

Aggregate wage developments in Austria since the introduction of the euro

Gerhard Fenz, Christian Ragacs, Alfred Stiglbauer¹

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Real gross wages per worker have experienced a very subdued development since the introduction of the single currency in Austria. Average hourly wages, on the other hand, have evolved more dynamically. Between 1999 and the Great Recession, the wage share decreased continuously, and wage growth was less than suggested by the “Benya rule.” However, having increased significantly in the aftermath of the crisis, the wage share has been fairly constant in recent years. In 2017, the wage share was only slightly lower compared to that in 1999. The institutional specifics of Austrian wage setting are unique for a developed country (neo-corporatist system, almost complete union coverage and highly coordinated wage setting). Despite declining union density, the system has remained virtually unchanged since the early 1980s. Arguably, joining Economic and Monetary Union (EMU) did not lead to pressures to change the wage bargaining process as Austria had already been part of the “hard currency bloc” in Europe before the introduction of the euro. Phillips curve estimations suggest that nominal wage growth in the past twenty years has been mainly determined by labor productivity and past inflation but has reacted only weakly to the cyclical stance of the economy. In addition, we analyze the effects that structural changes in the labor market and the internationalization of the Austrian economy have had on wage developments. We find evidence that the increased openness of the Austrian economy and changes in participation rates have had a dampening effect on wage growth. In contrast, we find no significant effects for changes in the share of part-time and fixed-term contracts, and in the share of foreign workers. The overall cumulative effect of EMU on wage growth in Austria is estimated to be positive.

JEL classification: E25, J30, J51

Keywords: wage share, collective bargaining, Austria, monetary union

This article discusses the aggregate wage development in Austria since the establishment of Economic and Monetary Union (EMU) and its main determinants. According to general understanding, the main determinants of nominal wage growth are inflation and productivity growth. When bargaining over wages, both workers and firms have, on the one hand, real consumption and real product wages in mind. On the other hand, when real wages grow in line with productivity, the functional income distribution (i.e. the income shares of labor and capital) remains constant – and may thus be regarded as a “benchmark” with both labor and capital receiving the same gains from economic growth. In addition to inflation and productivity, many other factors can be expected to influence wage growth. These include the economic cycle and specific labor market shocks, such as changes in labor market participation rates or migration. Furthermore, structural factors may also be relevant: Among these are the institutional structure of collective bargaining, EU and EMU accession, growing internationalization as well as growth of both non-standard and part-time contracts in the labor market.

The article is structured as follows: Section 1 starts by presenting stylized facts on the development of wages and employment. Section 2 then presents key institutional

¹ Oesterreichische Nationalbank, Economic Analysis Division, gerhard.fenz@oebn.at, alfred.stiglbauer@oebn.at, christian.ragacs@oebn.at (corresponding author). The authors thank Doris Ritzberger-Grünwald, Walpurga Köhler-Töglhofer, Doris Prammer and Lukas Reiss (all OeNB) and the referee for helpful comments and valuable suggestions.

characteristics of collective bargaining in Austria. Seeking to provide some empirical insights, sections 3 and 4 aim to quantify the influence of inflation, productivity and other factors on wage growth. More precisely, section 3 shows wage Phillips curve estimation results for Austria and other EU countries, while section 4 refines the empirical specifications of wage equations for Austria by explicitly allowing for structural factors.

1 Stylized facts: changes in wages, employment and wage shares

At the outset, some clarifying remarks on the wage measures used are helpful.² The wage rate is defined as the wage bill divided by employment. For the wage bill, we use total compensation of employees according to national accounts data, which is roughly equivalent to total wage costs. The measure for employment is the number of hours worked by employees, and the resulting wage measure is average compensation per hour worked. We prefer this measure over compensation per employee as the latter is biased by the pronounced downward trend in working hours per employee (mainly due to the rising share of workers in part-time jobs). When interpreting the aggregate growth of hourly wages, we have to bear in mind that the observed changes might be due to changes in wages while the composition of the workforce remains stable and due to changes in the composition of the number of employees while holding wages constant. The wage share is defined as compensation of employees as a percentage of net national income minus other taxes less subsidies on production and thus considers potential changes in the depreciation rate and other factors.³

The left panel of chart 1 displays indices for nominal and real wages in Austria, respectively, including collectively agreed wages.⁴ The difference between real and nominal wages is marked by inflation, as measured by the Harmonized Index of Consumer Prices (HICP), as consumer price inflation typically serves as the basis for wage negotiations in Austria (see the orange line).⁵ The chart reveals that real hourly wages experienced an increase of about 13% between 1999 and 2018. Over the same period, real labor productivity per hour increased by about 20% (see right panel of chart 1). The number of hours worked has grown steadily since 1999 (by about 14%), except for a temporary sharp contraction during the Great Recession in 2008/2009. The number of employees has increased by 23% over the same period; yet, the contraction experienced during the crisis was much smaller due to labor hoarding. This implies that the growth in real compensation per worker was much weaker (+4.5%) than the growth in real wages per hour worked (+12.8%).

² Data on wages and employment are seasonally and working day-adjusted national accounts data if not indicated otherwise (until Q4 2018, trend-cycle component). The cut-off date for all data is March 1, 2019. Due to data limitations, the wage shares could only be calculated until 2017.

³ For a detailed definition of the wage share, see annex.

