Minimum Wage and Individual Worker Productivity: Evidence from a Large US Retailer*

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February 1, 2019

Abstract

We study the effect of increasing the statutory minimum wage on individual worker productivity. Within a workforce of base+commission salespeople from a large US retailer, and using a border-discontinuity research design, we document that a $1 (1.5 standard deviations) increase in the minimum wage increases individual productivity (sales per hour) by 4.5%. With the help of a model, and of novel satellite imagery, we seek evidence in favor of two distinct channels through which this productivity gain could arise: a demand increase, and an incentive effect due to the increase in compensation. We find evidence only for the second, that is, the compensation channel: first, productivity gains are concentrated among low-productivity workers; second, productivity gains arise mostly during periods of high-unemployment, which when read through the lens of our model suggests an efficiency-wage story. We then document that the productivity gains of low-productive workers are sufficient to offset the higher worker pay, pointing to endogenous worker productivity as an explanation for why increasing the statutory minimum wage has no adverse employment effect.

Keywords: minimum wage, worker productivity, employment, efficiency-wage.
JEL Classification: J24, J30, M52.

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*Thanks to David Card, Luis Garicano, Mitch Hoffman, Daniel Parent, Daniele Paserman, Oskar Nordstrom Skans, Chris Stranton and seminar participants at Bank of Canada, McGill University, NBER-OE group, Barcelona GSE forum, Syracuse University, SIOE2018 conference, UCLA Anderson, Uppsala University, University of Miami, University of Toronto, the Productivity Partnership Labor Workshop (HEC Montreal) and the Wages and Labor Market Workshop (Helsinki). This research was conducted in collaboration with Workforce Science Project of the Searle Center for Law, Regulation and Economic Growth at Northwestern University, and was undertaken, in part, thanks to funding from the Canada Research Chairs program. We thank Athanasse Zafirov and Suhail Amiri for excellent research assistance. The authors declare they have no relevant or material financial interests that relate to the research described in this paper. This paper has been screened to ensure no confidential information is revealed. Data and institutional background will be provided such that we do not disclose information that may allow the firm to be identified. E-mails: decio.coviello@hec.ca; erika.deserranno@kellogg.northwestern.edu; nicola@nicolapersico.com.

1 Introduction

This paper studies how individual worker productivity is affected by increasing the minimum wage. Little is known about this question. We document that worker productivity is increasing in the minimum wage. We argue that an efficiency-wage channel is at play, and that the increased productivity helps explain the absence of disemployment effect, which has been found in the minimum-wage literature.

We tackle these issues using unique data on individual productivity and the payroll of salespeople from a large US retailer. Our firm operates across all 50 US States and employs between 5 and 10% of department store employees, or roughly 1-2% of employment in the entire US retail sector. The employees whose productivity is measured are salespeople who are paid an hourly base rate plus a commission tied to sales per hour. The law requires the firm to top up the worker's total wage (base+commission) in any week where that wage falls short of the statutory minimum wage level.

To estimate the effect of a minimum wage increase, we compare workers in "treated" stores which have experienced a minimum-wage increase with workers in nearby "control" stores which have not. To achieve a sample of comparable treated and control stores, we follow the approach developed by Card and Krueger (1994, 2000), Dube et al. (2010, 2016), Allegretto et al. (2011), and Addison et al. (2012, 2014). We restrict our sample to stores (and their respective workers) located in contiguous counties that straddle the same jurisdictional border and in which one side of the border experienced an increase in minimum wage and the other not. We then compare the productivity of workers in treated vs. control stores by including *county-pair-month fixed effects* and *worker fixed effects*. Our final sample comprises more than 200 stores (and more than 10,000 workers), with over half having experienced at least one increase in the minimum wage.

We find that a $1 increase in the minimum wage (1.5 standard deviations) causes individual productivity (sales per hour) to increase by 4.5%. The elasticity of labor productivity relative to the minimum wage is estimated at 0.35.

Two channels exist through which the minimum wage could affect the productivity of salespeople. First, a demand channel: retail demand might change systematically in conjunction with the statutory minimum wage, and this may affect average sales per hour. Second, a compensation channel: a higher minimum wage increases the pay of low-productive workers, which may have complex effects. On the one hand, a higher minimum wage may decrease workers' incentives to exert effort; on the other hand, workers are made better off and so they may care more about being retained – especially when the unemployment rate is high – and thus may exert more effort (this is an efficiency-wage channel).

To help discriminate between these channels, we present a simple model of a monopolistic firm setting a base+commission compensation scheme for workers with different productivity levels. The analysis shows that, if a positive demand shock is responsible for increased productivity then all workers, including the most productive, should benefit. If instead changes in the compensation scheme are responsible for the increase in productivity then the effect should work through increased effort, and the model indicates that: (i) it is the marginal (least productive) workers whose effort is most responsive; (ii) the effect should be sharper during worse unemployment spells.

When we take these theoretical predictions to the data, we find scant evidence for the demand channel. First, we find that the minimum wage does not affect store-level demand, which we proxy with stores' parking lots occupancy rates (measured using satellite imagery). Second, the most productive workers do not experience a productivity boost, which is consistent with an efficiency-wage effect but not with a demand effect. Instead, we find evidence in favor of the compensation channel: first, average productivity gains are sharper during periods of high unemployment; second, the productivity gains are larger for the least-productive workers; both effects are predicted by our efficiency-wage model after an increase in the minimum wage.

The increased productivity of low-productive workers might be confounded by two organizational adjustments: first, the firm might have cut their hours; second, the firm might have increased their earning opportunities by giving them access to better shifts or by moving them to better-selling departments. We find no evidence in favor of either organizational adjustment. Notice that in our setting the increase in productivity cannot be explained by an increase in consumer prices. First, in line with the findings of Della

Vigna and Gentzkow (2017), our company has a national pricing strategy and has uniform prices across all US stores. Second, an increase in prices should predict an increase in sales for all workers, not just for the low-productive ones.

Next, we examine, and ultimately rule out the possibility that, despite the presence of worker fixed effects, our productivity estimates might be inflated by the *selective termination* of low-productive workers: when we restrict the sample to a balanced panel containing only workers who are employed throughout the sample period, the estimated productivity gain associated with a minimum wage increase remains stable. Moreover, we show that the minimum wage does not increase the rate at which low-productive workers are terminated, and does not change the termination ratio between low- and high-productive workers. We also find no evidence of *selective migration* of high-productivity workers from control to treated counties. We show this by analyzing the movements of our store employees and the home-workplace distance of new hires.

Our findings on productivity are robust to alternative sample selections and model specifications. Using a border discontinuity design, we show that the results remain unchanged regardless of whether we restrict the sample to stores located less than 75 km, 38.5 km or 18.75 km from the border. The results are also robust to using the *entire* sample of stores in our data – regardless of how far they are located from the border – in a specification which replaces county-pair fixed effects with state-specific time trends (as in the difference-in-difference set-up of Neumark 2017). As a final robustness check, we estimate the effects of the minimum wage in a more demanding specification that includes department-store specific time trends and report comparable results.

Finally, we broaden our perspective and show that while minimum wage increases worker pay, labor productivity increases enough to keep store profits unchanged; and that employment is largely unaffected at the store level. The absence of any measured disemployment effect at the store level is consistent with the broad picture painted by the minimum wage literature (see, e.g., Card and Krueger 1994, Allegretto et al. 2013, Dube et al. 2010, 2016); but we attribute this finding to endogenous worker productivity, a channel that has been discussed theoretically but has been overlooked in the empirical literature perhaps because of the lack of data on individual worker productivity. There are, of course, alternative explanations for the lack of disemployment, including hiring-and-firing frictions and the monopsony power model. But, in our estimates, store-level profits are not reduced by the minimum wage increase, as they would be in either the friction model or the monopsony model. This observation suggests that endogenous worker productivity plays a role in explaining the absence of employment effect of the minimum wage.

The paper proceeds as follows. Section 2 presents an overview of the literature on minimum wage and sheds light on our contribution. Section 3 presents the model. Sections 4 and 5 describe the data, the institutional context, and the identification strategy. Section 6 discusses the effect of minimum wage on worker productivity, explores the underlying channels, rules out a number of confounding factors and examines the robustness of our results. Sections 7 studies the effect of the minimum wage on worker pay, and Section 8 explores whether the minimum wage affects store employment. Section 9 concludes.

2 Related Literature

Minimum wage and worker productivity To the best of our knowledge, there is only one paper that studies the effect of increasing the statutory minimum wage on individual worker productivity: Ku (2018). Ku (2018) measures the change in productivity for temporary workers hired on a day-to-day basis: tomato pickers in a large Florida farm, before and after the January 2009 minimum wage increase. Like us, Ku (2018) finds that less-productive workers gained more productivity than more-productive workers. However, Ku's (2018) research design only affords *relative* estimates (of low- relative to high-productivity workers) of the productivity gain. We are able to estimate the *absolute* productivity gains because we observe nearby jurisdictions experiencing no minimum wage increase. A further difference is that we observe many workplaces (stores), and thus can speak to the effect of the minimum wage on profits and employment levels. Finally, our richer data comprising 70 minimum-wage events allows for a richer set of covariates, e.g., unemployment level and store-level demand, which allows us to shed light on the underlying mechanisms. With that being said, our analysis is complementary and not substitute with Ku (2018) because the two workforces operate in different sectors (retail vs. agriculture), and because Ku's dependent variable, weight of fruit picked, is a more direct measure of productivity than sales per hour.

Minimum wage and employment There is a large literature on the effect of the minimum wage on employment summarized in Card and Krueger (2017). The literature typically finds limited disemployment effect associated with a higher minimum wage (e.g., Card and Krueger 1994 in the fast food industry, and Allegretto et al. 2011 in the restaurant industry). Closer to our paper, Giuliano (2013) uses similarly-detailed HR data from a large US retailer in the apparel industry and finds that a higher minimum wage has a statistically insignificant effect on overall employment. None of these papers have linked empirically the lack of disemployment effect to an increase in endogenous worker productivity, as we do in this paper.

Experimental literature on efficiency wages A large experimental literature has studied efficiency wages interpreted as gift exchange or reciprocity (e.g., Gneezy and List 2006, Della Vigna et al. 2016). Jayaraman et al. (2016) study the effect of a contract change on the productivity of tea pluckers. In 2008, the minimum wage payable to Indian plantation workers was raised and they document a sharp increase in output. This effect is attributed to reciprocity because tea pluckers are permanent workers who cannot be fired, so an efficiency-wage story as in Shapiro and Stiglitz (1984) cannot be invoked. Our paper, in contrast, provides evidence for the incentive effect provided by the outside option (being terminated). Only two experimental papers study this notion of efficiency wages: Macpherson et al. (2014), and Huck et al. (2011); neither studies the effect of increasing the minimum wage.

Unemployment and worker productivity Lazear et al. (2016) study worker-level data from a large US service company before and after the great recession and find that worker productivity increases after the recession and that this effect cannot be attributed to selection into employment. In addition, this effect is stronger in higher-unemployment areas. This evidence is consistent with, but not necessarily indicative of, an efficiency-wage channel. To this extent, our paper is related with Lazear et al. (2016).

Minimum wage and firm-level variables While there is limited evidence on the effect of minimum wage on individual worker productivity, a number of papers have studied the effect of minimum wage on firm-level productivity (e.g., Draca et al. 2011, Bell and Machin

2018, Riley and Bondibene 2017, Hau et al. 2016). Mayneris et al. (2016) look at firm-level TFP, before and after the 2004 increase in the Chinese minimum wage. They show that the productivity of more-exposed firms increased, conditional on survival, relative to less-exposed firms.

Minimum wage and demand There is a small literature on the pass-through from the minimum wage to the demand for retail goods: Aaronson et al. (2012), Leung (2017), Ganapati and Weaver (2017) and Renkin et al. (2017). On balance, this literature is ambiguous as to whether such a pass-through exists. This literature is useful context for our analysis of the demand channel, which we rule out within our context.

3 Model

Several canonical models (actually, families thereof) speak to the effect of the minimum wage on employment, including: search models (e.g., Flinn 2006); monopsony models (e.g., Bhaskar et al. 2002); and efficiency wage models (Shapiro and Stiglitz 1984). While these families can blend into each other (see, e.g., Manning 1995), a basic distinction can be made among them: in the first two families of models (search and monopsony) worker effort is exogenous, and thus *a worker's productivity can only change by switching employer.* Instead, in efficiency wage models worker productivity can change within employer because worker effort is endogenous (for instance, to a minimum wage increase). Given our focus on changes in productivity within the firm, it is natural for us to build on efficiency wage models.

Among efficiency wage models, it is well known that increasing the minimum wage may incentivize the worker to work harder (Rebitzer and Taylor 1995). However, the efficiency wage literature has not, to our knowledge, dealt with the case of heterogeneous workers who are incentivized via a base+commission contract. In this case, increasing the minimum wage may actually *de-incentivize* those workers who make commissions. The model below sorts out the incentive effects of the minimum wage among workers with different productivity levels.

Time is discrete and infinite. There is a monopolistic firm and many workers (to fix ideas: sales agents). Workers are indexed by σ, where σ represents the hourly revenue that may be generated by that worker if the worker exerts effort. The index σ captures a variety of factors contributing to labor productivity, including: the agent's skill as a salesperson; the schedule/shift to which the worker is assigned (for example, the 6pm-9pm shift might be more busy); and, finally, consumer demand (later we will model an increase in demand as a across-type increase from σ to $\delta\sigma$, with $\delta > 1$). We assume that σ is distributed according to the density $f(\sigma) = \frac{1}{\sigma}K$ with support $[\varepsilon, 1]$, with K being the constant of integration.[1]

If a worker of type σ exerts effort $e \in [0, 1]$ she produces sales of either 0 or σ, with:

$$\Pr(\sigma) = \frac{1}{2}e.$$

It costs a worker $c \cdot e$ to exert effort e.

In each period, a worker of type σ is compensated with a base rate B, plus a commission $R\sigma$ in case the agent was productive, with $R \in [0, 1]$. If the compensation falls below the statutory minimum wage level M, compensation of low-σ workers must be topped up to M. The compensation scheme (B, R) is committed to by the firm.[2] An agent is terminated in period $t + 1$ unless the agent exerted effort in period t.[3]

Given a compensation scheme (B, R) a worker of type σ chooses her effort level $e^*(\sigma)$ by solving the following recursive problem:

$$V(\sigma) = \max_e \left[\max[M, B]\left(1 - \frac{1}{2}e\right) + (\max[M, B + R\sigma]) \cdot \frac{1}{2}e - c \cdot e\right] + \beta\left[eV(\sigma) + (1 - e)\,\Omega(M, u)\right].$$

$\Omega(M, u)$ represents the value of the worker's outside option if terminated, i.e., her labor-market value. This value is assumed to be non-decreasing in the minimum wage M,

[1]The density is decreasing, implying that more-productive workers are less represented. The constant $K = -1/\log\varepsilon$ ensures that $K\int_\varepsilon^1 \frac{1}{\sigma}d\sigma = K[\log\sigma]_\varepsilon^1 = K(-\log(\varepsilon)) = 1$.

[2]This commitment means that we are not in a relational contract setting, just in an efficiency wages setting.

