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Minimum wage effect on employment level and job flows: evidence from many recent minimum wage changes

par

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Résumé

Cette thèse analyse les effets causaux d'une augmentation du salaire minimum sur les revenus, l'emploi, les embauches, les séparations et le taux de rotation pour les adolescents et les travailleurs du secteur de la restauration sur le marché du travail aux États-Unis, en utilisant un modèle de discontinuité aux frontières comme approche privilégiée. Les différences de résultats liées au genre vis-à-vis les variations du salaire minimum dans ces deux groupes sont également documentées. Se basant sur les résultats d'une période de variations de salaire minimum exceptionnellement élevées, l'étude démontre des élasticités salariales positives pour les deux groupes, conformément à la littérature, et ne montre aucun effet significatif de déplacement de l'emploi parmi les travailleurs de la restauration. Cependant, les adolescents ont connu un léger impact négatif sur l'emploi. Les flux d'emplois, tels que les embauches et les séparations, diminuent de manière significative pour les adolescents. Ce document rapporte de nouvelles preuves montrant que les effets sont plus marqués chez les adolescentes que chez les adolescents dans toutes les élasticités calculées. Les estimations présentées dans le document indiquent également qu'il n'y a pas d'effets significatifs sur les revenus, l'emploi ou les flux d'emplois pour les autres industries étudiées dans cette étude et impactées par le salaire minimum.

Mots clés : Salaire minimum, Emploi, Flux d'emploi, Revenu, Adolescents, Genre, Travailleurs de la restauration,

Méthodes de recherche : Modèle à effets fixes, Modèle de discontinuité de frontière

Abstract

This thesis analyzes the causal effects of an increase in minimum wage on earnings, employment, hires, separations, and turnover rate for teens and restaurant workers in the US labor market using a border-discontinuity analysis. The gender differential in response to minimum wage variation in these two groups is also documented. Based on an unprecedented number of minimum wage changes, this thesis shows positive wage elasticities for both teenagers and restaurant workers, consistent with the literature, and no significant disemployment effect among restaurant workers. Teenagers faced a slight decrease in employment. Job flows, such as hires and separations, are significantly decreasing for teenagers. This paper presents fresh findings indicating that the impact of minimum wage changes is stronger for female teenagers than for their male counterparts across all calculated elasticities. This study also explores the impact of an increase in minimum wage on a number of other industries less impacted by wage variations than teens and restaurant workers. The estimates presented in the paper indicate no significant effect on earnings, employment, or job flows for these other industries.

Keywords: Minimum wage, Employment, Job flows, Earnings, Gender, Teenagers, Restaurant workers

Research methods: Two-way fixed effects model, Border discontinuity model

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Introduction

Given the prevalent income inequality in various countries, there is growing importance in studying the impact of labor market policies on income and employment distribution. One of the core policy tools to "overcome poverty and reduce inequality" (ILO, 2015) is the implementation of a minimum wage. This was the original intention behind the introduction of the minimum wage by the International Labor Office, to guarantee an "adequate minimum wage" for workers (Starr, 1981). Despite this objective, the advantages and disadvantages of minimum wage policies are still a matter of debate, especially in the United States (US).

The adjustment of the minimum wage poses a significant challenge for governments and holds crucial importance for workers and firms, as it directly influences labor costs. The increase in labor expenses is expected to have a direct impact on job flows and overall employment. In response to the changes in minimum wage, firms can adapt their operations in multiple ways, such as their hiring practices or adopting new technology that replace human labor (Neumark & Wascher, 2008). The effects on job flows and employment can also impact gender differently, given that women represent a higher proportion within the low-wage labor market in the US. In fact, between 2012 and 2020, women represents 64% of the workforce paid at or below minimum wage.

In 1938, the Fair Labor Standards Act established the statutory federal minimum wage for workers in the US (Starr, 1981). Since then, the hourly rate has progressed over the years. However, the federal minimum wage law has not been amended since 2009, and many administrations have decided to modify the minimum wage above the federal rate of $7.25 per hour (Neumark & Wascher, 2008). In contrast to the lack of changes at the federal level, the United States has implemented an unprecedented level of minimum wage changes across various jurisdictions, including states as well as counties and cities, between 2012 and 2020. This provides us with an important statistical opportunity because this new recent wave of minimum wage increases at city-level may yield distinct effects on workers compared to state or federal policies. Therefore, it raises the question of whether the recent hikes in the minimum wages have effects on firms and on workers.

The aim of the thesis is first to test the effects of minimum wage changes at city, county and state levels on workers and the government using up-to date data from 2000 to 2020. Specifically, it seeks to calculate the minimum wage elasticities of earnings, employment levels and job flows such as hires, separations, and turnover rate covering US states. Secondly, we document the gender differential in response to minimum wage variation in those two groups.

Finally, the impact of a change in the minimum wage policy on workers will be explored across different industries that could potentially be highly affected by such changes in minimum wage. The sectors chosen are gasoline stations, general merchandise retailers, building material, and garden equipment and supplies dealers. The professional scientific and technical services sector will be used for comparison as they are less likely to be affected by changes in minimum wage because workers in these sectors are rarely paid at this rate. In this study, we are not considering and measuring the possible ratchet effects.

These questions have been studied extensively by scholars, especially when assessing the employment effect following a minimum wage change such as Dube et al. (2016) who study employment and job flow effects of minimum wage changes in the US. The authors calculate the minimum wage elasticities of earnings, employment and job flows between 2000 and 2011 on two influential demographic and industry segments: teenagers and restaurant workers. During this period, they studied 196 distinct minimum wage variations. This thesis extends on this influential paper and replicates its findings using data up to 2020 including county and city changes.

The period between 2012 and 2020 is particularly relevant to consider as the substantial number of minimum wage variations at the state, county and city level which has not been previously studied when researchers looked at job flows and turnover rate. The data used in this study is a panel of cross-state contiguous county pairs from the Quarterly Workforce Indicators Data set (QWI) from 2000 to 2020 for every US state. The effect will be quantified by means of a border discontinuity analysis adapted from Dube et al. (2010) which facilitates a comparison between a county with a minimum wage

increase to another contiguous county with no minimum wage change on the other side of the border. The analysis is confined to counties whose centroids are separated with a maximum distance of 75 kilometers. Our data, which contains high-frequency of minimum wage variations, possesses a distinctive characteristic that is essential for implementing the border-discontinuity design. Specifically, during 2012 and 2020, there were 240 instances of yearly minimum wage change at city, county and states level.

The findings of this thesis are that the impact on earnings is positive and significant for both groups. With the preferred specification, a 10% increase in minimum wage leads to an increase in earnings by 3.5% for teens and 2% for restaurant workers. There is no significant disemployment effect for restaurant workers between 2012 and 2020, but teenagers experience a small one with an elasticity of -0.164. We can't conclude that the hours worked went done with the available data. Our evidence indicates a significant decrease in separations and hires among teenagers after a minimum wage increase.

This study finds that female teenagers experience larger impacts in all the elasticities calculated. The wage effects are more pronounced for women than men in both industries, which indicates that an increase in minimum wage can be a useful tool in reducing the gender wage gap. Additionally, there are noticeable differences in the impact on male and female restaurant workers, with adverse effects on separations and hires observed only for males, while turnover rates decrease for both genders, which benefits firms by reducing costs. Regarding the other studied sectors, no significant impact has occurred following a minimum wage increase for any of them.

The main contribution of this thesis is to analyze the impacts of many changes in the minimum wage policies on employment, earnings and job flows at the city, county and state levels. The primary objective of this thesis diverges from most studies in the literature, as it focuses on a broader range of policy changes instead of studying a limited amount of minimum wage changes or instead of pooling all variations together.

Although the minimum wage literature typically centers around the impact on employment, the results of this thesis emphasize the importance of studying the impact of

an increase of minimum wage on job flows especially with the recent increase of minimum wage. The utilization of the QWI dataset and the border discontinuity approach yields noteworthy findings concerning hires, separations, and turnover rates for highly affected groups and it allows to consider more specifically county-level data.

The remaining part of the study is structured with the following sections: the first chapter is a summary of the literature review related to the impacts of a variation of minimum wage on workers. Chapters 2 and 3 are devoted respectively to the description of the sample construction and to the econometric model used. The following chapter firstly analyses the results for this new period for teens and restaurant workers and then discusses the estimations by gender and by other industries. In chapter 5, we conduct robustness check regarding the choice of controls in the model, the long-term effect of policy change as well as the implications of our selection of contiguous counties. Finally, the study concludes by assessing how future minimum wage research could be directed.

Chapter 1
Literature Review and Testable Implications

1.1 Main findings concerning minimum wage's impact.

Raising income inequalities has been an important issue in the United States (US) since the late seventies (Hoffmann et al., 2020; Piketty, 2001). Compared to other OECD countries, the US has one of the highest income inequalities from the late seventies to early 2000's (Neckerman & Torche, 2007). The causes of those social and economic disparities have been studied by numerous scholars, and some argue that the contribution of minimum wage policies in the country is a key factor in partially explaining this phenomenon. Autor et al. (2016) identified that declining real value of minimum wage had a significant impact on lower tail inequality between 1979 and 1988. During this period, the real value of federal minimum wage decreased by 30 log points, and it explains 30% to 50% of the increase in wage inequality for workers in the low wage distribution. Therefore, the motivation on studying the US is driven by the prominent issue of growing inequalities in the country. The high number of minimum wage increases at all levels in the recent years is also an important incentive to calculate the overall impact on employees and on firms.

First and foremost, understanding the impact of a minimum wage increase on individuals in the lower income distribution is crucial. Specifically, it is essential to examine its effects on employment, earnings, hire rates, and turnover rates for workers. Identifying and quantifying those different channels of adjustment in the literature will allow us to determine if a policy change regarding minimum wage policy has positively impacted the population. In this section, the employment effect, the job flows and the impact on earnings will be analyzed by industry, by age and by gender.

It is important to highlight that articles on this subject have gone through a clear innovation period with the "new minimum wage research" in the nineties. Prior to this, most articles studied the impact of federal minimum wage on teen employment with aggregate time-series data, but from then on, the methodology has moved to the use of

cross-state variations minimum wage data and quasi experiments (Belman & Wolfson, 2014). Nonetheless, even with those advances, researchers can not reach a unanimous conclusion regarding the employment effect of a raise in minimum wage, and this has been a renowned issue between academics. One of the considerations of policymakers regarding a minimum wage change is the hypothetical reduction of employment that happens because firms could wand to decrease the numbers of employees. The increase in minimum wage could also motivate workers to relocate to a more lucrative jurisdiction.

Neumark and Wascher (2008)'s book on minimum wage and employment compiles the results of 20 years of research on the subject. They selected 33 relevant articles from 1991 to 2007 and found adverse employment effects in 80% of them. The employment elasticity varies from -1 to greater than 0 in the chosen articles compared to an average between -0.1 to -0.3 in the studies before the "new minimum wage research". This wider scope can be explained by the new methods used and the larger minimum wage fluctuations. The impact was shown to be stronger for the least-skilled groups and it confirmed their thesis that an increase in minimum wage reduces employment for low-skilled workers. However, one critique of the conclusion about the adverse employment effects following an increase in minimum change is that most of the methods used in those studies do not employ narrow geographic comparisons. It is then difficult to differentiate the negative impact from an increase in minimum wage on labor markets from the negative consequences associated with other factors that affect low-skilled labor markets. Those authors have a more traditional approach where an increase in minimum wage reduces labor demand in a competitive market, therefore, reducing employment and impacting low-paid workers in the long run (Stigler, 1946). The negative effect would be counter-intuitive to the initial aim of the policy since it would reduce the number of workers on the payroll of the firms.

Comparing conclusions drawn from traditional methods with studies employing local comparisons and industry-specific analyses is valuable in order to highlight their differences. One of the most cited papers on a natural experiment was written by Card and Krueger (1993) which is considered a reference for studies conducted in local areas. They use minimum wage variation between New Jersey and Pennsylvania in 1992 to

calculate the impacts on employment rate and compare the $4.25 to $5.05 increase in minimum wage in New Jersey to the steady minimum wage of $4.25 in the contiguous state of Pennsylvania. Using difference in difference estimates, they didn't find that an increase in minimum wage reduced employment in the fast-food industry in the short term in contrast to classical theory. Furthermore, the study estimated an employment elasticity of 0.7 implying that an increase of 10% of the minimum wage rise employment by 7%. A major critique of this article is that the results are too local to be generalized to other states. In addition, in their book "Myth and Measurement", Card and Krueger (1995) summarize many "new minimum wage researches" and come to the general conclusion that an increase in minimum wage does not reduce job opportunities for low wage workers.

