2. European Wage Dynamics and Labor Market Integration

Employment is notably higher across Europe, and unemployment substantially down—there are even labor shortages in some countries. Yet wage growth is stubbornly low in long-standing European Union (EU) countries (EU15), even if it has picked up notably in newer EU members.[1] *The source of these dynamics is explored in this chapter, which looks at the role of labor market slack, inflation, and productivity, as well as crisis legacies. Europe's cross-country varied but highly integrated economy—including for labor—gives a glimpse of possible spillovers across countries.*

An econometric analysis shows that wage developments in long-standing EU members and the newer EU members are driven by different factors. In the EU15, wages typically respond very slowly to changes in unemployment and are closely related to inflation and inflation expectations. Viewed against this evidence, current wage developments are not unusual. Rather, inflation and inflation expectations are unusually low. In the newer EU members, by contrast, the econometric evidence suggests that wage growth responds very quickly to changes in unemployment. This, together with lower importance of inflation and inflation expectations, explains why wage growth in these states is now running much higher. Other factors, such as cross-country labor market spillovers, also play a role in wage growth. For the EU15, this role is smaller than that of labor market slack and inflation. For the newer EU members, it is smaller than the role of slack but larger than that of inflation.

The chapter also documents spillovers between labor markets. Declines in both domestic and foreign slack contributed to the recent higher wage growth in newer EU members. The spillovers from euro area unemployment and wages to wages in newer EU members are likely the result of actual and potential emigration's effects on domestic labor supply and the integration of these countries in pan-European value chains. Also, wages in several old EU members appear affected by wages in Germany.

Conditions for wage growth to pick up in the EU15, this analysis implies, are improving thanks to declining slack in countries and in the region. Some recent wage negotiations have yielded significant increases. Nonetheless, sustained higher wage increases depend to a large extent on inflation and inflation expectations. Continued European Central Bank commitment to raising euro area inflation and inflation expectations is essential for durably higher wage growth.

In the newer EU members, higher wage increases are boosting people's incomes, but competitiveness could come under pressure, requiring reforms to ramp up skills and support labor force participation. Chapter 1 cautions newer EU member central banks with their own currencies to be alert to the inflation risks of higher wage growth and to bear in mind that raising policy rates could trigger capital inflows and exchange rate appreciation. Countries whose fiscal deficits are still relatively large given the state of the economic cycle should strive for more consolidation to help alleviate some exchange rate pressure.

There have been dramatic improvements in labor market conditions in the European Union in recent years. Employment has increased by 12.7 million people since early 2013, exceeding precrisis peaks by 2.2 percent at the end of 2017. In parallel, unemployment fell from 11 percent in early 2013 to 7.3 percent in late

The chapter was prepared by a staff team comprising Vizhdan Boranova, Jiaqian Chen, Dilyana Dimova, Christian Ebeke, Raju Huidrom, Nemanja Jovanovic, Li Lin, Aiko Mineshima, Jean-Marc Natal, Faezeh Raei, Tiberiu Scutaru, Jesse Siminitz, Yan Sun, Peichu Xie, Sophia Zhang. The team was led by Craig Beaumont and Emil Stavrev. Laura Papi provided useful advice and comments. Lian Veluz provided administrative support.

[1]Newer EU members (NMS) are Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic, and Slovenia. EU15 members are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom. Cyprus, Ireland, and Malta are not included in this analysis because problems with GDP data distort labor productivity numbers.

2017 (Figure 2.1). Unemployment dropped faster in the newer EU member states, falling by a total of 5 percentage points on average, yet the 3 percentage point decline in the EU15 average rate is also substantial.

However, nominal wage rises remain stubbornly low in the EU15 even as they are picking up in the newer members. Average EU15 wage increases have remained below 2 percent since 2012 and, at 1.8 percent in the fourth quarter of 2017, were only half of precrisis (2001–08) average growth rates (Figure 2.2). In sharp contrast, average wage increases in newer member states accelerated to 6¾ percent in the fourth quarter of 2017, from 3½ percent in 2014, led by the Baltics and southern European countries; central European country wages have picked up more recently. This divergence between the EU15 and newer EU members is also evident in real product wages (deflated by the GDP deflator): growth averaged ½ percent in the EU15 in 2017, little changed from 2014, but surged from 3 to 5¼ percent year over year during the same period in the newer members.[2]

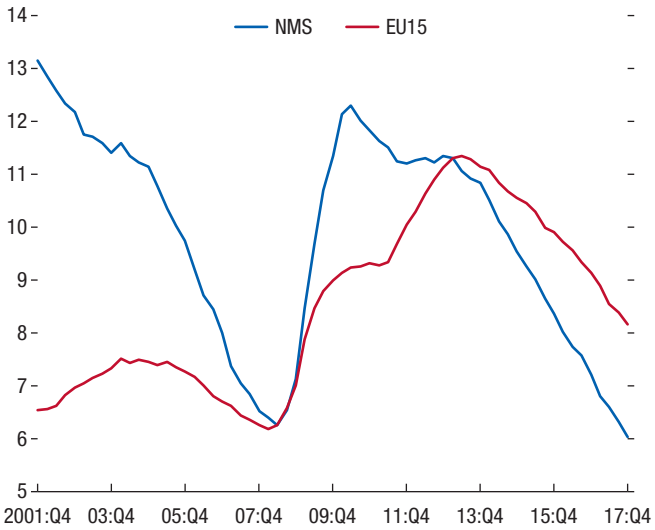
This chapter explores the drivers of these recent divergent wage dynamics, including the potential role of EU integration. As recently analyzed in Chapter 2 of the October 2017 *World Economic Outlook* (WEO), which focused on regions with low wage growth, the bulk of the wage slowdown in advanced economies can be accounted for by reductions in inflation expectations and trend productivity growth, together with expanded measures of labor market slack.[3] The WEO noted that domestic conditions driving wages could have a significant common component—given economic linkages between countries—and that there could also be direct spillovers on wage setting in other countries (see Box 2.2).

The main contribution of this chapter is to discuss wage dynamics in the EU15 and newer

[2]The GDP deflator is used to calculate real wages in this analysis, because it drives the nominal value added available for distribution to labor and capital and allows for the comparison of real wages with labor productivity.

[3]Chapter 2 of the October 2017 WEO.

Figure 2.1. Average Unemployment Rates
(Percent)

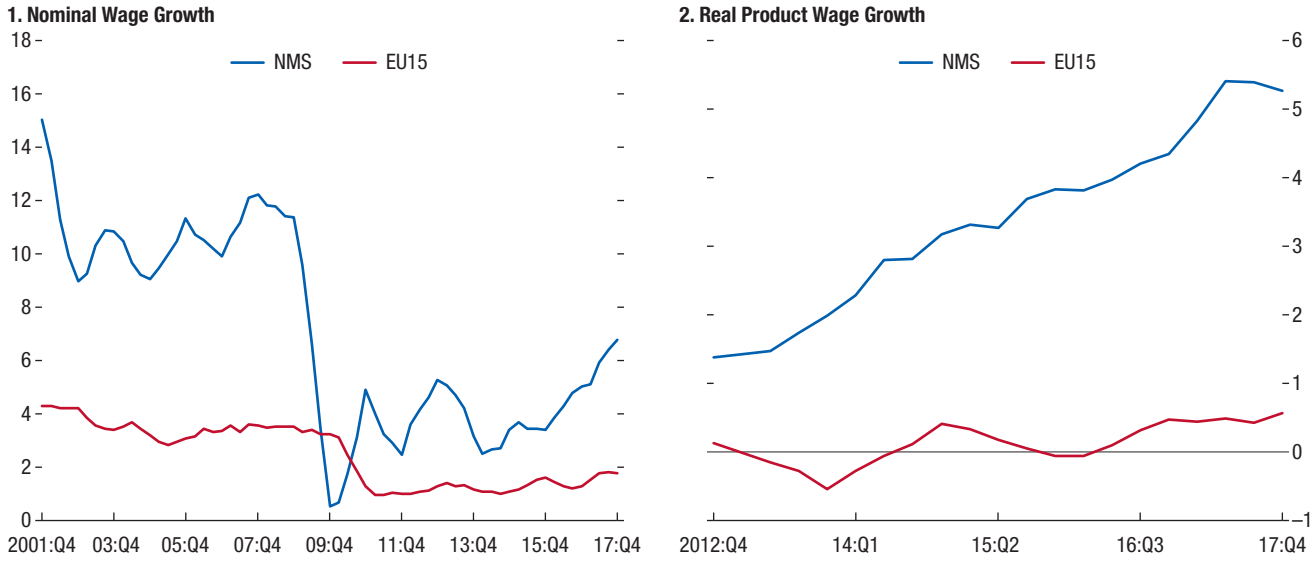


Source: Eurostat, Labor Force Survey.
Note: Footnote 1 defines EU15 and NMS.

EU members, explore the differences between the two groups, and look at spillovers. The chapter further analyzes the potential need to supplement unemployment with other indicators when assessing labor market slack, while controlling for inflation expectations in a wage Phillips curve. In view of the potential for wages to temporarily be away from equilibrium, especially given Europe's double-dip recession and nominal wage rigidities, the chapter also uses an error correction model (ECM) for wage analysis.

The chapter first describes recent wage developments in the EU15 and newer member states. Trends in EU labor market arrangements are described in the next section of the chapter, which also assesses whether other slack indicators might complement unemployment. The chapter then summarizes the integration of goods and labor markets in the European Union, with a preliminary assessment of the implications for the sensitivity of wages to global shocks. The analysis brings these factors together in a more formal analysis of wage dynamics, starting from the widely used Phillips curve model, evaluating an ECM alternative, and then exploring spillovers via slack, wages, and migration. Wages in the newer

Figure 2.2. Wage Growth
(Year-over-year percent change, four-quarter averages)



Sources: Eurostat, Labor Cost Index, Wages and Salaries; and IMF staff calculations.
Note: Footnote 1 defines EU15 and NMS.

EU members are found to be more flexible in relation to domestic labor market slack and more responsive to external labor market conditions. Next, the chapter examines any changes in the formation of wages and inflation expectations and the pass-through of wages to inflation. The final section of the chapter puts forth conclusions and discusses implications for policies.

Recent European Wage Developments

Slowing wage growth across EU15 countries has been accompanied by lower inflation and productivity growth (Figure 2.3). Average nominal wage growth has remained around 1½ percent since 2011, down from just over 3 percent during 2003–09.[4] This decline coincides with lower inflation in output prices (down 1 percentage point to about 1¼ percent in recent years) and slower trend productivity growth (down ½ percentage point to 0.6 percent). Average real wage growth has also slowed ½ percentage point to about 0.4 percent since 2011.

Part of the EU15 wage moderation reflects an unwinding of a wage overhang that emerged after the global financial crisis. Panel 6 in Figure 2.3 shows cumulative growth in real wages relative to the trend level of labor productivity.[5] After some decline in the first half of the 2000s, real wages were broadly stable relative to trend labor productivity during 2005–08.[6] The global financial crisis led to a 2 percentage point jump in this ratio during 2009 as nominal wage rises continued at almost 3½ percent despite the sharp fall in inflation and slowing trend productivity. Low real wage increases in the years that followed gradually unwound this overhang. The real wage level returned to its 2005–08 average relative to productivity by 2017, at a time when unemployment was just ½ percentage

[4]Nominal wages are labor compensation (including employers' social security contributions) per employee hour worked.

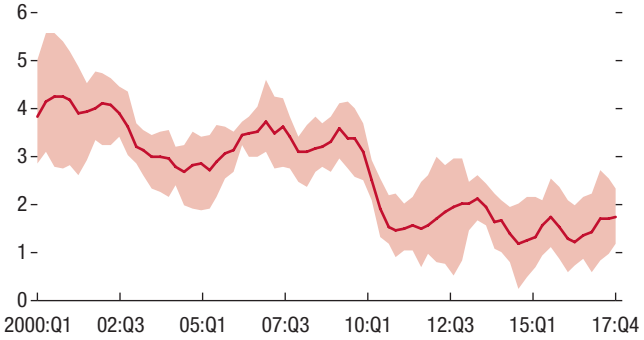
[5]Labor productivity is GDP per employee hour worked. The trend in labor productivity is a more useful benchmark because actual productivity is subject to significant cyclical and temporary volatility, whereas wages are relatively smooth.

[6]This earlier decline was largest and most prolonged in Germany, but there were also adjustments in Austria, Belgium, the Netherlands, and Sweden, along with Portugal and Spain.

Figure 2.3. EU15: Wages and Traditional Drivers

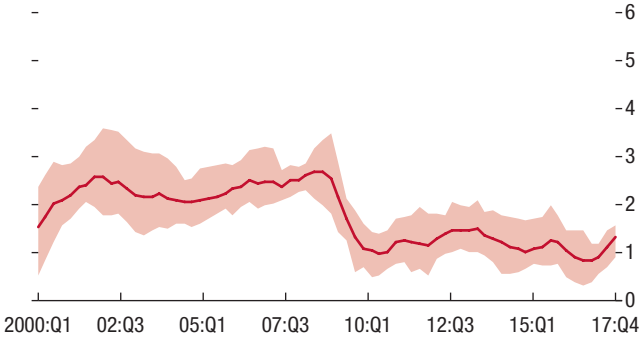
Wage rises slowed sharply in 2010, to average 1½ percent since 2011, down from just over 3 percent in 2003–09 ...

1. Nominal Wage Growth
(Year-over-year percent change, four-quarter average)



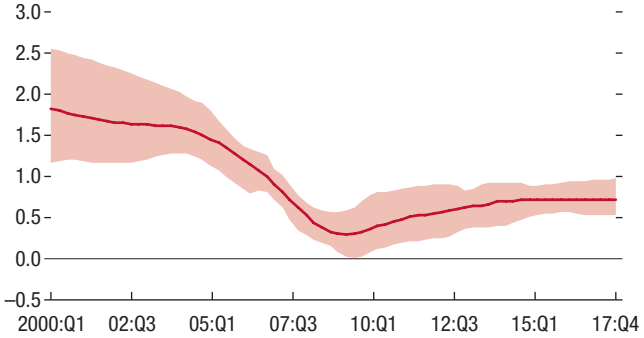
... after a sharp deceleration in price inflation during 2009, to about 1–1½ percent from 2–2½ percent.

2. GDP Deflator Inflation
(Year-over-year percent change, four-quarter average)



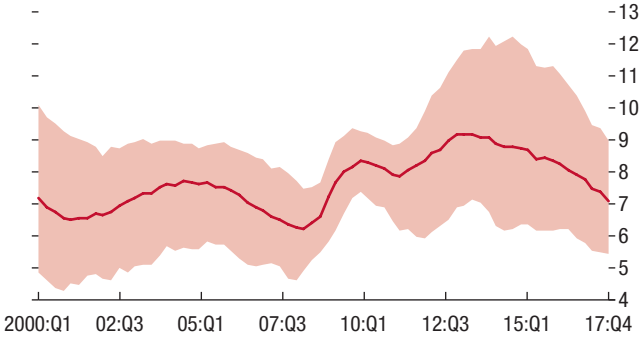
Growth in the estimated trend in labor productivity also slowed substantially ...

3. Trend Labor Productivity
(Year-over-year percent change, four-quarter average)



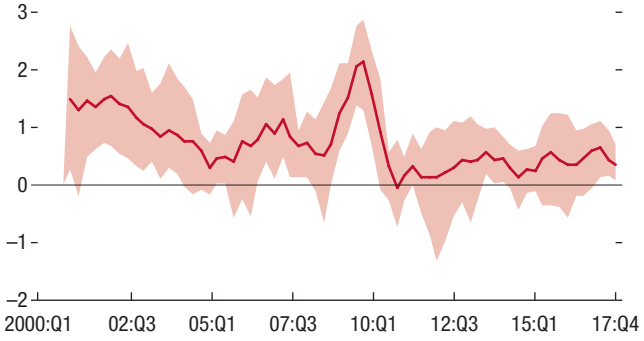
... while unemployment rose in 2008–09 and in 2011–13, before declining from 2014 back toward precrisis levels.

4. Unemployment Rate
(Percent, seasonally adjusted)



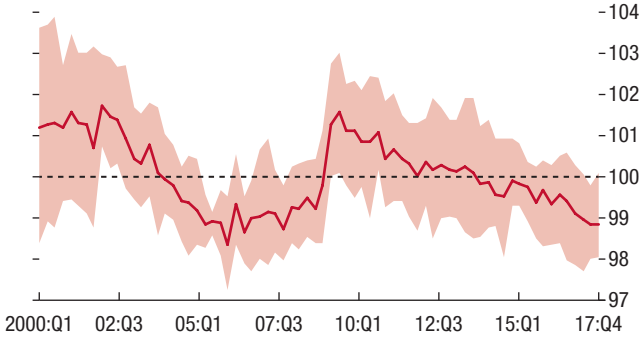
Real wages rose in 2009–10 as nominal wages slowed later than inflation. Subsequently, real wage growth was very low for some years, firming to about ½ percent by 2015–17.

5. Real Product Wage Growth
(Year-over-year percent change, four-quarter average)



The cumulative impact was a sharp rise in real wages relative to trend productivity during 2009, which gradually unwound, to reach 2006 levels in 2017.

6. Real Wage/Trend Labor Productivity
(Index; average for 2000–17 = 100)



Sources: Eurostat; Haver Analytics; IMF, *World Economic Outlook*; and IMF staff calculations.
Note: EU15 = long-standing EU members. The average is a trimmed mean to exclude some outliers while avoiding the volatility of the median. The bands are for the 25th and 75th percentiles.

point higher than in 2005–08. Country cases of slow wage growth also display a correction of wage overhangs, although a wage freeze played a significant role in Belgium in recent years. For euro area countries, the direction of wages since the global financial crisis has been broadly consistent with rebalancing of their external positions, although further adjustments will be appropriate in some cases, as discussed in Box 2.1.

In contrast, wage increases in newer EU members have picked up strongly in recent years as unemployment has fallen to low levels (Figure 2.4). A more rapid decline in nominal wage increases since the global financial crisis ensured that there was no lasting wage overhang in the newer members. Nominal wage growth of about 3½ percent in 2011–15 kept real wages stable relative to productivity, at about 1 percent below historical norms—reflecting the period of high unemployment in the newer members following the global financial crisis. But nominal wage growth picked up rapidly in 2016–17, hitting close to 6 percent year over year on average in 2017. This wage acceleration followed a steeper decline in unemployment, averaging 5 percentage points since the end of 2012, bringing unemployment down to an average of 6 percent by the end of 2017, in line with precrisis lows.

As a result, real wages in newer EU members have risen relative to trend productivity to levels comparable to precrisis peaks, when unemployment was similarly low. Inflation has risen in recent years, but only modestly, so that real wage gains also surged to 4.1 percent year over year in 2017, well above estimates of trend productivity growth, which averaged about 2 percent. The cumulative effect is that the average ratio of real wages to trend labor productivity was roughly 2½ percent higher than its historical average in 2017, a level exceeded only in mid-2008 for just two quarters.

Labor markets are notably tighter in newer EU member states, consistent with wage divergence from the EU15. Both unemployment gaps and surveys of labor shortages indicate tighter labor market conditions in the newer members (Figure 2.5).[7] Slack in those countries is estimated to have largely disappeared by about mid-2015, which is consistent with the timing of the wage acceleration in recent years. Labor shortages exceed precrisis peaks in the newer members—and are especially strong in industry, which may help explain the recent very strong pace of real wage growth in these countries. Yet other domestic factors and perhaps spillovers from the EU15 labor market recovery could also be at work.

Typical lags in adjustment between labor slack and wages could also help explain EU15 wage moderation in recent years. In EU15 countries, unemployment only recently fell in line with the estimated nonaccelerating inflation rate of unemployment (NAIRU). Analysis of the correlations between real wages (as deviations from trend productivity) and unemployment gaps finds that these correlations are initially higher in newer EU members and that they peak after six quarters; in EU15 countries these correlations start lower and peak after eight quarters (Figure 2.6).