[3]Note that the decision to terminate the worker is based on whether effort was exerted, whereas compensation is based on a noisy signal: whether the effort produced output. This modeling choice captures the idea that the decision to terminate is likely based on information that is less noisy than the factors that determine hourly compensation. In a more complex model one might build in a cost of terminating a worker, and a costly state-verification option (did the worker in fact shirk?) that the firm might trigger before deciding whether to terminate the worker.

and non-increasing in unemployment u.[4] We assume that $0 \leq \Omega_1 \leq 1$ and $\Omega_{12} < 0$, i.e.: as the minimum wage increases the worker's outside option does not grow faster than the value of the minimum wage itself, and this growth rate is decreasing in the unemployment level. For example, the worker's outside option might take the form:

$$\Omega(M, u) = \Pr(\text{finding another job}|u) \cdot W(M),$$

where $W(M)$ is the expected labor-market wage conditional on finding employment. Assuming that $\Pr(\text{finding another job}|u)$ is decreasing in u, all the assumptions in our model are satisfied. In this specification human capital σ has no value on the outside labor market (it is purely firm-specific).[5]

The firm chooses the compensation scheme to solve:

$$\max_{B,R} \sum_{t=0}^{\infty} \beta^t \int_0^1 \left[-\max[M, B] \left(1 - \frac{1}{2} e^*(\sigma) \right) + [\sigma - (\max[M, B + R\sigma])] \cdot \frac{1}{2} e^*(\sigma) \right] f(\sigma) \, d\sigma. \tag{1}$$

This formulation of the firm's objective function perfectly fits the case where σ represents the worker's shift. In the case where σ represents worker skill, this formulation implies the assumption that a terminated worker of skill σ is replaced by a worker of the same skill; we accept this simplifying assumption as the price for tractability.

This formulation also maintains the assumption that it is optimal for the firm to employ a worker even if she does not exert effort. This makes sense if we reinterpret effort as "above-and-beyond effort," and assume that even a worker who does not put in such effort can still be productive. If we relaxed this assumption and allowed some worker types to be truly unproductive, the firm may well select the least productive workers and terminate them. The fired workers would likely be the low-σ type. We stop short of making selective termination endogenous in this model, but we discuss it later as an empirical confounder of our estimates.

Denote the value of $V(\sigma)$ at $e = 0$ by:

$$V^S = \max[M, B] + \beta \Omega(M, u).$$

[4]Note that allowing Ω to depend on M or u is not necessary: all the results hold if the outside option is independent of these quantities.

[5]At the cost of additional complexity it is possible to generalize the analysis to the case where Ω is an increasing and concave function of σ.

This is the value of shirking for worker of type σ. The value for worker σ of exerting effort is given by the value of of $V(\sigma)$ at $e = 1$, which is denoted by:

$$V^W(\sigma) = \left[\frac{1}{2}\max[M, B] + \frac{1}{2}\max[M, B + R\sigma] - c\right] + \beta V^W(\sigma).$$

Solving for $V^W(\sigma)$ yields:

$$V^W(\sigma) = \frac{1}{2(1-\beta)}\left[\max[M, B] + \max[M, B + R\sigma] - 2c\right].$$

The function $V^W(\sigma)$ is non-decreasing in σ. The types who choose to exert effort are those σ's for whom $V^W(\sigma) > V^S$ (typically, higher types).

3.1 Determinants of Worker Productivity for Given Compensation Scheme

In this section we fix the compensation scheme and study several channels that may cause productivity to increase as the minimum wage increases. To this end we make the following assumptions on the compensation scheme (B, R).

Assumption 1: Base pay does not exceed the minimum wage: $B \leq M$.

Assumption 2: The compensation scheme (B, R) is not so generous that every worker exerts effort, i.e., we assume that $V^W(\varepsilon) < V^S$.

The first assumption ensures that we focus on the empirically relevant case in our data, where the base pay is always below minimum wage. The second assumption ensures that, as the minimum wage increases, there is room for productivity to increase: this assumption ensures that our question is meaningful. These assumptions will be maintained throughout Section 3.1.

The next proposition characterizes worker productivity. All proofs are in Appendix A.

Lemma 1. ***(worker behavior for given compensation scheme)***. *Fix any base+commission compensation scheme (B, R) and let*

$$\overline{\sigma} \stackrel{\text{def}}{=} \frac{(1-2\beta)\max[M, B] + 2(1-\beta)\beta\Omega(M, u) - B + 2c}{R}. \tag{2}$$

Then all types σ below $\overline{\sigma}$ exert zero effort and produce zero, all others types exert maximum effort and produce $\sigma/2$ in expectation.

Lemma 1 fully characterizes worker productivity. The expression for $\overline{\sigma}$ has intuitive properties: worker motivation to exert effort increases if the compensation scheme (B, R) is more generous. In addition, if β is sufficiently close to 1, increasing the minimum wage will motivate workers, provided that the minimum wage "bites," i.e., $M > B$. This says that net-net the minimum wage is a motivator for effort, despite the countervailing presence of a commission component. We now explore how productivity changes after a positive demand shock.

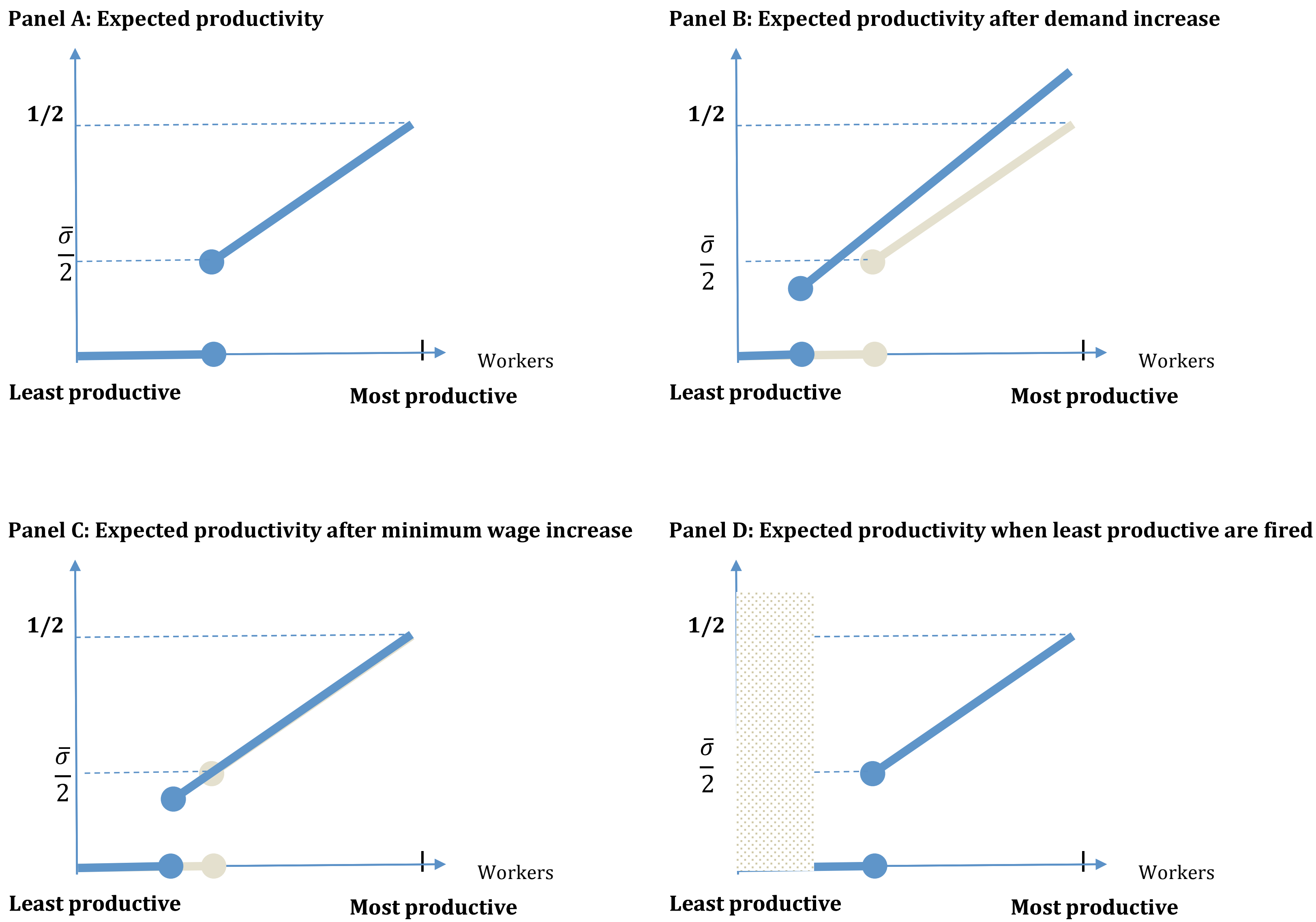
Proposition 1. ***(effect of demand increase, keeping the minimum wage constant)*** *Fix any base+commission compensation scheme (B, R) such that $\overline{\sigma} \in (\varepsilon, 1)$. Suppose a positive demand shock increases every worker's type σ to $(1+\delta)\sigma$. Then more workers exert effort, and workers at the upper tail of the productivity distribution become more productive after the demand increase.*

The productivity gains identified in Proposition 1 can be gleaned by comparing Panels (a) and (b) in Figure 1. The key feature is that the productivity of even the most productive types increases following a demand increase. This effect is not due to a change in effort since these types put in maximal effort even before the demand shock. This feature (increased productivity at the top) will provide a contrast with the effect of an increase in the minimum wage.

We now explore how productivity changes after an increase in the minimum wage.

Proposition 2. ***(effect of increasing the minimum wage, keeping demand constant)*** *Fix any base+commission compensation scheme (B, R) such that $\overline{\sigma} \in (\varepsilon, 1)$, and assume $\beta > \sqrt{1/2}$. Then average productivity increases as M increases. This effect is generated by the behavior of the least-productive workers (the productivity of the most-productive workers does not change), and it is more pronounced in times of high unemployment. The workers who switch to exerting effort avoid termination.*

Figure 1: Theory



Proposition 2 predicts that increasing the minimum wage should incentivize greater effort and thus increase productivity, at least if workers are sufficiently patient. This result may seem counter-intuitive because increasing the minimum wage increases the payoff from shirking. However, shirking is followed by termination and so, if workers are patient, the following efficiency-wage logic dominates: even a worker who plans to forever exert effort will produce zero sometime in the future, and in that case she will earn minimum wage. Thus increasing the minimum wage improves the future utility stream of forever exerting effort. If the worker is patient, the increase in this future utility outweighs the one-time increased payoff from shirking, which is followed by termination.

The productivity gains following a minimum wage increase can be gleaned by comparing Panels (a) and (c) in Figure 1. As stated in Proposition 2 and in contrast with Panel (b), the productivity of the most productive types does not change. This is because these types put in maximal effort even before the minimum wage increase. This contrast will provide a testable implication in the empirical section, which we will use to evaluate whether the productivity gains following an increase in the minimum wage can be partly attributed to a concurrent increase in demand. A further implication is that the effect of the minimum wage should be sharper when unemployment is high, because then the fear of losing one's job is more acute.

Panel (d) of Figure 1 represents the selection effect of terminating the least-productive workers. Average productivity increases because the lower tail of productivity is removed. If the firm does this following a minimum wage increase, this confounding effect could also be responsible, at least partly, for any observed *average* productivity gains following a minimum wage increase. Of course, Panel (d) also reveals that if we fix any type σ (empirically, this is achieved by introducing worker fixed effects in our regression), then there is no *individual* productivity gain for that type during their employment period.[6]

Overall, in this section we have studied two channels that may cause productivity to increase as the minimum wage increases: a concurrent increased demand (Proposition 1); and increased incentives due to the increase in minimum wage (Proposition 2). The theory provides ways to tease out these different channels. In addition we have pointed out a

[6]Fixed effects alone may not suffice to fully control for the selection effect in a population with high worker turnover. We carefully explore selection bias in Section 6.3.2.

possible confounder: concurrent increased selection, and pointed to empirical specifications to deal with this confounder (see above discussion of Figure 1, Panel d).

The theory has assumed that the compensation scheme does not adjust to the increase in the minimum wage. This assumption matches our environment because our firm's compensation policy is national and is not expected to meaningfully respond to statutory changes is a single state. The compensation scheme's lack of adjustment to minimum wage changes is confirmed empirically in Section 7.

4 Data and Institutional Background

Worker-level data We match bi-weekly worker-level payroll data with monthly personnel records of a nation-wide American retail store chain. The total sample covers more than 40,000 hourly salespeople paid on base+commission, working in more than 2,000 stores across the United States between February 2012 and June 2015. Salespeople provide proactive sales assistance to walk-in customers, and they also help stock the shelves. Their effort helps convert a walk-in customer into a profitable sale. Confidentiality restrictions limit our ability to disclose the exact number of employees/stores, and the exact nature of the products being sold.

For each salesperson we observe monthly worker-level productivity (sales per hour), which is used by the firm to compute the workers' monthly earnings. We match this info with monthly earnings, monthly hours worked, part-time/full-time status, probability of terminations.

Our identification strategy will require us to restrict to a sub-sample of stores (and their respective workers) located in contiguous counties that straddle the same jurisdictional border, some of which have experienced a minimum wage increase and some of which have not. The sample selection procedure is described in the next section. Table 1 reports descriptive statistics for workers within this restricted sample.

