Utrecht University School Economics

Faculty of Law, Economics, and Government

M.Sc. Law and Economics

Master Thesis U.S.E

Eat Your Cake and Have It Too?

The Effect of the Minimum Wage on Employment and Family Income as Evidenced by Germany's Federal Minimum Wage Implementation

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Abstract

This paper analyzes the short-run effects of the minimum wage on employment and the family income distribution, in line with the first two questions posed by Stigler (1946). For this purpose, the thesis examined Germany's recent implementation of a national minimum wage, expanding upon Caliendo et al. (2018). Regional variation in the policy's bite—as well as the presence of a common trend in state employment levels, bite statistics, and the mean family income earned by the bottom 50% of the income distribution—led this study to follow Card's (1992) and conduct a continuous difference-in-difference regression. Based on this paper's regression results, the minimum wage appears to have a small and statistically significant negative effect on the level of overall employment. Furthermore, when separately analyzing the policy's effect on regular and marginal employment, the findings indicate that the minimum wage has a larger negative effect on the latter category. Finally, this study's estimates do not provide evidence that the implementation of Germany's minimum wage led to the increase in family incomes along the lower half of the income distribution. Instead, there is some statistically significant evidence that the policy had a negative effect on the incomes earned by families located in the bottom 10 percent of the distribution. Based on these findings it appears that the minimum wage as a policy is not an effective tool to raise low-income families out of poverty.

Keywords

Table of Contents

Introduction

The question of how to best deal with poverty and inequality has long occupied the minds of scholars and politicians alike. One proposed solution that rose to prominence during the last century was to eliminate the exploitation of workers who were thought to have weak bargaining power by setting—either through legislation or collective bargaining agreements—price floors regarding the lowest level of remuneration that employers can pay their employees. Now, over the last decade, there has been a revitalized call for governments to update their minimum wage laws. This "*Fight for $15*" movement, which gained particular traction in the United States from 2012 onwards but has also spread to other countries across the globe, has called upon federal governments to increase the minimum pay to $15 per hour (Gundersen, n.d.). Although support for such a proposal would have seemed far-fetched 10 years ago, over time the "*Fight for $15*" push has managed to garner endorsements and even get into the political mainstream. In 2016, under pressure from Senator Sanders and labor unions, the Democratic party voted in favor of adding the $15 minimum wage to their party platform (Seitz-Wald, 2016). Four years later, during the 2020 presidential election, then-candidate Joe Biden—along with every other democratic candidate—campaigned on the promise to deliver this federal minimum wage increase (Washington Post, 2020). On April 27th, 2021, President Biden signed an executive order that would see all federal employees and contractors paid at a minimum of $15 per hour, but Congress has not been able to pass an across-the-board federal minimum wage increase (Draeger, 2021). Similarly, in the United Kingdom, the proposal for a £15 minimum wage has been voted for unanimously by the Labour Party Conference (Breese, 2021).

Although the minimum wage has currently regained its prominence among politicians, it is far from a new concept. In fact, the minimum wage, as a form of government regulation that specifies the lowest price at which labor may be employed, has been around since the beginning of the 20th century. The first introduction of a federal minimum wage in the United States came with the passing of the Fair Labor Standards Act of 1938 (Britannica, 2018). The goal of the policy, as explained by President Franklin D. Roosevelt, was simple: to help the ill-housed, ill-clad, and ill-nourished (Burkhauser & Finegan, 1993). Although the policy, in the United States, has gone through numerous transformations that increased the minimum wage from $0.25 to the current $7.25 (US Department of Labor, n.d.), its focus has remained the same: to better the lives of the poor and decrease inequality. As reiterated by Senator Edward Kennedy in 1989, the minimum

wage was supposed to be a "*living wage*" that would allow the working class to provide for their families, feed and clothe their kids, heat their houses, and pay their mortgages (Burkhauser & Finegan, 1993). It is precisely this image of whom the minimum wage is supposed to help that has remained with us and on whom the minimum wage draws its appeal as an antipoverty program. However, as Stigler would point out in the 1940s, the minimum wage as a program also has a cost and the picture that was sketched above by Senator Kennedy ignores any slippage between the implementation and raising of the minimum wage and the actual lifting of people out of poverty (Burkhauser & Finegan, 1993).

For the minimum wage to be presumed a successful antipoverty program it requires two assumptions: (1) the policy needs to indeed increase poor people's income by redistributing wealth from firms' profit margins to low-earning laborers and (2) it cannot impose its own social cost (MaCurdy, 2015). However, as MaCurdy (2015) also points out, firms have in general three options in response to an increase in the cost of labor. First, firms can force the workers to pay for the wage increase by reducing the level or hours of employment. Second, they can pay for the increase in the cost of labor themselves by lowering their profit margins. Finally, companies can make consumers pay for the higher costs through increased prices. Given that there might be evidence that low-wage employers are less likely to have large profit margins—mostly being smaller firms facing great competition in the labor and product market—combined with some evidence pointing to entrepreneurs being highly mobile and leaving industries with too low of a yield, profits might not bear the increased costs, especially in the long-run (Draca et al., 2011; MaCurdy, 2015). Furthermore, if domestic firms that are regulated under the minimum wage law face competitors that are not affected by a similar labor cost increase, they will face a competitive disadvantage and will not be able to pass through these costs as would be the case when the wage shock represents an industry-wide increase (Harasztosi & Lindner, 2019; MaCurdy, 2015). Thus, given that there appears to be at least the possibility that a legislated minimum wage can lead to a decrease in employment or hours employed, it is not possible to assume that this antipoverty and redistributive program does not impose its own social cost. Instead, there is a trade-off in which some low earners stand to gain while others from a similar background stand to lose (MaCurdy, 2015).

Given such unintended slippage and costs, there is a need to empirically estimate the outcomes of the policy as compared to its objectives: does it improve the lives of those it is meant

to help? To examine the policy's results, there are according to Stigler (1946) four arguments that need to be examined. In his paper, the first two questions—*What is the minimum wage's effect on employment?* And *what is its effect on family income?*—deal with measuring whether the empirical outcome of the policy lines up with the policy's aim of bettering the lives of low-income households and are of particular importance to this study. Currently, regarding this first question, depending on the study, the evidence of the effect of the minimum wage on employment is either characterized as established to not reduce employment, to be mixed with no strong conclusion either way, or to be established that the minimum wage decreases employment (Neumark & Shirley, 2021). The second question, how family income is affected by the policy, looks in addition to the elasticity of labor—concerning both jobs and hours—also at the distribution of minimum wage earners across the household income distribution (Leigh, 2007). In other words, for the minimum wage to effectively increase the income of the poor, it needs to also be earned by the poor: If the minimum wage is earned disproportionately by teenagers from affluent families, then it will have less of an effect at increasing household income for low-income families than were it earned by single parents trying to raise their kids (Leigh, 2007). Stigler's (1946) other two questions—*what is the policy's effect on the allocation of resources?* And *what are alternative policies that could accomplish the same result?*—deal with the efficiency of the minimum wage as compared to substitute methods and will not be discussed or examined here.

