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MONOPSONY IN THE LABOR MARKET: THE EMPLOYMENT EFFECTS OF THE GERMAN MINIMUM WAGE REFORM

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Firma dello studente

Acknowledgments

To my family, my safe place.

A deep thanks for your constant and sincere support through all these years.

To those who enlarge the meaning of family beyond the usual boundaries.

Thank you for bringing so much brightness.

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Abstract

In 2015, Germany introduced a statutory hourly minimum wage that was not only universally binding but also set at a relatively high level. By focusing on the short-run effects of the German Minimum Wage Reform, I estimate its impact on employment. Using a difference-in-differences framework, I exploit variation in the regional treatment intensity, assuming that the stronger a minimum wage 'bites' into the regional wage distribution, the stronger the regional labor market, and thus employment, will be affected. The data source I use is the German Socio-Economic Panel (SOEP). After verifying the absence of anticipation effects and testing the common trend assumption in wages and employment size, I estimate non significative coefficients of the interaction terms between the regional bite in 2014 and years from 2012 to 2017. However, these results allow me to assess that labor markets could be characterized by monopsonistic aspects, which make unclear the employment effects of the introduction of a wage floor.

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Introduction

Ensuring that workers earn adequate wages is an important element to guarantee decent working and living conditions, as well as to build fair and resilient economies and societies. During the last decades, in the European Union, many Member States have not kept up with their levels of wages. Labor markets are constantly being reshaped, characterized by an increasing job polarization and a rising share of low-paid and low-skilled occupations, due to structural trends such as digitalization or the rise in non-standard forms of work. In this way, the traditional collective bargaining structure is being eroded, while wage inequality has become a common issue among all Member States of the European Union.

When set at an appropriate level, minimum wages guarantee adequate living conditions for workers, helps sustain domestic demand, strengthens incentives to work, and reduces inequality at the lower part of the wage distribution. This, in turn, helps improving the fairness of the EU labor market and promoting economic and social progress. Minimum wage protection can be provided by collective agreements or by statutory minimum wages set by law. However, many workers are currently not protected by adequate minimum wages in the EU. During economic downturns, the role of minimum wages becomes even more important. The Covid-19 crisis has particularly hit sectors with a higher share of low-paid jobs (such as retail and tourism) and has had a stronger impact on the disadvantaged groups of the population. Adequate wage floors can help reduce the gender pay gap, since more women than men belong to the lower part of the income distribution. It also helps protect employers that pay decent wages to workers by ensuring fair competition. In light of this, the Political Guidelines for the Commission 2019-2024 announced an Action Plan to fully implement Principle 6 of the European Pillar of Social Rights. The proposed Directive aims to ensure that all workers in the Union are protected by adequate minimum wages. In order to reach this general objective, the proposal establishes a framework to improve the adequacy of minimum wages and to increase the access of workers to minimum wage protection.

In the countries where the collective bargaining coverage is higher, a lower share of low-wage workers is usually more common to be encountered, alongside with higher wage floors relative to the median wage, lower inequality, and higher wages than other countries. There are some Member States where minimum wage protection is exclusively provided by collective agreements, implying that the share of workers protected is directly determined by the functioning of the collective bargaining system. However, in Member States where statutory minimum wages are effectively

put in place, collective bargaining remains a very important element for the minimum wage adequacy. In these countries, the proposal aims at guaranteeing the conditions to set statutory minimum wages at adequate levels, without forgetting about socio-economic conditions and regional and sectoral differences. The proposed Directive also aims at achieving further improvements in adequacy by setting a limit to the application of variations of statutory minimum wage rates for specific sectors, or group of workers. Workers may also not be adequately protected by minimum wages because of lack of compliance with the existing collective agreements or national legal provisions. Ensuring compliance and effective enforcement is essential for workers to benefit from the introduction of the minimum wage and businesses to be protected from unfair competition. Therefore, the proposed Directive aims at promoting compliance as well as strengthening enforcement and monitoring in all Member States in a proportionate way.

The labor market has always been represented by the perfectly competitive model in the classical economic theory, which predicts that workers will be paid exactly equal to their marginal revenue product. According to this assumption, every intervention in the market made by the government will be inefficient and will reduce social welfare. The classical view suggests that if employers decrease wage rates by an infinitesimal amount, workers should immediately cut their labor supply, or leave their current job to pursue better options outside. This argument is too simplistic as it does not consider various important elements that discourage workers from reacting that way, such as non-compete agreements, geographic isolation, or moving costs. In a more realistic labor market, workers may be reluctant to look for different options and firms possess monopsony power. The employment effects predicted by the perfectly competitive model are then questioned by the monopsonistic model, as it could not be true that an increase in wage rates would lead to a reduction in employment size.

The first economist to write about imperfect competition in labor markets was Joan Robinson in 1933, using for the first time the term "monopsony". Before then, economists only focused on market power in product markets, showing the social harm of a monopoly. Only in recent years, researchers started to indicate that labor markets are better represented by imperfect competitive models. Increasing inequality in the income distribution and a falling labor share in national income have led to renewed interest in the idea that there is an imbalance in economic power between employers and workers in the labor market. The main idea behind monopsony is that the labor supply curve to an individual employer is not infinitely elastic, as the perfectly competitive model assume. If an employer reduces wages by an infinitesimal amount, it will not instantly lose all its

workers to competitors, due to different factors. Employees could have preferences that are excluded from their wage rates, such as the geographical location of their workplace, or other amenities that are offered by their job position, which prevent them from looking for different options outside. Non-monetary costs are another important element that prevent workers from immediately leaving their current position when facing a reduction in their wage, as there are search frictions which make it costly for them in time or effort terms to look for different opportunities outside. Thus, monopsony can explain why the introduction of a minimum wage may not always result in a reduction of social welfare, as, in some cases, it could also lead to an increase in the level of employment.

Monopsony power and employment effects of minimum wages have already been analyzed by researchers, mostly looking at federal minimum wages introduced in the United States. In this article I analyzed the introduction of the statutory minimum wage in Germany in 2015. On January 1, 2015, the reform became effective, setting a general statutory wage floor of €8.50 per hour. Before its introduction, there were only sector-specific wage floors set by collective agreements. It was a major intervention in the labor market, due to the very high "bite" of the reform: almost all employees were eligible for its application, given the very limited legal exemptions, and around 10 to 14 percent of those eligible workers were actually earning less than the new minimum before 2015. Due to the high percentage of affected employees, the German case reveals to be interesting since this reform can give insights into potential minimum wage effects even beyond the German context. The reform put in place was preceded by long debates about its potential effects, mostly on employment size. Critics of the reform predicted that it would have led to a massive job destruction, while supporters stressed positive distributional effects and fairness. The analysis conducted in this article provides evidence on the short run employment effects of the reform, based on data from the German Socio-Economic Panel (SOEP). The analysis uses a difference-in-differences regression framework (DiD) with continuous treatment, built on regional variation in treatment intensity, measured by the ratio of eligible workers who earned less than €8.50 prior to the introduction of the reform and the total population employed. The statutory minimum wage applies equally to all German areas, but the wage structures across Germany's *Raumordnungsregionen* (ROR) show some differences.

The first chapter of this paper focuses on reviewing the existing literature on monopsony and market power in labor markets in general. The first part explains the theoretical case of the monopsony model in a labor market, where the possible positive effects of the introduction of a

policy that establish a certain minimum level of wages are compared to the classical case of perfect competition, where any intervention in the market by the government results in a failure. In a monopsonistic labor market, the socially optimal quantity of a good or a service is not produced, resulting in the so-called deadweight loss, which gives a measure for the wasteful misallocation of resources. According to the research conducted in the article *Monopsony in labor markets: a review* (Manning, 2020), the most direct way to assess the importance of monopsony is to estimate the wage elasticity of the labor supply curve to individual firms. The first part of the paper discusses the work that has been done to model the monopsony power of employers according to two different methods: 'modern' monopsony based on search frictions in the labor market and 'new classical' monopsony based on thin labor markets deriving from idiosyncratic tastes among workers. The second part of the paper tries to show how monopsony can be useful in understanding a wider range of labor market phenomena, besides the introduction of a minimum wage. Some are well-established (e.g. the gender pays gap) while others are emerging (e.g. immigration, wage inequality, and the labor share) and monopsony has the potential to improve our knowledge of labor markets.

In the article *A generalized model of Monopsony* (Manning, 2006) the authors assume a critical view of both perfect competition and monopsony, arguing that, if the first model is extreme in assuming that a wage cut of one cent leads all the workers employed to quit instantaneously to look for a new opportunity outside, the assumption of the monopsony model implying that a firm can only grow in employment size raising the wage rate (and moving along an upward-sloping labor supply curve) seems implausible. The crucial point of this article is that employers have the possibility of increasing the flow of recruits also spending more resources. A more realistic model is presented by the authors, where the supply of labor to an individual employer is influenced by the wage rate and expenditure on recruitment activity. Starting from the assumption that the wage elasticity of the labor supply to an individual firm is finite, diseconomies of scale in recruitment for a given wage becomes the new discriminant to assess whether a labor market is better approximated by the perfectly competitive model or by monopsony. In this way, perfect competition is not considered anymore as a situation where the wage elasticity of the labor supply curve to an individual firm is infinite (which goes against both common sense and empirical evidence), but as one in which the marginal cost of recruiting a worker is independent of the level of employment. Monopsony, on the other hand, identifies the situation in which the marginal cost of maintaining a given stock of workers is increasing in employment. This model is considered as a generalized model of monopsony.

The second chapter of this article discusses the massive intervention in the wage structure that took place in Germany in 2015 with the introduction of the Minimum Wage Reform. The policy had a large impact on labor market, as the share of affected workers was very high, due to the universality of the reform with very few legal exemptions. The chapter presents the two different currents of thoughts that anticipated the introduction of the reform and tried to predict what the effects of a wage floor could be, especially on the national employment level. Then, different identification strategies are presented, explaining why, due to the universal validity of the reform and some non-compliance issues, the set of empirical identification strategies is considerably restricted in the German case. Following the identification approach proposed by Card (1992), which considers regional variation that does not depend on differences in legislation, it is possible to evince that the stronger that a minimum wage 'bites' into the regional wage distribution, the stronger the regional labor market is affected, and so should be the adaptation of labor demand.

In the third chapter, the difference-in-differences analysis is presented. The focus is on the short run employment effects. Using the German Socio-Economic Panel (SOEP) as the main data source, all the relevant variables that are part of the regression are presented. Year 2014 is taken as the reference point and all the coefficients of interests of the interaction terms between the level of the bite in 2014 and the other years have to be interpreted in relation to that year. Besides the inclusion of time- and region-fixed effects, GDP per capita and population size are used as control variables according to the assumption that the economic power of a specific ROR will have an impact on its employment size and employment is also obviously affected by population. Standard errors are clustered at the ROR's level. The main results presented are divided into different subcategories of employees. Results are estimated using overall employment as the dependent variable, as well as marginal and regular employment. Two further distinctions are then conducted, looking at the different impact that the reform have on males and females separately, as well as distinguishing German population into different education level.

1. The Economics of Imperfect Competition

In her State of the Union address on 16 September 2020, President Ursula von der Leyen stated that: "*The truth is that for too many people, work no longer pays. Dumping wages destroys the dignity of work, penalizes the entrepreneur who pays decent wages and distorts fair competition in the Single Market. This is why the Commission will put forward a legal proposal to support Member States to set up a framework for minimum wages. Everyone must have access to minimum wages either through collective agreements or through statutory minimum wages.*"[1]

Ensuring that workers earn adequate wages is essential to guarantee adequate working and living condition, as well as to promote fair economic and social progress. The increasing share of low-paid and low-skilled occupations have contributed to wage inequality. Debates about the desirability and consequences of labor market interventions like minimum wages, trade unions, welfare benefits, hours restrictions and firing costs continue to be at the heart of discussions about the way in which modern industrialized economies should be run. The merit of interventions is mostly put in terms of a trade-off between efficiency and equality. Employment effects have long been at the center of minimum wage research, questioning whether and how a minimum rate affects jobs, employee numbers and hours of work. The proposal of minimum wages arises in order to improve the standard of living of those households that are most vulnerable in the labor market, but, if it represents a threat for the employment of many of those same people, a serious analysis should be run to evaluate the relative costs and benefits of such a proposal. Different economic theories lead to different predictions. According to the model of perfectly competitive labor markets, minimum wages increase the cost of labor above the marginal productivity of workers and decrease the level of employment, leading to welfare inefficiencies. But, if employers have some market power over their workers, as a number of authors have argued in recent years, an unregulated market shows monopsonistic aspects, and this is likely to lead to a more positive view of labor market interventions. The foundation for this broader way of thinking about imperfect competition is widely attributed to Joan Robinson. In her book *The Economics of Imperfect Competition* (1969[2]) she refers to the case of a single buyer confronted in a market by many sellers. The microeconomic theory of monopsony assumes the single entity to have market power over all

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[1] Source: https://ec.europa.eu/commission/presscorner/detail/ov/SPEECH_20_1655

[2] Robinson attributes the term monopsony, derived from ancient Greek, to B.L. Hallward of Peterhouse, Cambridge. See Robinson (1969), p. 215. Note that Robinson's classic book, *The Economics of Imperfect Competition*, was first published in 1933. The 1969 publication date refers to the second edition.

sellers as the only purchaser of a good or service. This situation recalls the market power of a monopolist, which can influence the price for its buyers as the only seller of a good or service. It had long been clear that large corporations like Standard Oil monopolized goods and services, but Robinson realized that corporations also exercised market power on the buy side, in their purchases of inputs, including labor. The monopsony power of corporations was just as common as their monopoly power, perhaps more common, but harder to detect. In economic literature the term monopsony is predominantly used when referring to labor market, however it could be applied to any industry. The key idea behind monopsony is that the labor supply curve to an individual employer is not infinitely elastic. An employer who cuts wages by an infinitesimal amount may find it harder to recruit workers but does not immediately lose all their existing workers to competitors as the perfectly competitive model would predict. Therefore, monopsony can help explain why labor market interventions, such as a statutory minimum wage floor, may not always reduce employment.

A monopsonistic labor market is characterized by a firm that has market power in employing factors of production (labor, in this case). Considering a situation where there is only one major employer and many workers looking for employment, that firm has market power in setting wages and choosing how many workers to employ. The most common examples of monopsony in labor markets are a coal mine owner in a small town in the countryside where mining is the primary source of employment[3], or the government in the employment of nurses in the hospital. In the first theoretical example, the company that owns the mine can set low wages due to the fact that it faces no competition in hiring workers as the only employer in the mining town, and since there are geographical obstacles preventing workers from seeking employment elsewhere.

Other critics of capitalism had denounced employers' treatment of their workers before Robinson's book, arguing that firm owners could keep wages below the value of their labor, at the minimum they needed to keep working. Robinson provided a more detailed formulation of this issue, pointing out that, if employers actually pay workers only enough to avoid starvation, they will be able to sell their labor to other employers at a higher wage, in a competitive labor market. Yet, if labor markets are not competitive, the outcome for workers is similar to those identified by

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[3] There is a literary support for such characterization. The most famous may be *How Green Was My Valley*, a 1939 novel by Richard Llewellyn that was made into a film by John Ford in 1941. The book tells the story of a family in a Welsh coal mining town.

other economists: the unemployment is above the optimal level, and domination of the workers by employers results in poor working conditions and a permanent gap between wages and workers' productivity. It is possible that some elements of feudalism preserved through the last centuries, helping employers to gain and maintain monopsony power, an issue that retarded the development of appropriate legal responses.

The main sources of monopsony power can be identified through the more familiar analysis of the product market, which can be considered as the mirror image of the labor market, as in the first case the market power is exercised by the seller of goods, while in the second case by the buyer of labor. In product markets there are three major barriers to competition: *market concentration* refers to the case where there is only one or a few sellers, discouraging new entrants who have to face high fixed costs and hardly benefit from returns to scale or network effects; *product differentiation* makes comparison between different products more difficult, hence it reduces competition; *search frictions* do not help consumers in comparing products and finding the best offer. Although this last source of market power does not play a central role in the analysis of product markets, in the literature of labor markets, by contrast, the problem of search frictions has been further analyzed. If an employer is aware that a worker's search cost (in monetary terms or in terms of time and effort) to look for a new job offer outside is high, the employer can reduce compensation wages and benefits despite the worker's contributions, as it is already known that the worker will find it hard to look for an alternative opportunity. The labor market correlate to product differentiation could be firm-specific amenities of a workplace, which I will elaborate on later in this paper. From the point of view of an employee, it will be more difficult to compare firms when they offer amenities, such as a coffee bar, or a gym, that workers happen to like. Other amenities might rise more naturally: for example, the location of an employer might appeal to workers because of the convenience for commuting or the attraction of nearby restaurants or other businesses. Therefore, we can conclude that recent research made it clear that both product markets and labor markets are vulnerable to market power, and for the same reasons.