Average hourly productivity (sales per hour) is approximately 2. For confidentiality reasons, the unit is hidden: the number is re-scaled by a factor between 1/50 and 1/150 relative to its value in dollars. The average salesperson earns an average of \$12.5 per

Table 1: Descriptive Statistics

Variables	mean (1)	sd (2)	p10 (3)	p50 (4)	p90 (5)	N (6)
Worker-level variables						
Productivity						
Sales/Hrs. (hidden unit)	2.085	1.468	0.781	1.872	3.522	217,822
Compensation						
Reg.Pay/Hrs. (in $) [Base Rate]	6.120	1.181	4.500	6	7	217,822
Var.Pay/Sales (in %) [Comm.Rate]	3.462	3.188	1.057	2.343	7.531	213,726
Var.Pay/Hrs. (in $)	5.947	4.936	1.740	4.610	11.78	217,822
MinW.Pay/Hrs. (in $)	0.225	1.736	0	0	0.771	217,822
Tot.Pay/Hrs. (in $)	12.51	4.620	8.734	11.15	17.94	217,822
Tot.Pay (in 100$)	13.61	8.312	4.946	12.18	23.43	217,822
Tot.Hrs	106.5	44.12	46.47	107.6	162.3	217,822
Part-time (in %)	60.25	48.94	0	100	100	217,822
Turnover						
Tenure (in months)	48.92	65.01	4	24	126	217,822
Terminated (in %)	4.562	20.86	0	0	0	217,822
Store-level variables						
MinW (in $)	7.872	0.644	7.250	8	9	12,359
Number of cars in the parking lot	125.0	81.69	46	108	221	12,359
Parking lot occupancy rate (simple average)	0.230	0.147	0.091	0.194	0.410	12,359
Parking lot occupancy rate (residualized)	0.002	0.077	-0.069	-0.003	0.085	12,359
Unemployment rate (in %)	7.220	2.007	4.700	7.100	10.10	12,359

Notes: *Sales/Hrs* are the sales per hour rescaled by a factor between 1/50 and 1/150 relative to its $ value. *Base Rate: Reg.Pay/Hrs* are monthly regular earnings per hour worked (in $ per hour). *Comm.Rate: Var.Pay/Sales* are earnings from commissions and incentives divided by sales (in %). *Var.Pay/Hrs* are earnings from commissions and incentives per hour worked (in $ per hour). *MinW.Pay/Hrs* are the monthly earnings from minimum wage adjustments divided by hours worked (in $ per hour). *Tot.Pay/Hrs* is the monthly total pay from total take home pay divided by total hours (in $ per hour). *Tot.Pay (in 100$)* is the monthly total pay from total take home pay. *Tot.Hrs* is the total number of hours worked in a month. *Part-time (in %)* is the percent probability that an employee is a part-time employee in a given month (takes value 0 in a given month if a worker is full-time and takes value 100 if the worker is part-time). *Tenure* is the number of months of tenure. *Terminated (in %)* is the percent probability that an employee is terminated in a given month (takes value 0 in a given month if a worker is not terminated and takes value 100 if the worker is terminated). *MinW (in $)* is the store's monthly predominant minimum wage. *Number of cars in the parking lot* is the average number of cars parked in the store's parking lot. *Parking lot occupancy (simple average)* is the average occupancy rate of the store's parking lot (0 means no-occupancy and 1 means full occupancy). *Parking lot occupancy (residualized)* is the residualized average occupancy rate of the store's parking lot. *Unemployment (in %)* is the monthly unemployment rate in the county of any given store.

hour. Total compensation includes base (\$6.12/h) + commission pay (\$5.95/h). If a worker's average hourly pay (base+commission) falls below the minimum wage in a week, the worker is paid a "minimum wage adjustment" (mean of \$0.23/h) which brings total pay in line with the statutory minimum wage requirements. In an average month: 3% of the workers receive the adjustment each week and 42% receive it in a sub-sample of the weeks. The workforce we are analyzing is thus one for which the minimum wage is largely binding.[7]

Sales associates work an average of 106.5 hours per month and earn \$1,361 per month. Sixty percent of them are part-time employees and their average tenure (which is based on the worker's hiring date) is 49 months. The data show a large dispersion in tenure; this dispersion partly reflects a large turnover, which is typical in retail sales position. The average monthly termination rate is 4.6%.[8]

Table 1 reveals considerable cross-worker variation in base and commission rates.[9] This reflects mostly within-store rather than across-store variation. Within a store, the compensation scheme varies from one department to another. We will later control for this by adding department fixed effects in all our specifications. Conditional on the department, the compensation scheme is mostly constant across stores. This is because the central headquarters of our multi-jurisdictional firm values compensation uniformity across stores. This implies that, in our setting, compensation adjustments to local market conditions (e.g. the minimum-wage level) are limited. Consistent with this, we will later show that the compensation scheme (base rate and commission rate) does not react to a higher minimum wage. We return to this lack of endogenous reaction from the firm side in Section 7.

[7]Our workforce has a number of similarities with the workforce in the restaurant industry (which has been vastly analyzed in the minimum wage literature). Both types of workers are compensated with a base+commission contract, and their measure of productivity (sales per hour) increases with demand. Moreover, both types of workers are largely affected by the minimum wage: 20% of salespeople in our sample and 23% of restaurant workers are paid within 10% of the minimum wage in an average paycheck period (Dube et al. 2016).

[8]Termination is defined as the sum of voluntary and involuntary terminations in order to sidestep the arguably subjective distinction between leaving one's job voluntarily and involuntarily.

[9]The base rate (\$6.2/h) is computed by dividing "total monthly regular pay" by "hours worked." The commission rate (3.3%) is computed by dividing "total monthly variable pay" by ("sales per hour" x "hours worked"). The field "total monthly variable pay" is an aggregate of a number of corporate incentive programs tied to productivity (sales per hour).

Store-level data Our data contain time-invariant information on the geographical location of stores (latitude and longitude), which we match with the monthly statutory minimum wage level in that store.[10] As shown in Figure 2, variations in minimum wage take place at state, county and city levels; with city and county minimum wages always set to be higher than the state minimum wage.

From February 2012 to June 2015, our sample of stores is affected by 70 variations in minimum wage: 49 variations are at the state level, and 21 are at the county or city level. The exact timing of each minimum wage change is reported in Table B.2, and Table B.1 lists the set of states that had no change in their minimum wage in our sample period. As reported in Table 1, the mean minimum wage is $7.87 per hour and the average increase in minimum wage is $0.54.[11]

For each store, we acquired *parking lot traffic data*, which we use as a proxy of store-level demand. The data are extracted from high-resolution satellite imagery by RS Metrics (see Figure 3 for an example of a satellite image).[12] Each satellite image is digitized using a machine learning and computer vision algorithm which (1) identifies parking lot areas around each store, (2) counts the number of parking spaces in the parking lot, and (3) counts the number of cars parked. We aggregate these high-frequency satellite data at the store-month level and create a store-specific monthly measure of parking occupancy, i.e., the average proportion of parking spaces that are filled in a given store and in a given month.[13] We will later use this measure of average parking lot occupancy rate as a proxy

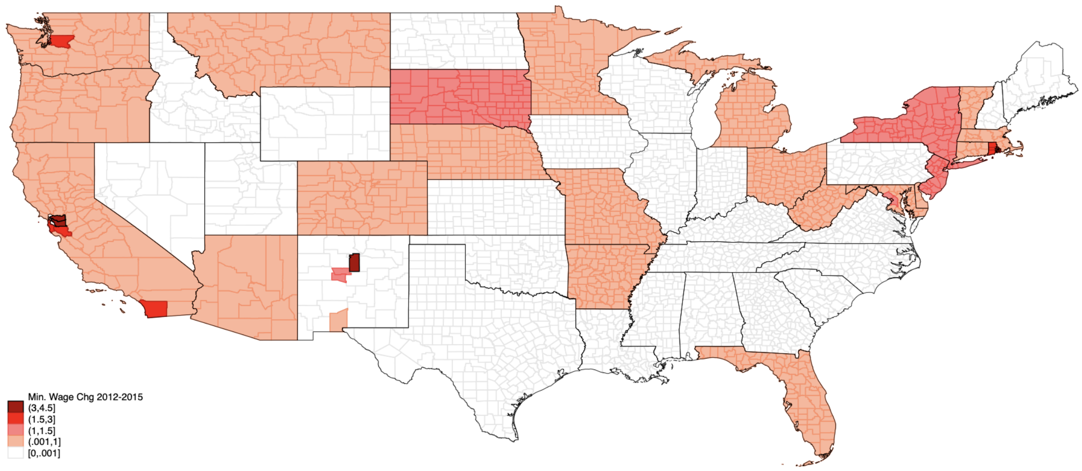
[10]The data on minimum wage are extracted from the public dataset maintained by the Washington Center for Equitable Growth.

[11]Beyond the effect of changes in the statutory minimum wage, there is a notable event related to the minimum wage that is specific to our company. In November 2014 our company chose to increase the base pay in its California stores to the prevailing minimum wage levels, i.e., to a considerably higher level than base pay in other states. By increasing its base pay to the level of the minimum wage, the firm was able to use a safe-harbor provision which was endorsed by the California Labor and Workforce Development Agency as a legal means to avoid costly record-keeping requirement regarding the hour-by-hour nature of each worker's task. We regard this variation in base pay as not directly related to any minimum wage increases (there was none in November 2014), and so we account for this variation by including an interaction term for California post November 2014 in all specifications throughout the paper. The results are qualitatively and quantitatively robust to removing the post-November 2014 data from California.

[12]The same satellite parking data have been used by Nsoesie et al. (2015) as a proxy of "hospital attendance" and by UBS Investment Research as a proxy of "Walmart store-level demand" (see McCarthy and Harris 2012). For a general overview of the use of satellite imagery in economics see Donaldson and Storeygard (2016).

[13]During our sample period, the data contain about 51,000 satellite images of the parking lots of the

Figure 2: Variations in Minimum Wage from February 2012 to June 2015



Notes: Store locations are withheld for confidentiality reasons.

of store-level demand, with the caveat that it only captures *customer volume* and not *quantity purchased*.

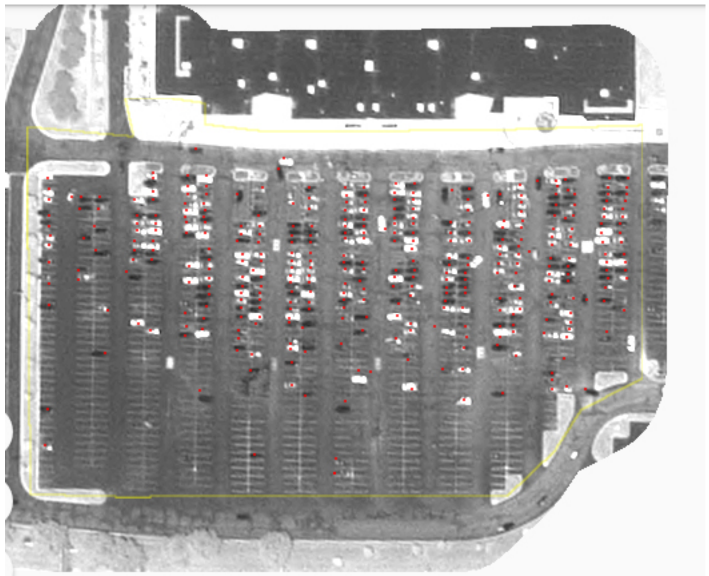
In our sample, the average parking lot holds 125 cars and the average occupancy rate is 23% (see Table 1). To improve comparability of the occupancy measure across stores and across date/time at which the image is taken, we build an alternative "residualized" measure of parking lot occupancy by extracting the residual from a regression of store-level parking lot occupancy rate on store-month-weekday-hour fixed effects.

For each store, we also obtained data on monthly unemployment in the county level in which it is located from the Bureau of Labor Statistics website, which we use as a proxy of local labor market conditions around each store.

Finally, we also have information about store-level financial performance (EBITDA), store-level employment and store-level total hours worked, which we use in Section 8 to broaden our analysis of the effects of the minimum wage at the store level.

stores in our data. Images cover 93% of the stores in our dataset and, conditional on having at least one picture in a given month, the average store has 2.6 images per month. Missing images are attributable to indoor parking lots that could not be caught by satellites, and to the lower frequency of satellite images in less populated areas.

Figure 3: Satellite Image of One Store with Parking Lot Area and Car Counts Highlighted



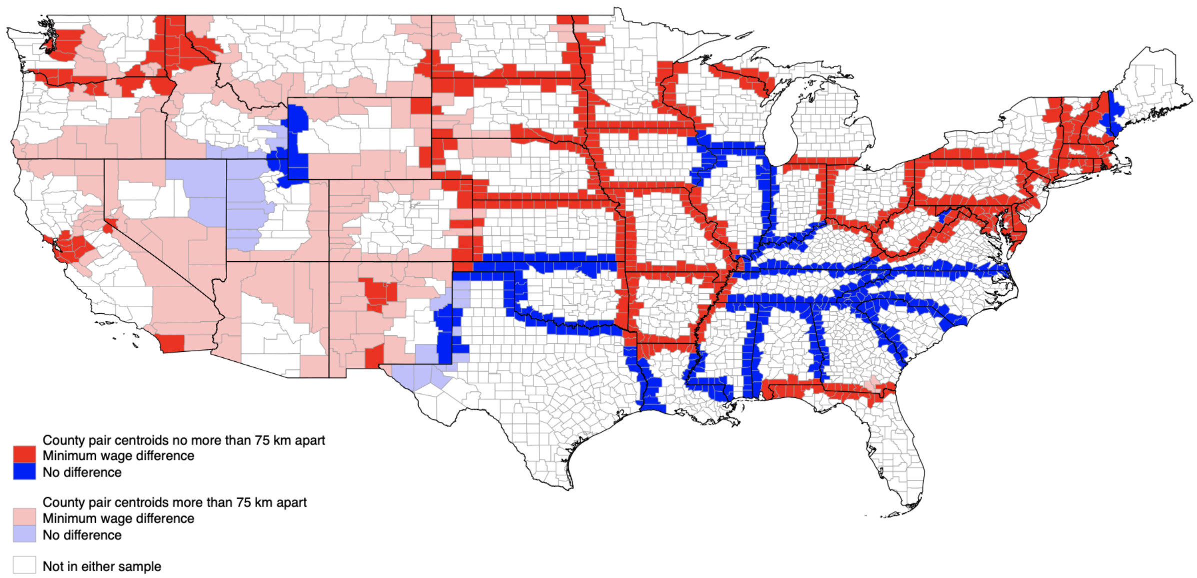
Notes: Data © 2018 RS Metrics; Imagery © (CNES) 2018; Distribution Airbus DS Imagery © 2018 DigitalGlobe

5 Identification Strategy

We use a border discontinuity design, as implemented in Card and Krueger (2000), Dube et al. (2010, 2016), Allegretto et al. (2013, 2017). This approach exploits minimum wage policy discontinuities at the state- or county-border by comparing workers on one side of the border where the minimum wage increased (treatment group) to workers on the other side where the minimum wage did not increase (control group). As shown in Dube et al. (2010), this research design has desirable properties for identifying minimum wage effects since workers on either side of the border are more likely to face similar economic conditions and are likely to experience similar shocks at the same time.

Following Card and Krueger (2000), Dube et al. (2010, 2016) and Allegretto et al. (2013, 2017), we restrict our sample to stores (and their respective workers) located in adjacent counties that share a border. For *state*-level minimum wage variations, we keep stores located in counties that share the same *state*-border and whose centroids are within 75 km (see Figure 4). For instance, Rockland County (New York) and Bergen County (New Jersey) are in the sample because they share the same state-border and their centroids are within 75 km. For *county*- and *city*-level minimum wage variations, we keep stores located in counties that share the same *county*-border and whose centroids are within 75 km. For instance, for San Francisco's variations we include all counties that share a county-border with San Francisco and whose centroids are within 75 km (i.e., the counties of Marin, Alameda and San Mateo). Our final sample contains more than 200 stores (with over 10,000 salespeople), approximately half of which experienced variations in minimum wage in our sample period.

Figure 4: Variations in Minimum Wage in Bordering Counties



Notes: Store locations are withheld for confidentiality reasons.

We estimate the effect of a $1 increase in the minimum wage with the following model:

$$Y_{ijt} = \alpha + \beta MinW_{jt} + X_{it} \cdot \zeta + \delta_i + \phi_{pt} + \varepsilon_{ijt}, \tag{3}$$

where: Y is the outcome of interest (e.g., individual worker productivity) for worker i, in store j and in month t. $MinW_{jt}$ is the applicable statutory minimum wage (the highest among state-county-city minimum wages) in store j and in month t.[14] X_{it} is a vector

[14]Our estimates of the overall impact of minimum wage are based on multiple variations in the minimum

of time-varying worker's characteristics that are likely to predict worker productivity: a worker's tenure and the department in which she works. δ_i are worker fixed effects.[15]

As in Dube et al. (2010, 2016), specification (3) includes *county-pair-month fixed effects* (ϕ_{pt}). ϕ_{pt} is obtained by interacting 113 unique county-pair identifiers with 41 month dummies (covering our sample period). To correctly estimate this equation we stack our data: i.e., stores/workers located in a county sharing a border with n other counties appear n times in the final sample.