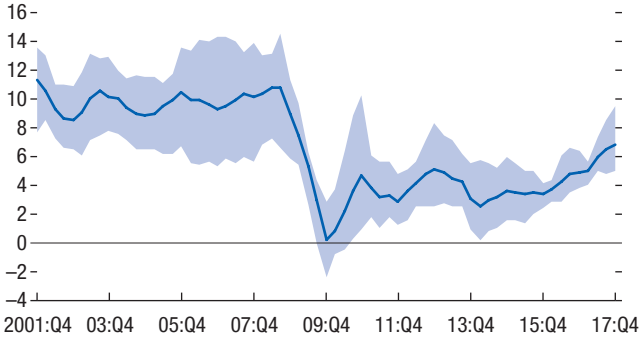
Low EU15 nominal wage growth overall is not clearly underpinned by unusual real wage behavior, but the drivers of rapid wage increases in the newer EU members clearly merit further analysis. After allowing for some correction of earlier wage overhangs and for typical lags in the wage response to declining unemployment, EU15 real wages do not as yet appear out of line with developments in productivity and unemployment. This suggests a need to explore the role of inflation and inflation expectations in driving low nominal wage growth, but it also leaves scope for cross-border spillovers to contribute to wage moderation and low inflation. In newer members, low domestic slack is consistent with the strength of wages, but the role of other factors, such as spillovers from EU15 labor markets, still merits analysis given the recent noticeable pickup in EU15 employment growth. Together with appreciably higher wages, this makes the EU15 an attractive destination for

[7]Unemployment gaps are subject to uncertainty around the NAIRU, which is based on Organisation for Economic Co-operation and Development (OECD) estimates for OECD members and Hodrick-Prescott (HP) filters for other countries. Analytical results are similar when applying an HP filter in all cases.

Figure 2.4. Newer Member States: Wages and Traditional Drivers

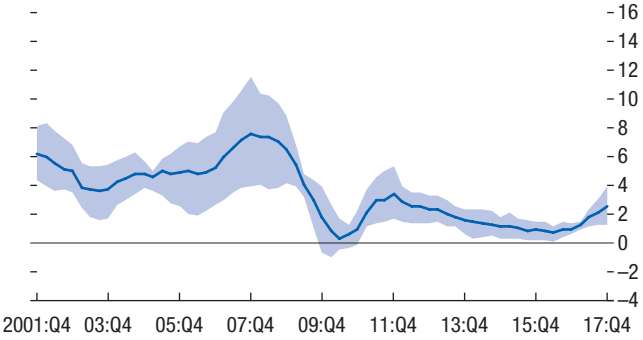
Wage rises slowed sharply in 2009, to about 3½ percent in 2011–15, but had accelerated to 6½ percent by 2017.

1. Nominal Wage Growth
(Year-over-year percent change, four-quarter average)



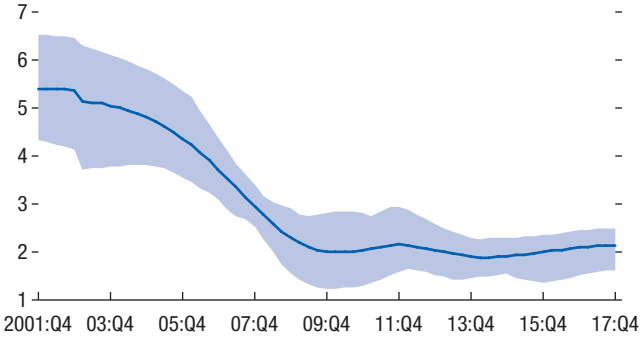
Inflation has moved to a lower level since the global financial crisis, to as low as 1 percent in 2015–16, but has firmed to 2 percent recently.

2. GDP Deflator Inflation
(Year-over-year percent change, four-quarter average)



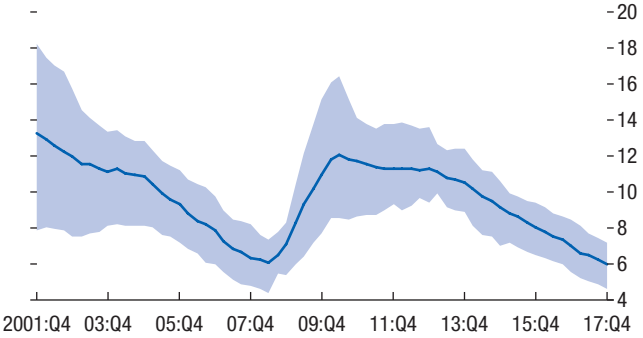
Growth in the estimated trend in labor productivity also slowed substantially to about 2 percent in recent years ...

3. Trend Labor Productivity
(Year-over-year percent change)



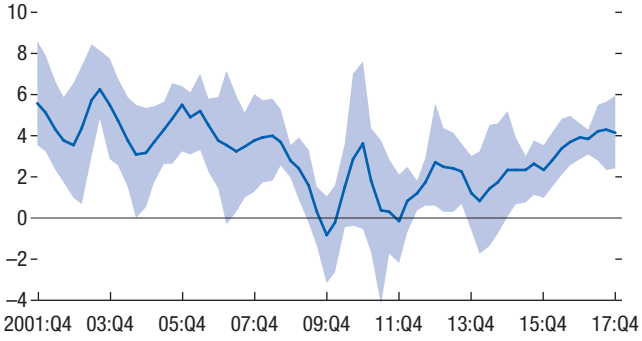
... while unemployment rose in 2008–10, to plateau until 2013, then fell rapidly to reach precrisis lows by 2017.

4. Unemployment Rate
(Percent, seasonally adjusted)



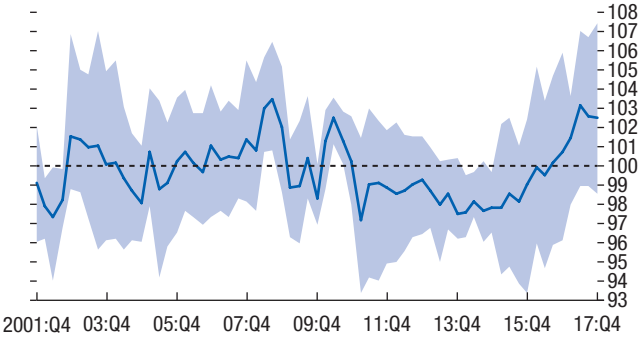
Real wage growth slowed after the crisis, but picked up notably in 2016–17, to about 4½ percent, well over productivity gains.

5. Real Product Wage Growth
(Year-over-year percent change, four-quarter average)



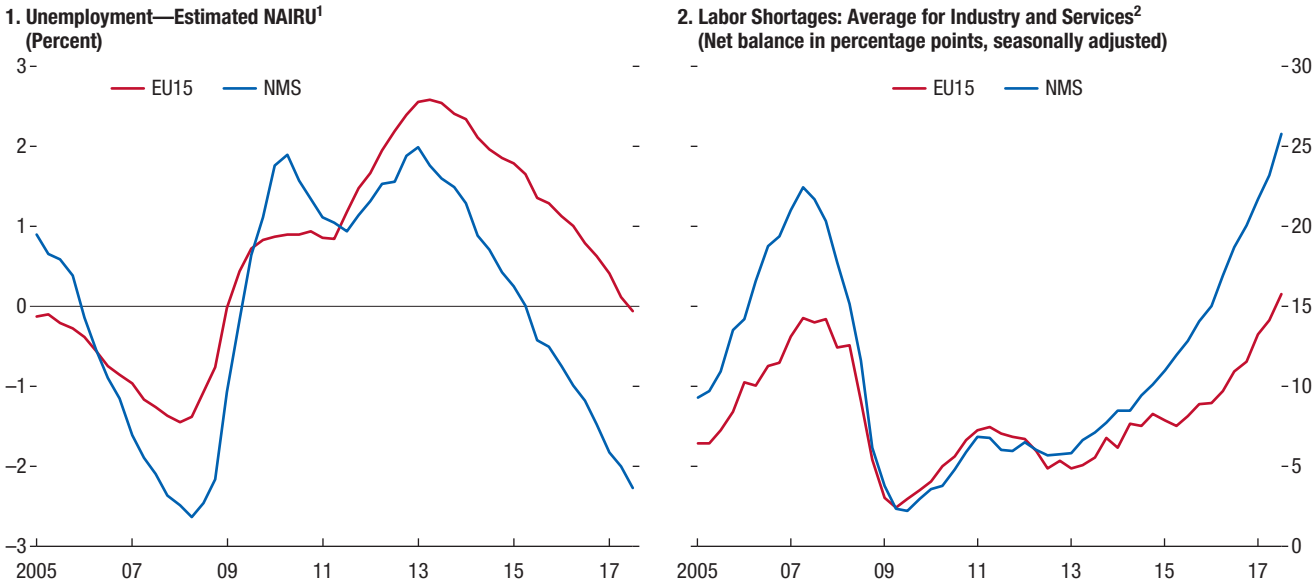
Real wages were stable relative to productivity in 2012–15, but this ratio had risen more than 5 percentage points by 2017, to reach precrisis peaks that lasted only briefly.

6. Real Wage/Trend Labor Productivity
(Index; average for 2000–17 = 100)



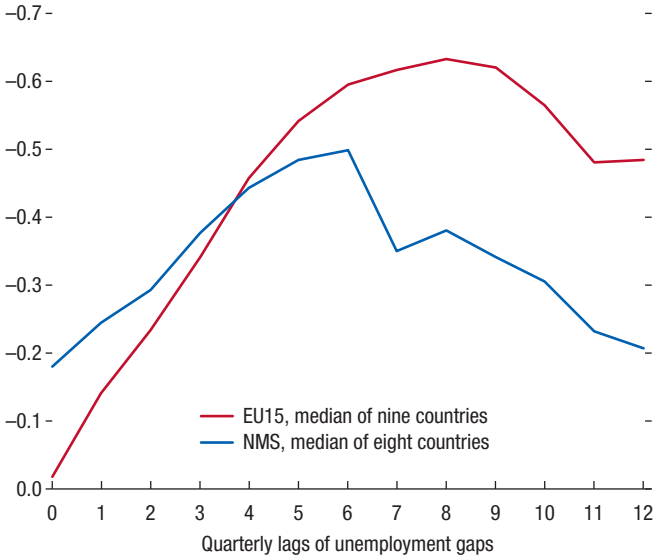
Sources: Eurostat; Haver Analytics; IMF, *World Economic Outlook*; and IMF staff calculations.
Note: The average is a trimmed mean to exclude some outliers while avoiding the volatility of the median. The bands are for the 25th and 75th percentiles.

Figure 2.5. Unemployment and Labor Shortages
(Percent)



Sources: European Commission, Business and Consumer Quarterly Survey; OECD; and IMF staff calculations.
Note: EU15 = long-standing EU members; NAIRU = nonaccelerating inflation rate of unemployment; NMS = newer EU members; OECD = Organisation for Economic Co-operation and Development.
[1]For all OECD countries, OECD estimates of the NAIRU are used. In other cases, a Hodrick-Prescott filter on unemployment is used.
[2]Labor shortage refers to the average of responses for industry and services to the European Commission survey question on labor as a limiting factor to production or business.

Figure 2.6. Correlations of Wage Deviations and Unemployment Gaps[1]



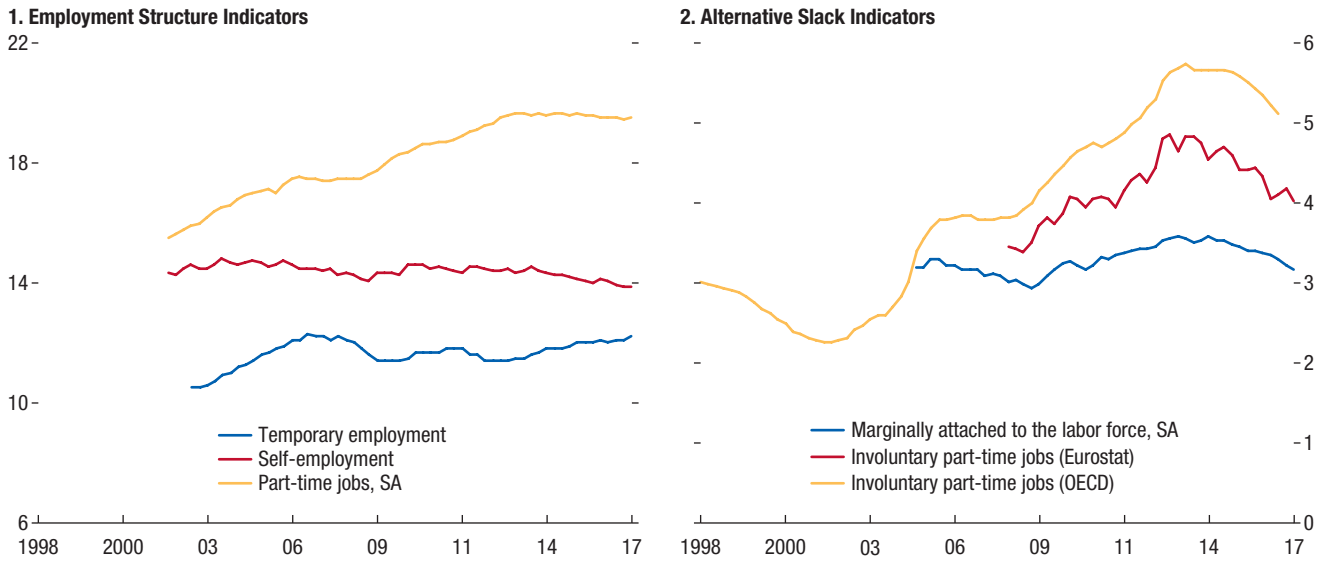
Source: IMF staff calculations.
Note: EU15 = long-standing EU members; NMS = newer EU members.
[1]Correlation between the ratio of real product wages and trend labor productivity with the unemployment gap, with the latter lagged from 0 to 12 quarters, using a 60-quarter window starting in 2002:Q2 for the wage variable.

workers from the newer member states.

Evolving Employment Arrangements and Measuring Slack

Potential explanations of wage moderation include declines in employment security after the global financial crisis and the potential for continued labor market slack despite falls in unemployment. In some EU countries, there has been a shift from regular contracts to self-employment, temporary contracts, and part-time jobs. If these employment arrangements are less secure, they could reduce workers' bargaining power and hence put downward pressures on wages. If such workers are also less fully employed, the underlying slack in the labor market may be larger than previously thought for a given level of unemployment. Chapter 2 of the October 2017 WEO finds that involuntary part-time employment increases slack,

Figure 2.7. Labor Market Structural and Slack Indicators: EU28
(Percent of total employment)



Source: Eurostat.
Note: EU28 = EU members; OECD = Organisation for Economic Co-operation and Development; SA = seasonally adjusted.

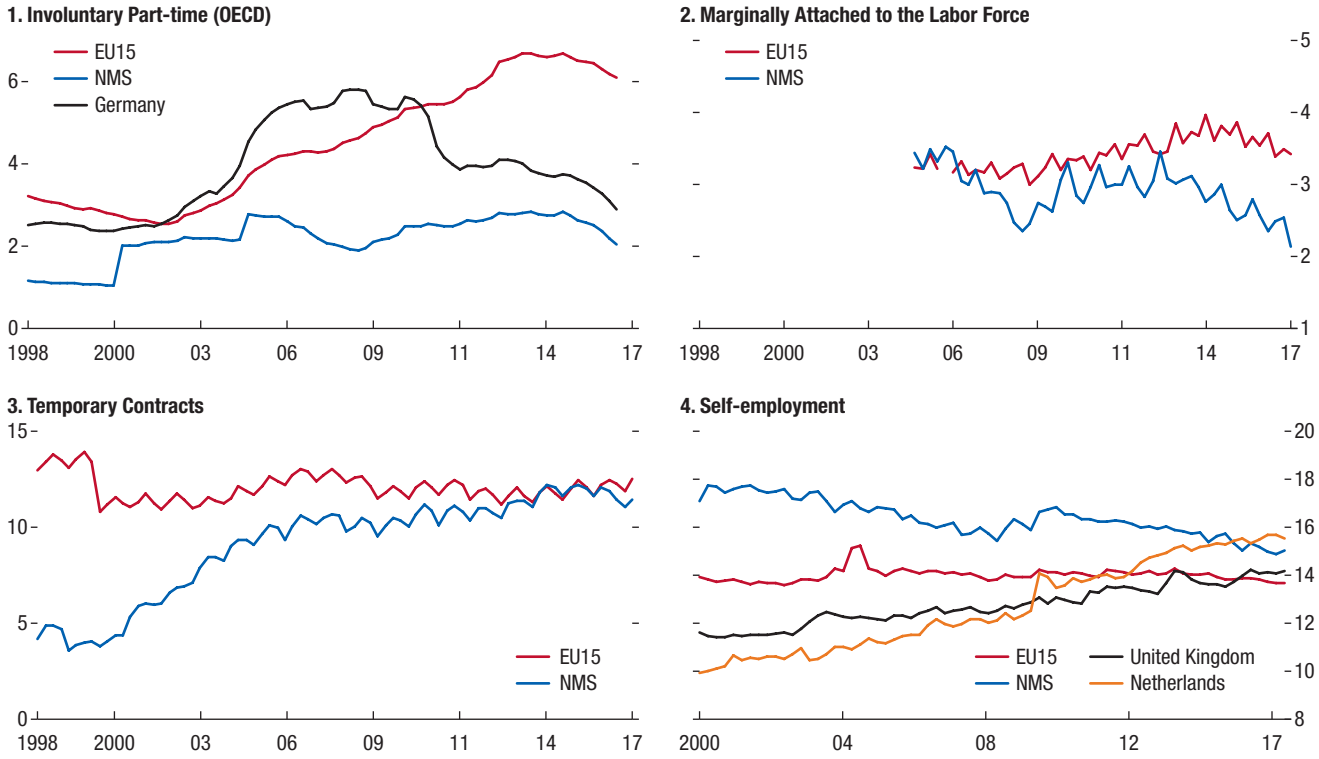
a result confirmed for Sweden (IMF 2017a) and the United Kingdom (IMF 2018), with UK wages also sensitive to cyclical self-employment.

EU employment arrangements remained broadly stable over the past several years, but underemployment indicators, especially involuntary part-time employment changed notably (Figure 2.7). Partly reflecting rising female participation, there has been a trend rise in part-time employment, whereas other indicators of the security of employment arrangements have been mostly stable, including the share of temporary employment and self-employment. The OECD measure of involuntary part-time jobs as a share of total employment rose starting in the early 2000s and peaked in 2014, which could potentially have contributed to wage moderation in recent years. Following the global financial crisis, some increases were also recorded in the share of people marginally attached to the labor force (that is, those who are not unemployed under typical labor force surveys, but who intend to work), but there has been a decline in recent years.

Aggregate EU developments mask some heterogeneities across regions and countries. In contrast with EU-wide developments, Germany managed to bring down involuntary part-time employment following the global financial crisis (Figure 2.8). Newer EU members recorded a declining share of people marginally attached to the labor force, consistent with declining unemployment in those countries, but in the EU15 there has been much less of a decline in the marginally attached. Underneath the relatively stable developments for temporary contracts and self-employment at the EU level, the share of temporary contracts has been rising in newer EU members, particularly in the years before the global financial crisis. Self-employment in the Netherlands and the United Kingdom has been higher as well.

At the EU level, the share of involuntary part-time jobs and the share of those marginally attached to the labor force appear to be useful additional measures of economic slack. Both shares have increased since the global financial crisis, and, across countries, the changes relative to precrisis levels are positively correlated with the

Figure 2.8. Labor Market Indicators
(Percent of total employment)



Source: Eurostat.
Note: EU15 = long-standing EU members; NMS = newer EU members; OECD = Organisation for Economic Co-operation and Development.