The social cost of monopsony is analogous to the harms caused by product markets monopoly: a monopolist is not a price-taker, it can raise the price of goods it produces at the cost of some lost demand, to increase total profits. Raising the price obviously results in lower sales, but the earnings for each unit of goods sold is higher. The monopolist will eventually set the price at a specific level where the value of the lost sales from increasing the price further is exactly equal to the additional profit given by the units of goods sold at the increased price. The difference

between the monopoly price and the firm's cost (or the competitive price) is the mark-up, which is a measure for market power. A similar situation can be analyzed in the labor market, in the case of a monopsony. A monopsonist faces the analogous trade-off when considering the fact that to hire an additional worker, it will have to increase wages for all its already existing workers, which implies an increase in its total labor costs. At the same time, if the employer decides to lower wages, it will lose some workers, but it will gain some profit due to a reduction in overall labor costs. As in the monopoly case, the monopsonist will choose a wage floor below the marginal revenue product. It must be noted that, just as with firms with market power, an employer with labor market power may not face the extreme situation of a monopsony, but as long as it will not lose its entire workforce by slightly lowering its wage, it has some labor market power.

1.1. Monopsony model of a labor market: the upward-sloping labor supply curve
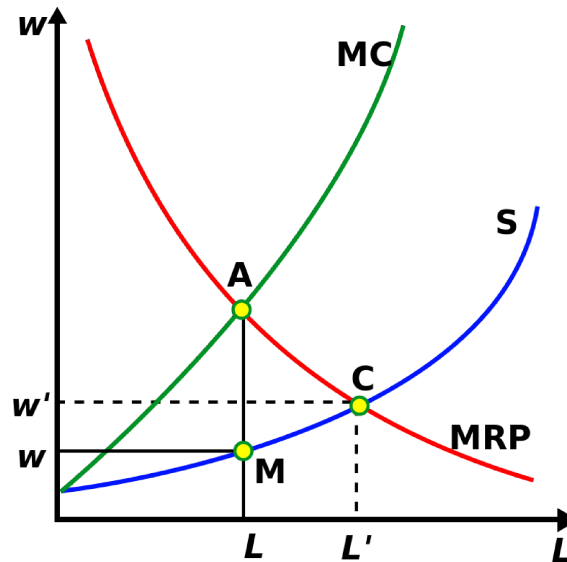

Figure 1

Figure 1 shows the situation of a static equilibrium in a monopsonistic labor market, with one single employer who pays the same wage rate to all workers. The vertical axis of the line chart represents the wage paid by the firm to each employee; the horizontal axis defines the employment size of the monopsonistic firm. The theoretical example of the mining town can be well explained by this graph. The downward sloping red line represents the individual employer's demand and marginal revenue product of labor. It is downward sloping because at lower wage rates the firm will be able to hire more workers since the revenue attributable to one additional worker decreases thanks to diminishing marginal returns[4]. The blue line represents the supply of labor. The upward sloping line shows that at higher wage rates, more households are willing to work in this market (in contrast with an infinitely elastic labor supply curve in perfect competition, where the firm is wage taker). This function relates the wage paid to the level of employment and can be denoted as $w(L)$. Total labor costs are given by $w(L) \cdot L$. The green line represents the marginal resource cost curve. The wage-making firm must raise wages to attract additional workers, therefore, the cost to attract an additional worker increases faster than the wage the firm actually has to pay to that worker because the employer pays the same higher rate to all the workers it already employs. A monopsonistic employer maximizes profits by choosing the employment level L, where the

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[4] In Economics, the decrease in the marginal output a production process as the amount of one single factor of production is incrementally increased, maintaining constant all the other factors of production.

marginal revenue product (*MRP*) equates the marginal cost *MC*, at point *A*. This condition can be expressed analytically as follows:

$$\pi(L) = r(L) - w(L) \cdot L \qquad (1)$$

Where *π(L)* represents the firm's profit, *r(L)* the total revenues, and *w(L)·L* is the total cost of labor. The firm wants to choose the level of employment in order to maximize its profit, so the first-order condition of equation (1), *π'(L)=0*, implies the following:

$$r'(L) = w'(L) \cdot L + w(L) \qquad (2)$$

The left-hand side is the marginal revenue product of labor (represented by the red *MRP* curve in the graph), while the right-hand side is the marginal cost of labor (the green *MC* curve).

The wage paid by the firm is then determined on the labor supply curve, at point *M*, and is equal to *w*. By contrast, in a competitive labor market, a new employer could enter the market and offer a wage higher than that at *M* by an infinitesimal amount. This would lead all the employees to prefer to work for the new competitor[5]. Repeating this mechanism, a competitive labor market would be forced to reach equilibrium at point *C*, where labor supply *S* equals demand, resulting in employment level *L'* and wage rate *w'*. This implies that the employer with monopsony power will maximize profits by hiring fewer workers than the otherwise equivalent employer in a competitive labor market, and thus paying lower wages.

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[5] The competitor would gain all the former profits of the first employer, minus a less-than-offsetting amount from the wage increase of the first employer's employees, plus profit arising from additional employees who decided to work in the market because of the wage increase.
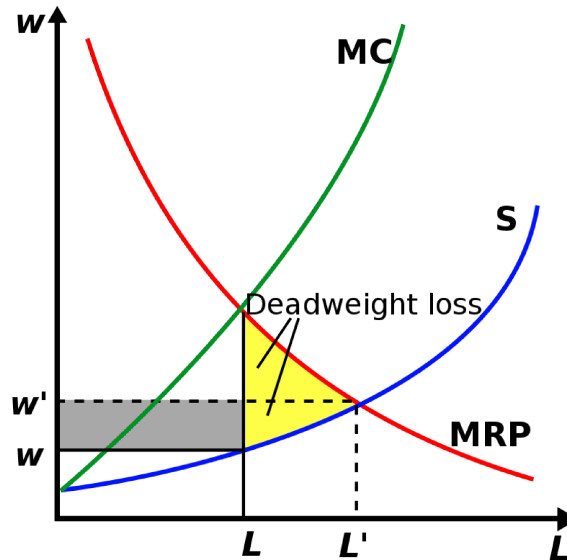
Figure 2

The workers' economic surplus is represented in Figure 2 by the area above the labor supply curve and below the horizontal line corresponding to the wage rate, up to the employment level. The employers' surplus is given by the area between the horizontal line corresponding to the wage and below the marginal revenue product curve, up to the employment level. The total social surplus is obtained summing these two areas. The consequences of monopsony have two distinct effects on the economic welfare of the people involved: the gray area in the line chart shows the amount of welfare redistributed from the workers to the monopsonistic employer, while the yellow area represents the overall deadweight loss[6]. It is a measure of the market failure caused by monopsony power through a wasteful misallocation of resources. When the difference between the marginal revenue product and the market wage determined on the supply curve (the vertical side of the yellow triangle) increases, the deadweight loss is larger. This difference can be expressed as a proportion of the market wage, according to the following formula:

$$e = \frac{r'(w) - w}{w} \tag{3}$$

Where the numerator represents the vertical segment in Figure 2 between the *MRP* curve and the supply of labor. The ratio in equation (3) has been called rate of exploitation[7], which, under perfect competition, equals to zero. It is helpful to the measurement of observed monopsony power. The

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[6] A deadweight loss is a measure of lost economic efficiency when the socially optimal quantity of a good or a service is not produced. In this case it represents the reduction of aggregate welfare enjoyed by both parties due to restriction of employment.

[7] Pigou, 1924; Hicks, 1932

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most common way to resolve the market failure of monopsony is through a binding minimum wage, often proposed as an antidote to labor market power. Most EU Member States have a statutory national minimum wage in place, although its level, adjustment mechanisms and coverage vary.

Note that the waste created by monopsony depends crucially on the inability of firms to pay different wages to different workers: if an employer can pay one worker a bit more than the worker's outside option, then then it could employ every worker whose marginal product revenue exceeds the wage. The problem is that employers' information about employees' outside options is not sufficient to practice wage discrimination very effectively. It is possible to identify other different negative effects produced by monopsony power, since when workers must choose between two employers, they may accept to work for the employer who offers a higher wage, even though this does not necessarily imply they are actually more productive in that position. This issue raises when the degree of monopsony power differs across employers, thus one of them may offer higher wages because of its limited market power, leading to misemployment.

1.2. The impact of the introduction of a minimum wage in a monopsonistic labor market

What happens if a minimum wage is introduced in this labor market, either directly by the government or through collective bargaining laws? According to the model of perfectly competitive labor market, it is clear how a minimum wage floor reduces employment and, as any other type of market intervention, leads to inefficiency. But some studies have shown that in the presence of monopsony power, the introduction of a minimum wage does not inevitably cost jobs: if set at an appropriate level, it could improve welfare losses and also increase the level of employment.
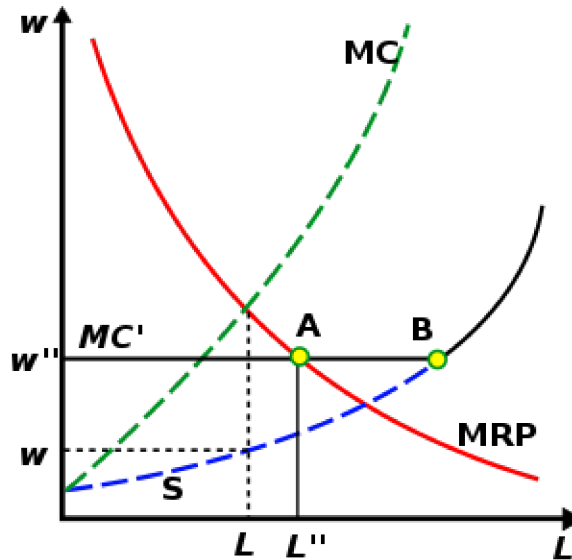
Figure 3

The effects of such a labor market intervention are shown in Figure 3. In this model, the statutory minimum wage rate is set at *w''*, which is higher than the monopsonistic *w*. The horizontal line becomes the new marginal resource cost curve up to the point where it crosses the supply curve (point *B*): the firm can hire an amount of workers between 1 and *L''* at the constant rate *w''*, whereas before it had to raise the wage to attract new workers in this market. At point *B*, the *MC'* curve jumps back to the original green line (this model assumes the employers has to pay the same wage to all its existing workers). The new labor supply curve is now represented by the black line in the graph, and it coincides with the *MC'* curve up to point *B*. The firm now maximizes its profit at point *A*, where the new marginal cost curve (*MC'*) crosses the marginal revenue product line (*MRP*). It is the point where it becomes more expensive to produce one additional unit than what is earned form selling that same unit of product. The intersection between *MC'* and *MRP* is not at the point where the original labor supply curve crosses *MRP*, therefore this condition is still inefficient compared to a competitive market. The segment *A-B* represents the unemployment rate for this industry: the number of individuals who are willing to work at the rate *w''* is larger than the demand of labor by the firm[8]. However, the introduction of a statutory minimum wage rate equal to *w''* raises the level of employment from *L* to *L''*, while, under perfect competition, any intervention in the market would reduce employment. The key is the wage increase for existing workers is not a marginal cost: the firm has to pay the higher wage to all its existing workers, regardless of whether or not it hires more labor. These theoretical results appear to suggest that the

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[8] It follows that there will be deadweight loss in a monopsonistic labor market regardless of minimum wage levels.

introduction of a statutory minimum wage is a win-win policy which could increase employment and wages at the same time.

However, it is not true that any intervention from the government in this market would increase employment. If, for example, a too high minimum wage floor is set, the intersection between *MC'* and *MRP* could result in a level of employment which is lower than the case of no intervention in the monopsonistic labor market (*L*). Imagine a horizontal black line that crosses *MRP* above the point of intersection between *MRP* and the original *MC* (green line). In this case it is commonly said that the government overshoots and the welfare losses are larger than in the case of no intervention.

1.3. Empirical estimates of non-infinite wage elasticity of the labor supply curve to an individual firm

During the 20th century, the labor literature largely focused on the pure monopsony model, giving little importance to the fact that the imposition of a minimum wage could increase employment and wage rates at the same time: this possibility has been generally regarded as empirically unimportant, due to the rarity of cases of monopsony in labor markets. Relatively little attention has been paid to the more general case of imperfect competition, where several competing firms exercise wage-setting power. Knowing the degree of firms' monopsony power is important to explain several empirical puzzles that have profound implications for how labor market policies affect workers and employers. From the regulatory perspective, it is important to identify conditions under which firms possess a high degree of wage-setting power, thus making workers especially vulnerable. For this reason, the question of how individuals and firms adapt their behavior in response to policy changes is now one of the most investigated topics in empirical labor economics. Many studies have been conducted over the past 15-20 years since Boal and Ransom (1997) and Manning (2003), including those with high quality research designs, showing that, although not monopsony in the strictest sense, monopsony power can be exercised by any employer that faces an upward sloping supply curve for labor, resulting in lower wages. Firms have some wage-setting power, even in the presence of many competitors, due to search frictions or high levels of differentiation. As previously mentioned, the classical economic literature relying on the perfectly competitive model suggests that if employers cut wage rates, workers should immediately cut their labor supply, or leave their current job to pursue better options outside. As appealing as it

is in its simplicity, this argument does not consider many important variables that could inhibit the workers from reacting that way, such as non-compete agreements, geographic isolation, moving costs, or simply the fact that workers may prefer their employer for non-monetary reasons. In a more realistic labor market, workers may be reluctant to look for different options and firms possess monopsony power, the extent of which depends on the elasticity of labor supply that the firm faces.

The first-order condition of the profit maximization problem for a firm that faces an upward-sloping labor supply curve yields a solution that links the wage paid by the firm, the marginal revenue product of labor and the elasticity of labor supply in the following way:

$$w = r'(L) \frac{\varepsilon_N}{1 + \varepsilon_N} \tag{1}$$

Where $r'(L)$ is the marginal revenue product of labor and ε_N is the elasticity of labor supply to an individual firm with respect to the wage, $\varepsilon_N \equiv \frac{\partial L}{\partial w} \frac{w}{L}$. If supply is perfectly elastic ($\varepsilon_N = \infty$), then the additional worker is paid exactly the incremental value they supply to the firm: $w = r'(L)$. While, if the elasticity is a high finite number, for example, if $\varepsilon_N = 9$, the worker is paid 90% of her worth to the firm. The lower the elasticity, the less the worker is paid: when $\varepsilon_N = 1$, the wage is 50% of the worker's worth.

According to the research conducted in the article *Monopsony in labor markets: a review* (Manning, 2020), the most direct way to assess the importance of monopsony is indeed to estimate directly the wage elasticity of the labor supply curve to individual firms. The effectiveness of labor market reforms crucially depends on the workers' labor supply responses to wage changes. Yet, the findings reported by different strands of empirical literature on monopsony remain very diverse as studies document substantially different empirical estimates, even for the same country and time period. The first part of the paper discusses the work that has been done to model the monopsony power of employers according to two different methods: 'modern' monopsony based on search frictions in the labor market and 'new classical' monopsony based on thin labor markets deriving from idiosyncratic tastes among workers. The second part of the paper discusses the areas where the monopsony perspective has proved or could prove useful in understanding labor market issues, such as wage inequality and the labor share of national income. Although anti-trust laws have been applied to limit market power in labor markets, as well as in product markets, competition policy that involves workers is a relatively new area of interest.

1.3.1. Modern Monopsony

Manning (2003) provides a turnover-based approach. According to modern monopsony, the main source of market power derives from the fact that it takes time for workers to find a new job, therefore they bear a cost, pecuniary or non-pecuniary. The basic assumption is that the firm's employment represents an equilibrium between the flow of workers who leave and those who join the firm. These flows are determined by the wage that the firm chooses (w), and other characteristics x (including the wages offered by other firms). The size in terms of employment *N(w,x)* in a steady-state can be written as:

$$N(w, x) = R(w, x)/q(w, x) \tag{1}$$

Where *R(w,x)* is the flow of recruits to the firm and *q(w,x)* is the quit rate, both assumed to be influenced by the offered wage and the factor x. In elasticity terms, the labor supply function in equation (1) can be written as the elasticity of the recruitment function minus the elasticity of the quit function, as follows:

$$\varepsilon_N = \varepsilon_R - \varepsilon_q \tag{2}$$

ε_R is the elasticity of new recruitments, and ε_q is the elasticity of quit rate. Therefore, equation (2) states that the elasticity of the labor supply to the wage can be inferred from empirical observations on the sensitivity to the wage of worker inflows (recruitment activity) and worker outflows (separations). To simplify things even more, Manning (2003) suggested that in a steady-state, the recruitment elasticity should, on average, be equal to minus the separation elasticity because, for job-to-job moves, one firm's quit is another firm's recruit ($\varepsilon_q = -\varepsilon_R$). As it is rare for a researcher to find reliable data to estimate both ε_R and ε_q, it is possible to infer ε_N in the following ways:

$$\varepsilon_N = -2\varepsilon_q$$
$$\varepsilon_N = 2\varepsilon_R \tag{3}$$

Very few papers concentrate their effort in the estimate of ε_R, as this operation requires information on both the workers employed and the number of qualified applicants a position received. Estimates of ε_q are much more common, as they only require the use of payroll data, which contain information on the length of an employee's tenure at a firm and on their wage at the same time: the covariance between these two variables identifies the quit rate elasticity. It is commonly agreed that there is an inverse relationship between wages and the quit rates; indeed,

there is a long literature in economics that examines this question[9]. According to Burdett and Mortensen (1998), workers randomly search employers for a job that pays a higher wage while they are employed and an acceptable wage when unemployed, whereas each employer posts a wage conditional on the search behavior of workers and the wage offered by other firms. The higher the rate offered by one employer the larger the labor supply to that specific firm, as more workers are attracted to the firm that offers a higher wage than competitors. However, if employed workers do not receive job offers but unemployed workers face a positive but finite arrival rate of offers, all employers will offer the monopsony wage, obtaining the monopsony equilibrium. Wage dispersion exists in equilibrium even when workers are equally productive in all jobs. Three predictions follow from this simplest version of the model. First, workers with more experience have more possibilities to be found in higher paying jobs. Then, there is a positive relationship between the labor force size and the wage paid, and finally, there is a negative relationship between wage offers and quit rates across employers.