Addressing the challenges of limited local data and isolated events, Dube et al. (2010) implements a research design that considers counties sharing state borders to calculate the impact of minimum wage change between counties in the United States on restaurant workers between 1990 and 2006 using panel data from Quarterly Census of Employment and wages (QCEW). With this approach, counties situated along state borders which usually have similar economic backgrounds offer strong case studies for examining the probable impacts of policy discontinuities. They compare results of this local difference method to results of the method adopted in most previous national studies which use panel data and time period fixed effect and obtain different outcomes. For the traditional method, the employment elasticities calculated is -0.176 and for the local estimates, the employment effect is indistinguishable from zero for restaurant industries. The divergent results are mainly explained by omitted variable bias in the traditional national-level studies implying that there are differences in employment trends between states. One of the limitations of this method is that researchers depend on the policy variation which consists mainly of modest increases in minimum wage. In this case, those results could not be extrapolated to larger increases in minimum wage.

In the literature, teenagers and restaurant workers represent the most studied groups that could be impacted by hikes in the minimum wage. This is because these groups of workers are more likely to be paid at the minimum wage. For this reason, Dube et al. (2016) analyze employment effect on teenagers (14-18) and on every restaurant

workers. They employed a traditional time period fixed effects method and a policy discontinuity at state borders model (preferred model) implemented firstly in Dube et al. (2010). For both specifications, they find similar results as Dube et al. (2010). Thus, they come to the conclusion that employment effect is not statistically different from zero for teens and restaurant employees between 2000 and 2011 when incorporating the consideration of spatial heterogeneity. Once more, this more recent and revised study has validated that a considerable portion of the unfavorable employment elasticity is attributable to spatial heterogeneity, resulting in a biased outcome. This thesis extends the previous paper by incorporating up-to-date data from 2012 to 2020, encompassing minimum wage changes at city, county and state levels.

Focusing precisely on teen employment in the United States from 1990 to 2009 with Current Population Survey (CPS) data, Allegretto et al. (2011) include geographic controls to eliminate spatial heterogeneity. They come to the same conclusion as Dube et al. (2010) that employment elasticity is not statistically different from zero when accounting for spatial heterogeneity and for lasting growth differences across states. They can't confirm that the results persist to other categories but the resemblance in outcomes between those two studies indicates that the findings have relevance in various industries. In a comparable study focusing on New York workers from 16 to 29 years old without a high school degree, Sabia et al. (2012) calculate the causal effect of an increase in minimum wage from $5.15 to $6.75 on employment rate between 2004 and 2006. Their difference-in-difference estimates indicate that this $1.60 increase in minimum wage reduced employment between 20.2% to 21.8% although, the most impacted age group was 16 to 24 years old. Their research method was inspired by the case study achieved by Card and Krueger (1993) which also earned similar critiques. However, they fail to quantify the long-term effect of this increase due to the fact that they only use a concise period of data which is a limitation of their studies.

While thorough studies have been conducted on the impacts on teenagers and restaurant workers, it is essential to analyze other population segments affected by a minimum wage increase in any industry sector. Cengiz et al. (2019) determine no evidence of disemployment with their general event study using 138 notable state-level

minimum wage increase between 1979 and 2016 in the United States with workers at the bottom of the wage distribution. This study is one of the most complete portrayals of the impact on minimum wage increase in the United States on low pay-workers because they don't quantify this effect on distinct groups and they use an important range of minimum wage changes at state level (Dube, 2019). However, they only focus on state changes and they don't calculate the effect on job flows. This motivates us to analyze a broader range of industries impacted by minimum wage to get a better representation of the lower wage distribution. Furthermore, since they only study variations at state level, it is interesting to check the entirety of the minimum wage changes and use the statistic opportunity offered within the period between 2012 and 2020.

Studying gender differences in the impact of the minimum wage is important, because women are generally more likely to be affected by these changes due to the fact that they are over-represented among low-wage workforce (Coviello et al., 2023). Focusing more specially on the employment effect in relation to gender, Belman et al. (2015) summarize the researches of scholars addressing women's employment and come to the conclusion that the impact is more significant for women than man. In fact, their analysis of 8 papers demonstrates that the employment effect is null for women in half the studies, three shows positive employment effect and only one demonstrate adverse employment. These conclusions motivate the need to further contribute to the literature on the gender-specific effects of minimum wage policy changes given the mixed outcomes.

The mixed conclusions regarding employment effect are also found internationally. For example, Sturn (2018) studies the employment effect of minimum wage on low-skilled and young workers in the Organization for Economic Co-operation and Development (OECD) members between 1983 to 2013. The analysis between the United States and countries in this organization are partially comparable since the US are part of the OECD, but there could be substantial differences between them such as employment growth. The biggest proportion of workers paid with minimum wage in the OECD countries are employees with low education, so it is logical why this category is frequently studied in minimum wage studies. In this study, the author contrasts results from different econometrics methods employed in his article such as two-way fixed effects model,

instrumental variable, dynamic estimators and specification in first difference with clustered standard errors to fix serial correlation. For low skilled workers, women, and teenagers, the employment elasticity is always near zero and insignificant, but the unemployment impact on low-skilled women is more negative. It contradicts the "consensus view" labeled by Neumark and Wascher (2004) mentioning that an increase in minimum wage will always lead to a negative employment effect for low-skilled workers. In the long term, the conclusion tested with distributed lags comes once again to no significant effect on employment rate by a change in minimum wage.

The literature generally agrees with a positive effect on low-skilled worker's wages fulfilling the public policy purpose of increasing the earnings of low-paid workers. The article from Dube et al. (2010) presented previously also discussed the impact of minimum wage on earnings. They found a significant and positive impact on earnings with their studies based on local and national data. The earning elasticities are significant at the 1% level and fluctuate between 0.149 and 0.232 for restaurant workers. The preferred model for the contiguous border county-pair sample shows an increase of 1.88% in average weekly earnings for every 10% rise in minimum wage. The effects on earnings are quite similar with the estimates with traditional specifications where a rise of 10% in minimum wage introduced a 2.24% increase in earnings.

Similar conclusions are found in Dube et al. (2016) where an increase of 10% in minimum wage leads to an increase in average weekly renumeration by 2.2% for teens and 2.1% for restaurant employees with the policy discontinuity at state borders model. It confirms that it is possible to detect differences in earnings between the controlled and treated groups even when we compare cross-border county pairs. With a similar method employed to calculate the diminution in flows, the increase in earnings occurs within three-quarters of the minimum wage variation. The overall earnings of those two groups are superior following a minimum wage adjustment and arise immediately. Continuing the analysis by gender, Belman et al. (2015) identified a positive and bigger effect on women than man following a change in minimum wage. More than 80% of the research on wage effects find higher earnings for women.

Most studies mentioned thus far focus on states or counties minimum wage variations. However, in the US since 2014, a growing number of changes to minimum wage within cities has motivated scholars to assess the benefits of these changes for workers at the city level. Dube and Lindner (2021) summarized 5 main articles in which authors based their work on a specific city or particular event, or a small number of them. Interestingly, 4 of the 5 studies focus on restaurant workers, particularly on the fast-food industry which is similar to the scope of this thesis. The conclusion regarding the effects on earnings is primarily positive and significant in all the cases. In general, the available evidence regarding minimum wage policies at the city level supports the substantial amount of conclusions that indicate the fact that modest increases in minimum wages have a minimal impact on employment. There is still uncertainty with the results of single case studies due to possible contamination from other shocks unrelated to minimum wage. Therefore, in the literature, the use of a high number of minimum wage variations for identification is missing. This thesis will contribute to this literature by analyzing minimum wage increases from states, counties and cities in the US from a period (2012-2020) with high events of minimum wage policy changes.

Finally, in opposition to the multitude of articles written on employment rates, the literature on employment flows is far more limited in the United States or, in fact, in any other OECD country. A broader range of studies analyzing hire rates, separation rates, turnover rates, and unemployment duration could be beneficial to advise governments regarding minimum wage policies if, for example, a change in minimum wage impacts hiring and terminations. It is therefore important for governments to understand the impact of this possible increase in unemployment duration, making studies of this kind crucial.

The paper by Dube et al. (2016) is one of the first to utilize data that is nationally representative of the US to understand the impact of an increase in minimum wage on separation, hires, turnover rates and unemployment duration for teenagers and restaurant workers. With the methodological specification discussed in the previous section (i.e. border discontinuity model), they calculate a separation elasticity of -0.233 for teenagers and of -0.225 for restaurant workers, between 2000 and 2011. This negative separation rate influences turnover rate directly since it is used in the calculation of turnover

measures (Abowd et al., 2009). Thus, the model estimates that turnover rates drop by approximately 2% for teens and 2.1% for the restaurant labor force for each 10% increase in minimum wage. This implies a positive impact on firms because it reduces turnover costs such as severance, recruitment, or training.

They also estimate the impact of an implementation of a higher minimum wage policy on unemployment duration due to job terminations, which is primordial since it directly impacts government spending through social benefits associated with longer unemployment periods. It is still useful to quantify this impact because it can help to discover if a raised minimum wage increases the difficulty to find a new job and thereby increase unemployment duration. Their results show that the repercussions of an increase in minimum wage are minimal, meaning that workers find new jobs easily. Based on their calculations, a 10% increase in minimum wage for movers leads to a negligible 0.3% increase in the average length of unemployment. Thus, although the separation rate is more negative, the unemployment duration remains constant, implying that workers don't find it more difficult to secure alternative employment if they desire. It indicates that the US government won't need to spend more in social benefits following a change in minimum wage policy.

To check the robustness of their results, Dube et al. (2016) use, in addition, to the actual logarithm of minimum wage, the logarithm of minimum wage with 4 quarters lead and 4 quarters lagged in their preferred model. They find that the movement out of employment occurs inside the first 3 quarters after the rise in minimum wage. The goal is to verify the possibility of pre-existing trends or lagged effects that could influence the estimates in the model. The outcomes show no kind of pre-existing pattern or delayed impact which confirm that reduction of employment flow comes from the increase in the minimum wage and not from some other underlying tendency. It also confirms that it is not a transitional effect, and it is a lasting adjustment.

In Canada, Brochu and Green (2013) analyze the impact of a higher minimum wage on job transitions for workers with a high school diploma or less between the ages of 15-59, throughout the period 1979 to 2008. The choice of this population section is based on

their assumption that minimum wage doesn't impact people with higher education. Using Canadian Labor Force Journey, they study separation rate and quit rate before and after the increase of minimum wage for employees. The feasible generalized least squares estimates show that an increase in minimum wage significantly reduces the separation rate for workers with less than a year of job tenure by approximately 5% for every 10% increase in minimum wage. However, the increase of minimum wage doesn't affect separation rate for workers employed for more than a year. They also conclude that hiring rate is lower when minimum wage is higher for all ages, but the effect is more important for teenagers. The main limitations with this study are the use of Canadian data with a limited number of provinces acting as policy clusters which causes an issue with the model identification and inference, as well as the presence of measurement errors with the use of survey data.

1.2 Testable implications

One of the primary implications of raising the minimum wage is its substantial impact on workers' earnings (Dube et al., 2016). The extent of this effect is contingent upon several variables. For instance, in response to higher wages, workers may choose to adjust their working hours, thereby influencing the magnitude of the outcome. However, the data used in the analysis does not include information on the hours worked, limiting the ability to investigate potential changes in work habits.

The effect on earnings also differs based on characteristics such as gender, age, race, education or the type of industry. Focusing more specifically on gender, a minimum wage increase can reduce the wage gender gap because women are inclined to be overrepresented in low-wage jobs (Coviello et al., 2023). Since minimum wage is more likely to affect female workers who are usually more represented at the bottom of the pay distribution, we expect the effects of the minimum wage on employment and job flows being larger for female workers. The conclusion is similar for teenagers because they are also a high proportion of minimum wage workers (Belman et al., 2015).

Neoclassical theory predicts that raising minimum wage reduces labor demand in a competitive market following this increase in labor costs. Consequently, it results in fewer job opportunities for workers whose productivity falls below the minimum wage level

(Stigler, 1946). This adverse employment impact is particularly pronounced among low-paid workers in the long run. In contrast, in a monopsony, a small minimum wage changes may increase employment. Monopsony's core concept lies in the notion that an employer's labor supply curve is not infinitely elastic, implying that reducing wages by a mere 1 cent might hinder worker recruitment and retention without immediately losing all existing workers to competitors, contrary to standard predictions (Manning, 2021b) .Therefore, the prediction of employment is theoretically mixed.

