The Price and Employment Response of Firms to the Introduction of Minimum Wages

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Abstract:

This paper studies the price and employment response of firms to the introduction of a nation-wide minimum wage in Germany. Instead of reducing employment, affected firms raised prices to absorb the increase in the wage bill. The price effect is prevalent across different sectors of the economy including manufacturing and is thus not limited to low-wage industries. The results indicate that speed and degree of price pass-through were remarkably high and substantial. Moreover, I find considerable heterogeneity in firms' responses to the minimum wage depending on their own business expectations, product market competition, and local labor market conditions.

Keywords: Price Pass-Through, Heterogeneity in Minimum Wage Effects, Firm Data, Germany
JEL Classification: J38, J08, E31, J31

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1. Introduction

Whether minimum wages lead to job losses or not has been an issue of intensive discussion among economists for decades (see e.g., Stigler, 1946; Card and Krueger, 1994; and Neumark and Wascher, 2000). While the debate on employment effects has not reached consensus yet, there is increasing evidence that firms pass through a substantial share of minimum wage costs to prices (see Lemos, 2008 and MaCurdy, 2015 for reviews). However, the importance of the price pass-through channel has usually been documented in industries that employ a large share of low-wage workers, such as restaurants (e.g., Card and Krueger, 1994; Aaronson, 2001; Aaronson et al., 2008; and Fougère et al., 2010) and retailing (Renkin et al., 2019 and Leung, 2018). In contrast, there is only scant evidence that the pricing margin is of comparable importance for firms in other sectors that typically differ strongly in their competitive environment.

This paper provides a comprehensive analysis of the price effect of minimum wages that documents that pass-through is a common pattern in large parts of the economy, presents novel evidence on heterogeneity in firms' responses to minimum wages, and performs an analysis of price adjustment dynamics at monthly frequency. Departing from a replication of existing evidence on the close-to-zero employment effects, the paper is the first to examine the price response of firms to the introduction of a statutory nation-wide minimum wage in Germany in 2015 (henceforth, NMW). The German NMW offers a unique opportunity to evaluate the reaction of firms to minimum wages because it directly affected more than 10% of all employment relations (Destatis, 2016).[1] While existing studies on the effects of minimum wages usually draw on a selected sample of low-wage sectors with sufficient variation in its bite, the NMW can hence be exploited to generalize these findings to firms in different sectors of the economy. In addition, the German NMW allows to analyze the heterogeneity in firms' responses to minimum wages depending on their business expectations, product market competition, and local labor market conditions that so far have widely been neglected by the literature.

The paper mainly focuses on firms' price response to the NMW which has not been studied yet because neither micro data on producer prices nor industry-specific price indices at regional levels are available. I circumvent this constraint by making use of the ifo Business Survey (IBS). This representative survey is unique in asking a panel of approximately 5000 German manufacturing firms and service companies about their planned changes in prices at monthly frequency. Despite of the qualitative nature of the questions, the IBS data closely track actual changes at the industry level. Hence, the IBS offers the best available data to assess the minimum wage-induced price response of firms in all relevant industries of the economy. Moreover, the IBS contains firms' planned employment changes which allows to replicate existing evidence regarding the employment effect found based on administrative data.

The reaction of firms to the NMW is estimated in a difference-in-differences design with continuous treatment. Using administrative wage data, the treatment intensity is proxied by the fraction of

[1] In contrast, at most 7% of covered workers were directly affected by each change in federal or state level minimum wages in the U.S. between the mid-1980s and 2014 (see Autor et al., 2016).

full-time employees in each firm's industry and location that was affected by the NMW. This bite measure is not only shown to be strongly correlated with alternative indicators using other sources of wage data, but also captures whether or not firms perceive themselves as being affected by the NMW.

The estimation reveals a strong minimum wage effect on prices across firms in different sectors of the economy. While planned price changes are not correlated with the bite of the NMW prior to the reform, this relationship is strong and significantly positive during the period around the introduction in January 2015. Using additional information on realized price changes provided by a subset of firms shows that firms not only planned to increase their prices in response to the NMW, but also implemented these changes. Given the same bite, the price reaction of firms is equally strong in manufacturing and services as well as in West and East Germany. Hence, the price pass-through channel constitutes an important margin of adjustment for firms in sectors that have not been covered by a large part of the minimum wage literature, so far.

Moreover, the results indicate that speed and degree of price pass-through were remarkably high. The monthly frequency of the IBS data allows for a detailed inspection of the adjustment dynamics. According to this, 70% of the NMW-induced price adjustment took place during the 12 months around its introduction. In addition, the strong correlation between aggregated IBS data and quantitative changes in industry-level producer price indices is exploited to approximate the effect of the NMW on the overall level of producer prices. A back-of-the-envelope calculation yields that prices in manufacturing and services were raised by approximately 0.24% in consequence of the NMW. In comparison, if firms had fully complied to the NMW and held their employment structure constant, this would have implied an overall cost increase of approximately 0.29%. Hence, the resulting elasticity of 0.82 indicates that the price pass-through of the NMW was substantial.

In contrast to the strong and sizable effect on prices, the estimated NMW effect on planned employment changes is only moderately negative and insignificant throughout all empirical specifications. In light of potential measurement error the bite measure arising from the fact that TI_i is constructed at the level of industry-region cells, however, a negative employment reaction cannot be ruled out with certainty. As the same argument applies to the estimated price effect, the results show that affected firms much more often increased prices in response to the NMW compared to cutting employment.

Further, the paper presents new evidence on heterogeneity in firms' responses to the NMW depending on the competition they face in the product market and local labor market as well as their business expectations. First, the price effect is stronger—and the employment response slightly muted—if firms' export share is smaller, their goods and services are traded more locally, and competition through imports is lower. These firms have a larger scope to pass-through the costs of the NMW to their customers because they are less likely to face foreign or domestic competitors that are either unaffected or hit less strongly by the German NMW. Second, the employment response is significantly more negative for a given bite of the NMW if firms did not report labor shortages or if they were located in counties with higher unemployment rates or less tight labor

markets, respectively. Third, the disemployment effect associated with the NMW is significantly negative for firms with rather grim expectations regarding the general future development of their businesses. In turn, these firms raised prices less frequently given the same bite.

The main contribution of the paper is to provide the most comprehensive assessment of firms' pass-through of minimum wages to prices comprising of (1) the generalization of existing evidence from highly affected industries to other sectors of the economy, (2) the presentation of novel evidence regarding heterogeneity along several dimensions, and (3) the evaluation of adjustment dynamics at monthly frequency. In this regard, the paper is closest to Harasztosi and Lindner (2019) who provide a detailed assessment of a large minimum wage increase in Hungary in 2001 along several margins of adjustment and show that 75% of its costs were paid by consumers via higher revenues. They restrict their main analysis to responses in revenues due to a lack of price data for services firms and only document a direct effect on prices for the subset of manufacturing firms. In contrast, I observe price responses of firms across all industries of a larger and more developed economy at monthly frequency. This allows for a direct comparison of the price response of manufacturers and services firms as well as for a more detailed inspection of the adjustment dynamics.[2] Moreover, Harasztosi and Lindner (2019) is the only other paper that (indirectly) examines heterogeneity in the price effect of minimum wages. They document a smaller revenue effect for firms in tradable, exporting, and manufacturing sectors. While my findings coincide with their first and second result, I do not find that manufacturing firms *per se* increased prices less frequently compared to services firms that were affected by the NMW to a similar degree. In addition, my results indicate that heterogeneity in industry-specific import pressure, local labor market conditions, and firms' expectations regarding the general development of their businesses are important in understanding their responses to minimum wages.

Specifically, my findings generalize the existing evidence on price effects of minimum wages by documenting that a substantial degree of pass-through is a commonly observed pattern across large parts of the economy. Although the view that higher minimum wages come along with higher prices is widely accepted (MaCurdy, 2015), earlier studies in favor of price pass-through usually draw on a selected sample of low-wage industries such as restaurants (e.g., Card and Krueger, 1994; Aaronson, 2001; Dube et al., 2007; Aaronson et al., 2008; Fougère et al., 2010; and Allegretto and Reich, 2018) and retailing (Renkin et al., 2019 and Leung, 2018). While many of these papers document (close to) full pass-through of costs to prices, the evidence on price effects in other sectors is sparse and less clear.[3] A recent exemption is Cooper et al. (2019) who document the effect of

[2] Harasztosi and Lindner (2019) use annual data and find that the price effect in the manufacturing sector took more than two years to turn significantly positive in accumulated terms. As summarized below, my results for German firms suggest a faster price adjustment compared to their case that is more in line with existing evidence from low-wage sectors as well as cost shocks of comparable nature.

[3] In contrast to the subsequent literature on price pass-through in restaurants, Katz and Krueger (1992) did not find evidence for a price response of the fast-food industry in Texas to changes in the federal minimum wage. Moreover, Machin et al. (2003) and Draca et al. (2011) show that price affects have been absent in the heavily affected, but price-regulated British residential care industry. In addition, Wadsworth (2010) does not find significant price effects in several low-wage industries in response to increases in the British national minimum wage based on industry-level price data. See Lemos (2008) for a survey.

minimum wage increases on local price indices in the U.S., which is found to be more pronounced in sectors and locations with higher shares of low-wage workers. Focusing on aggregate effects, they regress sector-specific CPIs on minimum wage changes without exploiting variation in bites across industries. Hence, their results are silent with respect to whether firms in different industries react to minimum wages in a comparable way for a given bite or not—the question that is at the heart of my paper.

In addition, the paper contributes to the literature investigating the speed of price adjustments to changes in minimum wages and comparable shocks. Detecting a prolonged positive effect on prices that is strongest during the months around the NMW introduction, my results range between those of Aaronson (2001) and Aaronson et al. (2008), who both find evidence in favor of immediate pass-through for restaurants in the U.S., and those of Fougère et al. (2010), who document that minimum wages take more than twelve months to fully pass through to French restaurant prices. Taking a broader perspective, my findings add to evidence in favor of relatively fast price pass-through in response to shocks of comparable nature, such as sales tax increases (Besley and Rosen, 1999), changes in exchange rates (Yang, 1997; Campa and Goldberg, 2005; and Gopinath et al., 2010), and emission costs in electricity markets (Fabra and Reguant, 2014).

Furthermore, the results of this paper are in line with other studies on the labor market consequences of the German NMW that add to the extensive literature on employment effects of minimum wages (see, e.g., Neumark et al., 2014 and Card and Krueger, 2015 for recent surveys). Despite of the large size of the minimum wage shock and consistent with my results, the effect of the NMW on overall employment is either found to be zero (e.g., Garloff, 2016 and Ahlfeldt et al., 2018) or negative, but small (e.g., Caliendo et al., 2018 and Bossler and Gerner, 2019).[4] Thus, the evidence from Germany is comparable to Bailey et al. (2018) and Harasztosi and Lindner (2019) who also find small disemployment effects following very large changes in minimum wages in the U.S. in the 1960s and Hungary in 2002, respectively.[5] However, my finding that the disemployment effect was significantly stronger for the small subset of firms with grim general business expectations as well as for firms facing more slack in the labor market suggests that the overall employment effect of the NMW might have been much more negative if it had not been introduced during a period of economic boom.

By highlighting the important role of price pass-through relative to employment adjustments, the paper also adds to an emerging literature that examines the effect of minimum wages on other margins of adjustment than employment. For example, some studies have emphasized that labor market flows and employment growth rates reacted more strongly to minimum wages than employ-

[4] See Caliendo et al. (2019) for a survey on the German NMW. In general, job loss has been more severe for marginally employed workers compared to regular employment. Among all studies, Caliendo et al. (2018) estimate the strongest disemployment effects: a reduction in the number of full- and part-time jobs by 78,000 (∼0.3% of all regular jobs) and a loss of roughly 180,000 marginal employment relations (∼2.4% of all "mini-jobs"). Still, these effects are much smaller than anticipated ex ante by Müller and Steiner (2013) and Knabe et al. (2014) who predicted a long run employment loss between 500,000 and more than one million.

[5] In contrast, Jardim et al. (2017) find negative employment effects of the strong increases in Seattle's city-wide minimum wage to $11 per hour in 2015 and $13 per hour in 2016. Their results suggest that the size of the disemployment effect increases strongly at high minimum wage levels.

ment stocks (Portugal and Cardoso, 2006; Brochu and Green, 2013; Dube et al., 2016; Meer and West, 2016) and that the profitability and stock market value of firms suffer from minimum wages (Draca et al., 2011; Bell and Machin, 2018). Moreover, the literature has provided evidence that affected firms reacted to minimum wags via non-compliance (Metcalf, 2008), tax evasion (Tonin, 2011), or substitution of jobs by machines (Lordan and Neumark, 2018). Taken together, this suggests that an assessment that is not limited to the employment margin but that also accounts for different potential adjustment channels is important to gain a comprehensive understanding of firms' response to minimum wages.

The remainder of the paper is structured as follows. Section 2 provides information about the institutional background of the German NMW introduction in 2015. Section 3 describes the data and Section 4 specifies the empirical strategy. Section 5 presents the main results regarding minimum wage effects on firms' pricing and employment including a back-of-the-envelope approximation of the quantitative size of the price effect. Then, Section 6 examines the heterogeneity in responses to the NMW. Finally, Section 7 performs diverse robustness checks and Section 8 concludes.

2. The German Reform as Unique Framework for Minimum Wage Evaluation

Institutional Background The German NMW was implemented at a gross wage of €8.50 per hour on January 1, 2015. The introduction of a wage floor that is binding for the vast majority of employment relations constituted a paradigm shift in the history of German labor market policy. Previously, wages had been determined almost exclusively through collective bargaining agreements between unions and employer associations. Consequently, minimum wages were only in force in a small number of industries provided that a wage floor, which was part of a collective bargaining agreement, was declared as binding for the rest of the industry.[6]

In general, the NMW applies to firms in all industries. As an exemption, firms in sectors with industry-specific minimum wages below €8.50 were conceded to delay their compliance to the NMW until the end of 2016.[7] In order to prevent malpractice, the NMW law was accompanied by strict obligatory requirements for firms to document daily working hours of each employee with a gross monthly wage below €2,958.

The NMW was implemented in the following way: after the federal election of September 22, 2013, the chairmen of the conservative parties (*CDU* and *CSU*) and the social democrats (*SPD*) signed a coalition agreement on November 27, 2013 that contained the intention to introduce a statutory minimum wage of €8.50 on January 1, 2015. The Federal Cabinet proposed the respective minimum

[6] Prior to 2015, industry-specific minimum wages had been in place for instance in the construction and roofing sector, in commercial cleaning, security, and laundry services, as well as in some handicraft sectors. In contrast to the NMW, they were allowed to differ between regions. See Fitzenberger and Doerr (2016) for a survey on the evidence regarding industry-specific minimum wages in Germany.

[7] These sectors include agriculture, forestry, gardening, the meat industry, manufacturing of textiles and clothing, temporary work agencies, hair dressers, and laundries. There are additional exemptions from the NMW for long-term unemployed during the first six months of re-employment, teenagers without training qualification, employees in vocational training, and internships compulsory for school programs, apprenticeship, or academic studies.

wage law ("*Mindestlohngesetz*" MiLoG) on April 2, 2014, including all relevant regulations regarding its introduction and details on the exemptions. Based on the comfortable majority of the "Grand Coalition" in both chambers of parliament, *Bundestag* and *Bundesrat* approved the law on July 3 and July 11, 2014 without major changes. After its introduction, the NMW remained constant until January 2017 when it was increased to an hourly rate of €8.84.

Unique Framework for Evaluation of Minimum Wage Effects From an international perspective, the case of Germany offers a unique setting for the evaluation of the response of firms to minimum wages because it strongly increased labor costs for firms in many different sectors of the economy. This is due to the fact that the German NMW was directly set to a relatively high level that corresponds to a minimum-to-median wage ratio of 0.48—a level that is lower than in France (0.62), close to the U.K. and the average across OECD countries (0.49), and much higher than in the U.S. (0.36), see OECD (2015). While the Kaitz indices of the national minimum wage have been historically quite stable at low levels in the U.S. and high levels in France, the British statutory minimum wage has been introduced at a lower level (0.42) in 1999 and was steadily increased thereafter. Hence, none of these most extensively studied countries observed variation in minimum wages during the last decades that was comparable to the case of the introduction of the NMW in Germany.

Consequently, the average "bite" of the German NMW was comparably very large. Prior to the introduction, 4.0 million employees (10.7% of all jobs) that were eligible to the NMW earned less than €8.50 per hour (Destatis, 2016). On average, the group of affected employees earned approximately €7.20 per hour in 2014. In order to fully comply to the NMW, firms therefore needed to increase the wages of affected employees by 18%, *ceteris paribus*, which corresponds to an increase in the overall wage bill of the economy by 0.43% (Destatis, 2016; Mindestlohnkommission, 2018). As documented in Section 4.1, the German NMW hence strongly affected firms in many different sectors of the economy.

Compared to existing literature based on changes in minimum wages in other countries, the German minimum wage reform thus allows to study the price and employment response of firms in a much broader setting without restricting the analysis to highly affected industries such as restaurants or highly affected groups such as young workers or teens, only.

3. Data

To evaluate the price and employment response of firms to the NMW requires micro data along both margins for firms in all relevant sectors of the economy. This is particularly restrictive for prices as the micro data of the German producer price index are not available for research purposes.[8] I circumvent this constraint by making use of the micro data of the ifo Business Survey (IBS). This

[8] Also, the CPI micro data are not available at the "Research Data Centers" of the Federal Statistical Office. Moreover, neither consumer price indices for different goods/servies nor industry-specific producer price indices are available at regional levels. Hence, an analysis of the effect on local price levels similar to Cooper et al. (2019) is currently not feasible for the case of the German NMW.

survey is unique in repeatedly asking a large panel of approximately 5000 German manufacturing firms and service companies, *inter alia*, about their planned and realized changes in prices and employment at monthly frequency. As documented in Bachmann et al. (2019) and in the analysis below, the survey data on prices closely track *quantitative* changes in industry-specific producer price indices despite of their qualitative nature. The IBS thus provides the best firm-specific price data available to study the price pass-through of German firms.[9]

In order to assess the firm-level effects of the NMW in the relevant sectors of the economy, I use the IBS data for the subset of manufacturing firms (IBS-IND, 2017) and service companies (IBS-SERV, 2017).[10] Firms that operate in industries that were allowed to pay wages below the NMW during a transition phase until the end of 2016 are omitted from the sample.[11] Restricting the data to January 2011 until December 2017 as well as to firms that responded at least twelve months to the survey, the data set comprises of on average 4500 firms per month (2300 manufacturers and 2200 service companies).[12] Attrition is very low in the restricted data set (on average, firms are observed for 5.5 years within these 7 years) and the ifo Institute puts effort to maintain a sample of firms that is representative of the German economy by finding suitable new respondents to replace exiting firms. Response rates to the survey are relatively high despite of the fact that participation is voluntary (firms answer the questionnaire in 84% of months on average).

The anonymized micro data of the IBS allow to track firms over the entire time span in the sample. The data contain information on firms' main sector of business following the standard

[9] In contrast to the unique nature of the IBS price data, the quality of the employment data is inferior to other sources. For example, the "IAB Establishment Panel" used by Bossler and Gerner (2019) contains quantitative data on firm-level employment. However, this data neither contains prices nor can be matched to the IBS. Still, the IBS employment data are useful to replicate the finding of Caliendo et al. (2018) and Bossler and Gerner (2019) that the NMW only had a modestly negative effect on the employment level.

[10] The IBS has been conducted since 1949 in order to construct the ifo Business Climate Index which is the most recognized lead indicator for economic activity in Germany. According to Sauer and Wohlrabe (2019), the survey is usually filled by informed personnel such as managing directors and department heads. The IBS is divided into four industry surveys that cover the main sectors of the economy (manufacturing, services, retail/wholesale, construction). I do not use data from the construction survey because these sectors were already covered by an industry-specific minimum wage above the NMW. Moreover, retailers and wholesalers are excluded because the direct effect of the NMW through higher labor costs cannot be disentangled from price increases of the products they sell, which have potentially been produced by firms affected by the NMW.

[11] Specifically, I exclude firms in the two-digit industries WZ08-13 "Manufacture of textiles," WZ08-14 "Manufacture of wearing apparel," WZ08-78 "Temporary employment agencies and other employment activities," WZ08-96 "Other personal service activities" (85% of all employees belong to WZ08-9602 "Hairdressing") as well as the three-digit industry WZ08-101 "Processing and preserving of meat and production of meat products." These firms cannot be used as a control group as their industry-specific minimum wages have been increased in steps during the treatment period to approach the level of the NMW by the end of 2016.

[12] The micro data do not allow to discriminate between subsidiaries of the same company in different locations and other firms as each subsidiary of multi-establishment firms that receives a questionnaire is assigned to its own identifier in the data. The term "firm" used in this paper hence refers to both types of entities. Although multi-establishment firms receive separate questionnaires for different subsidiaries, the location of production might differ from the address the questionnaire is sent to. However, this would only lead to classical measurement error in the bite measure described below biasing the coefficients towards zero. Moreover, the manufacturing survey is at the product level. However, only 0.3% of all observations between 2011 and 2017 refer to multiple products of the same firm at a given point in time. Following the procedure described in Link (2018), these observations are aggregated to the firm level by taking means across products and rounding to the next integer. Moreover, firms in the services survey have been coded with respect to the older "WZ 03" classification scheme until March 2011. The assignment of these firms to the "WZ 08" system is described in Link (2018).