As alluded to in the previous paragraph, this study will attempt to add to the current literature by empirically answering both of Stigler's (1946) first two arguments—the minimum wage policy's effect on employment and family income—by examining the introduction of the German federal statutory minimum price of labor of €8.50, which was introduced on January 1st, 2015. Before the passing and implementation of this *Gesetz zur Regulung eines allgemeinen Mindestlohns* (Minimum Wage Act), wage floors had been set regionally through voluntary collective bargaining agreements, with some areas having set minimum wages below, at, or above the newly legislated amount (Caliendo et al., 2018). Given the presence of such regional differences between the German States, this paper will follow Card's (1992) suggestion to analyze the variation in intensity to which varying regions are affected by the implementation of a nominal minimum wage, similar to the approach used by Caliendo et al. (2018), but expanding their framework to also take into account potential effects on the family income distribution. Thus, this study will examine whether the degree to which a German State is affected by the minimum

wage—i.e., the size of the minimum wage's bite on a particular region—influences the level of employment and/or the distribution of family income within a particular regional labor market. This research will be using survey data on households and individuals as provided by the German Socio-Economic Panel (SOEP) as well as regional data from Germany's Federal Statistics Office (Destatis) and the Federal Ministry of Labor (Bundesagnetur fur Arbeit).

The rest of the research will be structured as follows. The paper will begin by conducting a literature review to examine what previous studies found regarding the effect of a minimum wage as a policy. This literature background section will be split up into three parts. First, it will describe what previous research has found to be the characteristics of a minimum wage earner. Then, the literature background will discuss what previous studies have found to be the effect of a minimum wage on employment. Finally, there will also be an examination of the effect of a minimum wage on family income, as found by other studies. The information from this research literature will serve both as the foundation for this study's research methodology as well as the theoretical and contextual foundation along which the paper's results will be explained. Next, within the third part of the study—the methodology—the research will explain in detail the origin of the data, give descriptive statistics, formulate the hypotheses, and explain the used empirical model and its setup. Third, the paper will give a detailed overview of the results that were found using the explained models as well as give an interpretation as to what these results indicate. Finally, there will be a discussion of the research's limitations as well as a conclusion summarizing the findings.

Literature Background

1. Characteristics of the Minimum Wage Earner

It appears that the people who are most likely to be affected by the policy—the at-minimum or subminimum wage workers—tend to be younger than the total workforce. In fact, according to Dütsch & Himmelreicher (2020), the probability of earning at or below minimum wages decreases with age. According to evidence from Australia, individuals between the ages of 21 to 24 appear to be overrepresented in the group earning at/below minimum wage levels while persons between the age of 25 to 59 are underrepresented (Nelms et al. (2011). Such results appear to be reflective of Leigh's (2007) research which stated that 32% of the minimum wage earners and 57% of the subminimum wage earners category consist of workers in the age range of 15-24. Thereby giving credence to Leigh's (2007) finding that the median age of subminimum earners is 21 and the

median age of minimum wage earners is 32, while the median age of employed adults is 37. Furthermore, beyond age, there also appears to be evidence that the likelihood of a person being employed in a minimum wage job is tied to a person's sex, with prior research finding that women are overrepresented among those earning salaries at or below the minimum wage compared to the overall working population (Bradley, 2017; Dütsch & Himmelreicher, 2020; Nelms et al., 2011).

Beyond indicators at the level of the individual, there are also common characteristics at the household and employment level. It is estimated by Johnson and Stark (1991) that of the five million families that could benefit from a minimum wage increase in the United Kingdom, approximately two million are two-earner households and another two million are single-earner households without co-dependents. Leigh (2007) finds that only for one-third of the households containing a (sub)minimum wage earner is that earner also the sole breadwinner. Moreover, Leigh (2007) additionally finds that couples are underrepresented among those earning the minimum wage, while single-person households are overrepresented. This finding regarding people in couples is reiterated by Nelms et al. (2011), who also observed that employees who are in a relationship are less likely to earn a salary at or below the minimum wage. However, there is mixed evidence when it comes to single parents: while Johnson and Stark (1991) argue that single-parent families are little affected by minimum wages, Nelms et al. (2011) find that this group is more likely to earn a salary around the minimum wage.

In general, the average family income of a household with a minimum wage earner is found to be only slightly below the average family income (Johnson & Stark, 1991). Although there is a 50% higher chance that if a person from a poor household participates in the workforce, they will be located in the bottom quintile of the income distribution, the median low-wage worker's family income is considered a middle-income household (Leigh, 2007). This is because there are only slightly more low-wage workers found in the bottom 40% of households than the richest 40% (Leigh, 2007), a result explained by the low participation rates among poor households. Such low participation rates occur because the income earned by these individuals entering the labor force not being large enough to offset the loss in benefits that they are currently receiving. This leads to the clustering of (sub)minimum workers around the middle of the income distribution. It should be noted that as a result of the minimum wage this trade-off starts to look differently, thus potentially encouraging people in this group to take up work they otherwise would not have (Johnson and Stark, 1991).

Furthermore, there appears to be evidence that there is an overrepresentation of both part-time workers and individuals under casual and fixed-term employment contracts at the lower end of the income distribution (Nelms et al. 2011). In the case of Germany, there was also evidence that so-called marginally employed workers—a form of employment characterized by a monthly income of €450 and on which the employee pays no income tax while the employer pays a fixed 20% contribution to social security—held the highest risk of subminimum and low wages (Dütsch & Himmelreicher, 2020). Thus, such a form of employment creates a trade-off between the high flexibility it gives these workers and the low earnings that are paired with it. Finally, the risk of earning a minimum wage is also connected to the industry in which a person is active. In fact, the risk of earning a salary at or below the minimum wage is found to be especially more likely in sectors such as agriculture, food and accommodation, and retail (Dütsch & Himmelreicher, 2020; Nelms et al. 2011).

2. The Minimum Wage's Effect on Employment

Theoretically, the possible effects of the minimum wage depend on the ability of the employer to respond to the wage increase; it depends on the market structure (Caliendo et al., 2018). Economic theory, as argued by Stigler (1946), predicts that under a perfectly competitive market regime, either one of two results must be found: either those workers whose services—marginal output—are worth less than the minimum wage are discharged, or their productivity must increase. In such a setting, the aggregate output can only increase if the workers' output increases and this productivity increase can only come from an increased effort on behalf of the laborers or a switch to different production techniques (Stigler, 1946). There has, as shown by Riley and Bondibene (2017) indeed been evidence of growth in firm productivity after increases in minimum wage levels. This is mainly due to those firms having substituted labor for other production factors or having expanded the firm's investment in intangibles such as training and innovation (Riley & Bondibene, 2017). The latter is particularly the case in monopsony markets where the firm can exploit the training's rents (Riley & Bondibene, 2017). Therefore, it appears that in perfectly competitive markets such an increase in the cost of labor is paired with cuts in employment (Card & Krueger, 1993). This is, as explained by Brown and Kohen (1981), because when wages are located above the equilibrium rate, employers will respond by using less of it, which in turn creates an excess supply of labor since fewer jobs get distributed among more workers. In other words,

the additional revenue produced by the least productive worker will not be high enough to justify their wage (MaCurdy, 2015). In an expanding labor force, the minimum wage would translate into a lower growth of jobs available (Brown & Kohen, 1981). Given this relationship, the higher the minimum wage is set, the larger the pool of affected workers but also the greater the number of currently covered workers who would be discharged (Stigler, 1946). This is especially relevant given that empirical literature has also provided evidence that an increase in the level of the minimum wage also leads to a rise in other wages, potentially further amplifying the policy's negative effect on employment (Cahuc & Michel, 1996).