The inclusion of *pair-month fixed effects* is important because it allows us to estimate the effect of a higher minimum wage by relying only on the *within-pair-month* variation in minimum wage. In other words, we compare the individual productivity of workers located in "treated" stores (where the minimum wage increased) to those in "control" stores on the other side of the *same* border (where the minimum wage did not increase). To further account for time-varying local economic conditions, specification (3) also controls for monthly unemployment rate in the county in which the store is located.[16]

The standard errors of specification (3) are two-way clustered at the state level (32 states) and at the border-segment level (44 border-segments). As explained in Dube et al. (2010), the presence of a single county in multiple pairs along a border segment induces a mechanical correlation across county-pairs, and potentially along an entire border segment. This requires standard errors to be clustered not only at the state level but also at the border-segment level (two-way clustering). In Section 6.3.3, we will show that the productivity results are robust to using a non-stacked sample of stores in which standard errors are clustered at the state level only.

Testing pre-trends The border discontinuity research design is used to increase the comparability between workers in the treated stores (with minimum wage increase) and workers in the control stores (without increase). This is because bordering counties are

wage over time. If the minimum wage variation is at the state- (county-) level, all stores in the state (county) are simultaneously and equally "treated." If the variation is at the city-level, the stores in that specific city are "treated" while those in the rest of the city's county or state are not.

[15]Store fixed effects are here redundant and hence not added: worker swaps from one store to another are almost nonexistent in our data. More details on this below.

[16]All the results of this paper are robust to removing unemployment rate as a control.

likely to face similar trends in economic conditions absent the changes in the minimum wage. We formally check this assumption by testing for the presence of pre-existing trends in the outcomes of interest, as implemented in Dube et al. (2010):

$$\begin{aligned} Y_{ijt} &= \alpha + \eta_{12}(MinW_{j,t+12} - MinW_{j,t+4}) + \eta_4(MinW_{j,t+4} - MinW_{j,t}) + \\ &\quad \rho MinW_{j,t} + X_{it} \cdot \zeta + \delta_i + \phi_{pt} + \varepsilon_{ijt}, \end{aligned}$$

where $MinW_{j,t+m}$ is the minimum wage m months after month t and all other variables are defined as in equation (3). In this specification, η_{12} and η_4 are called leading coefficients and capture twelve and four months variations in Y *before* each change in the minimum wage. Among other things, this allows us to test whether differences between treated and control workers materialize only after the minimum wage effectively changes or whether it materializes before then, when the minimum wage increase is announced (this typically happens 6-12 months before the effective date).[17] To statistically test for the presence of pre-trends we estimate whether $\beta = \eta_4 - \eta_{12}$ is statistically different from zero.

Table 2 (Panel A) shows that our outcome variables of interest (productivity, compensation, hours) were *not* on a positive trend before the minimum wage actually increased. Indeed, none of the βs is statistically different from zero.[18] To further corroborate the validity of our research design, we show in Panel B of Table 2 that the lack of pre-trend holds also when we focus on a shorter-run trend, i.e., six months and two months variations in Y before each change in the minimum wage (i.e., $\beta = \eta_2 - \eta_6$).

In Section 7, we will show that the lack of pre-trends is satisfied not only within the entire sample of workers but also within the sub-sample of low-, medium- and high-productive workers, which we will later analyze as separate groups. Finally, in Table B.22, we show that the lack of pre-trends also holds at a more aggregate level for the set of store-level variables we will use in Section 8 (e.g., store profits, store employment).

[17] In the state of New Jersey, for instance, the September 2014 increase in the minimum wage was announced 10 months in advance, in November 2013.

[18] For two variables (sales per hour and total pay per hour): the 12 months lead coefficient (η_{12}) is large and statistically significant (likely because of a previous variation in the minimum wage, which frequently occurs 12 months before); while the 4 months lead coefficient (η_4) is not statistically significant. This is consistent with both variables increasing 12 months but not 4 months prior to a minimum wage change. We can thus reject that these variables are on a positive trend prior to the minimum wage change.

Table 2: No Pre-Trends in Worker-Level Outcomes

Var.Desc.	*Productivity*			*Compensation*					*Hours*
Dep.Var.	Sales/Hrs. (hidden units)	Reg.Pay/Hrs (in $) [Base Rate]	Var.Pay/Sales (in %) [Comm. Rate]	Var.Pay/Hrs. (in $)	MinW.Pay/Hrs. (in $)	Tot.Pay/Hrs. (in $)	Tot.Pay (in 100$)	Tot.Hrs	Part-time (in %)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A: 1 year trend								
η_{12}	0.088***	-0.019	-0.014	0.313	-0.078	0.321**	0.216	-0.340	0.280
	(0.027)	(0.026)	(0.053)	(0.206)	(0.107)	(0.147)	(0.367)	(1.089)	(1.183)
η_4	0.018	-0.047	0.060	0.180	-0.011	0.179	0.357	2.697	-1.148
	(0.048)	(0.066)	(0.165)	(0.670)	(0.040)	(0.552)	(1.158)	(2.547)	(2.754)
$\beta = \eta_4 - \eta_{12}$	-0.069	-0.029	0.074	-0.133	0.067	-0.143	0.141	3.037	-1.428
	(0.049)	(0.042)	(0.151)	(0.503)	(0.081)	(0.451)	(0.832)	(1.695)	(1.837)
Observations	112,341	112,341	110,180	112,341	112,341	112,341	112,341	112,341	112,341
Units	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers
Mean Dep.Var.	2.100	6.017	3.843	6.750	0.195	13.18	15.05	111.9	54.99
	Panel B: 6 months trend								
η_6	0.062	-0.037	0.123	0.259	-0.009	0.235	0.321	0.036	0.025
	(0.066)	(0.036)	(0.082)	(0.316)	(0.020)	(0.260)	(0.563)	(1.931)	(2.195)
η_2	-0.069	-0.060	0.076	-0.278	0.019	-0.245	-0.398	0.832	-0.726
	(0.081)	(0.059)	(0.156)	(0.393)	(0.038)	(0.284)	(0.672)	(2.311)	(2.107)
$\beta = \eta_2 - \eta_6$	-0.131	-0.024	-0.047	-0.537	0.028	-0.480	-0.719	0.796	-0.751
	(0.094)	(0.027)	(0.171)	(0.322)	(0.029)	(0.310)	(0.555)	(0.971)	(1.583)
Observations	150,576	150,576	147,797	150,576	150,576	150,576	150,576	150,576	150,576
Units	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers
Mean Dep.Var.	2.095	6.064	3.674	6.398	0.208	12.89	14.48	110.2	56.83

Notes: All the regressions include pair-month fixed effects, worker fixed effects and control for worker tenure, worker department and county-level unemployment. The number of observations in Panel A (Panel B) corresponds to the sample of workers who we observe for at least 12 (6) consecutive months before the change in minimum wage. *Sales/Hrs* are the sales per hour rescaled by a factor between 1/50 and 1/150 relative to its $ value. *Base: Reg.Pay/Hrs* are monthly regular earnings per hour worked (in $ per hour). *Comm.Rate: Var.Pay/Sales* are earnings from commissions and incentives divided by sales (in %). *Var.Pay/Hrs* are monthly commission earnings per hour worked (in $ per hour). *MinW.Pay/Hrs* are the monthly earnings from minimum wage adjustments divided by hours worked (in $ per hour). *Tot.Pay/Hrs* is the monthly total pay from total take home pay divided by total hours (in $ per hour). *Tot.Pay (in 100$)* is the monthly total pay from total take home pay. *Tot.Hrs* is the total number of hours worked in a month. *Part-time (in %)* is the percent probability that an employee works part-time in a given month (takes value 0 in a given month if a worker is full-time and takes value 100 if the worker is part-time). Standard errors are two-way clustered at the state level and at the border-segment level. *** p<0.01, ** p<0.05, * p<0.1.

Robustness checks A common critique of border-discontinuity research designs is that these designs may suffer from cross-border spillovers (Neumark et al. 2014, Dube et al. 2016): high- (low-) productivity workers may sort into counties with a higher (lower) minimum wage. In our setting, we are able to attenuate this concern by including worker fixed effects in all our analysis and thus effectively comparing the same worker at times with higher vs. lower minimum wage. To further corroborate the lack of spillovers, Section 6.3 shows that – among our sample workers – only approximately 1% of the workers in our sample move from one store to another after a minimum wage increase (and thus less than 1% move from a control to a treated store). Moreover, we leverage data on the distance between each worker's home zip code and workplace and find no systematic evidence of selective migration (refer to Section 6.3.2 for more details).

In Section 6.3.3, we explore the robustness of our results to alternative sample selections and model specifications. Using our main specification (3), we first show that the results are robust to narrowing down the definition of "bordering" by restricting the analysis to the sample of stores that are located less than 38.5 km or less than 18.75 km from the border. Next, we show that the results are robust to using the *entire* sample of stores in our data – regardless of how far they are located from the border – in a specification similar to (3) which replaces county-pair fixed effects with state-specific time trends (as in the difference-in-difference set-up of Neumark 2017), or with state-month fixed effects. Finally, we show that the results are robust to extending our main specification (3) to also include *department-store* specific time trends, in order to account for differential trends across departments of a given store.

6 Effects of Minimum Wage on Productivity and Underlying Channels

We first explore the effect of minimum wage variations on individual worker productivity. Col.1 of Table 3 indicates that a $1 (1.5 standard deviations) increase in the minimum wage raises individual productivity – sales per hour – by 0.094 (hidden unit). This corresponds to a 4.5% increase in productivity (see "Effect MinW (%)" at the bottom of Table 3). Because a $1 increase in the minimum wage is equivalent to a 12.7% increase relative to the mean, the elasticity of productivity relative to the minimum wage is estimated at 0.35. This productivity effect is economically large and statistically significant at the 5 percent level.

Table 3: Minimum Wage Increases Individual Worker Productivity

Dep.Var.	Sales/Hrs. (1)	Sales/Hrs. (2)	Sales/Hrs. (3)
MinW	0.094**	0.091**	0.091**
	(0.039)	(0.040)	(0.040)
Parking-lot occupancy rate		0.207*	
(simple average)		(0.110)	
Parking-lot occupancy rate			0.213**
(residualized)			(0.098)
Observations	217,822	217,822	217,822
Units	Workers	Workers	Workers
Mean Dep.Var.	2.085	2.085	2.085
Effect MinW (%)	4.485	4.377	4.348

Notes: All the regressions include pair-month fixed effects, worker fixed effects and control for worker tenure, worker department and county-level unemployment. *Sales/Hrs* are the sales per hour rescaled by a factor between 1/50 and 1/150 relative to its $ value. *MinW* is the predominant monthly minimum wage (in $). *Parking lot occupancy rate (simple average)* is the average occupancy rate of the store's parking lot. *Parking lot occupancy rate (residualized)* is the residualized average occupancy rate of the store's parking lot. *Effect MinW (%)* is the percent effect of $1 increase in MinW on the outcomes. Standard errors are two-way clustered at the state level and at the border-segment level. *** p<0.01, ** p<0.05, * p<0.1.

The increase in worker productivity, which is consistent with the theory, can be explained by two channels. First, a higher minimum wage may increase demand and, through this, raise worker productivity (sales per hour).[19] The second is a "compensation" channel: the theory shows that a higher compensation due to a minimum wage hike can result in increased worker effort and increased productivity (refer to Proposition 2).

We explore the relative contribution of the demand and compensation channels in Sections 6.1 and 6.2 respectively. In Section 6.3, we provide evidence against two possible confounding factors: (1) a *firm adjustment* channel (i.e., the firm reducing hours worked or improving work shifts), and (2) a *selection* channel (i.e., the firm terminating low-productivity workers, or hiring from an improved pool of workers).

6.1 Demand Channel

The productivity gains might result from a demand channel, if hikes in the minimum wage increase the demand for retail goods. The literature is mixed on whether there is a pass-through from the minimum wage to the demand for retail goods.[20] In this section we look for evidence of a demand shock within our sample.

Does a correlate of retail demand increase after a minimum wage hike?

We test whether minimum wage affects store-level demand, which we proxy with stores' parking lots occupancy rates.

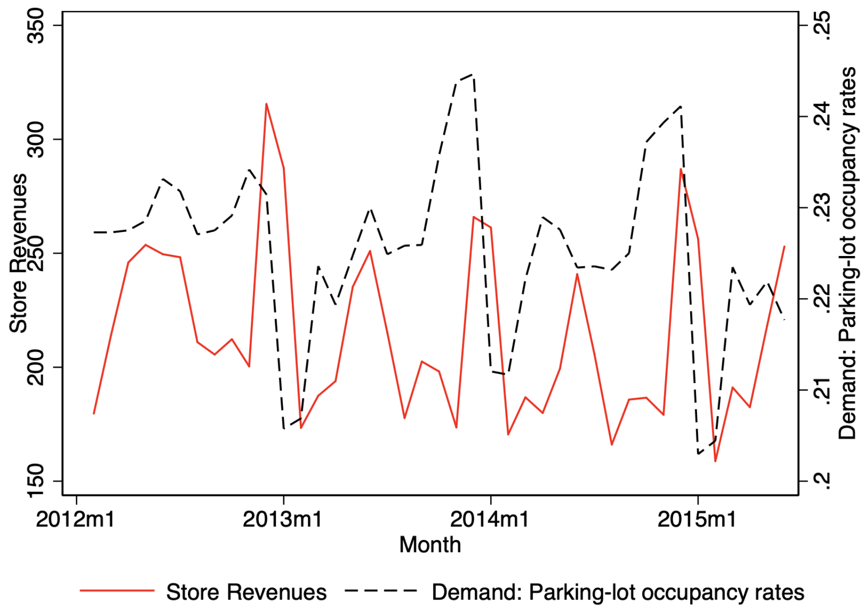
As a first (preliminary) step, we validate our proxy for store-level demand by showing that it correlates with store revenues. Figure 5 shows that average monthly parking-lot occupancy rates and average monthly store revenues (computed aggregating our worker-level data) co-move over time with peaks around holiday seasons. In line with this evidence, Table B.3 shows (in a specification with fixed effects as in equation (4) described below)

[19] Demand affects worker productivity in all jobs in which productivity is directly related to the number of clients (e.g., retail, restaurants). This is not necessarily the case for all jobs outside retail.

[20] Aaronson et al. (2012, Table 3) show that while most pass-through is channeled by automobile purchases, some pass-through is channeled by miscellaneous household items, which are sold by retail stores. On the other hand, Leung (2017, Table G8) shows that real sales of "General Merchandise" in mass merchandise stores decrease after a minimum wage hike.

that the correlation between occupancy rates and store revenues is positive and statistically significant: a one unit increase in occupancy rate is associated with 12% increase in store revenues.

Figure 5: Parking-lot Occupancy Rates Co-move With Store Revenues



Notes. This figure plots the evolution over time of "store revenues" and 'parking lot occupancy rates," averaged at the store-month level. *Store revenues* are the (average) total monthly store revenues generated by all sales associates in our sample divided by the total number of hours worked by these sales associates. We do not disclose the units of this variable for confidentiality reasons. *Parking lot occupancy rates* is the (simple average) occupancy rate of the store's parking lot.

As a second step, we estimate the effect of increasing the minimum wage on store-level demand with the following store-level regression model:

$$Y_{jt} = \alpha + \beta MinW_{jt} + \delta_j + \phi_{pt} + \varepsilon_{jt}, \tag{4}$$

where Y_{jt} is the average occupancy rate in the parking lot of store j in month t. δ_j are store fixed effects, ϕ_{pt} are county-pair-month fixed effects and standard errors are two-way clustered at the state level and the border-segment level (as we do for the worker level regressions). Table 4 shows that a higher minimum wage is not associated with a statistically higher parking lot occupancy rate. We interpret this evidence as suggestive that increases in the minimum wage are not associated with demand shocks, at least in our bordering-counties sample.

