

# REPORT

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## THE POSITIVE ECONOMIC IMPACT OF GERMANY'S STATUTORY MINIMUM WAGE - AN ECONOMETRIC ANALYSIS\*

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### AT A GLANCE

- A macro-econometric model is used to determine the short-run and the expected medium to long-run growth, price and employment effects of the introduction of the statutory minimum wage in Germany.
- The introduction of the minimum wage has tended to stimulate economic growth. This was mainly due to the higher wages of the minimum wage beneficiaries and a spill-over effect on adjacent wage groups. This benefited in particular those whose low savings rate led to a particularly strong increase in real private consumption.
- There was also a marked structural shift away from "mini-jobs" towards additional employment subject to social security contributions, although the total number of hours work hardly changed.
- A short-term VAR analysis identifies a significant positive wage effect for 2015, positive (but not significant) overall economic price effects as expected as well as a positive but not significant effect on employment.
- The introduction of the statutory minimum wage has helped Germany to move towards a more stable growth path based not only on export success but also on stable growth in domestic demand due to a better wage development.

### Podcast

by Alexander  
Herzog-Stein



On the effects of statutory minimum wage  
<https://bit.ly/2zweQJD>

\* Revised summary of the empirical part of a study conducted on behalf of the German Minimum Wage Commission (Mindestlohnkommission), "Macroeconomic consequences of the statutory minimum wage from a Keynesian perspective" by Hansjörg Herr, Alexander Herzog-Stein, Jürgen Kromphardt, Camille Logeay, Patrick Nüß, Toralf Pusch, Thorsten Schulten, Andrew Watt and Rudolf Zwiener.

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## INTRODUCTION

A federal statutory minimum wage was introduced in Germany on 1<sup>st</sup> January 2015, the first time in the country's history that a unique standard minimum rate of pay set by law applied across the whole country. This was, unquestionably, one of the most important labour market reforms that will have a lasting impact on the German labour market.

This report will begin with a descriptive analysis of the economic conditions prevailing when the minimum wage was introduced, moving on to the preliminary work required for a model-based empirical simulation analysis of the introduction of a statutory minimum wage in Germany. This analysis uses existing evidence of national and international research on key aspects, including changes in employment structure and the impact they have had on volume of work and employment as well as the significance and extent of potential spill-over and productivity effects resulting from the introduction of the minimum wage.

The economic impact of introducing a minimum wage in Germany is then considered empirically, presenting two macro-econometric analyses. The first – a detailed quantitative study – considers its short-, medium- and long-term effects of the minimum wage by means of model simulations using the IMK's Keynesian-type macro-econometric model. The second considers only the short-term macroeconomic effects using a small-scale vector autoregressive model. Finally, the report draws conclusions from these studies.

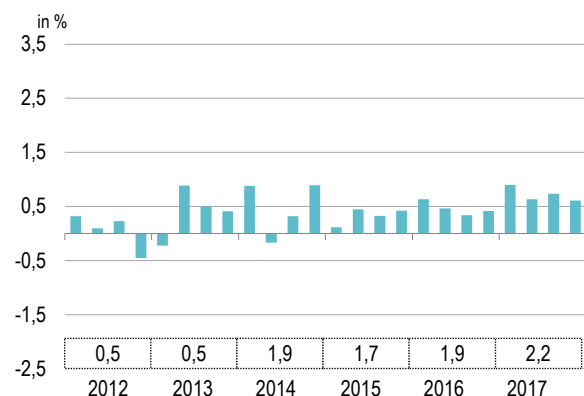
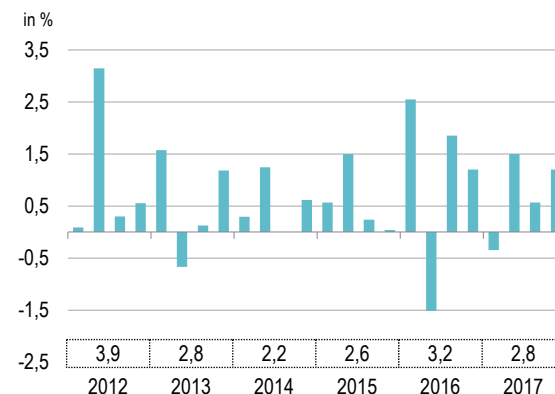
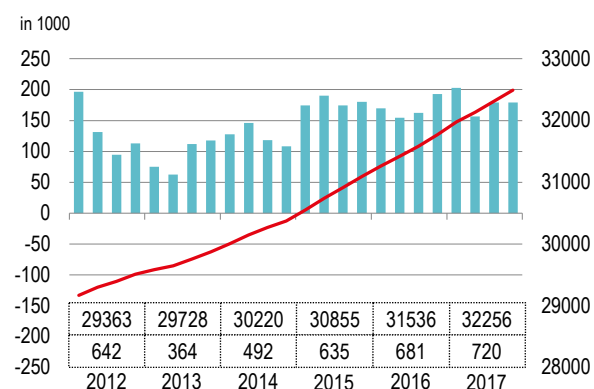
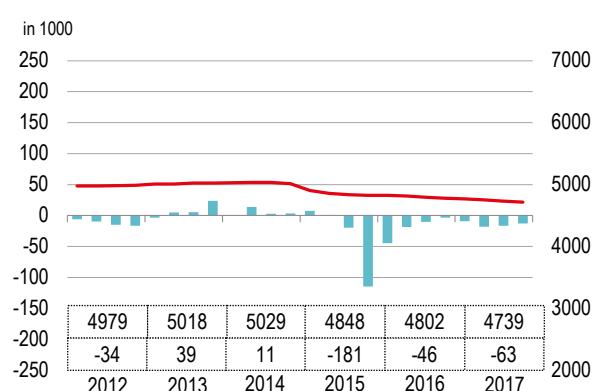
## MINIMUM WAGE, WAGE STRUCTURES AND SPILL-OVER EFFECTS

Germany introduced its statutory minimum wage at a time when the German economy was in a good economic situation: in the year before its introduction, in 2014, real GDP had grown by 1.9%, markedly more dynamically than in the two preceding years. Labour market trends remained positive: according to the National Accounts (NA) of the Federal Statistical Office, there was a marked increase of 0.8% in the number of persons in employment, driven by the increase in employment subject to social security contributions. Meanwhile the average hours worked also increased. Accordingly, unemployment continued to decrease and the annual average unemployment rate was 6.7%.

The overall economic development following the introduction of the minimum wage in 2015 continued the favourable pattern of the previous year (**Figure 1**) and continued uninterrupted since then. With GDP growing by 1.7%, 1.9% and 2.2%, economic performance developed even more dynamically in the years 2015 to 2017 than in previous years. The labour market also gained further momentum. The average annual employment figure rose by 0.9%, 1.3% and 1.5% over the same three years, underpinned by more rapid growth in employment subject to social security contributions (**Figure 1c**), while the number of those employed solely in "mini-jobs"<sup>1</sup> (low-paid and mostly part-time jobs representing the biggest category of marginal employment), which had been largely static in the previous years, has been falling since the introduction of the minimum wage (**Figure 1d**). Overall, from January 2015 onwards, the increase in employment subject to social security contributions considerably outweighed the fall in the number of "mini-jobs". In 2017, the unemployment rate reached a record low of 5.7%, a fall of one per-

<sup>1</sup> "Mini-jobs" in Germany refer to jobs that are exclusively low-paid and part-time and that are not subject to social security contributions.

## Macroeconomic trends before (2012-2014) and after (2015-2017) the introduction of the minimum wage

a) Real GDP<sup>1</sup>b) Wages and salaries per hour worked by employees<sup>2</sup>, nominalc) Employees subject to social security contributions (ESC)<sup>3</sup>d) Mini-jobs<sup>3,4</sup>

Note: all figures in boxes are annual:

- a) and b) rate of change from previous year (in %)  
 c) above: annual average ESC; below: change in ESC (in 1000s of individuals)  
 d) above: annual average "mini-jobs"; below: change in "mini-jobs" (in 1000s of individuals)

1: Rate of change from previous quarter, price-, seasonally- and calendar-adjusted.

2: Rate of change from previous quarter, seasonally adjusted with Census X-12-ARIMA.

3: Change from previous quarter, calculated on the basis of seasonally- and calendar-adjusted monthly figures.

4: Exclusively low-paid and part-time employees (change).

Sources: Federal Statistical Office; Deutsche Bundesbank; IMK calculations.



centage point compared to 2014. Wages and salaries per hour worked by employees rose year on year by 2.6%, 3.2% and 2.8% in the three years following the introduction of the minimum wage, and therefore faster than in 2014 when it increased by 2.2% in 2014 (Figure 2b). Current forecasts for 2018 and 2019 indicate a further positive overall economic outlook for Germany (Herzog-Stein et al. 2018).