There are three clear alternatives possible to the result found under perfect competition. First, you expect to find such negative effects on employment in market settings where the employer is a competitive price taker, however, this effect is not necessarily implied by a more monopsonistic demand (Caliendo et al., 2018). Therefore, the employment effects of the minimum wage are very dependent upon the specific conditions and institutional framework that are found in a respective market (Strobl & Walsh, 2011). Depending on how skillfully the level at which the minimum wage is set, a monopsonist's demand for labor may increase since he currently pays his employees below their marginal product of labor (Brown & Kohen, 1981; Caliendo et al., 2018). Secondly, if the market in which the firm operates functions less than competitively, then the increase in the price of labor might shock the employer into increasing his productivity (Brown & Kohen, 1981). Additionally, Stigler's idea that a higher minimum wage needs to lead to a larger number of discharged workers only holds, according to Strobl and Walsh (2011), if the firm operates in a framework where the labor input can be thought of as total hours worked. However, it may be that hours per worker have a diminishing marginal return. Lastly, as one moves away from the assumption of perfect competition in the labor market and toward monopsony, the elasticity of demand for labor is in line with the Hicks-Marshall rule of derived demand (Harasztosi & Lindner, 2019). This implies that the firm's response to a change in the minimum wage is dependent upon the cost-share of the varying factors of production, the substitution elasticity of labor and the other production factors, and the firm's output demand elasticity. This last factor, as explained by Harasztosi and Lindner (2019) implies that if a single firm is affected by the wage shock, its output demand tends to be highly elastic.

Although the empirical effects of the minimum wage remain heavily debated, Neumark and Shirley (2021) find that there exists a preponderance of negatively estimated effects of the

minimum wage on employment. In their summarization of the existing literature, it appears that approximately 78.9% of the conducted studies have found that increasing the minimum wage decreases employment. Roughly 54% of those same studies found that this effect was significant at a 10% significance level and 46% at a 5% significance level. The reduction that has been found over the last 40 years of empirical studies is relatively small (Burkhauser & Finegan, 1993). Most findings are similar to that of Brown and Kohen (1981), which see that a 10% increase in the minimum wage reduces employment led to a 1-3% decrease in employment, or to Harasztosi and Lindner (2019), which find that firms highly exposed to the minimum wage still employ fewer workers than their less exposed counterparts years after the implementation. However, others, such as Card and Krueger (1993) who examined the effect of a minimum wage increase in New Jersey on its fast-food industry compared to Pennsylvania which did not have this increase, did not find evidence of reduced employment. Hoffman and Trace (2009) performed a second study on those same two states and found evidence that workers who were more likely to be affected by the minimum wage were also more likely to be negatively affected, particularly non-teens with less than a high school degree. Furthermore, there appears to be strong evidence that the negative effects of the minimum wage are stronger for young adults and teens and the less educated (Brown & Kohen, 1981; Burkhauser & Finegan, 1993; Neumark and Shirley, 2021). Mincer (1976) finds that hikes in the minimum wage lead to a move of labor into the non-covered segment of the labor market, putting downward pressure on those labor prices. They also found that only a third of the employment loss caused by the disruption goes into unemployment with the rest withdrawing from the labor market.

3. The Minimum Wage's Effect on Family Income

The main rationale for the minimum wage has always been that it would lead to improvements in income distribution by raising low-income households out of poverty (Neumark et al., 2006). Given this primary goal, estimates of the policy's effect on employment will indicate relatively little about its ability to accomplish this goal (Neumark et al., 1998). Negative employment effects may represent the main cost of the policy, but the existence of such a cost in and of itself does not imply the regulation is a bad policy: Although the minimum wage could distort prices—and by extension reduce efficiency—all other redistributive regulations do so as well. Thus, the question regarding the viability of the minimum wage as a policy tool becomes a

political inquiry as to whether the benefits of income redistribution outweigh its cost (Neumark et al., 1998). Therefore, it is important to also examine the potential benefit arising from the policy in terms of its effect on the wage distribution and the incomes of low-income families.

If one assumes that job losses occurring only among those laborers directly affected by the policy are the only cost of the policy and that all the wage effects are found to top off salaries up to this new lowest price of labor, it is possible to easily find the approximate income effect of the policy on a particular subgroup using a methodology provided by Neumark et al. (1998). To estimate this effect, one first estimates the demand elasticity for minimum wage workers within a particular subgroup by finding the demand elasticity for a particular subgroup as a whole and dividing this value by the percentage of the subgroup that is classified as directly affected by the minimum wage. Next, this value is adjusted to reflect the idea that the average wage increase for the affected workers is less than the percentage increase of the minimum wage itself. This corrected elasticity can then be used to calculate the number of subgroup workers that would lose their job and, by extension, the number of laborers that would remain employed. Using this information, Neumark et al. (1998) calculate the income effect as the average percentage increase in income multiplied by the percentage of workers that kept their job minus the fraction of workers who lost their job and 100% of their income. In this scenario, as long as the job losses are solely concentrated among low-wage workers, or the average wage increase is smaller than the percentage increase in the minimum wage, then the non-corrected employment elasticity for the policy will overstate the gains received by low-wage workers (Neumark et al., 1998).

Furthermore, solely looking at individual income is not enough to determine whether the policy improves the standard of living for poorer households. This is according to Stigler (1946) because we cannot expect a close relationship between the hourly rate with which one is paid and their family income due to four issues. First, hourly rates are only effective for those who earn them and, as has already been established previously in the paper, the workers with the lowest productivity might be forced into unemployment. Additionally, issues such as seasonality and overtime reduce the correlation between hourly and annual wages. Next, given that family wages are the sum of the earnings of all workers in a household, there can be considerable variation within total household earnings. Lastly, wages are not the only component that constitutes a person's earnings. Therefore, the connection between below-median wages and family income has, according to Burkhauser and Finegan (1993), seriously weakened since 1939, mainly due to the

rise in multiple earners within a family. However, at its core, any impact the minimum wage might have on low-income households depends on three factors: the distribution of minimum wage earners across the household income distribution, the labor demand elasticity, and the elasticity of hourly wages (Leigh, 2007).

Unfortunately, there have been relatively fewer empirical investigations into the effect of the minimum wage on family income compared to the large and active literature on the policy's employment effects (Dube, 2019). When looking at the short term, most of the literature has indicated rather unanimously that minimum wages either do not deliver much in terms of benefits or result in adverse effects on poor families (Neumark et al. 2006). There are several factors as to why the government's influence on relative wages may be limited: there could be spillovers from sectors covered by the policy to uncovered industries or there could be noncompliance with the law on behalf of firms (Gramlich et al., 1976). This latter effect would be fully rational on behalf of companies when the expected value of the penalty for non-compliance lies below the cost of increasing wages to the new minimum level.

Additionally, there are also further plausible reasons as to why the minimum wage regulation is unable to deliver its redistributive promise. First, the policy may also force other wages to increase, leading it to alter the overall wage levels rather than the wage structure and thus not decrease inequality (Gramlich et al., 1976). Such an overall increase could occur due to labor unions or other collective bargaining groups emulating the wage increases stipulated or through substitution away from low-wage labor towards high-skilled substitutes. There is, according to Sabia (2015), evidence of such a redistribution of productivity from industries that employ a large fraction of low-wage workers to high-skilled industries occurring, with a 10% minimum wage increase decreasing the GDP generated by low-skilled sectors by 1-2% compared to their highly skilled counterparts. Next, the poverty-reducing effect of the policy may be limited due to the small number of low-wage workers that are either located in poor families or that are occupied full time (Mincy, 1990). Moreover, given that one of the policy's main appeals is its effect on the income distribution, the imperfect correlation between hourly wages and family income— stemming from factors previously explained by Stigler (1946)— needs to be taken into account. As Gramlich et al. (1976) show, such a loose correlation leads the minimum wage to not have a strong redistributive effect: For every billion dollar increase in low-wage earnings caused by the minimum wage, only $350 million goes to families with incomes below the median. These factors

are reflected by a large number of teenagers and women represented in the low-wage working population (approximately 77%), both of whom choose to work less than full time to take care of children or go to school (Mincy, 1990).