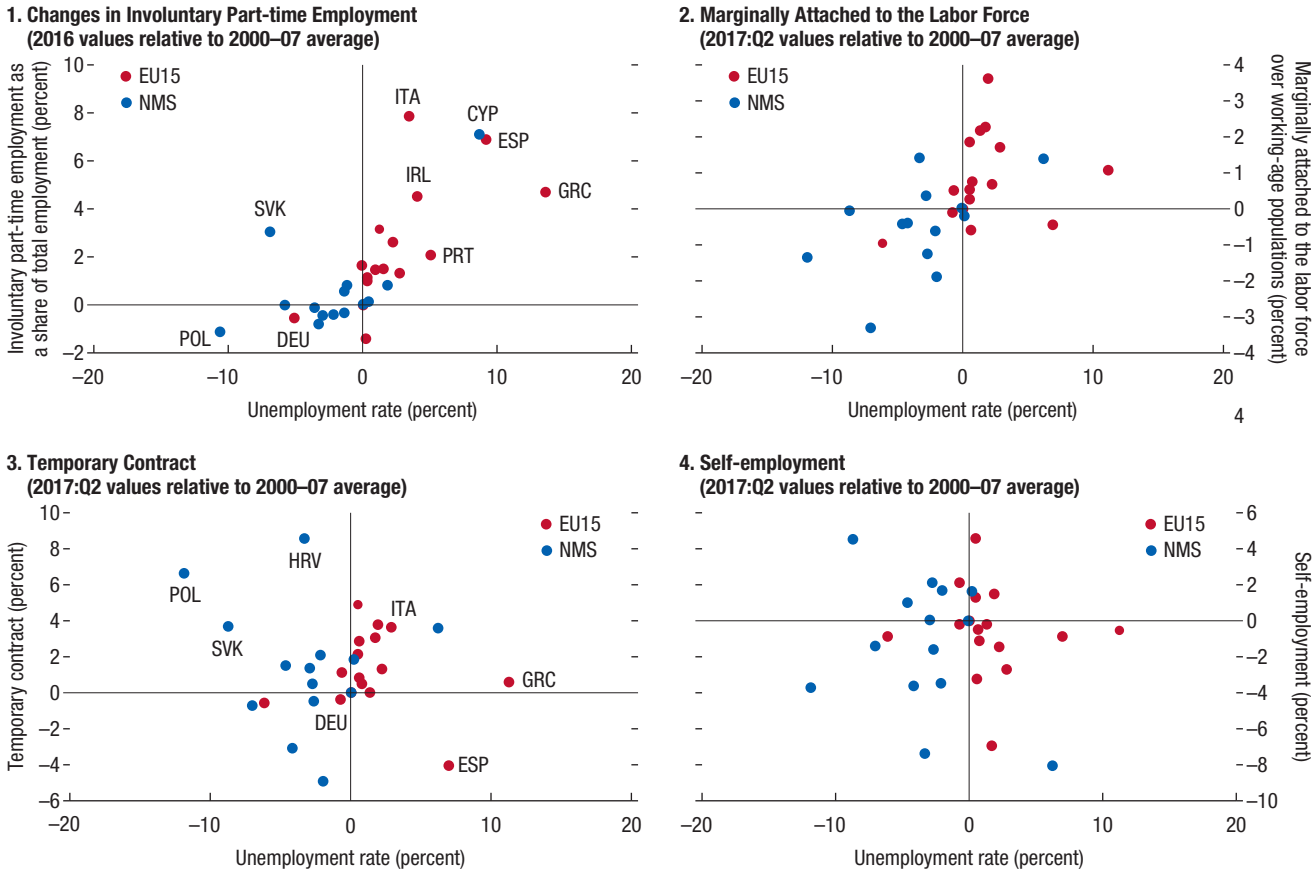
changes in the unemployment rates, suggesting that they may capture cyclical information (Figure 2.9). On the other hand, the shares of self-employment and temporary contracts did not increase visibly after the crisis. Across countries, the changes from precrisis levels have weak or even negative correlation with the changes in unemployment rates.

A nonemployment index, combining the unemployment rate with the measures discussed above, could provide greater information about slack. As discussed in Byrne and Conefrey (2017), the index incorporates potential labor input from those currently unemployed, marginally attached to the labor force, and underemployed. Across countries, changes in the nonemployment index appear somewhat positively correlated with the changes in unemployment rates, although the correlation is not perfect (Figure 2.10). This suggests that the nonemployment index potentially captures additional information that is not embedded in the unemployment rate.

Recent literature suggests using the intensive margin, or hours worked per person, as a further indicator of labor market slack (Figure 2.11). In a Phillips curve analysis of the wages in the euro area and its five largest economies, Bulligan, Guglielminetti, and Viviano (2017) find that the intensive margin of labor utilization is relevant for wage growth. Moreover, they find the shape of the Phillips curve becomes flatter for lower levels of hours per worker. Labor market arrangements in Germany, which tend to reduce hours to limit job losses, may make this indicator particularly relevant.

A simple correlation analysis finds that most of these slack indicators have significantly different information. As expected, the highest correlations

Figure 2.9. Cross Plots of Unemployment and Alternative Slack Indicators



Source: Organisation for Economic Co-operation and Development.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes.

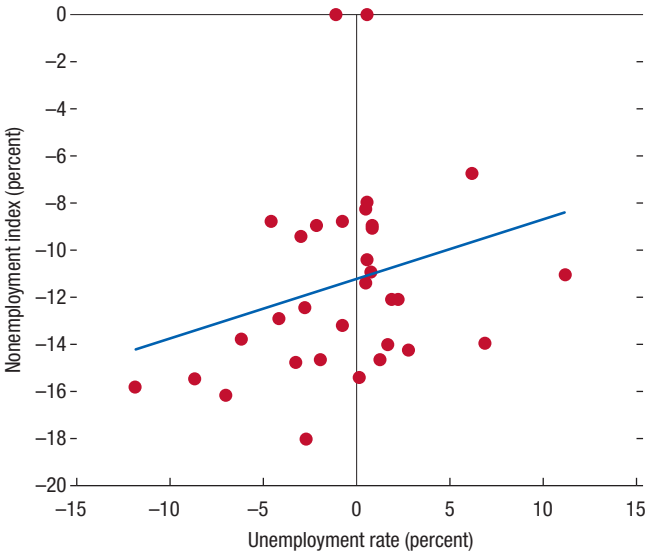
are between unemployment gaps and the nonemployment index gap, but it is envisaged that index gaps are an alternative to unemployment gaps in the econometric analysis. Among the other pairs, there are correlations between involuntary part-time employment and unemployment and nonemployment index gaps. The highest is 0.72, between the unemployment gap and changes in involuntary unemployment in Germany, and the next highest is 0.5, also in Germany, for the nonemployment index gap. The hours per employee indicator has low correlations with the other indicators.

EU Integration and Labor Market Developments

EU integration can shape wage behavior through a number of channels. The integration of EU labor and goods markets could shape wage setting by changing the elasticities of both labor demand and supply.[8] Integration could also influence wages via labor market slack. For example, migrant inflows could initially increase slack in destination countries, although the longer-term impact is likely small. Migration, together with posted workers and workers commuting across borders, redistributes labor supply, while production

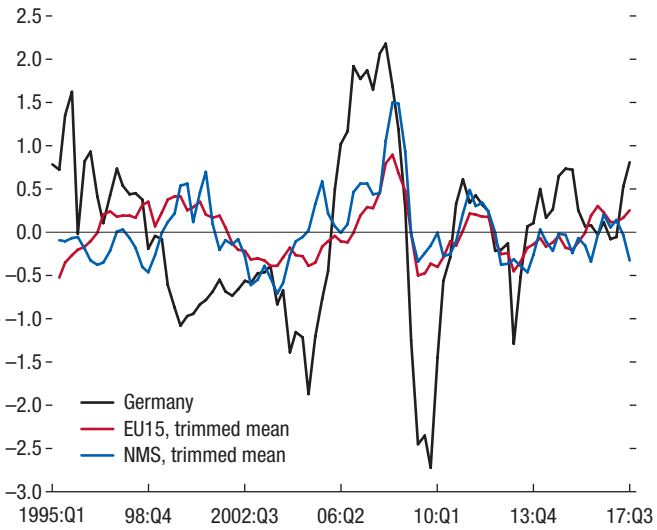
[8]Over the longer term, integration is expected to promote convergence in productivity through the diffusion of technology and management skills (see Chapter 4 of the April 2018 WEO).

Figure 2.10. The Nonemployment Index and Unemployment Rate
(2017:Q2 values relative to 2000–07 average)



Source: Organisation for Economic Co-operation and Development.

Figure 2.11. Hours Worked per Employee
(Percent deviation from trend)



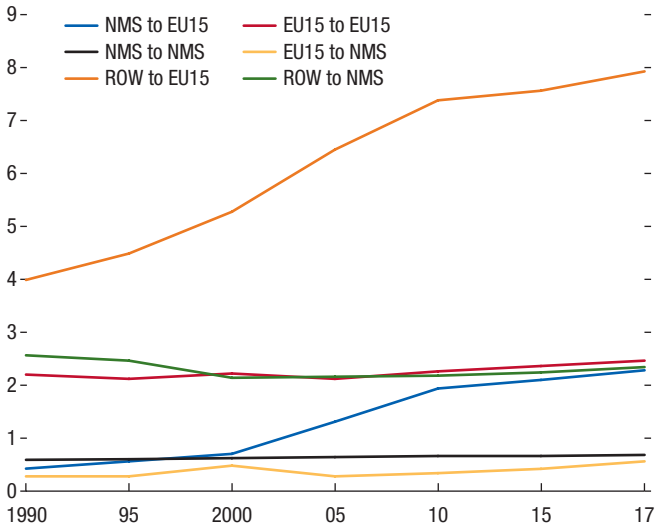
Source: Eurostat.
Note: EU15 = long-standing EU members; NMS = newer EU members.

relocation and outsourcing shift the demand for labor between countries. Accordingly, this section illustrates interconnections between EU goods and labor markets, providing stylized facts on labor movement and global value chains.

Labor Market Integration

New accessions to the European Union since 2004 facilitated a rise in migration from these countries to the EU15, although migration from outside the European Union has also been sizable (Figure 2.12; Box 2.3). Intra-EU migration is largely from new member states to the EU15, driven by differences in wage levels. Between 2000 and 2015, the stock of migrants from new members in the EU15 tripled to 2.1 percent of the EU15 population. In large part this migration took place before the global financial crisis, but it continued over 2010–15, in part as some new members gained free access to key EU15 countries, with a lag.[9] In contrast, migration stocks within new members and from EU15

Figure 2.12. Migration (Stock) to European Union
(Percent of host region's population)



Sources: Eurostat; United Nations, Department of Economic and Social Affairs, Population Division (2017); and IMF staff calculations.
Note: EU15 = long-standing EU members; NMS = newer EU members; ROW = rest of the world.

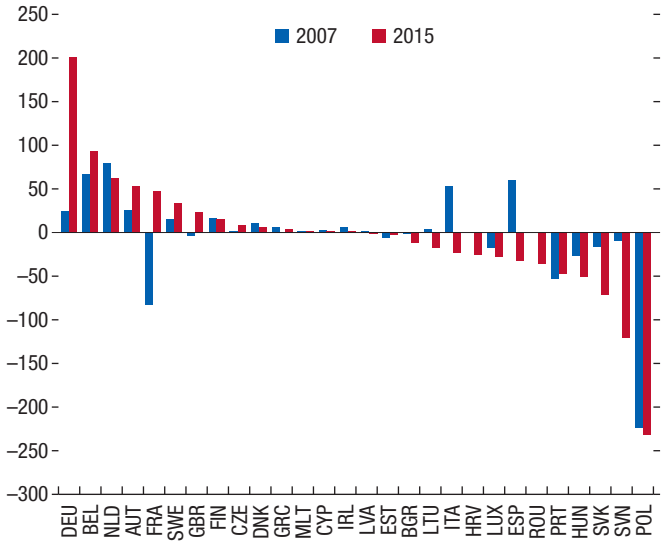
[9]For example, Bulgaria and Romania joined the European Union in 2007, yet their workers gained free mobility to Austria, Belgium, France, Germany, Luxembourg, and the Netherlands only in 2014.

countries to new members remained broadly stable as shares of the respective populations, and within the EU15 migrant stocks, rose gradually to 2.5 percent of the EU15 population.[10] Migration from outside the European Union has been large, with migrants to the EU15 coming mainly from the former Soviet Union in the early 1990s, from former colonial countries, and in recent years as refugees. Migration from outside the European Union to newer members does not appear to be significant, with some exceptions (for example, Poland has seen very large inflows from Ukraine).

Alongside increased migration, EU labor market integration has intensified through posted workers and cross-border workers. "Posted workers" are employees sent by their employer to carry out a service in another EU country on a temporary basis. For example, a service provider may win a contract in another country and send employees there to deliver the services. Posted workers differ from EU mobile workers in that they remain in the host EU country temporarily and do not integrate into its labor market, yet they can still affect the host country's labor market slack.[11] Net inflows of posted workers to some EU15 countries—especially Germany—have increased since 2007, matched by rising net outflows from newer members such as Slovenia and the Slovak Republic (Figure 2.13). In addition, the number of "cross-border workers" who live in one EU country and work in another was estimated at 1.3 million (or 0.6 percent of the total employed) across the European Union in 2015.[12]

Most emigrants from newer EU member countries are highly educated, causing skill shortages in the home countries. The education levels of newer EU member emigrants tend to be higher than their home-country averages (IMF 2016). The prevalence of better-educated and working-age people among emigrants leaving newer member countries has significantly reduced the supply of skilled labor, with the brain drain most prominent in the Baltics, potentially contributing to the recent hikes in wages in these countries. Furthermore, the large-scale emigration may also have slowed growth and income convergence with the EU15, while also contributing to fiscal burdens from the higher dependency ratio.

Figure 2.13. Posted Workers (Net flows)
(Thousands of people)



Source: Eurostat.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes.

Goods Market Integration

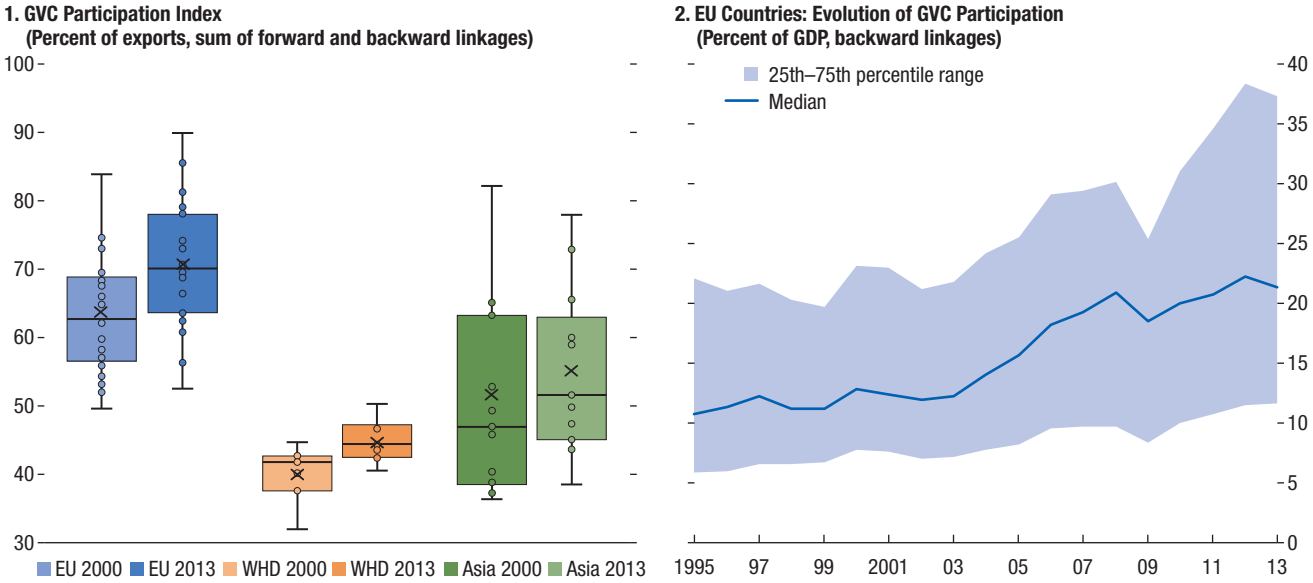
The rise of global supply chains and fragmentation of production across borders affects labor markets in the short and long term. In the short term, for countries that are highly integrated into global supply chains, domestic conditions (such as the demand for labor) become more sensitive to global production cycles, leading to increased business cycle synchronization (IMF 2013). From a long-term perspective, offshoring increases cross-border wage linkages across countries (Feenstra and Hanson 1997; Grossman and Rossi-Hansberg 2008). In addition, offshoring

[10]Migration among the EU15 countries includes retirees who do not increase the labor supply.

[11]On the contrary, EU mobile citizens who go to another member state to seek work are entitled to equal treatment with nationals in access to employment, working conditions, and all other social and tax conditions.

[12]Cross-border workers include "frontier workers" who return to their country or residence daily or at least once a week and "seasonal workers" who work in another EU member state for a limited amount of time.

Figure 2.14. Integration of the European Union into Global Supply Chains



Sources: EORA Database; Ignatenko, Raei, and Mircheva (forthcoming); and IMF staff calculations.
Note: Whisker boxes represent the 25th and 75th percentile of the distribution of the respective variables. Within each box, the line and the cross represent the average and median. Asia = Australia, China, Hong Kong SAR, India, Japan, Korea, Malaysia, New Zealand, Philippines, Singapore, Vietnam; GVC = global value chain; WHD = Argentina, Brazil, Canada, Chile, Mexico, Peru, United States.

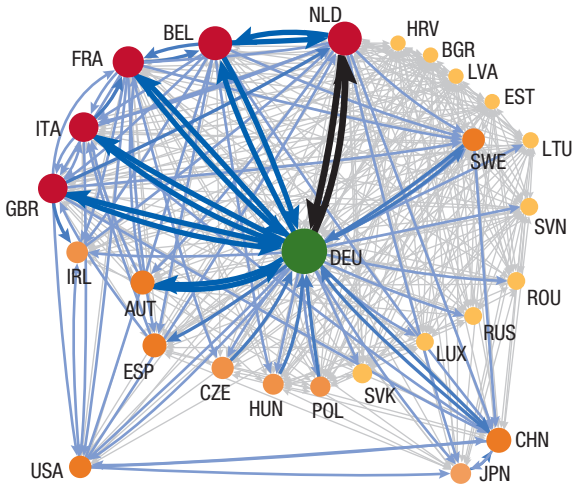
(or the threat of it) further reduces the bargaining power of labor (Harrison 2002). On the other hand, demand for labor in emerging market economies (or the destination of offshoring) becomes increasingly linked to external conditions.

EU countries are highly integrated through pan-European supply chains. On average 70 percent of exports of goods and services of EU countries represents trade in intermediate goods that are part of supply chains (Figure 2.14, panel 1). This share is significantly higher than in other parts of the world and has been on the rise in the European Union, particularly over 2000–07, helped by the expansion of global trade and EU enlargement (Figure 2.14, panel 2). EU linkages are generally stronger than non-EU linkages, as on average two-thirds of foreign value added in EU exports originates from within the European Union.

Germany plays a key role in EU supply chains. Over time, the integration of EU countries has increased the most with Germany, followed by China, and to a lesser extent with France and Italy. Germany is by far the most important source of intermediate inputs for many EU countries, followed by France, the United Kingdom, and Italy (Figure 2.15). A point worth noting is the role of Germany acting as a hub, with large inflows and outflows of intermediate goods and services flowing through Germany to various EU countries. Global value chain linkages outside Europe (to China and the United States) appear fairly small compared with pan-European linkages and possibly go through Germany as well.

Foreign direct investment flows within the European Union mirror these tightly knit supply chains. As supply chains have expanded in newer EU members, the stock of foreign direct investment has also been increasing in those countries over time (Figure 2.16, panels 1 and 3). Within the European Union, newer members are the largest recipients of foreign direct investment; EU15 countries are generally net foreign direct investment exporters, and this pattern has remained broadly the same over time. In line with the tight global value chain integration within Europe, about 90 percent of inward foreign direct

Figure 2.15. EU Integration into Global Supply Chains: Pan-European Supply Chains
(Arrows are proportional to nominal GVC trade flows between countries, 2013)



Sources: EORA Database; Ignatenko, Raei, and Mircheva (forthcoming); and IMF staff calculations.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. GVC = global value chain.

investment to newer EU members is from within Europe and 85 percent from within the European Union. Germany and Austria are major senders of foreign direct investment to central, eastern, and southeastern Europe, while Sweden is the largest financier in the Baltics (Figure 2.16, panel 2).

It appears that supply chain integration has increased the sensitivity of labor markets to external conditions, particularly for highly integrated newer member states. Integration into global supply chains contributes to synchronization of business cycles across economies (Figure 2.17, panel 1). External conditions are transmitted to the domestic economy through various channels. Regarding labor market outcomes, indicators of labor shortages for EU countries are highly correlated with indicators of external demand (for example, aggregate EU industrial production), particularly for more integrated newer member states (Figure 2.17, panel 2). The sensitivity of labor shortages to external conditions has increased over time for both the newer members and the EU15, but labor shortages in the newer members are more sensitive to global shocks than in the EU15 (Figure 2.17, panel 3). Nevertheless, a formal empirical analysis that includes all the various drivers of wage dynamics is needed—this is the subject of the next section.

