

Wage growth in Germany: assessment and determinants of recent developments

The swift macroeconomic recovery in Germany following the recent recession was accompanied by strong growth in employment. Furthermore, last year saw unemployment hit its lowest level since German reunification. While the initial phase of the economic recovery brought with it catch-up effects in nominal rates of wage growth, the rise in hourly earnings since 2014 has failed to keep pace with the continuing high demand for labour. The finding of comparatively moderate wage growth over the past few years has also attracted attention internationally. Moreover, as wage growth is a key determinant of trend inflation, it is in the interests of monetary policymakers to observe and analyse the wage formation process.

Comparisons with similar phases of the business cycle before the Great Recession and with wage growth in other euro area countries do not suggest a weakening of wage dynamics. The leeway for income distribution, which can be defined by labour productivity and prices, has also been utilised quite well over the past few years – in contrast to the preceding decade. Nevertheless, the finding of moderate wage growth emerges more clearly by placing it in the empirical context of the determinants used in the economic literature. Analyses using the Beveridge curve and the wage Phillips curve present a picture of perceptibly dampened wage dynamics.

The results also indicate that the high level of labour market-oriented net migration over the past few years, chiefly from other EU countries, has helped to satisfy the increasing demand for labour. This has tended to be accompanied by a wage dampening effect. All things considered, the data currently available suggest that this effect stems to a large extent from many immigrant workers taking up employment in comparatively low-paid areas of activity or sectors.

Over the past few years, relatively moderate productivity growth and subdued inflation itself have also played a part in wage growth. Their impact in this period does not appear to be larger than average, however. Furthermore, non-wage-related factors in the negotiated pay settlements, such as making working hours more flexible combined with possibilities of opting for a higher wage increase or more time off, were of major importance, although it is difficult to quantify their impact on wage dynamics.

Looking to the future, there is much to suggest that the dampening effects will have a decreasing impact. The tightening of the situation on the labour market, which can already be identified on the basis of several indicators, is therefore likely to play a greater role in shaping wage growth.

Moderate wage growth with high increase in employment

Wage growth since 2014 rather moderate

The rapid macroeconomic recovery in Germany following the end of the recession in 2008-09 was accompanied by strong growth in employment. Last year, unemployment, which has been declining since then, hit its lowest level since German reunification. Moreover, wage bargainers have once again been achieving pay settlements which are higher than those agreed during the period of marked wage moderation between 1997 and 2007. Added to this are instances of higher profit-sharing granted to employees, including as compensation for wage concessions during the crisis and in view of rising corporate profits.¹ In the following years, too, high bonus payments were made, especially in the large industrial corporates. Over the past few years, the upward trajectory of the dynamics of both negotiated pay rates and gross earnings has not continued at the same pace, however. Negotiated rates of pay on an

hourly basis rose comparatively moderately by 2.4% on an annual average during the period from 2014 to 2017.² In the case of actual earnings, the rates of growth during this period, at an annual average of 2.7%, may likewise be regarded as rather moderate when measured by the ongoing positive development of the labour market.³

The moderate nominal wage dynamics in Germany over the past few years are, taken in isolation, inconsistent with the extremely high demand for labour. For some years now, various survey findings and indicators have been pointing to increasing tightness in the German labour market. For example, the ifo Institute's labour shortage indicator,⁴ the Federal Employment Agency's BA-X job vacancy index and the aggregate ratio of vacancies to unemployed persons have been reaching all-time highs since 2015.

Growing labour market tightness

For monetary policy, the analysis of wage growth is of major importance with regard to potential instances of price pass-through which may be reflected in the Harmonised Index of

Positive analysis of wage growth

Negotiated pay rates and actual earnings in Germany

Year-on-year percentage change, on an hourly basis



Sources: Federal Statistical Office (actual earnings) and Bundesbank calculations (negotiated pay rates). ¹ The large rise in actual earnings in 2009 is due to special factors during the Great Recession, such as the reduction of positive balances on working time accounts with no cut in remuneration.

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¹ In the metalworking and electrical engineering industries, for example, the IG Metall trade union entered pay negotiations in the winter of 2010 without any specific wage demands, and the ensuing negotiated pay settlement contained an agreement that there would be no increase in scheduled rates of pay for 11 months. As compensation, employees received two one-off payments. The 2012 pay agreement then contained a permanent 4.3% increase in scheduled rates of pay from May 2012.

² Calculations based on the Bundesbank's negotiated pay rate statistics covering around 500 collective wage agreements and regulations on civil servant pay relating to roughly three-fifths of employees. Rates of remuneration in sectoral or firm-level collective wage agreements serve as a benchmark for a further fifth of employees. See P Ellguth and S Kohaut, *Tarifbindung und betriebliche Interessenvertretung: Ergebnisse aus dem IAB-Betriebspanel 2016*, WSI-Mitteilungen, pp 278-286.

³ The gross salaries and wages per hour worked by employees designated as actual earnings also include individual supplementary payments, bonuses, allowances outside collective agreements and other, for example, commission-based remuneration components. These cover all forms of paid employment.

⁴ According to ifo Institute data for manufacturing and construction. Multi-year and consistent time series since 1991 are available only for these two sectors.

Consumer Prices.⁵ Nevertheless, wages are only one of several factors that determine prices. Moreover, they are not a politically manageable macroeconomic variable but rather the outcome of a negotiation process, enshrined in the German constitution, between autonomous wage bargaining parties or individual employers and employees. From a monetary policy perspective, the analysis of wage developments is therefore based on a positive approach. The aim is not only to classify wage dynamics in terms of the real economic situation on the product and labour markets but also to set it in relation to current and expected macroeconomic price developments. This is because the latter are essentially what determines the monetary policy stance.

Various reference values for recent wage dynamics

In order to assess recent wage dynamics in Germany, use is made, first, of comparisons with earlier boom periods in the German economy, with wage dynamics in other euro area countries, and with the nominal leeway for income distribution resulting from productivity growth and inflation. Second, wage dynamics can be gauged on the basis of more econometrically shaped model approaches. Two frequently used concepts for analysing cyclical developments in wages are the labour market search model, of which the Beveridge curve is one of the core components, and the (wage) Phillips curve.

