy and Ireland, which show a large positive deviation of real wage costs per hour vis-à-vis real productivity. During the start of the recession, real wage costs kept on growing, causing a large gap with productivity. It takes several years after the initial shock before a stabilization of the real wage costs takes place. Figure 4.5 illustrates the pattern for Italy and Spain. In the case of Italy a large gap still remains. In Ireland and Spain the gap is closed slowly but steadily.

Some countries are not easily categorized. In the case of Portugal, data on hours worked in different sources deviate substantially, making data on wage costs per hour worked unreliable. In Greece, labour productivity has dropped rapidly. As a consequence, it is difficult to determine a structural trend of labour productivity development. We do not include Portugal and Greece in any of our "wage adjustment groups", as these countries show dissimilar patterns from any of these groups and should be considered case studies by themselves. To summarize, Table 4.1 provides the country clustering with regard to wage adjustments.

Table 4.1 Real wage adjustment groups

Wage costs < productivity	Wage costs = productivity	Wage costs > productivity
US	France	Spain
UK	The Netherlands	Ireland
Germany	Belgium	Italy
	Czech Republic	
	Sweden	
	Japan	
	Korea	
	Canada	
	Austria	
	Finland	
	Norway	

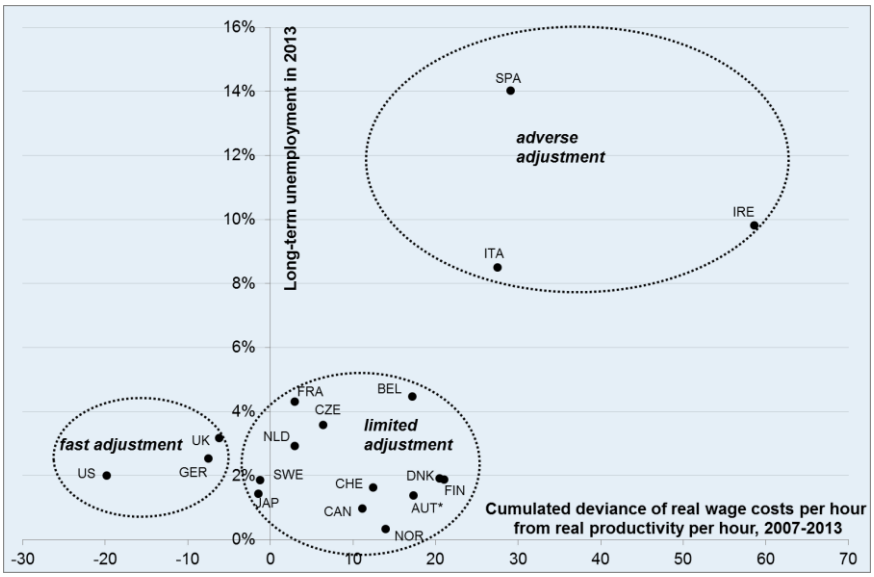
4.3 Trade-offs between adjustment mechanisms

Previously, we discussed that a fall in aggregate demand must be accommodated by the changes in the real wage rate and/or unemployment. This implies that real wage costs should decrease and/or unemployment must rise. In this section we try to shed more light on the trade-off between (long-term) unemployment (i.e. quantity adjustment) and real wages (price mechanism). In our theoretical framework we already addressed that countries with more flexible wage costs adjustment are expected to show less impact on (long-term) unemployment than countries lacking this adjustment mechanism. Furthermore we addressed the influence of openness of the economy on opportunities to change wages. We will examine this trade-off using our empirical data.

Figure 4.6 illustrates a simple correlation between the wage costs adjustment (horizontal-axis) and the level of long-term unemployment in 2013 (vertical-axis). The wage costs adjustment is calculated by accumulating the gap between real wage costs (per hour) and

real labour productivity (per hour) over the period 2007-2013. Because of arguments mentioned in the preceding section, we leave out Portugal and Greece from our analysis.

Figure 4.6 **Cumulated deviation of the real wage from real productivity over 2007-2013 vis-à-vis the long-term unemployment rate in 2013**



There appear to be three different groups of countries, which can be derived from this simple correlation. We will examine these countries in more detail below.