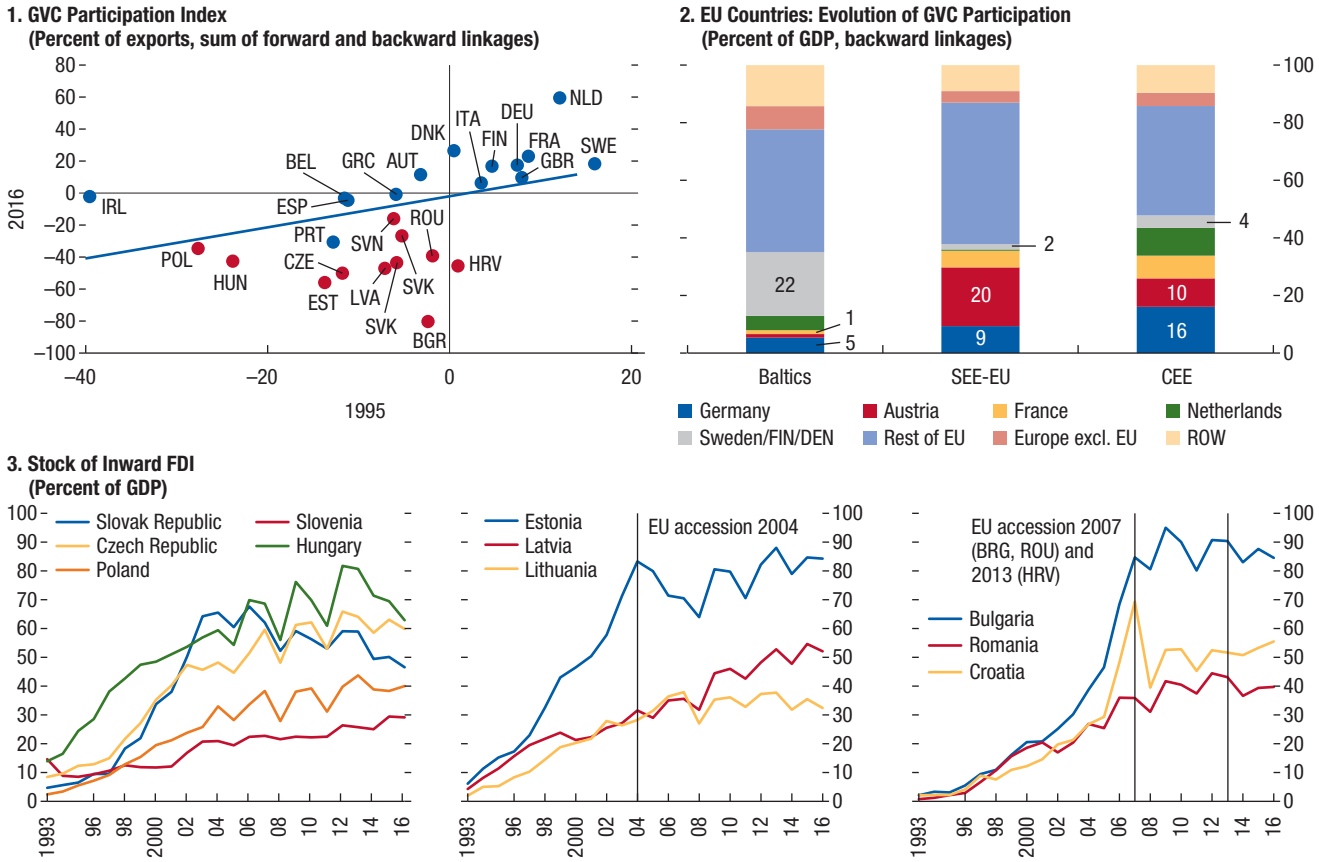
Exploring Drivers of European Wage Behavior

EU integration could make wages in EU countries more dependent on labor market conditions, including wages, in other countries.[13] Firms in different countries across the European Union are often competing in goods markets both within and outside the union, and increasingly in services as these become more tradable. In wage bargaining, firms will seek to preserve cost competitiveness across these markets, while unions and workers will also consider risks to firms' sales and employment. Hence, wage growth in one country may have a direct spillover on wage setting in others. Higher labor market slack in another country could indicate future wage moderation, which may also impact wages elsewhere. Such spillovers could strengthen with the increasing integration of European goods and labor markets through labor movement and relocation of production.

Recent work on wage drivers in some EU countries provides evidence of such spillovers from foreign wages and labor market slack. For Sweden, the IMF (2017a) finds that in the long term real wages are determined by labor productivity. But the growth in Swedish nominal wages shows a sizable spillover from German wage growth, and this linkage became stronger beginning in the early 2000s. A second spillover channel operates via changes in euro area unemployment, with a

[13]Being a member of a currency union could also affect wage dynamics. We tested this for the newer EU members in the empirical analysis by using an interaction dummy on slack for euro area membership. The estimates for the dummy suggest that there is no structural break in the relationship between wages and unemployment in the newer EU economies (Estonia, Latvia, Lithuania, Slovak Republic, Slovenia) after they joined the euro area. But we acknowledge that this test is imperfect, for various reasons. For older euro area members we did not test this because our data only start in 1995.

Figure 2.16. EU Integration into Global Supply Chains



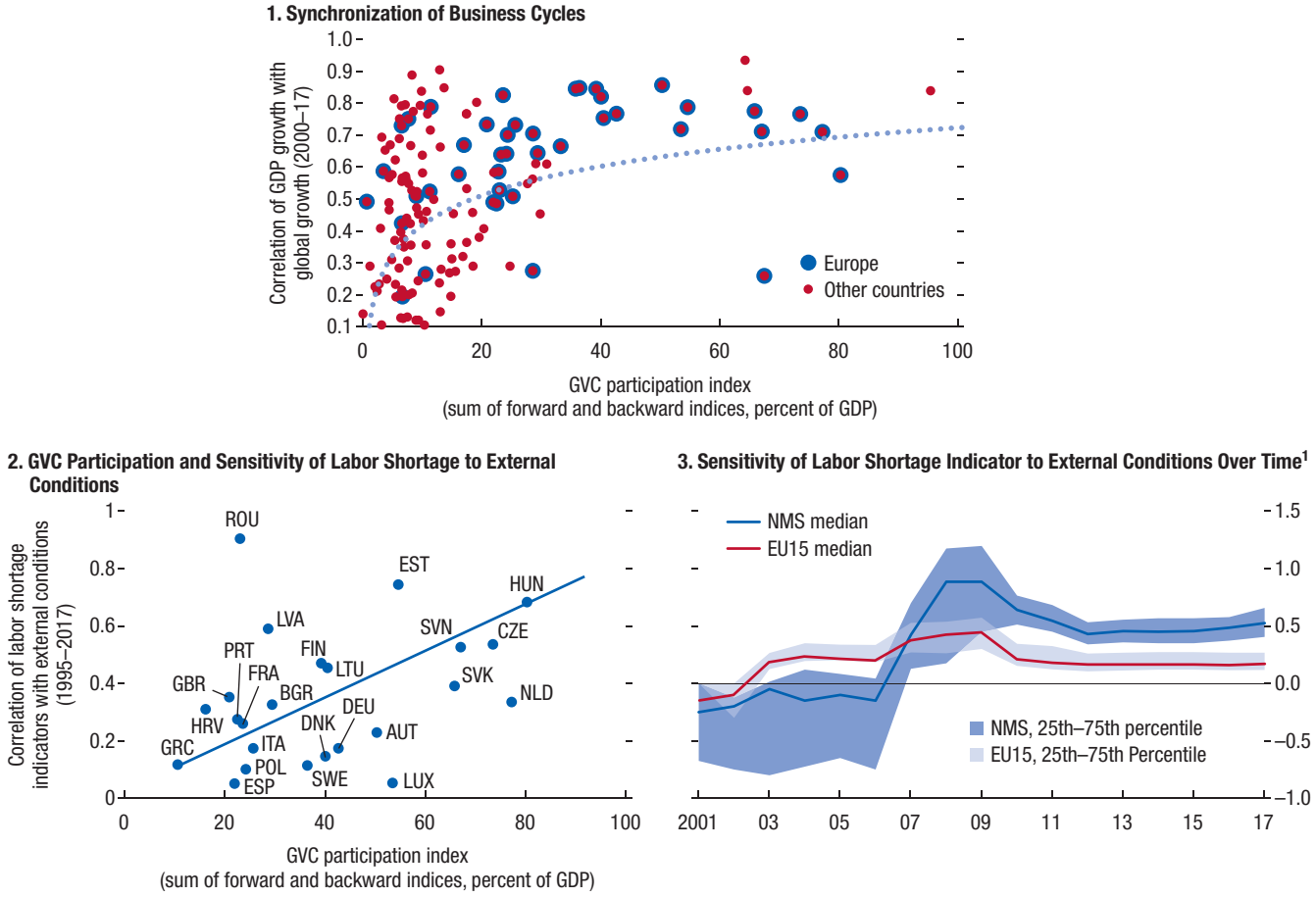
Sources: Haver Analytics; Organisation for Economic Co-operation and Development; United Nations Conference on Trade and Development; and IMF staff calculations.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. Baltics = Estonia, Latvia, Lithuania; CEE = central and eastern Europe; FDI = foreign direct investment; GVC = global value chain; ROW = rest of world; SEE = southeastern Europe.

negative effect on wage growth that also increased starting in the early 2000s. For the United Kingdom, the IMF (2018) finds growth in wages to be negatively affected by the EU unemployment gap. These papers also use broader indicators of labor market slack, with involuntary part-time employment having a significant negative impact on wages in both cases, while in the United Kingdom, cyclical increases in self-employment also have negative effects on wages. In addition, the IMF (2016) finds that the large wave of emigration from eastern to western Europe in response to income differentials lowered labor supply in the east in the past quarter century and was associated with higher remittances, which may have eased budget constraints and contributed to higher wages in the east.

This section provides an integrated analysis of drivers of European wages, including

- *Broader indicators of slack:* Starting from the headline measure of unemployment as in the traditional Phillips curve, the analysis also uses the nonemployment gap, hours per employee gap, and involuntary part-time employment.
- *Inflation and inflation expectations:* The analysis includes lags of actual inflation and of Consensus Forecasts (one year ahead) for inflation as a proxy for inflation expectations

Figure 2.17. Supply Chain Participation and Sensitivity to Global Conditions



Sources: Haver Analytics; EORA Database; Ignatenko, Raei and Mircheva (2018); and IMF staff calculations.
Notes: Data labels in the figure use International Organization for Standardization (ISO) country codes. EU15 = long standing EU members; NMS = newer EU members.
[1]For each country and time *t*, the sensitivity of quarterly labor shortage indicator to lagged EU industrial production is calculated over 1995 to year *t*. Lines for New Member States and the EU15 represent the median sensitivity coefficient for each group, and the shaded areas represent 25th–75th percentiles.

to allow for a mix of forward- and backward-looking wage adjustment.

- *Overhangs:* The graphical analysis earlier in this chapter found that EU15 wages rose relative to productivity trends during the global financial crisis, weighing on subsequent wage rises. The analysis explores augmenting the Phillips curve with an error correction term toward long-term equilibrium.
- *Spillovers from foreign wages and labor market slack:* Drawing on research noted above, the analysis brings in foreign labor market slack, foreign wages, and migration flows.

Three groups of countries are used in this analysis:

- Germany is analyzed separately as it is often seen as a wage leader in the region;[14]
- An "other euro area" panel (Austria, Belgium, France, Netherlands, Spain);
- A newer EU member panel (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic, Slovenia).

[14]Ramskogler (2012) finds that wage-following behavior across Economic and Monetary Union members under German leadership has emerged since the introduction of euro.

The EU15 countries outside the euro area are not analyzed given the recent studies on Sweden and the United Kingdom. Italy was initially included in the "other euro area" panel, but the trend level of labor productivity has been almost flat. It has risen only 1 percent cumulatively since 2002, resulting in low explanatory power and unreliable estimates of the long-term impact of productivity on real wage levels.[15] The reported results are for total labor compensation (national accounts) per employee hour—which includes social security contributions of employers—but estimates of the same specifications using data on wages and salaries per employee hour and the labor cost index yield similar results.

The key steps are as follows:

(1) *Long-term models of real wages based on trend labor productivity are estimated.* Labor productivity is the principal driver of real product wages in the long term, as seen in the relatively narrow range of variations in the ratio of real wages to productivity in Figures 2.3 and 2.4, despite substantial variation in productivity growth across time and countries.[16] A trend measure of labor productivity is preferred since wages show inertia through short-term and cyclical productivity swings. Separate ordinary least squares regressions for each country are used to allow for differences in long-term impacts of productivity. In the euro area countries, the effects of reforms are controlled for using a database on major reforms (IMF 2017d). In the case of some small European countries, the potential for a long-term spillover from foreign wages is explored. For newer EU members, the long-term real wage model includes only domestic productivity—the convergence of wages to the EU15 levels in the long term hinges on productivity convergence by the newer EU members since firms must generate adequate profits to remain viable. Newer EU member labor markets tend to be relatively flexible, with no major reforms evident in the sample period.

(2) *Short-term baseline models are estimated for nominal wage growth.*[17] These include a set of core variables that are standard in the Phillips curve literature and Chapter 2 of the October 2017 WEO: lagged inflation, inflation expectations, trend productivity growth, the unemployment gap (both level and change), and lagged wage growth. Adding the fourth lag of the residual from the long-term equation to this Phillips curve gives the error correction model specification. In view of the relatively rich parametrization, panel estimation is used to ensure more robust estimates, except for Germany.

(3) *The impact of broader indicators of slack is assessed*. In both the Phillips curve and the error correction model, the nonemployment index gap is assessed as an alternative to headline unemployment. For Germany, involuntary part-time employment is included separately, similarly to Sweden and the United Kingdom. Based on Bulligan, Guglielminetti, and Viviano (2017), the intensive margin (hours worked per employee) is also included.

(4) *Spillovers from external unemployment and wages and the impact of migration are estimated.* To limit the scope for spillovers to reflect the omission of relevant domestic factors, a preferred baseline specification including broader indicators of slack is used. Variables for external unemployment and foreign wages are added sequentially. Migration flows are the last variable added, in part because data for 2016–17 are not yet available.

Long-Term Analysis

Structural reforms are found to affect the level of real wages in the long term and some long-term

[15]Kangur (2018) finds that Italian wages show low responsiveness to firm-specific productivity, regional disparities, and skill mismatches and that rigid nominal wages imply that adjustment occurs through lower profits and employment.

[16]Modeling the level of real product wages implies a restriction that nominal wages respond to the GDP deflator with a unity coefficient in the long run that is consistent with economic theory. But the short-term error correction models of nominal wage growth allow real wages to be affected temporarily by inflation shocks. In contrast, the Phillips curve without the error correction model term imposes no long-term restrictions on the impact of inflation and productivity on wages (see Blanchard and Katz 1999).

[17]Modeling the four-quarter growth rate is consistent with wage-setting practices and allows dynamics over a one- to two-year period to be modeled with fewer estimated parameters.

Table 2.1. Euro Area: Long-Term Equations for Total Labor Compensation[22]

Variables	(1) Germany	(2) France	(3) Austria	(4) Belgium	(5) Spain	(6) Netherlands
Log Trend Productivity	1.027***	0.932***	0.789***	0.437***	0.868***	0.898***
	(0.0328)	(0.0193)	(0.0300)	(0.152)	(0.0486)	(0.0229)
Log Real German Wage[1]			0.179***	0.117*		0.262***
			(0.0509)	(0.0590)		(0.0353)
Log Real French Wage[1]				0.494***		
				(0.165)		
Hartz Reform Dummy	−0.0546***					
	(0.00541)					
Unemployment Benefit Reform Dummy		0.0319***			−0.0389***	
		(0.00272)			(0.00561)	
Employment Protection Reform Dummy			−0.0299***			
			(0.00507)			
Constant	−5.996***	−5.537***	−4.760***	−2.327**	−5.688***	−4.964***
	(0.147)	(0.0874)	(0.178)	(0.888)	(0.222)	(0.110)
Observations	91	91	87	74	91	86
R-Squared	0.967	0.986	0.973	0.886	0.802	0.949
Dickey-Fuller Test	−2.661	−2.648	−3.880	−1.720	−2.843	−3.660

Source: IMF staff calculations.
Note: Standard errors in parentheses.
***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.
[1]Deflated by individual countries' GDP deflator.

wage spillovers are found in smaller euro area countries (Table 2.1):[18]

- *Germany:* The Hartz reforms implemented in 2003–05 are found to lower the equilibrium real wage by 5½ percent, and the long-term productivity coefficient is close to unity.[19] Absent the reform dummy, the latter coefficient is 0.73, which is too low given the near parallel trends in real wages and productivity both before the Hartz reforms and since the global financial crisis.
- *France and Spain:* Long-term real wage developments depend on domestic productivity trends. In Spain, reforms, including unemployment benefits, reduce real wages by an estimated 4 percent.[20] In France, such a dummy has a counterintuitive positive sign, as it was implemented close to the global financial crisis, a period when French real product wages rose about 3 percent relative to productivity, owing to nominal wage growth inertia. In France, this real wage increase has not subsequently unwound, unlike in other EU15 countries.
- *The Netherlands and Austria:* Wages in these two countries are driven principally by domestic productivity, but German wages (deflated by the domestic GDP deflator of each country) also have a long-term impact with a coefficient of about 0.2. This reflects the domestic wage-setting anchor that Germany provides in these two countries, consistent with their high interconnection with the German economy. In Austria, reforms of employment protection are found to reduce real wages by 3 percent.
- *Belgium:* French wages, in addition to German wages, are found to have a lasting effect on Belgian wages. This finding is broadly consistent with a 1996 law that links Belgian wage setting to wage developments in neighboring countries.[21]

[18]A Dickey-Fuller test rejects a unit root in the residuals of most country equations, consistent with a cointegrating relationship between real wages and productivity.

[19]From the outset of reforms in the first quarter of 2003, the Hartz reform dummy rises from 0.1 in steps of 0.1 each quarter to reach 1 in the second quarter of 2015, just after the final stage of these reforms.

[20]An employment protection reform dummy is also statistically significant for Spain, but it results in an implausibly high estimated parameter (about 1.5) on labor productivity. See IMF (2015) for a more comprehensive analysis of the impact of the 2012 labor market reforms.

[21]Further information is provided in the IMF's 2017 Article IV Consultation for Belgium (IMF 2017c, Box 2). The estimated

Table 2.2. Newer EU Members: Long-Term Equations for Total Labor Compensation

Variables	(1) Czech Republic	(2) Estonia	(3) Hungary	(4) Latvia	(5) Lithuania	(6) Poland	(7) Slovak Republic	(8) Slovenia
Log Trend Productivity	1.074***	1.187***	0.598***	1.012***	0.936***	0.696***	1.031***	0.789***
	(0.0163)	(0.0320)	(0.0311)	(0.0245)	(0.0205)	(0.0314)	(0.0159)	(0.0162)
Constant	−4.179***	−8.116***	0.163	−7.549***	−7.211***	−4.770***	−7.323***	−5.557***
	(0.0734)	(0.146)	(0.141)	(0.108)	(0.0911)	(0.146)	(0.0712)	(0.0722)
Observations	87	71	91	91	91	62	91	91
R-Squared	0.981	0.952	0.806	0.950	0.959	0.892	0.979	0.964
Dickey-Fuller Test	−3.512	−2.616	−1.914	−2.034	−2.609	−2.588	−2.922	−3.038

Source: IMF staff calculations.
Note: Standard errors in parentheses.
***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

In the newer EU members, productivity gains are generally translated into similar real wage rises over the long term (Table 2.2). In the Czech Republic, Estonia, Latvia, the Slovak Republic, and to a lesser extent Slovenia, the coefficient on labor productivity is close to unity. Poland and Hungary are outliers. In the case of Poland, the low coefficient appears to reflect real wage levels that are exceptionally high relative to productivity in the early years of the sample, a public sector wage freeze after the crisis, and the surge in temporary foreign migrant workers in more recent years—the impact of which is not captured in official statistics. In Hungary, some data issues—including discontinuities in hours worked that affect both wages and productivity—may contribute to the very low coefficient estimate.

Short-Term Regional Panel Analysis

In the regional panel analyses, the preferred baseline model is the error correction model using the nonemployment index gap rather than unemployment, with hours per employee as an additional slack indicator.[22] Baseline Phillips curve model estimates are presented in column (1) of Tables 2.3 and 2.4, with columns (2) and (3) progressively including broader slack indicators. Columns (4) to (6) are similar, but also include the error correction model term. The explanatory variables are lagged four to five quarters, with the exception of changes in unemployment or the nonemployment index, which are often included in wage equations in part to proxy short-term unemployment. The wage Phillips curves have sensible properties, with sizable effects from trend productivity growth, expected inflation, lagged inflation in the case of the other euro area region, and indicators of slack. The notably higher coefficients on slack in the newer member states indicate greater real wage flexibility, which will aid adjustment to asymmetric shocks.[23] Columns (4) to (8) show that the error correction parameter is sizable (–0.36 in "other euro area" and –0.40 in newer member states), and highly significant—further evidence consistent with the above long-term equations being cointegrating relationships.[24] The error correction model with the nonemployment index gap has more explanatory power than that for unemployment, with the gain larger for newer member states than for the "other euro area" panel.[25]

weights on foreign wages are sensitive to changing the dependent variable to wages and salaries (which exclude social security contributions by employers), with the estimated weights on French real wages lower at 0.194 and those on German wages higher at 0.163.