Table 4: Minimum Wage Has No Effect on Store-level Demand

Dep.Var.	Parking-lot occupancy rate (simple average) (1)	Parking-lot occupancy rate (residualized) (2)
MinW	-0.005	-0.001
	(0.017)	(0.017)
Observations	12,359	12,359
Units	Stores	Stores
Mean Dep.Var.	0.230	0.002

Notes: All the regressions include pair-month fixed effects and store fixed effects. *Parking lot occupancy (simple average)* is the average occupancy rate of the store's parking lot (0 means no-occupancy, 1 means full-occupancy). *Parking lot occupancy (residualized)* is the residualized average occupancy rate of the store's parking lot. Standard errors are clustered at the state level and at the border-segment level. *** p<0.01, ** p<0.05, * p<0.1.

As a third step, we estimate whether the effect of minimum wage on individual worker productivity changes after we control for store-level demand. If the observed productivity gains were due to a demand surge, the minimum wage coefficient should shrink after controlling for demand. Table 3 (Cols.2-3) proves this is not the case: after controlling for the occupancy rate, the coefficient for minimum wage is similar.

Increased demand-per-worker?

A more subtle channel might be that an increase in the minimum wage causes the number of salespeople to be reduced but the number of customers to stay the same. Then demand-per-worker increases, and individually each worker might well become more productive. However, in Section 8 we will show that the number of salespeople employed by the firm does not change after a minimum wage increase, which leads us to discount this demand-per-worker channel.

Are productivity gains shared by workers of all productivity levels?

A positive demand shock should be a tide that lifts all boats, that is, workers of all productivity types should become more productive if more customers walk through the doors. (This assumption is embedded in our theory: see Figure 1, Panel b.) To explore whether a minimum wage increase is in fact a tide that lifts all boats, following Aaronson et al. (2012), we create three categories based on past productivity: workers who at month *t-1* are paid the minimum wage (the least productive types); intermediate types who are paid more than the minimum wage but less than a threshold (180% of the minimum wage, or alternatively 160%, 140%, 120%); and the most productive types who are paid more than the threshold. We use "total pay per hour" as opposed to "sales per hour" to proxy for productivity because our theoretical definition of an unproductive worker is a worker whose total pay is propped up by the minimum wage.[21]

To stay as close as possible to our main specification (3), we estimate the following worker-level regression model:

$$\begin{aligned} Y_{ijt} = {} & \beta_0 + \beta_1 MinW_{jt} + \beta_2 \mathbb{1}(W_{it-1} > MinW_{jt-1})_{it} + \beta_3 \mathbb{1}(W_{it-1} >> MinW_{jt-1})_{it} + \\ & \beta_4 MinW_{jt} \cdot \mathbb{1}(W_{it-1} > MinW_{jt-1})_{it} + \beta_5 MinW_{jt} \cdot \mathbb{1}(W_{it-1} >> MinW_{jt-1})_{it} + \\ & X_{it} \cdot \zeta + \delta_i + \phi_{pt} + \varepsilon_{ijt}, \end{aligned} \tag{5}$$

where Y is the outcome of interest (here, individual worker productivity) and where $MinW$ is the predominant minimum wage (centered around the sample mean). $\mathbb{1}(W_{it-1} > MinW_{jt-1})$ is a lagged indicator for workers paid between the minimum wage and 180% (160%, 140%, 120%) of the minimum wage. We will refer to these workers as the *medium-productive* ones. $\mathbb{1}(W_{it-1} >> MinW_{jt-1})$ is a lagged indicator for workers paid more than 180% (160%, 140%, 120%) of the minimum wage. We will refer to these workers as the *high-productive* ones. Workers paid *at* the minimum wage (*low-productive*) are the omitted group.[22] The estimated effect of a \$1 increase in the minimum wage is given by $\hat{\beta}_1$ for the low-productive group, $\hat{\beta}_1 + \hat{\beta}_4$ for the medium-productive group and $\hat{\beta}_1 + \hat{\beta}_5$ for the high-productive group. The interaction terms, $\hat{\beta}_4$ and $\hat{\beta}_5$, measure whether the effect of minimum wage is statistically different for the medium- and high-productive workers, relative to the low-productive ones.

[21] Ranking workers in terms of their "sales per hour" is equivalent to ranking them in terms of their total pay because the relationship between sales per hour and total pay is monotonically increasing. Table B.4 reports the average productivity of the three worker categories (low-, medium-, high-productive) using the 180%, 160%, 140% or 120% threshold.

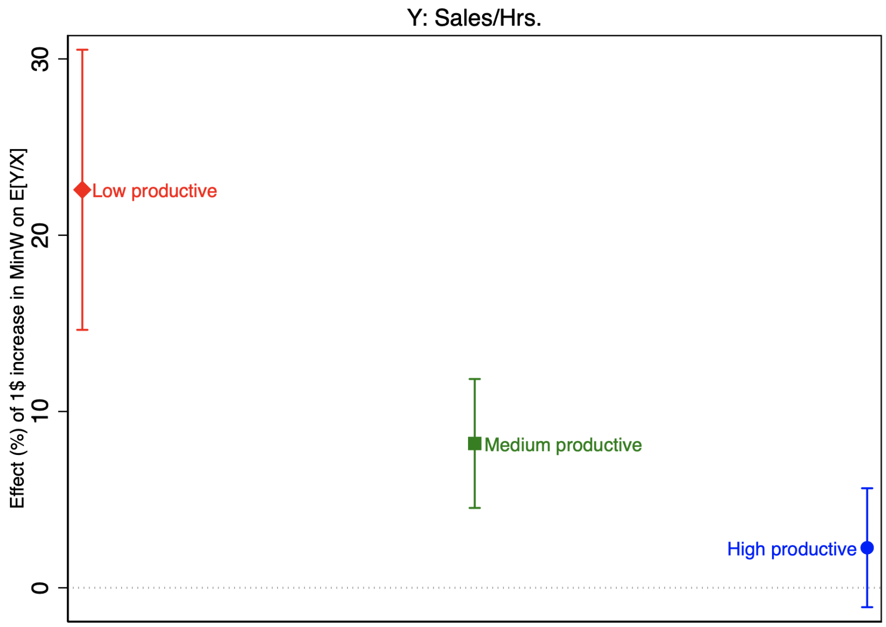
[22] We define a worker as being "at minimum wage" if her total compensation is below 1.02*minimum wage. We do so because the "total compensation" field is sometimes off by a few cents. The results are robust to defining workers "at minimum wage" as those who earn exactly the minimum wage.

Using the 180% threshold, descriptive statistics are as follows (see Table B.5): 4% of workers have their monthly pay *at* minimum wage (*low productive*), 72% of the workers earn between the minimum wage and 180% * minimum wage (*medium productive*), 24% earn more than 180% * minimum wage (*high productive*). The low-productive workers are those for whom earnings are topped-up by the company the most frequently and are those most affected by an increase in the minimum wage. The medium-productive workers are topped up in some but not all weeks: their compensation is affected by the increase in minimum wage but less so than low-productive workers. The high-productive workers have their earnings largely above the minimum wage and their total compensation is less likely affected by the increase in minimum wage.

Figure 6 plots the estimated effects of a $1 increase in the minimum wage for the low-, the medium- and the high-productive group using the 180% threshold and using specification (5). The effect of minimum wage on productivity is shown to be concentrated among low- and medium-productive workers, while the effect is zero (small and not statistically significant) for the high-productive workers. As reported in Table B.6 (Col.4), a $1 increase in minimum wage raises the productivity of low-types by 22.6% and the productivity of medium-types by 8.2%. The effect on high-types is 2.3%, and is not statistically significant. This vanishing effect of the minimum wage on the most productive types is difficult to reconcile with a positive demand shock that lifts all boats.

Table B.6 presents the heterogeneous effects of minimum wage on worker productivity for all thresholds (120%, 140%, 160%, 180%) that define medium productive and high productive workers. Notice that as the threshold increases (i.e., from 120% to 180%), the mass of low-productive workers remains unchanged but the top category of high-productive workers becomes thinner and more outstanding. Using the 120% threshold, for instance, the vast majority of the workers (75%) are classified as "high-productive" (their earnings are above 120% * minimum wage, see Table B.5) while only 24% are classified as "high-productive" with the 180% threshold. In this sense, the highest the threshold, the most "productive" is the top category and the least affected this category should be by the minimum wage hike. Consistent with this, we find that the productivity effect on the top category of workers vanishes as the threshold increases, achieving a precisely

Figure 6: Minimum Wage Has No Effect on the High-Productive Workers



Notes: Effects of a $1 increase in minimum wage on the percent change in productivity (Y: Sales/Hrs) for low-, medium- and high-productive workers. Low productive worker = monthly pay at $t-1$ is "at minimum wage." Medium productive = monthly pay at $t-1$ is between the minimum wage and 180% * minimum wage. High productive worker = monthly pay at $t-1$ is above 180% * minimum wage. Vertical bars represent 95% confidence intervals computed using the estimated coefficients ($\hat{\beta}_1$, $\hat{\beta}_1 + \hat{\beta}_4$ and $\hat{\beta}_1 + \hat{\beta}_5$) from Eq.5, and associated standard errors that are two-way clustered at the state level and at the border-segment level.

estimated zero at the highest (180%) threshold (i.e., for the best 24% of workers).[23] In contrast, the productivity of low-productive workers is found to increase by 19% - 23% regardless of the threshold; while the productivity of medium-productive workers increases by 7% - 9%. Importantly, we find that the productivity gain is consistently weaker for the more-productive types than for the low-productive ones, regardless of the threshold used (120%, 140%, 160%, 180%). This relative estimate (high- relative to low-productive) of the minimum wage's productivity effect is consistent with Ku (2018); here, we further contribute by estimating the *absolute* effect of the minimum wage (approximately 19% - 23% for the low productive and zero for the high productive).[24]

[23] Mean reversion is an unlikely explanation for this phenomenon because the estimated coefficient for $\mathbb{1}(W_{it-1} >> MinW_{t-1})$, $\hat{\beta}_3$, is consistently positive, not negative.

[24] Ku (2018) documents that the productivity gain associated with a $1 increase in the minimum wage is 7% larger among low-productive workers (defined as the bottom 40th percentile) than among the rest

In Table B.7, we assess the robustness of these results using two alternative classifications of workers productivity. First, we divide workers into three categories (low-medium-high productive) based on their total pay in the *first* month on the job, rather than on their lagged monthly pay (Cols.1-4). Second, we divide workers in low-medium-high productive types using their productivity during the first quarter on the job (Col.5). To do so, we estimate workers' fixed effects based on their sales per hour in the first quarter and we use that to then divide workers into terciles.[25] Both these classifications have pros and cons relative to the one we use in Figure 6 (i.e., pay in month *t-1*). They better isolate permanent unobserved heterogeneity from state dependence or mean-reverting shocks. However, they have the disadvantage of being time-invariant and do not allow us to quantify level effects in our specification with worker fixed effects. Reassuringly, the findings paint the same picture regardless of the classification method: the least-productive workers become significantly more productive, while the most-productive workers do not become more productive when minimum wage increases. This result is difficult to reconcile with a positive demand shock that lifts all boats.

In sum, in this section we have first checked whether demand, proxied with parking lot occupancy rates, is correlated with minimum-wage levels and found that it is not. Next, we have asked who among the workers is mostly responsible for the productivity increase. We found that the most-productive workers are not responsible for the productivity gain; instead, it is the least productive workers who contribute a sizable productivity gain (between 19% and 23% relative to their base level). We interpret this finding as inconsistent with the demand channel – the notion that productivity increased because more customers walked through the door. Instead, this finding is consistent with a model where the productivity gains reflect increased effort by the least-productive workers. Overall, we conclude that the demand channel is not responsible for the increased productivity.

of the workers.

[25]We estimate the following model: $Y_{ijt} = \beta_0 + \beta_1 MinW_{jt} + \beta_2 MinW_{jt} \cdot \mathbb{1}(Prod.Terc.2)_{it} + \beta_3 MinW_{jt} \cdot \mathbb{1}(Prod.Terc.3)_{it} + X_{it} \cdot \zeta + \phi_{pt} + \delta_i + \varepsilon_{ijt}$, where $MinW \cdot \mathbb{1}(Prod.Terc.2)$ *[*$MinW \cdot \mathbb{1}(Prod.Terc.3)$*]* is the interaction between $MinW$ and an indicator for whether or not the worker's productivity in the first quarter on the job is in the second *(third)* tercile of the productivity distribution based on the estimated worker fixed effects, and the rest of the variables are like in specification (3).

6.2 Compensation Channel

In this section we ask whether the increase in worker productivity is explained by a compensation channel, i.e., by an increase in worker effort as a response to an increase in worker compensation. As we will document in Section 7, a \$1 increase in the minimum wage raises worker compensation by \$0.64 per hour.[26]

If changes in compensation are responsible for the productivity increase, then the theory provides two implications/tests. First, increasing the minimum wage should affect average productivity more sharply during periods of high unemployment (refer to Proposition 2). Second, the productivity effect should be disproportionately concentrated in the lower tail of the productivity distribution (refer to Proposition 2). In this section we show support for both predictions.

Are average productivity gains sharper during high-unemployment periods?

As indicated above, the compensation channel implies that increasing the minimum wage should affect average productivity more sharply during high-unemployment spells. To test this, we extend the original model to make use of differences in local labor market conditions:

$$\begin{aligned} Y_{ijt} \; = \; & \gamma_0 + \beta_0 MinW_{jt} + \\ & \gamma_1 \mathbb{1}(P25 < U_{jt} \leq P50)_{jt} + \beta_1 \mathbb{1}(P25 < U_{jt} \leq P50)_{jt} \cdot MinW_{jt} + \\ & \gamma_2 \mathbb{1}(P50 < U_{jt} \leq P75)_{jt} + \beta_2 \mathbb{1}(P50 < U_{jt} \leq P75)_{jt} \cdot MinW_{jt} + \\ & \gamma_3 \mathbb{1}(U_{jt} > P75)_{jt} + \beta_3 \mathbb{1}(U_{jt} > P75)_{jt} \cdot MinW_{jt} + \\ & X_{it} \cdot \zeta + \delta_i + \phi_{pt} + \varepsilon_{ijt}, \end{aligned} \qquad (6)$$

where $\mathbb{1}(P25 < U_{jt} \leq P50)_{jt}$ equals one if the the unemployment rate in the county of store j at time t is between the 25^{th} and 50^{th} percentile of the within-county unemployment rate distribution. $\mathbb{1}(P50 < U_{jt} \leq P75)_{jt}$ equals one if the unemployment rate is between the 50^{th} and 75^{th} percentile. $\mathbb{1}(U_{jt} > P75)_{jt}$ equals one if the the unemployment rate is

[26] In our setting, this is entirely explained by worker's wage being propped up by higher "minimum wage adjustments," and not by the firm endogenously adjusting the compensation scheme. Both the base rate and the commission rate indeed remain unchanged after an increase in minimum wage. Refer to Section 7 for more details.

above the 75^{th} percentile. The omitted category is $\mathbb{1}(U_{jt} \leq P25)_{jt}$, i.e., the unemployment rate is below the 25^{th} percentile.