1. *Wage adjustment (UK, US and Germany)*: these countries combine a relatively low level of long-term unemployment with a relative large decline of real wages costs vis-à-vis productivity. The situation in Germany, however, is somewhat different than the situation in the Anglo-Saxons. In Germany wages costs were already below structural productivity levels when the crisis hit the global economy. So, there was room for upwards wage adjustment without significant erosion of competitiveness in the German economy. This was not the case in the US and the UK, where wages cost levels were (approximately) on par with productivity level at the start of the crisis and the adjustment took place during the crisis.
2. *Limited flexible wage adjustment (the Netherlands, France, Czech Republic, Belgium, Sweden, Switzerland, Denmark, Finland, Japan, Canada, and Norway)*: this group contains countries with moderate levels of unemployment and wage costs which move in concordance with productivity levels. These countries show hardly any real wage adjustments (vis-à-vis changes in productivity) in response to the economic shock of the Great Recession. Within this group there seems a division between exposed and sheltered economies (see Box 2). In comparison with the wage adjustment group, the exposed economies (the Netherlands, France, Czech Republic and Belgium) are coping with somewhat higher levels of long-term unemployment. More sheltered economies (i.e. Japan, Sweden, Canada, Austria, Denmark, Finland, Switzerland, and Norway) do not show such a high long-term unemployment level. Within the latter economies, a deviation between wage costs and structural productivity will not be penalized by a lower international market share due loss of competitiveness. Therefore, these

sheltered economies are able to maintain a situation where wage costs deviate from structural productivity as producers are more able to pass on higher labour costs by raising (domestic) prices and thereby limit the rise in real wages compared to producers in the exposed sectors of open economies.

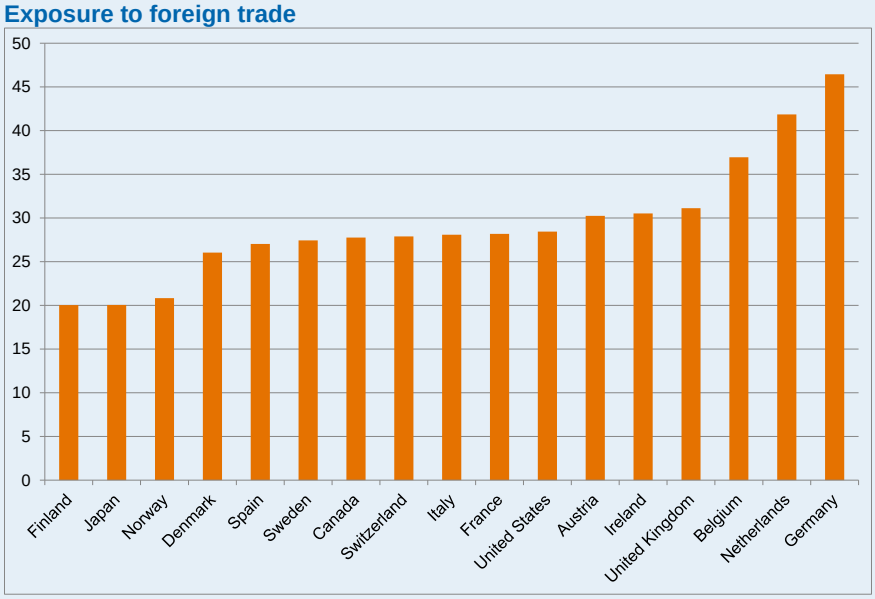
3. *Adverse wage adjustment (Italy, Spain, and Ireland)*: these countries show a large deviation of wage costs from structural productivity, as well as a high level of long-term unemployment. Although each of these countries tells a different story, we elaborate on the case of Spain to exemplify the situation in this cluster. The problems with long-term unemployment in Spain relate to a core problem on the Spanish labour market, being the pronounce insider-outsider divide. Workers under standard open-ended contracts are subject to high firing costs and are covered by collective bargaining agreements that protect wages and working conditions against inflation and adverse productivity shocks (Bentolila et al., 2012). As workers under fixed-term contract have little employment protection, adjustments to productivity and demand shocks are absorbed mainly by dismissal of temporary workers. When the crisis hit the global economy, Spanish unemployment reacted fiercely and shot up from 8.2% in 2007 to a staggering 26.1% in 2013. The long-term unemployment already was quite prominent in 2009, but the situation deteriorated rapidly in the period 2010-2013.