[22]For the euro area excluding Germany, estimation of a six-country panel including Italy gave similar results to those in Table 2.3 column (8), but hours per person are not significant, and the mix of spillovers differs, with a larger coefficient on euro area wage growth and a smaller and insignificant coefficient on changes in euro area unemployment. But, as noted above, the long-term estimates may be less reliable given the near absence of productivity growth since 2002 in Italy.

[23]Panel regressions that replace the nonemployment index gap with both unemployment and changes in involuntary part-time employment, while retaining the hours gap, yield similar results.

[24]Note that the error correction model term is at the fourth lag, so roughly 40 percent of a deviation from long-term equilibrium is corrected each year, or 64 percent after two years and 78 percent after three years.

[25]Although the parameter on trend labor productivity growth tends to be lower in the error correction model, productivity also affects wages through the error correction model term, and in the long run the impact of productivity on real wages is higher in the error correction model.

Table 2.3. Euro Area Excluding Germany: Short-Term Equations: Total Labor Compensation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variables	Standard Phillips Curve			ECM Wage Curve			Spillover Analysis			
Wage, Log, Four-Quarter Change (*t*–4)	−0.08*	−0.11**	−0.04	0.04	0.02	0.05	0.06	0.03	0.10*	0.10*
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Trend Labor Productivity, Log, Four-Quarter Change (*t*–4)	0.82***	0.79***	0.76***	0.63***	0.63***	0.63***	0.57***	0.57***	0.17	0.18
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.12)	(0.12)
HICP, Log, Four-Quarter Change (*t*–5)	0.31***	0.34***	0.33***	0.19***	0.21***	0.21***	0.24***	0.20***	0.20**	0.20**
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)	(0.08)
Expected Inflation, One Year Ahead (*t*–4)	0.50**	0.72***	0.61***	0.58***	0.72***	0.66***	0.63***	0.75***	0.94***	0.90***
	(0.21)	(0.19)	(0.19)	(0.19)	(0.18)	(0.18)	(0.18)	(0.19)	(0.20)	(0.20)
Unemployment Gap (*t*–4)[1]	−0.34***			−0.23***						
	(0.03)			(0.03)						
Unemployment Rate, Four-Quarter Change	−0.26***			−0.09*						
	(0.05)			(0.05)						
Nonemployment Gap (*t*–4)[2]		−0.62***	−0.60***		−0.45***	−0.45***	−0.42***	−0.39***	−0.29***	−0.29***
		(0.06)	(0.05)		(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Nonemployment Rate, Four-Quarter Change		−0.32***	−0.30***		−0.09	−0.10	−0.04	−0.05	0.01	−0.03
		(0.06)	(0.06)		(0.06)	(0.06)	(0.07)	(0.07)	(0.08)	(0.08)
Hours Gap (*t*–4)[3]			0.31***			0.16**	0.16**	0.14*	0.44***	0.50***
			(0.08)			(0.08)	(0.08)	(0.08)	(0.10)	(0.11)
EA Unemployment Rate, Four-Quarter Change (*t*–2)							−0.15	−0.20**	−0.34***	−0.34***
							(0.09)	(0.10)	(0.11)	(0.11)
EA Wage, Log, Four-Quarter Change (*t*–3)								0.15**	0.15*	0.18*
								(0.07)	(0.09)	(0.09)
Year-over-Year Change of Net Migrant Inflow (*t*–5)[4]									−0.44***	
									(0.16)	
Year-over-Year Change of Gross Migrant Inflow (*t*–5)[4]										−0.31*
										(0.17)
Year-over-Year Change of Gross Migrant Outflow (*t*–5)[4]										1.23***
										(0.37)
Error Correction Term (*t*–4)				−0.36***	−0.36***	−0.33***	−0.33***	−0.32***	−0.38***	−0.37***
				(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Constant	0.00	−0.00	0.00	0.00	0.00	0.00	0.00	−0.00	−0.00	−0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	383	380	380	383	380	380	380	380	296	296
R-Squared	0.53	0.54	0.56	0.60	0.61	0.61	0.61	0.62	0.68	0.69
Number of Countries	5	5	5	5	5	5	5	5	5	5

Source: IMF staff calculations.

Note: Standard errors in parentheses. EA = euro area; ECM = error correction model; HICP = harmonized index of consumer prices.

***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

[1]Calculated as the difference between actual unemployment rate and OECD nonaccelerating inflation rate of unemployment (NAIRU). When NAIRU is not available, a Hodrick-Prescott filter is used to estimate the gap.

[2]Calculated as difference between nonemployment rate and a trend estimated using the Hodrick-Prescott filter. Nonemployment rate is a composite index of unemployment rate, inactive labor force, and involuntary part-time employment.

[3]Calculated as the difference between actual hours per employee and a trend estimated using the Hodrick-Prescott filter.

[4]Percent of total workforce.

Table 2.4. Newer EU Members: Short-Term Equations: Total Labor Compensation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variables	Standard Phillips Curve			ECM Wage Curve			Spillover Analysis			
Wage, Log, Four-Quarter Change (*t*–4)	0.02	−0.05	0.00	0.19***	0.11**	0.16***	0.20***	0.20***	0.23***	0.23***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Trend Labor Productivity, Log, Four-Quarter Change (*t*–4)	1.20***	1.21***	1.18***	1.05***	1.08***	1.05***	1.03***	0.95***	0.96***	0.96***
	(0.12)	(0.12)	(0.11)	(0.11)	(0.11)	(0.11)	(0.10)	(0.11)	(0.12)	(0.12)
HICP, Log, Four-Quarter Change (*t*–5)	0.13	0.16*	0.10	−0.07	−0.02	−0.07	0.03	0.03	−0.00	−0.00
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
Expected Inflation, One Year Ahead (*t*–4)	0.63***	0.58***	0.58***	0.59***	0.54***	0.54***	0.31**	0.34**	0.38**	0.38***
	(0.14)	(0.14)	(0.14)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.15)	(0.15)
Unemployment Gap (*t*–4)[1]	−0.79***			−0.63***						
	(0.09)			(0.08)						
Unemployment Rate, Four-Quarter Change	−1.41***			−0.89***						
	(0.10)			(0.11)						
Nonemployment Gap (*t*–4)[2]		−1.27***	−1.13***		−1.09***	−0.97***	−0.84***	−0.86***	−0.82***	−0.82***
		(0.12)	(0.13)		(0.12)	(0.12)	(0.12)	(0.12)	(0.13)	(0.13)
Nonemployment Rate, Four-Quarter Change		−2.04***	−1.98***		−1.36***	−1.31***	−0.99***	−1.06***	−1.06***	−1.06***
		(0.13)	(0.13)		(0.14)	(0.14)	(0.15)	(0.16)	(0.17)	(0.17)
Hours Gap (*t*–4)[3]			0.31***			0.29***	0.29***	0.28***	0.26***	0.26***
			(0.10)			(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
EA Unemployment Rate, Four-Quarter Change (*t*–2)							−1.21***	−1.36***	−1.22***	−1.22***
							(0.26)	(0.27)	(0.30)	(0.30)
EA Wage, Log, Four-Quarter Change (*t*–3)								0.41*	0.40*	0.40*
								(0.22)	(0.24)	(0.25)
Year-over-Year Change of Net Migrant Inflow (*t*–5)[4]									−0.52*	
									(0.28)	
Year-over-Year Change of Gross Migrant Inflow (*t*–5)[4]										−0.36
										(0.54)
Year-over-Year Change of Gross Migrant Outflow (*t*–5)[4]										0.58*
										(0.32)
Error Correction Term (*t*–4)				−0.40***	−0.40***	−0.40***	−0.44***	−0.44***	−0.45***	−0.45***
				(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Constant	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.01	−0.01*	−0.01*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)
Observations	576	568	568	576	568	568	568	568	516	516
R-Squared	0.52	0.55	0.56	0.58	0.62	0.62	0.64	0.64	0.65	0.65
Number of Countries	8	8	8	8	8	8	8	8	8	8

Source: IMF staff calculations.

Note: Standard errors in parentheses. EA = euro area; ECM = error correction model; HICP = harmonized index of consumer prices.

***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

[1]Calculated as the difference between actual unemployment rate and OECD nonaccelerating inflation rate of unemployment (NAIRU). When NAIRU is not available, a Hodrick-Prescott filter is used to estimate the gap.

[2]Calculated as difference between nonemployment rate and a trend estimated using the Hodrick-Prescott filter. Nonemployment rate is a composite index of unemployment rate, inactive labor force, and involuntary part-time employment.

[3]Calculated as the difference between actual hours per employee and a trend estimated using the Hodrick-Prescott filter.

[4]Percent of total workforce.

Spillovers are found to have significant effects on wage growth in the "other euro area" panel and especially in the newer member states. In the other euro area countries, changes in euro area unemployment (lagged two quarters) and the growth rate in euro area wages (lagged three quarters) are both statistically significant (column 8).[26] German wages were not found to be statistically significant, hence they are not reported here. In the newer member states, changes in unemployment in the euro area (columns 8 and 9) have substantial and significant impacts on wage growth, with short lags, suggesting that wages need to respond quickly to improving job opportunities in euro area countries to help retain workers. The growth rate in euro area wages also has a significant impact (column 9), consistent with anecdotal reports that developments in euro area wages are the starting point for wage bargaining in many newer member states.

Increases in net migration inflows are found to weigh on subsequent wage growth in both regions, but the impact is modest and temporary. Column (9) adds the four-quarter change in net migration inflows in the prior year as a share of the labor force. Controlling for domestic slack and regional developments, a rise in inflows by 1 percentage point—which is an exceptionally large shock—is found to reduce wage growth in the following year by 0.4 percent in the "other euro area" and by 0.5 percent in the newer EU members.[27] But in practice, the changes in net migration flows are generally small relative to the labor force, so the wage effects are also small. These effects are also temporary, as they reflect the change in migration flows rather than the level, and wages also converge back to long-term equilibrium over time. Interestingly, when migration is separated into inflows and outflows, the latter have a larger coefficient, although the difference is not statistically significant. Nonetheless, it suggests that at least in the near term, migrants to a country are not perfect substitutes for people in the domestic workforce.

[26]For the smaller euro area economies, there are also spillovers through the error correction model term.

[27]The lag structure helps address concerns that migration is endogenous. However, this parameter does not capture the full impact of migration, as there could also be impacts on domestic demand and growth, with knock-on effects on labor market slack.

Short-Term Analysis of Germany

For Germany, the growth in involuntary part-time employment proved to be a key indicator of slack (Table 2.5). The wage Phillips curve again has sensible properties, with quite high responsiveness to the unemployment gap, trend productivity, and inflation expectations. A nonemployment index was also significant, but the coefficient on the growth rate in labor productivity became negative. Given the longer sample available for Germany, changes in involuntary part-time employment were included separately, with the sizable coefficient perhaps reflecting the more widespread use of changes in employee hours to avoid layoffs. The error correction term is particularly high (about –0.6), and it contributes substantially to explanatory power, making the error correction model with the changes in involuntary employment the best baseline model.

German wage setting appears to be anchored on domestic labor market conditions and less sensitive to spillovers than either of the regional panels. German wages are not found to be responsive to changes in euro area unemployment (column 7 in Table 2.5), while the estimated coefficient on euro area wage growth has the opposite sign (column 8) from that expected from a spillover. Changes in net migration flows also do not have a statistically significant impact on German wages (column 9).

Factors Driving Wages within Regions

In the "other euro area," inflation and inflation expectations have been key factors behind variations in nominal wage growth, together with domestic and external slack, with the correction of past wage overhangs also moderating wages (Figure 2.18). The initial slowing in wage rises (average from the five-country panel) by

Table 2.5. Germany: Short-Term Equations: Total Labor Compensation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variables	Standard Phillips Curve			ECM Wage Curve			Spillover Analysis		
Wage, Log, Four-Quarter Change (*t*–4)	0.18	0.15	0.37***	0.46***	0.43***	0.44***	0.53***	0.59***	0.62***
	(0.11)	(0.10)	(0.08)	(0.09)	(0.08)	(0.07)	(0.11)	(0.10)	(0.10)
Trend Labor Productivity, Log, Four-Quarter Change (*t*–4)	1.02***	0.63*	0.72***	0.76***	0.43*	0.58**	0.12	0.52	0.45
	(0.35)	(0.34)	(0.23)	(0.26)	(0.24)	(0.22)	(0.33)	(0.32)	(0.32)
HICP, Log, Four-Quarter Change (*t*–5)	0.11	0.24	0.18	0.01	0.16	0.16	0.24*	0.30**	0.27**
	(0.16)	(0.16)	(0.11)	(0.12)	(0.12)	(0.11)	(0.13)	(0.12)	(0.13)
Expected Inflation, One Year Ahead (*t*–4)	0.66*	0.36	−0.77***	0.98***	0.68***	−0.19	0.67***	0.42*	0.44*
	(0.36)	(0.34)	(0.27)	(0.27)	(0.25)	(0.30)	(0.25)	(0.24)	(0.24)
Unemployment Gap (*t*-4)[1]	−1.30***	−0.60**	−0.54***	−0.94***	−0.30	−0.40**	−0.12	−0.46*	−0.50*
	(0.23)	(0.29)	(0.20)	(0.18)	(0.21)	(0.19)	(0.25)	(0.25)	(0.27)
Unemployment Rate, Four-Quarter Change	−0.42**	0.07	0.01	−0.30**	0.13	0.06	0.28	0.12	0.14
	(0.19)	(0.21)	(0.15)	(0.14)	(0.16)	(0.14)	(0.19)	(0.18)	(0.18)
Involuntary PT Employment Four-Quarter Change (*t*–1)		−1.25***	−0.86***		−1.12***	−0.93***	−1.17***	−0.88***	−0.87***
		(0.33)	(0.23)		(0.24)	(0.22)	(0.24)	(0.23)	(0.23)
Hours Gap (*t*–4)[2]			0.81***			0.51***			
			(0.09)			(0.12)			
EA Unemployment Rate, Four-Quarter Change (*t*–2)							−0.26	−0.13	−0.20
							(0.19)	(0.17)	(0.19)
EA wage, Log, Four-Quarter Change (*t*–4)								−0.35***	−0.37***
								(0.09)	(0.09)
Year-over-Year Change of Net Migrant Inflow (*t*–4)[3]									−0.13
									(0.27)
Error Correction Term (*t*–4)				−0.62***	−0.60***	−0.32***	−0.61***	−0.66***	−0.65***
				(0.08)	(0.07)	(0.09)	(0.07)	(0.07)	(0.07)
Constant	−0.00	0.00	0.02***	−0.01**	−0.01	0.01	−0.01	0.00	0.00
	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)
Observations	83	81	81	83	81	81	81	81	80
R-Squared	0.45	0.56	0.79	0.70	0.77	0.82	0.78	0.82	0.82

Source: IMF staff calculations.

Note: Standard errors in parentheses. EA = euro area; ECM = error correction model; HICP = harmonized index of consumer prices; PT = part-time.

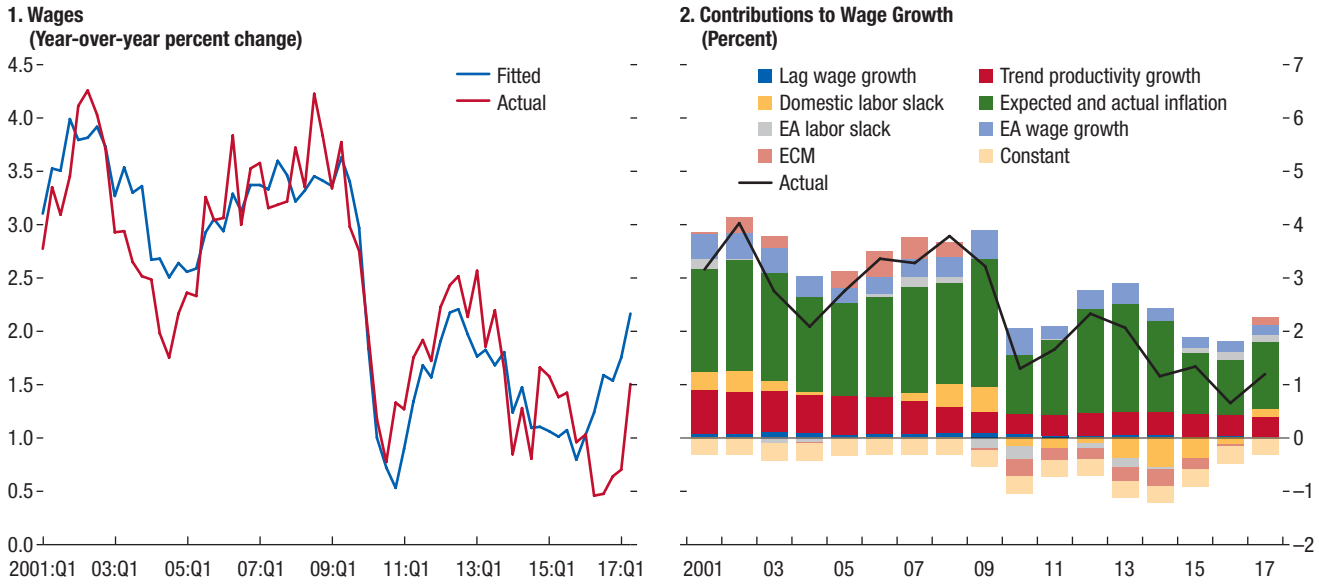
***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

[1]Calculated as the difference between actual unemployment rate and OECD nonaccelerating inflation rate of unemployment.

[2]Calculated as the percent deviation of actual hours per employee from the trend estimated using the Hodrick-Prescott filter.

[3]Percent of total workforce.

Figure 2.18. Wages: Euro Area Excluding Germany



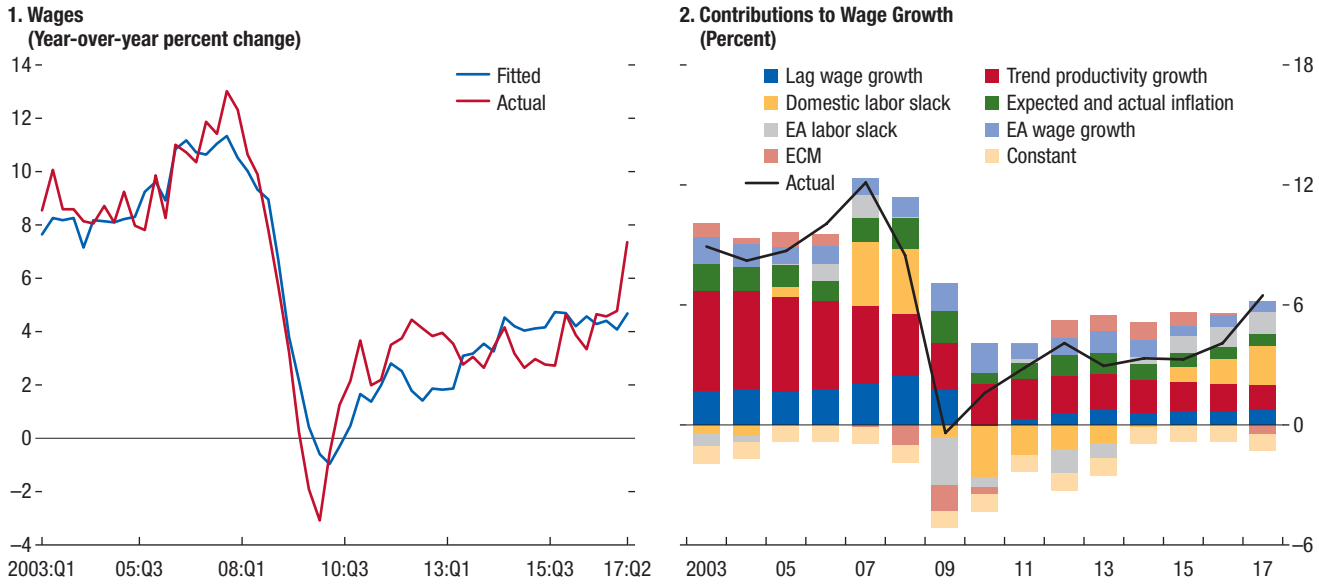
Sources: Eurostat; Haver Analytics; and IMF staff calculations.
Note: EA = euro area; ECM = error correction model.