The Macroeconomic Policy Institute (IMK) macro-econometric model uses a number of empirically supported assumptions to gauge the overall economic impact of introducing the statutory min-

imum wage in Germany<sup>2</sup>. The key model assumption relates to the magnitude of the wage impulse resulting from the introduction of the minimum wage of €8.50. The number of employees directly affected ranged from 3.97 million (2014 Structure of Earnings Survey (SES)) to 4.08 million (Socio-Economic Panel (SOEP) v32<sup>3</sup>). According to Federal Statistical Office calculations based on the SES 2014, over 4 million people paid at or below the minimum

2 For details of the model, see Herr et al. (2018), loc. cit.

3 Data for the period from 1984 to 2015 are from SOEP version 32, 2016, doi:10.5684/soep.v32.

wage received an average wage increase of 18% in 2015 (Federal Statistical Office 2016), equivalent to an overall 0.43% increase in wages and salaries (Mindestlohnkommission 2016, footnote 50, p. 116).<sup>4</sup>

A wage impulse on this scale feeds into the model as an exogenous increase in wage adjustment. In the model simulation, further wage adjustments then occur endogenously over the years because the minimum wage will also be increased – in the model – in line with estimated normal effective wage adjustments in the whole economy.<sup>5</sup> Moreover, the price and productivity increases generated by introduction of the minimum wage trigger small additional wage increases in subsequent wage rounds in all the sectors affected. Induced changes in the level of unemployment also have an impact on effective wage developments.

The minimum wage has two effects on the wage structure of an economy. First, it establishes a general pay floor that limits downward wage spread and produces a compression effect from the bottom of the wage structure, resulting in a more egalitarian wage distribution. Second, however, it may also have an opposite effect if its introduction or increase results in wages above the minimum wage level being raised too. This “spill-over effect” counteracts the compression effect and reduces the wage spread in the lower half of the distribution.

Both effects may be significant for the macroeconomic impact of a minimum wage, though the extent of that impact depends on many factors, particularly the level at which the minimum wage is set and the rate at which it is adjusted but also institutional factors, such as the structure and functioning of the national wage determination system – particularly the importance and coverage of collective agreements.

The SES 2014 and the 2015 Earnings Survey (ES) (Frentzen and Günther 2017) are a good basis for assessing the impact of introducing an €8.50 hourly minimum wage from 1<sup>st</sup> January 2015 (Figure 3 in Herr et al. 2018; see also Mindestlohnkommission 2016, pp. 49-59). They indicate that the proportion of all employees earning less than €8.50 per hour was greatly reduced, resulting in a marked compression

effect. Furthermore, it can be shown that there was a substantial increase not only in the group earning exactly €8.50 per hour but also among those earning up to €10.00 per hour, suggesting a marked spill-over effect. Above €10.00 per hour, by contrast, there was virtually no change in the wage structure except in Eastern Germany, where both the compression effect and the spill-over effect were rather more pronounced (Mindestlohnkommission 2016, p. 57).

On the basis of these observations, it seems appropriate to quantify a spill-over effect on gross hourly wages of up to €10.00. Calculations based on the data from SES 2014 and the ES 2015 – adjusted both for the overall increase in employment and average wage growth compared to the previous year – show that this can be estimated at a not insignificant total of around 5.4 billion € across the economy or of over 0.4% of wages and salaries in 2014 (see Appendix A3 in Herr et al. 2018). The extent of this indirect impact more or less mirrors the direct impact of the minimum wage on wages and salaries, justifying the inclusion of spill-over effects when considering the macro-econometric impact across the economy of a minimum wage.

Therefore, for the model simulations of the impact of introducing the minimum wage, this report assumes an exogenous impulse on wages and salaries of a total of 0.86%, split equally between direct effect and an induced spill-over effect (see Appendix A3 of Herr et al. 2018 for details of the calculation).<sup>6</sup> It also assumes that the minimum wage legislation has been correctly implemented (full compliance) and therefore an income effect of 0.43% of wages and salaries calculated by the Federal Statistical Office is used. The evaluation of the empirical composition of individual wage groups on the basis of the SES 2014 and the ES 2015 and the determination of the spill-over effects provide empirical evidence for the assumptions used overall – i.e. minimum wage effect plus spill-over effect.

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4 Technical model simulations were conducted for the period from 2001 to 2015. To reflect the lag built into the model, they actually began in 1999, carrying over the impulses to produce the same (relative) order of magnitude as in 2015. Given the relatively small impulse, the IMK model behaves in a largely linear way. The coefficients of the model are estimated over a period of time from 1980 to 2015 (the state sector uses a shorter period, from 1991 to 2015). It is, therefore, methodologically justifiable to carry out the simulation analyses with a time delay and to carry the interpretation of the findings over to the period after 2015.

5 Under the minimum wage legislation, the Minimum Wage Commission bases its two-yearly changes to the level inter alia of the average development of wages determined by collective bargaining. The model can depict only trends in effective wages.

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6 In reality, the impulse from the minimum wage did not occur in full as a one-off effect in early 2015; there were partial minimum wage effects that began before 2015 and effects that became evident only during the course of 2015. This time structure cannot be illustrated using a model simulation. For this reason, in reality, the total spread of the impulse over several quarters is assumed to be a one-off effect. However, this means that the effect of the minimum wage in the initial quarters of the model simulation (which follow directly from the exogenous momentum) are somewhat exaggerated. This, though, has no impact on the key short-, medium- and long-term effects described here.

## EMPLOYMENT, PRICES AND CONSUMPTION

### Employment and the minimum wage

#### Employment structure

The minimum wage debate has focused most closely on the link between the minimum wage and employment, as is also illustrated by the literature survey in the German Minimum Wage Commission's first report (Mindestlohnkommission 2016, pp. 22-25). There is more disagreement over the evaluation of empirical evidence in this area than in almost any other. However, the findings of several meta-studies show overall that the minimum wage has had few, if any, significant effects on employment (OECD 2015, Table 1.3, p. 47); the existing findings from the evaluation of sectoral minimum wages in Germany point in the same direction (see summary overview in Mindestlohnkommission 2016, p. 24); and the findings of two new macro-econometric studies also bear this out. In a recent analysis for the European Commission's 2016 annual report Labour Market and Wage Developments in Europe, Arpaia et al. (2017) examine the employment effects of statutory minimum wages across 18 EU Member States in a macroeconomic panel analysis. They find no statistically significant effects on employment as a whole but some negative effects on young employees and, to a certain extent, also on those with low skills levels (Arpaia et al. 2017, p. 19). A further new macroeconomic panel analysis for 19 OECD countries finds little empirical evidence for a substantial negative effect on employment for low skilled or young workers (Sturn 2018). Overall, the existing econometric evidence allows the conclusion that the introduction of a statutory minimum wage has little, if any, impact on employment.

The development of employment and individual working hours in the year in which the minimum wage was introduced in Germany is documented in detail in the Minimum Wage Commission's first report (Mindestlohnkommission 2016, p. 75ff. and 105ff.). In 2015, employment development was positive due to the increase in employment subject to social security contributions, which was almost four times as high as the decline in the number of employees in "mini-jobs". One reason for this marked shift in the employment structure is the introduction of the minimum wage. Taking account of tax exemptions, flat-rate payments from employers, and the administrative simplicity of subsidised "mini-jobs" at the expense of employment subject to social security contributions, the statutory minimum wage and the resulting greater transparency with regard to payment and employee rights appear to have made it more attractive for employers to offer contracts subject to social secu-

urity contributions. At the same time, the minimum wage combined with the fixed monthly wage limit of €450 per month for "mini-jobs" has reintroduced a ceiling on hours of work (between 12 and 13 hours).

The first empirical findings on the employment effects of the minimum wage are also now available. vom Berge and Weber (2017) find clear evidence of the shift in the employment structure identified above. Garloff (2017) also points to a significant positive correlation between regional and sector-specific impact and the increase in jobs subject to social security contributions but no significant link between the number of "mini-jobs" and jobs subject to social security contributions. Evaluations on the basis of data from the IAB Establishment Panel also show that companies impacted by the minimum wage have recruited fewer new employees than companies not affected (Bossler and Gerner 2016) and have taken a wide range of measures to adapt to the new rules on minimum pay (Bellmann et al. 2016), most commonly by reducing new recruitment.