The effect of the minimum wage on household income is ambiguous: The size of the disemployment effect by itself does not indicate what the effect on total low-income household earnings will be. Even in situations where the loss of employment is modest, minimum wages may have led to net income losses for low-income families, especially in the short-run. According to Neumark et al. (1998), although minimum wages are found to increase the earnings of some low-income families, the evidence indicates that the overall short-run effect is to increase the proportion of poor and near-poor households while decreasing the proportion of families with incomes 1.5 to 3 times the poverty level. On the other hand, in the medium to long-run, the policy might induce affected low-skilled workers to accumulate more human capital by taking up training or schooling (Cahuc & Michel, 1996). This is reiterated by Dube's (2019) finding that in the long-run—which he defines as more than three years—there is robust evidence that the higher the level of the minimum wage is set, the larger the earnings of the people at the bottom of the family income distribution increase. He finds that the long-run poverty elasticity with respect to the minimum wage lies between -0.22 to -0.46 and that this reduction affects all households whose earnings are located between 50% and 125% of the US federal poverty threshold.

Methodology

1. Data and Descriptive Statistics

To examine the relationship between the minimum wage and its effect on a country's levels of employment and family income, this study takes advantage of Germany's recent federal minimum wage introduction. Before the passing of their so-called *Gesetz zur Regulung eines allgemeinen Mindestlohns* (Minimum Wage Act), which set the nationwide minimum price of labor at €8.50 per hour (which increased to €8.84 in 2017), wage floors had been set regionally and mainly through industry-specific collective bargaining agreements (Caliendo et al., 2018). This means that before 2015, there was severe variation in the negotiated minimum wage accords at both state and industry levels, allowing this study to take advantage of such cross-sectional variations when examining the bite of the minimum wage. In determining the measurement for the minimum wage bite statistic, this paper follows the methodology of Caliendo et al. (2018), using

their two measures: the Kaitz index and the Fraction. This first bite statistic (the Kaitz index) is the ratio of the monthly minimum wage to the regionally earned mean monthly wage. The second variable (the Fraction) is simply the ratio of affected workers—workers who earned at or below the monthly minimum wage—to the total number of workers within the sample.

Given the fact the minimum wage was passed as a minimum per hour of work rather than per month and the SOEP only contains data on monthly wages, this paper follows Holtemöller and Pohle's (2020) method of defining the threshold of monthly minimum wage by multiplying the minimum hourly wage by the average weekly hours worked per state and a scaling factor ($Monthly\ Minimum = 8.5 * \frac{\sum weekly\ hours_{ij}}{n} * 4.35$). Furthermore, this study also defines the geographic scope of regional labor markets as the German states, in line with Holtemöller and Pohle's (2020). This implies that the paper differentiates Germany into sixteen distinct regions, as can be seen in Appendix A. To analyze and describe the data, this study follows the approach used by Caliendo et al. (2018) and divides each German state into one of three categories—low, medium, and high—based on the combination of their bite levels (the product between the Kaitz index and the Fraction) at the time the minimum wage was implemented. The cut-off points are set in such a way that each category will contain approximately 33% of the states. The classification of individual states can be found in Appendix A. Furthermore, based on the information from the German Federal Statistical Office (Statisches Bundesambt), this paper distinguishes between thirteen industries within each state, as seen in Appendix A.

The constructed dataset utilizes a variety of data sources to obtain and/or generate the information used in the model and which is described in Table 1. This study, as mentioned in the introduction, utilized the German Socio-Economic Panel (SOEP) to find longitudinal data at both the individual and the household level for each German State. The SOEP panel was chosen because it is an annual and representative longitudinal study of approximately 30,000 German individuals and 18,000 households that began in 1984 and whose surveys take place on an annual basis. This survey panel allows us to find information regarding net incomes as well as individuals' gross earnings and actual hours worked in the month before the survey. Further information regarding the German states' employment levels was retrieved from the German Federal Employment Agency (Bundesagnetur fur Arbeit). Furthermore, information regarding the net level of migration for each state, the regional number of employees within a particular market sector, and the regional level of GDP growth were retrieved from the German Statistische Bundesamt.

Table 1

Descriptive Statistics: All States, Timeframe 2010 - 2015

Variable	Unit of Measurement	Mean	Std. Dev.	Minimum	Maximum
Employment Level	$\dfrac{Employment}{Population}$	0.4267	0.053	0.350	0 .571
Household Income	$\dfrac{Household\ Income}{Household\ Size}$	694.39	60.27	571.31	863.66
Kaitz index	$\dfrac{Monthly\ Minimum}{Average\ Wage}$	0.5702	0.085	0.427	0.741
Fraction	$\dfrac{Total\ Affected\ Employees}{Total\ Employed\ Individuals}$	0 .315	0.0382	0.202	0.3927
Net Immigration	$\dfrac{Total\ Net\ Immigration\ Inflow}{Population}$	0.0056	0.0044	-0.0003	0.0203
Economic Growth	Annual percentage	3.40%	1.61%	-0.948%	8.00%

Notes: All data except for Economic Growth and Inflation are measured at the state level. Economic Growth and Inflation are measured at the Country level. The Kaitz index and Fraction information as shown in the table were calculated for each year assuming the €8.50 minimum wage had been implemented during that year. Household Income refers here to the per person household income earned by individuals in the bottom 50% of the family income distribution.

2. Model Validity

For this study to follow Caliendo et al. (2018) in applying the methodology of Card (1992) by conducting a continuous difference-in-difference regression it requires a valid common trend assumption prior to implementation of the minimum wage. In this case, as explained by Caliendo et al. (2018), there needs to be a common trend in both the level of employment and family income, as well as in the wages in all areas: In absence of the reform, both variables ought to have developed equally in all states. To test this assumption, a graphical examination is conducted as to whether there was an equal trend pre-treatment. Following Caliendo et al. (2018), this paper uses the previously mentioned categorization of the German states based on the minimum wage's regional bite to plot the developments in employment, family income, and wages for each type of state.