Figure 7 presents the effects of minimum wage on the percent change in productivity at different levels of unemployment by plotting $\hat{\beta}_0$, $\hat{\beta}_0 + \hat{\beta}_1$, $\hat{\beta}_0 + \hat{\beta}_2$, $\hat{\beta}_0 + \hat{\beta}_3$ (and the corresponding 95% confidence intervals). Panel A shows that the effect is statistically significant only during periods of high unemployment, consistent with the theoretical predictions. Moving from the bottom to the top quartile of unemployment almost doubles the effect of minimum wage on productivity. The table counterpart of Figure 7 is presented in Table B.8.

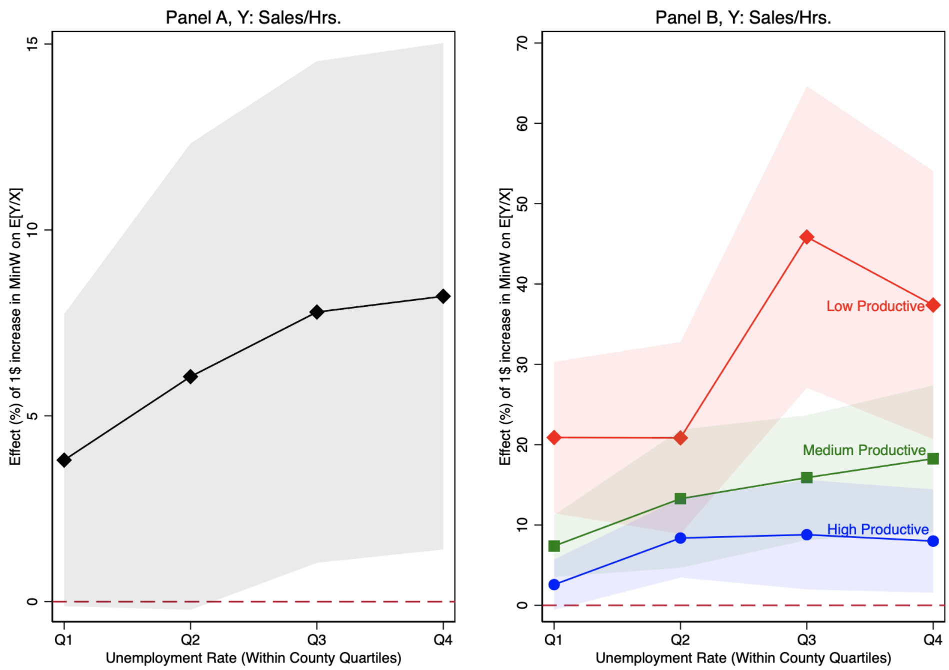
Are productivity gains greater for low-productivity workers?

Further evidence in favor of the compensation channel is the pattern of the productivity gain disaggregated by productivity type. The theory predicts that the effect of minimum wage on productivity should be disproportionately concentrated in the lower tail of the productivity distribution.

Consistent with the model prediction and with Figure 1 Panel (c), the estimates of Figure 6 indicate that the productivity gains are greater for low-productivity workers and negligible for high-productivity workers. Moreover, the slope of the productivity gain relative to the unemployment rate is steeper for low-productivity workers than for high-productivity workers (refer to Figure 7, Panel B, and to Table B.8, Cols.2-5).[27] Overall, these results highlight that the efficiency wage channel materializes more strongly within the population of low-productive workers, whose pay is more strongly affected by the increase in minimum wage (we show this empirically in Section 7).

[27] These results are obtained by estimating equation (6) separately for low-, medium- and high-productive workers by further interacting the βs with worker type indicators ($\mathbb{1}(> MinW)$ and $\mathbb{1}(>> MinW)$).

Figure 7: Unemployment Sharpens the Effect of Minimum Wage



Notes: Effects of a \$1 increase in minimum wage on the percent change in productivity (Y: Sales/Hrs) when unemployment is below the 25^{th}, between 25^{th} and 50^{th}, between 50^{th} and 75^{th}, and above 75^{th} percentiles of the within-county unemployment rate distribution. The shaded areas represent 95% confidence intervals computed using the estimated coefficients from Eq.6, and associated standard errors that are two-way clustered at the state level and at the border-segment level. Panel A presents the average effect across all workers ($\hat{\beta}_0$, $\hat{\beta}_0 + \hat{\beta}_1$, $\hat{\beta}_0 + \hat{\beta}_2$, $\hat{\beta}_0 + \hat{\beta}_3$). Panel B presents the effect for low-, medium-, and high-productive workers separately by further interacting the βs in Eq.6 with worker type indicators. Low productive worker = monthly pay at $t-1$ is "at minimum wage." Medium productive = monthly pay at $t-1$ is between the minimum wage and 180% * minimum wage. High productive worker = monthly pay at $t-1$ is above 180% * minimum wage.

6.3 Confounders and Robustness Checks

6.3.1 Confounder: Organizational adjustments

The fact that the productivity gains are concentrated among the low-productive workers has been interpreted as evidence against the demand channel and in favor of the compensation/ efficiency-wage channel leading to increased worker effort. But these productivity gains might, instead, reflect organizational adjustments targeting sub-populations of workers, namely, after a minimum wage increase: (1) the firm might have changed the number of work hours of low-productive employees only; (2) the firm might have improved the earning opportunities of low-productive workers, which in our firm is done mainly by moving a worker from part- to full-time status,[28] or scheduling them to the top (best-selling) departments.[29] If that were the case, the observed productivity boost among the low-productive employees only might be evidence of a re-organization and not necessarily of higher effort by low-productivity workers.

The evidence suggests that the minimum wage has no statistically significant effect on the number of hours worked by a sales associate, the proportion of sales associates who work part-time, and the proportion of workers who work in the top departments (Table B.9). Using the 180% threshold, we can see that the effect is comparable for low-, medium- and high-productivity types whether it is estimated in percent change relative to the group mean (Figure 8) or in percentage points difference (Table B.9). Taken together, these findings indicate that the gains in productivity are unlikely to reflect organizational adjustments in hours or shifts. These organizational adjustments are also unlikely to explain the heterogeneous effects we identified above.

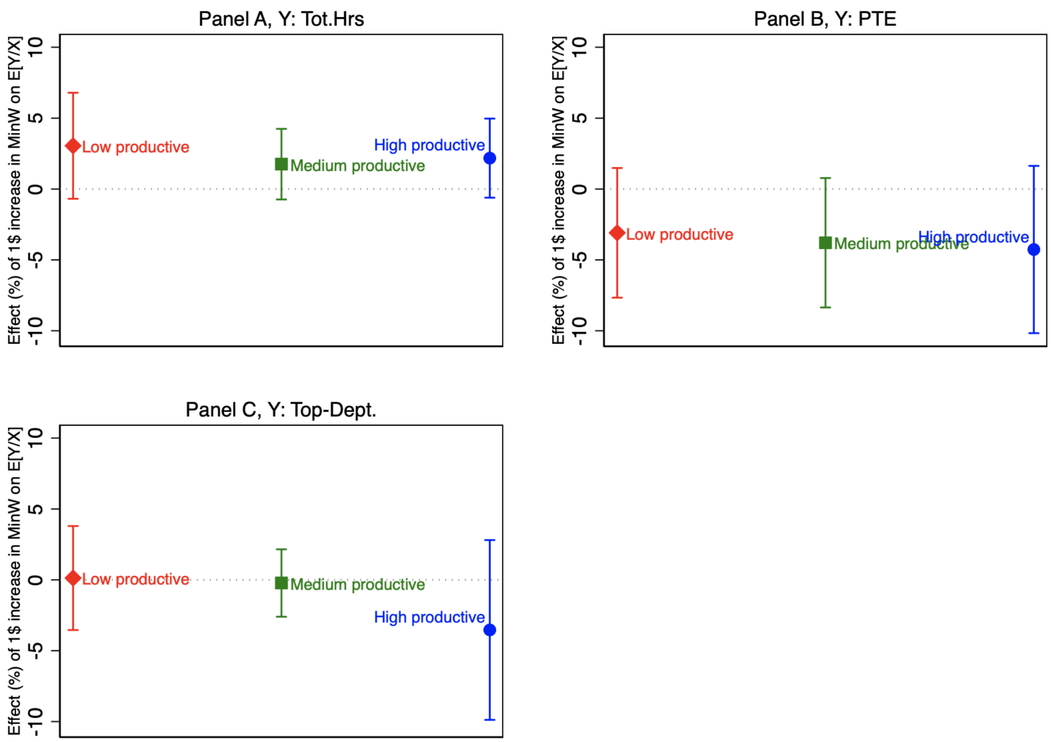
Finally, another potential explanation for why workers increase the dollar amount they sell is that the firm increases consumer *prices*. This is unlikely to be the case for two reasons. First, in line with the findings of Della Vigna and Gentzkow (2017), our company has a national pricing strategy and has uniform prices across all US stores. Second, an

[28] The high-demand hours in our firm are the 6-9pm ones, and these "good shifts" are typically allocated to full-time workers.

[29] Two of the store departments are substantially more popular than others and attract more demand. Sales associates working in these two "popular" departments tend to sell more and hence earn higher commissions, holding effort constant.

increase in prices should be a tide that lifts all boats, like what would happen in the case of a demand shock, and should increase sales for *all* workers, not just for the low-productive ones.[30]

Figure 8: Minimum Wage Has No Effect on Hours Worked, Part-Time Status (PTE), and Allocation to Top Departments



Notes: Effects of a \$1 increase in minimum wage on the percent change in Y; where Y is the number of hours worked per month (Panel A), an indicator for being a part-time worker (Panel B), an indicator for working in the top department (Panel C). Low productive worker = monthly pay at $t-1$ is "at minimum wage." Medium productive = monthly pay at $t-1$ is between the minimum wage and 180% * minimum wage. High productive worker = monthly pay at $t-1$ is above 180% * minimum wage. Vertical bars represent 95% confidence intervals computed using the estimated coefficients ($\hat{\beta}_1$, $\hat{\beta}_1+\hat{\beta}_4$ and $\hat{\beta}_1+\hat{\beta}_5$) from Eq.5, and associated standard errors that are two-way clustered at the state level and at the border-segment level.

[30]Using Nielsen retail scanner data and a variety of identification strategies, Ganapati and Weaver (2017) find no increase in prices following a minimum wage increase.

6.3.2 Confounder: Worker selection

One may wonder whether the estimated average productivity gains are inflated by a selection effect whereby stores terminate less-productive workers, or hire from a better pool, following a minimum wage increase. We expect this "worker selection" confounder to have been largely controlled for by the inclusion of worker-fixed effects in all our specifications, thus effectively using within-worker variation in productivity, but worker-fixed effects may not necessarily eliminate the entirety of the selection bias.[31]

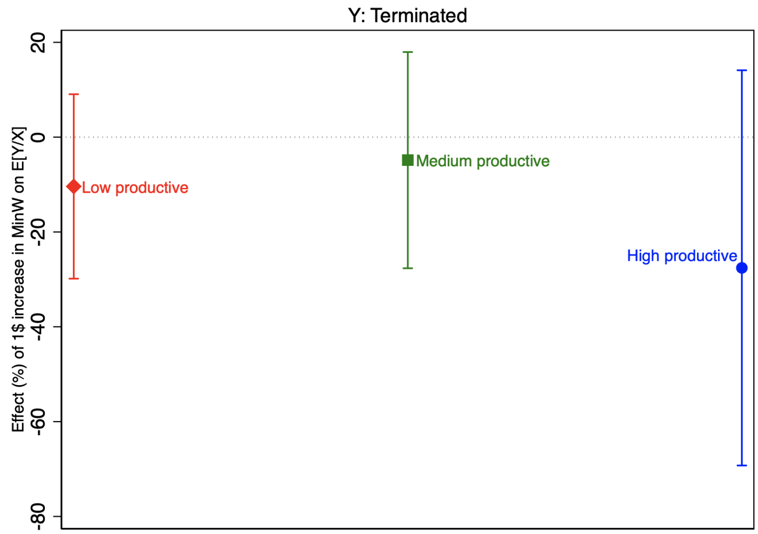
As an additional check, Lazear et al. (2016) suggest restricting the sample to a balanced panel containing only workers who are employed throughout the sample period. When we do this (Table B.10), the sample size drops but: a) average hourly productivity of this sub-population is similar to the productivity of the workers in the main sample; b) the estimated productivity gain associated to a minimum wage increase remains large and significant (6.5% on average, and 32% for low-productive workers). This provides further evidence that the estimates in our baseline specification are not inflated by selection.

If any concerns remain that our productivity estimates are an artifact of *selective termination* of low-productivity workers after a minimum wage increase, or an artifact of an improved hiring pool (due to *selective migration* of high-productivity workers from control to treated counties), Tables B.11 and B.12 should further reassure the reader.

Table B.11, along with the corresponding Figure 9, show that there is no selective termination of workers across productivity types. The minimum wage has no effect on the termination rates of both low- and high-productive workers. The relative comparison between worker types suggests that, if anything, the low-productive workers seem to be terminated slightly less after a minimum wage hike than the high-productive workers. The difference in termination rates across worker types, however, is small and not statistically significant, whether we estimate it in percent change (Figure 9) or in percentage points change (Table B.11). We discuss the economic implication of a zero termination effect on store-level employment in Section 8.

[31] Adding worker fixed effects does not fully account for selection if changes in the minimum wage affect the type of workers who exit/enter our panel. In this scenario, the effect of the minimum wage could be confounded by the fact that the panel of "retained" workers may have changed after a minimum wage increase.

Figure 9: Minimum Wage Has No Effect on Terminations



Notes: Effects of a $1 increase in minimum wage on the percent change in termination. Low productive worker = monthly pay at $t-1$ is "at minimum wage." Medium productive = monthly pay at $t-1$ is between the minimum wage and 180% * minimum wage. High productive worker = monthly pay at $t-1$ is above 180% * minimum wage. Vertical bars represent 95% confidence intervals computed using the estimated coefficients ($\hat{\beta}_1$, $\hat{\beta}_1 + \hat{\beta}_4$ and $\hat{\beta}_1 + \hat{\beta}_5$) from Eq.5, and associated standard errors that are two-way clustered at the state level and at the border-segment level.

Table B.12 provides evidence against selective migration by leveraging data on the worker's home zip code. If workers cross jurisdictional boundaries in pursuit of higher wages, then we would expect work-home distance to increase in "treated" stores relative to "control" stores. Col.1 shows that this is not the case: new hires in treated stores live equally far from work than new hires in control stores. In line with this finding, our data indicate that only approximately 1% of the workers in our sample moved from one store to another after a minimum wage increase (and thus less than 1% moved from a control to a treated store), and these were equally likely to be high-, medium- or low-productive workers.[32] Overall, we discount the possibility that the minimum wage hike triggers systematic worker selection.[33]

[32] These results are in line with Rinz and Voorheis (2018) who leverage data on individual home location before and after minimum wage changes and find no evidence of directly-induced interstate mobility.

[33] For further evidence on home-work distance by worker type: see Table B.12, Cols.2-6.