As discussed in Dube et al. (2016) and Brochu and Green (2013), minimum wage changes have decreasing effect on job flows. Two search models, the job ladder model and the match quality model, offer an inherent structure to comprehend the effects of policies on separations given that search models analyze the formation and dissolution of worker-firm matches. The job ladder model, considering a labor market with search frictions and endogenous separations, suggests that higher minimum wages decrease the frequency of job transitions by reducing the rate at which higher-paying job offers arrive. Due to the predictions of the job ladder model, a higher minimum wage is expected to lead to a decrease in quits and subsequently result in a lower rate of job-to-job (EE) transitions (Dube et al., 2016). On the other hand, in the match quality model, a decrease in layoffs results in lower rates of job-to-unemployment (EU) transitions since the majority of workers who are laid off ends up in a state of nonemployment. This model incorporates the idea that match quality is established after an initial probationary period, with varying costs associated with posting job vacancies. With this model, an increase in the minimum wage leads employers to be less inclined to lay off workers with lower match values and search for new employees. A higher minimum wage also increases the expenses of hiring new recruits during the probationary period, consequently decreasing the value of the termination option for existing employees, as job search is now burdened with higher sunk costs tied to the minimum wage.

One limitation of our study is that the data available from the QWI dataset does not allow for a perfect tracking of job-to-job transitions for workers. Therefore, it is not possible to separate the employment-employment separations to employment to non-employment separations. Consequently, it becomes challenging to distinguish those who

permanently ceased to work long-term from those who will seek a job in the near future from the labor force.

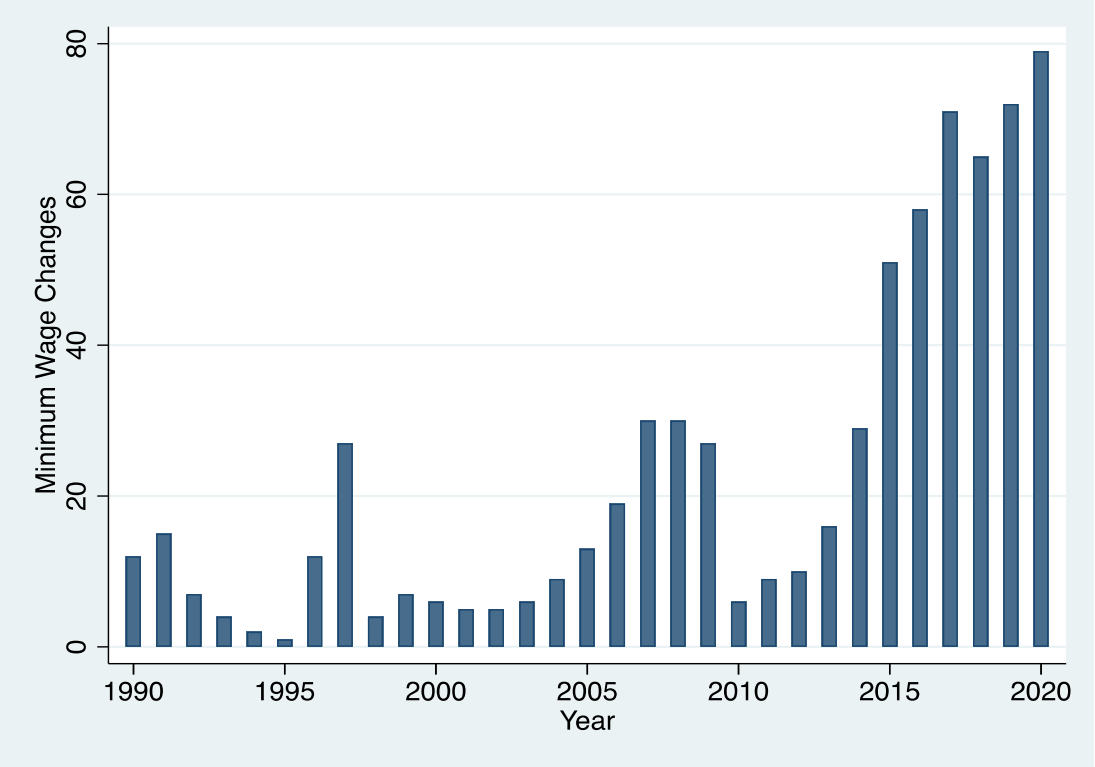
This thesis makes a distinct contribution to the existing literature by examining minimum wage variations at multiple levels, including city, county, and state levels in contrast to prior studies that primarily focus on state-level minimum wage variations. Utilizing a richer dataset with a high number of smaller variations in recent years sets this research apart from previous work. Furthermore, the data employed in this thesis facilitates the calculation of the effects on job flows, a dimension that has not been extensively explored in previous research.

Chapter 2
Data

2.1 Description of the database

The main datasets used in this research were compiled from various sources. First of all, one of the key variables in the model is the historical minimum wage, which assumes the role of the independent variable. The nominal minimum wage data has been obtained from the Washington Center for Equitable Growth. The updated version (Vaghul, 2022) covering the second quarter of 1974 to the last quarter of 2022 is used in this thesis. This analysis focuses more specially on the different levels of minimum wage changes since the federal minimum wage has not increased since 2009. Over the period from 2000 to 2020, a total of 616 changes in minimum wage occurred at the state and substate levels in the US. However, most of the variations took place between 2012 and 2020 where 176 instances of state-level minimum wage changes and 275 episodes at the county and city level were implemented as depicted in figure 1 which describes the number of minimum wage variations across all levels by year. Notably, there is a substantial increase in minimum wage changes after 2014, predominantly occurring at a city level. The increases in minimum wage in the US are usually small. For instance, during the period from February 2012 to June 2015, the average rise in the minimum wage stands at $0.54 (Coviello et al., 2022). The fluctuations in the minimum wage throughout the 2012-2020 timeframe exhibit a resemblance to the preceding period with an average increase of $0.72.

Figure 1- Yearly changes in minimum wage in the US between 1990 and 2020.



In contrast to the original paper by Dube et al. (2016) where they only utilized minimum wage variations from San Francisco city, this analysis has been expanded to incorporate minimum wage changes at every level. It includes examining minimum wage changes from 48 cities and 8 counties between 2012 and 2020. To be more precise, the minimum wage in a particular area is determined based on the highest rate among the state, county, or city levels which is explained in Coviello et al. (2022).

In addition to the minimum wage data, a quarterly US county population data set has been created to merge with the final dataset. The population data, collected from the National Cancer Institute (SEER, 2022) covers the period from the first quarter of 1969 to the last quarter of 2020. Due to the availability of data, the analysis is constrained and will only include data up until 2020. Using the available information, age group categories for each county, such as teen category (14-18) and the total population (14-99), have been created.

2.2 Sample selection

The labor data utilized in this study were collected by the United States Census Bureau and state Labor Market Information offices from the Quarterly Workforce Indicators Data set (QWI). The QWI is a combination of the Quarterly Census of Employment and Wages (QCEW) and unemployment insurance data (BLS, 2022). It provides extensive public statistics on both firm characteristics and worker demographic information, categorized by US states, metropolitan areas, counties and workforce investment board areas.

The data has been extracted on March 29, 2023. It includes information for each state, tabulated by US counties, by industries, by sex, and by age and covers the period from the first quarter of 1990 to the fourth quarter of 2022. The dataset is not seasonally adjusted, by sex-by-age tabulations, no firm age or size details, by counties, by NAICS subsectors and provides information for workers from all private sectors.

The selected data consists of observations from 49 US states and the District of Columbia. The QWI compiles information from various age categories and employer sectors, including gender-specific data. This allows us to reshape the dataset by industry, age, and gender. In the primary research, the focus is on all subsectors (NAICS subsectors 0), and on food services and drinking places (NAICS subsectors 722), allowing us to study teenagers and restaurant workers. To extend the main analysis, the database has been expanded by including additional subsections: food manufacturing (311), gasoline stations (457), clothing Retailers (458), professional, scientific, and technical services (541), and building material, garden equipment and supply dealers (444). Workers in these industries typically receive one of the lowest hourly rates on average. Therefore, they are likely to be more significantly impacted by changes in minimum wage policies (BLS, 2023).

In this study, the main variables extracted from the QWI data source are employment, earnings, separations, hires, and turnover rate. These variables will be further discussed and elaborated upon in detail in the following section. It should be noted that the worker-employer pair is the operational unit in this data source which implies that if an employee works multiple jobs within a quarter, they will be included in the dataset more than once to account for each job. To ensure confidentiality, certain random data points in the QWI

dataset have been blurred and flagged with the code 9. However, despite the possible distortion in the data, no data has been severely distorted in our sample. Observations with no disclosed information on employment or with a value of zero, indicated by data quality flags 0 or 5, have been removed from the analysis. Furthermore, the QWI data are manipulated such as creating the logarithms (log) of the dependent and independent variables. The use of logarithms is a frequent method employed in minimum wage literature as it enhances flexibility and facilitates the interpretation of the results. In other words, it displays the elasticity directly. Finally, the overall turnover rate, as described in the section 1.2, has been generated because the variable turnover rate in the QWI dataset is only available for employees with tenure longer than one quarter.

Finally with all those datasets, two panels of quarterly observations are constructed: one for every US county and another one for contiguous border county pairs that combine the labor, population and minimum wage data. To create the “All Counties Database", the QWI database is merged with the minimum wage database, and then subsequently merged with the county population database which contains sociographic statistics for each county. By merging the QWI data with the county population data, the analysis aims to provide a comprehensive understanding of the relationship between minimum wage policies, labor market outcomes, and population characteristics across different age groups in U.S. counties.

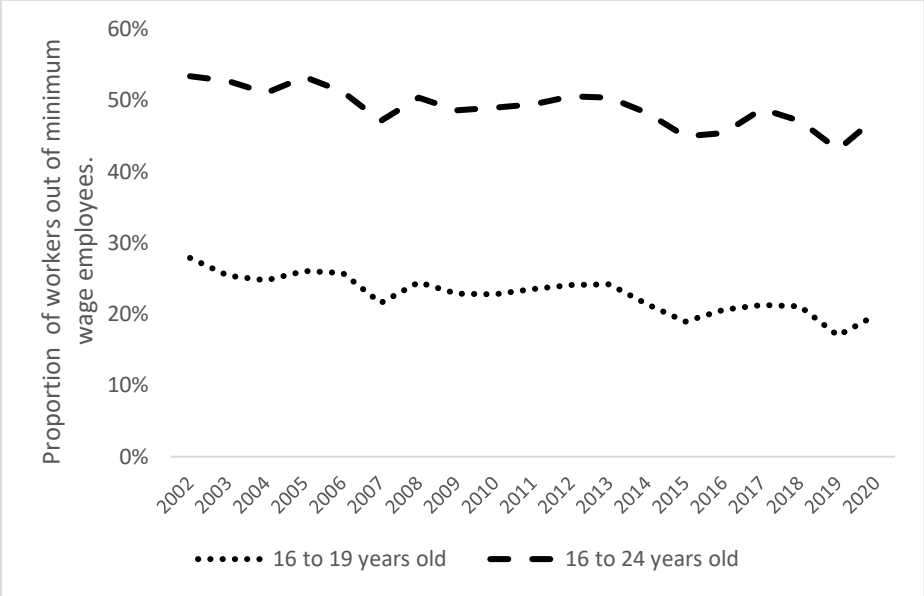
For the contiguous border county pair, the process is more complex. The QWI dataset provides a summary of information for 1,130 counties that are located adjacent to another state. From these border counties, we have identified a total of 1,181 distinct pairs of counties. The geographical distances between those counties can be large particularly in the West of the US and it can be detrimental to the results based on the econometrics method chosen. Indeed, Dube et al. (2016) demonstrated that as the distance between county centroids increases, the disparities in covariate levels and trends among counties also increase. For their analysis, the covariates selected are the log of overall private sector employment, the log of population, the employment-to-population ratio, the log of average private sector earnings, the log of the overall turnover rate, and the log of the teen share of the population.

To address this, using the same logic, counties with centroids more than 75 kilometers from each other have been excluded. This 75 km limits allows the study to minimize the mean-squared error based on data-driven randomization inference procedures and reduces the number of contiguous counties to 972 (Dube et al., 2016). This is particularly crucial as the purpose of this policy discontinuity at state borders model is to compare counties that exhibit similarities. Limiting the distance between counties ensures that the selected pairs are more likely to share similar characteristics and become suitable for comparison. After limiting the distance between counties, the QWI dataset has been merged to the same county population and state's minimum wage analogous to the "All Counties Database".