Assessment of recent wage dynamics based on historical and regional comparisons

Increase in earnings since 2014 stronger than in earlier periods of expansion

It is true that wage dynamics over the past few years have been weaker than they were in periods of economic prosperity in the former Federal Republic of Germany prior to reunification. They were, however, noticeably stronger than in the two earlier expansionary periods for Germany as a whole: the economic upswing around the turn of the millennium as well as the boom immediately preceding the outbreak of the Great Recession of 2008-09. Actual



hourly wages in Germany increased by 2.7% per year on an average of the period from 2014 to 2017, while the increase in the two four-year periods from 1997 to 2000 and from 2004 to 2007 amounted to no more than 2.0% and 0.6% per year respectively.⁶ A similar picture can be seen in the case of negotiated rates of pay on an hourly basis, which, at 2.4% on average in the period from 2014 to 2017, likewise showed a higher rate of growth than in the two reference periods used for comparison,

⁵ There is a two-way relationship between wages and prices; inflation may have feedback effects on wage formation. From a monetary policy angle, the focus is less on an analysis of real wages that is possibly of more immediate interest from the perspective of the social partners and with regard to issues to do with the real economy.

⁶ The introduction of the general statutory minimum wage at the beginning of 2015 and its latest increase in 2017 also play a certain part in this context. Roughly calculated, the introduction of the minimum wage contributed, as a one-off effect, around ½ percentage point to the rise in actual earnings in 2015. The introduction of the minimum wage had a minor effect on the increase in aggregate negotiated rates of pay, as the wage surge due to the minimum wage predominantly affected low-paid workers not covered by collective pay agreements. In addition, a series of generally binding sector-specific minimum wages were raised perceptibly immediately prior to 2015, for example in the hairdressing trade. See Deutsche Bundesbank, Impact of the introduction of the minimum wage on consumer prices – initial findings, Monthly Report, May 2015, pp 64-66. Together with the general statutory minimum wage, this also had an impact on higher pay grades. See Deutsche Bundesbank, Initial indications of how the minimum wage is affecting the increase in earnings, Monthly Report, August 2015, pp 55-56. The upward wage impulses resulting from the latest increase in the minimum wage in 2017 remained manageable from a macroeconomic perspective.

Negotiated pay rates and actual earnings from a long-term perspective

Year-on-year percentage change



Sources: Federal Statistical Office (actual earnings) and Bundesbank calculations (negotiated pay rates). **1** Change in methodology in 1985; data are of only limited comparability with earlier figures. **o** West Germany up to 1991, Germany as a whole thereafter.

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when the average annual increase was 1.9% and 1.0% respectively. This was also reflected in the recently positive wage drift – the difference between the rates of change in actual and negotiated rates of pay. The longer-term average of 2.1% per year since 1994 in the case of negotiated hourly rates of pay and of 2.2% per year in the case of actual hourly remuneration was likewise exceeded on an average of the past four years.

Higher rates of growth in actual earnings in Germany than on euro area average

Hourly wages have also increased relatively sharply in Germany recently when compared with other countries of the euro area. Since 2014, which marked the beginning of the latest economic upturn in the euro area, actual earnings in Germany – as mentioned above – have gone up by 2.7% per year on average, whereas the increase in other euro area countries has been only 1% during the same period.⁷ Before the financial and economic crisis, however, the period from 2000 to 2007 saw a sharp rise in gross hourly earnings in the other

euro area countries, at 3.5%, while the increase in Germany was considerably weaker at 1.4%. Overall, wage growth since the financial and economic crisis shows that the period of wage moderation in Germany has come to an end. Moreover, wage dynamics in Germany are serving as a positive stimulus for the aggregate rate of wage growth in the euro area.

Wage growth and the leeway for income distribution

One key benchmark for aggregate wage growth in the long term is provided by the leeway for income distribution. If real gross wages and salaries per hour grow on a long-term average at the same rate as hourly labour productivity, the aggregate labour income share fluctuates around a constant average value that is consistent with a long-term growth equilibrium. Market-based wage growth in the long term is thus likely to be guided by both developments in labour productivity and the aggregate price level.⁸ Nevertheless, structural changes in an economy's institutional framework can lead to permanent changes in the level of the equilibrium labour income share. Additionally, the full effect of cyclical factors on the labour income share may unfold over a period of several years. As a result, aggregate wage growth may, on average, remain either above or below the leeway for income distribution for several years before the labour income share approaches the equilibrium level.

Prices and labour productivity important in long term

⁷ In many member states, key factors behind the wage increases following the financial and economic crisis, as well as the sovereign debt crisis, were the – sometimes marked – underutilisation in the labour market, country-specific adjustment processes as well as, in some cases, the labour market effects of major reforms. See Deutsche Bundesbank, Wage dynamics amid high euro area unemployment, Monthly Report, December 2016, pp 33-55.

⁸ From the employers' perspective, the cost-related impact of wage increases relative to sales prices is likely to be of main interest, whereas for employees' wage demands, a comparison with consumer prices in terms of the wage increases' purchasing power is of particular importance.

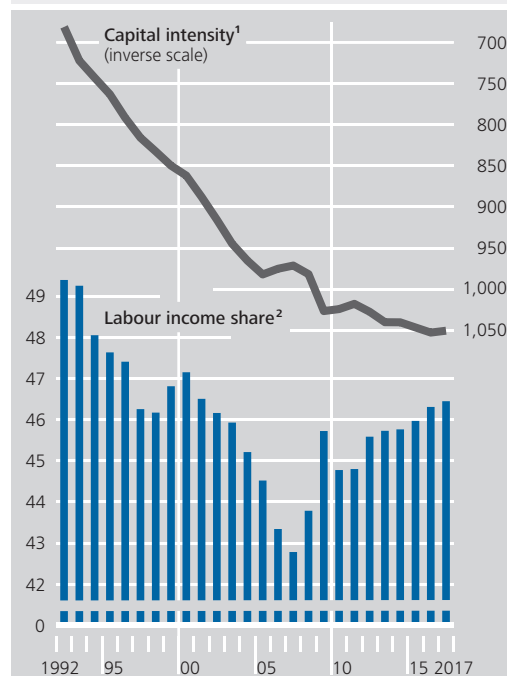
Temporary trend decline in the labour income share

From German reunification until about 2007, the price-adjusted rise in wages failed to keep pace with growth in labour productivity.⁹ Owing to this development, the aggregate labour income share followed a downward trend in this period. The “wage moderation”, which persisted roughly from 1997 until 2007, was possibly also a response to technological change, especially to the capital intensification of production from the early 1990s to the outbreak of the financial and economic crisis in 2008. As a result, it was presumably possible to limit the employment losses caused by an increased substitution of capital for labour.¹⁰ The diminishing degree of collective bargaining coverage among employees – as documented by the IAB establishment panel – may have also contributed to the declining labour income share in this period. This effect is likely to be due – at least in some sectors – to the associated reduced bargaining power of trade unions in collective wage bargaining.