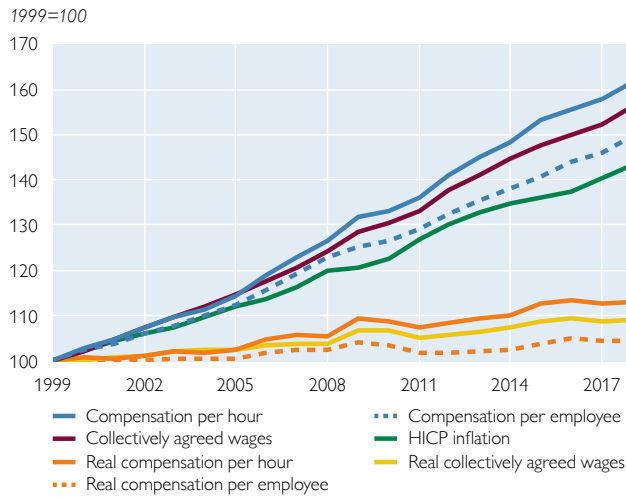
⁴ As measured by the Tariflohnindex (TLI), an index measuring the evolution of collectively agreed minimum wages and salaries.

⁵ Strictly speaking, the Consumer Price Index (CPI) – as opposed to the HICP – is regarded as the relevant inflation measure for Austrian wage negotiations. The difference in growth rates between the two indices was, however, very small, with the CPI increasing by 44.1% from 1999 to 2018, and the HICP by 43.3%. From the perspective of employers, the GDP deflator would be the appropriate inflation measure. In the remainder of the article, unless stated otherwise, we use the consumption deflator to calculate real wages and the GDP deflator to calculate real productivity. For further information on the effects the different inflation measures have on the wage share, see the annex. See also Marterbauer und Walterskirchen (2003).

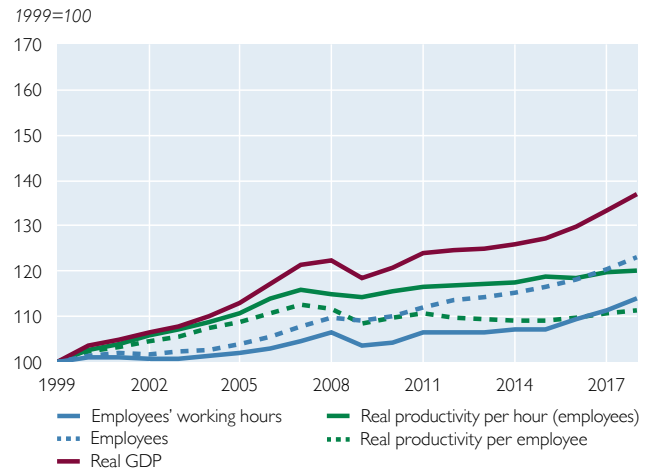
Chart 1

Wages, employment and productivity in Austria from 1999 to 2018 (total economy)

Nominal and real wages and inflation



Employees, real GDP and productivity



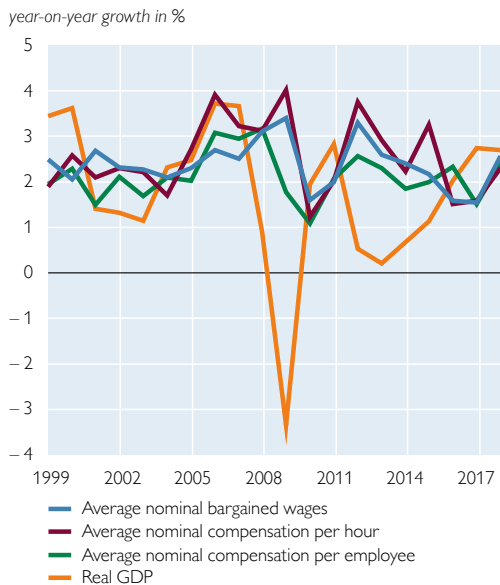
Source: Statistics Austria, OeNB, authors' calculations.

Note: Collectively agreed wages are based on the "Tariflohnindex" (TLI).

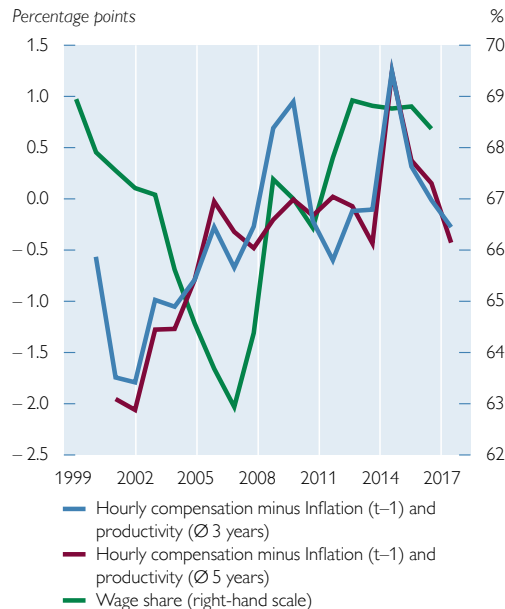
Chart 2

Wages and the business cycle, the "Benya rule" and the wage share

Nominal wages and the business cycle



Hourly compensation less "Benya rule" and wage share



Source: Eurostat, Statistics Austria, OeNB, authors' calculations.

The left panel of chart 2 shows the annual growth rates of various measures of nominal wages, i.e. hourly wages, wages per employee and bargained wages (together with real GDP growth). As can be seen in the chart, the growth rates of the various wage measures are highly correlated and wage changes tend to lag the business cycle.

When nominal wages grow at the same pace as inflation and real productivity do each year, then the functional income distribution remains unaffected, and the wage share constant.⁶ In fact, the right panel of chart 2 shows that the wage share is characterized by large movements in the period under investigation. Between 1999 and the Great Recession, the wage share declined steadily, before increasing significantly in the aftermath of the crisis and remaining fairly constant in recent years. In 2017, the wage share was only slightly lower compared to that in 1999.⁷

According to Mesch (2015), unions aim to maintain a constant wage share. This is exemplified by the so-called “Benya rule”,⁸ according to which nominal wage increases should be equal to the sum of consumer price inflation in the past year and medium-run productivity growth, which roughly implies a constant wage share in the medium term. Did actual wage growth conform to this rule? The right panel of chart 2 depicts the difference between the actual increase of hourly wages and the hypothetical wage growth implied by the Benya rule.⁹ Since “medium-run productivity growth” is not clearly defined, two different definitions are applied: productivity growth over the past three years and productivity growth over the past five years. Regardless of which definition is used, the chart reveals that, between 1999 and the Great Recession, actual wage growth was below the level suggested by the Benya rule. After the crisis, wage growth has been above the benchmark on average.