German industry classification system of 2008 (WZ 08) which largely corresponds to the European NACE Rev. 2 classification. In addition, I gained access to confidential information about the firms' location at the level of counties. Hence, the firms in the IBS can be merged to disaggregate wage data at the level of industries and counties as described in Section 4.1 which is crucial for the identification of the bite of the NMW.

The analysis of NMW effects mainly focuses on the following questions regarding expected changes in prices and employment:[13]

Q1 *"Expectations for the next 3 months: The prices of our goods/services will [1] increase, [0] stay the same, or [-1] decrease."*

Q2 *"Expectations for the next 3 months: The number of employees will [1] increase, [0] stay the same, or [-1] decrease."*

In addition, the subset of manufacturing firms *reports realized* price changes and services companies provide information on *realized* employment changes:

Q1a *"During the past month, the domestic (net) sales price [1] increased, [0] stayed the same, or [-1] decreased."* [only asked in manufacturing survey]

Q2a *"During the past (2-3) months, the number of employees [1] increased, [0] stayed the same, or [-1] decreased."* [only asked in services survey]

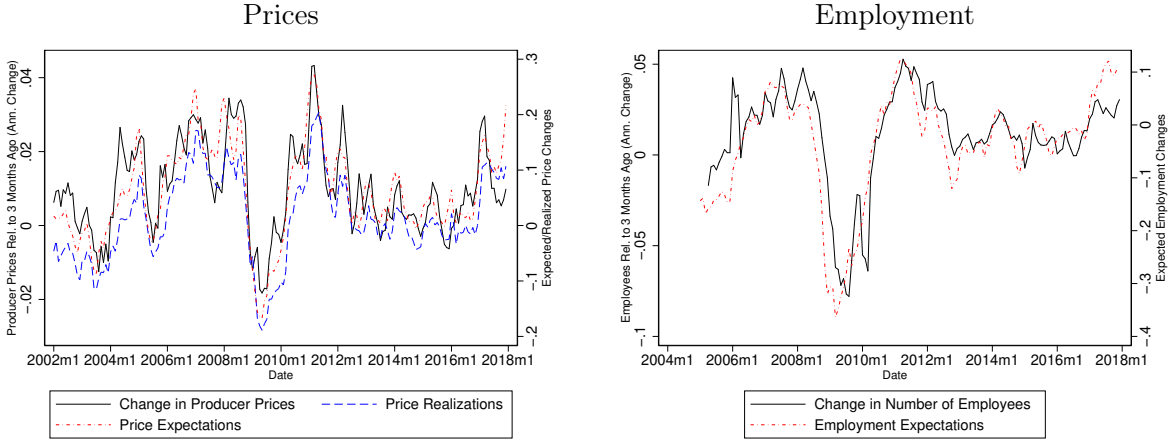
In general, firms stick to their pricing and employment plans. Pesaran and Timmermann (2009) show that the price expectations of manufacturing firms are highly predictable for the realized price changes reported to the IBS in the subsequent months. In line with this, Appendix Tables A.1 and A.2 document that approximately 80% of manufacturing firms (67% of services companies) report realized price (employment) changes between months $t+1$ and $t+3$ that are in line with their expectations in month t. As shown in Section 5.2, the estimated NMW effects are comparable irrespective of using expected or realized changes in the respective sub-sample of firms. Therefore, the baseline estimation of the NMW effects uses price and employment expectations, which are available for all firms in the sample.

Importantly, the qualitative price and employment changes reported to the IBS on average closely track *quantitative* price and employment changes observed in administrative data. For the subset of manufacturing firms, Figure 1 plots the average answers to Q1 ($\overline{\text{Price Exp.}}_t^{+3m}$), Q1a ($\overline{\text{Price Realiz.}}_t^{-1m}$), and Q2 ($\overline{\text{Empl. Exp.}}_t^{+3m}$) against the change in producer prices ($\Delta\overline{PPI}_t$) and the number of employees ($\Delta\overline{Empl}_t$) relative to the level three months before, respectively.[14]

[13] The wording of the questions slightly differs between both surveys but is largely comparable. See Appendix A.1.1 for the translated questions. Moreover, firms' current backlog of orders is used to control for demand measured as "[1] comparatively large, [0] sufficient (typical for the season), or [-1] too small." Further, the NMW effect on firms' current business conditions being either "[1] good, [0] satisfactory, or [-1] bad" as well as their expected business conditions in the next six months or production and demand expectations in the next three months is examined in Section 5.

[14] The German Federal Statistical Office provides time series of producer price indices ($PPI_{s,t}$) and the number of employees ($Empl_{s,t}$) at the level of two-digit industries s in the manufacturing sector. The indices are weighted by the average share of firms in the respective sector of the IBS (ω_s) in order to get an aggregate time series that is representative for the manufacturing firms in the sample, i.e., $\overline{PPI}_t = \sum_s \omega_s PPI_{s,t}$. The employment time

Figure 1: Aggregated IBS Data and Quantitative Changes in Prices and Employment



Notes: The left (right) figure plots time series of the realized change in producer prices $\Delta\overline{PPI}_t$ (in the number of employees $\Delta\overline{Empl}_t$) in the manufacturing sector relative to three months before (solid line; left axis) against mean reported price expectations/realizations (employment expectations) of firms in the manufacturing survey of the IBS (dashed lines; right axis). The German Federal Statistical Office provides producer price indices and employment data for two-digit industres. For aggregation, the time series are weighted by the average share of firms per sector in the IBS. $\Delta\overline{Empl}_t$ is seasonally adjusted using month fixed effects. As documented in Appendix Table A.3, the correlation between $\Delta\overline{PPI}_t$ and mean price expectations is highest at the first lag of expectations ($\rho = 0.85$), while the correlation with price realizations is highest at contemporaneity ($\rho = 0.82$). Comparably, the correlation between $\Delta\overline{Empl}_t$ and employment expectations is highest if employment expectations are lagged by 2 months ($\rho = 0.80$).

As documented in Appendix Table A.3 , the time series correlation between $\Delta\overline{PPI}_t$ and average price expectations in the IBS is highest if price expectations are lagged by one month ($\rho(\overline{\text{Price Exp.}}_{t-1}^{+3m}, \Delta\overline{PPI}_t) = 0.85$), while the correlation with average price realizations is highest at contemporaneity ($\rho(\overline{\text{Price Realiz.}}_{t}^{-1m}, \Delta\overline{PPI}_t) = 0.82$).[15] Comparably, the correlation between $\Delta\overline{Empl}_t$ and average employment expectations is highest if employment expectations are lagged by 2 months ($\rho(\overline{\text{Empl. Exp.}}_{t-2}^{+3m}, \Delta\overline{Empl}_t) = 0.80$). In light of the strong correlation with administrative data, the survey questions appear to be useful indicators of firms' pricing and employment policies.

Restricting the time series underlying Figure 1 to the time frame covered by the empirical analysis, I estimate semi-elasticities that map qualitative survey responses to quantitative changes in producer

series is purged by month fixed effects for seasonal adjustment. For services, producer prices are only available at quarterly frequency and at heterogeneous aggregation levels for a small number services that are mostly industry-related. In turn, CPI data for services are not useful for my analysis because they are not limited to domestic service providers and cannot be linked to the the "WZ 08" classification system.

[15] Note that the aggregate price change relative to three months in the past ($\Delta\overline{PPI}_t$) fits the average survey data on price realizations better than monthly changes in $\overline{PPI}_t$, see Appendix Table A.3. Moreover, it is unreasonable to map qualitative survey responses to changes in producer price indices separately for each industry because the number of firms per sector is usually too low in the IBS. As can be inferred from Panel B of Appendix Table A.4, however, the cross-correlations and semi-elasticities in the three two-digit industries that cover the highest number of firms are qualitatively comparable and of roughly equal size as for all manufacturing firms. In sectors with fewer firms, the correlations between $\overline{\text{Price Exp.}}_{s,t}^{+3m}$ and $\Delta\overline{PPI}_{s,t}$ are weaker due to the trichotomy of the survey data.

price indices.[16] They are defined as follows

$$\hat{\psi}^{Exp} := \frac{\mathrm{d}\Delta\overline{PPI}_t}{\mathrm{d}\overline{\text{Price Exp.}}_{t-1}^{+3m}} = 0.130 \text{ and } \hat{\psi}^{Realiz} := \frac{\mathrm{d}\Delta\overline{PPI}_t}{\mathrm{d}\overline{\text{Price Realiz.}}_{t}^{-1m}} = 0.144. \quad (1)$$

Hence, an appreciation of average price expectations (realizations) in the IBS by 0.1 that lasts twelve months corresponds to an increase in producer prices by roughly 1.6 (1.7) percentage points.

4. Empirical Strategy

4.1. Identification of Minimum Wage Bite

In order to evaluate the reaction of firms to the NMW, the degree to which each firm is affected needs to be identified. Unfortunately, the IBS does not include any information about wages or labor costs at the firm level. I circumvent this constraint by following the minimum wage "bite" approach in the tradition of Card (1992), which is a standard method for the identification of heterogeneity in treatment intensity based on the variation in the fraction of affected workers across different groups, regions, or industries. Accordingly, the firms in the IBS are matched to administrative wage data of full-time employees in their sector and location. The treatment intensity specific to each firm i (TI_i) is then proxied by the fraction of affected employees in the respective region-industry cell.

Construction of Bite Measure The bite measure is based upon data on the wage distribution of full-time employees in each two-digit industry at the level of counties (NUTS-3 regions) as well as labor market regions (LMRs) from the administrative remuneration statistic ("*Entgeltstatistik*," henceforth "RS").[17] The data is collected by the Federal Employment Agency (FEA) via the reporting procedure of the social security system ("*Meldeverfahren zur Sozialversicherung*") and thus covers all employees prone to social security in Germany. Based on this, the FEA provided me with the deciles of the distribution of gross monthly wages of full-time employees in each industry-region cell that contained at least 1000 full-time employees (Federal Employment Agency, 2016).[18] Despite of this data protection restriction, the wage data at the level of two-digit industry*county-cells cover 68.8% of all full-time employees in Germany. At the level of LMRs, 92.3% of full-time employees can be assigned to the wage distribution in their industry. The baseline specification therefore uses the industry-specific wage distribution at the county level and replaces missing values by wage data

[16] The close relationship between the IBS data and quantitative changes in producer prices is exploited in a back-of-the-envelope calculation in Section 5.3 in order to approximate the quantitative size of the minimum wage-induced price effect.

[17] There are 96 labor market regions ("*Raumordnungsregionen*") in Germany that typically describe commuting zones consisting of on average 4 out of a total number of 402 counties (295 "*Landkreise*" and 107 "*kreisfreie Städte*"). Close to my specification, Garloff (2016) uses the RS data to construct bite measures of full-time employees at the level of LMRs, age-cohorts, and gender in order to analyze the relationship between (un-)employment growth and the regional bite of the NMW.

[18] Every firm is required by law to report the gross wage that each employee earned in a given year as well as information on the duration of the employment relation and whether the employee worked full-time or part-time. As the reports do not contain detailed information on hours worked, the FEA only provides data on gross monthly wages of full-time workers.

at the level of LMRs. The robustness checks presented in Section 7, which solely use wage data either at the level of counties or at the level of LMRs, show that the results do not hinge on this choice.

TI_i is calculated as the fraction of full-time employees that earned a gross wage below the NMW of €8.50 per hour in each firm's industry and location in the year prior to its introduction. The choice of the 2014 wage distribution is justified by the findings of Caliendo et al. (2018) who show that anticipation effects in wages were absent and wages followed a common trend before the NMW reform using wage data from the German Socio-Economic Panel (SOEP). As demonstrated in Section 7, the results do not change once TI_i is instead based on 2013 wages. Appendix A.2.1 describes the calculation of TI_i in detail and discusses the assumptions regarding the shape of the wage distribution in the area below the first decile, which do not drive the results as demonstrated in the robustness checks of Section 7. Following this procedure, 84.2% of firms in the data set can be assigned to a bite measure.

Validity of Bite Measure In order to be a valid proxy for the NMW bite, TI_i should meet the following three requirements: First, TI_i should capture the degree to which full-time employees are affected by the NMW sufficiently well despite of the assumptions underlying its construction and despite of the fact that the wages of 6.7% of full-time employees are not covered by the RS data. Second, TI_i should not only reflect the variation in the bite with respect to full-time employees, but should also capture the increased wage costs for all types of employment relations. Third, the degree to which firms were affected by the NMW should be reflected by the bite in its industry and location.

To tackle the first concern, the overall NMW bite calculated from RS data is compared to results based on individual wage data of the 2014 wave of the Structure of Earnings Survey (SES). The micro data of the SES contain detailed individual-level information on income and working hours for a set of one million workers employed in 60 000 firms that is representative at the level of federal states and two-digit industries, see SES (2014). In contrast to the RS data, the SES allows to determine the overall bite of the NMW for different groups of workers by directly examining hourly wages of individuals and without imposing assumptions on the the shape of the wage distribution. Strikingly, both the SES and RS data deliver the same bite of 3.9% affected workers in the subset of full-time employees in the manufacturing and services sectors prone to the NMW, see Panel A of Table 1.

In addition, the SES allows for the construction of alternative bite measure along the same lines as TI_i, i.e., the fraction of affected full-time employees that earned less than €8.50 in 2014 in each firms sector and location ($TI_i^{SES,FT}$). In this respect, however, the SES data have at least two disadvantages relative to the RS data: first, the SES data are not representative at the level of LMR*industry cells (and below) while the RS by construction covers all full-time employees. Second, $TI_i^{SES,FT}$ can only be constructed for less than half of the manufacturing and services firms in the IBS sample even if the SES data are required to cover a minimum of 100 employees in each LMR*industry

Table 1: Bites Calculated from Remuneration Statistic vs. Structure of Earnings Survey

Wage Data	Remuneration Statistic	Structure of Earnings Survey
Source	Federal Empl. Agency	Federal Statistical Office
Employees Covered	Full-Time only	All Types
Representative at Region*Sector Level	yes	no
Panel A: Fraction of Workers Affected By NMW in Manufacturing & Services Sectors Prone to NMW		
Fraction of Eligible Workers w/ $w <$ €8.50		
All Employees		0.107
Full-Time Employees	0.039	0.039

*Panel B: Correlation b/w Bite Measures at Region*Sector Level*			
Correlation	TI	$TI^{SES,FT}$	$TI^{SES,all}$
TI	1	.	.
$TI^{SES,FT}$	0.871	1	.
$TI^{SES,all}$	0.886	0.894	1

Notes: This table compares the baseline bite measure TI based on wage data for full-time employees from the Remuneration Statistic (RS) to alternative measures using wage data from the Structure of Earnings Survey (SES) for full-time employees ($TI^{SES,FT}$) and all employees ($TI^{SES,all}$). Panel A summarizes the nationwide fraction of workers affected by the NMW in manufacturing and services sectors prone to the NMW in the group of all workers as well as restricted to full-time employees. Panel B provides the correlations between these bite measures calculated for each two-digit industry*LMR cell for which RS data are available and the SES contains at least 100 employees.

cell, only. Despite of these disadvantages, the correlation of TI_i and $TI_i^{SES,FT}$—calculated for each LMR*industry combination for which RS data are available and the SES contains at least 100 employees per cell—is very high ($\rho(TI_i, TI_i^{SES,FT} = 0.87)$). Taken together, the RS data thus appear to plausibly capture the NMW bite for full-time employees despite of missing data for 7% of workers and despite of the assumptions made when constructing the measure.

The second concern is eased by showing that TI_i does not only reflect the bite for full-time employees, but also captures the degree to which firms in specific industry-region cells were affected by increased wage costs for all types of employment relations. This is crucial because part-time employees and marginally employed workers were on average more strongly affected by the NMW than full-time employees.[19] To cope with this, the SES data are used to construct the additional bite measure "$TI_i^{SES,all}$" that equals to the fraction of all employees—including part-time and marginally employed workers—that earned less than €8.50 in 2014. Again, $TI_i^{SES,all}$ is only calculated for LMR*industry cells with at least 100 employees in the SES data. As summarized in Panel B of Table 1, the correlation between TI_i and $TI_i^{SES,all}$ is strikingly high ($\rho(TI_i, TI_i^{SES,all} = 0.89)$).[20]

[19] In the SES data, the number of workers in manufacturing and services sectors that earned less than €8.50 in 2014 was higher among all employees eligible to the NMW (10.7%) compared to the group of full-time employees (3.9%). In these sectors, 61% of jobs were full-time, 25% part-time, and 14% marginally employed. Assuming full compliance to the NMW and holding the employment structure constant, the overall wage bill of firms in these sectors would have had to be increased by 0.44% due to the NMW. In this scenario, full-time employees would have been responsible for 40% of this implicit wage bill increase.

[20] As shown in Section 7, the main results of the paper are robust to using $TI_i^{SES,all}$ or TI_i calculated based on

Table 2: Plausibility Check of the Treatment Intensity Measure

	Treatment Intensity $TI \in$		
	[0%]	(0%,20%]	(20%,100%)
prob("Affected" = 1)	0.172	0.379	0.753
prob("Plan to Adjust Business" = 1|"Affected" = 1)	0.472	0.551	0.822
prob("Do Not Plan to React" = 1|"Affected" = 1)	0.528	0.449	0.178

Notes. "TI" refers to the fraction of full-time employees that earned an hourly gross wage of less than €8.50 in 2014 in each firm's two-digit industry and region. *prob*("Affected" = 1) displays the probability that a firm responded to be "affected" by the minimum wage in the special questions of the IBS in November 2014 depending on its proxied treatment intensity as indicated at the top of each column. *prob*("Plan to Adjust Business" = 1|"Affected" = 1) captures the frequency that "affected" firms stated to plan to react in at least one of the following ways: reduction in staff, reduction in working hours, price increases, decreased investment volume, cuts in bonus payments, or other action. *prob*("Do Not Plan to React" = 1|"Affected" = 1) is defined accordingly.

Lastly, I provide evidence that TI_i is strongly correlated with firms' self-assessment of being affected by the NMW. For this purpose, I analyze a special survey regarding the upcoming NMW introduction that supplemented the IBS in November 2014. Specifically, firms were asked whether they were affected by the new regulation and how they planned to react in case of being affected, e.g., whether they planned to reduce their workforce or working hours, to cut bonus payments or investment volumes, or to increase prices.[21] As sketched in Table 2 and documented in further detail in Appendix A.2.2, the frequency that firms stated to be affected by the NMW increases substantially in TI_i. Only 17% of firms perceived themselves as "affected" if they operated in sector-region combinations in which no full-time employee earned less than €8.50 in 2014. This fraction increases to 75% for firms in sector-region cells with more than 20% of full-time employees being treated. Moreover, the planned reaction of firms that perceive themselves as "affected" despite of $TI_i = 0$ differed strongly from their counterparts with $TI_i = 0$. While more than 80% of firms with $TI_i > 0.2$ planned to react to the NMW anyhow, the majority of firms that reported to be affected by the NMW despite of $TI_i = 0$ did not plan to react. Arguably, the later group was only affected indirectly by the NMW or perceived themselves as being affected because of the obligatory and time-consuming documentation requirements.[22] Using firms' self-assessed affectedness by the NMW as a dummy for the treatment instead of the continuous bite measure TI_i delivers qualitatively the same results compared to the main findings presented below, see Appendix Table A.6.

Overall, the evidence presented confirms that TI_i plausibly captures the degree to which firms

thresholds above €8.50 in order to capture firms in industry-region cells that paid full-time employees more than €8.50 per hour but arguably needed to increase wages of part-time employees and marginally employed workers.

[21] As discussed in Appendix A.2.2, the special survey neither asks for treatment intensity, nor contains information about the channels through which firms are affected. Moreover, the questions regarding firms' planned reaction are restricted to affected firms and one direction. Hence, the special survey itself neither permits an identification of firms' kind and degree of affectedness, nor allows for causal inference on firms' response to the NMW using their responses as dependent variables.

[22] According to the National Regulatory Control Council ("*Nationaler Normenkontrollrat*"), the NMW introduction and its first adjustment in 2017 imposed annual compliance costs of €6.3 billion on firms (National Regulatory Control Council, 2017, p.19).

Table 3: Variation in Treatment Intensity Across Firms

	Total		Manufacturing		Services		West Germany		East Germany	
	# Firms	%	# Firms	%	# Firms	%	# Firms	%	# Firms	%
Firms	3838	.	2043	.	1795	.	3303	.	535	.
$TI = 0$	2809	73.2	1700	83.2	1109	61.8	2634	79.7	175	32.7
$TI \in (0, 0.1)$	544	14.2	228	11.2	316	17.6	361	10.9	183	34.2
$TI \in (0.1, 0.2)$	295	7.7	82	4.0	213	11.9	208	6.3	87	16.3
$TI \in (0.2, 0.3)$	96	2.5	15	0.7	81	4.5	55	1.7	41	7.7
$TI \in (0.3, 0.5)$	77	2.0	13	0.6	64	3.6	44	1.3	33	6.2
$TI \in (0.5, 1)$	17	0.4	5	0.2	12	0.7	1	0	16	3.0
Mean TI	0.034		0.016		0.053		0.024		0.097	
Mean TI if $TI > 0$	0.125		0.097		0.139		0.115		0.145	

Notes: Distribution of firms (in January 2015) across different groups of treatment intensity as captured by the fraction of full-time employees in their two-digit industry and region that earned less than €8.50 per hour in 2014.

are affected by the NMW through its effect on labor costs.