2.3 percentage points in 2010 is linked to lower inflation expectations (0.8 percentage point), lower past inflation (0.5 percentage point), domestic labor slack (0.6 percentage point), and the error correction (0.3 percentage point), as wage rises remained solid in 2009 even as inflation and productivity growth fell. The error correction continued to weigh on wages by 0.2 to 0.3 percentage point during 2011–15, helping account for wage moderation. During 2011–13, inflation expectations and actual inflation recovered, lifting their combined contribution to wage growth by 0.9 percentage point. But the euro area crisis meant that domestic and external slack began to weigh more heavily on wages during 2012–14, with a total drag of 0.6 percentage point on wage growth in both 2013 and 2014. This drag was amplified by the contributions from inflation expectations and inflation falling sharply during 2014–15 by 0.9 percentage point, with only a slight increase seen by 2017.

In the newer member states, declines in both domestic and foreign slack have contributed to wages picking up in recent years, based on average results from the eight-country panel (Figure 2.19). The sharp halt in wage rises in 2009 reflected large negative contributions from both rising domestic slack and rising euro area unemployment, plus some error correction drag. Even as the high level of domestic and external slack continued to drag on wage rises during 2010–14, by 2011 the declines in domestic slack began to support wages, while declines in euro area unemployment began to support wages beginning in 2014. By 2016–17, the low level of domestic slack began to reinforce wage rises. Yet this combination of domestic and external pressures does not fully account for the extent of wage acceleration during 2016–17, which may be partly due to migration. However, data on migration in recent years are not yet available.

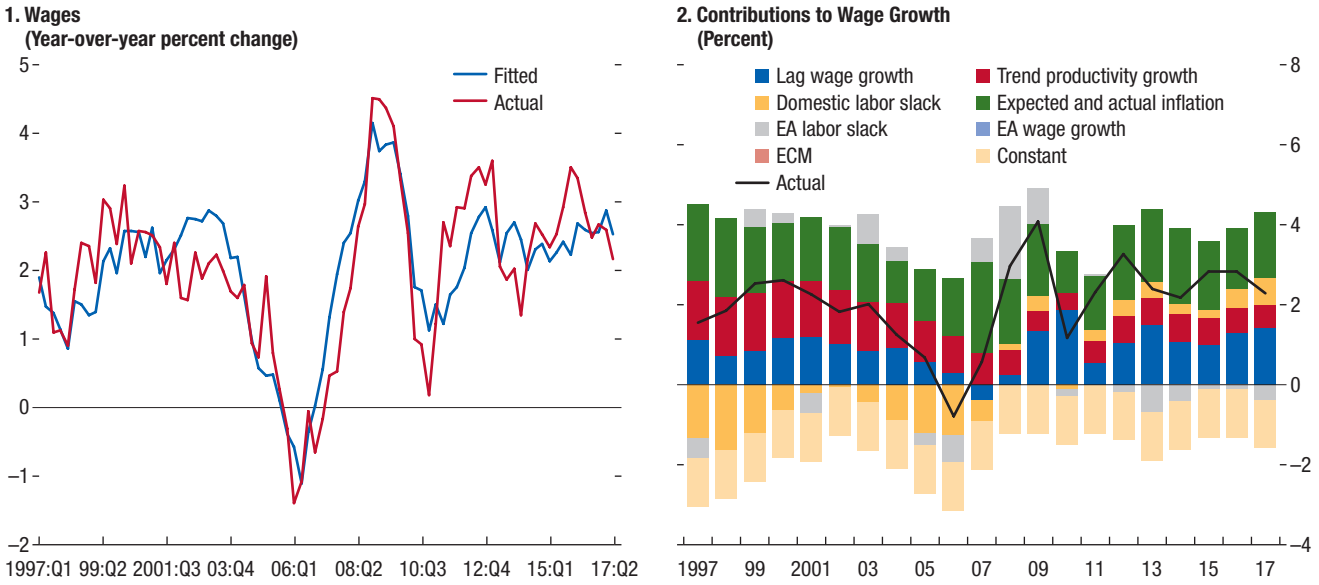
In Germany, domestic labor market conditions and inflation expectations have been key factors behind variations in nominal wage growth (Figure 2.20). The steep initial fall in wage growth by 2.9 percentage points in 2010 is linked to lower inflation expectations (0.9 percentage point), domestic labor slack (0.3 percentage point), and the error correction (1 percentage point). Domestic slack also weighed on wages in 2011,

Figure 2.19. Wages: Newer EU Members



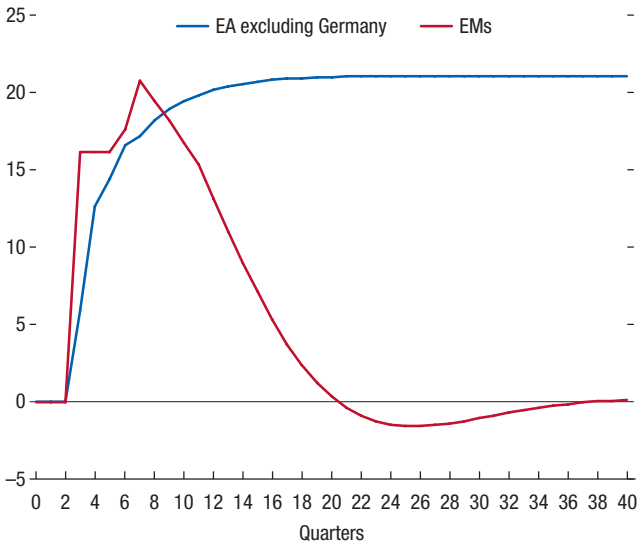
Sources: Eurostat; Haver Analytics; and IMF staff calculations.
Note: EA = euro area; ECM = error correction model.

Figure 2.20. Wages: Germany



Sources: Eurostat; Haver Analytics; and IMF staff calculations.
Note: EA = euro area; ECM = error correction model.

Figure 2.21. Impact on Domestic Wage Growth given 1 Percent Increase in German Wage Growth
(Percent)



Source: IMF staff calculations.
Note: EA = euro area; EMs = emerging markets.

and has not become a source of upward wage pressure in more recent years. During 2011–13, inflation expectations recovered, lifting the contribution of those expectations to wage growth by 0.8 percentage point. Wage growth higher than 3 percent in 2012, despite low inflation and productivity growth, led to a significant error correction drag on wages during 2012–14, peaking at 0.7 percentage point in 2013. This drag was amplified by the contributions from inflation expectations falling during 2014–15 by 0.4 percentage point, with a slight additional decline in 2017.

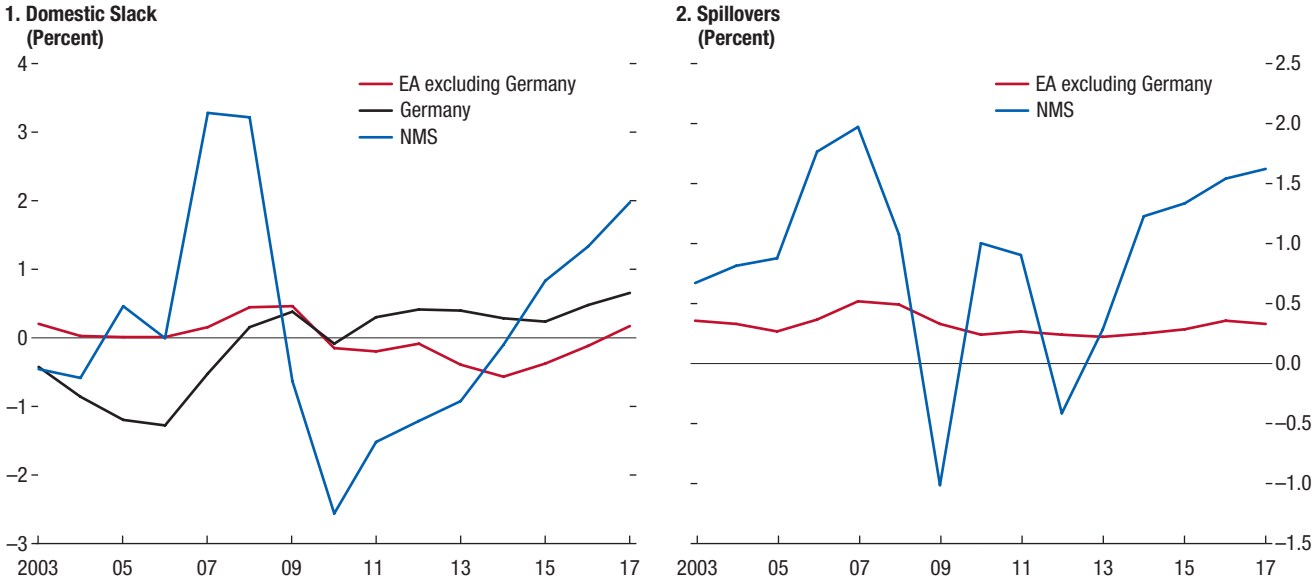
The scale and nature of spillovers can be illustrated through a scenario analysis of a rise in German wage growth (Figure 2.21). For illustrative purposes, hourly wage rates in Germany are assumed to rise 1 percentage point faster than in a baseline, which would raise euro area wage growth by about 0.4 percentage point given Germany's weight in the euro area. This would spill over into the growth of wages in both regional panels. Moreover, higher German wages also spill over through the long-term equations for Austria, Belgium, and the Netherlands. Overall, wage growth in the euro area excluding Germany rises about 0.1 percent after one year and 0.2 percent in the medium term. The impact on newer EU member country wages is slightly larger in the near term (about 0.15 percent after one year), but fades to zero over time because in the long term real wages in the newer member states depend only on domestic labor productivity. To the extent that higher wages lead to higher inflation, through either domestic demand or cost channels, the medium-term impact on wages would be higher than these simulations indicate.

Impacts of Regional Differences in Wage Formation

In newer EU members, greater wage sensitivity to domestic labor slack and external developments help account for the faster wage increases in these countries (Figure 2.22). Wages are found to be more responsive to domestic labor slack in the newer members, with the coefficients on the nonemployment gap and hours gap about two times larger (column 8), and the impact of changes in nonemployment is much larger in the newer members than in the EU15, so wages also respond more rapidly to slack. Hence, in the wake of the global financial crisis, the adverse impact of domestic slack on newer member state wage growth was much larger than in the euro area excluding Germany. In more recent years, as discussed earlier in this chapter, domestic slack has diminished more rapidly in the newer member states, with an estimated contribution to wage growth of about 2 percentage points. In addition, wage dynamics in the newer members are also found to be more sensitive to external labor market developments, with combined spillovers from euro area unemployment and euro area wage rises accounting for about 1½ percentage points of the wage pickup in the newer members, compared with less than ½ percentage point in the euro area excluding Germany during 2015–17.

In the euro area, subdued inflation has been a key factor weighing on wage rises in recent years (Figure 2.23). Compared with the new EU

Figure 2.22. Contributions to Wage Growth

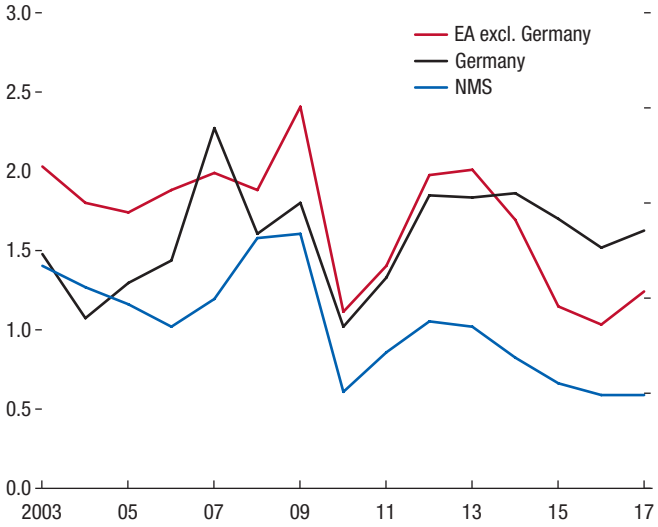


Sources: Eurostat; Haver Analytics; and IMF staff calculations.
Note: EA = euro area; NMS = newer EU members.

members, expected and lagged inflation are much more important factors driving wage formation in the EU15, with the coefficient on lagged inflation much more significant and the contribution from expected inflation more than two times higher in the EU15 than in the newer member states. Despite some recent increases in actual inflation, near-term expected inflation in the euro area remains subdued. Thus, the overall contribution of inflation expectations to wage increases declined by half a percentage point during 2016–17 compared with 2012–13.

To summarize, wage developments in the EU15 and newer EU members are driven by different factors. In the EU15, wages typically respond very slowly to changes in unemployment and are closely related to inflation and inflation expectations. Viewed against this evidence, current wage developments are not unusual, rather, inflation and inflation expectations are unusually low. By contrast, in the newer EU members, the econometric evidence suggests that wage growth responds very quickly to changes in unemployment. This, together with lower importance of inflation and inflation expectations,

Figure 2.23. Contribution to Wage Growth from Inflation and Inflation Expectations
(EA excluding Germany versus EMs, percent)



Source: IMF staff calculations.
Note: EA = euro area; EMs = emerging markets; NMS = newer EU members.

explains why wage growth in these states is now running much higher. Other factors, such as cross-country labor market spillovers, also play a role in wage growth. For the EU15, this role is smaller than that of labor market slack and inflation. For the newer EU members, it is smaller than the role of slack but larger than that of inflation.

Expectations, Wages, and Inflation

Understanding wage dynamics and how the role of key factors, such as slack, inflation, and inflation expectations, has evolved over time is particularly important for policymakers. Has the sluggish wage growth in the euro area been due to a flattening of the wage Phillips curve? Or is it because wages have become more tied to low inflation expectations, which have themselves become less anchored to targets given prolonged low inflation? Did wage moderation contribute to low inflation in the euro area, and what are the implications for getting inflation back to the European Central Bank's target? In the newer member states, would the already strong wage growth accelerate given the tight labor market conditions? How much of this wage growth, given productivity, would be passed to inflation?

To shed light on these questions, this section investigates how the role of slack, inflation, and inflation expectations has changed over time. Specifically, it looks at (1) how anchored inflation expectations have remained over time; (2) how the parameters of the baseline Phillips curve estimated earlier in this chapter have evolved over time; and (3) the extent of the pass-through from wage growth to inflation. Separate analyses are done for the EU15 and the newer EU members, in part because the chapter finds notable differences in wage behavior between these regions.

Anchoring of Inflation Expectations

The anchoring of inflation expectations is analyzed by assessing whether inflation expectations are systematically sensitive to movements in actual inflation. Drawing on similar approaches in the literature (see Chapter 3 of the April 2013 WEO; Strohsal, Melnick, and Nautz 2016; and Lyziak and Paloviita 2017), the equation below is estimated for the euro area countries and newer EU members with quarterly data beginning in the first quarter of 1998, wherever data are available, until the third quarter of 2017:

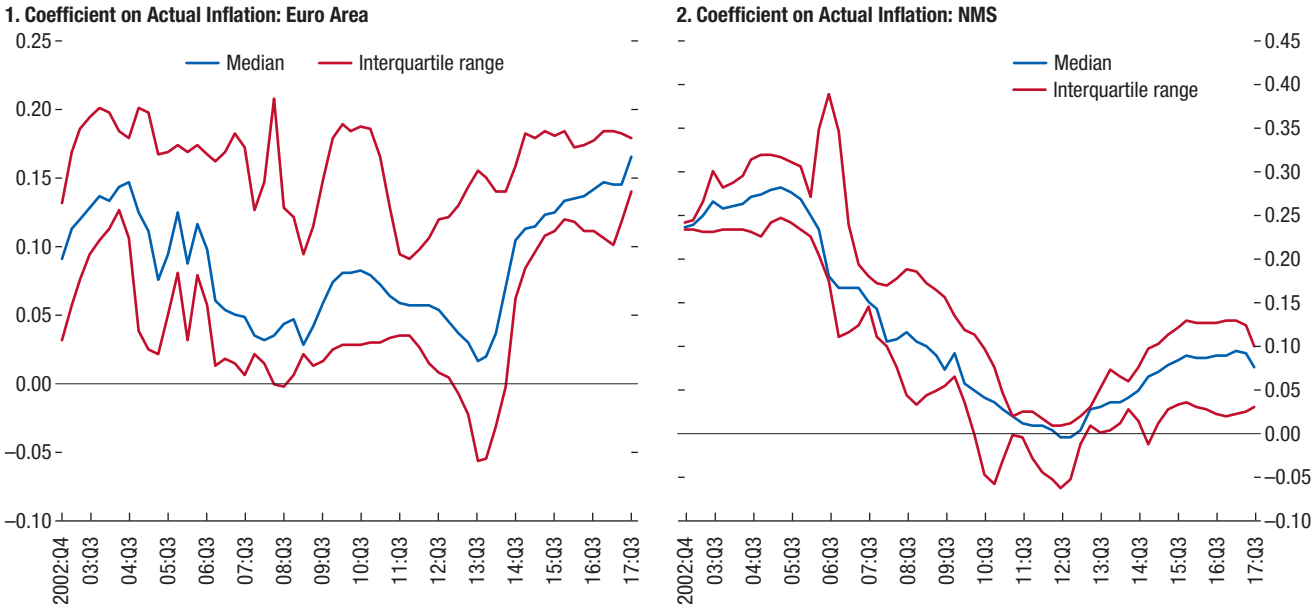
$$\pi_t^e - \bar{\pi} = \alpha + \beta(\pi_t - \bar{\pi}) + \varepsilon_t, \qquad (2.1)$$

in which π_t^e represents a measure of inflation expectations, π_t actual inflation, and $\bar{\pi}$ the inflation target for a given country. Inflation expectations are firmly anchored in the short term if they are not systematically sensitive to movements in actual inflation, that is, when $\beta = 0$ (see Bernanke 2007 for a similar concept). To assess how the anchoring of inflation expectations has evolved over time, five-year rolling regressions of the above equation are estimated.

Consensus Forecasts for inflation are used to measure inflation expectations. More specifically, two-year-ahead forecasts are used in the baseline estimates, and robustness of the results is checked with five-year-ahead forecasts.[28] For the euro area and each member country, the inflation target is taken to be 1.9 percent, in line with the European Central Bank's definition of price stability. For the Czech Republic, Hungary, Poland, and the Slovak Republic, the target is the rate announced by the central bank or the simple average of the announced rates at a given point in time, interpolating linearly wherever necessary.

[28]Market-based inflation expectations are appealing but they are potentially biased due to inflation risk, liquidity risk, and institutional distortions (Lyziak and Paloviita 2017). Such biases are likely significant during times of financial stress and unconventional monetary policy. Market-based measures are not available for all newer member states, or markets tend to be shallow. For the aggregate euro area for which data are available, the results are robust to using market-based measures of inflation expectations (five-year-forward inflation compensation five years ahead).

Figure 2.24. Rolling Regressions of Inflation Expectations over Actual Inflation



Sources: Consensus Forecasts; and IMF staff calculations.
Note: The blue lines denote the point estimates, and the red lines denote the 95 percent confidence bands. The time period shown on the horizontal axis reflects the end of each five-year rolling window. Euro area countries used in the estimation are France, Germany, Italy, Netherlands, and Spain; for NMS countries, Czech Republic, Hungary, Poland, and Slovak Republic. NMS = newer EU members.

In the euro area, there are some signs of a deanchoring of inflation expectations in recent years. The rolling regression estimates show an increase in the coefficient on actual inflation, indicating that inflation expectations have become somewhat more sensitive to movements in actual inflation (Figure 2.24). To address potential endogeneity, the equation is estimated using lagged actual inflation; the headline results remain robust. The results with the one-year-ahead inflation expectations (estimated at the country level) and five-year-ahead inflation expectations (estimated as an aggregate for the euro area) are similar. Overall, the results support the view that low inflation since the global financial crisis contributed to some deanchoring of inflation expectations in the euro area similar to Lyziak and Paloviita (2017).

In newer members, inflation expectations seem to have become more anchored over time. Expectations have become less sensitive to movements in actual inflation than they were during the period preceding the global financial crisis. Although there has been some reversal of this trend in the past five years, the sensitivity remains quite low.