2.3 Descriptive statistics

The primary analysis focuses on teens and restaurant workers in both data sets because of their high proportion of minimum wage workers. Even though teens and restaurant workers have been analyzed extensively in the literature, it is still highly relevant to study them further. This is because more than 25% of teenagers (16-19 years old) earned the federal minimum wage between 1979 and 2019 (Manning, 2021a). This has meant that teenagers have been the most affected group in the US relating to minimum wage changes in the past. Despite the fact that this percentage has dropped recently to 21% as shown in figure 2 (BLS, 2020), they remain an important category to analyze. We don't know if the teenagers are also in school.

Figure 2: Proportion of workers out of minimum wage employees by age groups.



The evidence for restaurant workers is similar. The industry with the most workers being paid minimum wage has been leisure and hospitality, categories primarily consisting of employees working in restaurants. During the period between 2012 and 2020, 58% of federal minimum wage workers were working in this private sector (BLS, 2020). This proportion highlights the importance of further examination into the restaurant industry and its workers. Examining the impact on different genders separately also presents an important avenue for analysis because the gender composition differs within the low-wage labor market. For instance, between 2012 and 2020, in the US, women represents 64% of the workforce paid at or below minimum wage.

Table 1 displays the definitions of the main variables used in this thesis as the dependant variables (Dube et al., 2016).

Table 1: Definitions of main variables used.

Main variables	Definitions
Earnings	The average monthly earnings for workers that remain on the payroll until the final day of the reference quarter, denoted as *t*, in county *i*.
Employment	the number of employees enrolled on the final day of the reference quarter *t* in county *i,* implying a minimum employment duration of one.
Hires	The number of employees who begin a new job or are recalled during any given period within quarter *t* in county *i* and remained employed until the end of that period.
Separations	The number of employees whose jobs have been terminated with a specific company during a quarter *t* in county *i*. In the context of this study, a job ending is defined as the absence of an employee's wage record in the subsequent period, denoted as *t* +1. It suggests possible scenarios such as termination, layoff, resignation, or retirement.
Turnover rate	The average of hires and separations, expressed as a proportion of total employment (Accessions + Separations)/(2 x Employment)

Table 2 displays the descriptive statistics for all US counties (2,960) and for contiguous county pairs in the sample, focusing on teenagers (14-18) and restaurant workers between 2012 and 2020. The averages are presented for all employees with a minimum of one year of tenure and for movers. The gender distribution in both samples is relatively equal, with approximately 54% of workers being women in the teenager category and around 61% of restaurant workers in both samples. As expected, there is an

overlap between the two studied categories as 17% of restaurant workers are teenagers. Monthly revenue tends to be higher for workers with more than one quarter of tenure, which represents approximately 72% of the sample for teenagers and 78% for restaurant workers. The monthly earnings are reported in nominal dollars. Hires, separation rates, and turnover rates are greater for teenagers than restaurant workers. This could potentially be explained in reference to the nature of the employment i.e. the flexibility of employment offered to teenager workers. However, turnover rates are relatively high in both cases as anticipated in the low-wage labor market.

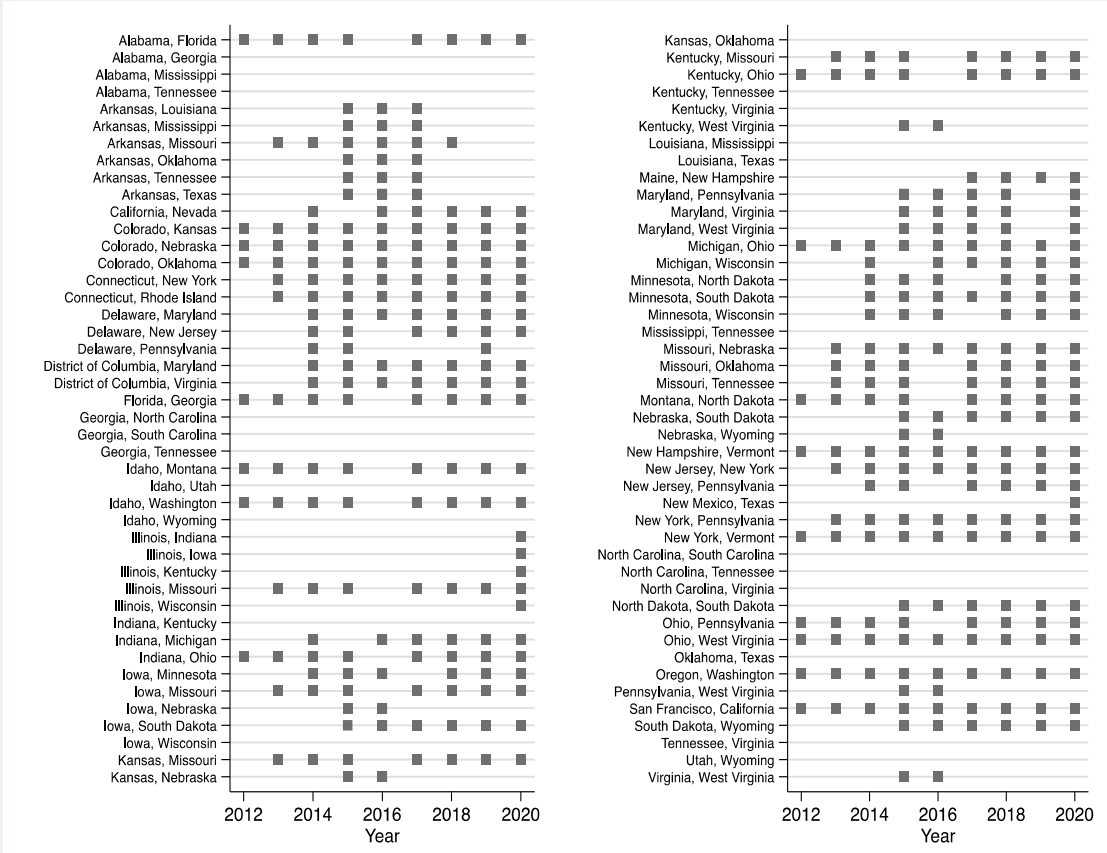
Table 2 : Descriptive Statistics

	All Counties Sample				Contiguous County Pair Sample			
	All Teens		Restaurant Workers		All Teens		Restaurant Workers	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
All:								
Monthly earnings ($)	624	220	1,146	339	604	167	1,112	321
Employment	1,012	2,628	3,946	13,154	1,008	2,172	3,851	10,734
Hire rates	0.61	0.33	0.35	0.15	0.59	0.29	0.34	0.13
Separation rates	0.44	0.19	0.34	0.10	0.43	0.18	0.33	0.10
Turnover rate	0.52	0.22	0.34	0.11	0.51	0.20	0.34	0.10
Fraction short term (tenure < 1 quarter)	0.28	0.10	0.22	0.06	0.27	0.09	0.22	0.06
Full Quarter (tenure ≥ 1 quarter):								
Monthly earnings ($)	724	234	1,330	381	699	203	1,287	365
Employment	722	1,858	3,130	10,655	721	1,543	3,052	8,630
Hire rates	0.22	0.05	0.13	0.03	0.22	0.05	0.13	0.03
Separation rates	0.14	0.04	0.13	0.03	0.14	0.04	0.13	0.03
Turnover rate	0.27	0.05	0.17	0.04	0.27	0.05	0.17	0.03
Monthly earnings ($) for movers (separations):	668	253	990	329	647	230	962	305
Monthly earnings ($) for movers (hires):	743	257	975	358	722	234	947	361
Fraction female	0.54	0.06	0.61	0.07	0.54	0.06	0.62	0.07
Fraction teen			0.17	0.06			0.17	0.06
Fraction young adult			0.14	0.03			0.14	0.03

NOTE.— Sample means are shown for all counties in the US and for all contiguous border county pairs with county centroids within a 75 kilometers limit. Hires, separations, and turnover rates are quarterly. The sample period is between the first quarter of 2012 and the last quarter of 2020. The number of observations vary from 103,647 to 138,139 for the all-county sample and from 52,801 to 87,571 for the contiguous county pair sample. Data source: Quarterly Workforce Indicators.

During the studied period, several minimum wage policies changes were implemented in the US, as illustrated in figure 1. However, since this study conducts a border discontinuity analysis, it is also important to consider county pairs that combine areas with differing minimum wage adjustments. Figure 3 combines all the minimum wage changes per year with the grey square representing a change in the hourly wage following the rule that the minimum wage is determined based on the highest rate among the state, county, or city levels. Within the sample's 88 policy borders, there were 240 minimum wage changes that occurred between 2012 and 2020, encompassing changes at all levels. Notably, the period 2015 to 2020 exhibits a widespread increase in minimum wage across counties.

Figure 3: Yearly minimum wage changes (city, county and state levels) in the US between 2012 and 2020



2.3 Strengths and limitations of QWI dataset

The QWI is a relatively new database which combines the advantageous features of the Current Population Survey and the QCEW datasets This integration provides us with even more extensive information compared to previous datasets, as it allows for easy linkage between workers and employers, given that the operational unit in the QWI is a worker-employer pair. The availability of such detailed job flow data is unique to this database, enabling us to study more than just the employment effect. Additionally, the data in the QWI are released at regular intervals, specifically every quarter, which grants us flexibility in choosing the period to be studied.

One of the main limitations of this dataset is the lack of information on hours worked or the number of days an employee works. This data would have been valuable in analyzing the behaviour of workers following an increase in their earnings. As the QWI dataset includes information for employees with multiple jobs, it does not allow us to differentiate whether the data for workers are from their primary or secondary job, which could potentially impact the observed earning effects. Additionally, it does not provide information on unemployment duration, which would be insightful to analyze in conjunction with our jobs flows estimates. Furthermore, the QWI dataset does not distinguish between voluntary and involuntary separations, which limits our ability to analyze the reasons behind job terminations. Finally, being a public dataset, an amount of values have been blurred to ensure privacy, which can reduce the accuracy of the data for some state (Dube et al., 2016).

Chapter 3
Econometric Model

3.1 Model specification

As mentioned in the literature review, a bountiful number of studies have analyzed the impact of an increase in minimum wage on employment using various methodologies. However, there is relatively limited research available on the minimum wage's effect on job flows in the US, particularly considering the recent data during an unprecedent time of minimum wage changes at all levels. In this research paper, the methodology adopted has been previously used in Dube et al. (2016) and initially implemented in Dube et al. (2010). Two strategies have been used to estimate the minimum wage's effect on workers.

The first method utilized is the two-way fixed effects model in which the fixed effects, county, and time, are employed as controls to correct for potential heterogeneity.

$$y_{ijt} = \alpha + \beta \ln\left(MW_{s(i)t}\right) + \Gamma \boldsymbol{X_{it}} + \epsilon_{ijt} \quad (1)$$

This two-way fixed effects regression (Equation 1) is equivalent to estimating a regression with demeaned data (Equation 2). A demeaned variable is represented in this specific case as follows: $\tilde{z}_{ijt} = z_{it} - \bar{z}_i - \bar{z}_t + \bar{z}$. The mean value of z specific to county *i* across all time periods is denoted as $\bar{z}_i$, while $\bar{z}_t$ represents the mean of z across all observations at time *t*. Additionally, $\bar{z}$ refers to the overall sample mean. This method using demeaned data has been explained in details in Conley and Taber (2011) and will be utilized in this thesis.

$$\tilde{y}_{ijt} = \alpha + \beta \ln\left(M\widetilde{W}_{s(i)t}\right) + \Gamma \widetilde{\boldsymbol{X}}_{\boldsymbol{it}} + \tilde{\epsilon}_{ijt} \quad (2)$$

In equation 2, *i* represents the primary county, *j* illustrates the paired county and *t* represents the time. The dependent variable y_{ijt} consists of the logarithms of employment, earnings, separations, hires, and turnover rate. The coefficient of interest is β, which explains the effect of an increase in the minimum wage on those dependent variables. As mentioned previously, the minimum wage is fixed at the state ($s_{(i)}$) level. The $\tilde{X}_{it}$ is added

as a vector of time-varying controls, which represent the logarithm of the total population and the logarithm of total employment of each county for the analysis of restaurant workers in other industries studied. For the teens analysis, the previous controls are used with the addition of the logarithm of total teen population by county. The application of logarithms for every variable in the dataset is prevalent in the minimum wage literature. Equation 2 will be calculated with the panel data described in chapter 2.

The assumptions behind the two-way fixed effects model implied that the error term is uncorrelated with the variables of interest. This assumption can also be written as $E\left(\left(M\widetilde{W}_{s(i)t}\right), \tilde{\epsilon}_{ijt}\right) = E\left(ln\left(M\widetilde{W}_{s(i)t}\right), \tilde{\epsilon}_{ijt}\right) = 0$. In other words, by controlling for these fixed effects, it is assumed that the remaining variation in the data can be reasonably attributed to the policy under investigation and it removes time-varying heterogeneity. This method also assumes that a parallel trend should exist among all US states.