Box 1

Real wages, employment and wage shares in selected euro area countries

In the period from 1999 to 2017, the developments of real wages per hour, employment and wage shares were not synchronized across euro area countries. Over the whole period, growth of hourly wages in Austria was stronger than the euro area average (left panel of chart 3). A comparison with other euro area countries shows that wage growth was stronger in France, but weaker in Germany and, above all, in Italy.

Interesting differences can be observed over time. Before the Great Recession, wage developments were remarkably dynamic in all countries except Germany. In the years 2010/2011, real wages decreased in most countries as a result of the crisis, before increasing in all countries except Italy and the Netherlands after 2012.

Similar observations can be made for hours worked. The middle panel of chart 3 shows that employment growth was strongest in Austria. Employment in the euro area increased strongly before the crisis and plunged during the crisis. In 2017 (the latest year for which harmonized data are available), the number of hours worked in the euro area was still below its pre-crisis level.

Finally, there is also considerable heterogeneity in the levels and development of wage shares (right panel of chart 3). In 2017, the wage share of the total economy was about 76.2% in

⁶ Strictly speaking, this only holds if the depreciation rate, the tax rate on production less subsidies and the ratio of GDP to gross national product (GNP) remain constant and consumer price inflation equals inflation according to the GDP deflator. For further details, see annex. We do not calculate adjusted wage shares where a correction is made for changes in the ratio of hours worked by employees to total working hours (including those of the self-employed) as this figure is distorted by structural changes in the agricultural sector (i.e. a sharp reduction in the number of part-time farmers).

⁷ For a discussion of the longer-term development of the wage share as well as of the development of personal income distribution in Austria, see Mayrhuber et al. (2018). For the historical development of the wage share between 1955 and 1995, see Chaloupek et al. (2008).

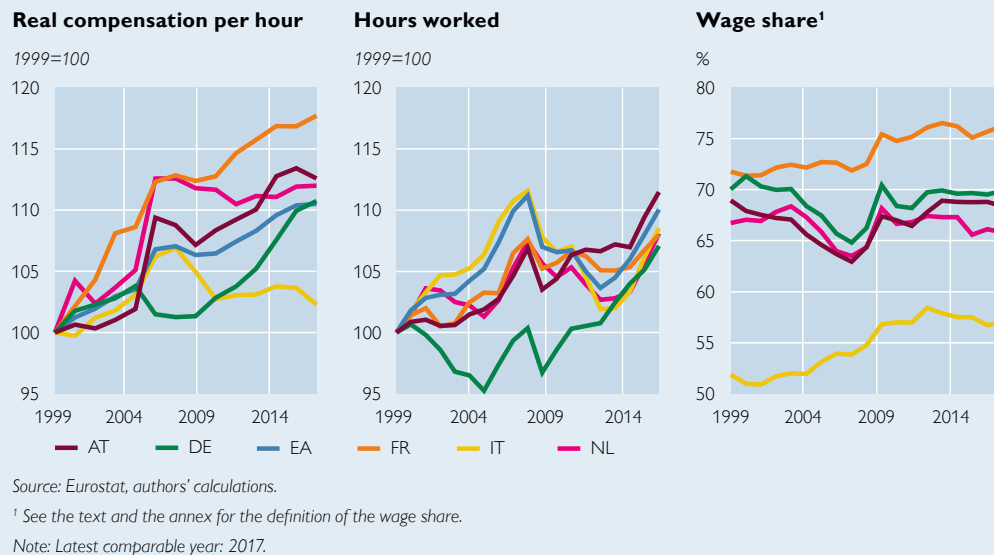
⁸ Named after Anton Benya, a former president of the Austrian Trade Union Federation.

⁹ Again, the HICP was used as the inflation measure.

France and close to 70% in Germany and Austria, while being considerably lower in the Netherlands (66%) and Italy (57%). When comparing 1999 and 2017, we see an increase in the wage share for Italy and France, respectively, and constant or slightly decreasing wage shares for Austria, Germany and the Netherlands.

Chart 3

Wages, employment and wage shares in Austria and selected euro area countries



2 Changes in the institutional specifics of wage setting in Austria

The evolution of aggregate wages is, to a considerable extent, shaped by collective agreements.¹⁰ How have wage-setting institutions evolved in the past 20 years? Following Visser (2016), we discuss several key dimensions of collective bargaining, one important aspect of which is membership to the contracting parties representing employers and workers, respectively. On the employers' side,¹¹ almost all private-sector collective agreements are negotiated by the Austrian Economic Chambers where membership is mandatory.¹² On the workers' side, bargaining is conducted by unions covering different sectors or occupations. However, union density, i.e. the share of union members as a percentage of total dependent employment, revealed a decreasing trend from 41.1%¹³ in 1995 to 27.4% in 2013.¹⁴ By international comparison, union membership in Austria ranks in the middle (left panel of chart 4).

¹⁰ As already mentioned, changes in hourly wages and wages per worker are highly correlated with changes in collectively agreed wages (see chart 2). Although, strictly speaking, collective agreements are about increases of sector-, occupation- and tenure-specific minimum wages ("Mindestlohn-Abschlüsse"), many firms increase pay rates by the same percentage as specified in collective agreements, even though they pay higher wages and salaries. Moreover, several collective agreements include increases in both minimum wages and actual wages ("Istlohn-Abschlüsse").