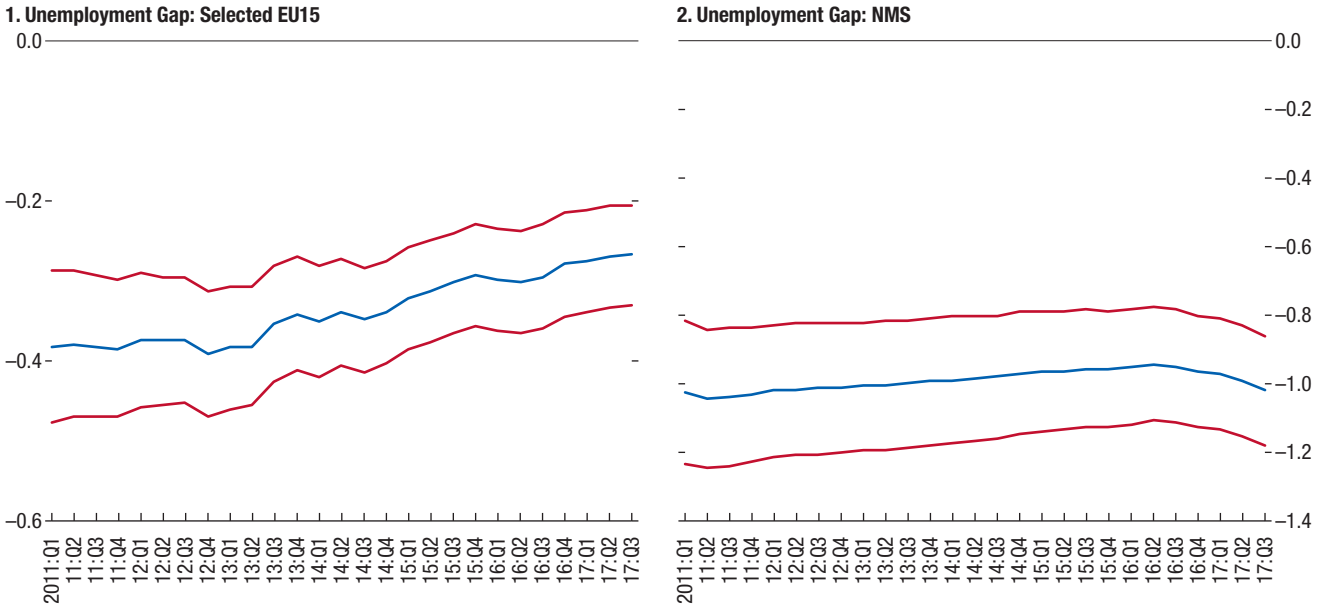
Role of Slack, Indexation, and Inflation Expectations for Wage Growth over Time

The stability of the wage Phillips curve coefficients is tested using rolling regressions. Following the baseline specification presented earlier in this chapter, the following equation is estimated:

$$w_t = \alpha + \beta X_t + \varepsilon_t, \qquad (2.2)$$

in which w_t denotes nominal wage growth and X_t denotes a vector of explanatory variables that includes actual inflation, expected inflation, and the unemployment gap. The vector also includes trend productivity growth and change in the unemployment rate as controls. Taken together, the vector includes a set of core variables in a standard Phillips curve analysis. Lags of the

Figure 2.25. Rolling Estimates of Coefficient before Unemployment Gap



Source: IMF staff calculations.
Note: The blue lines denote the point estimates, and the red lines denote the 95 percent confidence bands. The time period on the horizontal axis denotes the end of each 15-year rolling window. EU15 = long-standing EU members; NMS = newer EU members.

explanatory variables are taken consistent with the earlier analysis in this chapter. To assess how the impact of indexation, slack, and inflation expectations on wages has evolved over time, the above equation is estimated in a panel with 15-year rolling windows using quarterly data from the first quarter of 1996 to the third quarter of 2017, separately for the euro area (excluding Germany) and the newer EU member states, as before.

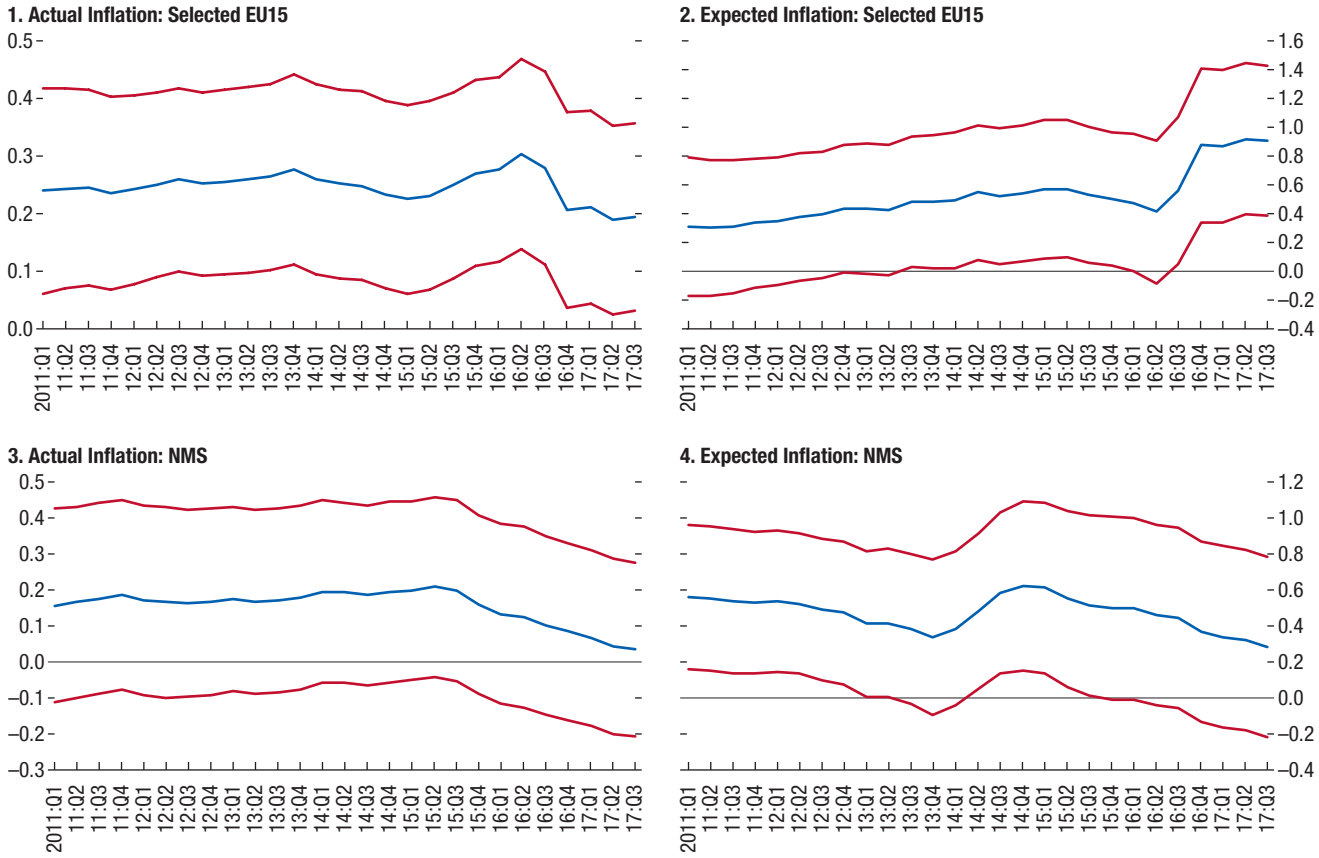
The slope of the wage Phillips curve is found to be broadly stable for both the euro area and the newer member states. For the euro area, the estimated coefficient on the unemployment gap starts at about –0.4 and rises only modestly to –0.3, while for the newer members, the coefficient is stable at about –1 (Figure 2.25). These results use hourly total labor compensation as in the baseline specification earlier in this chapter. Results using hourly wages and salaries paint a similar picture. Thus, the wage Phillips curve has not flattened significantly since the early 2000s. This result is consistent with existing studies that find that much of the flattening of the Phillips curve (for wages and prices) occurred in the 1980s, while the slope parameter has remained broadly stable since then (Blanchard, Cerutti, and Summers 2015; Borio 2017).[29]

In the euro area, wage setting has become notably more forward-looking over time. The coefficient on inflation expectations has increased from about 0.3 in the late 1990s to about 0.8 (and statistically significant) in recent years (Figure 2.26).[30] At the same time, wage adjustment in response to actual inflation has declined modestly in recent years, from about one-quarter to one-fifth. In newer member states, the coefficient on expected inflation has varied without a clear trend, and there is some decline in the impact of actual inflation in recent years.

[29]Recent literature offers little consensus on how the slope of the wage Phillips curve has evolved in recent times (Riggi and Venditti 2015; Constâncio 2017; Bonama, de Haana, and van Limbergen 2018).

[30]To the extent that inflation expectations in the euro area have become more sensitive to actual inflation in recent years, this would tend to increase the effect of actual inflation on wages. That said, the impact is likely minor given the modest estimated sensitivity of inflation expectations to actual inflation (Figure 2.24).

Figure 2.26. Rolling Estimates of Coefficient before Actual and Expected Inflation



Source: IMF staff calculations.
Note: The blue lines denote the point estimates, and the red lines denote the 95 percent confidence bands. The time period on the horizontal axis denotes the end of each 15-year rolling window. EU15 = long-standing EU members; NMS = newer EU members.

Pass-through from Wages to Inflation

The pass-through of wages to inflation is studied using a vector autoregression (VAR) model. Building on Peneva and Rudd (2017), a four-variable VAR is estimated comprising relative import price inflation (ratio of import prices over the GDP deflator), nominal wage growth adjusted for trend productivity growth, consumer price inflation, and an unemployment gap (based on OECD estimates of the NAIRU).[31] The multivariate framework of the VAR allows for assessing the pass-through of wages (adjusted for productivity) to prices while controlling for endogenous feedback effects with prices and slack.[32] The VAR is estimated as a panel separately for the EU15 and the newer members using quarterly data from the first quarter of 1998 to the third quarter of 2017. A Cholesky decomposition is used for the identification of the shocks, with the variables ordered as described above. The ordering reflects a relative exogeneity of the variables, whereby import prices are assumed most exogenous and the unemployment gap the most endogenous (Peneva and Rudd 2017). By ordering wage growth before inflation, it is assumed that movements in wages have an immediate impact

[31]Adjusting wages for productivity produces unit labor costs, which are a key driver of inflation in many economic models; they also shape external competitiveness.

[32]The responses of wage growth to shocks to inflation and the unemployment gap—positive in the former and negative in the latter—are consistent with the panel regression estimates in this chapter.

on inflation, but wages take at least a quarter to respond to price movements.[33] Results are robust to alternative ordering of variables (for example, ordering inflation before wages results in similar medium-term dynamics of inflation to a wage shock, even when the immediate impact is constrained to zero).

The medium-term pass-through from wages to prices, while positive, is less than full in both the EU15 and the newer member states. The immediate impact of a wage shock on price inflation is positive yet small, but the impact rises over time to peak around four to six quarters before dissipating after about three years (Figure 2.27). In the EU15, a wage shock that increases wage growth by 1 percentage point on impact is followed by cumulative increases over three years of 0.6 percent in prices, and 2.4 percent in wages, for a pass-through of 25 percent. For the newer members, the cumulative increase is 0.9 percent in prices, and 3.6 percent in wages, for a similar pass-through of 25 percent. The literature also find a less-than-full and relatively small pass-through from wages to inflation, especially after the 1980s (Mehra 2000; May 2017 *Regional Economic Issues: Central, Eastern, and Southeastern Europe*; Peneva and Rudd 2017).

Conclusions and Policy Implications

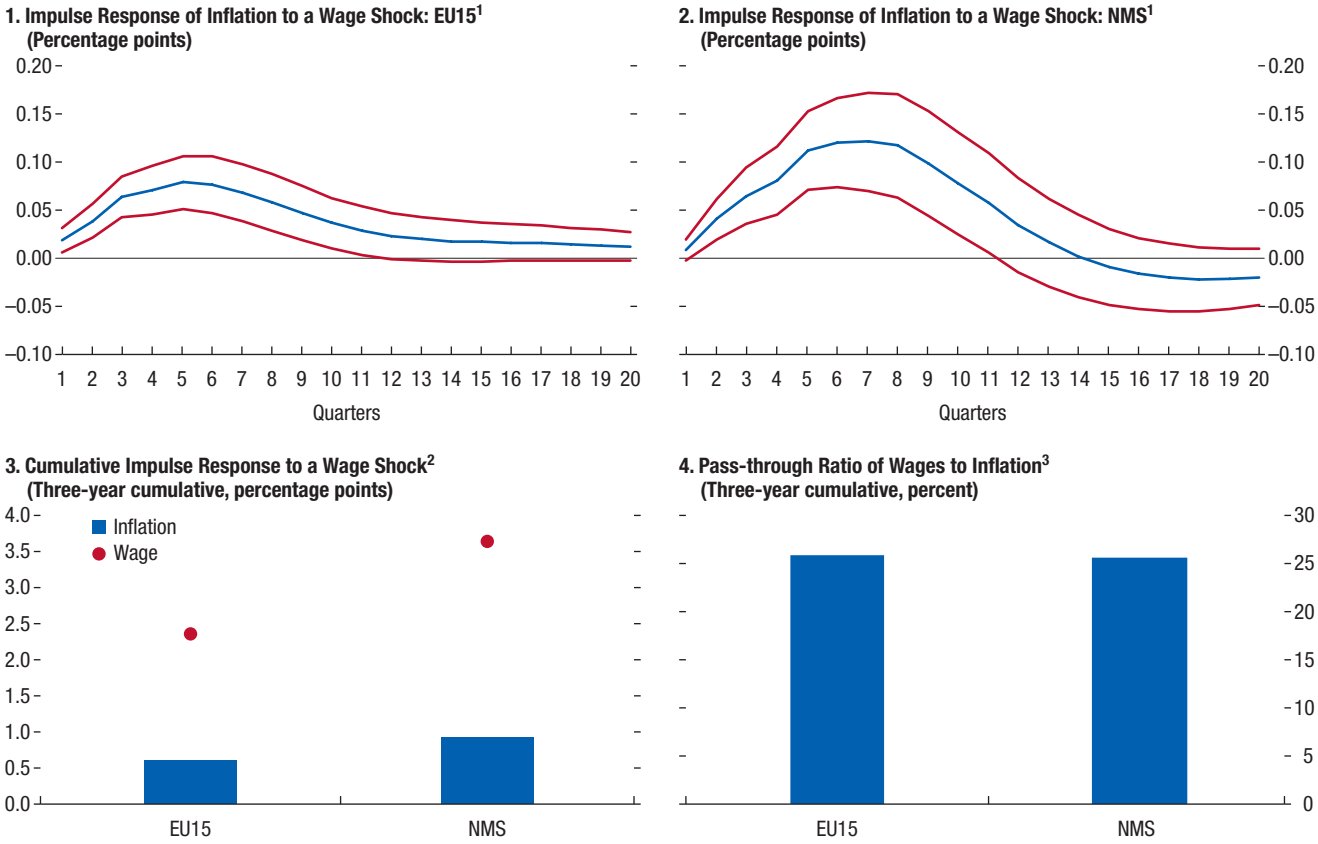
Wage formation in Europe remains principally driven by country-specific conditions, but global and regional factors play a significant role, especially in the newer EU member states. Key points from the analytical work presented in this chapter are the following:

- The wage Phillips curve appears alive and well, having broadly stable parameters, with a modest slope in EU15 countries, and especially strong wage responses to slack in the newer EU member countries. This contributed to the much faster deceleration of wages in the latter countries after the global financial crisis, together with the more recent wage acceleration.
- Real wages are anchored by labor productivity, but deviations from equilibrium can develop. Incorporating such deviations into the analysis facilitates understanding of wage moderation, especially in the wake of major shocks (global financial crisis and the euro area crisis) to regions with nominal wage inertia, such as the EU15.
- While unemployment remains the main indicator of slack, it is also useful to monitor involuntary part-time employment and hours worked per person. A nonemployment index can usefully summarize the first two variables plus marginally attached workers.
- Spillovers can operate via both wage and slack developments in other countries. Spillovers are especially strong in the newer EU members, which may reflect the positions of many of those countries in global supply chains and migration effects on domestic labor supply. Migration effects on wages appear to be statistically significant, but small and temporary.
- Inflation expectations are a key driver of nominal wage developments, especially in the euro area. Some deanchoring of these expectations has appeared in recent years owing to prolonged low inflation.

Although the models can broadly account for wage trends, wages in the newer EU member countries are growing somewhat faster than the models would indicate. The moderation of nominal wages in the EU15 is found to reflect principally low inflation expectations and slower productivity growth, together with the relatively modest and lagged impact of slack on wages. Accordingly, provided unemployment continues to fall and inflation gradually increases in line with projections in the April 2018 WEO, wage rises are also projected to pick up in the EU15,

[33]This distinguishes only between orthogonalized shocks to wages and inflation in the VAR system. A deeper structural interpretation of the fundamental drivers of wage and inflation shocks is beyond the scope of the chapter.

Figure 2.27. Pass-through from Wages to Inflation



Source: IMF staff calculations.
Note: EU15 = long-standing EU members; NMS = newer EU members.
[1]Impulse responses of inflation, for different horizons, to a wage shock that increases wage growth by 1 percent on impact. The blue lines denote the point estimates of the impulse responses, and the red lines denote the two standard deviations confidence bands.
[2]Cumulative impulse responses of inflation and wage growth to the wage shock at the end of three years.
[3]Pass-through ratio from wage growth to inflation at the end of three years. The pass-through is defined as the ratio of the cumulative change in inflation at the end of three years over the respective cumulative change in wage growth.

but the process will take much longer than in the newer EU members. In contrast, even with contributions from declining domestic slack in the newer members, and spillovers from declining euro area unemployment, the recent acceleration in new member state wages is not fully accounted for. Migration of skilled workers from the newer members and hikes in minimum wages and public sector wages are potential contributors to these developments, which have lifted wages to relatively high levels compared with trends in labor productivity.

For the euro area, the central policy implication is to underpin a firm reanchoring of expectations to the inflation target. The analysis suggests that the negative impact of slack on wages was deepened and prolonged by downward adjustments in inflation expectations, which have become more sensitive to actual inflation developments as inflation remained below target in recent years. Accordingly, to ensure the effectiveness of the inflation target in promoting macroeconomic stability, it remains essential for the European Central Bank to stay committed to its strategy to durably raise inflation to target. Regarding current account rebalancing within the euro area, the analysis suggests that although the wage and real exchange rate adjustments following the global financial crisis were sizable, they do not fully account for the major adjustments in current

accounts, which were principally the result of swings in domestic demand financed by capital inflows. Nonetheless, wage developments in the euro area are broadly consistent with promoting adjustment in current account imbalances, with room for further unit labor cost rises in Germany and perhaps also in the Netherlands.

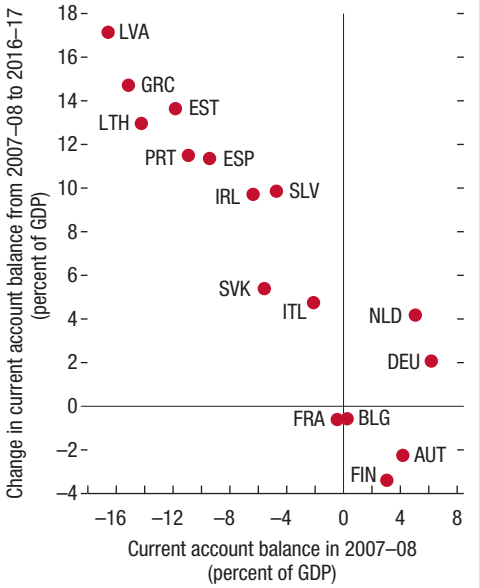
Recent wage developments in newer EU member countries increase the urgency for implementation of reforms to reduce skill mismatches and support labor force participation. The sharp acceleration of wages during 2016–17 lifted the average ratio of real wages to trend labor productivity to roughly 2½ percent over its historical average in 2017, a level only exceeded temporarily in mid-2008 for two quarters. There is naturally a concern that the impact on profitability will undermine investment and growth. Mobilizing labor supply through measures to reduce skill and locational mismatches could usefully help contain wage pressure and support employment and growth. Given unfavorable demographics and emigration, active labor market policies aimed at increasing participation rates and reducing structural unemployment are needed to boost labor supply. More retraining courses for the unemployed and apprenticeship systems would help systematically develop the necessary skills and alleviate skill mismatches. Also, structural reforms focusing on strengthening institutions and improving public sector efficiency would not only help convergence, but would also encourage potential emigrants to stay.