Variation of Treatment Intensity Across Firms The treatment intensity measure captures a substantial degree of variation in the bite of the NMW across firms, see Table 3. According to TI_i, 27% of firms in the sample were affected at least to some degree. Among firms with $TI_i > 0$, roughly one in two (one in five) of the affected firms had to increase wages of more than 10% (20%) of their full-time employees due to the NMW, *ceteris paribus*. Moreover, there is a sufficient degree of variation in TI_i that allows for separate analyses of firms in different sectors or regions. In general, service providers—of which approximately 40% are assigned to positive values of TI_i—have been affected more often by the NMW than manufacturing firms (17%).[23] In addition, one out of five firms in West Germany was affected according to TI_i, while more than two out of three East German firms were affected to at least some degree.[24] Conditional on being affected ($TI_i > 0$), however, the variation in TI_i is roughly comparable between firms in the different subsets: the mean treatment intensity among affected firms is 0.10 and 0.14 for manufacturing firms and service companies as well as 0.12 and 0.15 for firms in East and West Germany, respectively.

4.2. Empirical Model

The empirical strategy aims at evaluating whether firms that were more strongly affected by the NMW reacted more strongly along the pricing or employment margin. For this purpose, I use a generalized difference-in-differences (DiD) framework with continuous treatment to estimate how strongly the bite of the NMW (TI_i) is associated with firms' pricing and employment plans. By the nature of TI_i, the identifying variation is at the level of industry-region cells, while measurement is

[23] Furthermore, there is also substantial variation in TI_i within two-digit industries, see Appendix Table A.7.

[24] Throughout the paper, "East Germany" refers to the federal states of Mecklenburg-West Pomerania, Brandenburg, Saxony-Anhalt, Saxony, and Thuringia, while "West Germany" covers the remaining federal states.

at the firm level. In order to infer the timing of the effects, I start with a very flexible estimation of the dynamic treatment effect before turning to a more condensed examination of average minimum wage effects during the entire treatment period.

Specifically, the dynamic effects of the NMW on price and employment, denoted β_t, are estimated for each month relative to January 2013. By then, the NMW introduction in January 2015 could not have been anticipated as described in Section 2. The sequence of treatment effects is estimated based on the following empirical model[25]

$$Y_{i,t}^{+3m} = \sum_{t:t\neq 2013m1} \beta_t \times TI_i \times \mathbb{1}(\text{Date}_t) + \gamma \times \text{Demand}_{i,t} + \alpha_i + \delta_t \times \mathbb{1}(\text{Sector}_i) + \varepsilon_{i,t}, \quad (2)$$

where the dependent variable $Y_{i,t}^{+3m}$ corresponds to either firm i's expected price change in the next three months (Price Exp.$_{i,t}^{+3m}$) or firm i's expected change in employment (Empl. Exp.$_{i,t}^{+3m}$) as reported to Q1 or Q2 in month t. The bite measure TI_i is interacted with date dummies $\mathbb{1}(\text{Date}_t)$ for each $t \in [2011m1, 2017m12] \wedge t \neq 2013m1$. This is a standard method for the identification of a dynamic treatment effect of an intervention in a DiD design and delivers an estimate of each element of β_t relative to the effect of TI_i on $Y_{i,t}^{+3m}$ in the baseline period and after controlling for all other covariates (c.f., Angrist and Pischke, 2008). Hence, the sequence of estimates around January 2015 should capture the NMW effects on price and employment plans of firms. In contrast, estimates for the dates prior to the treatment period should be equal to zero because the NMW should not have influenced firms' plans at that time. This parallel trends assumption is verified in Section 5.1.[26]

The set of control variables in the baseline specification of model (2) includes current demand of each firm (Demand$_{i,t}$) as reported to the IBS, firm fixed effects α_i, and date fixed effects δ_t at the level of two-digit industries. Firm-specific demand controls for the fact that price or employment changes are potentially demand-driven. As documented in Section 5, Demand$_{i,t}$ itself is unaffected by the NMW. In addition, firm fixed effects capture time-invariant firm-specificities such as persistent optimism or pessimism that have been found to be important for the understanding of expectations in the IBS by Bachmann and Elstner (2015). Furthermore, date fixed effects at the level of two-digit industries flexibly control for industry-specific fluctuations that similarly influence the pricing and employment policies of all firms in each industry irrespective of TI_i. Notably, the date fixed effects also eliminate the entire variation in firms' price and employment plans due to aggregate fluctuations or other policies at the national level. Thus, the identification of the treatment effects relies on variation in TI_i between firms in different regions of the same two-digit industry.

While model (2) delivers a very detailed documentation of the timing of the effects, the multitude of coefficients complicates the interpretation of the overall effect of the NMW. To facilitate the

[25] Ideally, I would estimate a two-stage model comparable to Machin et al. (2003) who regress the outcome variable of interest on the NMW induced wage increase that has been estimated in the first stage. However, the empirical model can only be estimated in reduced form as firm-specific wage data are not available.

[26] Another concern of the DiD approach is that the Stable Unit Treatment Value Assumption (SUTVA) is violated due to spillover effects. If firms that were not directly subject to the NMW ($TI_i = 0$) were affected via spillover effects, the empirical results would be biased. Section 7 provides evidence that this is unlikely to be the case.

latter, model (2) is adjusted as follows

$$Y_{i,t} = \beta \times TI_i \times \mathbb{1}(t \in (\underline{t}, \bar{t})) + \gamma \times \text{Demand}_{i,t} + \alpha_i + \delta_t \times \mathbb{1}(\text{Sector}_i) + \varepsilon_{i,t}. \quad (3)$$

Here, β captures the average NMW effect on firms' price and employment plans during the treatment period defined as dates between $\underline{t}$ and $\bar{t}$ relative to all other dates outside this window and after controlling for the same set of covariates. As shown in Section 5.1, it is reasonable to define the treatment period of the NMW to expectations formed between July 2014 and June 2016. When estimating the NMW effect on realized changes in prices and employment for the subsets of firms that report these variables, the treatment period is shifted by three months in order to cope with different time periods covered by Q1a and Q2a. Lastly, the months following the treatment period are from the estimation to prevent that the control period is corrupted by potential effects of the 2017 NMW increase.

The estimated NMW effect $\hat{\beta}$ can be interpreted as follows: Relative to the pre-treatment period, a firm with TI_i reported planned price or employment changes—scaled as "[1] increase," "[0] stay the same," "[-1] decrease"—that were *ceteris paribus* increased by $\hat{\beta} \times TI_i$ on average. Within the two-year treatment window, affected firms thus reported planned price or employment changes of a one-step higher category—i.e., increased instead of constant or constant instead of decreased prices—in $\hat{\beta} \times TI_i \times 24$ additional months compared to the counterfactual scenario in absence of the NMW.

Despite of the discrete and ordinal nature of the data, models (2) and (3) are estimated using ordinary least squares. This choice is due to the fact that standard methods for the estimation of generalized DiD models with fixed effects and non-binary ordinal data are not established in the literature, yet. However, Riedl and Geishecker (2014) find that linear panel data models generally perform quite well in comparable settings with large cross-sections and long time series. Moreover, standard errors are multi-way clustered at the levels of counties, two-digit industries, and dates.[27]

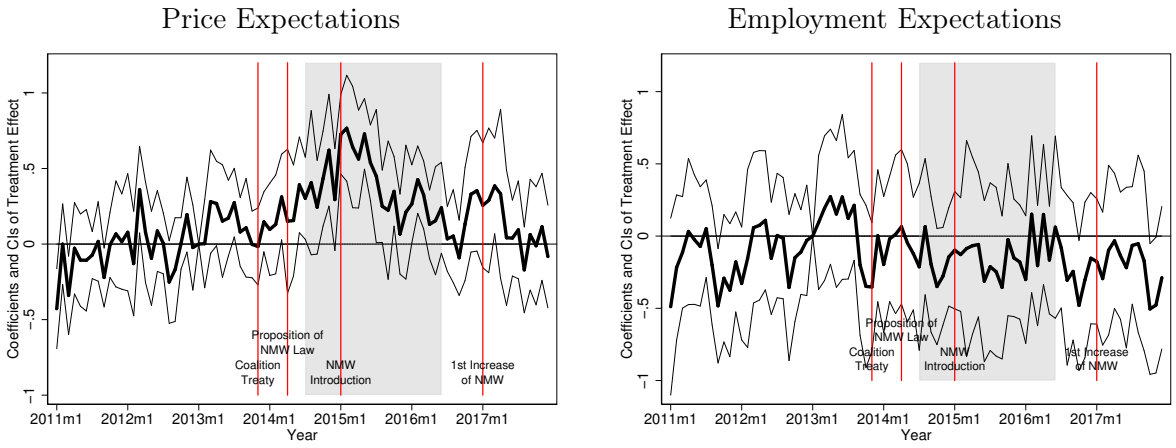
5. Main Results

5.1. Dynamic Price and Employment Response of Firms to the NMW Introduction

The estimation of model (2) provides a first indication that firms affected by the NMW introduction reacted more strongly along the pricing margin than adjusting employment plans. The estimated sequences of treatment effects β_t are plotted in Figure 2 along with the 95%-confidence intervals. The positive effect on planned price changes is clearly concentrated in the time period around

[27] As highlighted by Bertrand et al. (2004), serially correlated error terms might cause severe inconsistencies in the estimated coefficients even after controlling for fixed effects. In my setting, the OLS standard errors are subject to different sources of potential bias which are taken into account via multi-way clustering as proposed by Dube et al. (2010) and Cameron et al. (2011). First, TI_i varies between two-digit industries and counties only. Hence, error terms are clustered at the level of two-digit industries and counties. Moreover, there might be a concern that common shocks lead to a downward bias in standard errors which is controlled for by additionally clustering along the time dimension.

Figure 2: Dynamic Response of Firms to the NMW



Notes: The figure plots the coefficients of the dynamic treatment effect of the NMW introduction in January 2015 estimated in model (2). The dependent variables are firms' planned price or employment changes during the next three months. The effects are estimated relative to January 2013. The vertical lines in November 2013, April 2014, January 2015, and January 2017 indicate the dates of the coalition treaty mentioning the NMW introduction, the decision of the federal cabinet containing the relevant details of the NMW law, its introduction, and its first increase, respectively. The shaded area indicates the treatment period used in model (3). The thin lines display the 95%-confidence intervals based on standard errors clustered at the levels of industries, counties, and dates.

the NMW introduction. Obviously, the results do not hinge on the choice of the baseline period in January 2013. Overall, price expectations of firms are not correlated with TI_i prior to 2014. Hence, affected firms did not follow a different pre-trend in their pricing plans relative to their unaffected counterparts and after controlling for firm-specific demand as well as firm fixed effects and industry-specific trends.

The NMW induced an appreciation of pricing plans of affected firms between mid-2014 and mid-2016. Apparently, the coalition agreement on the NMW of November 2013 did not have an immediate effect. Instead, the treatment effect on firms' pricing plans has been appreciating over the course of 2014 as more details about the NMW became available and the introduction date approached. Strikingly, the treatment effect has been strongest between the last quarter of 2014 and the second quarter of 2015. This indicates that the bulk of the price adjustment took place immediately in the period around the NMW introduction. While the pass-through on prices slowed down during the second half of 2015, NMW-induced increases in pricing plans appear to have continued until mid-2016 at lower speed. In light of the first increase of the NMW in January 2017 to a level of €8.84 per hour, the association between TI_i and firms' pricing plans seems to have appreciated again. However, TI_i only imperfectly captures the degree to which firms are affected by the 2017 increase by definition. Based on these insights, the treatment period is defined such that expectations formed between July 2014 and June 2016 are covered when average NMW effects are estimated in model by means of model (3). Moreover, observations thereafter are excluded from the sample in order to prevent the control period to be corrupted by effects of the 2017 increase.

In contrast, the dynamic response of firms' employment plans to the NMW does not deliver a clear

Table 4: Minimum Wage Effects at the Firm-Level: Baseline Results

	Price Exp.$_t^{+3m}$ (1)	Empl. Exp.$_t^{+3m}$ (2)	Cond. Exp.$_t^{+6m}$ (3)	Prod./Dem. Exp.$_t^{+3m}$ (4)	Cond.$_t$ (5)	Demand$_t$ (6)
TI $\times \mathbb{1}(t \in \{2014m7, 2016m6\})$	0.34***	-0.08	-0.04	0.07		
	(0.07)	(0.06)	(0.08)	(0.07)		
TI $\times \mathbb{1}(t \in \{2014m10, 2016m9\})$					0.01	0.08
					(0.06)	(0.08)
Control for Demand$_{i,t}$	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes
Time*Sector FE	yes	yes	yes	yes	yes	yes
R^2	0.337	0.357	0.368	0.390	0.628	0.455
Observations	253350	253440	253394	254105	265227	265582

Notes: The dependent variables are planned price or employment changes during the next three months (Price Exp.$_t^{+3m}$ and Empl. Exp.$_t^{+3m}$), expected business conditions for the next six months (Cond. Exp.$_t^{+6m}$), expected production (manufacturing firms) or demand (services firms) for the next three months (Prod./Dem. Exp.$_t^{+3m}$), as well as current business conditions and current backlog of orders of firms in the IBS (Cond.$_t$ and Demand$_t$). "TI" is the bite of the NMW and "$\mathbb{1}(t \in \{2014m7, 2016m6\})$" and "$\mathbb{1}(t \in \{2014m10, 2016m9\})$" indicate the respective treatment period. "Time*Sector FE" are time fixed effects at the level of two-digit industries. Standard errors are multiway clustered at the levels of sectors, counties, and dates. Levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

pattern. As displayed in the right-hand graph of Figure 2, the results of model (2) are ambiguous with respect to whether or not more strongly affected firms reported significantly deteriorated employment plans in response to the NMW. This is due to the fact that the coefficients largely depend on the choice of the baseline period and the association between TI_i and employment expectations is not constant throughout the pre-reform period. This problem is alleviated by model (3) that estimates the average NMW effect relative to a control period comprising of 42 months instead of a single baseline date.

5.2. Firms' Adjustment to NMW Introduction: Baseline Results

Next, I estimate average NMW effects by means of model (3). Table 4 summarizes the baseline results with respect to price and employment expectations (Columns 1 and 2). Columns (3) and (5) display the NMW effect on expected and realized general business conditions and Columns (4) and (6) examine the effect on firms' expected production or demand expectations as well as on current demand. As realized conditions and demand refer to the date of completing the survey, the treatment period is shifted by one quarter in the respective specifications.

Baseline Results for Price Expectations The NMW had a strongly positive effect on the frequency that affected firms increased their prices (or refrained from price cuts that otherwise would have taken place) as displayed in Column (1) of Table 4. The average treatment effect on planned price changes reported between July 2014 and June 2016 is estimated to $\hat{\beta} = 0.34$ and statistically significant at the 1% level. Hence, a firm that is affected with degree TI_i reported additional planned price changes of a one-step higher category—i.e., increased instead of constant or constant instead of decreased prices—compared to the counterfactual scenario in $8.2 \times TI_i$ months. Accordingly,

Table 5: Minimum Wage Effects at the Firm-Level: Binary Outcome Variables

	Price Exp.$_t^{+3m}$			Employment Exp.$_t^{+3m}$		
	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline	$= 1$	$\neq -1$	Baseline	$= 1$	$\neq -1$
$TI \times \mathbb{1}(t \in \{2014m7, 2016m6\})$	0.34***	0.30***	0.05**	-0.08	-0.01	-0.07
	(0.07)	(0.06)	(0.02)	(0.06)	(0.03)	(0.04)
Control for Demand$_{i,t}$	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes
Time*Sector FE	yes	yes	yes	yes	yes	yes
R^2	0.337	0.307	0.345	0.357	0.343	0.289
Observations	253350	253350	253350	253440	253440	253440

Notes: The dependent variables are planned price or employment changes during the next three months as reported to the IBS. In Columns (2) and (5), the dependent variables are binarized to capture increases in expectations only ($\mathbb{1}(Y_t^{+3m} = 1)$). In Columns (3) and (6), the dependent variables are restricted to planned changes that are non-negative ($\mathbb{1}(Y_t^{+3m} \neq -1)$). "$TI$" is the bite of the NMW and "$\mathbb{1}(t \in \{2014m7, 2016m6\})$" indicates the treatment period. "Demand$_{i,t}$" is firms' current backlog of orders as reported in the IBS. "Time*Sector FE" are time fixed effects at the level of two-digit industries. Standard errors are multiway clustered at the level of sectors, counties, and dates. Levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

a firm with $TI_i = 0.25$ reported on average more than two additional price increases due to the NMW.

The price pass-through mainly took place immediately in the period around the NMW introduction. Panel A of Appendix Table A.8 reports the treatment effects separately for the first and second half of the treatment period, denoted β_1 and β_2. In line with the dynamic effects displayed in Figure 2, the results indicate that 70% ($\hat{\beta}_1/(\hat{\beta}_1 + \hat{\beta}_2) = 0.7$) of the NMW-induced effect on pricing plans took place during the 12 months around its introduction. During the second half of the treatment period, the effect is smaller in size ($\hat{\beta}_2 = 0.20$) but still significantly positive at the 1% level. Hence, more strongly affected firms continued reporting significantly appreciated pricing plans even with some delay after the NMW introduction.[28]

The NMW effect on pricing plans mostly stems from additional price increases. Table 5 summarizes the results of estimating model (3) separately for binarized dependent variables that either capture planned increases in prices, i.e., using a dummy $\mathbb{1}(\text{Price Exp.}_t^{+3m} = 1)$, or refer to planned changes that are non-negative, i.e., $\mathbb{1}(\text{Price Exp.}_t^{+3m} \neq -1)$. The estimates can directly be interpreted as probabilities. As displayed in Columns (2) and (3), more than 85% of price effect can be attributed to additionally reported planned price increases. In turn, only a small part of the effect is due to firms refraining from price cuts that otherwise would have taken place. For the sake of convenience, I hence refer to "price increases" in response to the NMW when discussing the results based on the trichotomous dependent variable in the following.

The estimated NMW effect on firms' pricing plans is constant for different specifications of the control vector and does not hinge on the functional form of model (3). As documented in Appendix

[28] Panel B of Appendix Table A.8 displays the estimated NMW effects on a quarterly basis. They are strongest for reported pricing plans in the first and second quarter of 2015. In the second half of the treatment period, the coefficients are always positive, albeit statistically different from zero in only two out of four quarters.

Table 6: Minimum Wage Effects in Different Sectors and Regions

	Price Exp.$_t^{+3m}$		Price Change$_t^{-1m}$	Empl. Exp.$_t^{+3m}$		Empl. Change$_t^{-3m}$
	(1)	(2)	(3)	(4)	(5)	(6)
$TI \times \mathbb{1}(t \in \{2014m7, 2016m6\})$						
$\times\mathbb{1}$(Manufacturing)	0.39***			-0.02		
	(0.06)			(0.04)		
$\times\mathbb{1}$(Services)	0.30**			-0.13		
	(0.12)			(0.13)		
$\times\mathbb{1}$(West Germany)		0.32**			-0.04	
		(0.16)			(0.14)	
$\times\mathbb{1}$(East Germany)		0.34***			-0.08	
		(0.08)			(0.06)	
$TI \times \mathbb{1}(t \in \{2014m10, 2016m9\})$						
$\times\mathbb{1}$(Manufacturing)			0.27***			
			(0.06)			
$\times\mathbb{1}$(Services)						-0.10
						(0.09)
H0: Coefficients Equal: p-value	0.471	0.852		0.457	0.815	
Control for Demand$_{i,t}$	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes
Time*Sector FE	yes	yes	yes	yes	yes	yes
R^2	0.337	0.337	0.285	0.357	0.357	0.316
Observations	253350	253350	141589	253440	253440	122685

Notes: The dependent variables are planned price changes during the next three months, realized price changes during the previous month, expected price changes during the next three months, and realized employment changes during the last three months. "TI" is the bite of the NMW and "$\mathbb{1}(t \in \{2014m7, 2016m6\})$" and "$\mathbb{1}(t \in \{2014m10, 2016m9\})$" indicate the respective treatment periods. "$\mathbb{1}(t \in$ Manufacturing)," "$\mathbb{1}(t \in$ Services)," "$\mathbb{1}(t \in$ West Germany)," and "$\mathbb{1}(t \in$ East Germany)" are dummies for firms in manufacturing, services, West Germany, and East Germany, respectively. "Demand$_{i,t}$" is firms' current backlog of orders as reported in the IBS. "Time*Sector FE" are time fixed effects at the level of two-digit industries. Standard errors are multiway clustered at the levels of sectors, counties, and dates. Levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.9, the coefficients are virtually unaffected once time fixed effects specific for each county type or time fixed effects at the level of federal states are included to the regression in Columns (2) and (3). These specifications flexibly control for heterogeneous trends in more rural or more urban counties and shocks that heterogeneously affect firms in different federal states, respectively. Moreover, neither dropping the control for firm-specific demand in Column (4), nor controlling for expected demand (for service companies) or expected production volume (for manufacturing firms) instead of current demand in Column (5) affects the results. Finally, the results are robust to the inclusion of a squared term of TI_i to model (3), which enters insignificantly and does not affect the coefficient of the linear term of TI_i substantially, see Appendix Table A.10.