6.3.3 Robustness checks: Sample selection and model specification

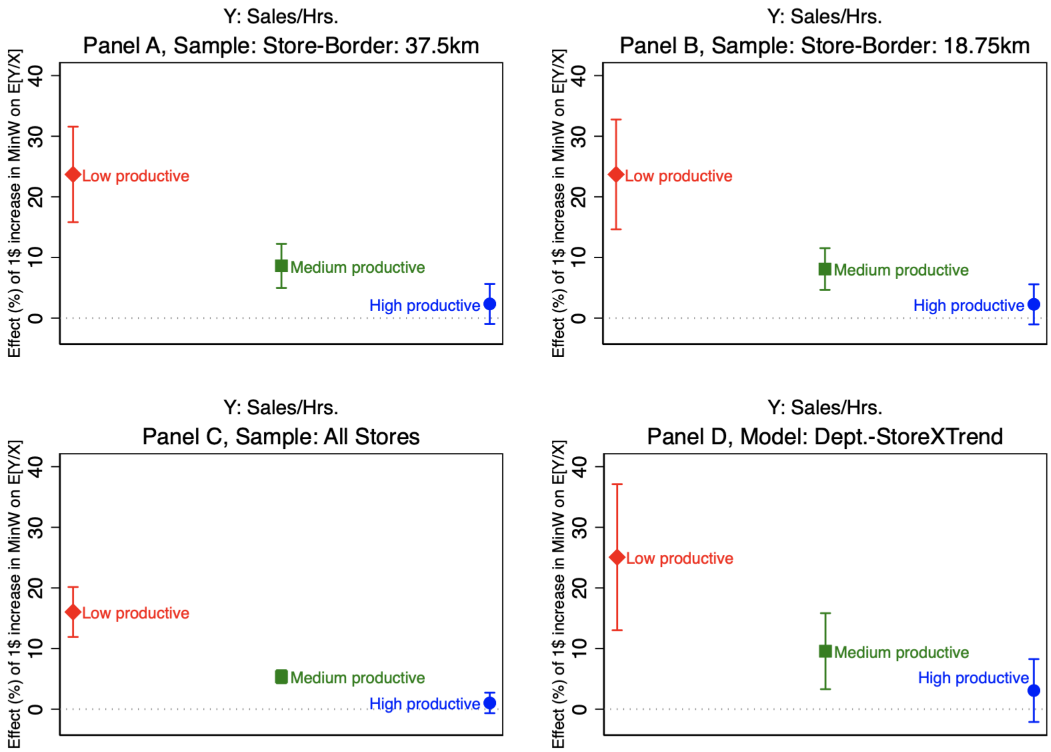
We explore the robustness of our results to alternative sample selections and alternative model specifications in Figure 10 and in Tables B.13 - B.16.

First, we show that our results are robust to changing the definition of "bordering" stores. In our main estimates, we follow the existing literature by restricting the sample to all stores located in counties that: (a) share a border and (b) whose centroids are less than 75 km apart (Card and Krueger 1994, Dube et al. 2010, Allegretto et al. 2013). In Figure 10 (Panels A and B) and Table B.13 (Cols.1-6), we check the robustness of our results to using the *exact GPS location* of a store rather than the centroid of the county in which it is located. Using our main specification (3), we test whether the results obtained in our main sample are robust or not to restricting our sample to those stores whose distance from the border is less than 75 km, less than 37.5 km, and less than 18.75 km. The rationale behind this test is that by narrowing down the definition of "bordering" store in our main sample, we lose a few observations but we increase the comparability of treated and control stores around the borders. Reassuringly, our results are broadly consistent across these samples.

Second, we test whether or not our findings are robust to using the *entire* sample of stores available in our original data, regardless of how far they are located from borders. We do so in a specification similar to (3) but which replaces county-pair fixed effects with either state-month fixed effects or state-specific time trends (as in the difference-in-difference set-up of Neumark 2017), and which clusters standard errors at the state level. Refer to Figure 10, Panel C for the more conservative specification with state-month fixed effects, and to Table B.13, Cols.11-14 for the rest of the results. Consistent with the main estimates obtained in the bordering sample, we find that the low types have a productivity gain which is significantly larger than the high types, although the magnitude of the difference is one third smaller.

Third, we study whether the results are robust to using the same county-level border discontinuity design as in our main estimates but *without* stacking the observations. Because pair-month fixed effects cannot be identified without stacking the data, we replace these fixed effects with state-specific time trends (Table B.13, Cols.7-8) or state-month

Figure 10: Minimum Wage Has a Robust Positive Effect on Low-Productive Workers and no Effect on High-Productive Workers



Notes: Effects of a $1 increase in minimum wage on the percent change in productivity (Y: Sales/Hrs) for low-, medium- and high-productive workers. Panel A (B) estimates Eq.5 in the sample of stores that are located less than 37.5 km (18.75 km) from the border. Panel C includes all stores, regardless of their distance from the border, in a specification with state-month fixed effects (and standard errors clustered at the state level). Panel D considers our main sample (stores located in counties whose centroids are less than 75 km apart) and extends Eq.5 to also include department-specific time trends. Low productive worker = monthly pay at $t-1$ is "at minimum wage." Medium productive = monthly pay at $t-1$ is between the minimum wage and 180% * minimum wage. High productive worker = monthly pay at $t-1$ is above 180% * minimum wage. Vertical bars represent 95% confidence intervals computed using the estimated coefficients ($\hat{\beta}_1$, $\hat{\beta}_1+\hat{\beta}_4$ and $\hat{\beta}_1+\hat{\beta}_5$) from Eq.5, and associated standard errors that are two-way clustered at the state level and at the border-segment level.

fixed effects (Table B.13, Cols.9-10), and cluster standard errors at the state level.[34]

Fourth, we show that the results are robust to extending our main specification (3) to also include *department*store* time-trends (i.e., unique department ID*time), in order

[34] An earlier version of the paper adopted this as its main specification and the main results are qualitatively and quantitatively similar.

to account for potential differential trends across departments of a given store. We do so because one may be concerned that a higher minimum wage induces demand/price changes that are confined into departments that exclude the most productive salespeople, thus potentially confounding the heterogeneous productivity effects identified in the paper. We attenuate this concern by showing that our findings are unaffected by the inclusion of department-specific trends: see Figure 10, Panel D, and Table B.14.

Finally, in Tables B.15 and B.16, we show that the zero termination result identified in Section 6.3.2 survives all the above robustness tests too.

7 Effect of Minimum Wage on Worker Pay

This section quantifies the effect of increasing the minimum wage on worker pay. A minimum wage increase affects compensation directly, when a worker's wage is propped up by higher "minimum wage adjustments." It can also affect compensation indirectly if the firm endogenously adjusts the compensation scheme (base rate and/or commission rate) to a higher minimum wage. Such an indirect effect is absent in our setting: both the base rate and the commission rate remain unchanged when the minimum wage increases (Table 5, Cols.1-2). As explained in Section 4, this is consistent with the fact that the firm under study is multi-jurisdictional and values compensation uniformity across stores.

Turning to the direct effect, the firm complies with a higher minimum wage requirement by topping up workers in any week in which the average hourly pay falls short of the new minimum wage level. For each $1 increase in the minimum wage, the average top-up amount ("minimum wage adjustments") increases by $0.25 per hour (Col.4). On the extensive margin, the share of workers who are topped up every single week of the month increases by 4.5pp (144%), while the share of workers who are topped up at least one week per month increases by 16pp (38.5%).[35]

Overall, worker total hourly pay is found to go up by 5% (+$0.65/h, or elasticity of 0.38) for each $1 increase in minimum wage (Table 5, Col.5). One third of this increase is explained by higher "minimum wage adjustments" (+$0.25/h, Col.4) and two-thirds

[35]Results available upon request.

Table 5: Minimum Wage Increases Worker Pay

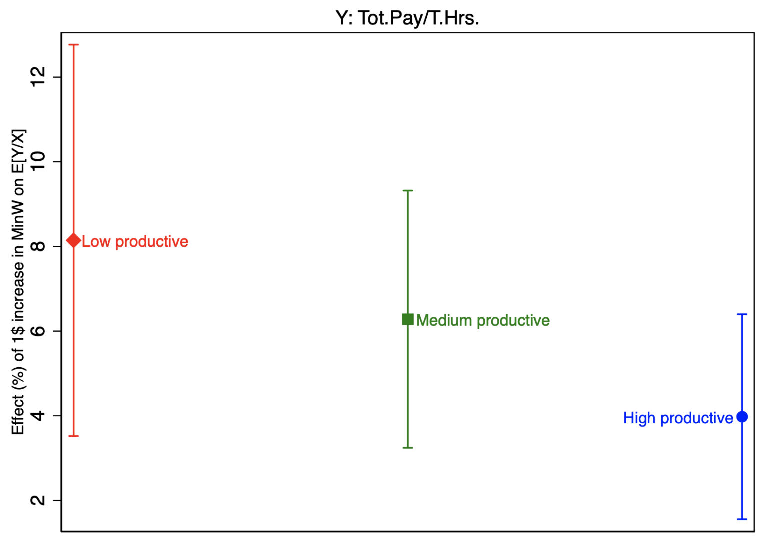
Dep.Var.	Base Rate: Reg.Pay/Hrs. (in $)	Comm. Rate: Var.Pay/Sales (in %)	Var.Pay/Hrs. (in $)	MinW.Pay/Hrs. (in $)	Tot.Pay/Hrs. (in $)	Tot.Pay (in 100$)
	(1)	(2)	(3)	(4)	(5)	(6)
MinW	-0.059	0.126	0.439*	0.250***	0.645***	0.856**
	(0.042)	(0.077)	(0.235)	(0.044)	(0.172)	(0.336)
Observations	217,822	213,697	217,822	217,822	217,822	217,822
Units	Workers	Workers	Workers	Workers	Workers	Workers
Mean Dep.Var.	6.120	3.462	5.947	0.225	12.51	13.61
Effect MinW (%)	-0.957	3.628	7.390	111.3	5.154	6.289

Notes: All the regressions include pair-month fixed effects, worker fixed effects and control for worker tenure, worker department and county-level unemployment. *Base: Reg.Pay/Hrs* are monthly regular earnings per hour worked (in $ per hour). *Comm.Rate: Var.Pay/Sales* are earnings from commissions and incentives divided by sales (in %). *Var.Pay/Hrs* are earnings from commissions and incentives per hour worked (in $ per hour). *MinW* is the monthly minimum wage in the jurisdiction in which worker is located (in $). *MinW.Pay/Hrs* are monthly earnings from minimum wage adjustments divided by hours worked (in $ per hour). *Tot.Pay/Hrs* is the monthly total pay from total take-home pay divided by total hours (in $ per hour). *Tot.Pay* is the monthly total pay from total take-home pay (in 100$). *Tenure* is the number of months of tenure. *Effect MinW (%)* is the percent effect of $1 increase in MinW on the outcomes. Standard errors are clustered at the state level and at the border-segment level. *** p<0.01, ** p<0.05, * p<0.1.

by higher variable pay/commissions (+$0.4/h, Col.3). Note that both these effects are endogenous to the increase in worker productivity (higher sales per hour): "minimum wage adjustments" would have been substantially higher (and variable pay would have been lower) had workers not increase their productivity. As expected, Figure 11 – and the corresponding Table B.17 – show that the increase in total pay per hour associated with a minimum wage hike is stronger for those workers who raise their productivity the most, i.e., the low-productive workers.

Dynamic effects of minimum wage We have just shown that the a higher minimum wage has an immediate positive effect on worker's pay, which is partly explained by the increase in worker's productivity (Section 6). But do these effects persist over time or are they short-lived? To answer this question, we leverage the 70 minimum wage variations

Figure 11: Minimum Wage Increases Worker Pay



Notes: Effects of a \$1 increase in minimum wage on the percent change in worker's total pay per hour. Low productive worker = monthly pay at $t-1$ is "at minimum wage." Medium productive = monthly pay at $t-1$ is between the minimum wage and 180% * minimum wage. High productive worker = monthly pay at $t-1$ is above 180% * minimum wage. Vertical bars represent 95% confidence intervals computed using the estimated coefficients ($\hat{\beta}_1$, $\hat{\beta}_1+\hat{\beta}_4$ and $\hat{\beta}_1+\hat{\beta}_5$) from Eq.5, and associated standard errors that are two-way clustered at the state level and at the border-segment level.

in our sample and estimate the same dynamic equation as in Dube et al.'s (2010):

$$Y_{ijt} \;=\; \alpha + \sum_{m=-3}^{+5} \beta_m \Delta MinW_{j,t-m} + \beta_6 MinW_{j,t-6} + X_{it} \cdot \zeta + \delta_i + \phi_{pt} + \varepsilon_{ijt}, \qquad (7)$$

where Δ represents a month-to-month difference operator. We focus on a time window that goes from $m=-3$ to $m=+6$ months around each change in minimum wage ($t+3$ to $t-6$). The three leading coefficients (β_{-3}, β_{-2}, β_{-1}) are used to test for the absence of pre-treatment trends, while the six lag coefficients (β_0 to β_6) quantify post-treatment effects. This dynamic model, which specifies all but the last (the sixth) lag in changes, produces coefficients representing cumulative as opposed to contemporaneous changes. The "lag 6" coefficient (β_6) thus represents the six-month cumulated effect of minimum wage.[36] We

[36] Dynamic effects are estimated on the sub-sample of workers who stayed on the job for at least 10 consecutive months around each change in the minimum wage (from $m=-3$ to $m=+6$). We do not estimate longer-run effects of minimum wage beyond $m=+6$ because we lose too many observations when we add more lag coefficients in the specification. This is because too few workers stay on the job *more* than 10 consecutive months.

estimate the effect of minimum wage separately for low-, medium- and high-productive workers by further interacting the βs with indicators for worker productivity type, i.e., $\mathbb{1}(> MinW)$ and $\mathbb{1}(>> MinW)$.

Tables B.18 - B.21 present the estimated cumulative response of minimum wage increases for each worker type. The first thing to note is that, for low-, medium- and high-types, the minimum wage does not seem to impact productivity or pay significantly in pre-treatment periods. Indeed, most of the leading coefficients ($m = -3; -2; -1$) are not statistically significant (Tables B.19 and B.21 report the percent effect of one dollar increase in minimum wage for the three types of workers and show that leading effects are small and not statistically significant for low-productive workers). This is reassuring as the contrary would have suggested pre-trends *within* a worker type, which does not seem to be the case here.[37]

Looking at lagged effects, six months after the change in the minimum wage ($m = +6$), low-productive types experience a cumulative increase in productivity of 0.17 and a cumulative increase in pay of \$1.3/h (see coefficient for $MinW_{j,t-6}$ in Col.4 of Tables B.18 and B.20, which is statistically significant at the 10% level for productivity and at the 1% level for pay.) These cumulated effects correspond to an increase of 18% in productivity and 13% in pay for low-productive types (see coefficient "Lag 6 for Workers at MW (m=+6)" in Tables B.19 and B.21). The cumulative effect of minimum wage on productivity is, however, negligible and not statistically significant for high-productive types (the coefficient for $MinW_{j,t-6} \cdot \mathbb{1}(>> MW)$ is large and negative; see also "Lag 6 for Workers >> MW ($m = +6$)" coefficient in Table B.19). We conclude that the effect of the minimum wage on the productivity and pay of low-productive workers is not short-run, but rather it persists for at least up to 6 months after the minimum wage hike.[38]

[37]In Table 2, we ruled out pre-existing trends for the average worker. The results reported in Tables B.18 - B.21 provide additional internal validity to our research design.