Equation (2) is coherent if the panel of counties is balanced. However, in reality, it can't be assumed and therefore a command is utilized to rectify this issue[1]. This command estimates time and county dummies as independent variables in the regression using a conjugate gradient method which is an iterative numerical technique.

However, the issue of omitted variable bias is often raised with this econometric method. As a result of spatial confounding, the estimated impact of the minimum wage is frequently inaccurate. Indeed, in the US, the minimum wage changes exhibit strong geographical clustering and there are factors other than minimum wage that potentially influence the labor market and vary across different regions. Consequently, the two-way fixed effects estimators tend to reflect local differences that arise from minimum wage policies. The bias in the estimators has been addressed in many articles such as Allegretto et al. (2011). However, this method is commonly used in minimum wage studies and so it is important to compare its estimates to other models.

Due to the bias in the two-way fixed effects estimates, this method will be contrasted to a border discontinuity design (Equation 3), the preferred model in this paper. This

[1] The Stata command used is the TWFE *written by Nikolas Mittag.*

method is known for its advantageous characteristics to calculate unbiased estimators. The objective of this approach is to assess the impact of minimum wage on employment and job dynamics through the utilization of minimum wage discontinuities at state borders. Workers on the side of the border where the minimum wage increased (treatment group) are compared to workers on the other side where the minimum wage did not increase (control group). The locally-differenced value is described as $\tilde{\tilde{z}}_{ijt} = z_{it} - \bar{z}_{ijt} - \bar{z}_i + \bar{z}$ where $\bar{z}_{ijt}$ corresponds to the mean of z for the county pairs i, j at time t. Thus, the border discontinuity model is written as:

$$\tilde{\tilde{y}}_{ijt} = \alpha + \beta \ln (M\tilde{\tilde{W}}_{s(i)t}) + \Gamma \tilde{\tilde{X}}_{ijt} + \tilde{\tilde{\epsilon}}_{ijt} \quad (3)$$

The description of the variables of equation (3) is similar to equation (2), except that equation (3) utilizes local comparisons within contiguous counties pair. The contiguous county pair where the minimum wage has not increased serves as a desirable control group in this analysis due to its help in controlling for spatial heterogeneity. The coefficient of interest in the equation (3) for this study is represented by β, which captures the minimum wage effect on employment, earnings, and job flows. In this specification, county fixed effect is incorporated as in equation (2), but period fixed effects that interact with each county pair are also included.

The assumptions for the border discontinuity model are less restrictive compared to the two-way fixed effects model because the minimum wages only need to be uncorrelated to the error term within each county pair, rather than for the entire country. It can be represented as $E\left(ln\left(MW_{s(i)t}\right), \epsilon_{ijt} | i,\ j \in p\right) = 0$.

This border continuity method has been proven to be one of the best approaches for addressing endogeneity concerns. Indeed, apart from minimum wage discontinuities, contiguous counties are assumed to have similar labor markets, local economic trends, and demand shocks. By conducting local comparisons, the disparities between county pairs can be eliminated. It is easier to assume the parallel trend assumption within counties that are located next to each other, which is essential to this model. This method also deals with the potential issue of policy endogeneity. Instead of solely considering counties

directly located at the border, minimum wage policies may respond to statewide shocks. As a result, policy discrepancies observed within cross-border pairs are less likely to be influenced by endogeneity concerns, which can significantly distort studies that rely on state-level variations (Dube et al., 2016).

The same command used to calculate equation (2), also enables a calculation of this equation with county and a pair-time fixed effect. It has the advantage of including an option to cluster standard error two-ways. Firstly, the standard error is clustered at the state level, not only using state minimum wage changes, but also county and city variations. In fact, minimum wage changes are linked to state level by choosing the highest minimum wage between state, counties and cities which represents the overall state minimum wage. As explained in the data section, counties can be repeated within the dataset as long as they have borders with other counties. Therefore, the use of state-level clustering automatically accounts for the existence of duplicate counties when estimating standard errors. Secondly, the standard errors relating to border segments between counties are clustered. This approach is also applied to the first regression by clustering the robust standard error at the state and border-segment levels. Finally, even though the second equation might suffer from omitted variable bias, equations 2 and 3 will be estimated for teenagers, restaurant workers, and for every other chosen industry sectors discussed. Those estimators will also be calculated by gender, and all the results will be explained in detail in section 4. Retaining both specifications allows a comparison and understanding of the differences between the methods chosen.

3.2 Critical review of the model

Despite the border discontinuity method having been employed by many scholars, its validity is not unanimous. On one side, scholars like Allegretto et al. (2011); Dube et al. (2016) are convinced, amongst others, that this econometrics method provides the best solution to the omitted variable bias that occurs with the two-way fixed effects estimators. In their opinion, this method enables a calculation of the most significant effect following a minimum wage increase as it accounts for spatial heterogeneity.

On the other side, Neumark et al. (2014) are more critical of this method. They argue that the border discontinuity model reduces the sample size used for the analysis and that the data discarded could significantly influence the estimates. They also assert that the inclusion of interaction variables between periods and regions can eliminate the effects of the variations in minimum wages between regions attributed to factors such as changes in inequality, union strength, or the federal minimum wage. These factors, which are mostly external to local low-skill labor markets, diverge more between regions than within regions and should be included in the estimates.

This ongoing debate highlights some limitations of the preferred model in this analysis. However, given the recent data used, and the fact that it was collected during a period of much higher changes to minimum wages, this paper commits to the border discontinuity model in order to find the most accurate results.

Chapter 4
Results and Analysis

The following chapter presents results concerning the impact of an increase in the minimum wage on employment, earnings, and job flows. These effects are specifically analyzed for teenagers, restaurant workers, women, men, and other industries that have received less attention. This research contributes to the existing literature by studying a period with multiple minimum wage changes and by providing additional data on the impact of job flows. Furthermore, it delves into the gender dynamics within the most studied categories: teenagers and restaurant workers.

The key results of this study are for the period between 2012 and 2020 in the US labor market. Additionally, the results from 2000 to 2011 from (Dube et al., 2016), regarding minimum wage elasticities for teens and restaurant workers, have been presented in the appendix (Table 1A). The replication of this period has been realized to confirm the validity of our data construction and baseline analysis. There are some minor differences between the estimates, but the level of significance and the signs of the estimates are all identical. Those discrepancies can be explained partly by the continuous update of the QWI data.

4.1 Main Analysis: teens and restaurant workers

The main results of the study are presented in table 2, which displays the minimum wage elasticities for teens and restaurant workers over the period from the first quarter of 2012 and the last quarter of 2020. Effects on earnings, employment, hires, separations, and turnover rate are thereby reported. Columns 1 and 3 represent the two-ways fixed effects model with common time effects as described in equation (1) and explained in the methodology section. Additionally, columns 2 and 4 show the border discontinuity analysis (preferred model), as referenced in equation (2), which will be the preferred specification of this thesis.

Table 3: Minimum wage elasticities for teens and restaurant workers: earnings, employment stocks and flows between 2012 and 2020.

	Teens		Restaurant Workers	
	(1)	(2)	(3)	(4)
Earnings	0.421***	0.346***	0.234***	0.195***
	(0.045)	(0.071)	(0.038)	(0.058)
	[68,119]	[68,119]	[67,881]	[67,881]
Employment	-0.396***	-0.164**	-0.167***	-0.097
	(0.084)	(0.083)	(0.042)	(0.086)
	[66,252]	[66,252]	[62,132]	[62,132]
Hires	-0.579***	-0.249***	-0.420***	-0.197*
	(0.107)	(0.096)	(0.091)	(0.119)
	[59,132]	[59,132]	[58,942]	[58,942]
Separations	-0.570***	-0.297***	-0.296***	-0.143
	(0.110)	(0.099)	(0.088)	(0.102)
	[56,710]	[56,710]	[57,611]	[57,611]
Turnover Rate	-0.164***	-0.080	-0.190***	-0.103
	(0.050)	(0.065)	(0.071)	(0.067)
	[56,494]	[56,494]	[57,323]	[57,323]
Controls:				
Common time effects	Yes	No	Yes	No
Pair-specific time effects	No	Yes	No	Yes

NOTE.—The table displays the log minimum wage coefficients associated with the log of the dependent variable in the first column. All regressions include controls for the natural log of county population and total private sector employment. Specifications 1 and 2 present estimates for teenagers aged 14-18, regardless of industry, and they also incorporate the log of teen population. Specifications 3 and 4 focus solely on workers in the restaurant industry (NAICS722). All samples and specifications include county fixed effects. Specifications 1 and 3 include common time period fixed effects. For specifications 2 and 4, period fixed effects are interacted with each county pair. Standard errors in parentheses are two-way clustered at the state and border-segment level. Sample sizes (observations) are reported as well for each regression in squared brackets.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

In table 2, the earnings elasticities are positive and significant, at the 1% level for both categories and specifications, ranging between 0.195 and 0.421. Based on the preferred model, the impact is more pronounced for teenagers than for restaurant workers, with an elasticity of 0.346 (column 2) compared to 0.195 (column 4). These results indicate that the comparison of local areas does not remove or negate the impact of an increased minimum wage on workers while using the border discontinuity model. These findings are consistent with the existing literature, which identifies a general increase in earnings following a raise in minimum wage. This leads to a general improvement in the living standard of employees. These estimates confirm that teenagers and restaurant workers are directly affected by changes in minimum wage policy.

As the literature has shown previously, when using the traditional model with controls for common time effects, the employment elasticity is negative for both categories studied (column 1 and 3). Compared to the range of -0.1 to -0.3 observed in the articles analyzed by Neumark and Wascher (2008), these outcomes are even more important for teenagers with an elasticity of -0.396. Compared to the period between 2000 and 2011 studied in Dube et al. (2016) (Table A1), the specification with controls for county-pair-specific time effects now shows a statistically significant negative employment effect at a 95% confidence level for teenagers, with an employment elasticities of -0.164 (column 2). However, there is no such effect observed for restaurant workers (column 4) which can be partially explained by the labor-intensive nature of the industry. Although the employment of low-wage teenagers is reduced by an increase in the minimum wage, the effect is not the most substantial factor affecting employment levels in a county. For instance, to illustrate this impact, if there were a hypothetical 5% increase in minimum wage, corresponding to the average state and substates minimum wage raise from 2012 to 2020, the disemployment effect would, on average, reduce employment levels in a county by approximately 8.27 fewer jobs for teenagers, using an average county employment level of 1008. However, for this period, it is no longer possible to come to the conclusion that accounting for spatial heterogeneity removes the disemployment effect of minimum wage for teenagers, as shown in Dube et al. (2016). The unprecedent number of minimum wage variations highlights this disemployment effect for teenagers.

Focusing now on the estimates regarding job flows in table 2, for teenagers, the increase in minimum wage has a considerable and statistically significant negative effect at a 99% confidence level on hires and separations, with smaller coefficients observed in the preferred model (column 2). This reduction in separations indicates that job stability has increased due to less uncertainty for teenage workers following an increase in minimum wage. The reduction of terminations is also beneficial for the government due to decrease of their spendings through social benefits. The decline in hires is linked to this decrease in separations because firms have less of a need to increase their workforce. On the other hand, this decline in separations due to a raise in minimum wage can also decrease the probability of low-wage workers finding a job and consequently increase the period between employment. Unfortunately, there is no available data on employment

duration in the QWI dataset to confirm this hypothesis[2]. Finally, the turnover rate for teenagers is negative but not significantly different from zero (column 2). However, a negative turnover rate elasticity, similar to the results from 2000 to 2011 (Table A1), might be beneficial for firms. This is because there is typically a high turnover rate in low-wage labor sectors, and employee turnover is typically expensive for employers.

In the context of restaurant workers, the estimates for job flows differ from those pertaining to teenagers in terms of hiring and separations. The effects on separations and turnover rate are negative but not significant in both cases. There is only a significant negative effect at a 90% confidence level (column 4) for hires, with an elasticity of -0.197. In other words, those estimates suggest that changes in minimum wage do not considerably impact job flows in this high-impact industry.

One possible channel of adjustment for firms to deal with an increase in minimum wage is to reduce working hours (Schmitt, 2015). In a scenario where the only modification made by the firm is a reduction in hours worked, it would be detrimental to employees' average earnings only if the hours worked are reduced more than the pay rises. There is no data available on hours worked in the dataset to confirm if the possible adjustment in hours have an impact on workers during the period studied. However, the positive earning elasticity for both industries is promising. In the literature, there is a similar and inconclusive conclusion regarding hours adjustment following an increase in minimum wage.