Moreover, the price response of firms only differed to a minor degree between firms in manufacturing and service sectors as well as between firms located in West or East Germany. As documented in Section 4.1, there is sufficient variation in TI_i across firms in the manufacturing sector and the services sector as well as in West and East Germany that offers scope for a separate analysis of firm-level NMW effects along these lines. The results in Column (1) of Table 6 show that in both sectors, affected firms planned to increase prices significantly more often than they would have done if they were not affected. If anything, manufacturing firms appear to have planned to increase

their prices slightly more often due to the NMW compared to their counterparts in the services sector given the same degree of affectedness ($\hat{\beta}_M^{\text{Price Exp.}} = 0.39 > \hat{\beta}_S^{\text{Price Exp.}} = 0.30$). However, the difference between both coefficients is insignificant ($p = 0.47$). For a given bite of the NMW, the price response of firms in West Germany is also comparable to the reaction of their counterparts in the East, see Column (2).

Baseline Results for Employment Expectations and Other Firm-Specific Variables In contrast to the price effect, the relationship between planned employment changes and the intensity to which firms were affected by the NMW is much weaker. As documented in Column (2) of Table 4, the average treatment effect on planned employment changes reported between July 2014 and June 2016 is only slightly negative ($\hat{\beta} = -0.08$). This is almost exclusively stemming from planned reductions in the number of employees instead of fewer hires, see Table 5. Taking the coefficients at face value, affected firms were hence more than four times more likely to increase prices instead of reducing employment in response to the NMW.

The estimated employment effect is statistically indistinguishable from zero although it is close to approaching significance (p-value = 0.24). Accordingly, different specifications of model (3) always deliver slightly negative, but insignificant employment effects as shown in Appendix Table A.9. Estimating the effect separately for the first and second half of the treatment period in Panel A of Appendix Table A.8 provides a similar picture: both coefficients are negative ($\hat{\beta}_1 = -0.09$ and $\hat{\beta}_2 = -0.07$), but statistically insignificant. As shown in Panel B, the association between TI_i and planned employment changes is negative in face value in seven out of eight quarters of the treatment period, but is significantly different from zero only during the fourth quarter of 2014 and the third quarter of 2015.

Services companies, which have increased their prices slightly less strongly for a given TI_i compared to manufacturing firms, appear to have in turn reacted slightly more strongly along the employment margin ($\left|\hat{\beta}_S^{\text{Empl. Exp.}}\right| = |-0.13| > \left|\hat{\beta}_M^{\text{Empl. Exp.}}\right| = |-0.02|$), see Column (4) of Table 6. However, the employment effects are not significant at the 10% level for each group and the difference between both coefficients is insignificant ($p = 0.46$). Moreover, a significantly negative effect on firms' employment plans can neither be detected for firms located in West Germany nor for their counterparts in the East, see Column (5).

Furthermore, the NMW does not appear to have had a strong effect on firms' expectations and realizations of revenues and demand.[29] First, neither firms' expected business conditions for the next six months (Cond. $\text{Exp.}_{i,t}^{+6m}$) nor their currently realized conditions ($\text{Cond.}_{i,t}$) appear to have significantly deteriorated due to the NMW, see Columns (3) and (5) of Table 4. Second, neither firms' expected production or demand changes (Prod./Dem. $\text{Exp.}_{i,t}^{+3m}$) for the next three months, nor their current demand ($\text{Demand}_{i,t}$) captured by the backlog of orders were affected negatively by the NMW, see Columns (4) and (6).

[29] Link (2018) demonstrates that Cond. $\text{Exp.}_{i,t}^{+6m}$ and $\text{Conditions}_{i,t}$ are very closely related to the level of revenues. Moreover, the expected change in production during the next 3 months is only asked in the manufacturing survey of the IBS, while services firms are asked for their demand expectations.

Minimum Wage Effect on Realized Price and Employment Changes Next, the effect of the NMW on realized price changes of manufacturing firms and realized employment changes of services companies are estimated along the lines of the baseline model (3). Besides using the respective reports to the IBS as dependent variable, the window of the treatment period is forwarded by three months to accommodate for the different time period covered by the questions. The results are presented in Columns (3) and (6) of Table 6.

Manufacturing firms reported to have indeed increased their prices in response to the NMW. The estimated treatment effect of $\hat{\beta}_M^{\text{Price Realiz.}} = 0.27$ is significant at the 1% level. Relative to all other periods when the NMW was not affecting them, a firm that is affected with degree TI_i reported additional price changes of a one-step higher category in $6.5 \times TI_i$ months between October 2014 and September 2016 due to the NMW. Moreover, the NMW effect on realized employment changes of services firms is insignificant. If anything, affected services companies decreased their stock of employees only slightly in response to the NMW ($\hat{\beta}_S^{\text{Empl. Realiz.}} = -0.10$).

The estimates of the NMW effect on realized price and employment changes are remarkably close to the estimated effects on expected changes during the next three months. In light of less variation in one-month realized price changes compared to three-month price expectations, it is not surprising that the coefficient with respect to realized price changes is slightly smaller than the effect on price expectations. As shown in Section 5.3, the quantitative size of the NMW effect on the overall level of producer prices in the manufacturing sector is in the same order of magnitude irrespective of the price data used in the estimation.

In general, firms hence appear to have reacted to the NMW in accordance with their previous plans. As survey data on realized price and employment changes are not available for all firms in the IBS, this finding can only be verified for the respective subset of firms. However, it is very unreasonable to assume that service companies differed from their counterparts in the manufacturing sector with respect to the degree to which their NMW-induced adjustment of pricing plans resulted in actual price changes.

5.3. Quantification of the Minimum Wage Effect on Producer Prices

In order to get an idea about the economic dimension of the price effect, this section provides a back-of-the-envelope calculation of its quantitative size. As documented in Section 3, aggregated survey responses closely track *quantitative* changes in price indices from administrative sources in a way that is captured by the semi-elasticities $\hat{\psi}^{Exp}$ and $\hat{\psi}^{Realiz}$ defined in equation (1). Assuming (a) that the aggregate relationship translates with comparable magnitudes into variation at the industry-region-level, (b) that the average size of NMW-induced price changes did not differ from the size of "normal" price changes, and (c) that $\hat{\psi}^{Exp}$ and $\hat{\psi}^{Realiz}$ are homogeneous across different subsets of firms, the average NMW-induced price reaction of each firm (ΔP_i) can be approximated

as[30]

$$\Delta P_i = \hat{\beta} \times TI_i \times \hat{\psi} \times \frac{\bar{t} - \underline{t}}{12 \text{ months}}, \tag{4}$$

where $\hat{\psi}$ refers to either $\hat{\psi}^{Exp}$ or $\hat{\psi}^{Realiz}$ and $\hat{\beta}$ is the treatment effect on firms' planned or realized price changes estimated in Section 5 based on model (3). Moreover, the length of the treatment period in years ($\frac{\bar{t}-\underline{t}}{12 \text{ months}}$) controls for the fact that $\hat{\psi}^{Exp}$ and $\hat{\psi}^{Realiz}$ map the survey responses to *annualized* changes in producer prices.

The price effect is considerable and firms increased their prices in response to the NMW by $\Delta P_i = 0.09 \times TI_i$ according to this approximation. Given the average bite of $\overline{TI}_{TI_i>0} = 0.125$, affected firms hence increased their prices on average by 1.1 percentage points due to the NMW. In line with the results in Section 5.2, the price effect of manufacturing firms does not differ substantially once it is approximated using survey data on price expectations or realized price changes.[31]

NMW Effect on Aggregate Level of Producer Prices In order to examine the effect of the NMW on the overall level of producer prices in Germany, I insert the average bite across all industry-region combinations ($\widetilde{TI}$) in equation (4). To capture the level of overall producer prices as closely as possible, each industry-region cell is weighted by revenues.[32] Given that revenues are higher in industry-region combinations which were less strongly affected by the NMW, the revenue-weighted $\widetilde{TI} = 0.027$ is slightly smaller than the average bite of all firms in the sample ($\overline{TI} = 0.034$).

According to this back-of-the-envelope calculation, aggregate producer prices in the manufacturing and services sectors prone to the NMW increased by approximately 0.24 percent in response to the NMW, see Table 7. As the average NMW bite largely differed between West and East Germany as well as between manufacturing firms and service providers, the aggregate price effect is heterogeneous among these groups. Producer prices were more strongly increased in East Germany (+0.80%) compared to West Germany (+0.19%) as well as in the services sector (+0.37%) in relation to the manufacturing sector (+0.13%). Again, estimating the overall price effect for manufacturing firms based on realized price changes (+0.10%) rather than expectations delivers comparable results.

The estimated size of the NMW-induced increase in producer prices is remarkably close to the prediction of the "German Council of Economic Experts." In their annual report to the federal government published two months prior to January 2015, they predicted an additional increase in CPI inflation by 0.2 percentage points due to the NMW (Sachverständigenrat, 2014). Hence, the

[30] The first two assumptions cannot be tested as data at industry-region levels as well as on the intensive margin of price adjustments are not available. The third assumption can be rationalized at least for firms in different manufacturing sectors. As can be inferred from Panel B of Appendix Table A.4, semi-elasticities in the three two-digit industries that cover the highest number of firms are of roughly equal size compared to the results for all manufacturing firms. In sectors with fewer firms, the correlation between $\overline{\text{Price Exp.}}_{s,t}^{+3m}$ and $\Delta\overline{PPI}_{s,t}$ is weaker due to the trichotomy of the survey data preventing the calculation of reasonable industry-specific semi-elasticities.

[31] Inserting the estimated coefficients of the price effect for manufacturing firms from Table 6 to equation (4) gives $\Delta P_i^{Exp} = 0.394 \times 0.130 \times 2 \times TI_i = 0.10 \times TI_i$ and $\Delta P_i^{Realiz} = 0.274 \times 0.144 \times 2 \times TI_i = 0.08 \times TI_i$.

[32] Revenue data are obtained from the Federal Statistical Office at the level of two-digit industries and federal states. From this, revenue weights are calculated for each county-sector combination using the county's employment share in the respective industry of the federal state. Moreover, I adjust the revenue weights for the fact that wage data are missing more often in East Germany compared to West Germany. For details, see Appendix A.3.

Table 7: Quantitative Effect of NMW on Overall Level of Producer Prices

	Quantification of Price Effect Based on					
	Price Expectations					Price Realizations
	Total	Manuf.	Services	West	East	Manuf.
PPI-Semi-Elasticity ($\hat{\psi}$)	0.130	0.130	0.130	0.130	0.130	0.144
Treatment Effect ($\hat{\beta}$)	0.345	0.394	0.296	0.323	0.343	0.274
Revenue-Weighted Treatment Intensity ($\widetilde{TI}$)	0.027	0.013	0.048	0.022	0.090	0.013
Overall Price Effect ($\Delta\widetilde{P}$ in %)	0.241	0.128	0.367	0.188	0.802	0.099
Wage Bill Increase c.p. ($\Delta\widetilde{W}$ in %)	0.436	0.262	0.637			
Wage Bill Increase × Labor Share ($\Delta\widetilde{C}$ in %)	0.294	0.192	0.412			
Pass-Through Elasticity ($\frac{\Delta\widetilde{P} \text{ in \%}}{\Delta\widetilde{C} \text{ in \%}}$)	0.82	0.67	0.89			

Notes: This table summarizes the approximated effect of the NMW on the overall level of producer prices "$\Delta\widetilde{P}$" and the degree of price pass-through "$\frac{\Delta\widetilde{P}}{\Delta\widetilde{C}}$." The "PPI-Semi-Elasticity ($\hat{\psi}$)" refers to the degree to which changes in average price expectations in the IBS translate to changes in producer price indices. $\hat{\psi}$ can only be estimated for manufacturing firms and is assumed to be constant across all sectors and regions. "Treatment effect ($\hat{\beta}$)" corresponds to the estimated coefficients of Tables 4 and 6. "$\widetilde{TI}$" is the revenue-weighted treatment intensity of all industry-region combinations as calculated in Appendix A.3. "$\Delta\widetilde{W}$" and "$\Delta\widetilde{C}$" indicate the average implicit increase in the wage bill and overall costs induced by the NMW.

back-of-the-envelope calculation does not seem to deliver unreasonable results despite of the strong assumptions needed to interpret the qualitative effects in a quantitative way.

Price Pass-Through Elasticity Lastly, the aggregate price effect, $\Delta\widetilde{P}$, is related to the average of NMW-induced implicit cost increases in the manufacturing and services sectors under consideration. This aggregate cost increase, $\Delta\widetilde{C}$, is calculated in three steps: first, I approximate the implicit wage bill increase in each industry s induced by the NMW, ΔW_s, based on the micro data of the Structure of Earnings Survey, i.e., the increase in wage costs firms would have had to bear if they fully complied to the NMW and held their employment structure constant. Then, the industry-specific wage bill increase is multiplied with each sector's labor share, LS_s, to obtain a measure for the cost increase in each industry, ΔC_s.[33] Finally, the aggregate cost increase is calculated as $\Delta\widetilde{C} = \sum_s(\omega_s \times \Delta C_s)$, where ω_s is the industry revenue weight as of 2014.

The resulting elasticity indicates a substantial price pass-through of the NMW. According to the approximation, the NMW increased overall costs in the sectors under consideration by 0.29%. Hence, a 1%-increase in overall costs came along with a price increase by 0.82%. The pass-through elasticity is slightly larger in the services sector (0.89) compared to the manufacturing sector (0.67). In light of the assumptions and simplifications, the results of the back-of-the-envelope calculation should be taken with a grain of salt. Nevertheless, the approximation clearly emphasizes that the

[33]The industry-specific labor share, LS_s, is calculated based on national accounting data provided by the Federal Statistical Office at the two-digit industry level and defined as the ratio between the total compensation, TC_s, and gross value added, GVA_s. As the data only include the total compensation of employees, $TC_{empl.,s}$, rather than the wage bill of all workers in the industry (incl. self-employed), I approximate the total compensation as $TC_s \approx TC_{empl,s} \times \frac{\text{All Workers}_s}{\text{Employees}_s}$.

size of the price effect is non-negligible and suggests that firms have rolled over a substantial share of the costs generated by the NMW to their customers.

6. Heterogeneity

6.1. Heterogeneous Responses to NMW: Product Market Differences

This section documents substantial heterogeneity in responses to the NMW across firms depending on product market competition. I show that price effects are stronger (and the employment response muted to some degree) if firms' export share is smaller, their goods and services are traded more locally, and competition through imports is lower. This is consistent with the role of price pass-through as these firms are less likely to face foreign or domestic competitors that are either unaffected or hit less strongly by the German NMW. Hence, these firms have a larger scope to increase prices without experiencing a strong decline in demand.

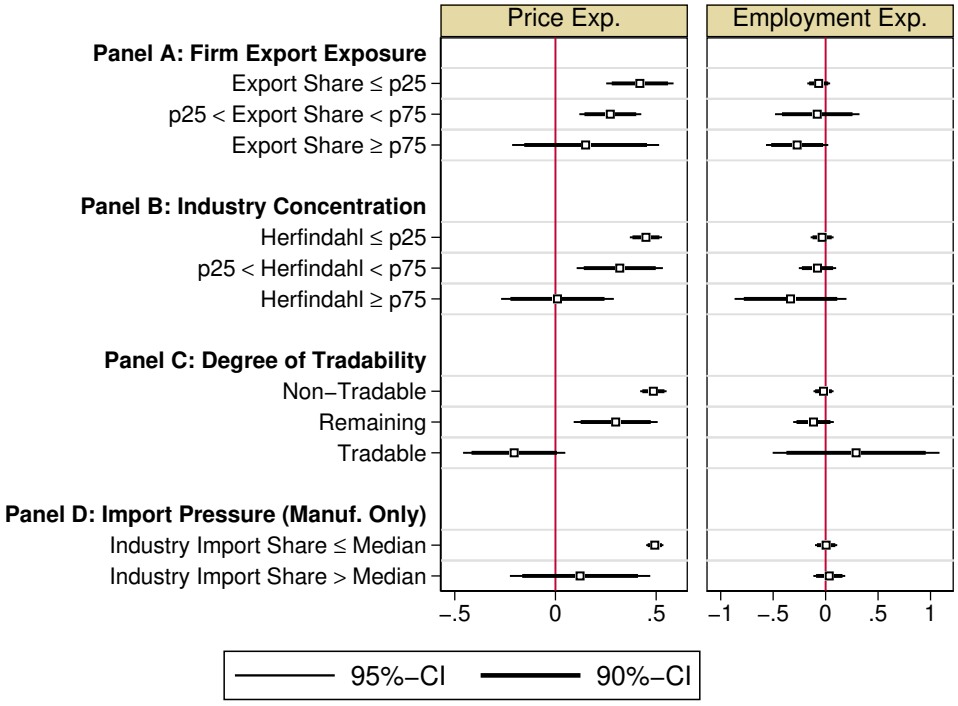
For this purpose, model (3) is augmented with an additional interaction term of the bite TI_i and factors that potentially influence the degree to which firms are able (or willing) to roll over increased costs to the prices of their products.[34] These measures include firms' export share, the degree of tradability of their good or service, as well as the import pressure in each industry. The firm-specific export share is proxied by the fraction of revenues generated abroad that has been reported by the firms to a special question of the IBS in September 2018.[35] Following Mian and Sufi (2014), the degree of tradability is proxied by the geographical concentration captured by the Herfindahl index at the two-digit industry level based on county-level employment in 2014. They argue that industries that meet mostly local demand are more uniformly distributed, while those relying on national or international customers tend to be geographically concentrated. Appendix Table A.7 lists the Herfindahl index for all 62 two-digit industries in the services and manufacturing sector that were prone to the NMW. Moreover, the import pressure is defined as the ratio of imports over revenues in each two-digit industry in 2014 based on trade statistics provided by the Federal Statistical Office. As this data is not available for the services sectors, the last measure can only be constructed for manufacturing firms.

The more firms export, the more rarely they increased prices in response to the NMW for a given degree of affectedness. Grouping treated firms into quartiles with respect to the export share, Panel A of Figure 3 shows that the price response is strongest in the group of firms with the lowest export share while the treatment effect is only insignificantly positive in the group that exported most. As documented in Columns (1) and (2) of Appendix Table A.13, the difference between the

[34] The informativeness of the heterogeneity analysis would be limited if there was heterogeneity in the mapping between survey data and actual price changes in the different groups of firms. As demonstrated in Panel A of Appendix Table A.4, at least the average mapping is not substantially between different subsets of firms. Note that these cross-correlations are only be calculated for manufacturing firms splitted according to their industry's Herfindahl index or import share as these are the only measures that are at the industry level.

[35] The IBS does not contain information on the volume of exports before this date. However, 52% of the firms in the treatment period can be assigned to their export share in September 2018. The remaining firms are captured by the dummy variable $\mathbb{1}$(Firm Export Share $= NA$) to ensure that industry-specific time fixed effects are identified based on the same set of observations as in the baseline regression.

Figure 3: Heterogeneous Responses to NMW: Product Market Differences



Notes: The figure plots the coefficients of the treatment effect of the NMW on planned price or employment changes in different groups of treated firms as indicated in each row. Each panel reports the results of a separate regression in which "$TI \times \mathbb{1}(t \in \{2014m7, 2016m6\})$" is interacted with dummies that group treated firms into bins of firms' export share, the industry-specific Herfindahl index, the degree of tradability, or the industry-specific import share, respectively. Panel A omits the coefficient for firms that did not report their export share. Moreover, I control for "$\text{Demand}_{i,t}$," time fixed effects at the level of two-digit industries and firm fixed effects. Standard errors are multiway clustered at the levels of sectors, counties, and dates. Confidence intervals are displayed at the 90% and 95% level. The complete regression output is displayed in Appendix Table A.11.

coefficients of these groups is significant at the 10% level and the direct interaction term between the treatment effect and firms' export share is significantly negative at the 5% level. In turn, the disemployment effect is significant stronger for treated firms in the group with the highest export share, see Column (9).

Moreover, firms reacted more strongly along the pricing margin if they operated in industries that were less concentrated. The interaction term between TI_i, the treatment period, and the industry Herfindahl is strongly negatively associated with firms' pricing plans, see Column (3) of Appendix Table A.13. Grouping treated firms into quartiles with respect to the Herfindahl index, Panel B of Figure 3 shows that the price effect is strongest for firms in the least concentrated industries and insignificant for firms in the most concentrated industries. Categorizing the top and bottom quartile of industries by geographical concentration as "tradable" and "non-tradable" according to Mian and Sufi (2014) provides a similar result: Firms in local markets increased prices strongly in response to the NMW, while higher TI_i is not associated with appreciated pricing plans for firms selling tradable goods or services, see Panel C. In both specifications, the differences between the treatment effects

of firms in the most and least concentrated markets are significant at the 1% level. As displayed in Columns (10) through (12), the relationship between firms' employment response and market concentration is slightly negative, but insignificant in all specifications. Overall, my results are less ambiguous compared to Harasztosi and Lindner (2019) who only find a small negative, but insignificant effect of geographical concentration on the revenue elasticity of a NMW increase in Hungary, which is their proxy for price changes.