¹¹ There is a lack of internationally comparable data on employer representation (Visser, 2016).

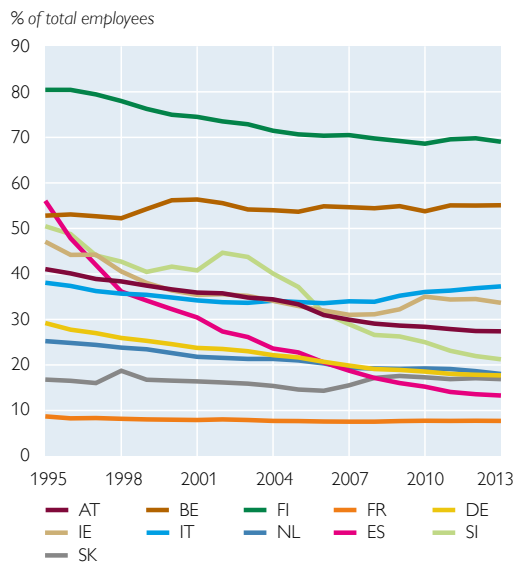
¹² For wage negotiations in the public sector, the contracting party on the employers' side is the state.

¹³ Union density and bargaining coverage data were obtained from AIAS (2016). The most recent data refer to 2013 or 2014.

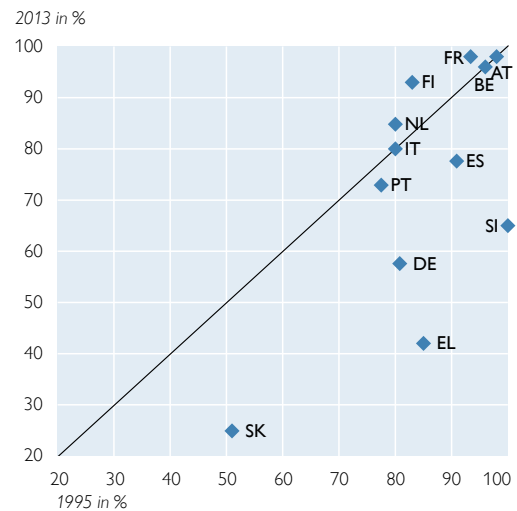
¹⁴ As a matter of fact, unionization had already started to decline much earlier. In 1970, Austrian union density stood at 62.7%.

Union density and collective bargaining coverage over time

Union density rates from 1995 to 2013



Bargaining coverage in 2013 vs. 1995



Source: AIAS (2016).

Note: The latest bargaining coverage data for Finland and Portugal refer to 2014, for France to 2012 and for Italy to 2010.

Unionization is not directly relevant for the wage setting process in Austria, because collective agreements are valid for all workers regardless of union membership. Hence, bargaining coverage, i.e. the share of all workers for which collective agreements are binding, is more crucial. Austria has almost complete¹⁵ coverage and this has remained constant over time, while coverage rates for several other countries, such as Germany and Spain, dropped considerably from 1995 to 2013 (right panel of chart 4).

A further key characteristic is the level at which bargaining is conducted. Single-employer or firm-level bargaining is common in Anglo-Saxon economies and in many Central, Eastern and Southeastern (CESEE) countries. Multi-employer bargaining, which usually means that collective agreements are bargained at sectoral (and sometimes also regional) levels, prevails in Western Europe. In Austria, although firm-level agreements do occur, the dominant level at which bargaining takes place was and is the sectoral level (see table 3 in Visser, 2016), as is the case in France, Germany, Italy and the Netherlands.

Apart from the level at which bargaining takes place, horizontal coordination of wage bargaining is also important (Flanagan, 1999). Coordination means the integration or synchronization of pay policies of distinct bargaining units (Visser, 2016). In Austria, coordination is achieved through “wage leadership” of the export-oriented metal sector – a system that has been in place since the late 1970s (Knell and Stiglbauer, 2012). In an international comparison (see table 4 in Visser, 2016), Austria belongs to the countries with high bargaining coordination.

¹⁵ According to AIAS (2016), about 98% of all workers are covered by a collective agreement. Bönisch (2008) reports a somewhat lower coverage (95%) for the total economy.

Furthermore, wage bargaining institutions have been very stable over time. They rely on strong involvement of both employer federations and unions not only in wage bargaining but also in economic and social policies in general. This system of “social partnership” has been characterized as “(neo-)corporatist.” Although there are signs of erosion (Pernicka and Hefler, 2015), Austria’s labor relations are still characterized by a high degree of trust between social partners, which tend to avoid labor conflicts (Addison, 2016).

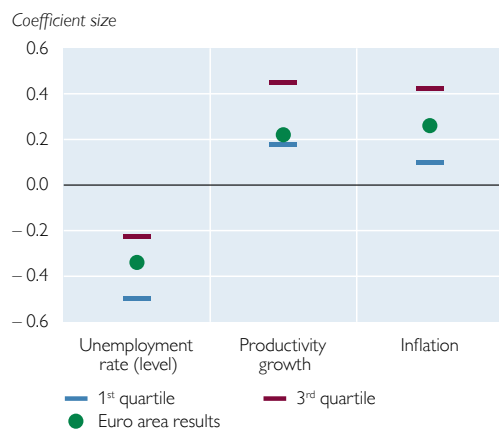
3 Wage Phillips curves for the euro area and other EU countries

What are the determinants of aggregate wage growth? For a start, we present the results of a recent empirical analysis at the level of the European System of Central Banks (ESCB), for which a wide range of wage Phillips curve specifications¹⁶ was tested for the euro area as a whole and for 19 individual countries, including Austria.¹⁷ The wage Phillips curve is a key macroeconomic relationship (Galí, 2011) that relates the observed nominal wage growth to the cyclical state of the economy (“slack”), inflation and labor productivity growth.