4.2 Analysis by Gender

In this section we consider the impact of minimum wage by gender. The effects on job flows and employment can impact gender differently, given that women represent a higher proportion within the low-wage labor market in the US. The same specifications are used as section 4.1 which includes common time effects and pair-specific time effects and are presented in table 3. Overall, female teenagers experience a larger impact in regard to the five elasticities studied with both specifications.

[2] The QWI dataset starting 2012 does no longer collect unemployment duration.

When analyzing the preferred model for teens (columns 2 & 4), the wage effects are more important for women than men, but both are significant at a 99% confidence level. The results are consistent with the conclusions mentioned in the literature and confirm that an increase in minimum wage is a useful tool to reduce the gender wage gap. Column 4 clearly illustrates that the disemployment effect affecting teens is concentrated exclusively on women, with a significant negative elasticity of -0.255 compared to a non-significant elasticity of -0.116 for men (column 2). The same conclusion is reached when examining the elasticities of hires, indicating that overall women have less opportunities for employment following an increase in the minimum wage. The effect on separations is similar between genders and is significant at the same level for both men and women. This implies that employees of both genders reduce the number of resignations, retirements, or the company reduces the layoffs.

Concerning the other category studied in table 3, all the positive effects related to earnings are attributed to female restaurant workers (column 8), which is surprising as many studies find a positive effect on earnings regardless of gender. There is no employment effect for both genders in the preferred model (columns 6 & 8), but there is still a significant disemployment effect when there is no control for spatial heterogeneity for both genders. This high-impact industry doesn't exhibit gender differences related to employment. When examining the elasticity of hires and separations, we observe that the adverse and significant impact is only experienced by male restaurant workers. Further analysis could be conducted to better understand this conclusion. When analyzing males and females together, no significant effect on turnover rate (Table 2) was found. However, when the impact of an increase in minimum wage is examined separately by gender, the turnover rate becomes significant at the 10% level and negative for both genders in table 3 (columns 6 & 8).

Table 4: Minimum wage elasticities for teens and restaurant workers: earnings, employment stocks and flows by gender between 2012 and 2020.

	Teens				Restaurant Workers			
	Male	Male	Female	Female	Male	Male	Female	Female
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Earnings	0.394***	0.294***	0.446***	0.403***	0.145***	0.096	0.262***	0.236***
	(0.049)	(0.092)	(0.042)	(0.068)	(0.039)	(0.073)	(0.037)	(0.054)
	[68,027]	[68,027]	[67,952]	[67,952]	[67,660]	[67,660]	[67,800]	[67,800]
Employment	-0.324***	-0.116	-0.453***	-0.255***	-0.174***	-0.086	-0.161***	-0.081
	(0.073)	(0.096)	(0.086)	(0.080)	(0.039)	(0.075)	(0.049)	(0.094)
	[62,744]	[62,744]	[63,000]	[63,000]	[58,812]	[58,812]	[61,802]	[61,802]
Hires	-0.526***	-0.187	-0.667***	-0.307***	-0.491***	-0.208*	-0.415***	-0.145
	(0.099)	(0.117)	(0.106)	(0.093)	(0.092)	(0.125)	(0.094)	(0.105)
	[50,704]	[50,704]	[51,740]	[51,740]	[48,070]	[48,070]	[55,644]	[55,644]
Separations	-0.485***	-0.233**	-0.639***	-0.343***	-0.348***	-0.200**	-0.298***	-0.127
	(0.099)	(0.104)	(0.112)	(0.088)	(0.078)	(0.096)	(0.091)	(0.099)
	[46,045]	[46,045]	[46,540]	[46,540]	[48,374]	[48,374]	[55,506]	[55,506]
Turnover Rate	-0.139***	-0.050	-0.183***	-0.086	-0.255***	-0.159*	-0.207***	-0.101*
	(0.050)	(0.062)	(0.046)	(0.059)	(0.072)	(0.088)	(0.068)	(0.057)
	[45,543]	[45,543]	[46,346]	[46,346]	[46,513]	[46,513]	[53,980]	[53,980]
Controls:								
Common time effects	Yes	No	Yes	No	Yes	No	Yes	No
Pair-specific time effects	No	Yes	No	Yes	No	Yes	No	Yes

NOTE.—The table displays the log minimum wage coefficients associated with the log of the dependent variable in the first column. All regressions include controls for the natural log of county population and total private sector employment. Specifications 1, 2, 3 and 4 present estimates for teenagers aged 14-18, regardless of industry, and they also incorporate the log of teen population. Specifications 5, 6, 7 and 8 focus solely on workers in the restaurant industry (NAICS722). All samples and specifications include county fixed effects. Specifications 1, 3, 5 and 7 include common time period fixed effects. For specifications 2, 4, 6 and 8 period fixed effects are interacted with each county pair. Standard errors in parentheses are two-way clustered at the state and border-segment level. Sample sizes (observations) are reported as well for each regression in squared brackets. * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

4.3 Analysis for other sectors

As discussed in the data section, the impact of minimum wage variations on teenagers and restaurant workers has been studied extensively for a reason. However, the period between 2012 and 2020, characterized by an unprecedented level of minimum wage variations, provides motivation to further investigate. Using the same methodology, we explore other possible high-impact industries. The analysis includes sectors such as food manufacturing, gasoline stations, clothing retailers, building material, garden equipment and supply dealers, and professional, scientific, and technical services. The estimates for

these industries are presented in tables 4, 5 and 6. In this section, both model specifications are presented similarly to section 4.1 and 4.2.

However, it becomes evident that there is no significant impact of a raise in minimum wage on any sectors, as indicated in the preferred model (columns 2 & 4) in the following tables. The lack of significant positive impact on earnings is particularly surprising, considering that industries with a high proportion of minimum wage workers would typically be expected to experience such an effect. The fact that there are no negative impact on employment is beneficial for workers in the future because the fear of disemployment effect is one of the contributing factors stopping people from implementing increases in minimum wage.

There are still elements worth discussing regarding the specification in columns 1 and 3. Without adding a pair-specific time effects, the effects on earnings are only positive and significant for general merchandise retailers, gasoline stations, and fuel dealers (Column 3, Table 4 & column 1, Table 5). This lack of a positive effect on earnings in other industries contradicts the findings mentioned in the literature review. One possible explanation for this discrepancy could be that workers in those industries were already receiving an hourly wage higher than the minimum wage, and therefore, the impact of the new minimum wage is not as significant for them.

The placebo industry, in this case, the professional, scientific, and technical services sector (Table 6), shows no significant effect following a minimum wage change, as predicted, except for a negative employment effect for the first specification (column 1). These results confirm the robustness of the data and the methodology employed. Overall, the limited data available for some sectors, especially for employment, hires, separations, and turnover rate, could be one of the reasons explaining the lack of significant results in those areas.

Table 5 : Minimum wage elasticities for food manufacturing and general merchandise retailers workers : earnings, employment stocks and flows between 2012 and 2020.

	Food Manufacturing		General Merchandise Retailers	
	(1)	(2)	(3)	(4)
Earnings	0.037	-0.039	0.132**	0.024
	(0.085)	(0.134)	(0.058)	(0.079)
	[53,492]	[53,492]	[65,795]	[65,795]
Employment	-0.151	-0.258	-0.124	-0.032
	(0.164)	(0.343)	(0.102)	(0.184)
	[16,188]	[16,188]	[36,920]	[36,920]
Hires	-0.441*	-0.252	-0.353***	-0.079
	(0.256)	(0.435)	(0.130)	(0.186)
	[11,344]	[11,344]	[34,008]	[34,008]
Separations	-0.252	-0.110	-0.392***	-0.050
	(0.284)	(0.457)	(0.138)	(0.181)
	[12,335]	[12,335]	[33,946]	[33,946]
Turnover Rate	-0.305*	0.026	-0.224***	-0.037
	(0.170)	(0.274)	(0.102)	(0.136)
	[11,194]	[11,194]	[33,525]	[33,525]
Controls:				
Common time effects	Yes	No	Yes	No
Pair-specific time effects	No	Yes	No	Yes

NOTE.—The table displays the log minimum wage coefficients associated with the log of dependent variable in the first column. All regressions include controls for the natural log of county population and total private sector employment. Specifications 1 and 2 present estimates for teenagers aged 14-18, regardless of industry, and they also incorporate the log of teen population. Specifications 3 and 4 focus solely on workers in the restaurant industry (NAICS722). All samples and specifications include county fixed effects. Specifications 1 and 3 include common time period fixed effects. For specifications 2 and 4, period fixed effects are interacted with each county pair. Standard errors in parentheses are two-way clustered at the state and border-segment level. Sample sizes (observations) are reported as well for each regression in squared brackets.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

Table 6: Minimum wage elasticities for gasoline stations and fuel dealers and clothing retailers workers: earnings, employment stocks and flows between 2012 and 2020.

	Gasoline stations and fuel dealers		Clothing retailers	
	(1)	(2)	(3)	(4)
Earnings	0.126***	0.046	-0.071	-0.164
	(0.036)	(0.072)	(0.096)	(0.228)
	[67,662]	[67,662]	[53,655]	[53,655]
Employment	0.036	0.111	-0.304**	-0.030
	(0.048)	(0.087)	(0.138)	(0.162)
	[59,196]	[59,196]	[21,894]	[21,894]
Hires	-0.155*	0.072	-0.417**	0.085
	(0.082)	(0.146)	(0.188)	(0.206)
	[49,082]	[49,082]	[12,178]	[12,178]
Separations	-0.110	0.039	-0.329*	-0.002
	(0.083)	(0.150)	(0.172)	(0.186)
	[51,289]	[51,289]	[13,513]	[13,513]
Turnover Rate	-0.168***	0.004	-0.211***	-0.068
	(0.064)	(0.094)	(0.068)	(0.099)
	[48,547]	[48,547]	[11,690]	[11,690]
Controls:				
Common time effects	Yes	No	Yes	No
Pair-specific time effects	No	Yes	No	Yes

NOTE.—The table displays the log minimum wage coefficients associated with the log of the dependent variable in the first column. All regressions include controls for the natural log of county population and total private sector employment. Specifications 1 and 2 present estimates for teenagers aged 14-18, regardless of industry, and they also incorporate the log of teen population. Specifications 3 and 4 focus solely on workers in the restaurant industry (NAICS722). All samples and specifications include county fixed effects. Specifications 1 and 3 include common time period fixed effects. For specifications 2 and 4, period fixed effects are interacted with each county pair. Standard errors in parentheses are two-way clustered at the state and border-segment level. Sample sizes (observations) are reported as well for each regression in squared brackets.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

Table 7: Minimum wage elasticities for professional scientific and technical services and fuel dealers and building material and garden equipment and supplies dealers: earnings, employment stocks and flows between 2012 and 2020.

	Professional scientific and technical services		Building material and garden equipment and supplies dealers	
	(1)	(2)	(3)	(4)
Earnings	0.027	0.041	-0.041	-0.035
	(0.041)	(0.100)	(0.049)	(0.073)
	[67,857]	[67,857]	[66,542]	[66,542]
Employment	-0.124**	-0.078	-0.032	0.112
	(0.049)	(0.106)	(0.058)	(0.123)
	[60,614]	[60,614]	[40,298]	[40,298]
Hires	-0.080	-0.002	-0.236**	-0.001
	(0.084)	(0.155)	(0.106)	(0.108)
	[31,864]	[31,864]	[20,690]	[20,690]
Separations	-0.001	-0.007	-0.172*	-0.002
	(0.070)	(0.143)	(0.093)	(0.128)
	[31,002]	[31,002]	[22,292]	[22,292]
Turnover Rate	0.011	0.024	-0.137**	-0.019
	(0.066)	(0.143)	(0.068)	(0.104)
	[29,545]	[29,545]	[20,167]	[20,167]
Controls:				
Common time effects	Yes	No	Yes	No
Pair-specific time effects	No	Yes	No	Yes

NOTE.—The table displays the log minimum wage coefficients associated with the log of the dependent variable in the first column. All regressions include controls for the natural log of county population and total private sector employment. Specifications 1 and 2 present estimates for teenagers aged 14-18, regardless of industry, and they also incorporate the log of teen population. Specifications 3 and 4 focus solely on workers in the restaurant industry (NAICS722). All samples and specifications include county fixed effects. Specifications 1 and 3 include common time period fixed effects. For specifications 2 and 4, period fixed effects are interacted with each county pair. Standard errors in parentheses are two-way clustered at the state and border-segment level. Sample sizes (observations) are reported as well for each regression in squared brackets.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

Chapter 5
Robustness Check

Given the primary results regarding teenagers and restaurant workers (Table 2), there are some limitations with the methodology used that need to be tested to ensure its validity. These tests will focus on the choice of controls in the model, restrictions on the sample size, and the choice of periods studied.