Lastly, industry-specific import pressure dampens the price response in the subset of manufacturing firms. Panel C reveals that the price effect is only significantly positive for treated manufacturers that face below-median import pressure.[36] In contrast, firms in industries with high import pressure did not show significantly appreciated pricing plans in response to the NMW. The interaction term with respect to the industry import share also enters significantly negative at the 5% level, see Column (6) of Appendix Table A.13. While import pressure appears to be important for the size of the price effect, I cannot detect a relationship between firms' employment response and import pressure.

6.2. Heterogeneous Responses to NMW: Labor Market Differences

This section investigates the heterogeneity in responses to the NMW across firms depending on the labor market conditions they face. The results presented in Figure 4 and Appendix Table A.12 are consistent with the notion that firms are more reluctant to lay off workers if vacancies can be filled less easily. For this purpose, model (3) is augmented with an additional interaction term of the bite TI_i and dummies that indicate whether firms reported a lack of skilled workers to the IBS in January 2015 or indicators of county-level unemployment and labor market tightness at the date of the NMW introduction.[37]

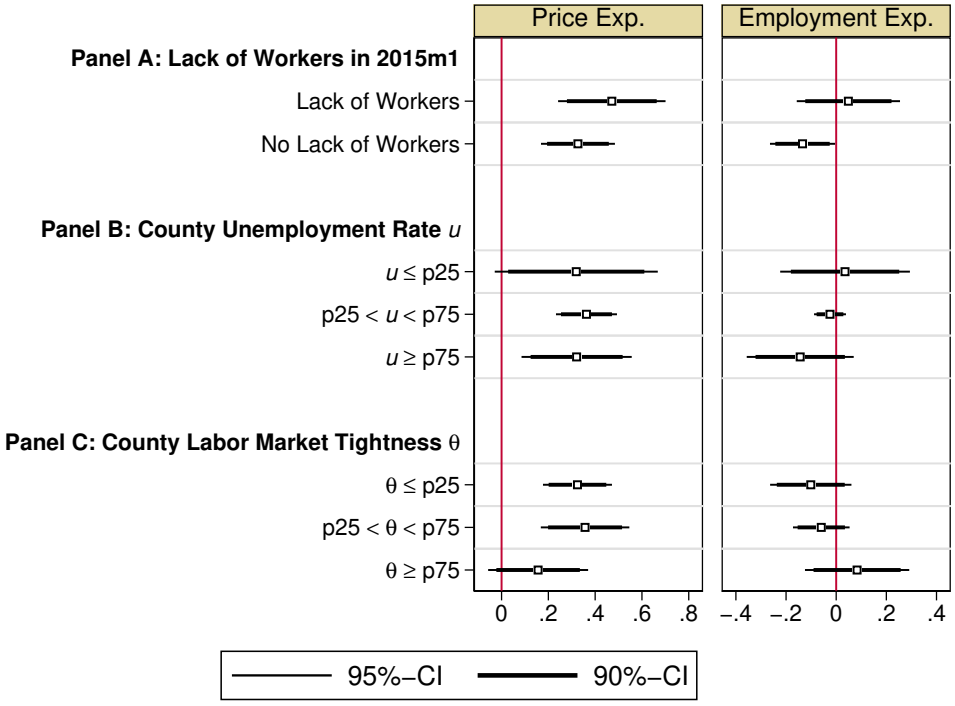
The employment response is found to be heterogeneous with respect to firms' self-reported lack of workers during the period of the NMW introduction. The results in Panel A show a significantly negative employment response for the group of firms that was not constrained by labor shortages. Given the same degree of affectedness, these firms were significantly more likely to report depreciated employment plans compared to their counterparts that faced difficulties in satisfying their demand of workers, see Column (4) of Appendix Table A.12. Instead of laying off workers, the later firms appear to have increased prices more frequently in response to the NMW. However, the estimated price effects are only significantly different from each other at the 20% level.

Moreover, the degree of firms' employment response is correlated with local labor market conditions at the time of the NMW introduction, see Panels B and C. Given the same degree of af-

[36] The analysis is restricted to median splits as there are less than 350 manufacturing firms in the IBS with $TI_i > 0$.

[37] The IBS asks for constraints to business activity on a quarterly basis. Once affirming firms are asked for the reason including whether they were constrained by a lack of skilled workers. Clearly, lack of skilled workers is only an imperfect proxy for the unsatisfied demand for low-wage workers prone to the NMW as these workers are less skilled on average. However, shortages with respect to both types of workers are likely to be correlated. The dummy $\mathbb{1}$(Lack of Workers = 1) subsumes firms that reported to be constrained by a lack of skilled workers in January 2015. Firms not replying to this question are grouped to $\mathbb{1}$(Lack of Workers = NA) in order to insure that the industry-specific time fixed effects nest on the same set of observations as in the baseline regression.

Figure 4: Heterogeneous Responses to NMW: Labor Market Differences



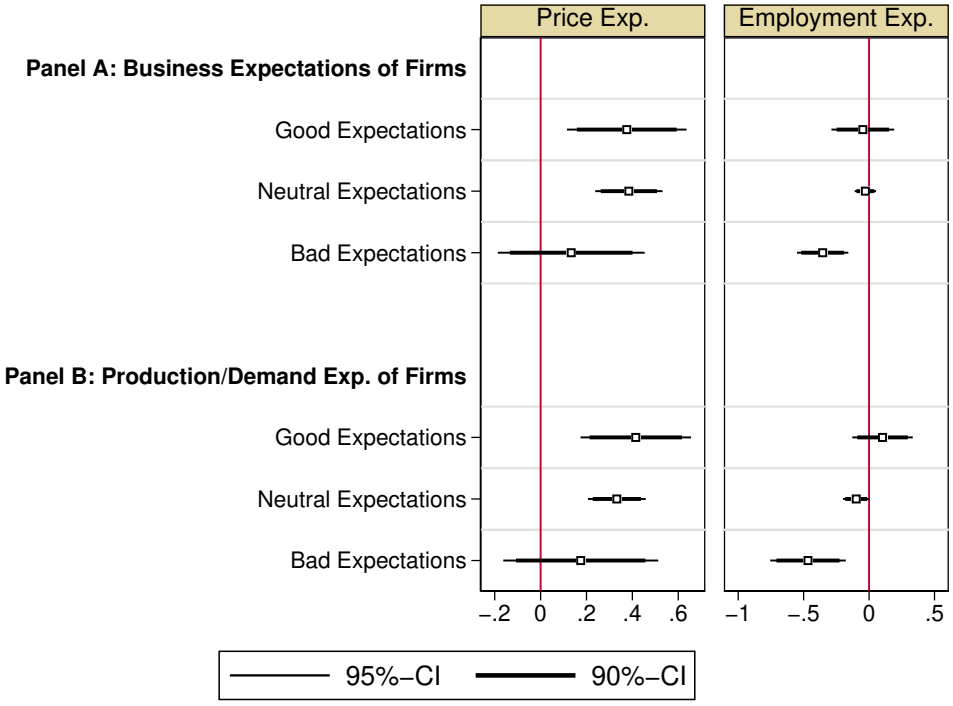
Notes: The figure plots the coefficients of the treatment effect of the NMW on planned price or employment changes in different groups of treated firms. Each panel reports the results of a separate regression in which "TI $\times$ $\mathbb{1}(t \in \{2014m7, 2016m6\})$" is interacted with dummies that group treated firms into bins of firms' self-reported lack of workers in January 2015 and the unemployment rate/labor market tightness in the county they are located in. Panel A omits the coefficient for firms that did not respond to the lack of worker-question in January 2015. Moreover, I control for "Demand$_{i,t}$," time fixed effects at the level of two-digit industries and firm fixed effects. Standard errors are multiway clustered at the levels of sectors, counties, and dates. Confidence intervals are displayed at the 90% and 95% level. The complete regression output is displayed in Appendix Table A.12.

fectedness, the employment effect is strongest for firms in counties with the highest unemployment rates and most slackness according to the ratio of total vacancies over the number of unemployed. While the respective coefficients themselves are not statistically different from zero, the employment responses are significantly more negative at the 5% level compared to the group of treated firms located in the tightest local labor markets, see Columns (5) and (6) in Appendix Table A.12.

6.3. Heterogeneous Responses to NMW Depending on General Expectations of Firms

Lastly, this section provides evidence that the reaction of firms to the NMW strongly depended on their expectations regarding the general development of their businesses. For this purpose, model (3) is augmented with an additional interaction term of the bite TI_i and dummies that indicate whether firms over the course of the treatment period on average reported to be optimistic, neutral, or pessimistic regarding the development of their business conditions during the next six months ("Cond. Exp.$_{i,t}^{+6m}$") or regarding expected changes in production or demand during the

Figure 5: Heterogeneous Responses to NMW: General Expectations of Firms



Notes: The figure plots the coefficients of the treatment effect of the NMW on planned price or employment changes in different groups of treated firms as indicated in each row. Each panel reports the results of a separate regression in which "$TI \times \mathbb{1}(t \in \{2014m7, 2016m6\})$" is interacted with dummies that group treated firms according to their average reports during the treatment period with respect to reported business expectations for the next six months, expected production (manufacturing firms) or demand (services firms) for the next three months. "Good Expectations" are defined as an average expectation between 1/3 and 1 during the treatment period, "Bad Expectations" as mean expectations between -1/3 and -1. Moreover, I directly control for each of these measures along with "Demand$_{i,t}$," time fixed effects at the level of two-digit industries, and firm fixed effects. Standard errors are multiway clustered at the levels of sectors, counties, and dates. Confidence intervals are displayed at the 90% and 95% level. The complete regression output is displayed in Appendix Table A.13.

next three months ("Prod./Dem. Exp.$_{i,t}^{+3m}$").[38] Importantly, neither measure was directly affected by the NMW as shown in Table 4. Furthermore, I control for "Cond. Exp.$_{i,t}^{+6m}$" and "Prod./Dem. Exp.$_{i,t}^{+3m}$" in the respective regression in order to capture the direct effect of each measure on pricing and employment plans.

The results presented in Figure 5 and Appendix Table A.13 show that treated firms with on average solid expectations regarding the future development of their businesses reacted much more strongly along the pricing margin. In contrast, their counterparts with grim expectations anticipated significantly more layoffs. These results are even stronger when grouping firms according to their

[38] The IBS asks firms whether their expected business conditions during the next six months are [1] "more favorable," [0] "about the same," or [-1] "more unfavorable". Moreover, the expected change in production during the next three months is only asked in the manufacturing survey of the IBS, while services firms are asked for their demand expectations. Firms are grouped as "optimistic" or "pessimistic" if their average reports during the treatment period were above 1/3 and below -1/3, respectively. In both cases, roughly 20% of treated firms are labeled "optimistic", while less than 10% of firms are "pessimistic".

mean production and demand expectations. In both specifications, the price effect of the most pessimistic firms is positive, but not significantly different from zero. In contrast, the employment response is significantly negative at the 1% level and sizable ($\hat{\beta}^{\text{Empl.Exp.}} = -0.35$ for the case of on average pessimistic general expectations and $\hat{\beta}^{\text{Empl.Exp.}} = -0.47$ for grim production/demand expectations).

Hence, the relative importance of the different margins of adjustment appears to strongly depend on firms' general assessment of the future development of their businesses. To my knowledge, the literature has not studied this mechanism previously. In the aggregate, the negative employment response of the small subset of pessimistic firms was masked by the insignificant employment response of the vast majority of remaining firms. Hence, these findings suggest that the overall employment effect of the NMW might plausibly have been more negative than observed if the NMW had not been introduced during a period of economic boom when the share of pessimistic firms was particularly low.

7. Robustness and Additional Analyses

Robustness. The previous results documented that affected firms increased their prices in response to the NMW, while their employment reaction appeared to be—if anything—only very modestly negative on average. Besides providing additional insights about the firms' reaction, this section conducts several robustness checks that confirm the main findings with respect to firms' adjustment of pricing and employment plans. In addition, Appendix Table A.14 summarizes the results of all robustness checks with respect to realized price changes in the subset of manufacturing firms which are comparable to the findings presented in the following.

First, the results do not change once controlling for attrition. If dropout of firms from the sample was correlated with the NMW bite, the baseline could be biased. To accommodate this concern, the sample is restricted to firms that stay in the data set until the end of the treatment period. The estimated NMW effect on firms' price and employment expectations are very close to the results of the baseline regression as shown in Column (2) of Tables 8 and 9.

Second, the results are robust to the choice of the aggregation level in the RS wage data used for the construction of the bite measure. As described in Section 4.1, 52% (84%) of firms in the sample can be matched to administrative, industry-specific wage data at the level of the county (labor market region) they are located in. Trading off the higher coverage of wage data at the level of labor market regions and the fact that firm-level wages are better reflected by county level data, the baseline specification uses county-level wage data once available and replaces missing values by data at the more aggregated level of labor market regions. If wage data at the level of labor market regions are used to determine TI_i for all firms instead, the results do not change substantially, see Column (3) of Tables 8 and 9.

As expected, the estimated NMW effects are stronger if the construction of TI_i is restricted to industry-specific wage data at the county level. Capturing the actual bite with less measurement error reduces the attenuation bias in the estimated coefficient. Regarding the price reaction of firms,

Table 8: Price Response to the Minimum Wage Introduction: Robustness

	Planned Price Change in Next 3 Months								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Specification	Baseline	No Attrition	RS Wage Data			SES Wage Data		$w(p0)$	
			Region Only	County Only	2013 Wages	Fulltime Workers	All Workers	$0.7w(p10)$	$0.9w(p10)$
$TI \times \mathbb{1}(t \in \{2014m7, 2016m6\})$	0.34***	0.35***	0.32***	0.50***	0.29***	0.35***	0.19**	0.34***	0.34***
	(0.072)	(0.068)	(0.079)	(0.087)	(0.067)	(0.051)	(0.074)	(0.079)	(0.073)
Control for $\text{Demand}_{i,t}$	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time*Sector FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
R^2	0.337	0.331	0.337	0.337	0.337	0.334	0.333	0.337	0.337
Observations	253350	220710	253350	154882	253536	146333	146333	253350	253350
PPI-Semi-Elasticity ($\hat{\psi}$)	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130
Revenue-Weighted TI ($\widetilde{TI}$)	0.027	0.027	0.028	0.023	0.029	0.023	0.071	0.046	0.024
Overall Price Effect ($\Delta\widetilde{P}$ in %)	0.241	0.248	0.234	0.297	0.212	0.212	0.345	0.408	0.216

Notes: The dependent variable is expected price changes during the next three months reported to the IBS. "TI" is the NMW bite and "$\mathbb{1}(t \in \{2014m7, 2016m6\})$" indicates the treatment period. "$\text{Demand}_{i,t}$" is firms' current backlog of orders reported to the IBS. "Time*Sector FE" are time fixed effects specific to two-digit industries. "$\hat{\psi}$" denotes the semi-elasticity mapping changes in price expectations to quantitative producer prices. "$\widetilde{TI}$" and "$\Delta\widetilde{P}$" reflect the overall treatment intensity in the economy and the overall effect of producer prices based on revenue weights for each county-industry cell as described in Section 5.3. Standard errors are multiway clustered at the levels of sectors, counties, and dates. Level of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 9: Employment Response to the Minimum Wage Introduction: Robustness

	Planned Employment Change in Next 3 Months								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Specification	Baseline	No Attrition	RS Wage Data			SES Wage Data		$w(p0)$	
			Region Only	County Only	2013 Wages	Fulltime Workers	All Workers	$0.7w(p10)$	$0.9w(p10)$
$TI \times \mathbb{1}(t \in \{2014m7, 2016m6\})$	-0.079	-0.070	-0.065	-0.13	-0.062	-0.049	-0.089	-0.091	-0.086
	(0.065)	(0.059)	(0.072)	(0.12)	(0.058)	(0.095)	(0.077)	(0.076)	(0.064)
Control for $\text{Demand}_{i,t}$	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time*Sector FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
R^2	0.357	0.349	0.357	0.373	0.357	0.367	0.367	0.357	0.357
Observations	253440	220803	253440	155005	253633	146459	146459	253440	253440

Notes: The dependent variable is the expected employment change during the next three months reported to the IBS. "TI" is the NMW bite and "$\mathbb{1}(t \in \{2014m7, 2016m6\})$" indicates the treatment period. "$\text{Demand}_{i,t}$" is firms' current backlog of orders reported to the IBS. "Time*Sector FE" are time fixed effects specific to two-digit industries. Standard errors are multiway clustered at the levels of sectors, counties, and dates. Level of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

the treatment effect is estimated to $\hat{\beta}^{\text{Price Exp.}} = 0.50$, see Column (4) of Table 8. Consequently, the approximated effect on the level of overall producer prices is stronger (+0.30%) compared to the baseline specification (+0.24%). For the case of employment expectations, the estimated treatment effect increases in absolute value to $\hat{\beta}^{\text{Empl. Exp.}} = -0.13$, see Column (4) of Table 9. Although the estimate is still insignificant, I cannot rule out that firms' employment reaction would be estimated to be significantly negative if firms' treatment intensity was observed without measurement error. Hence, the results of the baseline specification are likely to reflect a lower bound of firms' price and employment reaction to the NMW.

Third, using the share of full-time employees that earned less than €8.50 per hour in 2013 instead of 2014 as bite measure does not alter the results substantially. As can be inferred from Column (5) of Tables 8 and 9, the coefficients of the treatment effects are slightly smaller in absolute value but in the same order of magnitude compared to the baseline scenario. This can be attributed to the fact that wages have increased irrespective of the NMW in 2014. Hence, there is larger measurement error and more variation in TI_i when using 2013 wages for the identification of the bite both resulting in coefficients that are slightly smaller in absolute value.

Fourth, the documented responses are robust to the utilization of alternative bite measures based on the Structure of Earnings Survey. On the one hand, the SES allows to construct a bite measure along the same lines as TI_i capturing the fraction of affected full-time employees ($TI_i^{SES,FT}$). On the other hand, the treatment intensity in each firm's sector and location can be calculated based on the fraction of all affected employees, including part-time employees and marginally employed workers ($TI_i^{SES,all}$). However, the SES data have at least two disadvantages: first, they are not representative at the level of LMR*industry cells (or below) while the RS by construction covers all full-time employees. Second, $TI_i^{SES,FT}$ and $TI_i^{SES,all}$ can only be constructed for less than half of the manufacturing and services firms in the IBS sample even if the SES data are required to cover only a minimum of 100 employees per LMR*industry cell. As documented in Column (6) of Tables 8 and 9, the coefficients of the NMW effect on price and employment expectations are virtually unchanged when using $TI_i^{SES,FT}$ as bite measure.

Moreover, abstracting from affected part-time employees or marginally employed workers in the baseline scenario does not drive the results. Using the fraction of all workers—including part-time and marginally employed workers—that earned below the NMW in 2014 as captured by $TI_i^{SES,all}$ in the regression, again uncovers a strongly positive price effect, see Column (7) of Table 8. Naturally, the coefficient on the price effect is smaller compared to the baseline scenario because of the difference in the variation covered by the bite measures. However, the approximated effect on the overall level of producer prices is slightly larger, but in the same order of magnitude once using $TI_i^{SES,all}$ (+0.34%). In turn, the coefficient on employment expectations is slightly more negative, but again not approaching significance.

Fifth, the results are robust to different assumptions about the minimum of the wage distribution $w(0)$ which is not given in the RS wage data. The baseline specification is based on the assumption that $w(0)$ is related to the wage at the 10^{th} percentile ($w(10)$) in the same way as $w(10)$ is related to

Table 10: Firms' Responses to the NMW Introduction: Different "Virtual" NMW Levels

	Planned Price Change in Next 3 Months					Planned Empl. Change in Next 3 Months				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Specification	Baseline	Threshold $\bar{w}$				Baseline	Threshold $\bar{w}$			
		6.50€	7.50€	9.50€	10.50€		6.50€	7.50€	9.50€	10.50€
$TI \times \mathbb{1}(t \in \{2014m7, 2016m6\})$	0.34***	0.85***	0.55***	0.21***	0.13***	-0.079	-0.19	-0.13	-0.061	-0.047
	(0.072)	(0.26)	(0.13)	(0.050)	(0.038)	(0.065)	(0.21)	(0.11)	(0.043)	(0.033)
Control for $\text{Demand}_{i,t}$	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time*Sector FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
R^2	0.337	0.337	0.337	0.337	0.337	0.357	0.357	0.357	0.357	0.357
Observations	253350	253350	253350	253350	253350	253440	253440	253440	253440	253440
PPI-Semi-Elasticity ($\hat{\psi}$)	0.130	0.130	0.130	0.130	0.130					
Revenue-Weighted TI ($\widetilde{TI}$)	0.027	0.005	0.012	0.047	0.073					
Overall Price Effect ($\Delta\widetilde{P}$ in %)	0.241	0.111	0.180	0.253	0.243					

Notes: The dependent variable is expected price changes and expected employment changes during the next three months reported to the IBS, respectively. "TI" is the NMW bite and "$\mathbb{1}(t \in \{2014m7, 2016m6\})$" indicates the treatment period. "$\text{Demand}_{i,t}$" is firms' current backlog of orders as reported in the IBS. "Time*Sector FE" are time fixed effects specific to two-digit industries. '$\hat{\psi}$" denotes the semi-elasticity mapping changes in price expectations to quantitative producer prices. "$\widetilde{TI}$" and "$\Delta\widetilde{P}$" reflect the overall treatment intensity in the economy and the overall effect of producer prices based on revenue weights for each county-industry cell as described in Section 5.3. Standard errors are multiway clustered at the levels of sectors, counties, and dates. Level of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

wages at the 20^{th} percentile. In this specification, the minima of the wage distribution on average correspond to approximately 85% of the wage rates at the 10^{th} percentile. As documented in Columns (8) and (9) of Tables 8 and 9, the estimated treatment effects are unchanged once the wage curve below the 10^{th} percentile is assumed to be either steeper (with $w(0) = 0.7 \times w(10)$) or flatter (with $w(0) = 0.9 \times w(10)$).