Although Figure 4.6 only displays a simple correlation without providing any information on the causal relationship between wage costs adjustments and long-term unemployment, we are able to draw one tentative conclusion. For countries dealing with relatively large exposure to international competition, there seems to be a trade-off between real wage costs flexibility (compared to changes in labour productivity) and long-run unemployment.

Box 2. Sheltered and exposed economies

The figure below shows exposure to foreign trade as an indicator of the relative openness of an economy in 2013. The indicator of openness is based on Bassanini et al. (2001) and is controlled for the size of the economy. Most of the countries in the sheltered group are countries with a relatively low exposure to foreign trade (i.e. Finland, Japan, Norway, Denmark, Canada, and Switzerland), while the countries in the middle group tend to have above-average openness levels (i.e. Belgium, the Netherlands).

Exposure to foreign trade



Explanation: exposure to foreign trade = export intensity + (1-export intensity/100)*ratio of imports to domestic demand), adjusted for the relative size of economies

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Appendix A. Details on derivation of the decomposition

In the national accounts, GDP (in market prices) is equal to the sum of:
1. compensation of employees
2. taxes and subsidies on production and imports
3. operating surplus and gross mixed income

This relationship can be expressed as:

$$p_y y = w\overline{L} + T + Z \tag{1}$$

where p_y represents the market price of real production y, w is the gross nominal compensation for every hour of labour input $\overline{L}$, T represents the total nominal value of taxes and subsidies and Z measures the total nominal operating surplus and mixed income.

In what follows, we approximate a change in the combination of two values:

$$\Delta(XY) \approx Y_{t-1}\Delta X_t + X_{t-1}\Delta Y_t \tag{2}$$

Using (2), we can decompose the change in nominal GDP:

$$\Delta(p_y y) \approx \overline{L}_{-1}\Delta w + w_{-1}\Delta\overline{L} + \Delta T + \Delta Z \tag{3}$$

The first definition we apply is that the total hours of labour input $\overline{L}$ is the result of hours worked per employee h and the labour demand L^d in persons:

$$\overline{L} = h\ L^d \tag{4}$$

This implies that (3) becomes:

$$\Delta(p_y y) \approx \overline{L}_{-1}\Delta w + w_{-1}\Delta(L^d h) + \Delta T + \Delta Z \tag{5}$$

Rewriting this, using (2), results in:

$$\Delta(p_y y) \approx \overline{L}_{-1}\Delta w + w_{-1}(h_{-1}\Delta L^d + L^d{}_{-1}\Delta h) + \Delta T + \Delta Z \tag{6}$$

The second definition we apply is that labour demand is the product of the labour supply L^s(in persons) and the employment rate$1 - u$, where u is the unemployment rate:

$$L^d = (1-u)L^s \tag{7}$$

Implementing this in (6) and rewriting as we did before, using (2), leads to:

$$\begin{aligned}\Delta(p_y y) &\approx \overline{L}_{-1}\Delta w + w_{-1}\left[h_{-1}\{(1-u_{-1})\Delta L^s + L^s_{-1}\Delta(1-u)\} + L^d_{-1}\Delta h\right] + \Delta T + \Delta Z \\ &\approx \overline{L}_{-1}\Delta w + w_{-1}\left[h_{-1}\{(1-u_{-1})\Delta L^s - L^s_{-1}\Delta u\} + L^d_{-1}\Delta h\right] + \Delta T + \Delta Z\end{aligned} \tag{8}$$

The third definition we apply is that he unemployment rate can be split into the rates of short-term unemployment (less than one year) and long-term unemployment (more than one year):

$$u = u^S + u^L \tag{9}$$

Using this in equation (8), and rewriting, we get:

$$\begin{aligned}\Delta(p_y y) \approx\ & \overline{L}_{-1}\Delta w \\ & + w_{-1}\left[h_{-1}\{(1-u_{-1})\Delta L^s - L^s_{-1}\Delta u^S - L^s_{-1}\Delta u^L\} + L^d_{-1}\Delta h\right] \\ & + \Delta T + \Delta Z\end{aligned} \tag{10}$$

The final definition is that labour supply is the product of the total working age population N and the participation rate q. This participation rate measures the ratio of people in the labour supply to the total working age population.