#### Working time

These changes within the employment structure induced by the introduction of the minimum wage mean that a minimum wage simulation using the IMK macro-econometric model require a number of empirically supported assumptions: the model cannot endogenously depict the effects of these structural shifts on volume of work and employment.

This also requires more detailed information on the development in working hours. The existing empirical German and international literature on the influence of a minimum wage on working time provide however no such information.<sup>7</sup> Initial findings for Germany suggest that companies are adjusting the working time of their employees: Bellmann et al. (2016) indicate that 18.0% of companies affected by the introduction of the minimum wage have cut hours of work or intensified work, with a higher figure in Eastern Germany (20.0% of companies affected).

Existing findings on trends in working time vary by data source. Wanger and Weber (2016) use working time data from the microcensus to show that the hours worked by those in "mini-jobs" fell by more than 5% across the country following the introduction of the minimum wage, although in Western Germany alone, the fall was only half that. With a minimum wage of €8.50, this effect is most visible at the point at which workers are likely to switch to jobs subject to social security contributions (those working between 12 and 13 hours per week).

On the basis of the quarterly ES, the Minimum Wage Commission concludes that full-time employees in the sectors most impacted by the minimum

<sup>7</sup> See Mindestlohnkommission (2016, p. 105) for a short overview of the literature on changes in working hours induced by the minimum wage.

wage saw no significant changes in their hours of work, but that cuts in hours among part-time workers were evident in these sectors during the first three quarters of 2015; these were more marked in Eastern Germany (Mindestlohnkommission 2016, p. 105ff.). On the basis of the SES 2014 and the ES 2015, a comparison of the average weekly working hours of persons earning less than €8.50 per hour in 2014 with average weekly working hours of those earning between €8.45 and €8.54 in 2015 shows a fall in hours of work among full-timers and those in “mini-jobs” by 3.8 and 0.8 hours respectively and a slight rise, of 0.4 hours a week, among part-timers (Frentzen and Günther 2017, Table 10).

### Own calculations and model assumptions

The changes in the employment structure induced by the introduction of a minimum wage between “mini-jobs” and full-time and part-time employment subject to social insurance contributions have an impact on the total hours worked in the economy. Own calculations show a possible effect of between 0.04% and +0.02% of the total hours worked in 2014 (Table 1). This suggests that the direct effect of these changes in the employment structure on total hours worked is likely to have been extremely small.

In terms of employment, our calculations indicate that the minimum wage produced a negative net effect across the economy of 74 400 persons working in “mini-jobs” by the end of 2015 and a further 43 400 by the end of 2016 (see Appendix A2 in Herr et al. 2018). However, this reflects only the decline in “mini-jobs”. Overall, employment in Germany in-

creased to differing extents in 2015 and 2016 and, according to the NA, the total number of employees at the end of 2016 was 1.2 million higher than at the end of 2014.

What is striking about reactions to the introduction of the minimum wage in 2015 is the rapid and marked decline in the number of those in “mini-jobs”. IAB studies found that immediately following the introduction of the minimum wage, the fall in “mini-jobs” was compensated for by a greater increase in part- and full-time employment in sectors particularly impacted by the minimum wage (vom Berge and Weber 2017). Based on these findings, we calculate that the volume of work may well have remained unchanged. With an unchanged number of hours worked, the total employment effect as the result of the shift in the employment structure was -0.3% by the end of 2016 (see Appendices A1 and A2 in Herr et al. 2018).

For the simulations, this observed shift in the employment structure was included exogenously in the model.<sup>8</sup> This means that the numbers in paid employment fell by 0.25% in year 2. There is likely to be a further slow decline, taking employment losses to up to 0.4% after five years. It is assumed that the impact of the decline in the numbers in “mini-jobs” on the volume of work will continue to be largely offset by an increase in part- and full-time employees. With this structural shift between “mini-jobs”

<sup>8</sup> The employment and wage equations of the macro-econometric model are estimated on a per capita basis.

Table 1

### Effect of volume of work

	Change from previous year (persons)		Difference in differenus	Variant 1		Variant 2	
	2014 vs 2013	2015 vs 2014		working time (in hours)	Effect on annual work volume	working time (in hours)	Effect on annual work volume (in hours)
<b>"Mini-Jobs"</b>							
End-of-year departures; destination unknown	+12 000	+80 400	+68 400	0	-32 099 143	0	-32 099 142
<b>End-of-year switches</b>							
of which: to full-time	+600	+5 200	+4 600	36.3	+6 548 100	36.3	+6 548 100
of which: to part-time	+5 800	+51 200	+45 400	9.0	+0	23.8	+35 035 828
<b>Total impact on work volume</b>							
in hours:					<b>-25 551 042</b>		<b>+9 484 785</b>
in % of 2014 work volume:					<b>-0.044</b>		<b>0.016</b>

Note: figures on departures and switches from “mini-jobs” are taken from Table 2 in vom Berge and Weber (2017). Figures on weekly hours of work relate to information from Table 10 in Frentzen and Günther (2017). In the case of end-of-year departures (unknown destination), it is assumed that on the basis of the information from Table 10 in Frentzen und Günther (2017) that previous weekly working hours were g.o.

In variant 1, the assumption is that weekly working hours do not change on switching from marginal to part-time employment. Weekly hours therefore continue to reflect the hours of those in “mini-jobs”, who in 2014, earned below €8.50 per hour gross.

In variant 2, the assumption is that the weekly hours of those switching to part-time work reflect the weekly hours in 2014 of all part-time workers earning below €8.50 per hour.



and part- and full-time employment, wages and salaries – calculated by multiplying per capita wages by persons employed – rose by 0.43%, according to Federal Statistical Office calculations, reflecting the simultaneous rise in the product of hourly wages and the unchanged volume of work.

### Price increase and the minimum wage

As the theoretical considerations show (see Herr et al. 2018, section 2), the introduction of the minimum wage is likely to have had price effects, although the extent of this impact depends on the actual imperfections in the specific goods markets and parts of the labour market affected by the minimum wage. In reality, it can be assumed that introducing the minimum wage entailed some noticeable sectoral price increases, which are likely to have carried over into small-scale macroeconomic price effects. These in turn depend on the economic importance of the sectors affected by the minimum wage.

There is relatively little empirical research into the effect of the minimum wage on prices. For Germany, the first report of the Minimum Wage Commission (2016, p. 118) indicates that, for a range of reasons, no robust analysis of the price effects could be carried out as part of the assessment of sectoral minimum wages. Internationally, there are a number of relevant studies, particularly from the USA and the UK. In a literature survey, Lemos (2008) concludes that it is difficult to identify price effects across an economy and that across all existing studies, the overall price effect of a 10% rise in the minimum wage is around 0.2% (Lemos 2008, p 196).

Arpaia et al. (2017, pp. 25-26) analyse the minimum wage effect on consumer prices in 20 EU countries. They conclude that an increase of around 10% in the minimum wage drives up prices by between 0.4% and 0.6% overall, with the effect of a higher minimum wage varying greatly depending on the product category. Overall, they conclude that an increase in the minimum wage is only partly passed on into prices. Households in the lower income distribution are somewhat less affected by price increases than higher-income households (Arpaia et al. 2017, p. 27). Findings from the 2015 IAB Establishment Panel show that in Germany, higher retail prices were one of the favoured responses to the minimum wage (Bellmann et al. 2016).

German inflation was very modest in 2015, with an average increase in the consumer price index of just 0.3%, down from 0.9% the previous year. The same pattern was in evidence in the first quarter of 2015; in particular in January the index actually fell by 0.3%. However, only the (unobservable and counterfactual) 2015 rate of inflation rate excluding the effect of the minimum wage could accurately demonstrate the impact on prices. Consideration of the economic environment at the time shows that in early 2015, slower growth in oil prices also had

a dampening effect on inflation. Furthermore, the price development in the sectors most impacted by the minimum wage was above average in 2015 (Mindestlohnkommission 2016, p. 118). In its report (Table 12, p. 119), the Minimum Wage Commission lists price rises for 17 goods and services in these sectors. Taking into account the weight of these goods and services in the calculation of the consumer price index (Federal Statistical Office 2013), which together is just over 11%, and multiplying the price increases shown by the corresponding weight of the goods or services in the calculation of the consumer price index and adding this up for all 17 goods and services suggests that they contributed 0.22 percentage points to the overall price increase of 0.3% in 2015 (Table 2)<sup>9</sup>. Inflation was very low in 2015, so price increases in the sectors most impacted by the minimum wage were therefore a considerable contributor to the just positive overall price development across the economy, suggesting a noticeable price shifts in the sectors most impacted by the minimum wage.