When analyzing the development of each category's mean level of employment-to-population—as can be seen in Graph 1—it appears that there is evidence that the level of employment would have followed a parallel trend in the absence of the minimum wage legislation. The level of employment is consistently higher in low bite states than it is in medium bite states,

whose employment levels in turn are consistently higher than those of the high bite states. Furthermore, based on Graph 1, the percentage point difference between each category appears to remain remarkably consistent throughout the entire time horizon. Next, the graphical analysis of the mean family-wage per household member—as seen in Graph 2—indicates that there is a clear common trend between the low and the medium bite regions before the implementation of the federal minimum price of labor. However, the high bite states appear not to follow such a common trend, instead taking a slightly different path by not decreasing between 2012 and 2013. Note that for each of these four graphs, the yearly observations refer to measurements on June 30th.
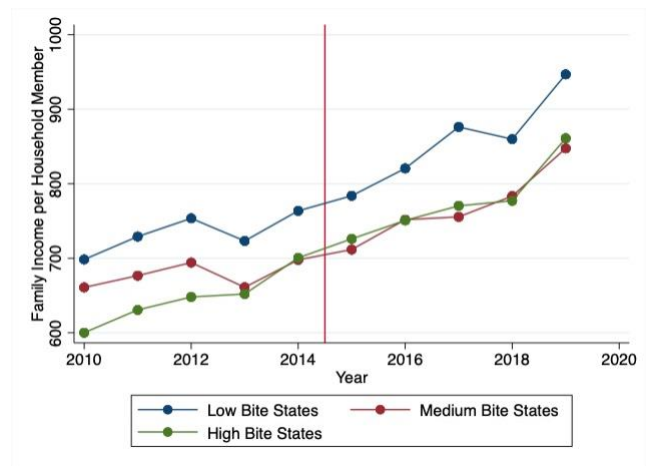
Graph 1

The Mean Level of Employment-to-Population by Category over Time
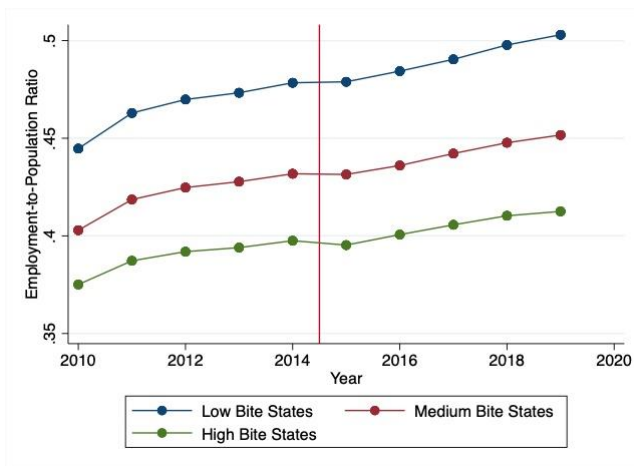
Graph 2

The Mean Family Wage per Household Member bottom 50% Distribution by Category over Time

Lastly, the potential common trend in the development of wages during the period before the minimum wage legislation was studied by plotting both the mean level of the Kaitz index and the mean level of Fraction for each of the three categories of states. As can be seen in Graph 3, there appears to be a clear indication of a common trend in the mean Kaitz index, especially after 2011. This trend even appears to hold beyond the minimum wage's implementation. The mean Kaitz index for high bite states appears to consistently remain above the medium bite states, which in turn remained consistently above the low bite states, all of whom appear to experience a similar significant decrease between 2013 and 2014. Furthermore, when instead of looking at the

categories' mean Fraction, as described in Graph 4, there also appears to be evidence of such a common trend, although there are some slight differences in the trend lines between the different types of regions. From 2010 to 2011, the median bite states appear to follow a slightly different path than the other two categories, while between 2012 and 2013 it is the high bite states that differ slightly from the others.
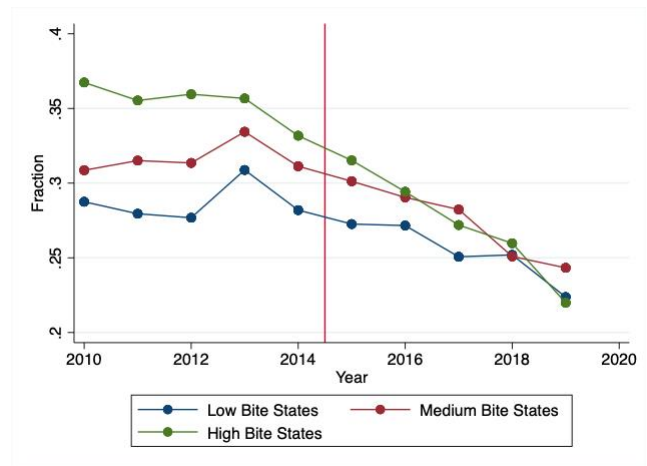
Graph 3

The Mean Level of Kaitz index by Category over Time
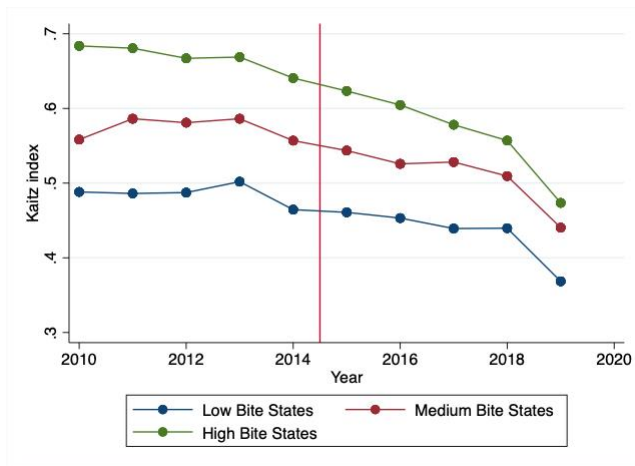
Graph 4

The Mean Level of Fraction by Category over Time

The graphical results regarding wages and employment are in line with the results found by Caliendo et al. (2018), which gives credence to the idea that the different categories of regions followed a joint trend up to 2015 both in the development of wages and in the development of employment. Therefore, this paper is allowed to make use of the methodology proposed by Card (1992) and apply a continuous difference-in-difference model similar to what was applied by Caliendo et al. (2018), to examine the effect of a minimum wage on employment. Furthermore, the graphical analysis concerning the development of family income indicates that a common trend can also be assumed to be present between the low and the medium bite regions. Thus, the paper will also apply a similar methodology as it does for employment—a continuous difference in difference model—to examine the effect of the minimum wage on family income development, limiting itself to only using the two groups for which this trend assumption was found to hold.

3. Hypotheses

Following previous literature, this study will attempt to answer what the empirical effects of the minimum wage as an antipoverty program are. Specifically, two effects will be considered: The effect of the minimum wage on employment and the effect of the minimum wage on household income earned by lower-income individuals. The first effect measures the policy's social cost while the second effect measures the effect it brings on the income distribution. In case both these effects are negative (the policy decreases employment and decreases household income), the policy's cost is ipso facto larger than its benefit, while if both are positive the benefits are larger than the costs. If, however, one is negative while the other is positive, then the viability of the policy depends on a political calculation. To conduct this empirical examination, this study will attempt to answer the following hypotheses:

Hypothesis 1: *The bigger the minimum wage's bite—the higher the minimum wage is set relative to the mean wage earned within a particular region (Kaitz index) or the more people are affected by its implementation within a certain area (Fraction)—the more negative the minimum wage's effect on employment will be.*

Hypothesis 2: *The bigger the minimum wage's bite—the higher the minimum wage is set relative to the mean wage earned within a particular region (Kaitz index) or the more people are affected by its implementation within a certain area (Fraction)—the more positive the minimum wage's effect on family income in the lower parts of the distribution will be.*

This first hypothesis is based on Stigler's (1946) idea that the higher the minimum wage is set, and the larger the pool of affected workers is, the greater the number of currently covered individuals that will be discharged. It implicitly assumes that the labor market operates under perfect competition. The first part of this hypothesis—that the relative size of the minimum wage partly determines the effect on employment—stems from the fact that when the market operates under perfect competition (Card & Krueger, 1993; Stigler, 1946), or under a regime in between perfect and monopsony competition and thus is governed by the Hicks-Marshall rule of derived

demand (Harasztosi & Lindner, 2019), the reaction to a minimum wage increase will be dependent upon the elasticity of labor. In other words, when the competitive price of labor lies below the legislated minimum wage, employers will respond by using less of it (Brown & Kohen, 1981; MaCurdy, 2015). Thus, while keeping other factors affecting labor demand equal, this would imply that the larger the increase in the price of labor—ergo, the larger the bite as measured by the Kaitz index—the larger the decrease in labor demand. The second part operates under the same market assumptions as previously mentioned and argues that the larger the pool of affected workers is, the larger the effect of such a legislated minimum wage will be. This means, according to Stigler (1946) and Leigh (2007), that the larger the pool of affected laborers is before the implementation, the larger the number of currently employed individuals will be affected, both in terms of those whose situation will improve and those who will become unemployed.