Wage-dampening effect of capital intensification weaker in recent years

In the period from 2011 to 2017, the pace of capital intensification slowed down, ie fewer workers were substituted by capital than before. More recently, the ratio of capital employed to total hours worked remained more or less unchanged. The wage-dampening effect of capital intensification has therefore been less pronounced over the past few years than on average since reunification, although the effect continues to exist. The decline in collective bargaining coverage has also slowed down since the end of the financial and economic crisis. In line with this, relatively small negative contributions to wage growth have been documented in empirical model analyses since then. Nevertheless, the precise timing of the effects of lower collective bargaining coverage and reduced trade union bargaining power on wage formation is subject to uncertainties. Therefore, it cannot be ruled out that this development is affecting current wage dynamics more strongly than is suggested by the more or less unchanged degree of collective bargaining coverage in recent years.

Capital intensity and labour income share



1 Capital stock at constant 2010 prices (€ billion) divided by total hours worked (in billion hours). **2** Gross wages and salaries divided by gross value added (each at current prices).
 Deutsche Bundesbank

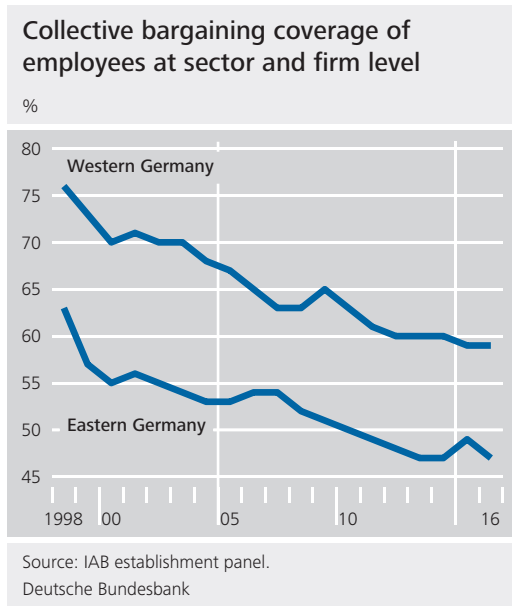
In the course of the recovery from the financial and economic crisis, labour productivity rapidly regained its previous level. Since then, however, labour productivity has grown at an annual average of roughly 0.8%, which is considerably below the pace in the years prior to the crisis.¹¹ Its contribution to wage growth in recent years was thus, if anything, below average. Moreover, the average inflation rate over the period from 2011 to 2017, at 1.3%, under-

Recently, merely subdued impulses from labour productivity growth and inflation

⁹ In this case, Labour productivity is based on the hourly concept in order to capture the rising share of part-time employees in the period under consideration.

¹⁰ See L Karabarounis and B Neiman (2014), The global decline of the labor share, The Quarterly Journal of Economics, pp 61-103, as well as D Acemoglu and D Autor (2011), Skills, tasks and technologies: implications for employment and earnings, Handbook of labor economics 4b, Chapter 12.

¹¹ Possible factors in this context are also the productivity-dampening effects of the labour market integration of low-skilled persons in the wake of labour market reforms in the first half of the last decade as well as the high level of immigration over the past few years. See also Deutsche Bundesbank, Demographic change, immigration and the potential output of the German economy, Monthly Report, April 2017, pp 35-47.



shot its long-term average. According to Consensus Economics data, the expected medium-term inflation rate relative to horizons of two to ten years fluctuated only a little around its long-term mean.¹² Furthermore, owing to sharply falling energy prices, the inflation rate was extremely low in 2015 and 2016. If the period since 2011 is analysed to assess the effects of actual and expected inflation, wage-boosting impulses are likely to have been generated to a certain extent from 2011 to 2014 compared with more wage-dampening ones in the years thereafter.¹³ In summary, wage growth over the past few years was higher than the contributions due to the increase in productivity and inflation.¹⁴ The trend of wage moderation has thus reversed. Nevertheless, at the end of the period under review, the aggregate labour income share was still below its early-1990s level.¹⁵

Wage developments through the lens of the Beveridge and Phillips curves

The assessments of wage developments in recent years made thus far, which have been based on simple comparisons with previous expansionary periods, with other countries, and with the leeway for income distribution,

do not support the notion of surprisingly weak wage growth in Germany. However, such comparisons largely neglect the respective economic environment and the situation on the labour market itself. Approaches which are more deeply rooted in the empirical economic literature and which take these factors explicitly into account are available in the form of the Beveridge curve and the Phillips curve.

Wage growth in the recent past has exceeded the rates seen in previous economic upturns. However, in view of the currently very low level of underutilisation in the labour market, current wage growth is only moderate by historical standards. For instance, the ratio of job vacancies to unemployment has increased in recent years. This development is probably partly attributable to increased labour market efficiency. The rise in the ratio of job vacancies to unemployment appears to be more than just a short-term cyclical phenomenon, as it also manifests itself in the longer-term trends of unemployment and vacancies. Placing the vacancy-unemployment ratio – which, according to the Beveridge curve concept, is an indicator of labour market tightness – in relation to wage growth shows that wage developments have been in line with trend growth in the ratio

Measured in terms of labour market tightness, current wage growth only moderate

¹² The expected inflation rate is cited in the press releases of some German trade unions as an important determining factor in wage negotiations. The estimation of expected inflation may be historical or forward-looking; see German Council of Economic Experts, Für eine zukunftsorientierte Wirtschaftspolitik, Jahresgutachten 2017/18, p 128.

¹³ According to a special survey by the Deutsche Bundesbank on the 2015-16 pay round, wage bargainers considered both the low actual rate of inflation and subdued inflation expectations to be of relevance at that time to the moderate outcome of wage negotiations.

¹⁴ This applies not only to the growth rate of negotiated wages but also, in particular, to that of gross wages and salaries. Over the past few years, the long-term determinants were of greater importance for growth in negotiated wages than they were for growth in gross wages and salaries, which reacted more strongly to changes in cyclical factors. In this regard, variable compensation components in the high income segment outside the collective wage scales possibly also played a part.

¹⁵ Data for the Federal Republic of Germany prior to reunification suggest that the aggregate labour income share had already been following a downward trend since the early 1980s, which was interrupted only for a short while in the early 1990s owing to high wage growth rates, especially in eastern Germany.