Sokolova and Sorensen (2020) employ Google Scholar to search for papers related to monopsony and papers that estimate parameters of monopsony power. They analyze 1320 estimates of the labor supply elasticity to the firm reported in 53 different studies published between 1977 and 2019. Exploring how supply elasticity estimates vary according to relevant economic and institutional factor used by researchers and using meta-regressions to examine these and other sources of variation, they try to provide the average elasticity of the labor supply. Through this measure, it is possible to see how far, on average, labor markets deviate from the perfectly competitive behavior. Many papers estimate effects that can, through linear transformations, be converted to measures of the supply elasticity (e.g. studies that estimate ε_N with a direct regression of the number of workers employed at a given firm on the wage paid to those workers, or studies that report ε_q or ε_R). These 'direct' estimates comprise 1140 estimates out of the total sample, while the remaining 180 estimates come from studies computing the inverse elasticity of labor supply. Out of the 1140 'direct' estimates, about 870 estimates are derived from studies that use quit rates elasticities, and typically come up with numbers that imply labor supply elasticity around 2. The remaining (approximately 270) estimates are derived from studies that use recruitments elasticity or some type of structural estimation, and they come up with a result slightly higher than 2. These estimates are all quite small, suggesting significant levels of market power for employers.

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[9] See, for example, Pencavel (1972) and Parsons (1972).

1.3.2. New Classical Monopsony

Alongside the research on modern monopsony, rooted in search frictions, there has been a revival in the interest in new classical monopsony models, which consider idiosyncratic tastes among workers to be the reason why the labor supply curve to an individual firm is not perfectly elastic. Card, Cardoso, Heining and Kline (2018) provide a microeconomic foundation for imperfect labor market competition by allowing workers to have idiosyncratic preferences over the work environments of different potential employers. Rather than build a model of the supply side based on search frictions, they follow the industrial organization literature, working with a model that focuses on heterogeneity across workers in their valuation of jobs. The working conditions can reflect differences in the length of commute, firm location, corporate cultures, or other factors that are not fully priced into wages. Idiosyncrasy makes employers imperfect substitutes in the eyes of workers, endowing firms with some wage-setting power as in classical monopsony models. Even without search frictions, this model implies that labor is supplied inelastically to firms.

The utility of a worker i from working in a firm f is given by:

$$u_{if} = \frac{1}{\varepsilon}\left[w_f - \tilde{b}_f\right] + \theta_{if} \tag{1}$$

Where $\tilde{b}_f$ is a measure of how attractive it is to work in firm f for all workers and θ_{if} is the idiosyncratic factor. Denoting the total labor supply as L[10], the number of workers employed in firm f is computed through the multinomial logit form:

$$N_f = \frac{e^{\left(\frac{1}{\varepsilon}[w_f - \tilde{b}_f]\right)}}{\sum_{f'} e^{\left(\frac{1}{\varepsilon}[w_{f'} - \tilde{b}_{f'}]\right)}} L \tag{2}$$

The denominator represents the wages and amenities offered by all firms in the market. Equation (2) can be rewritten taking a log linear approximation, as follows:

$$n_f = \frac{1}{\varepsilon}\left[w_f - b_f\right] \tag{3}$$

n_f and w_f are respectively the log employment and the log wage, while the term b_f is a labor supply shifter that can be expressed in the following way:

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[10] This assumes total labor supply to the market as a whole is inelastic, so that firms are competing for market share.

$$b_f = \tilde{b}_f + \varepsilon l - \sum_{f'} s_{f'}[w_{f'} - \tilde{b}_{f'}] \qquad (4)$$

Where $s_{f'}$ represents the market share of each firm, or, in other words, the probability of working for each firm. The labor supply shifter is a function of the amenities offered by firm f, the total labor supply, and the wage rates and amenities offered by the other firms in the market, weighted by the probability of working for those firms. If worker i consider one employer in the market a close substitute for employer f, the first one will receive a high weight.

From the log linear approximation in equation (3), it is possible to derive the wage elasticity of the labor supply curve to an individual firm:

$$\frac{1}{\varepsilon_f} = \frac{1 - s_f}{\varepsilon} \qquad (5)$$

With s_f being the market share of firm f and ε the inverse of the labor supply elasticity facing the firm. When $\varepsilon = 0$, it is the case of a perfectly competitive labor market, while a higher value implies the employer has more monopsony power. If firms are small related to the total size of the market, the market share of firm f can be approximated to zero ($s_f \approx 0$), implying that firms with higher market share are likely to have more wage-setting power.

Azar, Berry and Marinescu (2019) estimate the wage impact on workers' choice among differentiated jobs in the largest occupations. They use an online job posting and applications dataset from CareerBuilder.com to estimate a model of demand for jobs that differ in terms of geographic location, as well as job characteristics that are known to market participants. The authors find the firm-level labor supply elasticity is about 5.8, higher than found in many other applications, implying that workers are paid only around 85% of their worth to the firm, but consistent with employers having a non-trivial amount of monopsony power even for the largest occupational labor markets.

While the ability of firms to set wages is disciplined by market competition, this article provides evidence that there are clearly limits to those competitive forces. Modern monopsony is based on the idea that workers bear some costs to find and start a new job, but even without search frictions, firms will be able to set wages if workers differ in their valuation of firms' nonwage characteristics. New classical monopsony considers heterogeneity in tastes among different workers to be the explanation for labor being supplied inelastically to firms, providing some scope to set wages. Both approaches are likely to contain some elements of truth, but the new classical

view assumes that workers have the possibility to choose between all the firms existing in the market, which is exactly what modern monopsony considers rare due to search frictions. It is possible to combine these two different approaches rewriting the equation in the multinomial logit form (2) with the assumption that workers have a smaller choice set than the whole set of firms in the market. The number of these firms decreases when search frictions are higher.

1.3.3. Applications of Monopsony

The second part of the paper tries to show how monopsony can be useful in understanding a wider range of labor market phenomena, besides the introduction of a minimum wage. Some are well-established (e.g. the gender pays gap) while others are emerging (e.g. immigration, wage inequality, and the labor share) and monopsony has the potential to improve our knowledge of labor markets.

I. Debates about the introduction of a binding minimum wage has been the main area where the monopsonistic model had a wider impact for a long time, though it remains a contentious issue in many countries. The balance of opinion among both researchers and policymaker has probably shifted recently to a more positive view of setting a minimum wage at an appropriate level. One fundamental question is how high minimum wages can be pushed, as monopsony predicts that there is a limit to the level at which the wage rates can be set without having a negative effect on employment, but the existing literature does not help in finding the adequate level which maximizes employment. It is plausible that firms have more monopsony power in some labor markets than others, suggesting that minimum wage has a more positive impact in less competitive labor markets as monopsony would predict.

II. Anti-trust is one of the areas where monopsony has attracted more interest recently. Naidu, Posner and Weyl (2018) investigate how there have been an historical imbalance between product market and labor market anti-trust laws. The labor market practices which are attracting more interest recently regards no-poaching agreements among employers, the use of non-competes both directly and indirectly through franchises, and the level of labor market concentration among employers in local markets and how that might be affected by mergers.

III. One under-explored application of monopsony is to the economics of immigration. Most frameworks try to analyze the impact of immigration through a perfectly competitive model

where all workers are paid their marginal product. Under perfect competition, it makes no difference for an individual employer to hire migrants or not, as the labor supply elasticity is infinite. In reality, many employers do care about having access to migrants, and a number of reasons suggests that the migrant labor market might be considered more monopsonistic than the native one. Immigrants have lower reservation wages than existing residents, which allow employers to lower their labor cost in less competitive labor markets, where the wage-setting power is higher and the rates are more likely to be linked to reservation wages rather than to productivity. Hirsch and Jahn (2015) present evidence for Germany that the wage elasticity for migrants is lower than for natives. Amior and Manning (2020) show that in the US labor market, more migrants could be associated with more monopsony power. These recent studies confirm that the interaction between immigration and monopsony is an area that deserves more consideration.

IV. Another important reason for the current revival in interest in monopsony is a rise in wage inequality, the fall in the labor share and a shift in the balance of power between workers and employers to the advantage of business. Robinson (1933) paid attention on the gender pay gap and Manning (2011) reported several studies that found a lower level of quit rates elasticity for women than that for men, implying that employers have more wage-setting power on women.

1.4. Monopsony and the Wage Effects of Migration

The literature that has traditionally studied the impact of migration on native wages, has concentrated on competitive labor markets, where wages are equal to the marginal products of labor. In such a scenario, under the sole assumption of constant returns to scale, Borjas (1995) proved the "immigration surplus", which assesses that the marginal products of native-owned factors must always increase (on average, in a closed economy) when the supply of migrants is larger (keeping their skill mix constant). And, if capital is supplied elastically, this surplus passes entirely to native labor in the long run, increasing the average native wage. This does not mean that the marginal products of all native workers will increase, however this result holds for any number of labor types, any number of goods, and any form of technology, as long as the empirical model imposes constant returns and perfect competition.

Amior and Manning (2020) studied the impact of immigration in the absence of perfect competition: in a monopsonistic labor market, wages will also depend on any mark-downs applied by firms and, if immigration affect these mark-downs, it will have an impact on native wages too. In particular, it has been proved that migrants supply labor to firms less elastically than natives (or migrants' reservation wages are lower) due to a number of reasons. First, language barriers or visa-related restrictions on labor mobility implies that migrants may be less efficient in job search. Second, migrants may intend to work in the host country only for a limited period, which leads them to discount theirs time more heavily. Third, migrants may face more restricted access to out-of-work benefits. Finally, migrants may base their reference points on their country of origin. These intuitions are empirically consistent and confirm that migrants do indeed supply labor less elastically than natives. Their reservation wages are also sensitive to exchange rate fluctuations.

Directly testing the claim that monopsony power depends on the migrant share, Amior and Manning reject the null hypothesis that native and migrant mark-downs are equal and independent of the migrant share. Their estimates suggest that an increase by 1% in the share of migrants allows firms to mark down native wages by 0.5-0.6% more. This effect more than offsets the positive effect of the immigration surplus which increases marginal products, leading to lower mean native wages overall, even in the long run. However, it is important to note that such negative effects on mark-downs may be offset through policies which constrain monopsony power, such as minimum wages, rather than by restricting migration itself. If policy interventions can make the labor market more competitive (by limiting the power of firms to set mark-downs), immigration would only have the surplus-raising effect.

1.5. Antitrust laws in Labor Markets

In their paper *Antitrust Remedies for Labor Market Power*, Naidu, Posner, and Weyl (2018) propose methods to evaluate labor market power in antitrust contexts, as they claim that the government is usually unsuccessful in preventing firms from restricting competition in labor markets. The reason is that analytic methods for evaluating labor market power are far less sophisticated than the regulations used to judge product market power. In recent years, a declining economic growth rate and rising income inequality are at the center of many economics debate, leading to develop research that show how labor market power has contributed to wage inequality and economic stagnation. The ability of employers to set wages below workers' marginal revenue

product is one of the causes that received increasing attention from economists. Recent evidence is supporting the idea that in many countries, employers possess considerable market power which allows them to suppress wages, increasing inequality between the income of people who work in concentrated and competitive labor markets. Low-income workers are the most affected, as they have the least bargaining power. The fact that employers set wages below the potential optimal level has consequences on economic growth since it results in underemployment of labor: qualified workers will not accept to receive wages artificially suppressed, and workers may underinvest in schooling and skills. This in turn costs the government both in lost taxes and in greater expenditures. Naidu, Posner, and Weyl estimate monopsony power in the U.S. economy reduces overall output and employment by 13%.

We can think of labor market power as the mirror image of product market power, as in the first case it is exercised by the buyer (of labor) rather than by the seller (of goods) in the second case. When there is a small number of sellers or, in the extreme case, one seller in the product market, they have the power to charge a price higher than the marginal cost, or the price that would exist in a competitive market. In both cases (product or labor market), one major source of market power is concentration. The authors of the paper report the example of a small town where operates only a few gas stations, setting the price of gas to compete with the prices of other gas stations. If one station lowers the price of its gas, it will gain market share, which increase its profits, but will lose profit in sales revenues. The few gas stations could also illegally enter a cartel in which they charge an above-market price and divide the profits, or they might informally coordinate, leading to the same social harm in a more legal way. This situation would not happen in the case where a large number of gas stations operates, competing between each other in setting the level of the price of gas, resulting in the efficient level, or the marginal cost. This outcome produces a higher aggregate output of gasoline and reduces prices for consumers.

Labor market concentration creates monopsony, where labor market power is exercised by the employers who are buying labor from employees. When there is only one or a few employers hiring from a pool of workers, then the labor market is concentrated, and the employers have market power. They will therefore set wages below the level at which workers would be paid in a competitive labor market (their marginal revenue) in order to minimize labor costs, this will discourage qualified workers to accept working there, but the employers gain more from cutting wages than they lose as a result of being able to hire fewer workers.

The authors want to emphasize that product market concentration has historically received a much bigger attention by researchers and governments, while labor market concentration has received hardly any attention at all. Although there is no distinction between seller and buyer power in evaluating the effects of mergers in the market, antitrust laws are not sufficiently developed to prevent the possible adverse labor market effects of mergers. There are several reported cases concerning firms that have illegally cartelized product markets, while there are relatively few cases involving allegations of illegally cartelized labor markets, and almost all those cases regard specialized settings such as sport leagues, which restrict the hiring of players. However, concentration is not the only source of market power, as previously discussed in this paper, search frictions is another important element in this issue. If antitrust keeps focusing almost exclusively on product market power, all these sources of market power could lead to social inefficiency and the economic surplus is transferred from employees to firm owners.

Even though the dangers to public welfare posed by product and labor market power are of the same entity from an economic standpoint, there is an historical imbalance in the importance given to labor market antitrust in the economic theory. The authors suggest four different possibilities that could explain this issue. In the first place, legal theory has placed more emphasis on product markets because consumers are primarily harmed by price increases caused by product market power, and, as workers are consumers too, they benefited from the law's attention to product markets, even though they would have benefited more if the law had paid attention to labor market as well. Second, it has been naturally assumed by researchers that labor markets are competitive, giving little attention to labor market power as a social problem. Workers who live in urban areas can choose between several different employers, and they have also the possibility to move around the country (and the world nowadays) if they are not satisfied with the job offers or the pay is low where they live. Only recently, many of these assumptions have been thrown into doubt. Third, labor law and employment law have always seemed sufficient to protect workers in a legal sense. Workers have historically used collective bargaining and the threat of strikes to prevent employers from paying them monopsony wages, while employment law countered labor market power by preventing employers from granting workers' wages and benefits below an established artificial floor. However, both types of legal protection have eroded over the years, due to deregulation, foreign competition, and a chilly legal environment, accompanied by inflation, which eroded federal minimum wages. Fourth, antitrust litigation against employers is more difficult than antitrust litigation based on product market concentration, perhaps giving the illusion that the latter problem is more significant than the former. Class action brought by workers have

less chances of success than class action by consumers, because workers, unlike consumers, are frequently in diverse positions, defeating the common interest requirement: some workers are senior, others are junior, qualifications vary, contract terms vary, and so on. In the case of consumers, the argument is much simpler, as they claim that the price paid is higher than what it should be, which means they share a common interest as required by courts. And because successful antitrust actions by workers have been so rare, there is little developed law on the topic, which discourage employees and renders further litigation risky.