Different "Virtual" Levels of NMW. In addition, the results are robust to the choice of different "virtual" minimum wage levels $\bar{w}_{min}$ for the construction of TI_i, see Table 10. If TI_i measures the fraction of all full-time employees that earned less than €6.50 or €7.50 in 2014, the bite measure only captures firms that are affected very strongly by the introduction of a NMW of €8.50 per hour. Unsurprisingly, the estimated effect on the overall price level is smaller (+0.11% for $\bar{w}_{min} =$ €6.50 and +0.18% for $\bar{w}_{min} =$ €7.50) because fewer firms are considered as being affected, see Columns (2) and (3). Further, the estimated employment reaction among these highly treated firms is more negative than in the baseline specification ($\hat{\beta}^{\text{Empl. Exp.}} = -0.19$ and $\hat{\beta}^{\text{Empl. Exp.}} = -0.13$) but still insignificant, see Columns (7) and (8). Despite of being insignificant, this points into the direction that deteriorated employment plans were—if anything—more likely to occur among very strongly affected firms.

If the NMW bite measure is calculated based on thresholds above €8.50, TI_i assigns a positive treatment intensity to firms that operate in industries and regions where all full-time employees

Table 11: Minimum Wage Effects at the Firm-Level: Test for SUTVA

	Price Exp.$_t^{+3m}$				Employment Exp.$_t^{+3m}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		$\bar{w}^{alt}$				$\bar{w}^{alt}$		
Omit if $TI = 0$ & $TI(\bar{w}^{alt}) > 0$	Baseline	10€	12€	15€	Baseline	10€	12€	15€
$TI \times \mathbb{1}(t \in \{2014m7, 2016m6\})$	0.34***	0.36***	0.38***	0.36***	-0.08	-0.04	-0.04	-0.07
	(0.07)	(0.08)	(0.09)	(0.09)	(0.06)	(0.07)	(0.07)	(0.07)
N	253350	205322	144047	91262	253440	205385	144048	91295
R^2	0.337	0.330	0.324	0.336	0.357	0.363	0.364	0.336
Control for Demand$_{i,t}$	yes	yes	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes
Time*Sector FE	yes	yes	yes	yes	yes	yes	yes	yes

Notes: The dependent variables are planned price or employment changes during the next three months reported to the IBS. "TI" is the NMW bite and "$\mathbb{1}(t \in \{2014m7, 2016m6\})$" indicates the treatment period. In Columns (2) through (4) and (6) through (8) firms are dropped from the sample if they are unaffected according to the baseline bite measure, but would be affected by a hypothetical minimum wage of $\bar{w}^{alt}$, i.e., if $TI^{Baseline} = 0$ and $TI(\bar{w}^{alt}) > 0$. "Demand$_{i,t}$" is firms' current backlog of orders reported to the IBS. "Time*Sector FE" are time fixed effects at the level of two-digit industries. Standard errors are multiway clustered at the levels of sectors, counties, and dates. Level of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

earned wages slightly above the NMW prior to its introduction. However, it could be argued that these firms employed at least some part-time employees or marginally employed workers that previously earned less than €8.50. The results in Columns (4) and (5) of Table 10 indicate that price expectations in the period around the NMW introduction reacted less sensitive to a given variation in TI_i based on the thresholds of $\bar{w}_{min} =$ €9.50 and €10.50 compared to the baseline specification. Naturally, the revenue-weighted mean of overall treatment intensity $\widetilde{TI}(\bar{w}_{min})$ is larger in these specifications, i.e., $\widetilde{TI}(9.50) = 0.047$ and $\widetilde{TI}(10.50) = 0.073$. Strikingly, the overall effect on producer prices (+0.25% and +0.24%) is comparable to the baseline scenario (+0.24%). This indicates that the price effect is generated by firms that were already captured by the baseline specification of the treatment intensity measure. Abstracting from firms that were affected by the NMW only through higher wage costs for part-time employees or marginally employed workers does hence not appear to be worrisome.

SUTVA. A major concern of the DiD approach is that the Stable Unit Treatment Value Assumption (SUTVA) is violated. If firms that were not directly subject to the NMW ($TI_i = 0$) were affected via spillover effects, the empirical results would be biased. The SUTVA is very likely to hold in the case of the German NMW due to several reasons. First, existing evidence does not speak in favor of wage spillovers to workers that previously earned above the German NMW.[39] Second, general equilibrium effects on firms that are perceived as unaffected by the baseline bite measure

[39]For example, Caliendo et al. (2017) do not find positive wage spillovers using wage date from the "Socio-Economic Panel" (SOEP). Moreover, Ahlfeldt et al. (2018) find stronger wage growth in low-wage regions relative to high-wage regions using administrative wage data in the "Integrated Employment Biographies" provided by the Institute for Employment Research (IAB). See Caliendo et al. (2019) for a comprehensive survey on this issue.

are arguably limited. Despite of the fact that more than 10% of all employment relations were directly affected by the NMW, their share in the overall wage bill of the economy corresponded to 0.43% (Destatis, 2016). Although affected firms rolled over a substantial share of this wage bill increase to their customers, the second order effects on untreated firms are hence small. Third, even if there was sizable reallocation of workers from small, low paying firms to large, high-paying firms as suggested by Dustmann et al. (2019), the fact that treatment effects are identified using industry-region level variation reduces the possibility that worker reallocation violates the SUTVA. In addition, restricting the set of firms in the control group by omitting those firms that paid wages within a certain range above the minimum wage threshold prior to the reform does not alter the main results of the paper. Table 11 shows the results of the main regressions when omitting firms with $TI_i = 0$ that would have been affected positively by alternative wage floors at levels as high as $\bar{w}^{alt} \in \{€10,€12,€15\}$. Apparently, the estimated price and employment responses of affected firms to the NMW are not different in any of these specifications suggesting that the results are not biased by cost spillovers or worker reallocation.

8. Conclusion

This paper studies the price and employment reaction of firms in manufacturing and services in response to the introduction of nationwide wage floor in Germany in 2015. Instead of reducing employment, affected firms increased prices more frequently in order to absorb the increase in the wage bill. The results indicate that the speed of price adjustment was relatively fast and that the degree of pass-through is substantial.

My results generalize the findings of other studies on price effects of minimum wages that are usually based on data from highly affected industries such as restaurants and retailers, only. Documenting strong price responses of firms in different sectors of the economy, including manufacturing, I show that the importance of price pass-through is not limited to firms in specific low-wage sectors but a widespread phenomenon. Moreover, my findings indicate that the size of the price response to minimum wages is heterogeneous and depends on firms' expectations regarding the general future development of their businesses as well as the competition firms face in the product market and local labor market. Especially the finding that both firms with worse general business expectations as well as firms facing more slack in the labor market reacted more strongly along the employment margin suggests that the disemployment effect might have been more negative if the NMW had not been introduced during a period of economic boom.

The results presented in this paper have implications for the general understanding of the employment response to minimum wages. The small effect of minimum wages has often been associated with the importance of monopsony behavior (see Bhaskar et al., 2002 for a survey) or the role of informational frictions or search frictions in the labor market (e.g, van den Berg, 2003 and Dube et al., 2016). In light of the relatively restrictive labor market institutions and employment protection in Germany, my results cannot rule out that labor market frictions explain the weak effect of the German minimum wage on employment as proposed by Blömer et al. (2018). However,

Aaronson and French (2007) and Aaronson et al. (2008) show that the monopsony model cannot explain strong price rises after minimum wage increases. Hence, my results suggest that monopsony power did not play a major role in explaining the small employment effect of the introduction of a nation-wide minimum wage in Germany.

Taken together, the findings of this paper suggests that a joint assessment of different potential adjustment channels, which is not limited to the employment margin, is important to gain a comprehensive understanding of firms' response to minimum wages.

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A. Appendix

A.1. Additional Material Regarding IBS Data

A.1.1. Wording of Survey Questions

The following set of questions, which are asked regularly on a monthly basis in the IBS, are used in this paper (English translation of German original):

Services Survey (S):

S:Q1 Price Expectations:
"During the next 3 months, the prices of our services will [1] increase, [0] stay the same, or [-1] decrease."

S:Q2 Employment Expectations:
"During the next (2-3) months, the number of employees will [1] increase, [0] stay the same, or [-1] decrease."

S:Q2a Realized Employment Changes:
"During the past (2-3) months, the number of employees [1] increased, [0] stayed the same, or [-1] decreased."

S:Q3 Current Backlog of Orders:
"We evaluate our backlog of orders as [1] comparatively large, [0] sufficient (typical for the season), or [-1] too small."

S:Q4 Current Business Situation:
"We evaluate our current business situation as [1] good, [0] satisfactory (typical for the season), or [-1] bad."

S:Q5 Expected Business Situation:
"During the next six months, our business situation will be [1] more favorable, [0] stay the same, or [-1] more unfavorable."

S:Q6 Demand Expectations:
"During the next (2-3) months, the demand for our services and/or our revenues will [1] increase, [0] stay approximately the same, or [-1] decrease."

Manufacturing Survey (M):

In the manufacturing survey, firms are asked for assessments regarding specific products. However, only 0.43% of all observations between 2011 and 2017 refer to multiple products for the same firm at a given point in time. Following the procedure described in Link (2018), these observations are aggregated to the firm level by taking means across products and rounding to the next integer.

M:Q1 Price Expectations:
"During the next 3 months, the domestic (net) sales prices for product X will—in consideration of changes in conditions—probably [1] increase, [0] roughly stay the same, or [-1] decrease."

M:Q1a Realized Price Changes:
"During the past month, the domestic (net) sales price for product X—in consideration of changes in conditions— [1] increased, [0] stayed the same, or [-1] decreased."

M:Q2 Employment Expectations:
"During the next 3 months, the number of employees for the production of product X will [1] increase, [0] roughly stay the same, or [-1] decrease."

M:Q3 Current Backlog of Orders:
"We evaluate our backlog of orders for product X as [1] comparatively large, [0] sufficient (typical for the season), or [-1] too small."

M:Q4 Current Business Situation:
"We evaluate the current business situation for product X as [1] good, [0] satisfactory, or [-1] bad."

M:Q5 Expected Business Situation:
"Expectations for the next six months: the business situation for product X will be [1] more favorable, [0] stay the approximately same, or [-1] more unfavorable."

M:Q6 Production Expectations:
"Expectations for the next three months: the domestic production of product X will [1] increase, [0] stay the approximately same, or [-1] decrease."

A.1.2. Descriptive Statistics of IBS Data

Table A.1: Price Expectations and Realized Price Changes in the Subsequent Three Months

	Obs.	Fractions of Mean Realized Price Changes b/w $t+1$ & $t+3$			Sum
		> 0	$= 0$	< 0	
Price Exp.$_t^{+3m} = 1$	14003	0.62	0.35	0.03	1
Price Exp.$_t^{+3m} = 0$	88288	0.09	0.83	0.08	1
Price Exp.$_t^{+3m} = -1$	7073	0.03	0.27	0.69	1

Notes: This table contrasts the micro data of expected price changes during the next three months stated in t with the mean reported (monthly) price changes during the following three months, i.e., between $t+1$ and $t+3$. The sample is restricted to manufacturing firms that reported price expectations in t as well as price realizations in the subsequent three months.

Table A.2: Employment Expectations and Realized Changes in the Subsequent Three Months

	Obs.	Fractions of Realized Empl. Changes b/w $t+1$ & $t+3$			Sum
		> 0	$= 0$	< 0	
Empl. Exp.$_t^{+3m} = 1$	17173	0.74	0.20	0.06	1
Empl. Exp.$_t^{+3m} = 0$	69549	0.22	0.66	0.12	1
Empl. Exp.$_t^{+3m} = -1$	6295	0.08	0.25	0.67	1

Notes: This table contrasts the micro data of expected employment changes during the next three months stated in t with the reported employment change three months later. The sample is restricted to services companies that reported employment expectations in t as well as employment realizations in $t+3$.

Table A.3: Cross-Correlation b/w Average Reports to IBS and Changes in Quantitative Price Data

Panel A: Changes in PPI Relative to 3 Months Before

Lag i	-3	-2	-1	0	1	2	3
$\rho(\overline{\text{Price Exp.}}_{t-i}^{+3m}, \Delta\overline{PPI}_t)$	0.334	0.54	0.696	0.812	**0.845**	0.799	0.653
$\rho(\overline{\text{Price Realiz.}}_{t-i}^{-1m}, \Delta\overline{PPI}_t)$	0.609	0.714	0.797	**0.821**	0.777	0.648	0.483

Panel B: Changes in PPI Relative to Previous Month

Lag i	-3	-2	-1	0	1	2	3
$\rho(\overline{\text{Price Realiz.}}_{t-i}^{-1m}, \Delta\overline{PPI}_t)$	0.599	0.578	0.674	0.633	0.468	0.339	0.225

Notes: Cross-correlogram of time series of changes in weighted producer prices ($\Delta\overline{PPI}_t$) relative to three months ago (Panel A) or one month ago (Panel B) and average expected price changes for the next three months ($\overline{\text{Price Exp.}}_t^{+3m}$) or average realized price changes during the previous month ($\overline{\text{Price Realiz.}}_t^{-1m}$) as reported to the IBS. The sample is restricted to manufacturing firms between January 2011 and June 2016 or September 2016 for the specifications using price expectations and price realizations, respectively.

Table A.4: Cross-Correlation and Semi-Elasticity in Different Groups of Firms

	Lag i							Semi-Elasticity
	-3	-2	-1	0	1	2	3	$\hat{\psi}^{Exp}/\hat{\psi}^{Realiz}$
Panel A: Cross-Correlation for Subsets of Firms Splitted w.r.t. Product Market Competition								
Concentration: Herfindahl Index < Median								
$\rho(\overline{\text{Price Exp.}}_{t-i}^{+3m}, \Delta\overline{PPI}_t)$	0.351	0.561	0.710	0.812	**0.846**	0.817	0.662	0.131
$\rho(\overline{\text{Price Realiz.}}_{t-i}^{-1m}, \Delta\overline{PPI}_t)$	0.648	0.745	0.814	**0.831**	0.791	0.654	0.486	0.153
Concentration: Herfindahl Index ≥ Median								
$\rho(\overline{\text{Price Exp.}}_{t-i}^{+3m}, \Delta\overline{PPI}_t)$	0.073	0.246	0.399	0.544	**0.555**	0.518	0.374	0.135
$\rho(\overline{\text{Price Realiz.}}_{t-i}^{-1m}, \Delta\overline{PPI}_t)$	0.270	0.340	0.447	**0.495**	0.466	0.335	0.172	0.129
Industry Import Share < Median								
$\rho(\overline{\text{Price Exp.}}_{t-i}^{+3m}, \Delta\overline{PPI}_t)$	0.275	0.489	0.656	0.788	**0.843**	0.837	0.695	0.121
$\rho(\overline{\text{Price Realiz.}}_{t-i}^{-1m}, \Delta\overline{PPI}_t)$	0.630	0.732	0.821	**0.833**	0.794	0.650	0.491	0.147
Industry Import Share ≥ Median								
$\rho(\overline{\text{Price Exp.}}_{t-i}^{+3m}, \Delta\overline{PPI}_t)$	0.112	0.334	0.542	0.717	**0.742**	0.660	0.470	0.173
$\rho(\overline{\text{Price Realiz.}}_{t-i}^{-1m}, \Delta\overline{PPI}_t)$	0.372	0.518	0.646	**0.701**	0.630	0.461	0.267	0.178
Panel B: Cross-Correlation at Level of Two-Digit Industries (Sorted by Number of Firms)								
28 Machinery and equipment n.e.c. (451 firms)								
$\rho(\overline{\text{Price Exp.}}_{s,t-i}^{+3m}, \Delta\overline{PPI}_{s,t})$	0.004	0.213	0.431	0.629	0.792	**0.835**	0.640	0.117
$\rho(\overline{\text{Price Realiz.}}_{s,t-i}^{-1m}, \Delta\overline{PPI}_{s,t})$	0.33	0.472	0.695	**0.805**	0.749	0.486	0.251	0.147
25 Fabricated metal products, except machinery & equipment (304 firms)								
$\rho(\overline{\text{Price Exp.}}_{s,t-i}^{+3m}, \Delta\overline{PPI}_{s,t})$	0.414	0.617	0.707	**0.803**	0.787	0.774	0.688	0.151
$\rho(\overline{\text{Price Realiz.}}_{s,t-i}^{-1m}, \Delta\overline{PPI}_{s,t})$	0.738	0.777	**0.794**	0.759	0.734	0.680	0.578	0.161
22 Rubber and plastic products (182 firms)								
$\rho(\overline{\text{Price Exp.}}_{s,t-i}^{+3m}, \Delta\overline{PPI}_{s,t})$	0.003	0.116	0.389	0.705	**0.857**	0.769	0.530	0.193
$\rho(\overline{\text{Price Realiz.}}_{s,t-i}^{-1m}, \Delta\overline{PPI}_{s,t})$	0.197	0.421	0.694	**0.865**	0.835	0.618	0.352	0.213
27 Electrical equipment (181 firms)								
$\rho(\overline{\text{Price Exp.}}_{s,t-i}^{+3m}, \Delta\overline{PPI}_{s,t})$	-0.259	-0.253	-0.140	0.042	0.214	**0.223**	0.143	0.028
$\rho(\overline{\text{Price Realiz.}}_{s,t-i}^{-1m}, \Delta\overline{PPI}_{s,t})$	-0.022	0.054	0.151	**0.165**	0.154	0.073	-0.050	0.028
23 Other non-metallic mineral products (116 firms)								
$\rho(\overline{\text{Price Exp.}}_{s,t-i}^{+3m}, \Delta\overline{PPI}_{s,t})$	-0.17	-0.069	0.080	0.271	0.484	0.563	**0.565**	0.088
$\rho(\overline{\text{Price Realiz.}}_{s,t-i}^{-1m}, \Delta\overline{PPI}_{s,t})$	-0.064	0.131	0.352	0.495	**0.581**	0.527	0.385	0.127
20 Chemicals and chemical products (115 firms)								
$\rho(\overline{\text{Price Exp.}}_{s,t-i}^{+3m}, \Delta\overline{PPI}_{s,t})$	0.267	0.399	0.534	0.628	**0.655**	0.614	0.531	0.316
$\rho(\overline{\text{Price Realiz.}}_{s,t-i}^{-1m}, \Delta\overline{PPI}_{s,t})$	0.420	0.454	0.522	0.579	**0.598**	0.526	0.418	0.260
18 Printing and reproduction of recorded media (96 firms)								
$\rho(\overline{\text{Price Exp.}}_{s,t-i}^{+3m}, \Delta\overline{PPI}_{s,t})$	0.013	0.043	0.085	0.149	**0.211**	0.170	0.159	0.054
$\rho(\overline{\text{Price Realiz.}}_{s,t-i}^{-1m}, \Delta\overline{PPI}_{s,t})$	0.006	0.098	0.069	**0.152**	0.007	-0.038	-0.073	0.033

Notes: This table presents cross-correlations for different groups of firms in manufacturing between changes in producer prices ($\Delta\overline{PPI}_t$) relative to three months ago and average expected price changes for the next three months ($\overline{\text{Price Exp.}}_t^{+3m}$) or average realized price changes during the previous month ($\overline{\text{Price Realiz.}}_t^{-1m}$) as reported to the IBS. Panel A provides information on different subsamples of manufacturing firms splitted with respect to the median of their two-digit industry's Herfindahl index or import share. Within each group, industry-specific PPIs are weighted by the number of firms in the IBS. Panel B reports information on the six largest manufacturing industries, separately. "$\hat{\psi}$" denotes the semi-elasticity that maps changes in average price expectations/realizations to quantitative producer prices as described in Section 3. The sample is restricted to firms between January 2011 and June 2016 or September 2016 for the specifications using price expectations and price realizations, respectively.

A.2. Supplementary Material Regarding Treatment Intensity Measure

A.2.1. Details on Construction of the Bite Measure

This appendix complements Section 4.1 by providing detailed information on the construction of the bite measure TI_i. I obtained data of gross monthly wages paid to full-time employees in each two-digit industry at the level of counties (NUTS-3-regions) as well as labor market regions (LMRs) in 2014 at the following percentiles: $p \in \{10, 20, 30, 40, 50, 60, 80\}$ from the Federal Employment Agency (2016). As described in the main text, the baseline specification of TI_i is based on the industry-specific wage distribution at the county-level and missing values are replaced by wage data at the LMR-level.

Monthly wages are converted to hourly wages by means of the number of paid working hours per month collected by the Quarterly Earnings Survey ("*Vierteljährliche Verdiensterhebung*"). This survey, which is conducted by the statistical offices of the federal states, covers 40,500 German firms (7.4% of all firms) and is representative at the level of two-digit industries in both East and West Germany.[40] After calculating the average amount of monthly working hours in 2014 for each industry in West and East Germany, the monthly wages at each percentile are transformed to an hourly basis for each sector-region cell, i.e., to $w_{s,r}(p)$ which denotes the p^{th} percentile of hourly wages in sector s and region r (counties or LMRs).