Individuals and households entitled to the minimum wage are not likely to be disproportionately affected by greater price increases, particularly for labour-intensive services, so that there was no counter-effect to the higher propensity to consume among this group. Another special feature in 2015 was that the decline in energy prices that already took place in previous years reduced prices of a great number of goods and services.

In the model, the development of unit labour

Table 2

#### Price effects

	2013	2014	2015
Rate of change in consumer prices (in %)	1.50	0.90	0.30
Contribution to inflation of 15 goods and services from 12 sectors particularly affected by the statutory minimum wage <sup>1</sup> (in percentage points)	0.36	0.26	0.22

1 Individual consumption (sectors): Passenger transport by road (taxi operation); Passenger transport by sea and inland waterway (inland passenger water transport); books, miscellaneous printed matter, newspapers and periodicals (publishing of books, periodicals and other publishing activities); restaurants, cafés and the like and canteens (food and beverage service activities); accommodation services (accommodation); postal services (other postal and courier activities); fish and seafood (fisheries and aquaculture); bread and cereals (manufacture of bakery and farinaceous products); hire cars (rental and leasing activities); fees for fitness studios (sports activities and amusement and recreation activities); cultural services (motion picture, video and television programme activities); and games of chance (gambling and betting activities).

Sources: Mindestlohnkommission (2016, Table 12, p. 119); Federal Statistical Office, Fachserie 17 Reihe 7 and Federal Statistical Office (2013); IMK calculations.



9 This procedure is likely to exaggerate the effect because it assumes that price increase compared to 2014 in the sectors particularly affected by the minimum wage was caused solely by the minimum wage. However, in 2015, there was virtually no evidence of general price increases, which suggests that the procedure chosen is likely to have over-estimated the effect on prices induced by the minimum wage to only a minor extent.

costs is important in the price equations but is relativised through companies' pricing-to-market strategies (Horn et al. 2017). These strategies are, however, likely to have played only a small part in the case of domestic services, which are all subject to the same minimum wage and face little competition from imports. To that extent, a greater and more rapid transfer into prices can be expected than is normally observed following general wage rises across the economy. In the model, the – estimated – process of passing on higher unit labour costs lags to some extent. After the introduction of the minimum wage, however, prices rose immediately in most of the sectors affected (Mindestlohnkommission 2016, p. 119). Without an exogenous intervention in the model, the simulation shows a short-term price increase induced by the minimum wage of “only” 0.1%. Therefore, for the simulation of the introduction of the minimum wage, right at the beginning of the simulations a permanent premium of 0.1% was set on the simulated price level of private consumption. Thus the price effect in the model, with the exogenous additional impulse, is still somewhat lower than the estimated induced price effect from the literature and own calculations presented above.

### Development in consumption and the minimum wage

In empirical studies on the effects of introducing the minimum wage, there is little discussion of the extent to which the comparatively high propensity to consume of individuals and households benefiting from the minimum wage or spill-over effects has further boosted demand. This absence may be attributable to the fact that partial equilibrium models cannot answer this question. An economic model like the IMK model does, however, enable this issue to be addressed.

Arpaia et al. (2017, p. 28ff.) investigate the influence of the minimum wage on average consumer spending by consumption quintiles for 18 EU member states. Econometric estimates show a significant positive effect of a minimum wage increase on overall economic consumption, with a stronger effect at the lower end of the distribution, suggesting that a 1% increase in the minimum wage produces a 0.7% increase in consumption in the bottom quintile, a 0.6% increase in the second quintile and an increase of between 0.3% and 0.4% in the third quintile. These values are seen as the upper limits of the consumption effect of the minimum wage (see Arpaia et al. 2017, pp. 29-30 and particularly Table 11)<sup>10</sup> and are very high, given that only some households in the three lowest quintiles benefit directly from any

increase in the minimum wage. As far as the transferability of these values to Germany is concerned, it should be noted that these orders of magnitude reflect average values for all 18 countries included in the study and that the minimum wage may well have a quite different impact on income quintiles in these countries than in Germany. Moreover, there is no empirical evidence for the impact of a minimum wage on household incomes in Germany, so it is not possible to gauge the transferability of the findings.

Despite these limitations on transferability, it can be assumed that the introduction of the minimum wage in Germany has produced a significant additional consumption effect. A study based on the 2011 Socio-Economic Panel (SOEP) provided information on the distribution of (then potential) recipients of an €8.50 minimum wage across various equivalence-weighted net household incomes (Müller and Steiner 2013, Table 4). Our own calculations on the basis of this information shows that more than two thirds of the individuals affected by the introduction of an €8.50 minimum wage were in the lower half of the income distribution, with more than three quarters in the lowest three quintiles.<sup>11</sup> Because the propensity to consume of these households is above average (Stein 2009, Figure 8; Klär and Slacalek 2006, Figure 3, Brenke 2018), it can be assumed that the introduction of the minimum wage had a particularly positive effect on consumption, especially since there was no negative employment effect across the economy to depress spending. In any case, the consumption effect is likely to be significantly higher than with a general wage increase: households with an above-average propensity to consume are likely to have benefited more from the minimum wage than from a conventional general wage increase, whereas for households with a below-average propensity to consume, exactly the opposite is likely to have been the case, suggesting that across the economy, the minimum wage has a greater impact on spending than a general wage increase.

Since those receiving a minimum wage live predominantly in households with incomes in the lower income distribution, the marginal propensity to consume is likely to be high. Without an exogenous intervention in the consumption equation, real private consumption would also rise in line with the estimated equation, but by less than expected due to the higher propensity to consume. Furthermore the model is likely to overestimate slightly the negative effects from taxes because it uses average rates. The model estimates also a certain time-lag for the full effect of income changes to consumption changes. In the case of a high number of persons with low incomes and very low, or even, negative

<sup>10</sup> Figures in Table 11 in Arpaia et al. (2017) suggest that the effect for the third quintile is between 0.5% and 0.3% (average: 0.4%).

<sup>11</sup> Similar distribution findings are available for Austria on the basis of information from Ederer et al. (2017), but on the basis of a monthly minimum wage of €1500.



savings rates, however, the adjustment process may be more rapid.

For 1995 to 2007, for example, an estimate based on SOEP data produces downward divergences of between 4 and 8 percentage points between the savings rates of first quantile households and average savings rates of all households; this divergence increased noticeably over time (Stein 2009). In its annual report for 2016/2017, the German Council of Economic Experts reports calculations by the Federal Statistical Office for the years 1998 to 2013 showing that the savings rate over these 15 years fell markedly – by just under 2 percentage points on average but by 5 percentage points for many households (German Council of Economic Experts 2016, p. 329). Average savings rates were positive only for households with a net monthly income above €2000, whereas 15 years earlier, a net household income of €1300 had sufficed for a positive savings rate. The increase in price level in those 15 years can only explain half of this change. The current average savings rate of around 10% requires a net monthly income of between €3600 and €5000. A recent study by Brenke (2018, p. 188ff) for 2013 shows that a total of 30% of all households are in debt. Considering the 20% poorest households, about half of them have negative savings. In the top income decile, by contrast, only around 10% of households have a negative savings rate. Assuming that the vast majority of employees receiving the minimum wage are members of households with below-average incomes and very low savings rates or very high consumption rates, this produces a major additional consumption effect over and above the effect calculated by the model using average values.

To avoid this underestimation by the model in case of minimum wage simulations, an additional impulse of 0.1% of consumption was assumed. As will be demonstrated in the simulations, this increases real private consumption across the economy in the long term by 0.2%. Assuming a long-term 1.3% increase in the real wage bill, a 0.8% increase in real transfers and a 0.2% decline in real profits (all in relation to the status quo scenario), imply that real private consumption increases additionally just under 0.7% and the savings rate of private households declines by 0.09 percentage points. Without this assumption, the savings rate would have increased by 0.02 percentage points (see Table 4, Infobox 1).

### **Development of productivity and the minimum wage**

Some surveys indicate that, alongside price adjustments and reductions in working time, attempts to increase productivity might have been important for quite a few companies after the introduction of the minimum wage (Herr et al. 2018). This was certainly possible to a limited extent. However, the limits of

such a strategy become evident in view both of the observed virtually more or less complete substitution (in volume of work terms) of part- and full-time employment for “mini-jobs” and the passing of additional cost by the minimum wage on prices. This was also taking place when the economic situation was favourable and jobs were being created, which suggests that the short-run hourly productivity improvements induced by the minimum wage are likely to have been only small. In the medium- and long-run, efforts to achieve higher productivity effects (on an hourly basis) may be more successful but will probably remain limited unless there is additional investment. To take this into account, additional induced productivity effects need to be assumed in minimum wage simulations. This should compensate for the additional effects from a reduction in working time and work intensification that are not already included in the productivity estimate of the model. Here, they are assumed to be around 0.1% of total employment across the economy.