The second hypothesis is based on Stigler's (1946) idea that the minimum wage's effect on unemployment alone is not in and of itself sufficient to determine the overall effect of the legislated minimum price of labor as a policy. Given that the main rationale for its implementation, as argued by Neumark et al. (2006), is its effect on improving the income distribution by raising low-income families out of poverty, one has to look at whether the policy improves the standard of living among the bottom percentiles of households. This effect needs to be examined, since, according to Leigh (2007), the policy implementation will decrease the household income inequality among those that keep their job while displacement effects may reduce the total income received by the low-wage households. If the policy's assumed effect of improving the living situation among poor families holds, this would imply that the larger the effect of the minimum wage as measured by the Kaitz index and Fraction, the larger the increase in household income among the bottom of the distribution, ceteris paribus other factors that may affect household income.

4. Empirical Model

To examine the first hypothesis—that the minimum wage's bite affects the level of unemployment—this study utilizes two models to measure this relationship. The first model, as can be seen in Equation (1), aims to measure whether the size of the minimum wage's bite affects the total level of employment. This model will be running twice: once using the Kaitz index and once using the Fraction. Next, the model from Equation (1) will be re-estimated, this time

analyzing the effect of the minimum wage's bite separately for marginal employment and regular employment. As a timeframe, given that we examine the short-term impact of the minimum wage, all models look at a period that begins in 2010 and goes up to and including 2015. This is because in 2016 the German Government announced that it would increase the minimum wage to €8.84. The second hypothesis aims to analyze the effect of the minimum wage's bite on the level of family income. This study will utilize a model similar to what was used when testing the first hypothesis. The only difference is the addition of certain control variables for state migration levels and regional sector-specific job levels. This regression Equation can be seen in Equation (2).

(1) $$Employment_{i,t} = \beta_0 + \beta_1 BITE_{i,2014} * Post + \beta_2 GDP_{t-1} + \beta_3 POP_{i,t} + \beta_4 R_i$$
$$+ \beta_5 T_t + \varepsilon_{i,t}$$

(2A) $$Income_{i,t}^c = \beta_0 + \beta_1 BITE_{i,2014} * Post + \beta_2 GDP_{i,t-1} + \beta_3 POP_{i,t} + \beta_4 MIG_{i,t}$$
$$+ \beta_5 \lambda_{i,t} + \beta_6 R_i + \beta_7 T_t + \varepsilon_{i,t}$$

In the above models, *Employment* refers to the natural logarithm of employment-to-population within a particular German State and year. *Income*, on the other hand, refers to the natural logarithm of regional mean income earned up to and including a particular percentile C of the income distribution during a particular year, in line with the methodology applied by Neumark et al. (2006). The treatment effect of the minimum wage's implementation is estimated in Models (1) and (2) by the coefficient of the interaction term between the *BITE* and the variable *Post* which is a binary variable equal to one for the years after the passing of the minimum wage legislation. As can be seen from the model, both the Kaitz index and Fraction are locked in their value the year before the minimum wage implementation as this is argued by Caliendo et al. (2018) to be the policy's bite. The GDP_{t-1} variable indicates the level of economic growth within Germany during the previous year. This variable is added to control for any potential macroeconomic fluctuations that could impact the conditions in the labor market. The variable *POP* refers to the natural logarithm of a region's population level. Furthermore, as previously mentioned, Model (2) contains additional control variables—λ and *MIG*—which respectively refer to a vector variable for all state industry-specific employment levels and to the natural logarithm of migration into a particular state. The interstate migration control variable is added because there is some empirical evidence

suggesting that migration may cause modest negative effects on wages earned by low-skilled workers (Orrenius & Zavodny, 2007). The additional controls for state level industry-specific employment levels were added to control for changes in wages due to shifts in employment towards a higher or lower-paying industry (Keller, 2009). Finally, the variable T controls for any potential time fixed effects while R controls for potential regional fixed effects, similar to Caliendo et al. (2018).

Results

1. The Relation Between Minimum Wage Bite and Unemployment

To test whether the size of the minimum wage's bite affects the level of employment, the first hypothesis is tested by running the regression seen in Equation (1) for the total level of employment as well as for regular and marginal employment. This model aims to test whether the relative size of the minimum wage—measured either as the level of the minimum wage relative to the regional mean wage or as the share of affected workers—has a significant negative effect on the level of employment. Beginning with the legislation's effect on total employment, the regression results for Equation (1), as seen in Table 2, indicate that there is a significant negative treatment effect whose coefficients, depending on the measurement of the minimum wage's bite as either Kaitz index or Fraction, are either -0.035 or -0.087 respectively. Quantifying the minimum wage's bite using the Kaitz index, this paper finds that a one percentage point increase in the level of minimum wage relative to the mean wage leads to a decrease of 0.035% in the level of total employment, ceteris paribus. Meanwhile, if the policy's effect is measured purely as the number of people directly affected by the legislation to the total people employed, a one percentage point increase in this fraction is found to decrease the level of total employment by 0.087%, ceteris paribus. Both these results indicate statistically significant small negative effects that are in line with the results found by Caliendo et al. (2018), who find that a percentage point increase in Fraction decreased total employment by between 0.03% and 0.089%.

Table 2

Model 1: The minimum wage effects on the overall employment rate, 2010 – 2015

	(1) Total Employment	(2) Total Employment
Kaitz * Post	-0.035 **	
	(0.016)	
Fraction * Post		-0.087 *
		(0.0459)
GDP_{t-1}	0.0004	0.0004
	(0.0011)	(0.0011)
POP_t	0.355 ***	0.373 ***
	(0.081)	(0.079)
Constant	-6.221 ***	-6.487
	(1.218)	(1.197) ***
Time & Regional Fixed Effects	Yes	Yes

Robust Standard errors in parentheses
* = p<0.1, ** = p<0.05, *** = p<0.01
Note: Sample size for both regressions consisted of 80 observations

Next, the same Equation (1) was used to separately examine the policy's effect on regular and marginal employment (so-called mini jobs), as can be seen in Table 3. Turning first to the policy's effect on marginal employment, the model finds that the minimum wage negatively affects the level of marginally employed individuals when using the Fraction as a measure of the minimum wage's bite and that such effect is statistically significant. Using the Fraction as a proxy for the minimum wage's bite, it appears that a one percentage point increase in the ratio of affected workers to total employees decreases the number of individuals employed in mini-jobs by 0.254%, ceteris paribus. Such large negative effects are similar to the effects found by Caliendo et al. (2018), who found that a one percentage point increase in Fraction decreases marginal employment between 0.168% and 0.233%. However, unlike Caliendo et al. (2018), this study did not find that the negative coefficient of the Kaitz index was statistically significant. Furthermore, this research also found that there was a significant negative effect on regular employment when using the Fraction as a measure of the minimum wage's bite. According to this study's regression model, a one percentage point increase in the share of affected workers decreases the level of regular employment by 0.083%, ceteris paribus. Such a large and statistically significant negative effect

is again argued to be conforming to the effects found by Caliendo et al. (2018), who argue that a one percentage point increase in Fraction decreases the level of regular employment between 0.08% and 0.011%. Here again, however, this study is unable to find a statistically significant effect of the Kaitz index when solely examining the effect on regular employment.