Box 2.1. Euro Area Wage Developments and External Rebalancing

Wage developments in the euro area are broadly consistent with promoting adjustment in external imbalances, with a need for further unit labor cost rises in Germany and the Netherlands. Other countries should seek higher productivity growth, including improvement in competitiveness.

There have been substantial reductions in external imbalances within the euro area since the global financial crisis. Countries with large external deficits in 2007–08 (Estonia, Greece, Latvia, Lithuania, Portugal, Spain) have seen the largest increases in their current account balances. Italy's balance also rose notably, though its initial deficit was modest (Figure 2.1.1). In some countries with surpluses of 3 to 4 percent of GDP balances declined (Austria and Finland). Outliers from this perspective are Germany and the Netherlands, whose large intial surpluses continued to increase after the global financial crisis.

Figure 2.1.1. External Adjustment Relative to Initial Conditions in Euro Area Countries



Source: IMF staff calculations.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes.

Developments in unit labor costs are mostly supportive of this external adjustment. Unit labor costs in Greece, Portugal, and Spain have fallen 10 percent or more relative to the euro area average since the global crisis. This adjustment reflects labor shedding at first and below-average wage rises more recently (Figure 2.1.2). In some countries with declines in their external balances, relative unit labor costs increased (Austria and Finland). Beginning in 2011, Germany's wage growth appropriately drove an increase in its relative unit labor costs, although its external surplus continued to rise. However, the relative unit labor costs in the Netherlands declined in recent years despite its strong initial surplus.

These adjustments in relative unit labor costs within the euro area have also supported adjustments in multilateral indicators of competitiveness. Recent research finds that the unit-labor-cost-basis real effective exchange rate has a strong negative correlation with the external balance, whereas there is no such relationship for measures based on the consumer price index or the GDP deflator (Ahn, Mano, and Zhou 2017). The very high unit-labor-cost-basis real effective exchange rates in Portugal and Spain have unwound and are close to 30-year averages, although Portugal remains a little above that.[1] Real effective exchange rates in France and Italy have declined more modestly, and in Austria and Belgium they are broadly stable. Despite the significant rise in Germany's unit labor costs relative to the euro area, the multilateral unit-labor-cost-based real effective exchange rate still appears low, as is true in the Netherlands, albeit to a lesser extent.

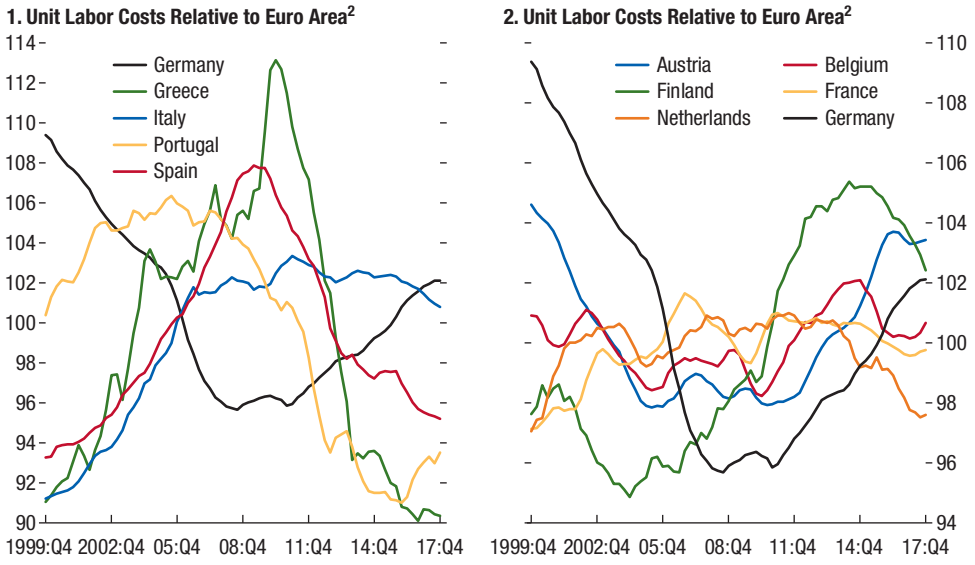
But changes in competitiveness account for only a fraction of the very large current account adjustments. An analysis of the linkage between the exchange rates and the trade balance finds that on average a 10 percent depreciation is associated with a rise in real net exports of 1.5 percent, or a 0.15 elasticity (see Chapter 3 of the October 2015 *World Economic Outlook*). Country-specific elasticity estimates are provided in IMF (2017b),

[1]Data for Greece could not be calculated on this basis as it starts only in 2000.

Box 2.1 *(continued)*

Figure 2.1.2. Unit Labor Costs Relative to Euro Area[1]

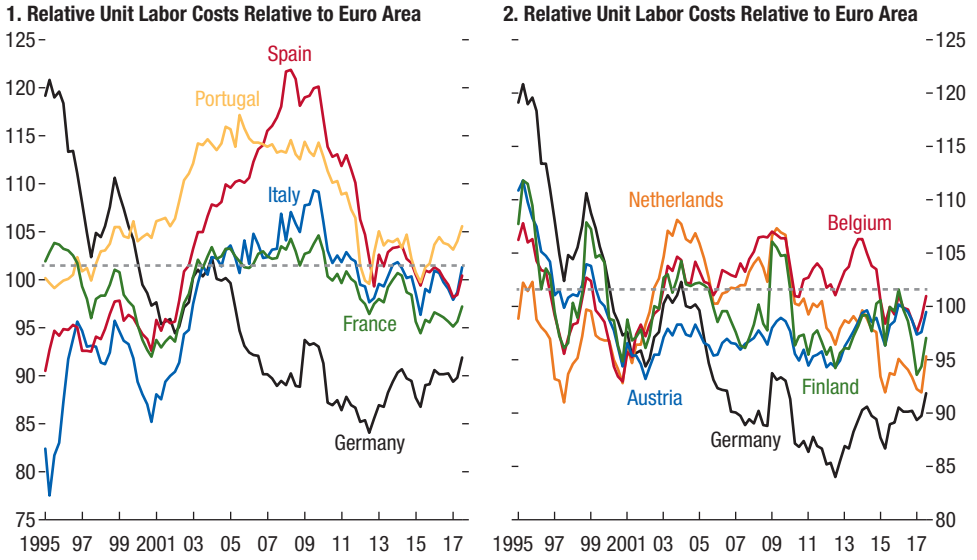
(Average for 2000–16 = 100)



Source: IMF staff calculations.
[1]Using the historical average as the base for unit labor cost-based real effective exchange rate aims to allow for differences in competitiveness at a time of entry to the euro area, without implying this is a long-term equilibrium exchange rate. For each country, the index is computed relative to the euro area and then averaged over 2000–16.
[2]Unit labor costs are the ratio of wages and salaries per hour (national accounts) to the trend in hourly labor productivity from a Hodrick-Prescott filter.

Figure 2.1.3. Relative Unit Labor Costs Relative to Euro Area Average

(Average for 1985–2015 = 100)



Sources: Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: Unit labor costs are the ratio of wages and salaries per hour (national accounts) to the trend in hourly labor productivity from a Hodrick-Prescott filter.

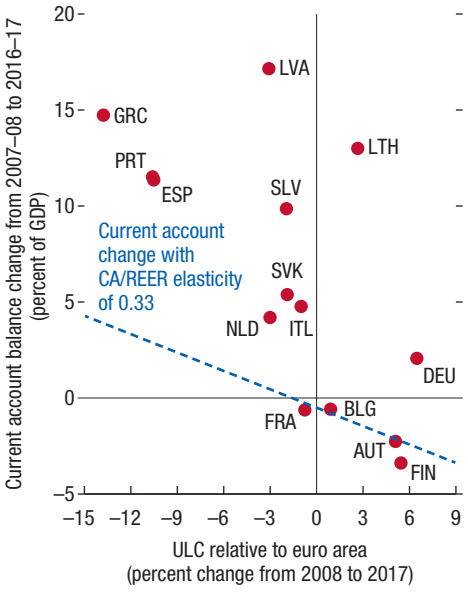
Box 2.1 *(continued)*

with a median of 0.33 for the euro area countries identified. Applying this elasticity to either (1) the change in relative unit labor costs relative to the euro area average or (2) the change in the multilateral real effective exchange rate on a unit labor cost basis, generates implied current account adjustments well short of those in the countries with large adjustments.

This observation is consistent with the view that a sudden stop in capital inflows drove the sharp adjustment in external balances within the euro area (Baldwin and others 2017). From this perspective, the pre-global-financial-crisis external deficits to a large extent resulted from capital inflows driving aggregate demand via credit growth and/or fiscal deficits. When these inflows ended—as a result of the global and euro area crises and the unwinding of distorted asset prices, risk premiums, and private sector expectations—saving and investment also shifted in a manner that increased the current account balance consistent with full employment. The labor market slack arising during the adjustment process, to varying degrees in different countries, also supported a decline in wages relative to productivity and hence declines in unit labor costs. Although these relative declines were supportive of an external adjustment feasible with a smaller than otherwise reduction in domestic demand, their co-movement with the external balance does not make them the primary driver.

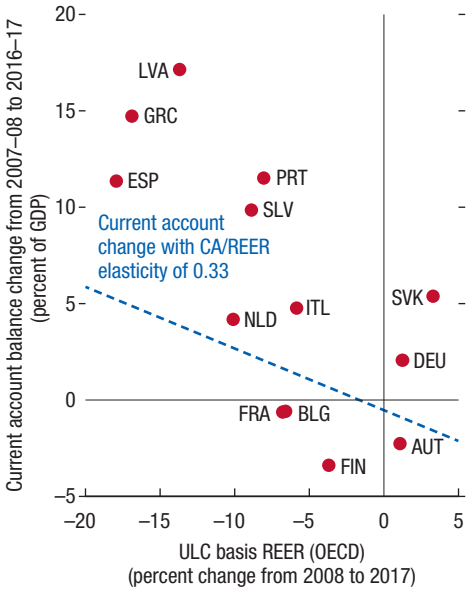
Real exchange rate adjustment remains appropriate in countries with large current account deficits before the crisis. The external balances of Greece and Portugal are now at or above their External Balance Assessment norms, with Spain in surplus yet below its norm (see IMF 2017b). Nonetheless, these three countries have large negative international investment positions, adding to the importance of aiming for higher productivity

Figure 2.1.4. External Adjustment and Euro Area Relative Unit Labor Cost Developments



Source: IMF staff calculations.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. CA/REER = current account/real effective exchange rate; ULC = unit labor cost.

Figure 2.1.5. External Adjustment and Multilateral Relative ULC Developments



Source: IMF staff calculations.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. CA/REER = current account/real effective exchange rate; OECD = Organisation for Economic Co-operation and Development; ULC = unit labor cost.

Box 2.1 *(continued)*

growth to boost competitiveness.

The continued sizable surpluses in Germany and the Netherlands call for policy adjustments to promote a greater balance of saving and investment. Such policies should include supporting continued relative gains in unit labor costs in Germany and a shift toward relative increases in the Netherlands.

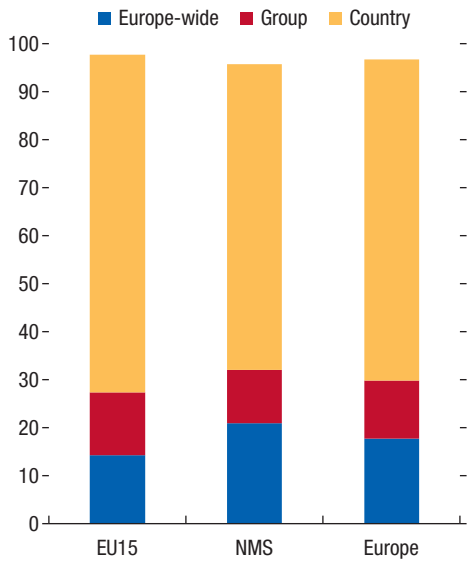
Box 2.2. Wage Dynamics: How Important Are Common Factors?

Wages across Europe can have common underlying drivers. Domestic drivers of wages—such as unemployment and inflation—could have a significant common component either due to common shocks (for example, commodity price shocks) or through spillovers (given trade and finance channels). Common factors could be even more important in European countries. For instance, European Union (EU) trade and labor market integration could make wages in EU countries more dependent on labor market conditions, including wages, in other countries due to the threat of production relocation or migration. The common monetary policy in the euro area could increase wage co-movement in these countries as well. Thus, it is important to understand the extent to which movements in domestic wages stem from forces beyond borders.

The objective of this box is to quantify the role of common factors in driving wage dynamics in the EU15 and newer EU member states. It addresses the following questions: (1) How important are common factors in driving wage dynamics in European countries? (2) To what extent are these common factors Europe-wide; that is, common to both EU15 and newer members, and, given their structural differences, specific to EU15 and newer member states? (3) How has the role of these common factors evolved over time?

This box uses a multifactor dynamic factor model to analyze the cyclical drivers of wage growth across European countries. The model decomposes wage growth (year-over-year growth of quarterly wages, demeaned) at the country level into the following factors: (1) a Europe-wide factor that captures fluctuations common across all European countries; (2) two group-specific factors that capture fluctuations common across the EU15 and the newer EU members; and (3) idiosyncratic terms or country factors that are specific to each country.[1] The common factors capture wage co-movement due to either common shocks or spillovers, but cannot distinguish between the two. Given structural differences across the EU15 and newer EU member countries that could produce different wage dynamics, the group-specific factors are designed to capture commonalities specific to each group. The model is estimated using Bayesian techniques for 26 European countries (the EU15 countries and 11 newer EU members) for the first quarter of 2002 to the third quarter of 2017. To assess how common factors have evolved over time, the model is estimated using five-year rolling windows.

Figure 2.2.1. Variance Explained by Europe-wide, Group, and Country Factors: Full Sample
(Percent)



Source: IMF staff calculations.
Note: Variance in wage growth explained by the estimated Europe-wide, group, and country factors using the full sample estimate of the dynamic factor model. Numbers are unweighted averages across countries in each group. EU15 = long-standing EU members; NMS = newer EU members.

Common factors explain a significant portion of wage growth in European countries. More precisely, the Europe-wide and group-specific factors combined explain more than a quarter of the variance of wage growth during 2002–17 (Figure 2.2.1). The role of the Europe-wide factor is larger for the newer members, consistent with the fact that they are small

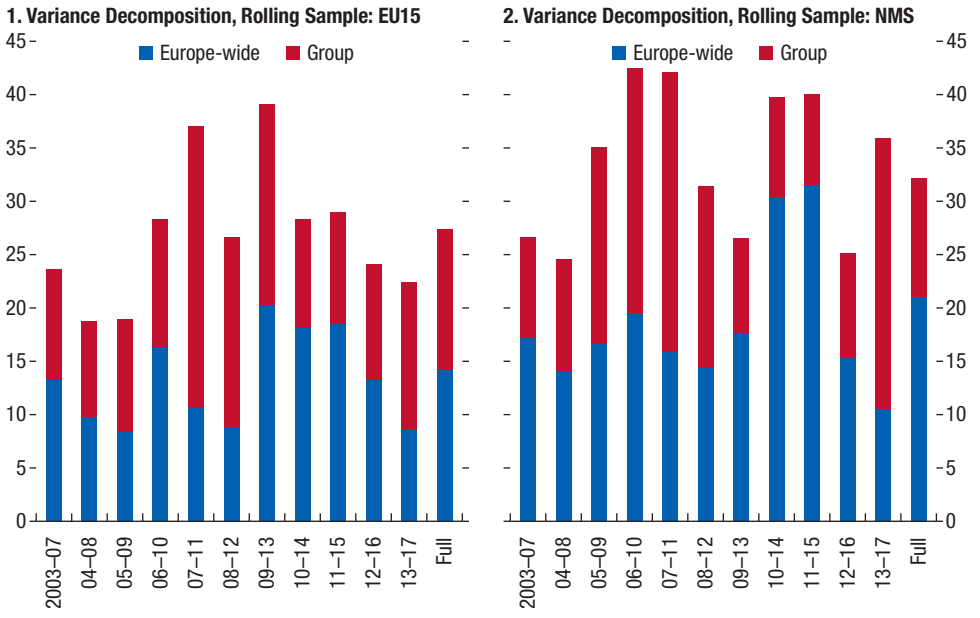
[1]To the extent that Europe-wide factors evolve as part of a broader global phenomenon, the Europe-wide factor could represent global developments as well. For a detailed discussion of the model and estimation, see Kose, Otrok, and Whiteman (2003).

Box 2.2 *(continued)*

open economies. On the other hand, the group-specific factor has a somewhat larger role for the EU15. This can be rationalized in terms of more synchronous business cycles in a monetary union that characterize the EU15. Even though common factors play an important role, country-specific factors remain the most significant driver of wage dynamics, explaining about three-quarters of their variance. The results are robust to using a simpler Principal Components Analysis to estimate the common factors. Also, while work on wage co-movement is scant, the above findings are broadly in line with the literature on inflation co-movements. For instance, the European Central Bank (2017) finds that common factors explain about a quarter of the variation in core inflation based on a comparable sample used in this box.[2]

The rolling estimates suggest that wage co-movement increased during crisis periods (Figure 2.2.2). This is in line with Chapter 2 of the October 2017 *World Economic Outlook*, which attributes increased wage co-movement to downward pressure on wage demands due to synchronized recessions and elevated concerns about job losses in the aftermath of the 2008–09 global financial crisis and the European sovereign debt crisis. More generally, Chapter 3 of the April 2013 *World Economic Outlook* finds that activity and financial variables are more correlated during crisis periods. While wage co-movement in recent years was somewhat smaller than during these crisis episodes, it nonetheless remained sizable.

Figure 2.2.2. Variance Explained by Europe-wide and Group Factors: Rolling Samples
(Percent)



Source: IMF staff calculations.
Note: Variance in wage growth explained by the estimated Europe-wide, group, and country factors using the rolling sample estimates of the dynamic factor model. Numbers are unweighted averages across countries in each group. EU15 = long-standing EU members; NMS = newer EU members.

[2]Several studies also find a significant role of common factors in driving inflation (Ciccarelli and Mojon 2010; Mumtaz, and Surico 2012; Kamber and Wong 2018). Admittedly, our quantitative findings are more in line with the co-movement of core inflation than headline inflation. See ECB (2017) for a survey.

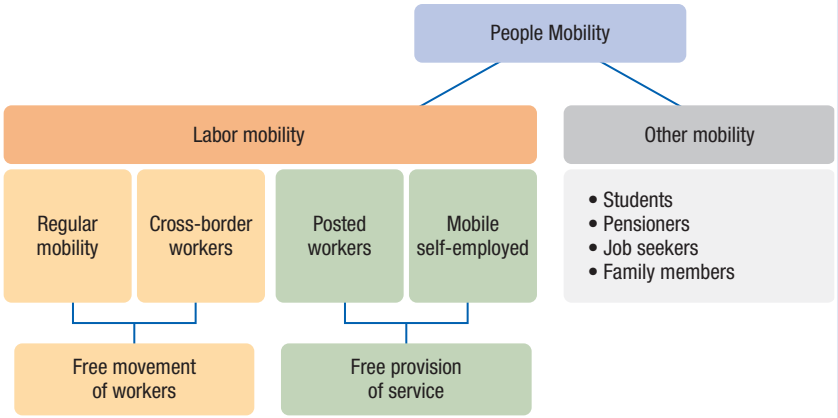
Box 2.2 *(continued)*

Overall, these results attest to an important role of common factors for wage dynamics in European countries. Common wage drivers, such as slack and inflation—given strong economic integration among European countries, and direct spillovers from wage setting in one country to others as a result of product, labor, and financial markets—likely explain a significant portion of European wage dynamics in recent years.

Box 2.3. Labor Mobility in Europe

Freedom of movement for workers is a fundamental principle enshrined in Article 45 of the Treaty on the Functioning of the European Union (EU). Labor mobility also occurs via the free cross-border provision of services as illustrated in Figure 2.3.1:

Figure 2.3.1. Mobility of People in the European Union



Source: Barslund and Busse (2016).

Under the Treaty:

- EU citizens are entitled to (1) look for a job in another EU country; (2) work there without needing a work permit; (3) reside there for that purpose; (4) stay there even after employment has finished; and (5) enjoy equal treatment with nationals in access to employment, working conditions, and all other social and tax advantages.
- EU nationals may also have certain types of health and social security coverage transferred to the country in which they go to seek work.
- People working in some occupations may also be able to have their professional qualifications recognized abroad.
- Free movement of workers also applies, in general terms, to the countries in the European Economic Area, which covers Iceland, Liechtenstein, and Norway.

EU social security coordination provides rules to protect the rights of people moving within the European Union, Iceland, Liechtenstein, Norway, and Switzerland.

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