Chart 5

Wage Phillips curve estimation results based on a common specification

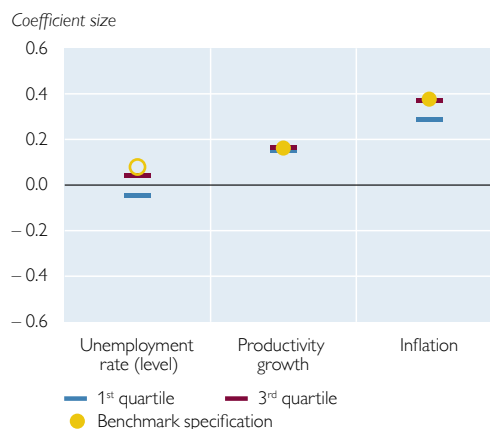
Results for 15 euro area countries and 5 other EU Member States



Source: ECB (forthcoming).

Note: The green dots represent the point estimates of a benchmark specification of the wage Phillips curve for the euro area as a whole, while the blue and red dashes mark the interquartile range of the individual country estimation results. The specification is as follows: The dependent variable is the growth rate of compensation per employee (annualized, quarter on quarter), the regressors are an autoregressive (AR(1)) term (the magnitude of which is 0.16; it is only marginally significant), the level of the unemployment rate (logged by one quarter), the contemporaneous growth rate of real productivity per worker and the average year-on-year HICP inflation rate over the previous four quarters. The coefficient of the autoregressive term implies that the long-term coefficients are 19% higher than their short-term counterparts.

Results for Austria



Source: Authors' estimates.

Note: The benchmark specification is the same as for the euro area (see left panel of this chart). The estimated autoregressive coefficient is 0.37. The coefficients for the AR(1) term, productivity growth and inflation are highly statistically significant, while the estimates for the unemployment rate are not significant. For the Austrian estimates, Newey-West corrected standard errors were used. The yellow dots represent the point estimates of the benchmark specification. The red and blue dashes mark the interquartile range of coefficient estimates of variations of the benchmark specification (see running text). The long-term coefficients are 58.7% higher than the short-term coefficients.

¹⁶ For results of a similar exercise with price Phillips curves, see the contribution by Fritzer and Rumler in this volume.

¹⁷ For more details, see the ECB's research report on wage growth in the euro area and European countries (forthcoming). The estimations comprise the results of 15 euro area countries (including France, Germany, Italy, the Netherlands and Spain) and four other EU Member States.

A “benchmark” specification for the growth rate of compensation per employee¹⁸ was estimated for all EU countries, using the Eurostat unemployment rate, the growth of real productivity per worker and past inflation as explanatory variables.¹⁹ The results are depicted in the left panel of chart 5, with the green dots representing the estimated coefficients for the euro area as a whole, and the blue and red dashes representing the interquartile range of the individual country results. There is considerable cross-country variation in the impact of unemployment, productivity and inflation on wage growth.

The right panel shows the results of Phillips curve estimations for Austria. The yellow dots mark the point estimates for the benchmark specification (and are thus directly comparable to the results in the left panel), whereby the coefficient of the unemployment rate is depicted merely as a circle as it is not statistically different from zero. The coefficients for productivity and inflation, on the other hand, are highly significant. The short-term elasticity of productivity is somewhat lower than that for the total euro area, while the elasticity of inflation is rather high. Taking the coefficients of the autoregressive terms into account shows that the long-term coefficients of both productivity growth and inflation are higher in Austria than in the euro area (see the notes in chart 5).

The blue and red dashes in the right panel indicate the range of the estimates when slightly changing the specification of the benchmark equation by using different measures for inflation²⁰ and economic slack²¹. The results indicate that the estimated coefficients of productivity and inflation do not change much and that the level of the unemployment rate remains insignificant on average. However, some of the slack measures (especially the output gap variables) are significant and have the expected sign.

To sum up, the wage Phillips curve estimations show a robust influence of productivity growth and (past) inflation on wage growth. To some extent, the economic cycle also plays a role. Wage Phillips curves are a rather simple way of “explaining” the variation of wage growth. In the next section, we will go back to hourly wages as our preferred wage measure and adopt richer specifications, enabling us to determine whether structural changes in the economy and the labor market affect wage growth as well.

4 Wages and structural change

Apart from inflation, productivity growth and the economic cycle, wage growth is also likely to be affected by structural changes in the economy. In what follows, we will discuss several indicators for structural change, which will be used as additional regressors in refined estimations of wage equations for Austria. Among

¹⁸ As argued before, it would be preferable to use hourly wage costs; for many countries, however, working time data are not particularly reliable.

¹⁹ For more details on the “benchmark” specification, see the notes in chart 5.

²⁰ Nine different inflation measures were employed, including six backward-looking and three forward-looking inflation measures. It turns out that the measure for inflation over the last 4 quarters performs best in terms of statistical significance.

²¹ Altogether, 19 slack measures were used. These included real GDP growth, the absolute change in the unemployment rate, measures for the output and unemployment gap from different institutions (Eurosystem, International Monetary Fund (IMF), Organisation for Economic Co-operation and Development (OECD), European Commission) and several underemployment measures as alternatives to the unemployment rate.

those indicators are the growing importance of part-time and fixed-term work and the rise in the participation rate, especially among elderly workers. Moreover, the increasing share of foreign workers and the ongoing internationalization of the Austrian economy may have had an effect on wages.