The consensus that labor markets are competitive is recently collapsing in response to many investigations conducted by economists, such as Card and Krueger, who found evidence of monopsony in their analysis of the insignificant employment effects of a minimum wage hike in New Jersey in 1992. Several other studies of minimum wage increase in other jurisdictions and at other times produced similar result: even if employers raise wages, employment is not affected as the previous economic theory predicted. The most direct explanation for this phenomenon could be that labor markets are actually concentrated, and employers do pay workers less than their marginal product, which give importance to the monopsony theory.

In their article, the authors suggest that the danger that mergers may lead to labor market power as well as product market power should be taken more seriously, providing a more detailed legal framework, comparable to that already existing for product market power, for evaluating the effects of a merger on labor markets.

1.6. Expenditures on recruitment activity have an impact on the supply of labor to an individual firm

In the article *A generalized model of Monopsony* (Manning, 2006) the authors assume a critical view of both perfect competition and monopsony, arguing that, if the first model is extreme in assuming that a wage cut of one cent leads all the workers employed to quit instantaneously to look for a new opportunity outside, the assumption of the monopsony model implying that a firm can only grow in employment size raising the wage rate (and moving along an upward-sloping labor supply curve) seems implausible. In reality, employers have the possibility of increasing the flow of recruits also spending more resources. This article presents a more realistic model where the supply of labor to an individual employer is influenced by the wage rate and expenditure on recruitment activity. Starting from the assumption that the wage elasticity of the labor supply to an

individual firm is finite, diseconomies of scale in recruitment for a given wage becomes the new discriminant to assess whether a labor market is better approximated by the perfectly competitive model or by monopsony. In this way, perfect competition is not considered anymore as a situation where the wage elasticity of the labor supply curve to an individual firm is infinite (which goes against both common sense and empirical evidence), but as one in which the marginal cost of recruiting a worker is independent of the level of employment. Monopsony, on the other hand, identifies the situation in which the marginal cost of maintaining a given stock of workers is increasing in employment. This model is considered as a generalized model of monopsony.

In the static model presented in this article, the labor cost function, denoted by $C(w,N)$, is defined as the cost per worker of maintaining employment size at level N, when the wage rate is w. The costs of recruiting a worker also include the training costs which are denoted by $H(w)$, while the separation rate is $s(w)$. In order to keep employment at N, a flow of sN recruits is needed, resulting in a labor cost function which is independent of employment: $C(w,N) = H(w)s(w)$. But, if it becomes increasingly hard to recruit and train workers, the recruiting and training costs $H(R,w)$ are function of the flow of recruits $R = sN$, and it follows that the labor cost function will be of the form $C(w,N) = H[s(w)N, w]s(w)$.

Considering the case with no training or recruitment costs, in the perfectly competitive model the wage is w^c and the labor cost function can be written as follows:

$$C(w,N) = 0 \; if \; w \geq w^c$$
$$C(w,N) = \infty \; if \; w < w^c$$

(1)

Meaning that any amount of labor can be recruited at zero cost if the wage rate is at or above the competitive level, but it is impossible to recruit labor if the wage offered is below the competitive level.

The form of the labor cost function in the case of monopsony is:

$$C(w,N) = 0 \; if \; N \leq N^s(w)$$
$$C(w,N) = \infty \; if \; w > N^s(w)$$

(2)

Which says that if a firm paying a wage w wants to employ less workers than the labor supply forthcoming at that rate, $N^s(w)$, it has zero recruitment costs, but there is no possibility to attract a higher level of labor.

Both cases consider an unrealistic situation and are non-differentiable: in the case of perfect competition any wage cut results in the impossibility to recruit new workers, while under monopsony the only thing the employer can do to attract new workers is to raise the wage. The more reasonable generalized model of monopsony assumes the separation rate to be continuous in the wage, which is a feature of dynamic monopsony models.

The steady-state profits of a firm with a revenue function denoted by *F(N)* can be written as:

$$\pi = F(N) - [w + C(w, N)]N \tag{3}$$

The firm has a choice of the wage it can pay if it wants to maintain employment at *N*. It will obviously choose *w* to minimize direct and indirect labor costs.

$$\omega(N) = \min_w w + C(w, N) \tag{4}$$

$\omega(N)$ represents the relevant labor supply curve, or effective labor supply curve, which can replace *w(N)* in the decision problem for the employer, as follows:

$$\pi = F(N) - \omega(N)N \tag{5}$$

Assuming that the labor cost function is differentiable, and the second derivative is positive, equation (4) has the following first-order condition:

$$-1 - C_w(w, N) = 0 \tag{6}$$

If the labor cost function is increasing in employment, the effective labor supply curve facing the firm is upward-sloping, while, if the labor cost function is independent of employment, then the effective labor supply curve will be infinitely elastic and will be the case of perfect competition. It is important to note that this result is obtainable even if the wage elasticity of labor supply to the firm is not infinite, so that the labor market would initially appear monopsonistic. The slope of $\omega(N)$ is important to understand the impact of the minimum wage in the case of perfect competition and monopsony.

Considering the employment decision, the profit maximization problem of the employer implies what follows:

$$F'(N) = \omega(N) + \omega'(N)N \tag{7}$$

The firm will choose that level of employment which equalize the marginal product of labor to the marginal cost of the effective labor supply curve.

When a binding minimum wage is imposed on a firm, in the standard monopsony case the new labor supply curve becomes horizontal for the level of employment where the firm would otherwise pay a wage below $w_{\min}$. In this model, the relevant analysis is focused on the effects of $w_{\min}$ on the slope of the effective labor supply curve, and thus its impact on employment. Looking at equation (7), there are two distinct effects on the marginal cost of labor: $w_{\min}$ increases $\omega(N)$ but reduces $\omega'(N)$. The first derivative of the marginal cost of labor with respect to the minimum wage shows the total effect of $w_{\min}$ on MCL:

$$\frac{\partial MCL}{\partial w_{\min}} = 1 + C_w(w_{\min}, N) + C_{wN}(w_{\min}, N)N \tag{8}$$

From equation (6) it follows that $(1 + C_w) = 0$ and the impact of the minimum wage on employment depends only on the sign of C_{wN}. Under perfect competition the labor cost function is independent of employment, $C_N = C_{wN} = 0$, hence the marginal effect on employment is zero. But any level of the minimum wage above the one chosen by the firm will reduce employment. However, in the non-competitive case, equation (8) shows that, when $C_{wN} < 0$, there is a negative effect of the minimum wage introduction on the marginal cost of labor and a positive effect on employment, while if $C_{wN} > 0$, the opposite happens. To assess whether the first or the second case is more plausible in reality, it is helpful to consider the relationship between the effective labor supply curve and the wage paid without the introduction of a binding minimum wage. By differentiating equation (6), it follows that:

$$\text{sgn}\left(\frac{\partial w}{\partial N}\right) = -\text{sgn}[C_{wN}(w, N)] \tag{9}$$

Equation (9) shows that there is an inverse relationship between the sign of C_{wN} and the sign of $\left(\frac{\partial w}{\partial N}\right)$. If $C_{wN} < 0$, the slope of the effective labor supply curve decreases and moving up the curve implies that the effective marginal cost of labor reduces, while the wage paid by the employer rises. If $C_{wN} > 0$, the minimum wage results in a higher slope of the effective labor supply curve, hence the marginal cost of labor increases, while the wage falls. The first case seems more plausible as it is consistent with several empirical estimates of a positive employer-seize wage effect, and a higher wage generally reduces expenditure on training and recruitment costs decreasing the separation rates. These results confirm the importance of the form of the labor cost function: the labor market

is considered monopsonistic when $C(w, N)$ is increasing in employment and competitive when it is independent of employment.

1.7. Discussion and Conclusion

All the articles presented in this chapter show how it is becoming clear beyond any reasonable doubt that labor markets have important elements of monopsony power. The results obtained by the researchers provide evidence on both the elasticity of the labor supply curve and diseconomies of scale in expenditure for recruitment activity, implying a considerable degree of firms' wage-setting power. Recently, academic research on such labor markets has made its way into policy debates, though there is a number of economists who believe perfect competition is a better model to approximate the dynamics of a labor market. The amount of monopsony power estimated in some studies is not negligible and offers a useful perspective in several areas of interventions such as the introduction of a binding minimum wage. The article *Monopsony in labor markets: a review* attempts to synthesize empirical evidence on the elasticity of the labor supply curve to an individual firm, a parameter that captures the extent of firms' wage-setting power. The first approach presented by the authors ('modern' monopsony) is rooted on search frictions: it is implausible to assume that workers can look for different jobs outside and quit their current positions without bearing any cost, pecuniary or non-pecuniary. The second approach focuses on idiosyncratic tastes among workers for the amenities offered that are not fully priced into wages, which makes employers imperfect substitutes in the eyes of a worker. These studies provide evidence for a non-negligible level of wage-setting power. The generalized model of monopsony has presented a more sensible framework, different from the canonical models that are typically used in the literature which are very stylized and easy to criticize. Those who are critical of monopsony point out the implausibility of assuming that the only way an employer can increase employment size is to raise the offered wage and move along an upward-sloping labor supply curve. Starting from the assumption that the wage elasticity of the labor supply to an individual employer is finite, the variable considered to assess whether labor markets are best thought of as 'competitive' or 'monopsonistic' are diseconomies of scale in recruitment. If the labor cost function is independent of employment, hence if there are no diseconomies of scale in recruitment activity, what would appear at first sight a monopsonistic labor market, in this model is characterized by an infinitely elastic effective labor supply curve and falls within the case of a perfect competitive market. Imperfect competition among employers can lead to workers being paid less than their worth to the firm. Whether such welfare losses are experienced in reality is determined by the extent to which firms and governments exploit their monopsony power. However, the results obtained by these studies show how salary markdowns can be predicted assuming that employers

fully exploit the power they have over workers[11]. The idea that even highly advanced labor markets might be better characterized as imperfectly competitive raises questions about the welfare implications of labor market policies and institutions. Yet significant challenges remain. The field continues to rely almost exclusively on observational studies based on plausible, but ultimately debatable, identifying assumption. More studies are needed using research designs that can credibly identify the causal link from firm-specific shocks to workers' wage.

The article proposed by Naidu, Posner, and Weyl points out that labor market power is costly to society and bad for economic growth, and equality. Despite this, this issue is generally ignored by antitrust authorities, and never considered as a reasonable justification for further analyze merger effects, from the point of view of labor markets. The authors suggest applying the economic analysis of product markets in the scrutiny of mergers also to labor markets.

Amior and Manning show that, under the assumption of constant returns, a larger supply of migrants must always increase the marginal products of natives, unless they both have identical skill mixes. Moreover, in the long run, this surplus is entirely passed to native labor. This result is questioned in the case of a monopsonistic labor market, since wages also depends an any mark-downs imposed by the firms, that can exploit immigration imposing even larger mark-downs on the wages of both migrants and native, if migrants supply labor less elastically than natives (and there is evidence that supports this assumptions). The article then show that immigration may indeed reduce mean native wages overall, even in the long run, but this result does not necessarily mean that migration is generally harmful for native workers: if policy interventions would make the labor market more competitive by limiting in some way employers' market power, immigration would then only have the positive effect of increasing the marginal products of native-owned factors on average.

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[11] George Priest's (2010) paper describes one direct evidence for monopsony power being exploited by agents: employers use non-wage compensations for the allocation of workers (e.g., forced matching programs). Once worker wages are removed from competition, other forms of compensation will inevitably play an important role in worker allocation.

2. Empirical analysis on the effects of the national statutory minimum wage introduction in Germany

2.1. Germany Minimum Wage reform

Since the early 1990s, Germany experienced a dramatic increase in wage inequality. Most notably, real wages of workers in the lower part of the distribution have decreased: between 1995 and 2015, real wages increased by nearly 20% at the 90th percentile, by 8% at the median, and declined by 13% at the 10th percentile. In response, on January 1, 2015, German labor market was exposed to a massive intervention in its wage structure: the Minimum Wage law[12] (*Mindestlohngesetz*) entered into force, introducing a national statutory minimum wage at a level of €8.50 gross per hour. Prior to this reform, in 2013, Germany had already put in place a number of sector-specific minimum wages, which allowed to predict some of the potential wage floor effects. Until then, wage floors were set by collective, voluntary agreements within specific sectors. The Federal Ministry of Labor and Social Affairs conducted an analysis on eight sectors[13], which overall suggested no or small statistically significant negative effects on employment for most sectors, but small positive wage effects of the sectoral minimum wages. In January 2015, a Minimum Wage Commission (*Mindestlohnkommission*) was also established, with the aim of monitor and evaluate the implementation of the reform and its effects every 2 years, in order to provide appropriate protection to workers and ensuring fair market competition. Sectors with existing minimum wage floors below €8.50 were allowed to slowly adapt to the reform, granting them a transition period through January 2017. Permanent exemptions apply to minors, trainees and interns (e.g., students or apprentices completing required or elective internships of up to three months), volunteers and long-term unemployed (those who have been registered as such for at least 12 months), which substantially reduce the number of eligible individuals. In light of minor short-term employment effects, the wage floor was progressively increased to €8.84 in 2017 and to €9.35 in 2019. The reform put in place in 2015 provides an interesting case for international research, as it was the first time a nationwide statutory minimum wage was implemented, with very limited legal exemptions. It was binding for nearly all 37 million dependent employees, unfolding a substantial 'bite': around 10% to 14% of the eligible work force earned less than €8.50 per hour in

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[12]MiLoG, https://www.gesetze-im-internet.de/englisch_milog/index.html, last accessed on December 3 2020.

[13] The waste industry, the main construction trade, the roofing industry, electrician trade, facility cleaning services, care sector, painters and varnishers, and laundry services.

the previous year, meaning that around 4 million jobs were directly affected. The wage floor was introduced at a comparatively high level in Germany[14] (see Figure 4), affecting most of the population, which is the reason why this reform can give insights into potential minimum wage effects even beyond the German context. In 2015, the ratio between the minimum and the median wage in Germany was 0.48, lower than the French one (with minimum wage-to-median ratio of 0.61), but considerably higher compared to the US ratio of 0.36. The German economy was characterized by robust economic growth in the years surrounding the implementation of the reform. Between 2010 and 2016, Germany nominal GDP grew by 20%, while unemployment fell from 5.5% in 2011 to 3.9% in 2016, a record-low level not seen since the early 1980s.
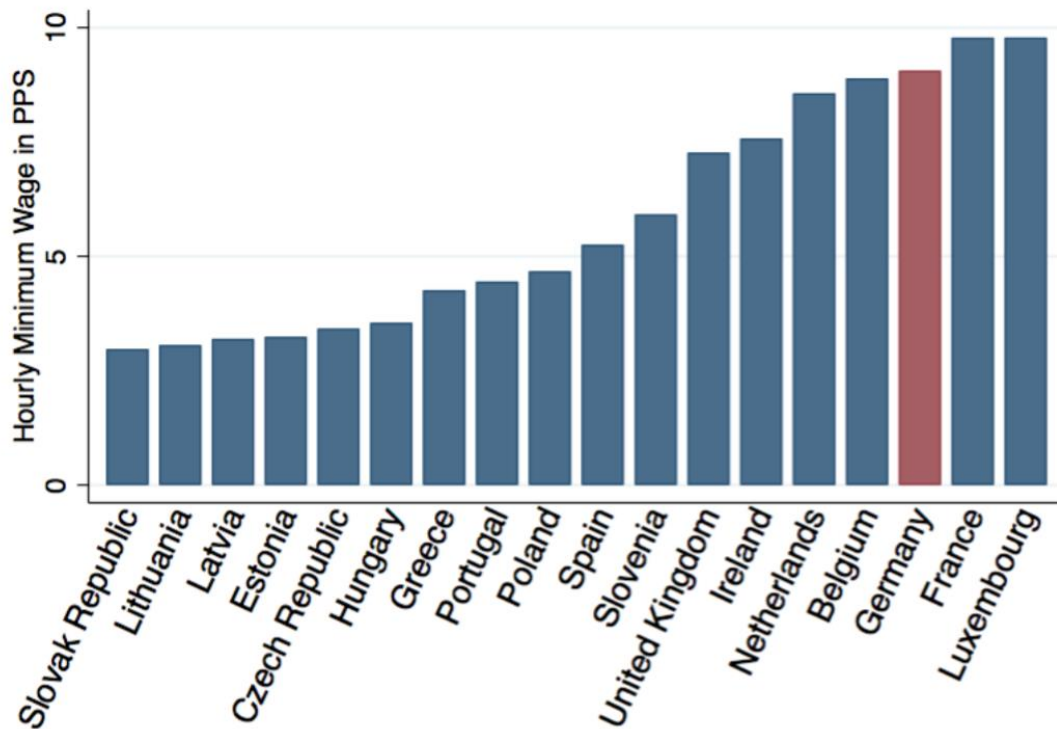

Figure 4. Hourly Minimum Wages in 2015 in Purchasing Power Parities (in Euro). Source: OECD.

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[14] In 2015, it ranked among the highest wage floors in Europe when accounting for purchasing power.