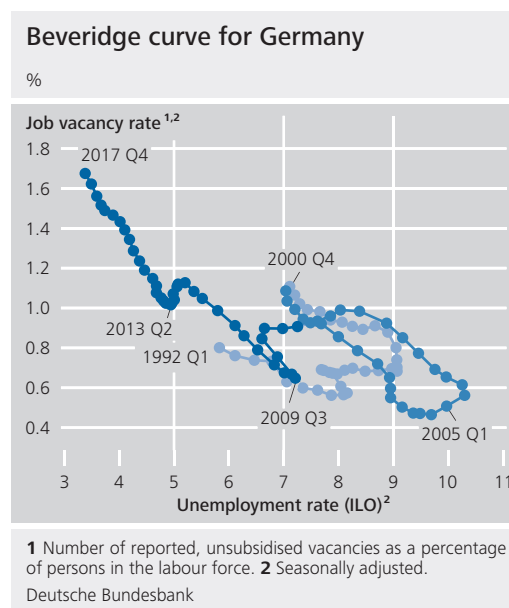
of vacancies to structural unemployment. However, given the currently high degree of labour market tightness, it is not just trend factors but also cyclical factors that have played a role. With this in mind, estimation results show that wage growth in recent years was weaker than would have been expected on the basis of actual labour market tightness alone (see the box on pages 20 and 21).¹⁶

Analysis in context of wage Phillips curve relationship

The Phillips curve concept is probably the most prominent model-based tool for analysing cyclical wage and price developments from a macroeconomic perspective.¹⁷ The wage Phillips curve approach captures the relationship between the labour market in the real economy and nominal wage growth. When employed in macroeconomic models, the wage Phillips curve allows for the analysis of wage developments in relation to key macroeconomic determinants. The core elements include a measure of labour market tightness and an assumption of how inflation expectations are shaped in the context of wage negotiations. Additional factors include labour productivity growth as well as, in some cases, institutional path dependencies in the wage-setting process. Furthermore, the effects of exceptional historical factors, such as German reunification or the currently observed labour market-oriented immigration flow from other EU member states, could also play a role. Using econometric techniques, it is possible to quantify the assumed relationships (see the box on pages 23 to 25).

Labour demand at record high

Following the wage Phillips curve concept, there is a positive relationship between wage growth and the contemporaneous degree of labour market tightness. One explanation for this is that, in times of high levels of employment, the search for a suitable job is considerably easier than in times of high underemployment. Employers may therefore increase their wage offers in order to recruit new staff or retain existing employees. Also, in collective wage negotiations, high labour demand is likely to strengthen the bargaining power of



employees over employers. Currently, a large number of indicators suggest that labour market demand is exceptionally high. For example, the number of registered unemployed is at its lowest level since German reunification. In addition, the ratio of vacancies to the number of registered unemployed in Germany reached a record high in 2017. The vacancy rate has also increased more or less continuously since 2013, when the latest upturn in employment began. Furthermore, survey-based indicators, such as the ifo Employment Barometer or the IAB labour market barometer, do indeed suggest very high labour demand in Germany. Estimates of the unemployment gap, which is the difference between the unemployment rate and the structural rate of unemployment, are consistent with this finding. Given the current results of the available indicators, it is likely that the excellent situation on the German labour market in recent years has, all else being equal, exerted upward pressure on wage dynamics.

¹⁶ Stronger wage growth in the light of the overall macroeconomic landscape was also widely expected on the basis of surveys. See European Central Bank, What can we learn from the ECB Survey of Professional Forecasters about perceptions of labour market dynamics in the euro area?, Economic Bulletin, 2017 (8), pp 49-51.

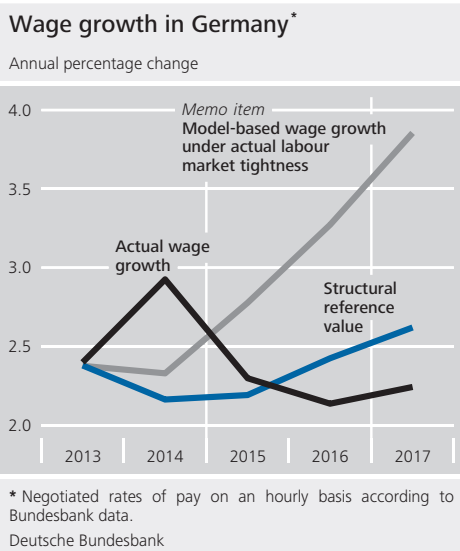
¹⁷ See also Deutsche Bundesbank, The Phillips curve as an instrument of analysis and forecasting inflation in Germany, Monthly Report, April 2016, pp 31-45.

Wages and labour market tightness from the perspective of the Beveridge curve

In addition to purely statistical benchmarks, current wage developments in Germany can be assessed using the wage dynamics that would be suggested by model-based analytical concepts. This can be done in a two-stage procedure. In a first step, the traditional search and matching model of the labour market – where unemployment may also arise in equilibrium – serves as a conceptual framework within which a trend measure for labour market tightness can be derived.¹ Equilibrium labour market tightness – ie the aggregate ratio of vacancies to unemployed – is the product of the interplay between wage-setting and the jobs on offer. It is assumed in this context that the larger the ratio of vacancies to unemployed, the higher the wages employees tend to be able to bargain. By contrast, the number of jobs offered by enterprises is likely to rise with lower wages, all else being equal. In the steady state, the vacancy to unemployment ratio is therefore associated with an equilibrium wage. From an empirical perspective, the trend components of the labour market variables are approximately in line with the steady state. In a second step, the rate of wage growth associated

with the development of trend labour market tightness according to the estimates derived from a standard vector-autoregressive model is determined as a reference measure.²

The starting point for calculating trend labour market tightness is the Beveridge curve, which represents the combinations of vacancies and unemployment. Its downward slope results from the fact that economic upturns typically go hand in hand with a decline in unemployment and an increase in the number of vacancies. Using Federal Employment Agency unemployment figures, the number of reported vacancies as well as labour market flows, it is possible to determine this macroeconomic relationship for Germany.³ Following Germany's far-reaching reforms in the first half of the 2000s, the underlying labour market conditions have, in some respects, changed substantially. This presents another difficulty when implementing such an approach empirically. The estimations indicate that the Beveridge Curve has changed significantly in the wake of the labour market



¹ See C Pissarides (2000), *Equilibrium Unemployment Theory*, 2nd edition, MIT Press.

² See F Kajuth (2018), A benchmark for wage growth through the lens of the Beveridge curve, *Applied Economics Letters* 25 (7), pp 487-492.