Table 3

Model 1: The minimum wage effects on the marginal and regular employment rate, 2010 – 2015

	Marginal Employment		Regular Employment	
	(1)	(2)	(1)	(2)
Kaitz * Post	-0.0285		-0.020	
	(0.192)		(0.018)	
Fraction * Post		-0.254 ***		-0.083 *
		(0.006)		(0.0492)
GDP_{t-1}	-0.001	-0.0002	0.001	0.001 ***
	(0.004)	(0.004)	(0.001)	(0.001)
POP_t	-0.449 ***	-0.141	0.411	0.394 ***
	(0.089)	(0.639)	(0.114)	(0.085)
Constant	-9.569	0.695	-7.21 ***	-6.961 ***
	(5.01)	(4.485)	(1.34)	(1.282)
Time & Regional Fixed Effects	Yes	Yes	Yes	Yes

Robust Standard errors in parentheses
* = p<0.1, ** = p<0.05, *** = p<0.01
Note: Sample size for both regressions consisted of 80 observations

Based on the results as found by our model using Equation (1), this paper rejects the null hypothesis that the minimum wage's bite does not affect the level of employment. Instead, it appears that there is significant evidence that this bite of the policy—measured both like the size of the minimum wage relative to the regional mean and the fraction of affected employees—has a significantly small negative effect on the level of employment. This general finding is in line with the findings of other studies regarding the employment effects of the German minimum wage such as those conducted by Caliendo et al. (2018) and Holtemöller and Pohle (2020). Furthermore, such relatively small negative effects are in line with what has been described in previous studies such as by Burkhauser & Finegan (1993) and by Brown and Kohen (1981).

2. The Relation Between Minimum Wage and Family Income

Finally, this research turns to estimating the minimum wages' distributional effects on household net incomes using the model from Equation (2). This part of the research aims to test whether the relative size of the minimum wage—measured using the same two-bite statistics—has a significant positive effect on the mean income earned by individuals located up to and including a particular percentile of the family income distribution. The results as seen in Table 4 include states from all three bite areas (Low, Med, and High). Due to potential issues regarding parallel trends when including the High bite states, the same model is also analyzed excluding those states and these results can be found in Table 5 in Appendix B. Based on our model, the minimum wage does not appear to decrease inequality by lifting the incomes of individuals located in the bottom half of the income distribution. Instead, it appears that the minimum wage's bite –measured both using the Fraction and Kaitz index—has a negative but insignificant effect on the mean household wage earned by people in this lower half of the family income distribution. Therefore, this research does not find evidence to reject the null hypothesis that there is no effect of the minimum wage on the mean family income of households located in the bottom 50% of the family income distribution.

Similar to the results described above for individuals located in the lower half of the family income distribution, it also appears that the size of the minimum wage's bite has a negative and statistically insignificant effect on the mean family income earned by individuals located in the bottom 20% of the family income distribution. Therefore, similar to the minimum wage's effect on households located in the bottom half of the distribution, this research cannot reject the null hypothesis that there is no effect of the minimum wage on the mean family income of households located in the bottom 20% of the family income distribution. Furthermore, when applying the model from Equation (2) to the income earned by the bottom 10% of the household income distribution, this paper finds that the implementation of the minimum wage may have a negative short-run effect on the mean level of household income earned by this part of the income distribution: When measuring the bite of the regulation via the Kaitz index, it appears that a one percentage point increase in the fraction of minimum wage to the regional mean wage decreases income earned by the lowest decile decreased by 0.29%.

Table 4

Model 2: The minimum wage effects on family income, 2010 – 2015

| | Mean Family Income up to and including C^{th} Percentile | | | | | |
| | 10th | | 20th | | 50th | |
	(1)	(2)	(1)	(2)	(1)	(2)
Kaitz * Post	-0.29 **		-0.235		-0.0045	
	(0.119)		(0.195)		(0.129)	
Fraction * Post		-0.002		-0.649		-0.144
		(0.567)		(0.453)		(0.369)
GDP_{t-1}	0.014 **	0.014	0.018	0.0185	0.001	0.001
	(0.013)	(0.013)	(0.015)	(0.0143)	(0.01)	(0.01)
POP_t	0.449	-0.286	-0.569	-0.978	-1.125	-1.095
	(2.743)	(2.62)	(1.454)	(1.43)	(1.48)	(1.47)
MIG_t	0.085 **	0.058 **	0.108 ***	0.102 ***	0.086 **	0.089 ***
	(0.036)	(0.025)	(0.036)	(0.029)	(0.035)	(0.028)
Constant	36.80	54.83	13.38	15.06	27.79	25.20
	(37.08)	(38.09)	(25.27)	(24.26)	(18.93)	(18.40)
λ	Yes	Yes	Yes	Yes	Yes	Yes
Time & Regional Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Robust Standard errors in parentheses

* = p<0.1, ** = p<0.05, *** = p<0.01

Note: Sample size for both regressions consisted of 80 observations

Based on the results as seen above, there appears to be no evidence that the minimum wage has a positive short-term effect on the family income earned by the bottom 50, 20, or 10 percent of the income distribution. Therefore, this paper does not find empirical support for the main rationale of the legislation: In the short term, no evidence implementing a minimum wage will lead to improvements in income distribution by raising low-income families out of poverty. These results are in line with the results found by Neumark et al. (2006), who, based on data from Brazil, found no evidence that minimum wages compress income inequality by raising those located at the lower points of the distribution. Thus, this study is unable to conclude that the minimum wage is a good redistribution tool, at least in the short term.

Discussion

Although the implementation of Germany's *Gesetz zur Regulung eines allgemeinen Mindestlohn* (Minimum Wage Act) allowed this paper to take advantage of the regional variation in how such a minimum wage introduction would affect each state, this was only possible for short-term effects. This is because the minimum wage was raised federally to €8.84 on January 1st, 2017, thereby distorting what the long-term effects could have been. Such longer-term effects may be of importance given the fact that low-skilled workers may take up training and schooling to accumulate more human capital (Cahuc & Michel, 1996). The results of such changes may lead to increases in earnings at the bottom of the income distribution in the medium to long-run as found by Dube (2019).

Next, this study also used the methodology of Holtemöller and Pohle (2020) in defining the geographic scope of Germany's internal labor markets to be the German states. Not only is it possible that these labor markets in reality do not closely match state borders and should have been defined more precisely, but it also limited the total labor markets in our sample to 16 markets. Caliendo et al. (2018) instead defined 141 distinct regional labor markets, potentially leading them to find more variation in the regional bite levels and more precise effects. This study also used Holtemöller and Pohle's (2020) methodology of defining the monthly minimum wage earned in a particular region based on the average hours worked in said region. This may be problematic due to it overestimating the monthly minimum wage for people that work fewer hours than the average person in their region while underestimating the monthly minimum wage for individuals working more hours than the average person in their region. It may be better to instead look at individuals' hourly earnings and whether these hourly earnings are above the minimum of €8.50 or not.