Table 7 presents the results pertaining to two robustness checks for the preferred model. First of all, one concerning aspect of the model is that outcomes related to teenagers' and restaurant workers' employment and job flow could be influenced by general labor market patterns within the county. In order to verify this possible bias, county linear trends are included in equation (2), explained in chapter 3, and are shown in table 7 (column 1). By comparing to the results for teenagers from the preferred model (columns 2 & 4 from Table 2), earnings, hires and separations elasticities remain robust with the inclusion of this control. However, there is no longer a significant disemployment effect when county trends are taken into account, suggesting that employment is more influenced by county dynamics. This result coincides more with the no-employment effect observed in the literature using a border discontinuity analysis. The effect of a change in minimum wage policy on turnover rate also differs from the main analysis. With this additional check in the strategy, the turnover rate elasticities become negative and statistically significant at the 5% level.

Additionally, concerning the results for restaurant workers, the estimates are virtually similar for earnings and employment (column 8). The reduction in hires is similar to the main results but even more significant. Regarding the separations and turnover rate, there is now a negative effect following an increase in minimum wage. Overall, this robustness check confirms the conclusions made in chapter 4 concerning the restaurant industry, except for separations for restaurant workers and the turnover rate for both groups.

The model is further tested by incorporating an alternative control variable, that represents the overall outcome at the private sector level. This is an ambitious test because a significant proportion of both separations and new hires originate from low-wage sectors. In general, the estimates in table 7 (column 2) are nearly identical to the results for teenagers in table 2 (column 2), confirming the significance of the chosen model, except for the turnover rate which, after the test, became negative and significant. For restaurant workers, the coefficient remains the same for earnings, employment, and hires (column 9). However, although estimates are relatively similar, the degree of significance is greater for separation and turnover rate. Based on this, it is possible to conclude that there are no general labor market patterns within any given county that influences the impact of an increase in minimum wage.

Subsequently in table 7, columns 3, 4, 6, 7, 10, 11, 13, and 14 represent an alternative test for checking preexisting trends and lagged effects. It has been observed that existing tendencies could impair the employment level and job flows estimates obtained with the model. The specifications for teens and restaurant workers introduce lagged and leaded variables at different time intervals. Specifically, this test examines a two-year lead (8 quarters) $LnMW_{t+8}$, a one year lead (4 quarters) $LnMW_{t+4}$, a two year lag (8 quarters) $LnMW_{t-8}$ and one year lag (4 quarters) $LnMW_{t-4}$.

In Dube et al. (2016), no significant prior or subsequent trends were detected, but over a longer period this may not be the case which must therefore be tested for. Regarding the lagged estimates for teenagers, the minimum wage changes have a significant negative impact on separation and turnover rate only one year before the event (column 4) and no significant leaded effects are detected (columns 6 & 7). For restaurant workers, the results demonstrate no significant impact one or two years before or after the minimum wage change, barring a positive turnover rate 8 quarters after the event (columns 10,11,13, and 14). Adding lagged and leaded minimum wage variables in the regression did not have a significant impact on the estimates at time *t* for both categories studied (columns 5 and 12). It demonstrates clearly that the effects on earnings, employment and job flows were not tarnished by prior trends.

Table 8 : Minimum Wage Elasticities for Earnings and Employment Stocks and Flows: Robustness Checks

	Teens							Restaurant Workers						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	$LnMW_t$	$LnMW_t$	$LnMW_{t-8}$	$LnMW_{t-4}$	$LnMW_t$	$LnMW_{t+4}$	$LnMW_{t+8}$	$LnMW_t$	$LnMW_t$	$LnMW_{t-8}$	$LnMW_{t-4}$	$LnMW_t$	$LnMW_{t+4}$	$LnMW_{t+8}$
Earnings	0.368***	0.348***	-0.095	0.151	0.320***	0.110	-0.015	0.174**	0.195***	-0.050	0.124	0.170**	-0.003	-0.046
	(0.089)	-0.071	(0.092)	(0.097)	(0.078)	(0.096)	(0.101)	0.077	(0.058)	(0.093)	(0.086)	(0.067)	(0.074)	(0.066)
	[68,119]	[68,119]	[68,119]	[68,119]	[68,119]	[68,119]	[68,119]	[67,881]	[67,881]	[67,881]	[67,881]	[67,881]	[67,881]	[67,881]
Employment	-0.094	-0.164**	-0.106	0.037	-0.168**	0.088	0.052	-0.060	-0.097	0.025	-0.012	-0.098	-0.115	-0.110
	(0.095)	(0.083)	(0.099)	(0.141)	(0.084)	(0.131)	(0.114)	(0.112)	(0.086)	(0.088)	(0.117)	(0.093)	(0.118)	(0.126)
	[66,252]	[66,252]	[66,252]	[66,252]	[66,252]	[66,252]	[66,252]	[62,132]	[62,132]	[62,132]	[62,132]	[62,132]	[62,132]	[62,132]
Hires	-0.388***	-0.256***	0.061	-0.145	-0.217**	0.085	0.095	-0.275***	-0.193*	0.028	-0.087	-0.182	-0.064	0.006
	(0.149)	(0.013)	(0.145)	(0.170)	(0.089)	(0.135)	(0.128)	(0.022)	(0.105)	(0.141)	(0.143)	(0.120)	(0.147)	(0.125)
	[59,132]	[59,132]	[59,132]	[59,132]	[59,132]	[59,132]	[59,132]	[58,942]	[58,942]	[58,942]	[58,942]	[58,942]	[58,942]	[58,942]
Separation	-0.379**	-0.327***	0.057	-0.292*	-0.239***	0.055	0.098	-0.267**	-0.153*	0.045	-0.111	-0.120	0.053	0.045
	(0.155)	(0.072)	(0.150)	(0.153)	(0.090)	(0.185)	(0.153)	(0.123)	(0.092)	(0.144)	(0.149)	(0.114)	(0.142)	(0.125)
	[56,710]	[56,710]	[56,710]	[56,710]	[56,710]	[56,710]	[56,710]	[57,611]	[57,611]	[57,611]	[57,611]	[57,611]	[57,611]	[57,611]
Turnover Rate	-0.275**	-0.098**	0.126	-0.172*	-0.047	0.016	0.081	-0.221*	-0.109**	-0.004	-0.117	-0.077	0.088	0.128**
	(0.109)	(0.043)	(0.082)	(0.097)	(0.064)	(0.075)	(0.072)	(0.112)	(0.054)	(0.098)	(0.113)	(0.072)	(0.081)	-0.061
	[56,494]	[56,494]	[56,494]	[56,494]	[56,494]	[56,494]	[56,494]	[57,323]	[57,323]	[57,323]	[57,323]	[57,323]	[57,323]	[57,323]
Controls and samples :														
County trends	Yes	No	No	No	No	No	No	Yes	No	No	No	No	No	No
Overall outcome	No	Yes	No	No	No	No	No	No	Yes	No	No	No	No	No
Pair-specific time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NOTE.—The table displays coefficients associated with log minimum wage on the log of the dependent variable noted in the first column. All regressions include controls for natural log of county population and total private sector employment. Specifications 1–7 provide estimates for all teens ages 14–18 regardless of industry, and they also include log of teen population. Specifications 8–14 are limited to all workers in the restaurant industry (NAICS722). All samples and specifications include county fixed effects and pair-specific time effects. Specifications 1 and 8 also include county-specific linear time trends. Specifications 2 and 9 also include the overall private sector outcome (e.g., private sector turnover rate) as a control. Specifications 3-4, 6-7, 10-11 and 13-14 also include a 4-quarter lead, 8-quarter lead, 4-quarter lag and a 8-quarter lag in log minimum wage. Standard errors in parentheses are two-way clustered at the state and border-segment level. Sample sizes (observations) are reported as well for each regression in squared brackets.

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

The confined scope of the research which limited the focus to counties whose centroids are separated by a maximum distance 75 kilometers, may also impact the robustness of the estimates. This separation affects the dataset by including or excluding certain counties pairs that may not be comparable. As a second robustness check, equation (2) is recalculated with samples using different maximum distances between centroids for teens and restaurant workers. Table 8 presents the results of the border discontinuity model with maximum distances between centroids ranging from 45 to 95 kilometers. The

original data set with the 75 kilometers limit restricts the analysis to only 84% of all possible county pairs in the US and this specification is represented in column 4 and 10 for teens and restaurant workers respectively. As shown in the table 8, in each column, the percentage of all county pairs chosen in the sample is shown and varies between 44 and 90 percent.

Overall, the results are robust for earnings for both teens and restaurant workers across all outcomes. When examining teen's employment, hires, and separations, the level of significance and the signs remain mostly the same from columns 1 to 6 but the impact of the minimum wage policy decreases as the distance between centroids increases. As mentioned previously, the border discontinuity model assumes that the local counties are identical except for the minimum wage. This assumption is easier to maintain when the county pairs are closer to each other. Moreover, the negative turnover rate impact increases and becomes more significant when the percent of all pairs decrease.

For restaurant workers, the results for employment and separation have not been affected by the cutoff distances. The hiring effect is similar for cutoff distances varying between 75 to 95 kilometers, but the significant elasticity disappears for any maximum distance between counties lower than 75 kilometers. The effect on turnover rate is not distinguishably different from zero (columns 9-12) but becomes significantly negative for the first two cutoffs (columns 7 & 8). Those results confirm the choice of the 75 kilometers cutoff.

Table 9:Minimum Wage Elasticities for Earnings and Employment Stocks and Flows: Robustness to Distance Cut-offs.

	Teens						Restaurant Workers					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Earnings	0.317***	0.335***	0.346***	0.346***	0.340***	0.339***	0.162**	0.145**	0.178***	0.195***	0.215***	0.220***
	(0.091)	0.072)	(0.071)	(0.071)	(0.069)	(0.071)	(0.066)	(0.059)	(0.052)	(0.058)	(0.063)	(0.062)
	[35,097]	[52,770]	[63,345]	[68,119]	[71,630]	[74,132]	[34,988]	[52,554]	[63,092]	[67,881]	[71,324]	[73,829]
Employment	-0.269**	-0.201**	-0.182**	-0.164**	-0.171**	-0.167**	-0.130	-0.062	-0.062	-0.097	-0.105	-0.110
	(0.108)	(0.100)	(0.084)	(0.083)	(0.080)	(0.078)	(0.123)	(0.100)	(0.087)	(0.086)	(0.084)	(0.082)
	[33,820]	[51,328]	[61,590]	[66,252]	[69,554]	[71,786]	[32,632]	[48,874]	[58,252]	[62,132]	[64,786]	[66,730]
Hires	-0.375***	-0.301**	-0.263**	-0.249***	-0.252***	-0.246***	-0.239	-0.183	-0.183	-0.197*	-0.200*	-0.200*
	(0.119)	(0.121)	(0.104)	(0.096)	(0.092)	(0.090)	(0.156)	(0.143)	(0.129)	(0.119)	(0.116)	(0.114)
	[30,744]	[46,646]	[55,540]	[59,132]	[61,642]	[63,586]	[31,284]	[46,878]	[55,556]	[58,942]	[61,380]	[63,180]
Separations	-0.426***	-0.366***	-0.322***	-0.297***	-0.300***	-0.292***	-0.195	-0.152	-0.134	-0.143	-0.141	-0.139
	(0.123)	(0.124)	(0.104)	(0.099)	(0.096)	(0.093)	(0.135)	(0.124)	(0.111)	(0.102)	(0.100)	(0.097)
	[29,910]	[45,016]	[53,342]	[56,710]	[59,003]	[60,803]	[30,672]	[46,011]	[54,232]	[57,611]	[59,832]	[61,632]
Turnover Rate	-0.114**	-0.115*	-0.097	-0.080	-0.078	-0.075	-0.144*	-0.137*	-0.112	-0.103	-0.097	-0.091
	(0.057)	(0.060)	(0.061)	(0.065)	(0.063)	(0.061)	(0.082)	(0.077)	(0.070)	(0.067)	(0.065)	(0.064)
	[29,766]	[44,800]	[53,126]	[56,494]	[58,715]	[60,443]	[30,528]	[45,795]	[53,944]	[57,323]	[59,544]	[61,344]
Maximum distance between centroids:	45	55	65	75	85	95	45	55	65	75	85	95
Percent of all pairs	44	66	79	84	87	90	44	67	79	84	87	90
Controls:												
Common time effects	No	No	No	No	No	No	No	No	No	No	No	No
Pair-specific time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes. The table displays estimates for alternative cut-offs in the maximum distance in kilometers between county centroids within a pair, as reported in the second to last row. The last row reports the fraction retained of the overall border pair sample when using each cut-off between 45 to 96 kilometers. The reported coefficients are for log minimum wage on the log of the dependent variable, as noted in the first column. All regressions include controls for natural log of county population and total private sector employment. Specifications 1-6 provide estimates for all teens age 14-18 regardless of industry and also include control for log of teen population. Specifications 7-12 are calculated with workers in the restaurant industry. All samples and specifications include county fixed-effects and pair-specific time effects. Standard errors in parentheses are two-way clustered at the state and border-segment level. Sample sizes (observations) are reported as well for each regression in squared brackets.