³ In the model-based approach, the Beveridge curve depicts combinations of vacancies and unemployed where the associated unemployment rate remains constant over time, all else being equal. This means that the percentage change in the size of the labour force corresponds to the percentage change of those in work. This is composed of the share of unemployed persons and inactive persons entering employment plus the share of workers becoming unemployed or inactive. See M Daly, B Hobijn, A Sahin und R Valletta (2012), A search and matching approach to labor markets: did the natural rate of unemployment rise?, *Journal of Economic Perspectives* 26 (3), pp 3-26; and R Barnichon, M Elsby, B Hobijn and A Sahin (2010), Which industries are shifting the Beveridge curve?, *Federal Reserve Bank of San Francisco Working Paper* 2010-32.

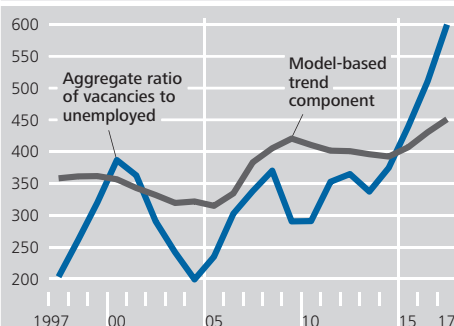
reforms.⁴ In line with the transmission mechanisms based on the model approach, this is likely to reflect mainly the improved employment opportunities for the unemployed since then. This is due to a number of factors, including more intensive job placement and greater efforts in job seeking.⁵

On the basis of the derived Beveridge curve relationship, it is possible to use data on the time-varying structural unemployment rate to calculate the trend component of the number of vacancies.⁶ The results indicate that the trend vacancy to unemployment ratio – the degree of structural tightness in the labour market – has risen markedly in the period since the labour market reforms were introduced. Moreover it has increased somewhat further of late. Comparing this trend variable as a structural benchmark with the actual relationship of the vacancy to unemployment ratio, actual labour market tightness has significantly exceeded its trend component over the past few years.

The trend labour market tightness derived from the Beveridge curve is then built into an econometric model as an explanatory variable for wage growth. Further explanatory variables are labour productivity and price dynamics.⁷ The benchmark for wage increases is the wage growth that was to be expected over the past years according to the model estimates and with regard to structural labour market tightness. The results indicate that actual wage dynamics in recent years were broadly consistent with the accelerating trend component of labour market tightness.⁸ With regard to the cyclical component of labour market tightness, larger wage increases were to be expected, all else being equal. If the simulation calculations are based on the actual tightness ratio, the wage increases in the period since about 2015 would, in fact, have to be rated as rather low in comparison with the model-based dynamics. This suggests that, in the past few years, additional dampening factors have been influencing the cyclical component of wages.

Labour market tightness in Germany

Number of job vacancies per 1,000 unemployed¹



¹ Aggregate number of vacancies extrapolated from the number of registered unsubsidised vacancies on the basis of data on the notification rate of the Institute for Employment Research (IAB). Broader concept of unemployment according to the definition of the Federal Employment Agency.

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⁴ In line with existing academic studies, dummy variables are used in our calculations to take account of possible structural breaks resulting from the labour market reforms. See R Fahr and U Sunde (2009), Did the Hartz reforms speed up the matching process? A macro-evaluation using empirical matching functions, *German Economic Review* 10 (3), pp 284-316; S Klinger and T Rothe (2012), The impact of labour market reforms and economic performance on the matching of the short-term and the long-term unemployed, *Scottish Journal of Political Economy* 59 (1), pp 90-114.

⁵ This is supported by the fact that there has been a persistent increase in transition rates of unemployed into employment since roughly 2007. See Deutsche Bundesbank, The macroeconomic impact of labour market reforms in Germany, *Monthly Report*, January 2014, pp 34-36.

⁶ The non-accelerating inflation rate of unemployment (NAIRU), calculated within a Phillips curve-based framework, serves as a measure of the structural unemployment rate. See F Kajuth (2016), NAIRU estimates for Germany: new evidence on the inflation-unemployment trade-off, *German Economic Review* 17 (1), pp 104-125. As with the other data on labour market flows used in the calculations, it is based on data on the unemployment rate according to the concept of the Federal Employment Agency. Using the trend unemployment rate based on the Hodrick-Prescott filter produces more or less identical results.

⁷ Wage dynamics data are based on negotiated rates of pay on an hourly basis. Labour productivity growth is expressed as real gross value added per hour worked. The percentage change of the private consumption deflator serves as the measure of inflation. The assessment period from 2013 onwards was not included in the estimation sample.

⁸ The relatively strong increase in negotiated rates of pay in 2014 is also, in part, attributable to back-payments relating to retail sector salary increases agreed the previous year. See Deutsche Bundesbank, Economic conditions in Germany, *Monthly Report*, February 2014, p 61. Overall, the dynamics of actual earnings show slight fluctuation around the reference value in the review period. Looking at actual earnings per hour, the interpretation of the wage dynamics barely changes.

Broader measure of underemployment also very low

In addition to the concept of registered unemployment, there are other approaches to measuring the underutilisation of labour based on a broader definition of underemployment. For example, the underemployment concept developed by the Federal Employment Agency also includes persons participating in active labour market policies or those not working due to temporary incapacity.¹⁸ As participants in active labour market policies are not counted as officially unemployed, but would often be unemployed if they were not on these schemes, it seems that the Federal Employment Agency's definition of underemployment more adequately captures the measure of labour market slack relevant for wage dynamics.¹⁹ The Federal Employment Agency's data on underemployment corroborate the results based on the narrower indicators, showing that the labour market is tight at present. Further, alternative measures of unemployment – for example, the internationally standardised unemployment rate (ILO definition) or the broad measure of underemployment based on Eurostat indicators – follow a broadly similar path to that of registered unemployment or that of underemployment as defined by the Federal Employment Agency, and therefore provide no notable additional explanatory power as far as wage growth is concerned.²⁰

Strong labour market-oriented immigration for a number of years

Given the high rates of immigration since around 2011, especially from central and eastern European countries that have joined the EU since 2004 and from southern European countries, it is possible that conventional measures of labour market tightness, such as the rate of job vacancies relative to underemployment in Germany, reflect actual labour market tightness only inadequately.²¹ The introduction of full freedom of movement for workers in the EU since 2011 is one of the factors that have caused potential labour supply in Germany to increase considerably.²² By mid-2017 (up to which point relevant data are available), a net total of around 1.8 million persons had immigrated to Germany from other EU member states.