2.2. Expectations about benefits and drawbacks of the Minimum Wage

The introduction of the minimum wage was preceded by a long debate among German economists and policymakers about potential threats and benefits of a national wage floor. From one side, supporters stressed fairness, inequality reduction, and positive distributive effects, as well as a reduced dependence of workers on social transfers. On the other side, opponents warned of the possible negative effects on employment in the long run, predicting an extensive job destruction (especially in the low-wage segment) of 500,000 to 900,000 jobs. Furthermore, achieving the main target of poverty alleviation was also questioned, since expectations on positive effects were small due to the German in-work benefits regulations and withdrawal rates of income from 80 to 100% for many low-income households. As a result, households with low income would gain nothing more than an increase in the risk of job loss caused by a strong rise of employers' labor costs. However, no or small negative short-run employment effects were expected by economists, rather, they suggested the reform could lead to "mini-jobs"[15] being transformed into regular employment. This transition does not necessarily entail more net income for workers as they start to pay taxes and social-security contributions. In addition, as mini-jobs are usually chosen due to a limited time budget, extending labor supply is often not desired. In sharp contrast, employers benefit from transitioning workers from marginal to regular employment thanks to a decrease in total labor costs, even in the presence of an increasing gross wage, as employers' marginal social security contributions are strongly reduced. Therefore, the decrease of marginal employment may not necessarily imply a rising unemployment since it could be associated with an increase in the demand of regular employment. In accordance with these consequences, studies on monopsonistic labor markets offer several possible explanations for the absence of negative employment effects after the introduction of a minimum wage, at odds with the huge negative employment effects that were predicted ex-ante. In addition, legal administrative hurdles may delay negative employment effects to the long term. One further explanation for such a result could be employers ignoring new minimum wage regulations due to insufficient control and enforcement mechanisms. Most contracts and paychecks in Germany do not stipulate hourly wages, rather monthly salaries and agreed working hours are specified, but detailed information are not always available: the contractual wage is set in employment contracts, while the actual wage depends on the effective

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[15] Mini-jobs or marginal employment are a specific type of job in Germany, defined by a monthly income below €450, no compulsory social security contributions by employee, and are exempted from income taxation. They can be pursued as a primary/sole or a secondary/add-on jobs.

workload of each employee (a common blind spot in administrative data). The German Customs Administration is responsible for conducting inspections of employer firms and enforcing compliance with social security laws and the Minimum Wage Law. Between 2014 and 2015 there has been a reduction of 30% in inspections conducted by the Customs Administration. In 2015, prosecutors initiated legal proceedings with 1.6% of the firms inspected, and the average fine was about 275€.

Table 1 summarizes the number of beneficiaries: at the time of its introduction, the minimum wage ranked among the highest wage floors among European countries when accounting for purchasing power, and combined with the limited number of legal exemptions, this high bite translated into a large number of affected individuals. In 2014, around 5.5 million workers earned less than €8.50 per hour, and 72% of this group (around 4.0 million employees) were eligible for the minimum wage. It must be noted that the timeline of the minimum wage introduction allows for potential anticipation effects, which have been neglected by some previous studies on the German case. Moreover, the German Federal Statistical Office estimates that some groups are particularly affected. It is clear form Table 1 that females and marginally employed workers are two of those groups.

Table 1. Minimum wage beneficiaries in 2014

	Absolute (in mio.)	Share (in %) of	
		Employees	Affected
Employed	37.4	100	–
Wage < €8.50	5.5	14.7	–
Wage < €8.50 and eligible thereof	4.0	10.7	100
West-German residents	2.9	7.8	72.9
East-German residents	1.1	2.9	27.1
Full-time employment	0.9	2.4	22.4
Part-time employment	0.9	2.4	22.4
Mini-jobs	2.2	5.9	55.1
Women	2.5	6.6	61.7
Men	1.5	4.0	38.3

Source: Destatis (2016)

As the German Minimum Wage Commission pointed out in 2018, overall, there are no statistically significant negative short-term employment effects found for most sectors, whereas wage increases

are apparent, especially for East Germany. Yet, negative employment effects are also found for single sectors and particular time frames. With the minimum wage in place for over 6 years, the number of *ex post* impact assessments is increasing. These focus mainly on employment and distribution effects, but also on a large variety of other outcomes: working hours and work intensity, inequality and fairness, reservation wages and prices.

2.3. Identification strategies

A large part of the literature on minimum wage regulations has used a variety of identification strategies for the causal evaluation of aggregated short- and long-term impacts on two economic outcomes: wage inequality and employment. In order to find reliable estimates, researchers used three main sources of variation in treatment intensity:

1. Identification using variation in treatment intensity over time. Such an application studies the effects of a given reform by exploiting inter-temporal variation in minimum wage when it has been adjusted over time or newly introduced. In the German case, this approach would compare wage growth and employment size before and after the introduction of the reform in 2015. Since there are many other factors that may affect the wage distribution besides the minimum wage, which cannot be assumed to be casual, variation over time is not an appropriate method to estimate the impact of the reform on employment and wage inequality in the German case.

2. Identification using variation of treatment by economic sectors. One strand of economic literature has exploited variation in minimum wage floors across sectors and over time. This method has proved reliable to estimates the sector-specific minimum wages in Germany. Yet, the assumption that all sectors would have developed equally in the absence of the reform and, thus, would share a common trend, is likely violated. Therefore, this approach is not feasible to estimate employment effect of the national minimum wage in Germany.

3. Identification using variation over regions. Inter-regional variation of minimum wage floors can be caused by legislative differences and/or by different wage structure, resulting in differences in the regional 'bite' of the minimum wage. In Germany, there is no legislative variation between federal states, but hourly wage distributions are relatively different across regions, hence there is variation in the regional 'bite' of the reform. This is measured by the regional shares of employees paid less than the minimum wage before 2015.

Due to the universal validity of the reform, the set of empirical identification strategies is considerably restricted in the German case. Following the identification approach proposed by Card (1992), which considers regional variation that does not depend on differences in legislation, it is possible to evince that the stronger that a minimum wage 'bites' into the regional wage distribution, the stronger the regional labor market is affected, and so should be the adaptation of labor demand. The imposition of a national wage standard implies the "treatment effect" varies across states depending on the fraction of workers initially earning less than the new minimum. Across regions, earnings and wages differences are caused by structural and environmental diversity. Among the 4 million workers directly affected by the introduction of the minimum wage (10.7% of employees according to the German Federal Statistical Office), some groups are disproportionally affected. Besides females and marginally employed, East-German residents are of particular interest. One in five East-German residents earned less than the new wage floor in the years before to the introduction of the reform, a much higher proportion compared to West Germany, where only 9% of the eligible workforce was affected. The 'regional bite' is defined as the degree to which a region is affected by the minimum wage and it is a crucial measure to the identification strategy. It is expressed through the two following variables: the Fraction and the Kaitz index (see Figure 4). The first one reflects the share of affected eligible employees per region, while the second one displays the relation of the minimum wage to the regional minimum wage. The higher this value is, the stronger that the minimum wage bites. Both bite measures reflect the long-lasting and significant structural differences between East and West Germany, as the bite is much higher in the eastern part. Cities and surrounding areas like Munich or Hanover, as well as highly industrialized areas, report a lower bite compared to different parts of Germany. The overall pictures look roughly the same, even though the two different measures do not always display the same ranking of areas by bite, due to the fact that the Kaitz index is a ratio between the minimum wage and the average wage, while the Fraction measures the percentage of affected workers. Therefore, the Kaitz index can be influenced also by movements in the upper part of the wage distribution. Overall, the graphical analysis suggests significant variability across regions' bite, revealing that it is an appropriate measure for the identification strategy.

(a) Fraction (b) Kaitz

Fraction legend:
(28,39.8]
(25.2,28]
(18.4,25.2]
(16.2,18.4]
(14.8,16.2]
(13.7,14.8]
(12.5,13.7]
(11.1,12.5]
(10.1,11.1]
[4.2,10.1]

Kaitz legend:
(68.5,81]
(63.9,68.5]
(60.3,63.9]
(57.7,60.3]
(55.8,57.7]
(53.7,55.8]
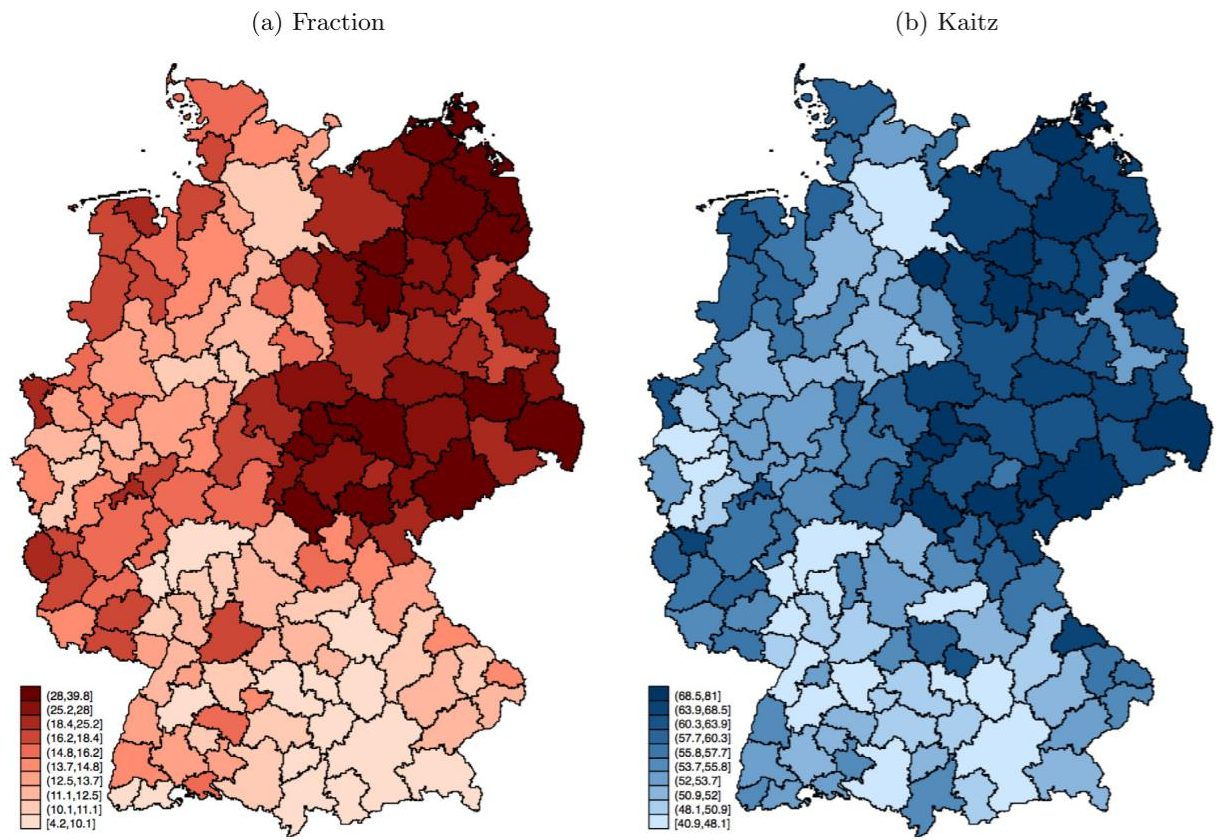(52,53.7]
(50.9,52]
(48.1,50.9]
[40.9,48.1]

Figure 5. Degree to which labor markets are affected in 2014[16]. Bite measures are divided into deciles.

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[16] Source: SES 2014.

2.4. Empirical approach: identification using regional variation

The German reform is an interesting case study to analyze the degree of monopsony power in labor markets, also outside the German context, as the minimum wage was set at a comparatively high level and it was binding for all 37 million employees. In contrast to most evaluation studies that exploit marginal changes in the existing minimum wage laws in the United States or other countries, the German case study proves particularly interesting because it represents a high-impact, binding minimum wage introduction with a large share of the population affected. The German reform offers a unique opportunity to more clearly establish causality and contribute to the broader debate in Germany and around the world. The primary goal of the reform, which set a wage floor of € 8.50 in all regions and economic sectors with few exceptions, was to increase gross hourly wages for low-wage workers. The minimum wage bit quite hard into the wage distribution, affecting directly around 4 million individuals who earned less than €8.50 prior to the reform (10%-14%, depending on the data source). Economists and policymakers analyzed all the possible outcomes of the reform, trying to predict what could be the direct effect of the intervention in the labor market on employment size in Germany. Two different ways of thinking lead to opposite expectations on the long-term effects of the reform: from one side, those who criticize the reform, predict a massive reduction in jobs number, especially in the low-wage segment, which lead to a failure in the policy target of poverty alleviation; from the opposite side, positive distribution effects suggests that this reform would reduce inequality among the distribution of wages.

These different expectations reflect the two different currents of thought described in the first chapter of this paper, suggesting that the introduction of the minimum wage in Germany in 2015 is indeed an interesting case to empirically analyze the potential monopsonistic aspects of the labor market. Most textbook treatments of the employment effects of the minimum wage rely on the simple supply-demand model of price floors and the outcome is often contrasted with that which occurs under monopsony. The neoclassical model, represented by the perfectly competitive labor market, predicts a reduction in demand for the factor that becomes relatively more costly. In this case, employees in the low-wage segment would become more costly to employers, leading the critics of the introduction of the minimum wage to expect a reduction in employment size. However, search models, also predict a positive effect of minimum wages because of rising marginal costs of labor from frictions. In recent years, the analysis of the effects of a minimum wage in a competitive labor market has been significantly extended (Brown et al., 2014). If the labor market shows some aspects that suggest the presence of certain levels of monopsony power,

labor demand effects could also be positive when employees are paid below the marginal product of labor beforehand. On the supply side, models predict that individuals whose reservation wages lie between the minimum wage and the previous market wage now enter the labor market, causing an increase in involuntary unemployment. For all these reasons explained above, employment effects are not clear *ex ante*; thus, the choice of the identification method is a crucial task for the minimum wage evaluation.

The aim of the analysis conducted in this paper is to give an overview of the short-term effects of the minimum wage introduction on employment size in Germany. Overall, the literature suggests small negative employment effects, while poverty is not found to be reduced. However, life and job satisfaction for affected individuals appear to be increased.

As previously mentioned, to estimate causal effects of the minimum wage, literature relies on a variety of identification approaches. The strategy that relies on legislative variation in the minimum wage regulation is not feasible for the German case, as the reform applies equally in all regions. It is applicable, for example, in the case of the United States, where differences in state-level minimum wages are used to evaluate diverging wage and employment trends. This approach is especially appealing when federal state labor markets are very similar and only differ with respect to their regulations and structure. There are some other identification approaches that rely on comparison of exempted sectors, but these groups tend to be systematically different and fail in the assumption that both groups would have developed equally in the absence of the reform. For this reason, it is not realistic to assume that the two different groups would share a common trend excluding the introduction of the reform. Following the analysis conducted by Card (1992), the most feasible approach to identify the employment impact of the German minimum wage is to rely on regional variation to which an area is affected by the wage floor.

Figure 5 shows that there is heterogeneity in wage levels among Germany's geographical areas, measured by the proportion of workers with hourly wages below €8.50 before the reform (the so-called Fraction). Thus, the key variable for the identification analysis proposed in this paper is the regional bite of the reform, which varies despite the legislative uniformity of the wage floor. The more strongly a region is affected by the minimum wage, the stronger the expected impact on wages and, in turn, the stronger the supposed reaction in the examined outcome. The causal effect can then be obtained in a difference-in-difference (DiD) framework, where it is captured by the coefficient of an interaction term between a post-reform dummy and the bite measure. (Caliendo, 2019).

The difference-in-difference framework is a methodology frequently used in microeconometrics in order to estimate the effect of a "treatment", such as the introduction of a policy in a group of subjects ("treated"), which is compared to a second group of subjects not exposed to the treatment ("control" group). These two groups are observed during two different periods in time: before and after the introduction of the so called "treatment" (the Minimum Wage Reform in our case). Once the dataset is defined, the regression model has the following structure:

$$y = \beta_0 + \beta_1 dB + \delta_0 d2 + \delta_1 d2dB + u \tag{1}$$

Where y is the dependent variable, observed during the two periods in time 1 and 2; $d2$ is a dummy variable which is equal to 1 during the second period, 0 otherwise; dB is a dummy variable which is equal to 1 in the case of the "treated" subjects, 0 otherwise. In other terms, this last variable explains the existing differences between the control and the treatment group. The variable $d2dB$ represents the interaction between $d2$ and dB, and it is equal to 1 when it refers to the treated subjects observed during the second period in time (after the introduction of the policy). The parameter of interest, which explains the effect of the treatment on the treated group, is the coefficient related to this last variable (δ_1). The variable u refers to the error term.