$$L^S = Nq \tag{11}$$

Combining this with equation (10) and rewriting this in similar fashion as done previously, we end up with the final decomposition equation:

$$\begin{aligned}\Delta(p_y y) \approx\ & \overline{L}_{-1}\Delta w \\ & + w_{-1}[h_{-1}\{(1-u_{-1})[N_{-1}\Delta q + q_{-1}\Delta N] - L^s_{-1}\Delta u^S - L^s_{-1}\Delta u^L\} + L^d_{-1}\Delta h] \\ & + \Delta T + \Delta Z\end{aligned} \tag{12}$$

These components can be rewritten to express the growth relative to the previous period by dividing by the lagged level value (denoted using °). Each component is multiplied by that same value to counter the extra division. The resulting specification is:

$$\begin{aligned}\Delta(p_y y) \approx\ & w_{-1}\overline{L}_{-1}\overset{\circ}{w} + w_{-1}L^d{}_{-1}h_{-1}\overset{\circ}{h} + w_{-1}h_{-1}(1-u_{-1})q_{-1}N_{-1}\overset{\circ}{q} \\ & + w_{-1}h_{-1}(1-u_{-1})N_{-1}q_{-1}\overset{\circ}{N} - w_{-1}h_{-1}L^s_{-1}(1-u_{-1})\frac{\Delta u^S}{(1-u_{-1})} \\ & - w_{-1}h_{-1}L^s_{-1}(1-u_{-1})\frac{\Delta u^L}{(1-u_{-1})} + T_{-1}\overset{\circ}{T} + Z_{-1}\overset{\circ}{Z}\end{aligned} \tag{13}$$

These expressions can be simplified to:

$$\Delta(p_y y) \approx w_{-1}\overline{L}_{-1}\overset{\circ}{w} + w_{-1}\overline{L}_{-1}\overset{\circ}{h} + w_{-1}\overline{L}_{-1}\overset{\circ}{q} + w_{-1}\overline{L}_{-1}\overset{\circ}{N} - w_{-1}\overline{L}_{-1}\frac{\Delta u^S}{(1-u_{-1})} - w_{-1}\overline{L}_{-1}\frac{\Delta u^L}{(1-u_{-1})} + T_{-1}\overset{\circ}{T} + Z_{-1}\overset{\circ}{Z} \quad (14)$$

To get the contribution of each term to the growth in production, we divide both sides by $(p_y y)_{-1}$ and then convert the relevant nominal values to real values. The equation is given by:

$$\overset{\circ}{y} \approx \omega_{l,-1}\left\{\frac{\overset{\circ}{w}}{p_y}\right\} + \omega_{l,-1}\overset{\circ}{h} + \omega_{l,-1}\overset{\circ}{q} + \omega_{l,-1}\overset{\circ}{N} - \omega_{l,-1}\left\{\frac{\Delta u^S}{1-u_{-1}} + \frac{\Delta u^L}{1-u_{-1}}\right\} + \omega_{T,-1}\left\{\frac{\overset{\circ}{T}}{p_y}\right\} + \omega_{Z,-1}\left\{\frac{\overset{\circ}{Z}}{p_y}\right\} \quad (15)$$

The growth in real production $\overset{\circ}{y}$ is thus determined by the contribution of:

$\omega_{l,-1}\left\{\frac{\overset{\circ}{w}}{p_y}\right\}$	= relative change in employee compensation per hour
$+\omega_{l,-1}\overset{\circ}{h}$	= relative change in average hours worked per employee
$+\ \omega_{l,-1}\overset{\circ}{q}$	= relative change in participation
$+\ \omega_{l,-1}\overset{\circ}{N}$	= relative change of total working age population
$-\omega_{l,-1}\frac{\Delta u^S}{(1-u_{-1})}$	=relative change in short-term unemployment relative to the employment rate
$-\omega_{l,-1}\frac{\Delta u^L}{(1-u_{-1})}$	=relative change in long-term unemployment relative to the employment rate
$+\omega_{T,-1}\left\{\frac{\overset{\circ}{T}}{p_y}\right\}$	=relative changes in tax and subsidies on products and production
$+\omega_{Z,-1}\left\{\frac{\overset{\circ}{Z}}{p_y}\right\}$	=relative changes in operating surplus and mixed income

where $\omega_{l,-1} = \frac{w_{-1}\overline{L}_{-1}}{(p_y y)_{-1}}$ is the labour income share in GPP in the previous period,
$\omega_{T,-1} = \frac{T_{-1}}{(p_y y)_{-1}}$ is the share of taxes and subsidies in GDP in the previous period and

$\omega_{Z,-1} = \frac{Z_{-1}}{(p_y y)_{-1}}$ is the share of mixed income and operating surplus in GDP in the previous period.