Immigration can affect wage dynamics in Germany via various channels. One important issue that needs to be determined is whether the skills profile of immigrants is relatively similar to that of domestic workers, or whether it tends to complement the latter.²³ If the skills profiles are similar, immigrants compete with domestic workers in the German labour market. The expansion of the relevant labour supply is thus likely to dampen wage growth – both in macroeconomic terms and for domestic workers. By contrast, if the skills profiles are complementary, the resident population's wages tend to rise as their skills profile becomes relatively scarcer as a result of immigration. Nevertheless, even in the latter case, there may be subdued wage growth at the macroeconomic level if the immigrants themselves are employed mainly in relatively low-paid jobs and if this effect prevails at the macroeconomic level.

In recent years, immigrants have largely taken up employment in sectors and low-complexity jobs with below-average wages, which has also been facilitated by the previous liberalisa-

Immigration impacts wage dynamics via various transmission channels

¹⁸ See Federal Employment Agency (2009), *Umfassende Arbeitsmarktstatistik: Arbeitslosigkeit und Unterbeschäftigung. Methodenbericht, Statistik*; and Federal Employment Agency (2011), *Weiterentwicklung des Messkonzepts der Unterbeschäftigung, Methodenbericht, Statistik*.

¹⁹ The added information value stems, in particular, from the fact that participation rates in active labour market policies are often the result of administrative factors – such as the testing of new programmes or the discontinuation of poorly evaluated ones – and therefore follow different trends than registered unemployment.

²⁰ The broad measure of underemployment based on Eurostat indicators comprises standardised unemployment (ILO definition) and additionally takes account of persons who work part-time but would like to work full-time, persons who are looking for employment but are not currently available to work, or those who are available to work but are not currently looking for a job. This measure is similar to the U-6 rate of unemployment used by the US Bureau of Labor Statistics.

²¹ Job vacancies in Germany are, in principle, available to all job-seekers in Germany and other EU countries, whereas underemployment is a purely domestic concept.

²² See Deutsche Bundesbank, *op cit*, Monthly Report, April 2017, pp 35-47.

²³ For a conceptual analysis of the wage and employment effects of labour market-oriented immigration, see A Chasamboulli and T Pavlios (2014), *A search-equilibrium approach to the effects of immigration on labor market outcomes*, *International Economic Review* 55 (1), pp 111-129.

Wage dynamics in Germany through the lens of a generalised wage Phillips curve

The Phillips curve is a widely used empirical tool for analysing aggregate wage dynamics. In the following, an example based on the wage equation of the Bundesbank's macroeconomic model is presented. This wage equation combines the most common explanatory approaches for wage dynamics in both the long and the short term.¹ Based on the concept of long-term labour market equilibrium, it is assumed that wage growth is related to developments in the aggregate price level and labour productivity. In addition, cyclical factors such as fluctuations in the utilisation of labour may also play a role in the short to medium term:

$$\begin{aligned} \Delta \log(w_t) = & c_1 + c_2 \{ \log(w_{t-1}) - \log(p_{t-1}) - \log(a_{t-1}) \} \\ & + \sum_{i=0}^m c_i^\theta \theta_{t-i} + \sum_{i=0}^n c_i^a \Delta \log(a_{t-i}) \\ & + \sum_{i=0}^q c_i^\pi \pi_{t-i} + \sum_{i=0}^r c_i^e \pi_{t-i}^e \\ & + \sum_{i=0}^s c_i^{EUI} EUI_{t-i} + \sum_{i=1}^u c_i^w \Delta \log(w_{t-i}) \\ & + \sum_{i=0}^v c_i^T T_{t-i} + \varepsilon_t \end{aligned}$$

The specification of the estimation equation relates the growth rate of gross wages and salaries, w_t , to their deviation from the level implied by their long-term relationship with labour productivity, a_t , and the aggregate price level (measured here by the national consumer price index excluding food and energy), p_t , (each in logarithmic form).² This equation assumes that, in the long term, wage growth will align with the leeway for income distribution, which results from developments in labour productivity and the aggregate price level. This concept is based on the assumption that the labour income share fluctuates around a constant average value in the long term.³

Additional cyclical factors include the degree of labour market tightness, θ_t , and

labour productivity growth. Furthermore, both the actual inflation rate, π_t , and survey-based inflation expectations, π_t^e , feed into the estimation equation, thus taking into account the forward-looking behaviour of employers and employees.⁴ The expected future inflation rate helps them to assess anticipated developments in real purchasing power and real labour costs.⁵ Moreover, net immigration from other EU member states to Germany relative to the domestic working age population (15 to 65 years), EUI_t , also plays an important role.⁶ This figure reflects the expansion of the labour force due to the arrival of labour market-oriented immigrants from other EU member states over the past few years, and thus supplements the traditional measure of labour market tightness.

¹ See O Blanchard and L Katz (1999), Wage dynamics: reconciling theory and evidence, *American Economic Review* 89(2), pp 69-74.

² All wage and productivity data used here are hourly figures.

³ This assumption is supported by the fact that the labour income share based on gross wages and salaries in Germany displayed a declining trend in the first half of the sample period, particularly up to around 2007. Yet an upward trend has been observed since 2007, meaning that at present, the labour income share is once again around the same level as in the mid-1990s.

⁴ The number of vacancies relative to the Federal Employment Agency's definition of underemployment serves as a measure of labour market tightness, partially constructed on the basis of data from the German Council of Economic Experts. The survey-based inflation expectations supplied by Consensus Economics are based on a five-year horizon.

⁵ Further one-off effects, T_t , which influence the growth rate of gross wages and salaries per hour, are due to unsystematic fluctuations in the total number of hours worked. This figure is affected, inter alia, by rates of absence due to illness and weather conditions (particularly in the construction sector).

⁶ Immigration from other EU member states is typically labour market-oriented, as indicated by, among other things, the high employment rates among nationals of these countries in Germany.

Wage equation estimation results*

As a percentage/in percentage points

| Explanatory variables | Quarter-on-quarter percentage change in gross wages and salaries per hour | | |
|---|---|------------------------|-----------------------------|
| | Partial effect ⁵ | t-value or F-statistic | Number of lags ⁶ |
| Error correction term ¹ | -0.032** | -2.29 | 1 |
| Labour productivity growth ² | 0.105[***] | 10.4 | 0 to 2 |
| Labour market tightness ³ | 0.377[***] | 6.05 | 1 to 3 |
| Immigration ⁴ | -0.002* | -1.8 | 10 |
| Inflation expectations | 0.004* | 1.89 | 1 |
| Past inflation rates | 0.247[**] | 2.97 | 1 to 4 |
| R ² | 0.73 | | |

* Sample period: 1996 Q2 to 2017 Q4. The estimation includes a constant and one-off effects (not shown). **1** Percentage deviation of wages from the model-based long-term relationship. **2** Gross value added in relation to the total number of hours worked. **3** Job vacancies in relation to underemployment (Federal Employment Agency definition). **4** Net immigration from EU member states in relation to the domestic population between the ages of 15 and 65. **5** */**/** denote significance at the 10%, 5% and 1% level. **6** Denotes individual past values.