Therefore, the difference-in-difference estimation will be represented as follows:

$$\hat{\delta_1} = \left(\overline{y_{B,2}} - \overline{y_{B,1}}\right) - \left(\overline{y_{A,2}} - \overline{y_{A,1}}\right) \tag{2}$$

The dataset I created to apply the difference-in-difference estimation is constructed using SOEP data from individual surveys from year 2012 to 2017. Years from 2012 to 2014 are used as pre-treatment period, while the three following years consist in the period after the introduction of the policy.

Since the statutory minimum wage in Germany is uniform in all regions and for basically all employees, identifying the reform's effect on wages is not straightforward. The identification analysis suggested by Card (1992) proposes to estimate the causal effect of minimum wages on employment using regional differences in relative treatment intensity. There is no distinction between only two groups of treated and not treated subjects, rather a continuous variable that identify the different intensity of this treatment. Even though the minimum wage is uniform in all regions, hourly wage distributions are relatively different across RORs, giving variation in the bite variable, measured by the regional percentage of workers earning less than the minimum wage in the year prior to the reform. We expect to find that the reform has a larger impact on regional wages in higher-treated regions.

One threat to this type of identification strategy based on regional variation is the spatial dependance of regions, which creates a bias in the regional effects of the minimum wage reform. Controlling for region-specific GDP removes this estimation bias. Another threat is that the regional bite is correlated with regional economic performance, in the sense that if the minimum wage bites harder in economically weak regions, these should exhibit the highest wage adjustment. Therefore, the regression equation should include controls for economic performance, such as lagged region-specific GDP per capita. One more threat to the identification is given by changes in population, which held particular relevance in 2015 due to a large inflow of migrants. For this reason, I include region-specific population levels as a control variable in the regression.

The regional treatment intensity is defined as the eligible share of employees paid less than the minimum wage prior to the reform (in 2014). These shares are derived from the SOEP. As bite indicator, I use the share of eligible employees with (both actual and contractual) hourly wages below the minimum wage threshold. Contractual hours are more accurate since actual hours could be more affected by measurement errors and in the SOEP it is asked individuals to give their gross monthly income, which should correspond to the wage stipulated in their contract. As seen before, the bite varies considerably between regions: East regions display higher treatment, while many regions with low treatment are located in the Southwest.

3. The Short-Term Employment Effects of the German Minimum Wage Reform

3.1. Data sources and implementation

It is possible to evaluate the employment impact of the minimum wage reform on the basis of regional variation, through comprehensive wage data on the eligible work force, as well as employment stocks on the regional level. The analysis conducted following Card (1992) is implemented trough an alternative identification approach which considers regional variation that does not depend on differences in legislation. Each area has a different average wage, thus, the intensity with which wages need to change to adapt with the new minimum introduction is different for each region considered. If the minimum wage has a very high bite in a certain area, wages will have to adapt stronger, compared to other parts of Germany, and so the adaptation of labor demand will influence more significantly the employment size. This approach is applicable to the German case and, in order to control for regional trends before the introduction of the reform, data from the years 2012 to 2014 are needed. The subsequent empirical analysis relies on hourly wages, working hours, and monthly earnings before and after 2015. Data are collected from the German Socio-Economic Panel (SOEP), an ongoing representative longitudinal panel survey with about 30,000 survey participants in 15,000 households per year. The SOEP measures differences in resources across individuals, not only at specific points in time but also across the life course. It was established in 1984 and located at the German Institute for Economic Research (DIW Berlin), providing representative longitudinal data of private households in Germany for a global research community. The SOEP has expanded its scope over the years: it now provides both a broad set of self-reported "objective" variables, such as income, age, gender, education, employment status, or gripping force, and a broad set of self-reported "subjective" variables, such as from satisfaction with life, over fairness and reciprocity perceptions to psychological measurement. It is then a valuable empirical basis for researchers to explore long-time societal changes; relationships between early life events on later life outcomes; interdependencies between the individual and the family or household; mechanisms of inter-generational mobility and transmission; accumulation processes of resources; short- and long-term effects of institutional change and policy reforms; speed of convergence between East and West or between migrants and natives. Summing up, SOEP is a comprehensive multi-dimensional database to understand human behavior and decision making in varying social as well as institutional settings and policy regimes.

The legislation sets the minimum wage on an hourly basis, leading to a number of problems for evaluations and compliance studies. In order to estimate how many people are affected by the minimum wage and what their wages are, the availability of comprehensive information on earnings and working hours is needed. The Minimum Wage reform establishes a certain minimum level for hourly wages; thus, corresponding data will be crucial for the calculation of the bite. Information on this variable is needed also before any potential anticipation took place. Hourly wages are not retrieved directly in the SOEP but can be calculated dividing the gross monthly wages by regular weekly working hours, multiplied by average weeks per month. The SOEP includes both contractual and actual (paid and unpaid overtime) weekly working time. Individuals in industries granted a period of transition to adapt own minimum wages below the new minimum level of €8.50 are especially complex to identify. These difficulties hold also for long-term unemployed, minors and individual interns, since their exemptions relies on very specific circumstances which cannot be captured easily in the data. For all these reasons, estimating non-compliance is not straightforward, as it depends on various assumptions made and the data source used.

Different evaluations of eligible employees still earning less than the wage floor imply that non-compliance with the minimum wage is an important issue in the analysis. Using SOEP data, Mindestlohnkommission (2018b) estimates 2.1 million employees still earning less than €8.50 in 2015 (and 1.8 million in 2016).

The following analysis is based on the crucial assumption that the geographical structure of the bite varies across German areas. The SOEP contains a great deal of geographically referenced indicators and regional information. SOEP contains variables that indicate the area in which survey respondents live at the time of the (household) interview. The values of these variables refer to official geographical units used either by German administrative bodies or by the postal service (Deutsche Post AG) to deliver mail to households in Germany. On the basis of these unique identifiers, it is possible, in principle, to match SOEP data with official, scientific or commercial macro-data at these levels. Regional policy regions (Raumordnungsregionen, ROR) are spatial units defined by the Federal Office for Building and Regional Planning (Bundesamt für Bauwesen und Raumordnung, BBR2) to differentiate areas in Germany based on their economic interlinkages. There are 96 different regional policy regions in Germany. Indicators at this geographical level represent the core element of the SOEP geocode data module of SOEP. For

SOEP users in Europe, access to this module containing regional information is conditional on submitting a special data protection plan and signing a data distribution contract.

A rigorous and comprehensive assessment of the minimum wage effects requires that the data should provide information on hourly wages and represent the entire eligible population. To compute the following analysis, it was necessary to merge the dataset containing all the information regarding work and employment of the interviewed individuals and households with the dataset that links the different households' codes through years to the RORs in which they live. In this way I was able to identify each individual's ROR. I merged the two different datasets using households' code and year as key variables to assign the geographical location to the individuals, which results in 670,157 observations matched. Besides the inclusion of time- and region-fixed effects, I also used logarithmic GDP and population to control for regional differences, assuming that a region's economic power and population size have a strong impact on employment. These variables are taken from Destatis (2016b) since they are not included in the SOEP data. In this way, the dataset I created contains a total of 175,188 observations of individuals through 2012 to 2017 in all 96 Germany's ROR.

3.2. Anticipation and common trend analysis

The longitudinal SOEP data allows to evaluate wages in years prior to the introduction of the reform, and this is relevant for the analysis because we should expect diverging changes in employment if wages adapt to the new minimum floor, set by the reform. The difference-in-differences analysis does not only imply a common trend concerning employment, but also in wages: for the construction of such analysis, in the absence of the introduction of the policy reform, wages and thus employment would have developed equally in all German areas. In order to examine whether those variables show equal trends in pre-treatment time frame, following Caliendo (2019), I divided all the considered regions into three different groups, depending on their bite level: low-, medium- and high-bite areas, according to SOEP data for year 2014. The cut points in the respective bites are set at specific levels, such that each group of regions comprises the same number of subjects (the 33rd and the 67th percentile). The graphical examination of these trends allows us to notice that Fraction in high-bite areas is significantly higher compared to the other regions, as the share of workers who earn less than €8.50 is above 15%, while it has been between 6 and 12% in low- and medium-areas between 2012 and 2014. In the pre-treatment years, Fraction

steadily remained large in high-bite areas, while it slightly changed in the other regions. However, overall, trends have been similar across Germany's region.

Figure 6 shows that from 2015 on, after the minimum wage introduction, common trends do not hold anymore, as expected. Fraction decreased by around 5% in and high-bite regions, and by around 3% in medium-bite regions while it remained more or less constant in low-bite areas. This evidence suggests that there is a positive wage effect in dependence of the regional bite level. The average Fraction in high-bite areas was approximately 23% in 2014, but it did not decrease to zero after the introduction of the policy reform. The same happened for medium- and low-bite areas, showing that the adaptation of wages, and thus Fraction, had not been executed completely in early 2015. Overall, in particular for low-bite regions, bite level changed only marginally after 2014 and did not significantly differ between regional categories.

These patterns reflect what already suggested by the available data, which shows a substantial amount of non-compliance in the short-run. This poses a problem for effect evaluations since possible impacts of the introduction of the minimum wage might be underestimated if there is non-compliance. It also highlights that the enforcement of the wage floor regulations was insufficient and that a number of issues should be considered when implementing a wage floor regulation. First, the policy should be designed in a way that facilitates also the monitoring of compliance, thus it should be considered whether the chosen measure (hourly wages in this case) is easily verifiable in employers' records. Moreover, the legislation should include regulation in order to enforce the minimum wage and take strong precautions such that employers' circumvention is difficult.

Since the analysis conducted in this paper assumes that also employment would have followed the same trend in absence of the reform, it is interesting to look at this dimension too. I divided all German regions into three groups, depending on their bite level, setting the threshold at the 33rd and 67th percentile. The three graphs in Figure 7 show the average logarithmic levels for the three employment types: overall, regular and marginal. It is possible to notice that both overall and regular log employment show significant lower values in high-bite regions, which is a sign of different population levels across the region types. However, the groups share a joint trend over the years prior to the introduction of the reform, meaning that German areas would have developed in a similar way in the absence of the minimum wage. This holds true for the whole time horizon, even after the introduction of the wage floor. The common trend in employment holds also for mini-jobs, even though the differences between high-bite areas and the other areas are more

pronounced. There appears to be a slightly decline in marginal employment between 2014 and 2015, in contrast to regular employment, which could signal a reaction to the introduction of the reform.

Figure 6. Level of bite within high-, medium-, and low-wage regions. Source: SOEP 2012-2017, own calculations. Each region has been sorted into the groups by its level of bite (Fraction) in 2014.

Overall employment level
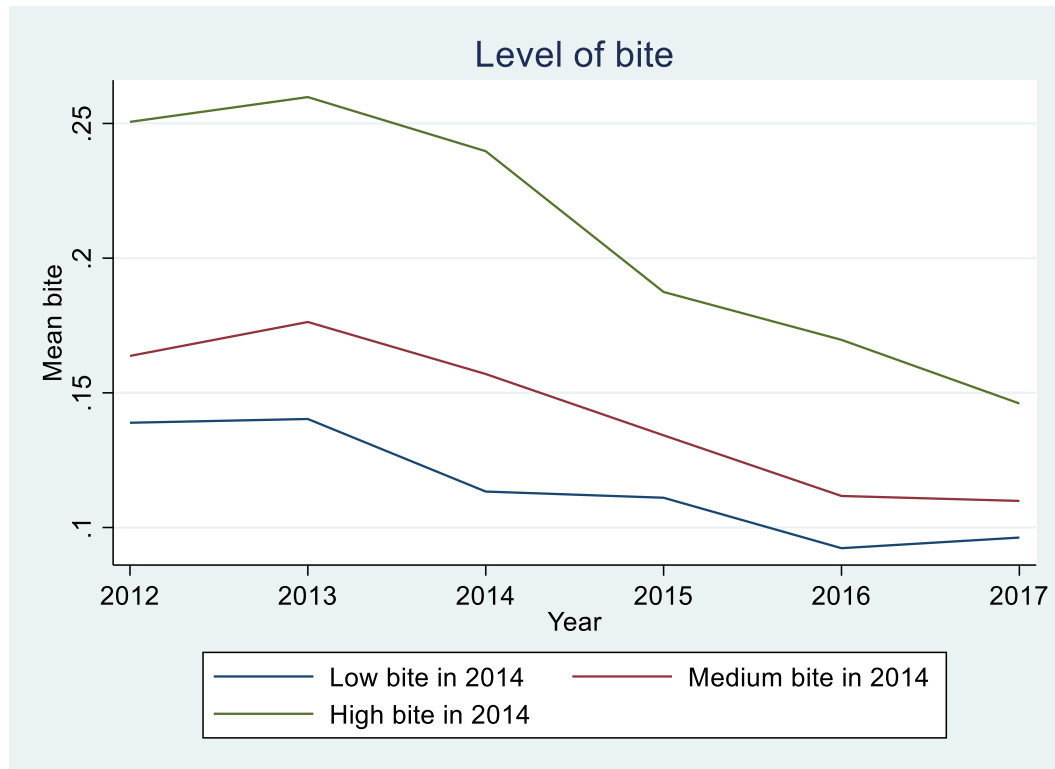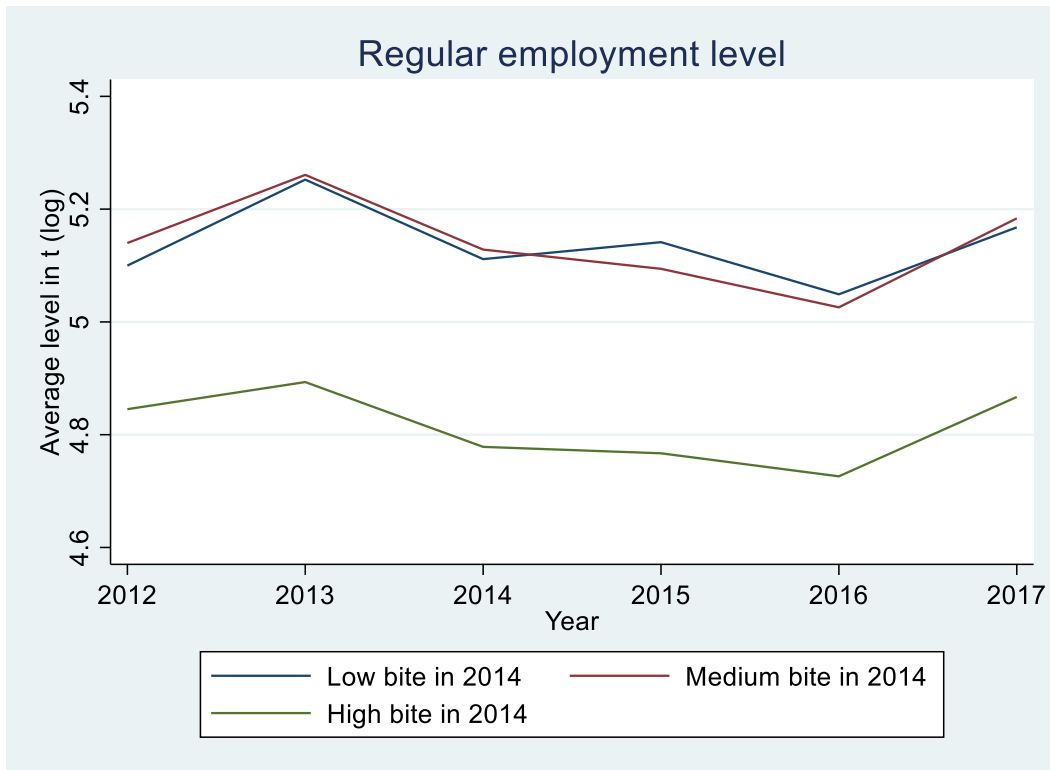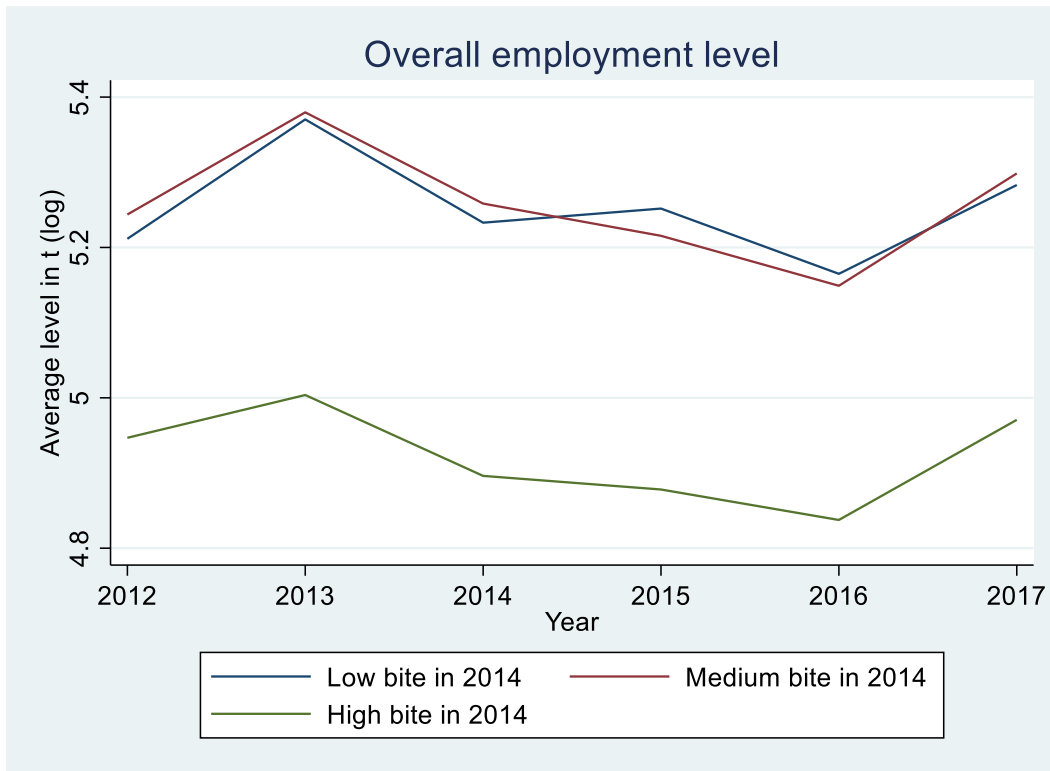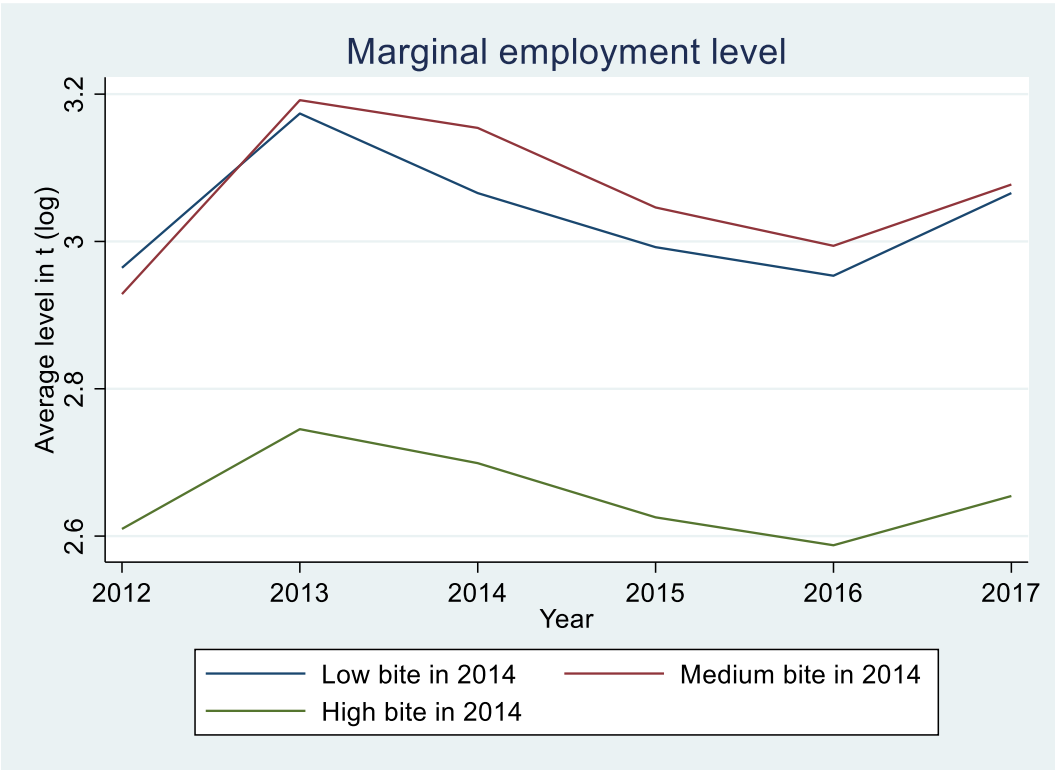