This paper was heavily reliant on the survey data from the German Socio-Economic Panel (SOEP) to create both the regional bite statistics as well as to create the regional distributions of family income. Due to the SOEP being a survey, it needs to be kept in mind that there may be measurement errors in the answers individuals provided. Furthermore, due to unanswered questions, the sample size used to create these regional statistics for the bite variables and income distributions may be smaller than the total size of individuals that responded to the survey. This may potentially harm the accuracy of these statistics. Moreover, the SOEP is collected on an annual basis and does not contain an equal number of observations for each German state. This forces the research to only consider changes on an annual basis, not allowing us to look at shorter time frames

or consider issues such as seasonality in employment, but this also leads us to have smaller sample sizes for certain states. Such smaller sample sizes potentially decrease the reliability of certain state bite and family income information. High bite states are particularly prone to having a smaller population and thus a smaller amount of data in the SOEP.

Conclusion

The purpose of this study was to empirically examine the potential costs and benefits, as described by Stigler (1946), of the federal minimum wage as an antipoverty policy. Based on evidence from the implementation of Germany's *Gesetz zur Regulung eines allgemeinen Mindestlohns*, this paper aimed at analyzing the regulation's effect on employment and its potential beneficial effects on individuals located at the bottom of the family income distribution. While decreases in employment are often argued to be the main cost of the policy, it cannot by itself indicate whether the regulation is good or bad. Instead, one needs to also examine the effect that such price floors for labor have on their primary goal of raising low-income households out of poverty. It is only after examining these dual effects that one can make an argument about the efficacy of the minimum wage as a policy tool. This paper's analysis of the minimum wage relies on regional differences in the wage levels during the pre-treatment period, in line with the methodology proposed by Card (1992) and applied by Caliendo et al. (2018). Such methodology is based upon the assumption that the greater the impact of the minimum wage is upon the regional wage distribution, as measured by the bite statistics, the larger its effect will be on said regional labor market. Theoretically, the magnitude of the regulation's employment effects depends upon the type of competition that is present in a particular labor market and the level at which the minimum wage is set. The distributional effect, on the other hand, is reliant upon the relative magnitude of the gains and losses to individual laborers and where these laborers are located within the income distribution.

With respect to the minimum wage's effect on employment, this study finds that the higher the minimum wage is set relative to the regional mean wage, the larger the loss in total employment will be. Furthermore, if the minimum wage's bite is instead measured as the share of directly affected workers, its effect is found to be even more negative. These effects with respect to overall employment are similar to those found by Caliendo et al. (2018) and support Neumark and Shirley's (2021) idea that empirical evidence points to the minimum wage negatively affecting

employment. Additionally, due to the legal differentiation that Germany makes between marginal and regular employment, the policy's effect was separately analyzed for each of these two job categories. In the case of regular employment, it appears that the minimum wage affects these types of jobs similarly to total employment in general: Both find that a 10-percentage point increase in the fraction of affected workers significantly decreases the employment level between 0.8 to 0.9%. However, this study finds that the effect of the minimum wage on individuals employed in marginal employment jobs is far greater. Here, a 10-percentage point increase in the share of affected workers decreases the level of marginal employment by approximately 2.5%. Such difference in effect is likely due to the higher probability of marginal employees to earn (sub)minimum wages, thereby being more likely to be directly affected by the policy. Furthermore, when looking at the distributional effects of the policy—effects that are often seen as the regulation's benefits or rationale—this study does not find evidence that a higher level of minimum wage bite will lift the incomes of families that are in the bottom half of the income distribution. Instead, this study finds some statistically significant evidence that the minimum wage's bite may in fact decrease the family earnings of households located in the lower tail of the distribution (up to and including the 10th percentile) in the short term, similar to what was found by Neumark et al. (2006). A one percentage point increase in the Kaitz index appears to decrease the mean per-person family income within this lowest part of the distribution by 0.29%.

Overall, the evidence found by this study does not lend support to the idea that minimum wages in Germany were effective at accomplishing its goal of raising low-income households out of poverty. Although the policy's negative employment effects were small, there was no evidence that it improved the mean wages earned by individuals in the lower half of the income distribution. Therefore, the short-term evidence of the €8.50 federal minimum wage appears to indicate that the policy's unintended slippage and costs are larger than the benefits it delivers. It is of course possible that there are postponed adjustments and longer-term effects that are not captured by the model and short timeframe used in this paper. Therefore, it is very well possible that the implementation of a minimum wage leads low-skilled workers to accumulate more human capital which in turn can lead to larger earnings for those low-income laborers currently located in the lower parts of the family income distribution. Additional research is needed to examine the minimum wage's effect over the longer term. In case such research indeed finds evidence of the previously described dynamic, there needs to also be an investigation into other policies that would

also accomplish such human capital accumulation in order to determine the relative efficiency of the minimum wage regulation as a policy, in line with Stigler's (1946) third and fourth arguments.

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Appendix A.

Additional Descriptive Information

German States	Classification	Occupational sector
Baden-Württemberg	Low	Agriculture, forestry, and fishing
Bayern	Low	Industry
Berlin	Medium	Mining and quarrying
Brandenburg	Medium	Manufacturing
Bremen	Medium	Electricity, gas, steam, air conditioning supply
Hamburg	Low	Water supply, sewerage, waste management, remediation
Hessen	Low	Service activities
Mecklenburg-Vorpommern	High	Trade, transport, storage, accommodation, food services, information and communication
Niedersachsen	Medium	Finance, insurance, business, and real estate
Nordrhein-Westfalen	Low	Professional, scientific and technical activities
Rheinland-Pfalz	Medium	Administrative and support service activities
Saarland	Medium	Public activities and services, education, healthcare
Sachsen	High	Arts, entertainment, recreation, and other services
Sachsen-Anhalt	High	
Schleswig-Holstein	High	
Thüringen	High	

Appendix B.

Regression Results Equation (2), Excluding High Bite States

Table 5

Model 2: The minimum wage effects on family income, 2010 – 2015

	Mean Family Income up to and including C^{th} Percentile					
	10th		20th		50th	
	(1)	(2)	(1)	(2)	(1)	(2)
Kaitz * Post	-0.485		-0.159		-0.114	
	(0.423)		(0.272)		(0.242)	
Fraction * Post		1.484		0.125		0.096
		(1.17)		(0.829)		(0.747)
GDP_{t-1}	0.013	0.016	0.022	0.020	0.008	0.007
	(0.02)	(0.012)	(0.025)	(0.024)	(0.011)	(0.01)
POP_t	0.606	-1.283	-0.502	-0.666	-0.232	-0.35
	(3.06)	(2.312)	(1.639)	(1.592)	(1.19)	(1.05)
MIG_t	0.085	0.034	0.045	0.035	0.061	0.054
	(0.084)	(0.058)	(0.078)	(0.068)	(0.061)	(0.059)
Constant	65.91	110.875 *	19.44	28.17	34.39	40.76
	(56.54)	(54.02)	(32.81)	(39.55)	(20.75)	(20.03)
λ	Yes	Yes	Yes	Yes	Yes	Yes
Time & Regional Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Robust Standard errors in parentheses

* = p<0.1, ** = p<0.05, *** = p<0.01

Note: Sample size for both regressions consisted of 55 observations