The Austrian economy became considerably more internationalized due to the fall of the Iron Curtain in 1989 and the accession to the European Union with its Single Market in 1995.²² According to standard economic theory, the increased internationalization may have exerted a downward pressure on wage growth. The bargaining power of unions is negatively related to the (inverse) wage elasticity of labor demand (Boeri and van Ours, 2013). On the one hand, internationalization is likely to increase this elasticity because of import competition or the possibility of employers to relocate their production facilities abroad, thereby weakening the bargaining position of unions. On the other hand, internationalization can foster economic growth and increase labor demand and wages. The introduction of the euro 20 years ago is likely to have enhanced internationalization further. The right panel of chart 6 shows that the openness of the Austrian economy, as measured by the share of imports and exports in GDP, increased strongly until the Great Recession and has remained, after a post-crisis rebound in 2010/2011, roughly constant thereafter.

Joining EMU is also relevant with respect to its effects on economic growth (which affects productivity and thus also wage growth) and, possibly, also on wage bargaining. The growth effects are the result of the elimination of exchange rate risks and transaction costs as well as of enhanced competition due to greater price transparency. Moreover, foreign trade and cross-border investments are likely to have increased, resulting in a further acceleration of economic growth. Breuss (2016) analyzed the effects of EMU accession and found an average annual increase of GDP growth of 0.5 percentage points in the period between 1999 and 2015. He also found productivity gains of 0.3 percentage points per year for the Austrian economy due to EMU membership. Being a member of Monetary Union, however, also entails costs. The most important ones are the loss of independent monetary and exchange rate policies. The theory of optimum currency areas calls for increased wage flexibility and/or increased labor mobility in the event of asymmetric shocks to member countries (De Grauwe, 2018). Both effects reduce the bargaining power of national labor unions. In Austria's case, however, joining the single currency arguably had no such impact as Austria had already been a member of the "hard currency bloc" in Europe (Handler, 2016) which was a de-facto currency union even before the introduction of the euro.²³

In addition, internationalization and, above all, the EU enlargement rounds in 2004 and 2007 have also spurred labor migration to Austria. Between the mid-1990s and 2018, the share of foreign workers in the labor force doubled (see the green line in the left panel of chart 6). This might have influenced the wages of incumbents; in any case, it has had a strong compositional effect on aggregate wages.²⁴

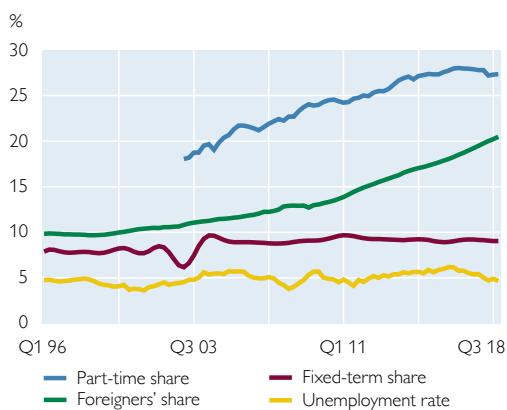
²² For an overview of the economic effects of Austria's EU and euro area membership, see Beer et al. (2017).

²³ To be able to retain a fixed exchange rate vis-à-vis Germany, Austria had to have flexible wages in order to achieve the desired real exchange rate target even before joining EMU.

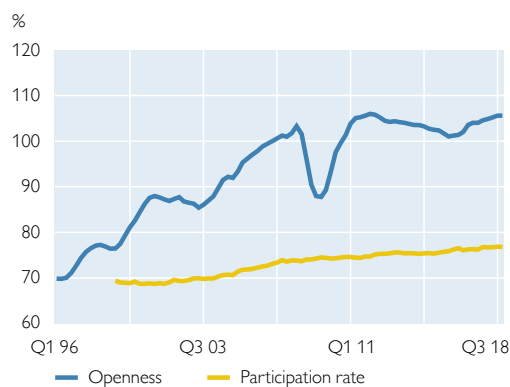
²⁴ Hofer et al. (2017) show that immigrants are more likely to work in unskilled or low-skilled jobs. Moreover, the authors show that immigrants face wage discrimination, i.e. they receive considerably lower pay than natives, even after controlling for a large number of personal and job characteristics.

Structural changes in the economy and the labor market

Selected labor market indicators



Openness and participation rate



Source: Eurostat, Statistics Austria, authors' calculations.

Note: For details on the data, see notes in table 1.

Further effects on wages may be the result of increases in the participation rate (right panel of chart 6) that are mainly due to rising participation rates of older workers and female workers and that are also likely to affect the composition of the workforce; however, it is unclear in which direction.²⁵ Average wages may also have been affected by “non-standard” forms of work. Part-time work increased significantly (see left panel of chart 6), which is mainly the result of increased participation by female workers, many of whom work part-time. Part-time work is likely to have a negative effect on average wages for various reasons.²⁶ Finally, another institutional indicator of structural change in the labor market is the share of workers in fixed-term contracts. This indicator is often used as a proxy for precarious labor contracts (Da Silva and Turrini, 2015). The left panel of chart 6 suggests that there has only been a slight increase of fixed-term work since the mid-1990s.²⁷

In what follows, we will present the results for wage equations for the Austrian economy, which capture a long-run equilibrium relationship, short-run developments and indicators of structural change in a cointegration framework.²⁸ For the long run, we find a cointegrating relationship between the level of nominal hourly wages, the level of real hourly productivity and the price level. Moreover, the openness indicator (i.e. the share of exports and imports in GDP) enters the error correction term capturing the downward trend in the wage share until the Great Recession.

In the short run, like in the Phillips curve estimations in section 3, the growth rate of nominal hourly wages is driven by the growth rates of real labor productivity and inflation. Effects of the business cycle are captured by the change in the unemployment rate. Additionally, the indicators of structural change and internationalization,

²⁵ For example, the rising participation of female workers is likely to slow down the growth of average wages (see footnote 26). On the other hand, more older workers may increase average wages (due to rising age-earnings profiles).