Regular employment level

Figure 7. Mean of log employment level within high-, medium-, and low-bite regions. Source: SOEP 2012-2017 own calculations. Each region has been sorted into the groups by its level of Fraction in 2014.

3.3. Descriptive statistics

Card (1992) and Stewart (2002) in their paper look at employment-to-population ratio to analyze the effect of the minimum wage on employment size. In this paper, I decided to estimate employment effects using log employment level as the dependent variable, since the employment-to-population ratio is affected also by changes in the population, not only in employment levels. In 2015 a large inflow of migrants held particular relevance; therefore, I analyze the log employment level including population levels as a control variable.

Only if different areas are affected differently can wage effects and thus employment effects be identified by the suggested model. The definition of the Bite is then another important crucial step to understand the following analysis. I previously presented two different measures: the Kaitz index and the Fraction. The former measures the ratio between the minimum wage and the regional mean wage. The latter represents the share of eligible employees who earn less than the new minimum. The development of the Kaitz is not only determined by changes caused by the minimum wage, but also by movement in other parts of the wage distribution will affect its value. The Fraction is focused on the group of affected individuals, showing how many of the working population eligible is actually affected by it. The Fraction thus neglects the density below the wage floor since it does not indicate the distance of the low-wage workers from the threshold. Both the Kaitz and the Fraction reflect the significant structural differences between East and West Germany since the bite is considerably higher in the Eastern part. While the overall picture remains roughly the same, the Kaitz displays more variation within the region of Bavaria than the Fraction. There are also some other light differences due to the fact that the Kaitz index measures the ratio between the minimum and the average wage, since it only decreases when the average wage is in fact increased. In this analysis I used the Fraction to construct the bite measure on a scale from 0 to 1.

The dataset I created is obtained merging the two different datasets in the SOEP: one contains information on work and employment and the other displays information on the geographical location of those same individuals responding to the surveys. I then computed my first variable of interest, the gross monthly income (summarized in Table 2), as it was crucial to the calculation of the bite, which represents the continuous treatment variable that I used in my difference-in-differences framework. In order to limit measurement errors, I apply a top and bottom recoding at the first and last percentile. The distribution of many statistics can be heavily influenced by outliers. Winsorizing is the transformation of statistics by limiting extreme values in the

statistical data to reduce the effect of possibly spurious outliers. I used this strategy since the distribution of gross monthly income was not realistic since it contained very low values close to 1, probably corresponding to measurement errors or wrong answers given by individuals.

Table 2. Gross monthly income

Variable	Observations	Mean	Std. Dev.	Min	Max
Income	90,655	2575.775	1916.799	72	10,000

Summary statistics for gross monthly income.

Hourly wages are not retrieved directly in the SOEP but can be calculated using the ratio of gross monthly income and weekly working hours, adjusted by average weeks per month. The SOEP contains both information on contractual weekly working hours, stipulated in the contracts, and actual weekly working hours, which include also paid and unpaid overtime. Using actual hours would be more accurate since the minimum wage needs to be paid for any working time. However, in the SOEP, individuals are asked to give information about weekly working hours in general and for income for the previous month, leading to possible measurement errors due to mismatch between these two variables. Therefore, the following analysis focuses on contractual wages. I winsorized also this variable not to include some extreme values due to measurement errors.

Table 3. Weekly contractual hours

Variable	Observations	Mean	Std. Dev.	Min	Max
Hours	95,870	35.92	13.767	4	70

Summary statistics for weekly contractual working hours.

The analysis has been conducted considering only the two main different categories of employment in Germany: marginal and regular. I counted the employment level for each ROR according to the number of employed respondents to the survey and assigned to the category of regular employed those who classified as full-time or part-time, while those who has mini-jobs as marginally employed. There are some other categories of employment contained in the SOEP data that I did not consider in my analysis. I excluded those workers belonging to the following

categories: vocational training; near retirement, zero working hours; voluntary military service; voluntary service; sheltered workshop; not employed; internship; completing compulsory military service. The reason is that some specific groups of workers were excluded from the minimum wage reform, namely the self-employed, trainees, specific types of interns, minors without vocational training, volunteers and the long-term unemployed. I obtained a total sample of 98,487 individuals, with the majority of them belonging to the category of full-time employment (64.09%) and of regular employment in general (89.17%), while only 10.83% of individuals is assigned to the category of marginal employment, as shown in Table 4.

Table 4. Employment status

Employment Status	Frequency	Percentage	Cumulative
Full-Time Employment	63,120	64.09	64.09
Regular Part-Time Employment	24,701	25.08	89.17
Marginal Employment	10,666	10.83	100.00
Total	98,487	100.00	

Total observations and percentage of employment status.

Table 5. Hourly wages

Variable	Observations	Mean	Std. Dev.	Min	Max
Hourly wages	15,071	5.999	2.031	0.245	8.492

Summary statistics for hourly wages below €8.50.

I then compute hourly wages of individuals as explained above, dividing the gross monthly income by the weekly contractual hours, adjusted by the average weeks per month. Table 5 summarizes the statistics found for hourly wages below the wage floor set by the reform.

As previously mentioned, I based the analysis on an area classification characterized by the 96 planning regions (ROR), which divide Germany into segregated regions by commuter flows and economic structure and are defined by the federal states according to their own regulations. In this way, each individual is assigned to one region. The smaller the area classification, the better the heterogeneous labor market performances and their variation can be captured, although it is more likely that the economic structure of one region is not picked up accurately. The 401

administrative districts would account for this diversity more accurately, but they are also more prone to high commuter flows. The RORs are then the most appropriate geographical classification to divide Germany in restricted areas, keeping the number of observations high and maintaining measures like GDP per capita still valuable to reflect the actual economic performance of a region.

In order to move from individual data to regional data, I counted the number of individuals employed in the selected categories above (regular and marginal employment) and the number of those employed individuals earning an hourly wage below €8.50. Dividing the number of individuals with an hourly wage below the new minimum and the total number of people employed for each ROR in all the years from 2012 to 2017, I computed the Fraction, the bite measure selected for my analysis. The regional bites for year 2014 (summarized in Table 6), the year prior to the introduction of the reform, are the ones that I used as treatment effect to estimate the impact of the reform on employment in the subsequent years. In this way I obtained my final dataset with 576 observations, 96 observations for the RORs in every year that ranges from 2012 to 2017.

Table 6. Regional bites

Variable	Observations	Mean	Std. Dev.	Min	Max
Regional Bites	576	0.1598	0.0659	0.0244	0.4167

Summary statistics for regional bite level.

Table 7. Bite in 2014

Variable	Observations	Mean	Std. Dev.	Min	Max
Bites 2014	96	0.1757	0.0615	0.0269	0.3718

Summary statistics for regional bite level in 2014.

Going back to the initial hypothesis of the analysis, we should expect that heterogeneous wage effects between regions can cause varying adaptation in employment. Overall employment is given by the sum of regular (full-time and part-time jobs) and marginal employment. Since I only have the total employment head count, it is not easy to differentiate between sectors exempted from the national minimum wage and non-exempted industries. Individuals in industries granted a transition period to adapt own minimum wages below €8.50 are especially difficult to identify. The

same is true also for long-term unemployed since their exemption relies on particular circumstances which are not fully captured in the surveys. For all these reasons, estimating non-compliance is not straightforward and depends on the assumptions made. Many evaluations of compliance find a considerable number of eligible workers who earn less than the new minimum in the years following its introduction. According to estimates derived from contractual wages in the SOEP, about 14% of employees were earning less than €8.50 during the first half of 2015 and around 12% in 2016. The Mindestlohnkommission (2018) estimates respectively 2.1 and 1.8 workers earning less than the minimum wage for 2015 and 2016. Even though these results have to be treated with caution because of measurement errors, they imply a considerable importance in non-compliance with the wage floor.

3.4. Employment effects

3.4.1. Results on different categories of employment

After looking at the employment dynamics descriptively, I will now apply a fixed-effects estimation to analyze employment effects of the new minimum wage in a difference-in-differences framework. I derived the following estimation:

$$E_{j,t} = \beta_0 + \sum_{i=2012}^{2017} \beta_{1i}\, T_i \times Bite_{j,2014} + \delta_1 GDP_{j,t} + \delta_2 POP_{j,t} + R + T + v_{j,t} \qquad (1)$$

Where $E_{j,t}$ represents the log employment level for each ROR in year t (where time t goes from year 2012 to 2017), calculated according to the SOEP data. I repeated the regression using not only overall employment level, but also distinguishing between different groups of workers. As previously mentioned, I estimate the effects of the introduction of the reform on overall employment, as well as on regular and marginal employment separately, in order to analyze the possible different effects that the reform had on the main subcategories of workers in Germany. As predicted by economists, marginal employed are expected to be affected more by the reform since their monthly wage is by definition lower than a certain level. The treatment effects are denoted by the coefficients of the interaction terms between the bite calculated in 2014 and the years (β_{1i}, where i goes from 2012 to 2017). I am especially interested in the coefficient of the interaction term between the bite and the year 2015, as it identifies the effect on employment in the year of the

introduction of the minimum wage reform. However, I also include years 2016 and 2017 to estimates short term effects in the years following the introduction of the policy. In order to control for pre-treatment trends, I used years 2012 and 2013, such that my observation period ranges from 2012 to 2017. The reference year remains fixed at 2014 and all the interaction terms between the bite in 2014 and the other years are related to the same year. I also include the regions and the years' dummies (respectively R and T) in order to control for those factors that should be attributed to single regions or specific years. Besides the inclusion of time- and region- fixed effects, I also include controls for regional differences in logarithmic GDP in t, according to the assumption that the economic power of a specific ROR will have an impact on its employment size, and logarithmic population in t since employment is also obviously affected by population size. Standard errors are clustered at the ROR's level.

Table 8. *Overall employment*

	Panel A: Overall employment		
	(1)	(2)	(3)
Bite x y2012			-0.0025
			(0.243)
Bite x y2013			-0.3765***
			(0.134)
Bite x y2015	-0.3995	0.1314	-0.0722
	(0.213)	(0.222)	(0.143)
Bite x y2016	0.2603	0.4960*	0.2870
	(0.221)	(0.253)	(0.184)
Bite x y2017	-0.0100	0.2881	0.0737
	(0.240)	(0.280)	(0.168)
GDP (*log, t*)		-0.2137	-0.1760
		(0.271)	(0.272)
Population (*log, t*)		1.6104*	1.4883*
		(0.820)	(0.928)
Constant	4.5822	-16.3978	-14.8701
	(0.014)	(11.122)	(11.192)
Region and Year FE	YES	YES	YES
Observations	576	576	576
R^2	0.9826	0.9829	0.9830

Note: Robust standard error in parentheses, *p<0.1, **p<0.05, ***p<0.01. Dependent variable is overall employment in logarithmic terms. Reference year in all specifications 2014.

Table 9. *Regular employment*

	Panel B: Regular employment		
	(1)	(2)	(3)
Bite x y2012			-0.1520
			(0.266)
Bite x y2013			-0.3805**
			(0.164)
Bite x y2015	-0.0200	0.1612	-0.1136
	(0.219)	(0.223)	(0.166)
Bite x y2016	0.2702	0.5199**	0.2418
	(0.226)	(0.249)	(0.170)
Bite x y2017	0.0675	0.3843	0.1028
	(0.249)	(0.279)	(0.290)
GDP (*log, t*)		-0.2945	-0.2715
		(0.288)	(0.289)
Population (*log, t*)		1.6703*	1.5958*
		(0.875)	(0.884)
Constant	4.4456	-17.0671	-16.0997
	(0.015)	(11.814)	(11.903)
Region and Year FE	YES	YES	YES
Observations	576	576	576
R^2	0.9827	0.9831	9831

Note: Robust standard error in parentheses, *p<0.1, **p<0.05, ***p<0.01. Dependent variable is regular employment in logarithmic terms. Reference year in all specifications 2014.

Table 10. *Marginal employment*

	Panel C: Marginal employment		
	(1)	(2)	(3)
Bite x y2012			1.1696
			(1.097)
Bite x y2013			-0.0365
			(0.901)
Bite x y2015	-0.854	0.0080	0.5293
	(0.558)	(0.597)	(0.975)
Bite x y2016	0.3577	0.4840	0.9880
	(0.843)	(0.942)	(0.844)
Bite x y2017	-0.7167	-0.5368	-0.0796
	(1.040)	(0.925)	(0.820)
GDP (*log, t*)		0.4392	0.5608
		(0.774)	(0.796)
Population (*log, t*)		1.1509	0.7570
		(2.289)	(2.294)
Constant	2.4838	-14.5298	-9.8688
	(0.045)	(31.051)	(31.030)
Region and Year FE	YES	YES	YES
Observations	576	576	576
R^2	0.8796	0.8798	0.8806

Note: Robust standard error in parentheses, *p<0.1, **p<0.05, ***p<0.01. Dependent variable is marginal employment in logarithmic terms. Reference year in all specifications 2014.