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According to the estimation results, all coefficients display plausible signs and are statistically significant in most cases.⁷ The results also show that growth in gross wages and salaries in the short to medium term is positively correlated with growth in labour productivity, in the degree of labour market tightness and in actual as well as expected inflation rates. On the other hand, net immigration from other EU member states has exerted a dampening effect on wage growth in recent years. In addition, the results indicate that, in the sample period, the greater the deviation of gross wages and salaries from the level expected on the basis of labour productivity and the national consumer price index, the higher the growth rate of gross wages and salaries in the following years.

Based on the estimation results, the contributions of the various factors to past wage

growth can be decomposed. In the long term, both consumer prices and labour productivity were important factors in wage growth. Among the cyclical factors, labour market tightness has delivered increasingly positive contributions to wage growth over the past few years. This also reflects the excellent situation on the German labour market against the background of an intact wage Phillips curve.⁸ Whilst underemployment has been declining in the past few years, firms may have tended to increase their wage offers in order to recruit new staff or retain existing employees. The contribution of the expected inflation rate to wage growth was above average in the period from around 2012 to 2014, and has been more or less neutral since.

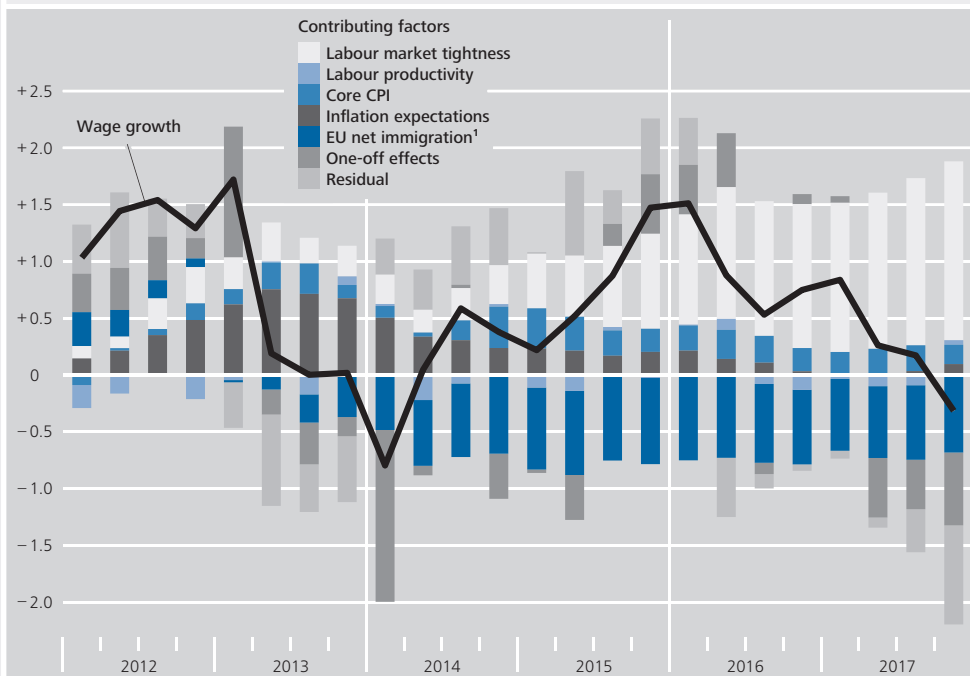
Strong labour market-oriented immigration from other EU member states has had a dampening effect on wage growth in the past few years. However, according to the estimations, wage pressures resulting from the domestic demand for labour have considerably exceeded the wage-dampening impact of immigration at the same time. Furthermore, the results suggest that the wage effect of immigration kicks in with a time lag of up to three years. This lag, which appears relatively long at first glance, is consistent with findings of other studies on the duration of immigrants' integration into the German labour market. For example, according to evidence from the migration sample of the Institute for Employment Research (IAB) and the German Socio-Economic Panel (SOEP), the employment

⁷ The estimations are based on quarterly data for the period 1996-2017. The number of lags used was determined on the basis of the statistical significance of individual lags.

⁸ This finding is robust to alternative measures of labour market tightness, such as the unemployment rate, its deviation from the structural unemployment rate, or the ifo indicator of labour shortages in the manufacturing sector.

Contributions to wage growth in Germany*

Year-on-year, percentage points



* Deviations from model-implied mean. Wage growth is measured in terms of gross wages and salaries per hour. Sample period: 1996 Q2 to 2017 Q4. ¹ Net immigration from EU member states (changing official composition) in Germany.

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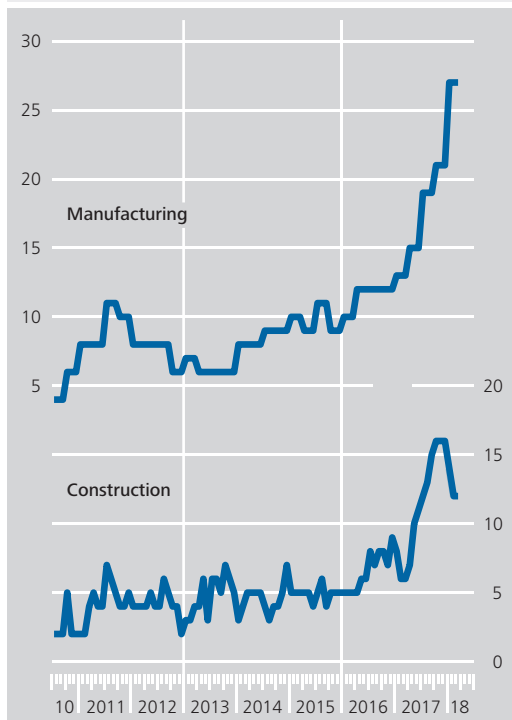
rates of non-refugee immigrants take around five years to converge to the levels observed among the domestic population.⁹ Potential reasons for the length of this process include a lack of language proficiency, a shortage of information concerning the institutional frameworks, and cultural barriers.¹⁰

⁹ See H Brücker, H Hauptmann and E Vallizadeh (2015), Flüchtlinge und andere Migranten am deutschen Arbeitsmarkt: Der Stand im September 2015, IAB Aktueller Bericht, No 14/2015, Institute for Employment Research.