Then, the fraction of full-time employees that earned a gross hourly wage of less than €8.50 is calculated for each sector-region combination. Figure A.1 provides an illustration of the procedure that is based on two assumptions about the shape of the wage distribution: first, the wage level of employees between any two percentiles for which wage data are available is approximated by linear interpolation. Second, the wage level at the minimum of the wage distribution $w_{s,r}(0)$ is assumed to be related to the wage at the 10^{th} percentile similarly as $w_{s,r}(10)$ is related to $w_{s,r}(20)$, i.e., $w_{s,r}(0)/w_{s,r}(10) = w_{s,r}(10)/w_{s,r}(20)$. Accordingly, the wage level at the maximum of the wage distribution is assumed to be $w_{s,r}(100)/w_{s,r}(80) = w_{s,r}(80)/w_{s,r}(60)$. Given these assumptions, the fraction of full-time employees that earned less than €8.50 per hour in 2014 in each sector-region cell—henceforth denoted as $TI_{s,r}$—can be derived from the intercept theorem:

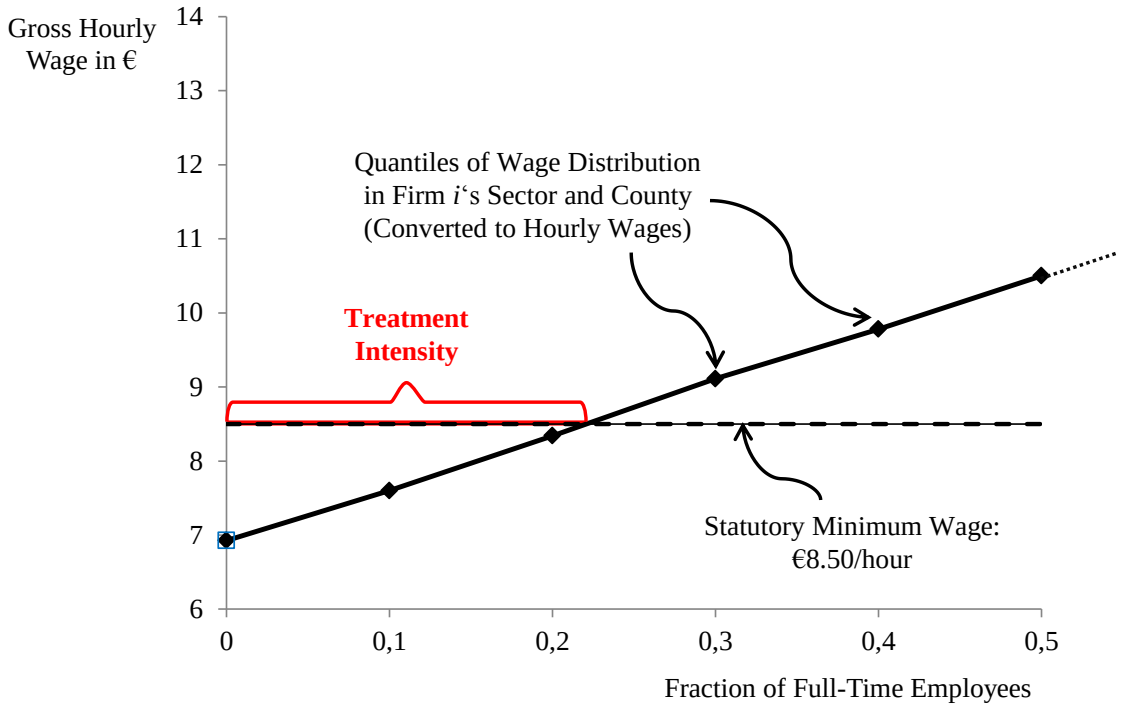
$$TI_{s,r} = \begin{cases} 0 & \text{if } \bar{w}_{min} \leq w_{s,r}(0) \\ p + 0.1 * \frac{\bar{w}_{min} - w_{s,r}(p)}{w_{s,r}(p+10) - w_{s,r}(p)} & \text{if } w_{s,r}(p) < \bar{w}_{min} \leq w_{s,r}(p+10) \wedge p \in \{10, 20, 30, 40, 50\} \\ p + 0.2 * \frac{\bar{w}_{min} - w_{s,r}(p)}{w_{s,r}(p+20) - w_{s,r}(p)} & \text{if } w_{s,r}(p) < \bar{w}_{min} \leq w_{s,r}(p+20) \wedge p \in \{60, 80\} \\ 1 & \text{if } w_{s,r}(100) \leq \bar{w}_{min} \end{cases} \tag{5}$$

where $\bar{w}_{min}$ denotes the level of the new statutory minimum wage of €8.50 per hour.

It is important to note that the relative ordering of sector-region combinations with respect to their fraction of full-time employed that earned less than €8.50 does not hinge on the choice of $w_{s,r}(0)$ and $w_{s,r}(100)$. I also computed TI_i assuming that $w_{s,r}(0) = 0.9 * w_{s,r}(10)$ or $w_{s,r}(0) = 0.7 * w_{s,r}(10)$.

[40] The quality of the data on working hours is perceived to be very high as response to the survey is compulsory. The data is publicly available from the Federal Statistical Office and described in more detail here: https://www.destatis.de/EN/FactsFigures/NationalEconomyEnvironment/EarningsLabourCosts/Methods/QuarterlyEarningsSurvey.html.

Figure A.1: Illustration of the Identification of Firms' Affectedness by the Minimum Wage



Notes: This diagram illustrates the identification of firms' affectedness by the NMW indicated by the red line ("Treatment Intensity") for the example of firms in industry "55 Accommodation/Lodging" in county "09180 Garmisch-Partenkirchen." The black rhombi refer to the deciles of the wage distribution of full-time employees in 2014 after conversion to hourly wages. The wage levels between the deciles given in the data are linearly interpolated, while the values for the minimum and maximum of the wage distribution are calculated as described in the main text.

The relative ordering of sector-region cells did not change substantially. Moreover, robustness checks presented in Section 7 show that the documented NMW effects do not hinge on the assumptions about $w_{s,r}(0)$.

A.2.2. Plausibility Test Exploiting Minimum Wage-Related Questions in IBS

This appendix complements the evidence presented in Section 4.1 regarding the plausibility of the treatment intensity measure TI_i by making use of firms' responses to a series of supplementary questions in the IBS. Specifically, the IBS version of November 2014 has been complemented by the following set of questions referring to firms' assessments about the upcoming NMW introduction in January 2015 (English translation of German original):

SQ1: *"The statutory minimum wage will be introduced on January 1st, 2015. Is your company affected by this regulation? [1] yes, [0] no.*"

"If yes, which actions are you going to undertake in reaction to the introduction of the minimum wage (multiple answers possible)?

SQ2: *No action planned: [1] yes.*

SQ3: *Reduction in staff: [1] yes.*

SQ4: *Reduction in working hours: [1] yes.*

SQ5: *Price increases: [1] yes.*

SQ6: *Decreased investment volume: [1] yes.*

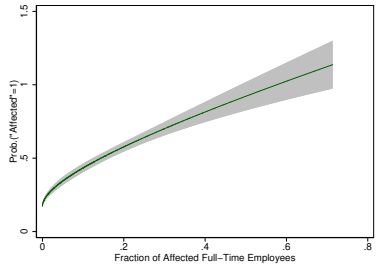
SQ7: *Cuts in bonus payments: [1] yes.*

SQ8: *Other action: [1] yes."*

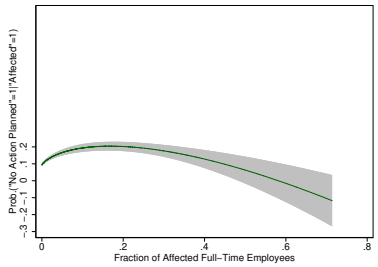
As the functional form of the relationship between TI_i and the frequency to which firms answered the supplementary questions in the affirmative is not clear *a priori*, I estimate a fractional polynomial of degree two of TI_i without adding any further covariates. Figure A.2 plots the resulting curves of the mean probability to affirm to the respective question at different levels of TI_i along with the 95%-confidence intervals. In addition, Table A.5 summarizes the average frequencies of responses at different levels of TI_i. The question about firms' affectedness (SQ1) neither provides any information about the intensity to which firms are affected nor contains any information about the channels through which firms are affected. As can be inferred from Figure A.2 and Table A.5, the frequency that firms stated to be affected by the NMW increases substantially in TI_i. The majority among the 17% of firms that reported to be affected by the minimum wage despite of $TI_i = 0$ did not plan to react to the NMW. Arguably, these firms were only affected indirectly by the NMW or perceived themselves as being affected because of the obligatory and time-consuming documentation

Figure A.2: Relationship Between TI_i and NMW-Related Supplementary Questions in the IBS

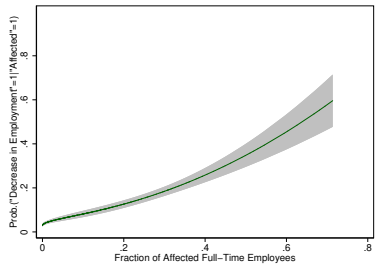
SQ1: Probability of "Affectedness"



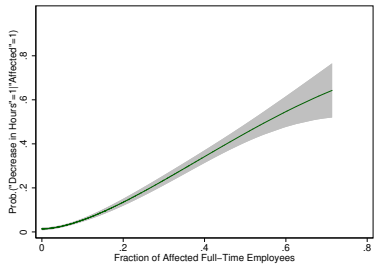
SQ2: No Action Planned if "Affected"



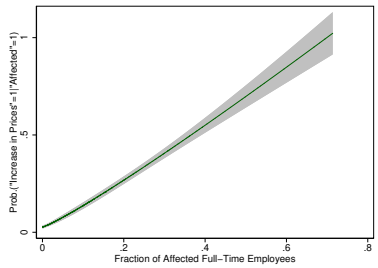
SQ3: Planned Empl. Decreases if "Affected"



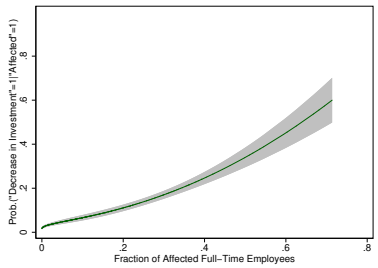
SQ4: Planned Decrease in Working Hours if "Affected"



SQ5: Planned Increase in Prices if "Affected"



SQ6: Planned Decrease in Investment if "Affected"



Notes: Each figure plots the predicted probability (green line) to affirm to the respective supplementary question by estimating a fractional polynomial of degree two of TI_i without adding any further covariates. The shaded area covers the 95%-confidence interval of the predicted probabilities.

Table A.5: Plausibility Check of the Treatment Intensity Measure: Extended Results

	Treatment Intensity $TI \in$		
	[0%]	(0%,20%]	(20%,100%)
prob("Affected" = 1)	0.172	0.379	0.753
prob("Do Not Plan to React" = 1|"Affected" = 1)	0.528	0.449	0.178
prob("Staff Reduction" = 1|"Affected" = 1)	0.175	0.179	0.310
prob("Hours Reduction" = 1|"Affected" = 1)	0.074	0.132	0.364
prob("Price Increase" = 1|"Affected" = 1)	0.147	0.287	0.612
prob("Reduction in Investment" = 1|"Affected" = 1)	0.101	0.132	0.302
prob("Reduction in Special Payments" = 1|"Affected" = 1)	0.147	0.236	0.380

Notes. "TI" refers to the fraction of full-time employees that earned an hourly gross wage of less than €8.50 in 2014 in each firm's two-digit industry and county. *prob*("Affected" = 1) displays the frequency that firms responded to be "affected" by the NMW in the supplementary questions of the IBS in November 2014 depending on TI_i as indicated at the top of each column. *prob*("Do Not Plan to React" = 1|"Affected" = 1), etc. are defined accordingly.

Table A.6: Response to Minimum Wage: Main Results Based on Self-Reported "Affectedness"

	Price Exp.$_t^{+3m}$ (1)	Empl. Exp.$_t^{+3m}$ (2)	Cond. Exp.$_t^{+6m}$ (3)	Prod./Dem. Exp.$_t^{+3m}$ (4)	Cond.$_t$ (5)	Demand$_t$ (6)
$\mathbb{1}$(Treated$_i$)						
$\times\mathbb{1}(t \in \{2014m7, 2016m6\})$	0.021**	-0.005	-0.000	0.008		
	(0.009)	(0.008)	(0.011)	(0.009)		
$\times\mathbb{1}(t \in \{2014m10, 2016m9\})$					-0.014	-0.004
					(0.009)	(0.010)
Control for Demand$_{i,t}$	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes
Time*Sector FE	yes	yes	yes	yes	yes	yes
R^2	0.329	0.348	0.372	0.391	0.626	0.456
Observations	230085	230210	230228	230835	241212	241512

Notes: The dependent variables are planned price or employment changes during the next three months (Price Exp.$_t^{+3m}$ and Empl. Exp.$_t^{+3m}$), expected business conditions for the next six months (Cond. Exp.$_t^{+6m}$), expected production (manufacturing firms) or demand (services firms) for the next three months (Prod./Dem. Exp.$_t^{+3m}$), as well as current business conditions and current backlog of orders of firms in the IBS (Cond.$_t$ and Demand$_t$). "$\mathbb{1}$(Treated$_i$)" is a dummy that is one if firms stated to be "affected" by the NMW to SQ1 and "$\mathbb{1}(t \in \{2014m7, 2016m6\})$" and "$\mathbb{1}(t \in \{2014m10, 2016m9\})$" indicate the respective treatment period. "Time*Sector FE" are time fixed effects at the level of two-digit industries. Standard errors are multiway clustered at the levels of sectors, counties, and dates. Levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

requirements.

Moreover, the probability that "affected" firms according to SQ1 stated to react to the NMW increases along all margins covered by the supplementary questions SQ3 through SQ7. Interestingly, the probability of stating to increase prices (SQ5) increases most strongly in TI_i. Albeit reacting less strongly compared SQ5, the probabilities of affected firms to confirm to plan reductions in employment (SQ3), cuts in working hours (SQ4), decrease investment (SQ6), or reduce special payments (SQ7) also increases in TI_i.

However, interpreting the correlations in a causal way is potentially misleading because the questions regarding firms' planned reactions to the NMW (SQ3-SQ7) are restricted to affected firms and one direction. For example, affected firms could only state whether they planned to reduce the number of employees or not. If firms were operating in monopsonistic labor markets, for example, they should be expected to *increase* their labor demand in response to a minimum wage that is binding at sufficiently low levels (Manning, 2003). If a non-negligible fraction of affected firms did so, the fraction of firms that planned to decrease their labor demand could hence be accompanied by a fraction of firms that planned to increase labor demand resulting in a total employment effect that potentially cancels out. Hence, the supplementary questions SQ3 through SQ7 themselves do not allow for causal inference on the firm-level response of the NMW due to missing counterfactuals as well as one-sided questions.

Lastly, firms' self-reported "affectedness" by the NMW is used to replicate the main findings of the paper. As the treatment-interaction term does not include a continuous bite measure, but the dummy ("$\mathbb{1}$(Treated$_i$)") according to firms' answers to SQ1, the coefficients displayed in Table A.6 cannot be directly compared to the main results of Table 4. Again, the effect of the NMW on firms'

pricing plans is significantly positive and absolute size of the coefficient of the employment response is only one quarter of the size of the price effect and statistically insignificant. Moreover, the effects with respect to firms' expectations regarding their general business conditions, production, and demand as well as realizations of their business conditions and current demand are statistically indistinguishable from zero.

A.2.3. Variation in Firms' Treatment Intensity In Different Industries

Table A.7: Variation of Minimum Wage Bite in Different Industries

Two-Digit Industry (WZ 2008)	Geogr. Herfindahl	Class.	# Firms	Mean TI	% Firms with Fraction of Affected Full-Time Employees =0%	>0%	>10%	>20%	>30%
Panel A: Firms in Manufacturing Survey of IBS									
10 Food products	0.0050	Non-Trad.	66	0.1820	6.1	93.9	63.6	33.3	19.7
11 Beverages	0.0077	Non-Trad.	12	0.0046	91.7	8.3	0	0	0
15 Leather products (& related)	0.0207	Remaining	1	0.0136	0	100	0	0	0
16 Wood & products of wood (excl. furniture)	0.0074	Non-Trad.	61	0.0135	86.9	13.1	3.3	1.6	1.6
17 Paper & paper products	0.0090	Non-Trad.	75	0.0131	86.7	13.3	8	0	0
18 Printing and reproduction of recorded media	0.0085	Non-Trad.	96	0.0153	79.2	20.8	2.1	0	0
19 Coke and refined petroleum products	0.0612	Tradable	1	0	100	0	0	0	0
20 Chemicals and chemical products	0.0108	Remaining	115	0.0068	88.7	11.3	4.3	0	0
21 Basic pharmaceutical products & preparations	0.0251	Remaining	14	0.0056	78.6	21.4	0	0	0
22 Rubber and plastic products	0.0064	Non-Trad.	182	0.0189	78	22	9.3	0.5	0
23 Other non-metallic mineral products	0.0054	Non-Trad.	116	0.0046	86.2	13.8	0	0	0
24 Basic metals	0.0163	Remaining	88	0.0007	90.9	9.1	0	0	0
25 Fabricated metal products, except machinery & equipment	0.0063	Non-Trad.	304	0.0192	73.7	26.3	5.6	0	0
26 Computer, electronic and optical products	0.0093	Remaining	96	0.0087	84.4	15.6	4.2	0	0
27 Electrical equipment	0.0123	Remaining	181	0.0078	92.8	7.2	4.4	1.1	0
28 Machinery and equipment n.e.c.	0.0059	Non-Trad.	451	0.0007	98.2	1.8	0	0	0
29 Motor vehicles, trailers and semi-trailers	0.0287	Tradable	80	0.0030	90	10	1.3	0	0
30 Other transport equipment	0.0851	Tradable	9	0	100	0	0	0	0
31 Furniture	0.0132	Remaining	44	0.0270	75	25	6.8	6.8	2.3
32 Other Manufacturing	0.0100	Remaining	44	0.0652	45.5	54.5	18.2	9.1	6.8
33 Repair and installation of machinery and equipment	0.0067	Non-Trad.	7	0.0154	71.4	28.6	0	0	0
Panel B: Firms in Services Survey of IBS									
35 Electricity, gas, steam, and air conditioning supply	0.0095	Remaining	7	0	100	0	0	0	0
38 Waste collection, treatment and disposal activities; materials recovery	0.0082	Non-Trad.	64	0.0073	78.1	21.9	1.6	0	0
41 Construction of buildings	0.0046	Non-Trad.	4	0.0301	75	25	25	0	0
43 Specialised construction activities	0.0048	Non-Trad.	16	0.0135	75	25	0	0	0
49 Land transport and transport via pipelines	0.0095	Remaining	130	0.1423	0.8	99.2	73.1	22.3	2.3
50 Water transport	0.1701	Tradable	3	0	100	0	0	0	0
51 Air transport	0.2882	Tradable	3	0	100	0	0	0	0
52 Warehousing and support activities for transportation	0.0106	Remaining	120	0.0156	76.7	23.3	8.3	0	0
53 Postal and courier activities	0.0070	Non-Trad.	8	0.0837	0	100	37.5	0	0
55 Accommodation	0.0128	Remaining	89	0.1852	1.1	98.9	70.8	37.1	13.5
56 Food and beverage service activities	0.0126	Remaining	58	0.3810	0	100	100	98.3	81
58 Publishing activities	0.0287	Tradable	14	0.0073	92.9	7.1	7.1	0	0
59 Motion picture, video & TV programme production, sound recording & music publishing	0.0905	Tradable	10	0.0305	0	100	0	0	0
60 Radio and Television	0.0982	Tradable	5	0	100	0	0	0	0
61 Telecommunications	0.0249	Remaining	6	0	100	0	0	0	0
62 Computer programming, consultancy and related activities	0.0220	Remaining	245	0.0022	94.7	5.3	0.8	0	0
63 Information service activities	0.0559	Tradable	13	0.0027	84.6	15.4	0	0	0
64 Financial service activities, except insurance and pension funding	0.0209	Remaining	49	0	100	0	0	0	0
65 Insurance, reinsurance and pension funding, except compulsory social security	0.0514	Tradable	1	0	100	0	0	0	0
66 Activities auxiliary to financial services and insurance activities	0.0338	Tradable	11	0.0021	90.9	9.1	0	0	0
68 Real estate activities	0.0279	Tradable	63	0.0493	23.8	76.2	20.6	0	0
69 Legal and accounting activities	0.0195	Remaining	74	0.0498	32.4	67.6	18.9	6.8	0
70 Activities of head offices; management consultancy activities	0.0255	Remaining	90	0.0062	88.9	11.1	2.2	0	0
71 Architectural and engineering activities; technical testing and analysis	0.0134	Remaining	368	0.0033	91.3	8.7	0	0	0
72 Scientific research and development	0.0245	Remaining	39	0	100	0	0	0	0
73 Advertising and market research	0.0421	Tradable	62	0.0194	74.2	25.8	0	0	0
74 Other professional, scientific and technical activities	0.0214	Remaining	22	0.0299	13.6	86.4	0	0	0
77 Rental and leasing activities	0.0137	Remaining	25	0.0269	72	28	16	0	0
79 Travel agency, tour operator and other reservation service and related activities	0.0256	Remaining	37	0.0217	51.4	48.6	16.2	0	0
80 Security and investigation activities	0.0241	Remaining	12	0.2192	0	100	83.3	41.7	33.3
81 Services to buildings and landscape activities	0.0132	Remaining	57	0.1954	0	100	96.5	33.3	14
82 Office administrative, office support and other business support activities	0.0168	Remaining	46	0.1206	6.5	93.5	54.3	15.2	2.2
84 Public administration and defence; compulsory social security	0.0085	Non-Trad.	3	0	100	0	0	0	0
85 Education	0.0134	Remaining	14	0	100	0	0	0	0
86 Human health activities	0.0076	Non-Trad.	6	0.1021	16.7	83.3	33.3	16.7	0
87 Residential care activities	0.0058	Non-Trad.	3	0.0181	33.3	66.7	0	0	0
88 Social work activities without accommodation	0.0138	Remaining	2	0.0819	0	100	50	0	0
90 Creative, arts and entertainment activities	0.0265	Remaining	9	0.0260	55.6	44.4	0	0	0
92 Gambling and betting activities	0.0088	Non-Trad.	1	0.3801	0	100	100	100	100
93 Sports activities and amusement and recreation activities	0.0108	Remaining	3	0.1338	0	100	100	0	0
94 Activities of membership organisations	0.0238	Remaining	3	0	100	0	0	0	0

Notes. Distribution of firms in the IBS surveys covering the manufacturing and services sectors within different two-digit industries with respect to TI_i. As the composition of firms is varying over time, this table displays the distribution of firms that reported to the IBS in January 2015. The industry-specific Herfindahl index is calculated based on county-level employment in 2014. The classification into "tradable," "non-tradable," and "remaining" sectors follows Mian and Sufi (2014).