Equation (15) can be summarized using two expressions:

$$\overset{\circ}{y} \approx \omega_{l,-1}\left\{\frac{\overset{\circ}{w}}{p_y}\right\} + \omega_{l,-1}\overset{\circ}{l} + \omega_{T,-1}\left\{\frac{\overset{\circ}{T}}{p_y}\right\} + \omega_{Z,-1}\left\{\frac{\overset{\circ}{Z}}{p_y}\right\} \quad (16)$$

$$\overset{\circ}{l} \approx \overset{\circ}{h} + \overset{\circ}{q} + \overset{\circ}{N} - \left\{\frac{\Delta u^S}{1-u_{-1}} + \frac{\Delta u^L}{1-u_{-1}}\right\} \quad (17)$$

Appendix B. Details on data construction

The table below indicates what source is used for what country. The numbers correspond to the explanation given below the table. Wherever a space is left blank, the source for that series and country complies with the base rule given in the first row.

Country	y	p_y	w h l^d	L^d	h	w	u	u^s u^l	L^s	N	q	T	Z	TFP
Base rule	1	2	3	4	5	6	7	8	9	10	11	3	3	55
Exceptions														
Australia				14	31									
Austria				15	32		37							
Belgium				16			38			52				
Canada				17										
Czech Rep.														
Denmark					33		39			52				
Finland								47						
France							40			53				
Germany				18			41			53				
Greece				19	34		42			52				
Ireland				20				48						
Italy				21			43			53				
Japan														
Korea			12										13	
The Netherlands				22	35		44	49						
New Zealand				23										
Norway				24				50						
Portugal				25	36		45			52				
Spain				26			46							
Sweden				27				51		52				
Switzerland				28										
United Kingdom				29						54				
United States				30										

1. GDP is obtained from the OECD National Accounts, according to income approach in domestic curreny at current prices. In some countries, the National Accounts report a statistical discrepancy. This statistical discrepancy, often of small order, is manually checked and corrected where necessary.

2. The price level series is constructed by combining the OECD National Account GDP series at current prices and at constant prices using 2005 as base year. By dividing the current prices series by the constant prices series we obtain a price index of GDP, with 2005 as a base. Wherever variables were made real with the resulting price index, these real variables were afterwards converted to US dollar values, using the Purchasing

Power Parity (PPP) value of the currency in US dollar in 2005, as published in the OECD National Accounts.

3. Total compensation of employees, taxes and subsidies and mixed income and operating surplus are obtained from the OECD National Accounts, according to income approach at current prices.

4. Labour demand for employees is constructed by taking the total employment and subtracting the self-employment. Both series were retrieved from the OECD national accounts database and follow the national concept of employment.

5. The average amount of hours worked per person was obtained from the OECD Economic Outlook (No. 96 OLIS version from November 2014). The data was cross-checked with the EUKLEMS database, Structural Analysis (STAN) database and Total Economy Database (TED). For the countries for which the data was deemed untrustworthy, the base series was replaced by the EUKLEMS version.

6. The average hourly wage was constructed by dividing the total labour income ($w\ h\ l^d$, compensation of employees) by the product of (employee) labour demand (l^d) and the average number of hours worked per employee (h).

7. The unemployment rate is the share of unemployed persons of the labour force. The number of unemployed persons was retrieved from the OECD Labour Force Survey. The data was cross-checked using the AMECO, Eurostat and OECD Economic Outlook Databases.

8. The OECD Labour Force Survey reports both the numbers of long-term unemployed (1 year or more) and the numbers of short-term unemployed (less than a year The total unemployment series we obtained from the LFS was in many cases not equal to the sum of the long and short-term unemployment series. As this equality is required in the decomposition, we constructed new long and short-term unemployment series. This was done by calculating the ratio between long and short-term unemployment. The calculated ratios were then multiplied with the original total unemployment series from the LFS. This results in a newly constructed number of short- and long-term unemployed that together match the original total unemployment. These numbers of unemployed are later used to calculate unemployment rates.