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Since the number of events concerning minimum wage changes varies throughout time, the choice of the period being studied can impact the outcomes. By extending the period being studied, we can compare the main estimates to estimates from a longer period. For the period between 2000 and 2020, the elasticity regarding earnings is as significant and positive, but with an impact less important for teens shown in table 9 (column 2). It implies that the impact on earnings has increased in the recent years. There remains a disemployment effect following an increase in minimum wage, but the level of

significance declines to a 90% confidence level. In contrast, the elasticity for separations and hires remains identical regardless of the period studied. The turnover rate is now significant at the 1% level and negative. For restaurant workers, there are no major differences in terms of earnings, employment, and separations. The significant negative impact on hirings disappears with this extended period, and a significant negative impact on turnover rate emerges, which originates from the previous period (2000-2011) in table A1.

Table 10 : Minimum wage elasticities for teens and restaurant workers: earnings, employment stocks and flows between 2000 and 2020.

	Teens		Restaurants Workers	
	(1)	(2)	(3)	(4)
Earnings	0.330***	0.250***	0.207***	0.163***
	(0.042)	(0.057)	(0.029)	(0.053)
	[154,482]	[154,482]	[153,999]	[153,999]
Employment	-0.290***	-0.136*	-0.128*	0.021
	(0.075)	(0.075)	(0.070)	(0.059)
	[150,083]	[150,083]	[140,577]	[140,577]
Hires	-0.452***	-0.256***	-0.331***	-0.108
	(0.083)	(0.080)	(0.079)	(0.096)
	[133,721]	[133,721]	[133,242]	[133,242]
Separations	-0.486***	-0.298***	-0.272***	-0.062
	(0.095)	(0.089)	(0.079)	(0.088)
	[128,339]	[128,339]	[130,300]	[130,300]
Turnover Rate	-0.156***	-0.130***	-0.187***	-0.130**
	(0.034)	(0.040)	(0.054)	(0.053)
	[127,846]	[127,846]	[129,629]	[129,629]
Controls:				
Common time effects	Yes	No	Yes	No
Pair-specific time effects	No	Yes	No	Yes

NOTE.—The table displays the log minimum wage coefficients associated with the dependent variable in the first column. All regressions include controls for the natural log of county population and total private sector employment. Specifications 1 and 2 present estimates for teenagers aged 14-18, regardless of industry, and they also incorporate the log of teen population. Specifications 3 and 4 focus solely on workers in the restaurant industry (NAICS722). All samples and specifications include county fixed effects. Specifications 1 and 3 include common time period fixed effects. For specifications 2 and 4, period fixed effects are interacted with each county pair. Robust standard errors, in parentheses, are clustered at the state and border-segment levels for all regressions. Sample sizes (observations) are reported as well for each regression in squared brackets.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

COVID-19 is also a major event that occurred in the main period studied (2012-2020) and could potentially impact the estimates. However, by removing the year 2020 from the sample, there is no major change in the elasticities of earnings and separations for both groups as shown in table 10. The level of significance is slightly reduced for the negative elasticity related to employment for teenagers (column 2). The effect on hiring is not

significant anymore for the restaurant workers with the preferred specification (column 4). Turnover rate is now negative and significant (column 4) for restaurant workers implying that the year 2020 drastically impact the results for this variable. This robustness check reinforces the results found in the main analysis, suggesting that the impact of minimum wage changes on the outcomes remains consistent even when considering the effects of the COVID-19 pandemic except for the turnover rate for restaurant workers.

Table 11: Minimum wage elasticities for teens and restaurant workers: earnings, employment stocks and flows between 2012 and 2019.

	Teens		Restaurant Workers	
	(1)	(2)	(3)	(4)
Earnings	0.410***	0.364***	0.284***	0.232***
	(0.043)	(0.071)	(0.040)	(0.055)
	[60,878]	[60,878]	[60,674]	[60,674]
Employment	-0.375***	-0.172*	-0.054	-0.047
	(0.087)	(0.089)	(0.041)	(0.098)
	[59,220]	[59,220]	[55,552]	[55,552]
Hires	-0.567***	-0.282**	-0.388***	-0.180
	(0.108)	(0.117)	(0.098)	(0.140)
	[52,868]	[52,868]	[52,702]	[52,702]
Separations	-0.639***	-0.370***	-0.357***	-0.169
	(0.114)	(0.126)	(0.094)	(0.125)
	[50,670]	[50,670]	[51,507]	[51,507]
Turnover Rate	-0.223***	-0.123	-0.336***	-0.165**
	(0.057)	(0.079)	(0.077)	(0.075)
	[50,478]	[50,478]	[51,251]	[51,251]
Controls:				
Common time effects	Yes	No	Yes	No
Pair-specific time effects	No	Yes	No	Yes

NOTE.—The table displays the log minimum wage coefficients associated with the log of the dependent variable in the first column. All regressions include controls for the natural log of county population and total private sector employment. Specifications 1 and 2 present estimates for teenagers aged 14-18, regardless of industry, and they also incorporate the log of teen population. Specifications 3 and 4 focus solely on workers in the restaurant industry (NAICS722). All samples and specifications include county fixed effects. Specifications 1 and 3 include common time period fixed effects. For specifications 2 and 4, period fixed effects are interacted with each county pair. Standard errors in parentheses are two-way clustered at the state and border-segment level. Sample sizes (observations) are reported as well for each regression in squared brackets * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Overall, the robustness checks conducted confirm the validity of the results presented in table 2. Through various tests such as incorporating additional control variables, examining lagged effects, exploring different maximum distances between centroids, extending the study period, and considering the impact of COVID-19, the main findings remain mostly consistent. These checks provide reassurance that the observed effects, relationships between minimum wage changes, and the outcomes of interest are robust and reliable with the preferred model.

Chapter 6
Conclusion

This thesis evaluates the effects of many recent changes of minimum wage on firms and workers. Throughout the thesis, the focus is on teenagers and on restaurant workers, as they are the most affected by minimum wage policies. To further develop the analysis, this thesis also examines the impact on gender and on different industries such as food manufacturing, gasoline stations, clothing retailers, building material, garden equipment and supplies dealers, and professional, scientific, and technical services. A series of regressions are conducted to determine the minimum wage elasticities of earnings, employment, hires, separations, and turnover rate using the QWI dataset. The results, obtained through a two-way fixed effects model and border discontinuity analysis, for the period between 2012 and 2020, indicates several important findings that contribute to the existing literature on minimum wage policies using recent data. Developing the minimum wage literature is important due to the mixed results concerning its impact on employment and the limited amount of research on job flows in the US.

Focusing on the preferred model, which accounts for time-varying heterogeneity and utilizes border discontinuity analysis, the estimates demonstrate positive and significant earnings elasticities, indicating an improved living standard for both groups (Table 2). This conclusion aligns with the existing literature explored at the beginning of the study. However, the employment effect following a raise in minimum wage is negative and significant for teenagers which diverges from the results of Dube et al. (2016). There is no significant impact on employment for restaurant workers.

Perhaps the effects of the minimum wage on employment are small because the minimum wage changes in the US are both small and regular. Our findings should not be extrapolated to other countries where increases in the minimum wage are typically larger. For this reason, employment effect in other countries is usually different from the US. One example is Germany where a significant disemployment effect following an important minimum wage change was observed (Bossler & Gerner, 2020).

Regarding the impact on job flows, the increase in minimum wage has a substantial and statistically significant negative effect on hires and separations for teenagers, potentially leading to increased job stability due to reduced uncertainty. In contrast, for restaurant workers, the impact on separations and turnover rates is negative but not statistically significant, and only hires show a significant negative effect.

The empirical findings related to gender as shown in table 3 reveal that the impacts of a minimum wage raise are more important for women than men among teenagers. This implies important gender disparities, especially in earnings, which can help reduce the gender wage gap. One of the most prominent findings is that the disemployment effect is only significantly experienced by female teens. Regarding the impact on restaurant workers, the increases in minimum wage only affect the earnings of women during this period and no significant gender differences related to employment are evident in this high-impact industry. When examining the elasticities of job flows, the effect on hires and on separations is only negative and significant for men. The gender differential results could be explained by a higher proportion of women being paid at minimum wage. This phenomenon could lead to further research to explain these results.

Overall, when analyzing the other chosen industries, there is no evidence of any impact on teens and restaurant workers following a minimum wage raise between 2012 and 2020 (Tables 6, 7& 8). The most intriguing outcome from this analysis is the lack of significant effect on earnings, as most studies in the past have discovered a positive effect.

Various robustness checks have been performed to validate the chosen methodology, including the addition of another control, the overall outcomes at the private sector level. The results of this test are largely similar to the preferred model. Adding county linear trends in the model also confirmed its reliability barring the disemployment effect found for teenagers. When we incorporate leads and lags of the minimum wage in the model, there were no trends that strongly affected the impact of the change in policy. Additionally, the choice of maximum distances between counties influenced the results, yet overall, the impact on earnings, employment and job flows remains robust. The choice of period can also impact the results, such as the year 2020, due to Covid-19 which had a

significant impact on the turnover rate. If 2020 is removed from the sample, the turnover rate becomes negative and significant for restaurant workers.

The subject of changes in minimum wage and their impacts on workers have been the focus of extensive research on numerous occasions, both within the United States and on an international scale. The ongoing debate surrounding this topic highlights its significance and complexity, particularly when considering the potential implications of policies related to minimum wage. Moreover, as the labor market continuously evolves and adapts to technological advancements and societal shifts, the implications of minimum wage policies can be extended beyond traditional employment scenarios. In conclusion, the ongoing debate on the implementation and increase of minimum wage remains a crucial area of inquiry for policymakers and researchers. The significance of this topic lies not only in its potential to shape the well-being of workers but also in the broader implications it can have on labor market outcomes and economic dynamics. Further research could explore the underlying mechanisms behind these effects and their implications on other labor market outcomes.

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Appendix

Table A1: Minimum wage elasticities for teens and restaurant workers: earnings, employment stocks and flows between 2000 and 2011.

	Teens		Restaurant Workers	
	(1)	(2)	(3)	(4)
Earnings	0.241***	0.213***	0.200***	0.217***
	(0.038)	(0.049)	(0.030)	(0.063)
	[86,255]	[86,255]	[86,010]	[86,010]
Employment	-0.155**	-0.087	-0.066*	-0.045
	(0.064)	(0.066)	(0.038)	(0.084)
	[83,723]	[83,723]	[78,337]	[78,337]
Hires	-0.466***	-0.281***	-0.411***	-0.225**
	(0.092)	(0.081)	(0.075)	(0.099)
	[74,481]	[74,481]	[74,192]	[74,192]
Separations	-0.519***	-0.261***	-0.414***	-0.188*
	(0.101)	(0.092)	(0.076)	(0.112)
	[71,521]	[71,521]	[72,581]	[72,581]
Turnover Rate	-0.315***	-0.155***	-0.344***	-0.164**
	(0.057)	(0.055)	(0.065)	(0.074)
	[71,244]	[71,244]	[72,198]	[72,198]
Controls:				
Common time effects	Yes	No	Yes	No
Pair-specific time effects	No	Yes	No	Yes

NOTE.—The table displays the log minimum wage coefficients associated with the dependent variable in the first column. All regressions include controls for the natural log of county population and total private sector employment. Specifications 1 and 2 present estimates for teenagers aged 14-18, regardless of industry, and they also incorporate the log of teen population. Specifications 3 and 4 focus solely on workers in the restaurant industry (NAICS722). All samples and specifications include county fixed effects. Specifications 1 and 3 include common time period fixed effects. For specifications 2 and 4, period fixed effects are interacted with each county pair. Robust standard errors, in parentheses, are clustered at the state and border-segment levels for all regressions. Sample sizes are reported as well for each regression in squared brackets.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.