¹⁰ See A Romiti, P Trübswetter and E Vallizadeh (2015), Lohnanpassung von Migranten: Das soziale Umfeld gibt die Richtung vor, IAB Kurzbericht, No 25/2015, Institute for Employment Research.

Impediments to production caused by labour shortages

Percentage of enterprises, seasonally and calendar-adjusted



Source: ifo Institute.
 Deutsche Bundesbank

Immigrants mainly employed in sectors and low-complexity jobs with below-average wages

tions of institutional conditions in the German labour market.²⁴ By contrast, in the 1990s, during the previous phase of strong net immigration to Germany, the capacity to absorb such forms of employment, which often serve as a stepping stone into the labour market, was more limited. Hence, the sectoral shifts towards low-paid jobs were much smaller at that time.²⁵

Wage-dampening effect of immigration in large part due to employment composition

Overall, based on the data currently available, the dampening effect of labour market-oriented immigration on wage growth seems to be largely attributable to the relatively low wages immigrants earn themselves, rather than being due to immigration pushing down the wages of domestic workers.²⁶ In addition, a comparison with previous groups of immigrants indicates that their relatively low average wage level thus far should increase considerably as they become continuously better integrated into the German labour market. Wage-augmenting effects resulting from this develop-

ment are therefore expected in the coming years.

■ Institutional factors

As far as negotiated pay rates are concerned, estimates using the wage Phillips curve show that the growth rates of negotiated rates of pay in previous periods also play a role in the current wage growth developments. One reason for this backward-looking component is likely to be the now rather common two-step structure of collective agreements concluded for a longer duration. Where collective agreements are concluded for a period of two years, an initial increase generally occurs at the beginning of the period, followed by a further increase after the end of the first year. The second increase is often slightly lower, but the amount is still in keeping with the first increase.²⁷

Phased increases in collective agreements

In addition to the model-based results, there have also been other determinants of wage growth in recent years, with non-wage components becoming more significant in the con-

Growing importance of non-wage components in collective agreements

²⁴ In 2017, immigrants from these countries were, to a large extent, employed as unskilled or skilled workers in sectors of the economy with a rather low average wage level (agriculture, temporary agency employment, hospitality, other business-related services excluding temporary agency employment, construction and logistics).

²⁵ For more information on the wage effects during the period of immigration in Germany in the 1990s, see C Dustmann, U Schönberg and J Stuhler (2017), Labor supply shocks, native wages, and the adjustment of local employment, *The Quarterly Journal of Economics* 132(1), pp 435-483; and FD'Amuri, G Ottaviano and G Peri (2010), The labor market impact of immigration in Western Germany in the 1990s, *European Economic Review* 54, pp 550-570.

²⁶ This assessment is consistent with the results of case studies on phases of labour market-oriented migration within the EU in the 2000s. See B Galgoczi, J Leschke and A Watt (2009), *EU labour migration since enlargement. Trends, impacts, and policies*, Ashgate Publishing, Farnham (GB).

²⁷ For example, the rather modest growth in negotiated rates of pay in 2017 is due in part to phased increases agreed more than one year previously in the context of very low inflation rates. A number of major economic sectors, such as the metal-working and electrical engineering industries, negotiated as planned in 2018 after the previous round in 2016.

text of collective agreements.²⁸ For example, questions relating to the sustainability of occupational pension schemes played a role in the pay round of central and local government in 2016, while the flexibility of individuals' working hours along with more options and personal freedom to take time off for family, to care for relatives, and for recuperation in the case of shift workers played a prominent role in the most recent pay round in the metal-working and electrical engineering industries.²⁹ The effects of such components on the agreed increases in negotiated pay rates are difficult to quantify. Under certain circumstances, they could lead, either directly or indirectly, to greater costs for employers – for example, if the increased complexity of human resources management raises the administrative burden. Moreover, agreed supplementary pension benefits increase employees' compensation. It can generally be assumed that the negotiated wage resulting from a collective agreement is not independent of side agreements on other components not directly related to wages. As the interests of workers have often been satisfied in this regard in recent years, it is likely that this has somewhat dampened the collectively agreed wage increase.³⁰

■ Conclusion and outlook

Comparisons with previous expansionary periods, developments in other countries and the leeway for income distribution provide no indication that nominal wage growth in Germany has been unusually weak in Germany in recent years. Given the very high level of employment and the increasing shortage of skilled workers, substantially higher wage growth would have been expected in the last few years, based purely on historical regularities. However, a number of factors counteracted this trend. For example, the increased supply of available workers from the EU dampened aggregate wage increases. One contributing factor was that the expansion of the labour supply due to immigration was often focused on sec-

tors and low-complexity jobs with below-average wage levels. Moreover, the low inflation rates in 2015 and 2016 and the relatively low productivity growth in recent years led to wage-dampening effects. Moreover, the importance of qualitative non-wage related components of wage agreements increased, but the direct and indirect wage effects of these are difficult to quantify. The fact that the collective bargaining coverage of employees has fallen significantly over much of the past 20 years has also played a role. While this decline has slowed in the past few years, it is likely that its effects were still unfolding.

From today's perspective, in view of the underlying economic conditions, it is likely that negotiated rates of pay will be higher in future than they have been in recent years. The dampening effect of labour market-oriented net migration on average earnings, which, according to estimation results, is subject to a time lag, may yet be felt for some time. However, the gradual rise in inflation is, when viewed in isolation, likely to support wage growth in the near future, the available indicators suggest that the already pronounced labour shortages will probably continue to grow, and the economic outlook remains favourable. In this respect, it is reasonable to assume that, in the coming years, labour market tightness will be reflected to a greater extent in actual wage developments.³¹

Current economic conditions favour higher nominal wage increases in future

Upward pressure on wages due to domestic labour market tightness dampened by net immigration

²⁸ For more information on qualitative components in the context of collective bargaining, see, for example, Deutsche Bundesbank, Economic conditions in Germany, Monthly Report, August 2017, p 55.

²⁹ The latest wage agreements for Deutsche Bahn, Volkswagen and Deutsche Post likewise give salaried employees the option of choosing between either the agreed wage increase or more leisure time.

³⁰ This effect is not directly captured in the empirical tests presented here using the Beveridge curve and the wage Phillips curve. Instead, it is reflected in the residuals of the respective estimation equations, or it is implicitly taken into account via other determinants that show a statistical correlation with this effect.

³¹ See Deutsche Bundesbank, Outlook for the German economy – macroeconomic projections for 2018 and 2019 and an outlook for 2020 Monthly Report, December 2017, pp 29-30.