9. Total employee labour supply is approximated by adding the employee labour demand in persons (see 4) and the number of unemployed persons (see 7).

10. The working age population is defined as the number of people between the ages of 15 and 65. The main data source is the OECD LFS.

11. The participation rate is calculated as the share of the labour supply of employees in the working age population group.

12. Compensation of employees for Korea in 2013 was obtained by adding the wages of employees with the social contributions. Both data series were found in the National Accounts.

13. Total mixed income for Korea in 2013 was constructed by subtracting the total taxes and subsidies and the total compensation of employees from the GDP value.

14. Total employment for Australia from 1970 to 1977 was constructed using the growth rates of the total employment as reported by the OECD Labour Force Survey. The self-employment data for the years 1970 to 1984 was constructed using the growth rates of self-employment as reported by the AMECO database.

15. Total employment for Austria from 1970 to 1975 was constructed using the growth rates of the total employment as reported by the Total Economy Database. The self-employment data for the years 1970 to 1975 was constructed using the growth rates of self-employment as reported by the AMECO database.

16. Total employment for Belgium from 1970 to 1980 was constructed using the growth rates of the total employment as reported by the Total Economy Database. The self-employment data for the years 1970 to 1979 was constructed using the growth rates of self-employment as reported by the AMECO database.

17. Total employment for Canada for the year 2013 was constructed using the growth rates of the total employment as reported by the OECD Labour Force Survey. The self-employment data for the years 2012 and 2013 was constructed using the growth rates of self-employment as reported by the AMECO database.

18. Total employment for Germany from 1970 to 1990 was constructed using the growth rates of the total employment as reported by the Total Economy Database. The self-employment data for the years 1972 to 1990 was constructed using the growth rates of self-employment as reported by the Entrepreneurs International (Compendia) database.

19. Total employment for Greece from 1970 to 1994 was constructed using the growth rates of the total employment as reported by the Total Economy Database. The self-employment data for the years 1970 to 1994 was obtained from the AMECO database.

20. Total employment for Ireland from 1970 to 1994 is obtained from the Total Economy Database. The self-employment data for the years 1970 to 1994 was obtained from the AMECO database.

21. Total employment for Italy from 1970 to 1980 was constructed using the growth rates of the total employment as reported by the Total Economy Database. The self-employment data for the years 1970 to 1981 was constructed using the growth rates of self-employment as reported by the AMECO database.

22. Total employment for the Netherlands from 1970 to 1994 was constructed using the growth rates of the total employment as reported by the Total Economy Database. The self-employment data for the years 1970 to 1994 was obtained from the AMECO database.

23. Total employment for New Zealand from 1970 to 1985 was constructed using the growth rates of the total employment as reported by the Total Economy Database.

24. The self-employment data for Norway for the years 2012 and 2013 was obtained from the AMECO database.

25. Total employment for Portugal from 1970 to 1994 was constructed using the growth rates of the total employment as reported by the Total Economy Database. The self-employment data for the years 1970 to 1994 was constructed using the growth rates of self-employment as reported by the AMECO database.

26. Total employment for Spain from 1970 to 1994 was constructed using the growth rates of the total employment as reported by the OECD Labour Force Survey. The self-employment data for the years 1970 to 1994 was obtained from the AMECO database.

27. Total employment for Sweden from 1970 to 1992 was constructed using the growth rates of the total employment as reported by the Total Economy Database. The self-employment data for the years 1970 to 1992 was obtained from the AMECO database.

28. Total employment for Switzerland from 1970 to 1994 was constructed using the growth rates of the total employment as reported by the Total Economy Database. The self-employment data for the years 1991 to 1994 was constructed using the growth rates of self-employment as reported by the AMECO database.

29. Total employment for the UK for 1970 was constructed using the growth rate of the total employment as reported by the OECD Labour Force Survey. The self-employment data for the years 1970 to 1983 was constructed using the growth rates of self-employment as reported by the AMECO database.