This productivity impulse is set so that the employment effect triggered by the minimum wage can be assessed as accurately as possible. It remains uncertain whether this effect will in fact occur, though even if it does, it will be difficult to gauge accurately, even in a few years’ time, because productivity effects are subject to strong economic fluctuations and the genuine minimum wage effects will be more and more mixed with other important determinants. What is uncontested is that the clear structural shift away from “mini-jobs” to employment subject to social security contributions is likely to have given rise to a clear increase in per capita labour productivity.

## **SIMULATIONS USING THE IMK MACRO-ECONOMETRIC MODEL**

### **The minimum wage scenario (scenario 1)**

First, the exogenous impulses described and discussed here are fed into the macro-econometric model and a minimum wage scenario is simulated. The results are then compared with the ‘status quo scenario’ (that is, assuming no minimum wage i.e. no impulse had been introduced). One advantage of this approach is that the comparison is not distorted by inaccuracies in adapting the model to reality. It compares only the results of two simulated conditions that can be traced back to clearly defined and diverse exogenous assumptions. The differences between the two scenarios can, therefore, be clearly attributed to the minimum wage. Below, we consider only relative divergences between the minimum wage scenario and the baseline scenario. Results for the second, fifth and tenth year of the simulation are

presented in **Table 3** and **Table 6** for a range of variables and in each case for comparison of the level of the variables. The dynamic change in a number of selected variables is presented in **Figure 2**. **Table 4** **Infobox 1** considers the influence of each of the exogenous assumptions on the total effect as part of a sensitivity analysis.

In the minimum wage scenario (scenario 1), it is clear that the initial rise in wages and salaries triggered by introducing the minimum wage – reinforced by the spill-over effects on adjacent areas of the wage distribution – is around 1% of wages and salaries across the economy after two years (**Table 3**). This effect almost doubles after 10 years (**Figure 2**), to a nominal level of around four times the original impulse created by introducing the minimum wage. Price effects triggered by the introduction of the minimum wage increase wages via collective bargaining in all sectors of the economy. By assumptions, minimum wages increase in the model at the same rate as actual wages across the economy over the 10-year period covered by the simulation. Compared with the status quo, the consumer price index grows initially by 0.2%, rising to 0.5% after 10 years<sup>12</sup>, an order of magnitude that is in line with international studies (Lemos 2008).

Under the model simulation, there is a small positive impact on real GDP from the introduction of the minimum wage (around 0.25% above its status quo level). For 2016, for example, this corresponds to an increase of around 7 billion €. This development is driven primarily by comparatively higher real private consumption of around 0.5% above the status quo, rising to as much as 0.7% above the status quo. State consumption, too, rises. In line with the estimated policy responses within the model, it adapts to economic developments. Real imports increase slightly, particularly in response to higher private consumption, and export growth is slightly dampened due to the stronger development of unit labour costs. As low-income households with a high propensity to consume benefit to a greater extent from the introduction of a minimum wage, the savings rate of private households decreases slightly.

At first glance, induced employment development is disappointing as the overall employment level in heads fall by around 0.25% compared with the status quo. However, it is important to recall the substantial drop in the number of “mini-jobs” in favour of part-time and, in some cases, full-time employment subject to social security contributions. Total hours worked is unlikely to have declined. Ultimately, this corrects somehow a development from pre-

### Simulations of the introduction of the minimum wage using the IMK model

	Minimum wage scenario			Deficit-neutral minimum wage scenario		
	Scenario 1			Scenario 2		
	Year 2	Year 5	Year 10	Year 2	Year 5	Year 10
	Divergence from status quo scenario in %					
Real GDP	0.27	0.25	0.27	0.59	0.69	0.66
Real private consumption	0.46	0.48	0.69	0.62	0.86	1.09
Real investments	0.06	0.03	0.11	0.27	0.21	0.26
Real public consumption	0.12	0.2	0.18	1.33	1.5	1.36
Real exports	-0.02	-0.15	-0.31	-0.02	-0.13	-0.33
Real imports	0.07	0.05	0.14	0.21	0.2	0.33
Nominal GDP	0.55	0.78	1.07	0.86	1.25	1.61
Nominal wages per capita	1.27	1.79	2.07	1.31	1.94	2.29
Nominal wages and salaries	1.06	1.51	1.81	1.23	2.02	2.44
Nominal gross profits	-0.36	-0.26	0.28	0.64	0.57	1.27
Consumer price index	0.21	0.38	0.49	0.19	0.37	0.55
Nominal transfers to private households	0.27	0.82	1.34	0.28	0.88	1.41
Memorandum item: employees (without structural shift) <sup>1</sup>	0.05	0.13	0.12	0.16	0.48	0.52
Employees (including structural shift)	-0.2	-0.27	-0.26	-0.09	0.08	0.14
Productivity per person in employment	0.23	0.15	0.23	0.45	0.3	0.28
Unit labour costs	0.79	1.26	1.54	0.63	1.32	1.76
Nominal public expenditures	0.22	0.7	1.07	0.72	1.33	1.82
Nominal public revenues	0.58	1.08	1.34	0.78	1.52	1.9
Memorandum item: Absolute divergence from status quo scenario						
Public deficit rate (% points) <sup>2</sup>	0.17	0.17	0.12	0.03	0.08	0.03
Wage share (unadjusted, % points)	0.29	0.38	0.32	0.12	0.31	0.24
Savings rate private households (% points)	-0.11	-0.1	-0.09	-0.01	-0.09	-0.09
Unemployment (1000s)	-21	-25	-14	-33	-51	-33

1 The structural shift illustrates the estimated net effect on employment of shifting from marginal employment to employment involving mandatory social security contributions.

2 Positive values: public deficits decrease or surpluses increase.

Source: IMK calculations using the IMK macro-econometric model.



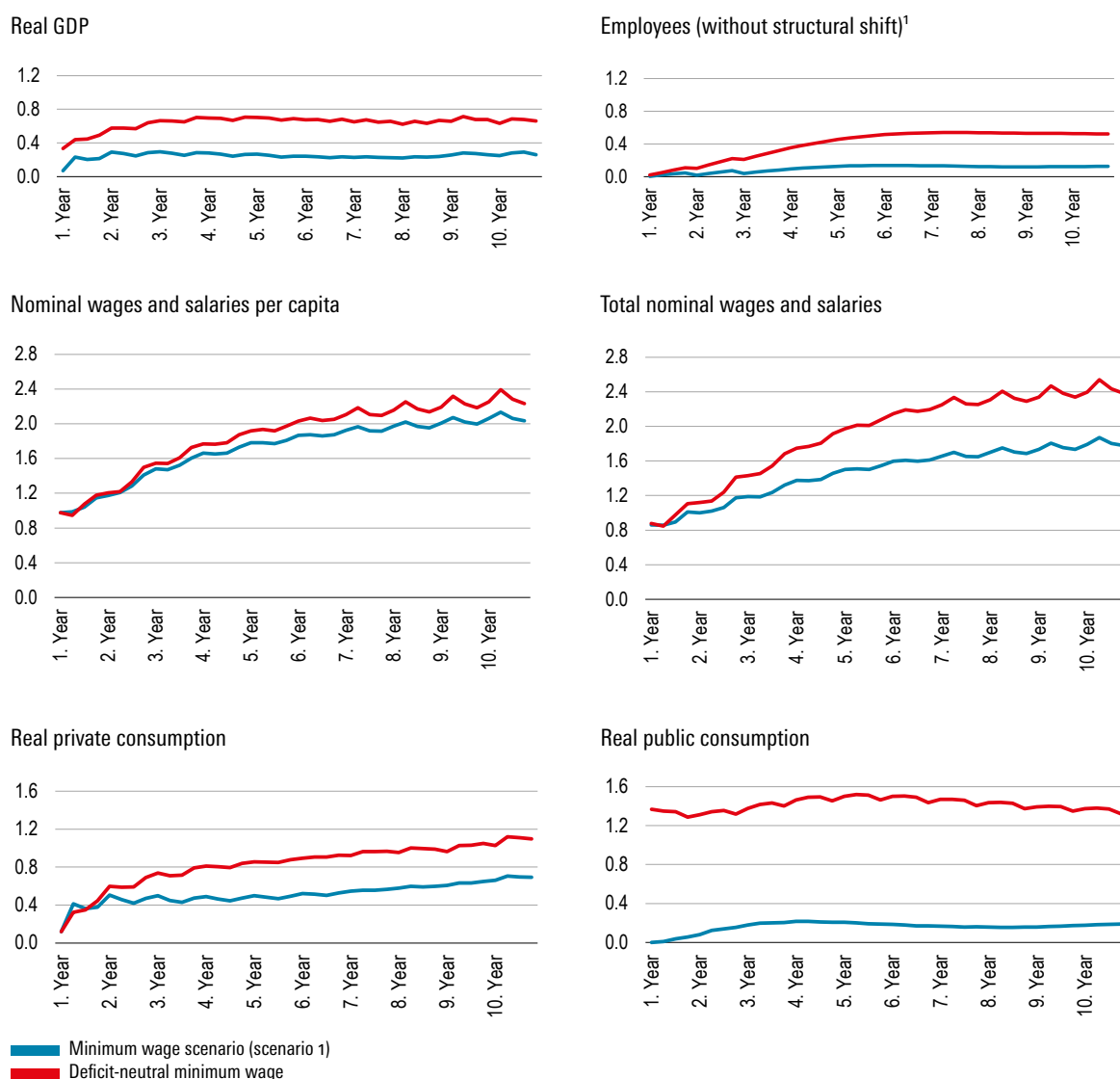
vious years in which subsidised “mini-jobs” partly replaced employment subject to social security contributions. In the pace of the introduction of the minimum wage the number of “mini-jobs” has fallen markedly, which in mathematical terms is reflected in a decrease in the number of employees. However, employment without this structural shift is actually higher and rising since the introduction of the minimum wage (**Figure 2**). The reason lies in a marked increase in employment subject to social security contributions with on average higher weekly working hours that overcompensate the lost “mini-jobs”.