²⁶ For example, part-time work may be regarded as a proxy for the gender pay gap (Böheim et al., 2013). Moreover, a genuine wage penalty (“part-time wage gap”) for working part-time has been observed empirically, even after controlling for several personal characteristics including gender (Manning and Petrongolo, 2008).

²⁷ The drop observed around 2003/2004 is due to a structural break in the time series.

²⁸ For a similar analysis, see the Deutsche Bundesbank (2018).

Table 1

Wages and structural change in a small open economy															
Dependent variable: nominal hourly wages, quarter-on-quarter growth, total economy															
	Constant	Productivity growth	Inflation	Δ Unemployment rate	EC	AR(1)	Δ Openness	Δ Part-time	Δ Fixed-term	Δ Foreign	Δ Participation rate	Dummy Q4 12	Adjusted R2	Adjusted sample	Observations
Coefficient:	0.00	0.29 (t)	0.32 (t-3)	-0.15 (t-1)	-0.03 (t-4)	0.42	-0.07 (t)					0.01	0.79	Q1 98–Q4 18	84
p-value:	0.01	0.00	0.00	0.00	0.05	0.00	0.00					0.00			
Coefficient:	0.00	0.39 (t)	0.66 (t-3)	-0.13 (t)	-0.05 (t-4)	0.33	-0.08 (t)	0.05 (t-1)	0.27 (t-1)	-0.12 (t)	-0.20 (t-1)	0.01	0.89	Q1 05–Q4 18	56
p-value:	0.11	0.00	0.00	0.02	0.00	0.00	0.00	0.31	0.15	0.49	0.00	0.00			
Coefficient:	0.00	0.25 (t)	0.48 (t-3)	-0.18 (t)	-0.04 (t-4)	0.34	-0.08 (t)				-0.11 (t-1)	0.01	0.83	Q2 00–Q4 18	75
p-value:	0.00	0.00	0.05	0.00	0.00	0.00	0.00				0.05	0.00			

Source: Eurostat, Statistics Austria, social security data, OeNB.

Notes: OLS with Newey-West correction, quarterly seasonally adjusted data. Lags of variables in parentheses. For details on the estimated equations, see box 2. Productivity growth: real hourly labor productivity growth of employees (Eurostat). Inflation: growth of seasonally adjusted consumption deflator (Eurostat). Unemployment rate: Eurostat. EC: Error correction term. AR(1): Autoregressive term. Openness: ratio of exports and imports to GDP (Eurostat). Part-time: share of part-time employment (Eurostat, data available since Q1 03). Short-term: Share of short-term workers (Eurostat, splined quarterly data). Foreign: share of foreign employees in total employment (social security data). Participation rate: participation rate of the 15 to 64 age group (Eurostat). Dummy Q4 12: Dummy set for unexplained quarter-on-quarter growth of nominal wages in the fourth quarter of 2012.

as described above, enter the equations. For details on the estimated equations and the data used, see box 2 and the notes in table 1. Out of a large set of estimated equations, we show the results for three selected equations in table 1 that summarize our main findings.

Our basic equation includes a constant, an error correction term, productivity growth, the inflation rate, unemployment, an autoregressive term and the indicator for openness. All variables enter the equation significantly and with the expected sign. The results for productivity and inflation are comparable to our findings in section 3. Now, the change in the unemployment rate is used as regressor and we find significantly negative effects of the business cycle. Furthermore, the increased internationalization (openness) of the Austrian economy seems to have had a negative effect on wage growth. In further specifications, we add more indicators of structural change. We find evidence that increases in the participation rate have had a dampening effect on aggregate wage growth. In contrast, we find no significant effects for changes in the share of part-time and fixed-term contracts, and in the share of foreign workers.

Has the introduction of the euro had a positive or negative effect on overall wage growth in Austria? In our empirical estimations, openness and productivity are exogenous variables for wage growth. According to our results, openness turned out to have had a significantly negative impact on the development of wage growth, whereas productivity has had a positive impact. The rise of the openness indicator is the result of a combination of several factors: the general trend of globalization, the opening of the East, the accession of Austria to the EU and the introduction of the euro 20 years ago. According to our estimation results, increased internationalization had an overall dampening effect on wage growth of almost 5 percentage points in the period from 1999 to 2018. A precise breakdown among the above-mentioned factors is difficult, but given the fact that Austria had already been a member of a hard currency block before 1999, the introduction of the euro accounts, most probably, only for a minor part. Breuss (2016) estimates productivity gains of 6.5 percentage points for the Austrian economy due to EMU membership in the period from 1999 to 2015, whereby the positive effects were most evident in the first years after the introduction of the euro. Productivity gains generate – according to our long-term estimation results – increases in wages by the same amount. Thus, the positive effects of EMU membership on wages via increased productivity growth (6.5 percentage points) outweigh the dampening effects via increased internationalization (up to 5 percentage points). Depending on the extent to which EMU is responsible for increased internationalization (and its wage-dampening effects), the overall effect of EMU on wage growth in Austria is positive, ranging from 1.5 to 6.5 percentage points.

Box 2

Details on the estimation of the effects of structural changes

We use the two-step Engle Granger cointegration procedure to estimate the effects of structural changes on wage growth. For the long run, we find a cointegrating relationship given by $\log(w_t) = \alpha_1 + \alpha_2 \cdot \log(\text{productivity}_t) + \log(\text{price}_t) + \alpha_3 \cdot \log(\text{openness}_t) + \varepsilon_{L,t}$, where w_t denotes nominal hourly wages, productivity_t real labor productivity per working hour, price_t the consumer price deflator, openness_t the ratio of nominal exports plus imports to nominal GDP and $\varepsilon_{L,t}$ the residual. The estimation results for the longest time horizon available are $\alpha_1 = -0.440$, $\alpha_2 = 0.969$ and $\alpha_3 = -0.002$.