30. The self-employment data for the US for the year 2013 was obtained from the AMECO database.

31. For Australia, the average hours worked data from 1970 to 2007 was obtained from the EUKLEMS database. The data for the years 2008 to 2013 was constructed using the growth rates of the OECD Economic Outlook (No. 96 OLIS version from November 2014).

32. For Austria, the average hours worked data was obtained from the EUKLEMS database.

33. For Denmark, various sources showed a different development of the average hours worked data. We chose to use the the data as provided by Statistics Denmark.

34. For Greece, the average hours worked data from 1970 to 2007 was obtained from the EUKLEMS database. The data for the years 2008 to 2013 was constructed using the growth rates of the OECD Economic Outlook (No. 96 OLIS version from November 2014).

35. The source for the average hours worked data for the Netherlands for the years 1995 to 2014 was the National Account as reported by Statistics Netherlands (CBS). The values for 1971 to 1993 were estimated using the growth rates of the EUKLEMS data. The values for the years 1994 and 1970 were constructed using the growth rates of the OECD Economic Outlook (No. 96 OLIS version from November 2014).

36. For Portugal, the average hours worked data from 1970 to 1994 was constructed using the growth rates of the EUKLEMS database.

37. Data for unemployed persons for Austria were obtained from the OECD Economic Outlook 96.

38. For Belgium, data for unemployed persons for the years 1971 to 1999 were constructed using the growth rates of the unemployment data in the AMECO database.

39. Data for unemployed persons for Denmark were obtained from the OECD Economic Outlook 96.

40. For France, the data for unemployed persons for the years 1982 to 2013 were constructed using the growth rates of the unemployment data in the AMECO database.

41. For Germany, data for unemployed persons for the year 2014 was constructed using the growth rate of the unemployment data in the AMECO database.

42. For Greece, data for unemployed persons for the year 2013 was constructed using the growth rate of the unemployment data in the AMECO database.

43. For Italy, data for unemployed persons for the years 1970 to 1997 were constructed using the growth rates of the unemployment data in the OECD Ecnomic Outlook.

44. For the Netherlands, data for unemployed persons for the years 2003 to 2014 were obtained from the Statistics Netherlands Labour Force Survey (CBS Enquête beroepsbevolking) after the revision in the start of 2015. For the years 1970 to 2002, the data were constructed using the growth rates of the unemployment data of the pre-revision version of the Statistics Netherlands Labour Force Survey.

45. For Portugal, data for unemployed persons for the years 1978 to 1998 were constructed using the growth rates of the unemployment data in the OECD Ecnomic Outlook.

46. For Spain, data for unemployed persons for the years 1983 to 2001 were constructed using the growth rates of the unemployment data in the AMECO database. Using the constructed value of 1983, the values for the years 1970 to 1982 were calculated using the growth rates of the OECD Labour Force Survey.

47. For Finland, the OECD Labour Force Survey does not report total and long-term unemployment numbers for the years 1981, 1988, 1990, 1992 and 1994. These values were generated using linear interpolation.

48. For Ireland, the OECD Labour Force Survey total and long-term unemployment for the years 1998 and 2000 were not reported. These values were generated using linear interpolation.

49. For the Netherlands, the OECD Labour Force Survey does not report total and long-term unemployment for the years 1984, 1986, 2000 and 2001. These values were generated using linear interpolation. The total, short- and long-term unemployment for the years 2003 to 2014 was obtained directly from the Statistics Netherlands Labour Force Survey (CBS Enquête beroepsbevolking) after the revision in the start of 2015.

50. For Norway, the OECD Labour Force Survey does not report long-term unemployment for the year 1986. This values was generated using linear interpolation.

51. For Sweden, the OECD Labour Force Survey does not report total and long-term unemployment for the years 2005 and 2006. These values were generated using linear interpolation.

52. Data for the working age population in Belgium, Denmark, Greece, Portugal and Sweden for the year 2013 was obtained from the AMECO database.

53. For France, Germany and Italy, the working age population was obtained from the AMECO database.

54. For the UK, the working age population was obtained from the Eurostat database.

55. To generate the Total Factor Productivity index, two steps were taken. The first was to calculate the real productivity per hour worked $\left({}^{y}/_{h\ l^{d}}\right)$. Then, a Hodrick-Prescott filter over the entire sample with $\lambda = 100$ was applied to this measure.

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