Triggered by the rise in unit labour costs, prices and hence also nominal GDP, rise steadily over the simulation period. Although higher prices in themselves reduce the purchasing power of employees and transfer income recipients, wages and transfers to private households also rise – and more rapidly than prices. This preserves the purchasing power of all employees and recipients of transfers. The largest group of transfer income recipients is pensioners, whose income benefits particularly from wage increases, albeit with a slight time lag. Major growth in real wages is, however, limited to persons directly affected by the introduction of the minimum wage or indirectly because their hourly wage was slight-

<sup>12</sup> This includes employers’ social security contributions, which also rose following the introduction of the minimum wage, triggering further pressure on prices. It is also important to note that the introduction of the minimum wage not only made private consumption more expensive but also affected other components of the GDP, such as the export of services as part of the tourist traffic sector.

## Macroeconomic impact of the introduction of the minimum wage

Divergence in % from status quo scenario



<sup>1</sup> The structural shift illustrates the estimated net impact on employment of switching from "mini-jobs" to employment subject to social security contributions.

Source: IMK calculations.



ly above the €8.50 threshold and therefore benefit from the spill-over effects. As long as there is no conflict with the ECB over fulfilment with the inflation target rate of just under 2%, restrictive measures from monetary policy are unlikely.

As real and nominal demand rises across the economy, the initially negative effect on profits of -0.36% become positive over time and equal to +0.28% after 10 years. The initial negative effect on profits indicates that the price pass-through of the higher wage cost is only partially successful. The improvement in profits over time is achieved although the wage share increased compared to the status quo without minimum wage introduction. Ultimately, wages rise more rapidly than profits. The state,

too, wins from the introduction of the minimum wage: although government expenditures also rise in the long-run by more than 1%, driven particularly by higher pension payments, its revenues increase even more, by 1.34%, its deficit ratio falls.

For a better understanding of the minimum wage scenario, in the following, the empirically justified exogenous impulses are removed one by one from the simulation, with the exception of the basic assumption of a wage impulse of 0.43% and the empirically founded assumptions relating to the net effect on "mini-jobs" following substitution. The results are presented in **Table 4 in Infobox 1**. This procedure makes it possible to identify the individual impact of these assumptions on the overall results.

## Sensitivity tests for the assumptions made

To ensure that Table 4 is readable, only the long-term effects for year 10 are presented. Variables feeding into additional assumptions or being removed are highlighted, both for scenario 1 and for the individual alternative scenarios. As expected, the impact of the spill-over effect and of the assumption of a high propensity to consume among households affected by the minimum wage are relatively strong. By contrast, the impact of the assumption of a higher transfer to prices or additional induced productivity is noticeably smaller.

As is evident from **Table 4**, the spill-over effect mainly affects private consumption, a direct result from the higher wage bill, and hence on GDP. This expansive effect is somehow weakened by the price development. The assumption of a high rate of consumption among beneficiaries of the minimum wage also produces a comparatively strong effect. Without this assumption, growth and employment are significantly weaker. The additional price impulse reduces real consumption, but its impact on growth remains limited. The assumption of slightly higher productivity growth being induced by the minimum wage also has only a small influence on growth but a clear influence on employment development. There is also an influence on the development of prices and wages. However, in their impact on real consumption, these effects weaken each other, producing virtually no impact on growth.

**Table 4**

### Sensitivity analysis of the impact of different assumptions under scenario 1

	Minimum wage scenario				
	Scenario 1	without exogenous spillover effects	without exogenous higher private consumption	without exogenous higher price effect	without exogenous higher productivity
	Year 10	Year 10	Year 10	Year 10	Year 10
	Divergence from status quo scenario in %				
Real GDP	0.27	0.17	0.14	0.33	0.27
Real private consumption	<b>0.69</b>	0.41	<b>0.48</b>	0.78	0.71
Real investments	0.11	0.07	0.05	0.13	0.11
Real public consumption	0.18	0.12	0.09	0.22	0.19
Nominal GDP	1.07	0.61	0.89	1.05	1.14
Nominal wages per capita	<b>2.07</b>	<b>1.28</b>	2.00	2.01	2.10
Nominal wages and salaries	1.81	0.95	1.60	1.81	1.95
Nominal gross profits	0.28	0.34	-0.01	0.21	0.25
Consumer price index	<b>0.49</b>	0.30	0.48	<b>0.38</b>	0.53
Nominal transfers to private households	1.34	0.67	1.20	1.21	1.27
Memorandum item: employees (without structural shift) <sup>1</sup>	<b>0.12</b>	0.05	-0.01	0.18	<b>0.23</b>
Employees (including structural shift)	<b>-0.26</b>	-0.33	-0.39	-0.20	<b>-0.15</b>
Unit labour costs	1.54	0.77	1.46	1.48	1.67
Nominal public expenditures	1.07	0.57	0.98	1.07	1.12
Nominal public revenues	1.34	0.75	1.13	1.32	1.42
Memorandum item:	Absolute divergence from status quo scenario				
Public deficit rate (% points) <sup>2</sup>	0.12	0.08	0.06	0.11	0.13
Wage share (unadjusted, % points)	0.32	0.13	0.33	0.33	0.35
Savings rate private households (% points)	-0.09	-0.1	0.02	-0.09	-0.09
Unemployment (1000s)	-14	-9	-8	-16	-14

1 The structural shift illustrates the estimated net effect on employment of a shift from "mini-jobs" to jobs subject to social security contributions.

2 Positive values: public deficits decrease or surpluses increase.

Source: IMK calculations using the IMK macro-econometric model.

Using an estimated VAR in VEC form (hereafter VECM: Vector autoregressive cointegrated model) enables us to explore the extent to which the short-term forecasts of the macro-econometric model are actually borne out (**Infobox 2** and Herr et al. 2018). The

VECM model forecasts like the macro-econometric model strong positive effects on wage and small positive effects on prices. The effects on employment are overall positive.

## Simulations with a VAR model

VAR (vector autoregressive model) models offer two major advantages in terms of providing empirical answers to economic questions. The first is that these models enable data to 'speak for themselves', so that the results are by far less influenced from ex ante theoretical conditions. The second is that their multivariate specification enables interdependencies between variables to be reflected, which is an important aspect of any macroeconomic analysis. The disadvantages of these models have also been researched. The choice of the specification has a great influence on the results and forecasts that underpin the analysis presented below. As with all common forecasting methods, the quality of the forecast also deteriorates as the time horizon extends. Both disadvantages reflect the nature of macroeconomic series: they possess stochastic trends – that is, they are non-stationary (White and Granger 2011).