The estimated dynamic (“short run”) equations follow the general form of

$$\begin{aligned} d\log(w_t) = & \beta_1 + \beta_2 \cdot d\log(\text{productivity}_t) + \beta_3 \cdot d\log(\text{price}_{t-3}) + \beta_4 \cdot \Delta(\text{unempl}_t) + \beta_5 \cdot EC_{t-4} + \\ & + \beta_6 \cdot d\log(w_{t-1}) + \beta_7 \cdot \Delta(\text{openness}_t) + \beta_8 \cdot \Delta(\text{parttime}_{t-1}) + \beta_9 \cdot \Delta(\text{fixedterm}_{t-1}) + \\ & + \beta_{10} \cdot \Delta(\text{foreign}_t) + \beta_{11} \cdot \Delta(\text{participation}_{t-1}) + \beta_{12} \cdot D2012Q4 + \varepsilon_t \end{aligned}$$

The residuals from the long-term equilibrium equation ($\varepsilon_{L,t}$) enter the regression as error correction term (EC_{t-1}). Additionally, the following variables are tested: unempl_t : unemployment rate, parttime_t : share of part-time workers, fixedterm_t : share of fixed-term workers, foreign_t : share of foreign workers and participation_t : participation rate of the 15–64 age group. For exact data definitions and sources, see the notes in table 1.

5 Conclusions

Since the introduction of the euro, average real hourly wages have risen by 13% in Austria, which is equivalent to an annual increase of 0.6%. Compared to other euro area countries, this is a rather large increase. Until the Great Recession, the Austrian wage share decreased significantly but has recovered thereafter. In 2017, the wage share was only slightly below its level in 1999. In Austria, collective agreements exert a significant influence on wage growth. Over the past 20 years, collective bargaining institutions have remained remarkably stable, as evidenced by a high bargaining coverage and a high degree of bargaining coordination. The empirical analysis reveals that nominal wage growth has mainly been determined by growth of consumer prices and labor productivity. In addition, wage growth also appears to have been affected by structural factors altering the bargaining position of workers or changing the composition of the workforce. The results indicate that the growing openness of the Austrian economy and the rise of participation rates have had a dampening effect on aggregate wages. The overall cumulative effect of EMU on wage growth in Austria is estimated to have been positive since 1999, ranging from +1.5 to +6.5 percentage points.

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Annex

The determinants of changes in the wage share

In this annex, we discuss the definition of the unadjusted wage share and how it is related to real wage growth, labor productivity growth and other factors. Let us start with a simplified definition of the wage share, which is equal to the total wage bill (nominal compensation of employees) divided by nominal GDP at market prices

$$s_1 = \frac{h \cdot w}{Y \cdot P_Y}, \quad (1)$$

whereby s_1 denotes the simplified wage share, h the number of hours worked, w the average hourly wage, Y real GDP and P_Y the GDP deflator. The change in the wage share in percentage points is given by the growth rate of real product wages minus the growth rate of labor productivity weighted by the wage share

$$\dot{s}_1 = s_1 \cdot [(\widehat{w} - \widehat{P}_Y) - (\widehat{Y} - \widehat{h})], \quad (2)$$

whereby a dot over a variable symbolizes first differences and a hat the time derivative of the log of this variable (which is equal to the percentage change over time for small changes). Note that labor productivity is measured as GDP divided by working hours of employees, ignoring working hours of self-employed, and that wages are deflated using the GDP deflator.

In contrast to the simple formula (1), the wage share in actual economic statistics (s_2) is computed as the compensation of employees divided by the net national income (NNI) at market prices minus other taxes on production plus subsidies. Using NNI instead of GDP and expanding the numerator and the denominator by P_C , the wage share changes to

$$s_2 = \frac{h \cdot w \cdot P_C}{Y \cdot P_Y \cdot n \cdot d \cdot t \cdot P_C}, \quad (3)$$

where n is the ratio of gross national income (GNI), defined as NNI plus depreciation, to GDP, d equals 1 minus the depreciation rate in % of GNI ($d = 1 - \delta$) and t equals 1 minus the tax rate (in % of NNI) on production less subsidies ($t = 1 - \tau$). We extend the fraction by the consumption deflator P_C to calculate real wages based on consumer prices, which typically form the basis for wage negotiations in Austria.²⁹ Now, the change in the wage share is given by the growth rate of real wages (deflated by consumer prices) minus the growth rate of labor productivity and minus the changes in n , d and t and P_Y/P_C

$$\dot{s}_2 = s_2 \cdot [(\widehat{w} - \widehat{P}_C) - (\widehat{Y} - \widehat{h}) - \widehat{n} - \widehat{d} - \widehat{t} - (\widehat{P}_Y - \widehat{P}_C)]. \quad (4)$$

²⁹ In Austrian collective bargaining, the CPI – rather than the consumption deflator – is usually regarded as the relevant inflation measure.

Table Annex

Decomposition of changes in the wage share

Wage share in 1999	70.5
Wage share in 2017	68.7
Difference	-1.8
Implicit change in the wage share due to differences in the growth of real wages and productivity from 1999 to 2017 ("Benya rule")	-5.0
thereof:	
change in actual wage share	-1.8
change in depreciation rate	-1.5
domestic vs. resident concept	0.7
changes in product tax rate	0.2
consumption vs. GDP deflator	-2.7
discrepancy	0.1

Source: Statistics Austria, WIFO, authors' computations.

The results in the table show that the difference between the growth rate of real wages and that of labor productivity suggests a much larger drop in the wage rate (-5.0 percentage points) than indicated by actual statistics (-1.8 percentage points). This is explained by an increase in the depreciation rate and higher inflation rates of consumer prices compared to product prices. Finally, changes in the relation between GDP and GNI (domestic versus resident concept in the table), on the one hand, and changes in the product tax rate, on the other hand, have small opposite effects.