Table 8, Table 9, and Table 10 show the coefficients of interest that explain the employment effects of the minimum wage, with their robust standard errors, as well as the number of observations, the inclusion of time- and region-fixed effects, and the R^2. Each Table present a specific panel: Panel A exhibit the result of the regression on overall employment, Panel B focuses on the subcategory of marginal employment, while Panel C shows the results only for regular employment, the sum of full-time and part-time workers. Column (1) reports all the coefficients of the interaction terms between the continuous variable bite (in 2014) and years of the post reform period, from 2015 to 2017. Column (2) presents the employment effects in the same years, adding controls for GDP per capita and population. Column (3) repeats the same results, also including the coefficients of the interaction between the bite in 2014 and years 2012 and 2013, to control for pre-treatment trends and test the common trend assumption, such that observations range from year 2012 to 2017. The reference years always remains fixed in 2014. The interaction between the bite and the year 2014 is omitted because of collinearity, while all the other interaction terms between bite and years have to be interpreted in relation to the year 2014. Total observations are given by each ROR's observation (96 in total) per year, from 2012 to 2017.

As shown above, from my own calculation, the average level for the bite in 2014, the year before the introduction of the minimum wage reform, was 17.6%, meaning that more than one in ten employees in Germany was affected. According to the classical theory, if the labor market is better represented by the perfectly competitive model, this intervention is expected to lead to an extensive job destruction in Germany. The aim of this analysis is to examine whether these expectations have actually proven to be true in the short term. However, the effect of the introduction of a wage floor on labor demand, and thus employment, depend on the market structure. In a competitive price-taker setting, the results would suggest negative effects on employment, but, if the labor market is considered to be monopsonistic, the effects on employment are not necessarily negative. According to recent studies presented in the previous chapters, my expectations on the results are not to find a massive reduction on jobs, as the demand for labor may also increase when employees are paid below their marginal product of labor.

The coefficients of the interactions have to be interpreted as the percentage change in employment when the Fraction (the bite) increases by one percentage point ceteris paribus. According to theory, my expectations are then not to find strong significative negative values, rather small variations which could also be positive. Column (1) presents the employment effects without controls for GDP and population, which are included in columns (2) and (3). Since

population would have affected employment in the absence of the policy reform, I considered fundamental to control for the current population level. There is a direct interrelation between population and employment level, meaning that population size in t explains a great share of variation in employment. This becomes even more relevant considering the large inflow of migrants in 2015. I expected that controlling for GDP would not have the same impact since regional differences in economic power seem to be already controlled for by regional fixed effects. Column (3) additionally includes years 2012 and 2013, which allow me to revisit the common trend assumption and to control for pre-treatment trends. The coefficient for the interaction term in 2012 is not significative, supporting the assumption previously made, which states that regions followed the same trend before the introduction of the policy reform. Nevertheless, the coefficient for the interaction in 2013 is significative, however, since Column (3) in Panel A and Panel B identify a slight increase in regular and overall employment already from 2013 to 2014, we need to be cautious with the interpretation. With the reference year 2014, an increase by one percent in the Fraction translates to 0.38% less overall and marginal employment in 2013, pointing to the fact that employment already increased in highly affected regions even before the minimum wage introduction. Only in the case of marginal jobs, as shown by the coefficients of interaction in Panel C, the common trend analysis is verified, as the coefficients for the years before the introduction of the reform are not significative. The estimation in column (3) is the more extensive and will serve as my preferred specification.

From the results I obtained I cannot conclude that the introduction of the minimum wage reform in 2015 had an impact on employment size since the coefficients of the interaction terms between the bite in 2014 and years are not significative. The results do not suggest that the effects are negative and that the reform has a strong impact on employed population, accordingly to the monopsony literature analyzed in this paper, but I can neither conclude what are the effects of the minimum wage. The standard errors are too big and do not allow me to state what is the impact on employment, even though the coefficients of interaction between the bite and year 2016 in Column (2) of Panel A and Panel B are significative and signal a slight positive employment effect of the minimum wage in the year after the introduction of the reform.

If the coefficients obtained in column (3) would be significative, I could not only assess if employment is affected in a positive or negative way by the minimum wage, depending on the sign of the value reported, but those results would allow me to translate the estimated treatment effects into aggregated effects. In order to provide a benchmark for the absolute nationwide impact of the

minimum wage and to predict the relative and absolute employment effect for the German labor market, we could multiply the estimated treatment effects with the regional bite level. In this way, it is possible to find the relative employment effects, which are put in relation to the employment level in 2014 to estimate absolute effects. The results would then tell us, on average, what is the relative reduction in overall employment in percentage points, and also the estimation of the actual head count of the number of jobs loss due to the wage floor.

I then analyzed separately marginal and regular employment, as mini-jobs are of special interest for the wage evaluation since the effects are expected to be larger for this group. Panel B shows the effects of the introduction of the minimum wage on regular employment, while Panel C focuses only on mini-jobs. This last type of employment is characterized by monthly income up to €450, and for this reason it is of specific interest for the analysis. Marginal employed earn low gross hourly wages and pay small social security contributions. The regression is structured in the same way of the one for overall employment, but the dependent variable only accounts for those individuals who belong to the category of marginal employed, excluding in this case part-time and full-time employment.

Table 3 shows the number of observations of individuals employed and the percentage for the three different groups. It is clear how results for regular employed will be much more similar to the results analyzed for overall employment before since the percentage of mini-jobs is only 10.83%. From the common trend analysis, it emerged that marginal employment already declined in highly-affected regions even before the introduction of the reform. My expectations were to find a stronger negative effects from 2015 on, indicating that the additional reduction is due to the introduction of the wage floor. I decided to look at these two groups of workers separately also to disentangle effects on the regular employed from effects on the generally more affected marginally employed. With the minimum wage introduction and the corresponding wage effect, some marginally employed exceed the threshold of €450 if their working hours are not reduced simultaneously. When exceeding the threshold a worker can switch to a midi-job, defined by an income between €450 and €850. A reduction in mini-jobs does not necessarily result in rising unemployment, but may be associated with an increase in the demand for regular employment. My expectations from the estimation were then to find a shift from mini-jobs to part time employment, with a small negative value for the coefficients of Panel C, while almost no effect in the case analyzed in Panel B. However, the coefficients of the interaction terms between the bite in 2014 and other years for regular and marginal employment are not significative, thus I cannot conclude

how the reform affected these two categories differently. Nevertheless, these result go in the right direction, since it is possible to assess that the non significative coefficients may be caused by monopsonistic aspects of the German labor market. Accordingly, the model of monopsony predicts that the introduction of a minimum wage does not affect employment as in the case of a competitive labor market. Moreover, the coefficients obtained have very low values, making the impact of the minimum wage neglectible even in the case of significative levels.

3.4.2. Results by gender

Joan Robinson's original application of monopsony was to gender pay gap and Manning supported the research on this issue, finding that the quit elasticity of women is, on average, lower than that for men, implying that firm owners can exercise more their market power over females than males, perhaps because women face greater constraints on the jobs they can take, mainly due to households' responsibilities. Given the over-representation of women in low-wage occupations, minimum wages can also make a significant contribution towards lower gender pay gaps. An important assumption in order for this intervention to reduce gender inequality is that the labor market policies do not directly or indirectly discriminate against vulnerable group of workers, for example by setting lower wage floors in sectors held by women.

I repeated the same estimation, looking at the overall employment level of females and males separately, to capture the impact of the wage floor on these groups. The total number of observations decreased compared to the previous estimation divided by category of workers since I discarded all those regions that resulted in less than 30 observations after separating the population by gender. In this way I have a total of 509 observation in the final dataset for females and 504 observations for males, while I only considered 89 ROR observation in 2014 for females and 67 for males. Analyzing the summary statistics in Table 11 and Table 12 for the bite in 2014 for men and women, it is clear that the average regional share of women earning a wage lower than the new minimum is considerably higher than men.

Table 11. *Women's bite in 2014*

Variable	Observations	Mean	Std. Dev.	Min	Max
Bite 2014 Female	89	0.2354	0.0721	0.0882	0.4516

Summary statistics for women's regional bite level in 2014.

Table 12. *Men's bite in 2014*

Variable	Observations	Mean	Std. Dev.	Min	Max
Bite 2014 Male	67	0.1765	0.0607	0.0469	0.3718

Summary statistics for men's regional bite level in 2014.

Table 13. *Males and Females*

	Males	Females
Bite x y2012	0.7551*	0.2976
	(0.419)	(0.233)
Bite x y2013	-0.0658	-0.0777
	(0.329)	(0.270)
Bite x y2015	-0.1935	0.0054
	(0.203)	(0.156)
Bite x y2016	-0.1154	0.2451
	(0.205)	(0.258)
Bite x y2017	0.2186	0.2481
	(0.305)	(0.287)
GDP (*log, t*)	0.2749	-0.1570
	(0.305)	(0.480)
Population (*log, t*)	-.01154	0.7507
	(0.205)	(1.013)
Constant	-9.7995	-6.0014
	(13.527)	(13.426)
Region and Year FE	YES	YES
Observations	504	509
R^2	0.9659	0.9723

Note: Robust standard error in parentheses, *p<0.1, **p<0.05, ***p<0.01. Dependent variable is overall employment (divided by gender) in logarithmic terms. Reference year in all specifications 2014.

The coefficients of the interaction terms between the bite and years shown in Table 13 are not significative for the estimation of employment effects for both males and females. Therefore, I cannot conclude that women suffered more by a reduction in their employment level due to the fact that their average wage level is lower, and thus the treatment intensity is higher, as shown by the summary statistics above. However, as in the previous estimation that distinguish individuals by their type of employment, this may be a sign of monopsonistic aspects of the labor market, which make it unclear the employment effects of the introduction of a minimum wage. Also, in the estimation divided by gender, the coefficients present low values, which do not impact employment even in the case of significative results.

3.4.3. Results by level of education

Additionally, I evaluate the employment effect of the minimum wage reform, looking at the different impact it has on two different categories of individuals, according to their education level. Through the variable that assess if the individuals obtained a university degree or not, I divided the RORs into two percentiles: low and high percent of degrees. In the years before the introduction of the reform, the number of respondents that obtained a degree is too low and I was not able to compute the coefficients of the interaction between the bite in 2014 and those years. Therefore, I only tested the common trend assumption for low education, which is not completely verified since the coefficients for 2013 is significative, meaning that employment was already affected by some anticipation effects before the introduction of the reform in 2015. However, the coefficient is not highly significative, and for 2012 the common trend assumption is verified.

Dividing population in these two percentiles I would expect that low education individuals earn on average an hourly wage lower if compared to the other percentile of population with a higher percentage of individuals that obtained a university degree. Therefore, according to my expectations, low education should display a stronger negative employment effect (or less positive) compared to high education.

The sign of the coefficients of the interaction terms between the bite in 2014 and other years are in line with my ex-ante expectations. Looking at the results for low education in Table 14, the estimation suggests that an increase by one percentage point in the Fraction in 2014 results in a decrease in the employment level of the population for all years considered, particularly for 2017. Comparing these results with high education, we can see how the sign of the coefficients

suggests the opposite impact of the minimum wage on employment: an increase in the bite in 2014 have a positive effect on employment for all the years after the introduction of the reform. The coefficients are not significative; therefore, I cannot conclude that low education individuals suffered more by a reduction in their employment level due to the fact that the level of their wages was indeed lower, and they were affected more by the reform. The only significative coefficient is the one of the interaction between the bite and year 2017 for high education, suggesting that in the short term, those individuals benefit from positive employment effects, which may signal monopsonistic aspects of the labor market, according to the theoretical expectations of the monopsony model.

Table 14. *Low and High Education*

	Low Education	High Education
Bite x y2012	-0.6550	0
	(0.529)	
Bite x y2013	-0.5127*	0
	(0.295)	
Bite x y2015	-0.2904	0.0111
	(0.290)	(0.214)
Bite x y2016	-0.5901	0.2067
	(0.977)	(0.260)
Bite x y2017	-1.1987	0.6684**
	(0.509)	(0.327)
GDP (*log, t*)	-0.4338	0.5136
	(0.732)	(0.507)
Population (*log, t*)	2.3957	0.3194
	(1.965)	(1.286)
Constant	-25.6625	-1.5507
	(25.452)	(17.600)
Region and Year FE	YES	YES
Observations	128	213
R^2	0.9764	0.9930

Note: Robust standard error in parentheses, *p<0.1, **p<0.05, ***p<0.01. Dependent variable is overall employment (divided by education level) in logarithmic terms. Reference year in all specifications

4. Conclusions

The Statement of President Ursula Von Der Leyen made it clear how it is becoming more and more relevant to ensure equality and fairness in the labor market. One of the probably reasons for the current revival interests in monopsony is anxiety about the rise in equality, the fall in labor share and a vaguer feeling that the balance of power between workers and employers in the labor market has shifted to the advantage of business. Although not monopsony in the strictest sense, labor markets are characterized by important elements of monopsony power and this issue is becoming clear beyond any reasonable doubt. There still is a number of economists who stick to the view that assumes labor markets as better represented by the perfectly competitive model, but several studies estimated considerable amount of market power. According to these researches, labor market interventions by the government would not result in a social welfare loss, but they could improve total benefits. The introduction of a statutory minimum wage is the instrument analyzed in this paper, trying to predict what the effects could be, taking into account the assumption that the labor market could actually be characterized by monopsonistic aspects. In this sense, not only it would result in an increse in the level of average wages, but also employment effects could be positive since employees are paid below the marginal product of labor beforehand.

The introduction of the Minimum Wage Reform in Germany was preceded by long debates about the expectations – predominantly negative – on employment effects. Critics of the reform predicted a massive job loss in the long-run, while those in favor of the reform considered fundamental to intervene in the labor market to reduce the rising wage inequality in Germany. The choice of the identification strategy used to estimate the employment effects of the minimum wage is complicated, due to the fact that the reform applies equally to all German areas and there are very few exemptions. Almost every employee in every region is affected by the wage floor, reducing the set of potential identification strategies. Following the identification approach proposed by Card (1992), which considers regional variation that does not depend on differences in legislation, it is possible to evince that the stronger that a minimum wage 'bites' into the regional wage distribution, the stronger the regional labor market is affected, and so should be the adaptation of labor demand. The imposition of a national wage standard implies the "treatment effect" varies across states depending on the fraction of workers initially earning less than the new minimum. Across regions, earnings and wages differences are caused by structural and environmental diversity. The regional treatment intensity is defined as the eligible share of employees paid less

than the minimum wage prior to the reform (in 2014). My data source is the longitudinal German Socio-Economic Panel (SOEP), which measures differences in resources across individuals, not only at specific points in time but also across the life course. I use the SOEP also to analyze potential anticipation effects and verify that regional wages and employment levels would have followed a common trend in the absence of the reform.

I estimate employment effects on population, analyzing if the minimum wage affected differently various categories of individuals. First, I looked at the impact of the minimum wage on three categories of employment (overall, regular and marginal) controlling for GDP per capita and population size. The coefficients of the interaction terms between regional bites in 2014 and years show the percentage change in employment when the Fraction increases by one percent. The values obtained are not significative, except for the coefficient of the interaction with year 2013, suggesting that the common trend analysis is not verified for overall and regular employment, but only for marginal. This means that there were some anticipation effects even before the introduction of the reform in 2015. However, the values obtained signal only small variation of employment due to the wage floor and the fact that they are not significative may suggest that the labor market is indeed characterized by monopsonistic aspects since, according to the theoretical model of monopsony, it is not possible to predict what are the effects when the government sets a certain level of wages. In the case of the perfectly competitive model, on the other hand, I would expect to find highly significant negative employment effects.

I then looked also at the different impact the reform had on men and women, as it makes sense to expect a stronger impact on employment for women since their average bite calculated is way higher than that for men. This should affect more demand for labor of females, resulting in a negative impact in employment, or less positive compared to men's estimation. Again, the coefficients of the interaction between bite in 2014 and years are not significative. Finally, I looked at results for two more categories of individuals: I divided RORs into two percentiles according to the share of population that obtained a university degree. I expected stronger employment effects for low education individuals than for high education since their hourly wage is on average lower, meaning that the first category is more affected by the introduction of the minimum wage reform. In this case the coefficients are in line with my expectations. The sign for low education is negative, while employment effects for high education seem to be positive. Nevertheless, the coefficients are not significative, except from the one of the interaction between the bite in 2014 and year 2017 for high education. This may signal that the labor market is characterized by imperfect competition.

Although my results do not display significative coefficients, the values obtained are quite different from the negative predictions of 500,000 to 900,000 job losses. One possible explanation could be that I only identify short-term effects, while the effects predicted in ex-ante studies considers a longer period. However, another reason for job losses to have failed may be given by the fact that other channels of adjustments were chosen, such as the reduction in working hours. Anyway, one relevant explanation is the possible existence of a monopsony, where the current minimum wage lies below the marginal product of labor, resulting in no job losses, as predicted by the theory. Moreover, the adaptation of the wage floor from €8.50 to €8.84 and then €9.35 introduces new movement and a possible route for further evaluation.

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