Specifically, in answering the question as to the macroeconomic effects of the minimum wage, the following VAR analysis follows three stages as in Logeay and Schreiber (2006). The first stage is to estimate a VAR that was actually specified as a VECM (vector autoregressive cointegrated model) for the period before the minimum wage was introduced. Second, this estimated VECM is used to calculate, for the period after the introduction of the minimum wage in Germany up to the current period, a forecast for changes in the time series used in the model (out-of-sample forecast). This forecast reflects extrapolation into the future of the trends in the variables as well as the interdependencies between the variables used in the model. The third and final stage compares this forecast with the actual changes in the variables used following introduction of the minimum wage. The departures of the out-of-sample

forecast from actual data are then interpreted as possible impact from the minimum wage, as in **Table 5** and **Figure 3**. Overall, the model accurately forecasts economic trends in the year in which the minimum wage was introduced, so that the minimum wage did not significantly overlay the impact of other factors influencing the economy. For 2015, with a difference of 0.2% between forecast and actual values, the forecast for real GDP was only slightly higher than actual development. In 2016, the positive economic development is interpreted as having been induced by the minimum wage. However, as a result of a more favourable global economic environment – something that the VECM cannot record because the estimation period came to an end in late 2014 – the impact from additional positive effects was greater. Hence the focus will be on 2015, a year during which the impact of the minimum wage on growth and exogenous economic impulses were not outweighed and it can, therefore, be assumed that divergences between the actual and the forecast values can largely be interpreted as resulting from the minimum wage.

The simulated positive wage effect of the minimum wage, of between 0.6% and 0.7%, is robust and statistically significant: the blue line in the second chart in **Figure 3** on the left, which reflects actual wage trend, ranges between the 68% and 95% confidence interval, with the divergence between the forecast and actual trends differing significantly from zero at the 33% significance level. The consumer prices, as expected, are positively affected, although not significantly. The divergences between the various employment values – working hours, number of employees and volume of work – point to an extraordinarily positive employment development. Reliable statements on the scale of employ-

Table 5

### Comparison of out-of-sample forecasts under the VECM<sup>1</sup> with actual changes

	Real GDP	Consumption deflator	Gross wages	Employees (1000s)	Volume of work	Unemployment rate (ILO concept) in percentage points
<b>2015</b>	-0.2%	0.2%	0.7%	147	0.2%	0.0
<b>2016</b>	0.5%	0.1%	1.6%	426	0.8%	0.0

Note: positive values signify that actual trends outperformed the forecasts.

<sup>1</sup> VECM with lag length p=2 and r=2 cointegration relationships.

Sources: Federal Statistical Office, National Accounts (data as of q2-2017); IMK calculations.

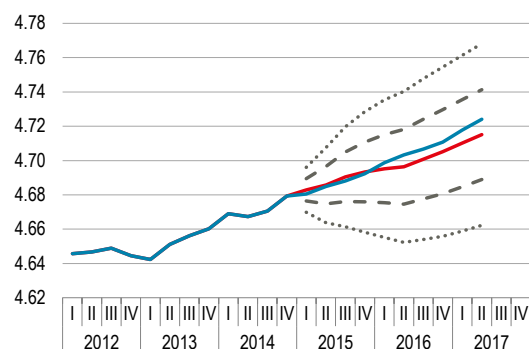
ment effects are not possible, however, because the results are not robust enough or statistically insignificant. In the short term, the results of the VECM model offer no basis for identifying negative effects

at macro-level of introducing the minimum wage; rather, they outline positive effects on labour market developments.

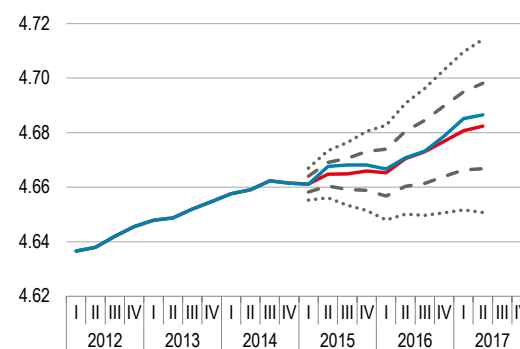
Figure 3

Out-of-sample forecasts of the VECM<sup>1</sup> and actual developments

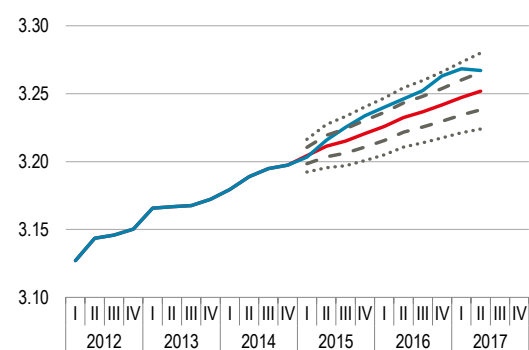
Log real GDP



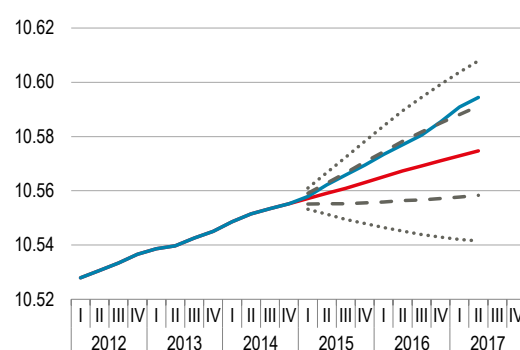
Log deflator of private consumption



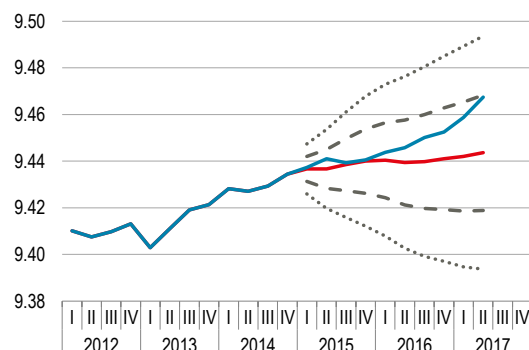
Log wages and salaries per hour worked by employees (nominal)



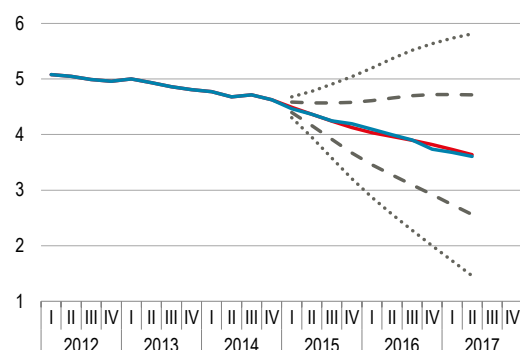
Log employees (domestic concept)



Log working hours per employee



Unemployment rate (ILO concept, in %)



— Forecast (VECM)     
 — Actual change     
 - - - - - KB-68%     
 ..... KB-95%

<sup>1</sup> Forecasts under the VECM with lag length p=2 and r=2 cointegration relationships.

Sources: Federal Statistical Office, National Accounts (data as of q2-2017); IMK calculations.



### Minimum wage simulation assuming a deficit-neutral fiscal policy (scenario 2)

The minimum wage simulation (scenario 1) demonstrates that the state can slightly improve its net lending/net borrowing as a result of the positive macroeconomic income and price effects and the associated additional tax and social security revenues. Its revenues rise more rapidly than its expenditures. To reflect a fiscal policy that is approximately deficit-neutral in reaction to the macroeconomic impact of the minimum wage, in scenario 2 public expenditures are increased so that net lending/net borrowing remains more or less balanced. For purposes of simplicity, real public consumption is raised by 1% compared with the status quo.<sup>13</sup> This scenario 2 is more likely to reflect reality in 2015 and 2016 accurately than scenario 1, which implicitly assumes a more restrictive fiscal policy. The results are presented in **Table 3** as scenario 2.

Comparing the results of scenarios 1 and 2 reveals more than twice the growth impact: GDP grows in 2016 by an additional 15 billion €. This also improves the labour market effects markedly. Employment, including structural effects, is now above the status quo in the medium to long term; excluding structural shifts, it is around 0.5% higher in the long term. In scenario 2, wages rise only slightly more than in scenario 1. Following the increase of nominal GDP, companies across the economy can increase their profits immediately. The negative effects on exports are similar to those under scenario 1 but – thanks to more positive economic development – imports rise more than twice as rapidly as in scenario 1.

In the case of the public budget, it is evident that the – assumed – higher public expenditures also cause a medium- to long-term increase in revenues. Part of the additional public expenditures are financed by the multiplier effects themselves. In the simulation, too, there is a slight improvement in the public deficit rate.