A.3. Revenue-Weighted Average Treatment Intensity of the German Economy

This appendix presents the calculation of the revenue-weighted average treatment intensity of all industry-region combinations ($\widetilde{TI}$) that is used for the quantification of the NMW effect on the overall level of producer prices in Section 5.3. To capture overall producer prices as closely as possible, the treatment intensity of each industry-county combination, $TI_{s,c}$, is weighted by the revenues generated in each cell, $\widetilde{revenues}_{s,c}$.[41] As data on industry-specific revenues are not available at the level of counties and the bite measure cannot be constructed for all cells due to data protection issues, the revenue weights are approximated as described in the following.

Revenue data are available at the Federal Statistical Office for two-digit industries s and federal states f ($revenues_{s,f}$) in 2014. In order to put an appropriate weight on each $TI_{s,c}$, the state-level revenue weights $revenues_{s,f}$ are assigned to each county in proportion to its relative size in the respective federal state. This relative size is approximated by the county-specific number of full-time employees that work in industry s, denoted $employees_{s,c}$. The employment data are included in the RS wage data received from the Federal Employment Agency (2016). From this, the total number of full-time employees represented by industry-specific wage data can be calculated for each federal state, i.e., $employees_{s,f} = \sum_{c \in f}(employees_{s,c} | w_{s,c} \notin \{\emptyset\})$.

The revenue weight for treatment intensities in counties for which wage data are available ($w_{s,c} \notin \{\emptyset\}$) is given by

$$revenues_{s,c} = revenues_{s,f} \times \frac{employees_{c,s}}{employees_{s,f}}. \tag{6}$$

Consequently, industry-county cells that are not covered by the RS wage data receive zero weight. This implicitly assumes that the industry-specific bite in these counties is similar to the average treatment intensity in all other counties of the same federal state.

However, state-level revenues cannot be matched to RS wage data in at least one of the respective federal state's counties in 10.9% (6.0%) of all East (West) German industry-federal state cells. Given that higher average bites in East Germany, $\widetilde{TI}$ based on the weights of equation (6) would be downward biased if the asymmetry in the availability of wage data was not controlled for. For this purpose, the revenue weights ($revenues_{s,c}$) are inflated by the inverse fraction of industry-specific revenues in East Germany that can be assigned to wage data in any East German federal state, i.e.,

$$\xi_{s,East} = \frac{\sum_{f \in \{East\}} revenues_{s,f}}{\sum_{f \in \{East\}} (revenues_{s,f} | w_{s,f} \notin \{\emptyset\})},$$

where $w_{s,f} \notin \{\emptyset\}$ denotes that industry-specific wage data are available in at least one county of state f. $\xi_{s,West}$ is defined accordingly for West Germany.

The resulting revenue weight for $TI_{s,c}$ is hence given by

$$\widetilde{revenues}_{s,c} = revenues_{s,f} \times \frac{employees_{c,s}}{employees_{s,f}} \times \xi_{s,EW \in \{East,West\}}.$$

[41] As in the baseline specification, empty county-level cells are replaced by wage data at the LMR-level.

A.4. Supplementary Tables Regarding NMW Effects

Table A.8: NMW Effects at the Firm-Level: Yearly and Quarterly Treatment Coefficients

	Price Exp.$_t^{+3m}$		Empl. Exp.$_t^{+3m}$	
Panel A: Yearly Treatment Effects				
$TI \times \mathbb{1}(t \in \{2014m7, 2015m6\})$	0.47***		-0.09	
	(0.09)		(0.07)	
$TI \times \mathbb{1}(t \in \{2015m7, 2016m6\})$	0.20***		-0.07	
	(0.06)		(0.06)	
Panel B: Quarterly Treatment Effects				
$TI \times \mathbb{1}(t \in \{2014m7, 2014m9\})$		0.27**		-0.04
		(0.13)		(0.11)
$TI \times \mathbb{1}(t \in \{2014m10, 2014m12\})$		0.41***		-0.19*
		(0.14)		(0.10)
$TI \times \mathbb{1}(t \in \{2015m1, 2015m3\})$		0.67***		-0.04
		(0.11)		(0.09)
$TI \times \mathbb{1}(t \in \{2015m4, 2015m6\})$		0.56***		-0.09
		(0.09)		(0.13)
$TI \times \mathbb{1}(t \in \{2015m7, 2015m9\})$		0.25*		-0.21**
		(0.13)		(0.09)
$TI \times \mathbb{1}(t \in \{2015m10, 2015m12\})$		0.16		-0.05
		(0.13)		(0.08)
$TI \times \mathbb{1}(t \in \{2016m1, 2016m3\})$		0.29***		-0.05
		(0.07)		(0.15)
$TI \times \mathbb{1}(t \in \{2016m4, 2016m6\})$		0.12		0.04
		(0.08)		(0.12)
Control for Demand$_{i,t}$	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes
Time*Sector FE	yes	yes	yes	yes
R^2	0.337	0.337	0.357	0.357
Observations	253350	253350	253440	253440

Notes: The dependent variables are planned price or employment changes during the next three months (Price Exp.$_t^{+3m}$ and Employment Exp.$_t^{+3m}$). "TI" is the NMW bite which is interacted with dummies for the respective periods indicated in each row. "Demand$_{i,t}$" is firms' current backlog of orders reported to the IBS. "Time*Sector FE" are time fixed effects at the level of two-digit industries. Standard errors are multiway clustered at the levels of sectors, counties, and dates. Levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.9: Minimum Wage Effects at the Firm-Level: Different Control Vector

	Price Exp.$_t^{+3m}$					Employment Exp.$_t^{+3m}$				
$TI \times \mathbb{1}(t \in \{2014m7, 2016m6\})$	0.34***	0.37***	0.34***	0.35***	0.34***	-0.08	-0.08	-0.01	-0.06	-0.07
	(0.07)	(0.07)	(0.10)	(0.07)	(0.07)	(0.06)	(0.06)	(0.08)	(0.06)	(0.06)
Control for Demand$_{i,t}$	yes	yes	yes			yes	yes	yes		
Control for Dem./Prod. Exp.$_t^{+3m}$					yes					yes
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time*Sector FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time*County Type FE		yes					yes			
Time*State FE			yes					yes		
R^2	0.337	0.338	0.340	0.329	0.346	0.357	0.357	0.359	0.318	0.380
Observations	253350	253350	253350	259214	258467	253440	253440	253440	259374	258626

Notes: The dependent variables are planned price or employment changes during the next three months reported to the IBS. "TI" is the NMW bite and "$\mathbb{1}(t \in \{2014m7, 2016m6\})$" indicates the treatment period. "Demand$_{i,t}$," "Dem. Exp$_{i,t}^{+3m}$," and "Prod. Exp$_{i,t}^{+3m}$" are firms' current backlog of orders and expected demand/production during the next three months, respectively. "Time*Sector FE," "Time*State FE," and "Time*County Type FE" are time fixed effects at the levels of two-digit industries, federal states, and county types, respectively. The Federal Office for Building and Regional Planning classifies counties into four categories: major cities, urban counties, rural counties, and sparsely populated rural counties. Standard errors are multiway clustered at the levels of sectors, counties, and dates. Level of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.10: Minimum Wage Effects at the Firm-Level: Test for Non-Linearity in Treatment Effect

	Price Exp.$_t^{+3m}$		Employment Exp.$_t^{+3m}$	
$TI \times \mathbb{1}(t \in \{2014m7, 2016m6\})$	0.34***	0.26**	-0.08	0.03
	(0.07)	(0.11)	(0.06)	(0.10)
$TI^2 \times \mathbb{1}(t \in \{2014m7, 2016m6\})$		0.20		-0.25
		(0.20)		(0.23)
Control for Demand$_{i,t}$	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes
Time*Sector FE	yes	yes	yes	yes
R^2	0.337	0.337	0.357	0.357
Observations	253350	253350	253440	253440

Notes: The dependent variables are planned price or employment changes during the next three months reported to the IBS. "TI" is the NMW bite and "$\mathbb{1}(t \in \{2014m7, 2016m6\})$" indicates the treatment period. "Demand$_{i,t}$" is firms' current backlog of orders reported to the IBS. "Time*Sector FE" are time fixed effects at the levels of two-digit industries. Standard errors are multiway clustered at the levels of sectors, counties, and dates. Level of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.11: Minimum Wage Effects: Heterogeneity in Product Markets

	Price Exp.$_t^{+3m}$							Employment Exp.$_t^{+3m}$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
$TI \times \mathbb{1}(t \in \{2014m7, 2016m6\})$			0.66***			0.78***				-0.01			-0.01	
			(0.07)			(0.14)				(0.12)			(0.08)	
$\times\mathbb{1}$(Firm Export Share $\neq NA$)	0.40***							-0.08						
	(0.06)							(0.07)						
×Firm Export Share	-0.91**							-0.34						
	(0.41)							(0.25)						
$\times\mathbb{1}$(Firm Export Share $\leq p25$)		0.42***							-0.07					
		(0.08)							(0.05)					
$\times\mathbb{1}(p25 <$ Firm Export Share $< p75)$		0.27***							-0.08					
		(0.08)							(0.20)					
$\times\mathbb{1}(p75 \leq$ Firm Export Share)		0.15							-0.27*					
		(0.18)							(0.15)					
$\times\mathbb{1}$(Firm Export Share $= NA$)	0.32***	0.33***						-0.06	-0.06					
	(0.09)	(0.09)						(0.06)	(0.06)					
×Herfindahl			-28.16***							-6.66				
			(5.48)							(13.23)				
$\times\mathbb{1}$(Herfindahl $\leq p25$)				0.45***							-0.03			
				(0.04)							(0.05)			
$\times\mathbb{1}(p25 <$ Herfindahl $< p75)$				0.32***							-0.08			
				(0.11)							(0.09)			
$\times\mathbb{1}(p75 \leq$ Herfindahl)				0.01							-0.33			
				(0.14)							(0.27)			
$\times\mathbb{1}$(Non-tradable)					0.49***							-0.02		
					(0.03)							(0.05)		
$\times\mathbb{1}$(Remaining)					0.30***							-0.12		
					(0.10)							(0.10)		
$\times\mathbb{1}$(Tradable)					-0.20							0.29		
					(0.13)							(0.40)		
×Industry Import Share						-1.01**							0.06	
						(0.38)							(0.19)	
$\times\mathbb{1}$(Industry Import Share $\leq p50$)							0.49***							0.00
							(0.02)							(0.05)
$\times\mathbb{1}$(Industry Import Share $> p50$)							0.12							0.03
							(0.17)							(0.07)
H0: Coefficients Equal: p-value		0.082		0.004	0		0.052		0.083		0.261	0.442		0.754
Control for Demand$_{i,t}$	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time*Sector FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
R^2	0.337	0.337	0.337	0.337	0.338	0.294	0.293	0.357	0.357	0.357	0.357	0.359	0.351	0.351
Observations	253350	253350	253350	253350	247422	126010	126010	253440	253440	253440	253440	247498	125669	125669

Notes: The dependent variables are planned price or employment changes during the next three months. "TI" is the NMW bite and "$\mathbb{1}(t \in \{2014m7, 2016m6\})$" indicates the treatment period. The product "$TI \times \mathbb{1}(t \in \{2014m7, 2016m6\})$" is either directly interacted with firms' export share, the industry-specific Herfindahl index, or the industry-specific import share or interacted with dummies that group treated firms into bins of each measure. "Demand$_{i,t}$" is firms' current backlog of orders reported to the IBS. "Time*Sector FE" are time fixed effects at the level of two-digit industries. The p-values at the bottom indicate whether the treatment effects in the highest group are statistically different from the lowest one. Standard errors are multiway clustered at the levels of sectors, counties, and dates. Level of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.12: Minimum Wage Effects: Heterogeneity in Labor Market Conditions

	Price Exp.$_t^{+3m}$			Employment Exp.$_t^{+3m}$		
	(1)	(2)	(3)	(4)	(5)	(6)
$TI \times \mathbb{1}(t \in \{2014m7, 2016m6\}) \times \mathbb{1}$(Lack of Workers = 1)	0.47***			0.05		
	(0.11)			(0.10)		
$\times \mathbb{1}$(Lack of Workers = 0)	0.33***			-0.13**		
	(0.08)			(0.06)		
$\times \mathbb{1}$(Lack of Workers = NA)	0.23*			0.06		
	(0.12)			(0.04)		
$\times \mathbb{1}$(County Unempl. Rate $\leq p25$)		0.32*			0.04	
		(0.17)			(0.13)	
$\times \mathbb{1}(p25 <$ County Unempl. Rate $< p75)$		0.36***			-0.02	
		(0.07)			(0.03)	
$\times \mathbb{1}(p75 \leq$ County Unempl. Rate)		0.32***			-0.14	
		(0.12)			(0.11)	
$\times \mathbb{1}$(Labor Market Tightness $\leq p25$)			0.32***			-0.10
			(0.07)			(0.08)
$\times \mathbb{1}(p25 <$ Labor Market Tightness $< p75)$			0.36***			-0.06
			(0.09)			(0.06)
$\times \mathbb{1}(p75 \leq$ Labor Market Tightness)			0.16			0.08
			(0.11)			(0.10)
H0: Coefficients Equal: p-value	0.197	0.994	0.175	0.021	0.031	0.030
Control for Demand$_{i,t}$	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes
Time*Sector FE	yes	yes	yes	yes	yes	yes
Observations	253350	253350	253350	253440	253440	253440
R^2	0.337	0.337	0.337	0.357	0.357	0.357

Notes: The dependent variables are planned price or employment changes during the next three months. "TI" is the NMW bite and "$\mathbb{1}(t \in \{2014m7, 2016m6\})$" indicates the treatment period. As indicated in each row, the product "$TI \times \mathbb{1}(t \in \{2014m7, 2016m6\})$" is interacted with dummies that group treated firms into bins of the following measures: firms' self-reported lack of workers in January 2015 and the unemployment rate/labor market tightness in the county they are located in. "Demand$_{i,t}$" is firms' current backlog of orders reported to the IBS. "Time*Sector FE" are time fixed effects at the level of two-digit industries. The p-values at the bottom indicate whether the treatment effects in the highest group are statistically different from the lowest one. Standard errors are multiway clustered at the levels of sectors, counties, and dates. Level of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.13: Minimum Wage Effects: Heterogeneity in Business Expectations of Firms

	Price Exp.$_t^{+3m}$				Employment Exp.$_t^{+3m}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$TI \times \mathbb{1}(t \in \{2014m7, 2016m6\})$	0.35***		0.32***		-0.07		-0.12**	
	(0.07)		(0.07)		(0.05)		(0.05)	
$\times\overline{\text{Cond. Exp.}}$	0.14				0.26***			
	(0.11)				(0.09)			
$\times\mathbb{1}(\overline{\text{Cond. Exp.}} \in (1/3, 1])$		0.38***				-0.05		
		(0.13)				(0.12)		
$\times\mathbb{1}(\overline{\text{Cond. Exp.}} \in [-1/3, 1/3])$		0.38***				-0.03		
		(0.07)				(0.04)		
$\times\mathbb{1}(\overline{\text{Cond. Exp.}} \in [-1, -1/3))$		0.13				-0.35***		
		(0.16)				(0.10)		
$\times\overline{\text{Prod./Dem. Exp.}}$			0.26***				0.39***	
			(0.09)				(0.09)	
$\times\mathbb{1}(\overline{\text{Prod./Dem. Exp.}} \in (1/3, 1])$				0.41***				0.10
				(0.12)				(0.12)
$\times\mathbb{1}(\overline{\text{Prod./Dem. Exp.}} \in [-1/3, 1/3])$				0.33***				-0.10*
				(0.06)				(0.05)
$\times\mathbb{1}(\overline{\text{Prod./Dem. Exp.}} \in [-1, -1/3))$				0.17				-0.47***
				(0.17)				(0.14)
H0: Coefficients Equal: p-value		0.196		0.065		0.002		0
Control for Cond. Exp.$_{i,t}^{+6m}$	yes	yes			yes	yes		
Control for Prod./Dem. Exp.$_{i,t}^{+3m}$			yes	yes			yes	yes
Control for Demand$_{i,t}$	yes	yes	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes
Time*Sector FE	yes	yes	yes	yes	yes	yes	yes	yes
R^2	0.346	0.351	0.346	0.352	0.390	0.395	0.403	0.408
Observations	236410	251935	237149	252633	236520	252018	237269	252729

Notes: The dependent variables are planned price or employment changes during the next three months. "TI" is the NMW bite and "$\mathbb{1}(t \in \{2014m7, 2016m6\})$" indicates the treatment period. The product "$TI \times \mathbb{1}(t \in \{2014m7, 2016m6\})$" is either directly interacted with firms' average reports (coded -1,0,1) during the treatment period with respect to business expectations for the next six months or expected production (manufacturing firms) or demand (services firms) for the next three months or interacted with dummies that group treated firms into bins of each measure. "Cond. Exp.$_{i,t}^{+6m}$" are firms' expected business conditions during the next six months, "Prod./Dem. Exp.$_{i,t}^{+3m}$" are firms' expected production changes (reported by manufacturing firms) or expected changes in demand (services firms) during the next three months, and "Demand$_{i,t}$" is firms' current backlog of orders reported to the IBS. "Time*Sector FE" are time fixed effects at the level of two-digit industries. The p-values at the bottom indicate whether the treatment effects in the highest group are statistically different from the lowest one. Standard errors are multiway clustered at the levels of sectors, counties, and dates. Level of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.14: Price Response to the Minimum Wage Introduction: Robustness

	Realized Price Change During Previous Month (Manufacturing Only)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Specification	Baseline	No Attrition	RS Wage Data			SES Wage Data		$w(p0)$	
			Region Only	County Only	2013 Wages	Fulltime Workers	All Workers	$0.7w(p10)$	$0.9w(p10)$
$TI \times \mathbb{1}(t \in \{2014m10, 2016m9\})$	0.27***	0.27***	0.22**	0.45***	0.22***	0.34**	0.28*	0.27***	0.27***
	(0.061)	(0.062)	(0.089)	(0.12)	(0.068)	(0.15)	(0.15)	(0.079)	(0.059)
Control for $\text{Demand}_{i,t}$	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time*Sector FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
R^2	0.285	0.274	0.285	0.273	0.286	0.269	0.269	0.285	0.285
Observations	141589	119085	141589	84750	141955	75503	75503	141589	141589
PPI-Semi-Elasticity ($\hat{\psi}$)	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.144
Revenue-Weighted TI ($\widetilde{TI}$)	0.013	0.013	0.013	0.012	0.014	0.013	0.036	0.028	0.011
Manuf.: Overall Price Effect ($\Delta\widetilde{P}$ in %)	0.099	0.098	0.083	0.153	0.088	0.129	0.297	0.218	0.085

Notes: The dependent variable is the change in prices in the previous month as reported by manufacturing firms. "TI" is the NMW bite and "$\mathbb{1}(t \in \{2014m7, 2016m6\})$" indicates the treatment period. "$\text{Demand}_{i,t}$" is firms' current backlog of orders reported to the IBS. "Time*Sector FE" are time fixed effects at the level of two-digit industries. "$\hat{\psi}$" denotes the semi-elasticity mapping changes in price expectations to quantitative producer prices. "$\widetilde{TI}$" and "$\Delta\widetilde{P}$" reflect the overall treatment intensity in the economy and the overall effect of producer prices based on revenue weights for each county-industry cell as described in Section 5.3. Standard errors are multiway clustered at the levels of sectors, counties, and dates. Level of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.