### Simulation of a macroeconomically oriented wage policy (scenario 3)

Macroeconomic analysis of the introduction of a universal statutory minimum wage in Germany, which goes further than a partial analysis and also considers the long-run, must also take account of the practical significance of the minimum wage for wage bargaining in the country. In an economic environment in which the proportion of employees covered by collective agreement has fallen substantially, there is a risk that medium- and long-term wage development no longer meets the needs of a

macroeconomically oriented wage policy and will tend to generate deflationary impulses. In this situation, the minimum wage is a necessary supplement to the collective wage determination system through centralised wage bargaining agreements and has an important part to play in stabilising the collective wage bargaining system. It limits the downward drift in wage distribution and, if designed properly, ensures that wages in the lower wage distribution ranges reflect an adequate share in growing social prosperity. It thus improves the likelihood of the wage development across the economy as part of a macroeconomically oriented wage policy.

The following analysis is designed to illustrate the complementary general economic effects of a macroeconomically oriented wage policy resulting from a collective wage bargaining system complemented and stabilised by a universal minimum wage as part of a Keynesian consideration. The starting point for this alternative wage development (scenario 3) is 2001, shortly after the formation of the European Monetary Union (**Table 6**). The yardstick for alternative wage-setting is the concept of a macroeconomically oriented wage policy under which wage increases across the economy generally exhaust the scope for

Table 6

#### Macroeconomically oriented wage policy

	Scenario 3		
	Year 2	Year 5	Year 10
	Divergence from status quo scenario in %		
Real GDP	0.4	1.4	1.9
Real private consumption	0.7	2.6	4.8
Real investments	0	0	0.4
Real public consumption	0.2	0.8	1.3
Real exports	-0.1	-0.5	-2.2
Real imports	0	0.2	0.7
Nominal GDP	0.9	3.6	8.1
Nominal wages per capita	2.4	8.5	15
Nominal wages and salaries	2.6	9.2	16.8
Nominal gross profits	-2.4	-5.8	-5.2
Consumer price index	0.3	1.2	3.3
Nominal transfers to private households	0.8	3.3	9.6
Employees	0.2	0.7	1.6
Productivity per person in employment	0.3	0.8	0.9
Unit labour costs	2.2	7.7	14.7
Nominal public expenditures	0.6	2.6	8.3
Nominal public revenues	1.2	4.8	10.5
Memorandum item:	Absolute divergence from status quo scenario		
Public deficit rate (% points) <sup>1</sup>	0.3	0.9	0.9
Wage share (unadjusted, % points)	1	3.1	4.2
Savings rate private households (% points)	0.2	0.3	0.1
Unemployment (1000s)	-25	-125	-133

1 Positive values: public deficits reduce or surpluses increase.

<sup>13</sup> Alternatively, public investment or state transfers could have been selected as spending impetus with comparatively higher or lower multipliers.

Source: IMK calculations using the IMK macro-econometric model.



distribution resulting from productivity rates and the ECB's target inflation rate (Horn and Logeay 2004; Herr and Horn 2012).

The simulation assumes a medium-term overall increase in productivity across the economy of 0.7% per year and per employee (the actual average increase per year over the past 15 years). With the ECB's target inflation rate at just under 2%, wage growth across the economy is then likely to be around 2.65% a year.

The induced price increases – 3.3% over 10 years – would offset part of the nominal wage increases. However, real wages would still have risen by almost 12% after 10 years, giving real private consumption an additional 4.8% boost. Economic growth and employment would rise modestly (Table 6 scenario 3). Because of the limited impact of higher wages on prices, real wages rise significantly and nominal profits are expected to be lower by 5%; in other words, the wage share is expected to rise.

The model's results show that after 10 years, unit labour costs would be almost 15% higher than in the status quo. Nevertheless, real exports would continue to rise significantly over the simulation period (Horn et al. 2017).

Actual changes resulting from a macroeconomically oriented wage policy are most evident in the domestic economy and, in particular, in the distribution between earned and capital income. With wage increases across the economy of 2.65% a year, the (unadjusted) wage share would not have fallen significantly over the last decade – as it actually did – but would have risen significantly over the period covered by the study.

In terms of employment and economic growth, Germany benefits from the macroeconomic-oriented wage policy. While there is little less growth in exports, the economy arguably follows a considerably much more balanced growth path, with stronger domestic growth more than compensating the somewhat weaker growth in exports.

The implications of improved wage development for public finances are interesting: when wages go up, so too do income tax, indirect taxation and the revenues from social security contributions. Only part of the additional induced revenues – institutionally specified – is then spent in scenario 3. Thus, wages and salaries of public employees rise and pension expenditures follow the wage increases with a time-lag. The public deficit rate – its net lending/net borrowing in relation to nominal GDP – would improve by almost one percentage point after 10 years (Table 6, scenario 3).

Leeway for fiscal policy arises by the fact that the state is the 'winner' from higher wage growth: the improved financial situation can be used for targeted fiscal stimuli (as described in scenario 2). And simply using the financial policy leeway, which makes a different wage policy possible, would significantly increase growth and employment as a result of higher wages and an expansive fiscal policy (Horn et al. 2017).

## CONCLUSIONS

Through its empirical analysis of the overall economic impact of the introducing a statutory minimum wage in Germany, the IMK has tried to determine the actual short-term and expected medium- and long-term effects on growth, prices and employment. This is a complex task, given that the available data relates to only the three years since the minimum wage was introduced and that it is not straightforward to separate out economic effects from those induced by the minimum wage.

A detailed descriptive analysis of the sectors particularly affected by the minimum wage was undertaken, showing significantly above-average wage developments in these sectors but also a very good development in profit and capital income without any notable impact on employment. However, the analysis does not answer the question of what would have happened if the minimum wage had not been introduced.

Some of the key inputs for the IMK's Keynesian-type macro-econometric model had to be obtained from empirical studies, in particular the extent to which the social partners attempted to offset the minimum wage's compression effect through a spill-over effect – above-average wage increases in wage bands above the minimum wage of €8,50. Such spill-over effects do not necessarily occur, but there is broad consensus within international research into minimum wages that they have an impact on the wage development in bands above the minimum wage level. This spill-over effect enhances the positive impact of the minimum wage on wages and salaries. The social partners in Germany did, indeed, react to: according to our calculations, there was twice the direct effect on the wage bill across the economy.

Specific pre- and post-minimum wage trends in the labour market were also noted: there was a significant structural shift away from "mini-jobs" towards additional employment subject to social security contributions, although the volume of work in terms of hours changed little, if at all. Ultimately, this partial correction of an earlier distortion, in which in some sectors conventional jobs had been split and converted into "mini-jobs", represents a 'loss' of "mini-jobs" and, hence, also of employment per capita.

To gauge the impact of the minimum wage empirically, a number of simulations were carried out using the IMK model, producing diverse and detailed results. In qualitative terms, the most significant findings are as follows:

- Economic growth tended generally to be stimulated by the introduction of the minimum wage, mainly through higher wages for those entitled to the minimum wage and a spill-over effect. Individuals who were unlikely to save and who therefore saw a particularly marked rise in real

- private consumption benefited particularly.
- While prices did rise, these rises were negligible in terms of a macroeconomic scale. Higher (minimum) wages and only minimal price increases trigger a process that, over time, also produces small rises in the wages of all employees in the normal wage rounds. As a result, those in employment are not disadvantaged overall. The price effects of introducing a minimum wage in 2015 helps significantly to counter deflationary tendencies, preventing even greater divergence from the ECB's target inflation rate.
- Alongside those benefiting directly from the minimum wage, the state also benefits: its revenues rise more rapidly than its expenditures. If the state spends this additional revenues in a deficitneutral way, economic growth is stimulated to a greater extent and employment rises. The findings of the model show that, if there is an appropriate fiscal policy response, additional revenues are not used to reduce the deficit (what would be a policy of austerity) and employment rises. The actual development in 2015 and 2016 suggests that this actually took place in Germany.
- With regard to wage developments across the economy that meet the important requirements of a macroeconomically oriented wage policy,

the minimum wage is a necessary supplement to the German collective wage bargaining system through centralised wage bargaining agreement. Without the minimum wage, individuals in companies outside collective agreements would work for very low wages and continue to be cut off from the benefits of growing social prosperity. The minimum wage gives them a stake in economic growth.

An atheoretical VECM also assesses the extent to which the quantitative results are driven by the specifications of the theoretical perspective. The VECM analysis, which covers only the short-term, identifies a significant positive impact on wages for 2015 and the expected positive (but not significant) price impact across the economy, with a markedly positive (but not significant) effect on employment. These findings support the short-term impact found using the macro-econometric model.

Taken as a whole, the findings presented here demonstrate that the macroeconomic impact of introducing a minimum wage in Germany has been positive and has helped to put the country on a more stable growth path based not only on successful exports but also on reliable growth in domestic demand as a result of a better wage development.

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