[38]This result contrasts the findings of Jayaraman et al. (2016), who find that the minimum wage increases the productivity of Indian tea-pluckers for a few weeks only, and vanishes thereafter. The discrepancy between our results and Jayaraman et al.'s results may be explained by the difference in the identified underlying mechanism. In a context with no firing, Jayaraman et al. (2016) show that a higher minimum wage increases worker productivity through a behavioral effect (positive reciprocity), which they show to be short-lived. In contrast, we explain our results with an efficiency wage story as in Shapiro and Stiglitz (1984), where the efficiency wage mechanism refers to the incentive effect provided by the outside option (being terminated). We show that this efficiency wage mechanism is more long-lasting than the

8 Effect of Minimum Wage on Employment

As explained in Section 6.3, worker-level termination is not abnormally high or low following a minimum wage increase (Table B.11, Col.1). Further, this holds true across worker productivity types: see Figure 9 and Table B.11, Cols.2-5.

The fact that our workers, including low-productivity ones, are not terminated more often after a minimum wage increase makes sense based on the evidence presented so far: as the minimum wage increases, wages and individual productivity both rise, suggesting that these two effects might offset each other. The offsetting hypothesis is supported in Table 6 (Cols.1-3), where we aggregate our worker-level data at the store*month level. Using the store-level specification (4), we find that the effect on overall total net revenues, which includes worker pay, is small and not statistically significant (Col.1). It appears, therefore, that the productivity boost documented in Section 6 is sufficient to offset the burden imposed on the firm by the mandated wage increase, but not strong enough to cause the firm to increase employment (Table 6, Col.2).

These same findings extend to a different store-level analysis, one in which we leverage the firm's internal information about financial performance at the establishment-level (refer to Table 6, Cols.4-6). Similar to Cols.1-3, we find that, at the store level, EBITDA per hour is unaffected by a minimum wage increase, as are employment and hours worked.[39] The fact that minimum wage has no effect on store-level profits/EBITDA suggests that, at its current levels, the added cost to the firm's wage bill of a minimum wage hike is approximately offset by the efficiency-wage boost to labor productivity.

The absence of any measured disemployment effect at the store level is consistent with the broad picture painted by the minimum wage literature (see, e.g., Card and Krueger 1994, Allegretto et al. 2013, Dube et al. 2010, 2016). We attribute this finding to endogenous worker productivity, which is a novel channel in the empirical literature. There are, of course, alternative explanations for the lack of disemployment, including hiring-and-firing frictions and the monopsony power model. But in our estimates, store-level

purely behavioral effect identified by Jayaraman et al. (2016).

[39] Tables B.22 and B.23 present the test of pre-trends and the dynamic effects of minimum wage for all store-level variables, respectively. Table B.23 (Cols.2 and 5) shows that: (1) employment does not show a pre-trend and, (2) employment does not decrease over time after a minimum wage hike.

profits are not reduced by the minimum wage increase, as they would in either the friction model or the monopsony model. This suggests that endogenous worker productivity plays a role in the picture, and that in our data hiring-and-firing frictions need not be invoked to explain the missing disemployment effect of the minimum wage.

Table 6: Minimum Wage Does Not Affect Store Profits and Employment

Sample	**Sales associates**			**All workers**		
Dep.Var.	Net Rev./Hrs (1)	N.Workers (2)	Hrs/N.Workers (3)	EBITDA/Hrs (4)	N.Workers (5)	Hrs/N.Workers (6)
MinW	1.030	-0.217	-0.975	0.383	2.063	0.0667
	(1.210)	(0.423)	(1.258)	(1.317)	(2.160)	(1.315)
Observations	12,359	12,359	12,359	12,359	12,359	12,359
Units	Stores	Stores	Stores	Stores	Stores	Stores
Mean Dep.Var.	51.54	16.64	107.7	5.946	116.9	80.82
Effect MinW (%)	1.998	-1.305	-0.905	6.441	1.764	0.0826

Notes: All the regressions include pair-month fixed effects, store fixed effects and control for county-level unemployment. In Cols.1-3, statics are obtained aggregating our worker-level data on sales associates at the store-level. Col.1: *Net Rev./Hrs* is the total monthly net revenues (revenues*profit margin minus wage bill) generated by all sales associates in our sample divided by the total number of hours they worked. We do not disclose the units of this variable for confidentiality reasons. Col.2: *N.Workers* is the total number of sales associates in the store. Col.3: *Hrs/N.Workers* is the number of hours worked in the store per sales associate. In Cols.4-6, statics are obtained from aggregate store-level data. Col.4: *EBITDA/Hrs* are equal to earnings before interest, tax, depreciation and amortization, divided by total hours worked in the store. We do not disclose the units of this variable for confidentiality reasons. Col.5: *N.Workers* is the total number of workers in the store. Col.6: *Hrs/N.Workers* is the number of hours worked in the store per worker. *MinW* is the predominant monthly minimum wage in the store (in $). *Effect MinW (%)* is the percent effect of $1 increase in MinW on the store-level outcomes. Standard errors are two-way clustered at the state level and at the border-segment level. *** p<0.01, ** p<0.05, * p<0.1.

9 Conclusions

We have studied a base plus commission sales force from a large US retailer. Using a border-discontinuity research design, we have documented that a $1 (1.5 standard deviations) increase in the statutory minimum wage increases individual productivity (sales per hour) by 4.5%. The elasticity of productivity relative to the minimum wage is 0.35.

Two channels might account for this productivity gain: a demand increase concurrent with minimum wage increases; and an incentive effect due to the increase in worker compensation. With the help of a model, and novel satellite imagery from which we derive proxies for time-varying store-level demand, we sought evidence for both channels and found support only for the second, that is, the compensation channel. Indeed, we found that the impact on productivity is stronger during periods of high unemployment, and furthermore, that the productivity gains are found among the low-productive workers but not among the high-productive workers; this evidence is consistent with an efficiency-wage effect but not with a demand effect.

We found that increasing the minimum wage has no impact on store-level profits, indicating that the productivity gains are sufficient to offset the higher labor costs. Consistent with this finding, we also documented that workers, including low-productivity ones, are not terminated more often after a minimum wage increase, and, at the store level, employment does not change. In our data, then, endogenous worker productivity offers a new explanation for why increasing the statutory minimum wage has no adverse employment effect, as has previously been found in the minimum-wage literature.

As with most studies, the results may not generalize to all types of firms and to all types of workers. Our results are more directly relevant for the set of low-pay workers who are paid on commissions. They are also more closely related to the context of national and large firms, which likely respond and absorb external shocks differently than small local firms.

We believe this to be the first study to examine the impact of the minimum wage on individual productivity, wages, and workplace employment. Our novel finding is that the minimum wage endogenously raises the productivity of precisely those workers who benefit from it, to the point that store-level profits are not negatively impacted by the minimum wage and therefore employment does not decrease. Another novel finding is that the productivity gains are limited to high unemployment spells, consistent with an efficiency-wage channel which we formalize in a new theoretical model. The idea that increasing the minimum wage may increase productivity through an incentive effect might provide an additional argument for minimum-wage proponents.

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Appendices

A Appendix: Theory

Proof of Lemma 1.

Proof. The function $V^W(\sigma)$ is flat for $B + R\sigma < M$ in σ and strictly increasing for $B + R\sigma > M$. If $V^W(\sigma)$ meets V^S it must be at a σ where $B + R\sigma > M$ and then the $\overline{\sigma}$ at which they meet solves:

$$\begin{aligned} 2(1-\beta)\max[M,B] + 2(1-\beta)\beta\Omega(M,u) &= \max[M,B] + B + R\sigma - 2c \\ (1-2\beta)\max[M,B] + 2(1-\beta)\beta\Omega(\sigma,M,u) - B + 2c &= R\sigma. \end{aligned}$$

Solving for σ yields:

$$\overline{\sigma} = \frac{(1-2\beta)\max[M,B] + 2(1-\beta)\beta\Omega(M,u) - B + 2c}{R}.$$

Our assumption that $V^W(\varepsilon) < V^S$ implies that $\overline{\sigma} > \varepsilon$. ■

Proof of Proposition 1

Proof. Now workers exert effort if $V^W((1+\delta)\sigma) > V^S$, and so there is a threshold $\overline{\sigma}_\delta$ that solves:

$$(1+\delta)\overline{\sigma}_\delta = \frac{(1-2\beta)\max[M,B] + 2(1-\beta)\beta\Omega(M,u) - B + 2c}{R}.$$

All types σ below $\overline{\sigma}_\delta$ exert zero effort, all others types exert maximum effort. As δ increases above zero $\overline{\sigma}_\delta$ must decrease, so more workers exert effort. In addition the high types in a neighborhood of $\sigma = 1$ exert effort both before and after the demand increase. Thus these workers' productivity increases approximately by δ (from 1 to $1+\delta$). ■

Proof of Proposition 2

Proof. The change in average (and total) productivity is:

$$\frac{\partial}{\partial M}\left(\frac{1}{2}\int_{\overline{\sigma}}^{1}\sigma f\left(\sigma\right)d\sigma\right)=-\frac{1}{2}\overline{\sigma}f\left(\overline{\sigma}\right)\frac{\partial\overline{\sigma}}{\partial M}=-\frac{K}{2}\frac{\partial\overline{\sigma}}{\partial M}.$$

Therefore, any changes in average and total productivity are due to workers in the neighborhood of $\overline{\sigma}$, which is the upper bound of the least-productive workers. This proposition assumes that as M changes the compensation scheme is unchanged, however, we can allow for greater generality and suppose that as M changes the incentive scheme also becomes more generous at rate: $[\partial B/\partial M\geq 0,\partial R/\partial M\geq 0]$, so that:

$$\frac{\partial\overline{\sigma}}{\partial M}=\frac{\left(1-2\beta\right)\mathbb{I}_{B\leq M}+\left(1-2\beta\right)\frac{\partial B}{\partial M}\mathbb{I}_{B>M}+2\left(1-\beta\right)\beta\Omega_{1}-\frac{\partial B}{\partial M}}{R}-\frac{\overline{\sigma}}{R}\frac{\partial R}{\partial M}.$$

Rearrange to isolate $\partial\overline{\sigma}/\partial M$:

$$R\frac{\partial\overline{\sigma}}{\partial M}=\left(1-2\beta\right)\mathbb{I}_{B\leq M}+2\left(1-\beta\right)\beta\Omega_{1}+\left(\left(1-2\beta\right)\mathbb{I}_{B>M}-1\right)\frac{\partial B}{\partial M}-\overline{\sigma}\frac{\partial R}{\partial M}\tag{8}$$

Therefore, $\partial\overline{\sigma}/\partial M$ has the same sign as the RHS of (8).

Case $B\leq M$. In this case the RHS of (8) reads:

$$\left(1-2\beta\right)+2\left(1-\beta\right)\beta\Omega_{1}-\frac{\partial B}{\partial M}-\overline{\sigma}\frac{\partial R}{\partial M}.$$

Since $\partial B/\partial M,\partial R/\partial M\geq 0$, this expression is negative (as desired) if:

$$\begin{aligned}&\left(1-2\beta\right)+2\left(1-\beta\right)\beta\Omega_{1}\\<&\left(1-2\beta\right)+2\left(1-\beta\right)\beta\\=&1-2\beta^{2}<0,\end{aligned}$$

i.e., if $\beta>\sqrt{1/2}$.

Effect of unemployment. The change in average (and total) productivity is mediated by unemployment as follows:

$$\frac{\partial^{2}}{\partial M\partial u}\left(\frac{1}{2}\int_{\overline{\sigma}}^{1}\sigma f\left(\sigma\right)d\sigma\right)=-\frac{K}{2}\left[\frac{\partial^{2}\overline{\sigma}}{\partial M\partial u}\right]$$

Differentiating (8) with respect to u under the assumption that $\partial R/\partial M=0$, one gets:

$$R\frac{\partial^{2}\overline{\sigma}}{\partial M\partial u}=2\left(1-\beta\right)\beta\Omega_{12}.\tag{9}$$

The RHS is negative because $\Omega_{12} < 0$, i.e., if $B \leq M$ the beneficial effect of increasing the minimum wage on productivity is sharper during times of high unemployment.

If base pay increases without any change in M then the effects on productivity are independent of the unemployment level.

$$\begin{aligned} \frac{\partial \overline{\sigma}}{\partial B} &= \frac{(1-2\beta)\,\mathbb{I}_{B>M} - 1}{R} \\ \frac{\partial^2 \overline{\sigma}}{\partial B \partial u} &= 0. \end{aligned}$$

■

B Appendix Tables and Figures

Table B.1: States With No Change in Minimum Wage from February 2012 and June 2015

State with no change	State Abr.
Alabama	AL
Georgia	GA
Iowa	IA
Idaho	ID
Illinois	IL
Indiana	IN
Kansas	KS
Kentucky	KY
Louisiana	LA
Maine	ME
Mississippi	MS
North Carolina	NC
North Dakota	ND
New Hampshire	NH
New Mexico	NM
Nevada	NV
Oklahoma	OK
Pennsylvania	PA
South Carolina	SC
Tennessee	TN
Texas	TX
Utah	UT
Virginia	VA
Wisconsin	WI
Wyoming	WY

Table B.2: Changes in Minimum Wages from February 2012 and June 2015

State	State	Date C.1	W_{t-1}	W_t	Date C.2	W_{t-1}	W_t	Date C.3	W_{t-1}	W_t	Date C.4	W_{t-1}	W_t
Alaska	AK	2015m2	7.75	8.75									
Arkansas	AR	2015m1	7.25	7.5									
Arizona	AZ	2013m1	7.65	7.8	2014m1	7.8	7.9	2015m1	7.9	8.05			
California	CA	2014m7	8	9									
Colorado	CO	2013m1	7.64	7.78	2014m1	7.78	8	2015m1	8	8.23			
Connecticut	CT	2014m1	8.25	8.7	2015m1	8.7	9.15						
DC	DC	2014m7	8.25	9.5									
Delaware	DE	2014m6	7.25	7.75	2015m6	7.75	8.25						
Florida	FL	2013m1	7.67	7.79	2014m1	7.79	7.93	2015m1	7.93	8.05			
Hawaii	HI	2015m1	7.25	7.75									
Massachusetts	MA	2015m1	8	9									
Maryland	MD	2015m1	7.25	8									
Michigan	MI	2014m9	7.4	8.15									
Minnesota	MN	2014m8	7.25	8									
Missouri	MO	2013m1	7.25	7.35	2014m1	7.35	7.5	2015m1	7.5	7.65			
Montana	MT	2013m1	7.65	7.8	2014m1	7.8	7.9	2015m1	7.9	8.05			
Nebraska	NE	2015m1	7.25	8									
New Jersey	NJ	2014m1	7.25	8.25	2015m1	8.25	8.38						
New York	NY	2013m12	7.25	8	2014m12	8	8.75						
Ohio	OH	2013m1	7.7	7.85	2014m1	7.85	7.95	2015m1	7.95	8.1			
Oregon	OR	2013m1	8.8	8.95	2014m1	8.95	9.1	2015m1	9.1	9.25			
Rhode Island	RI	2013m1	7.4	7.75	2014m1	7.75	8	2015m1	8	9			
South Dakota	SD	2015m1	7.25	8.5									
Vermont	VT	2014m1	8.6	8.73	2015m1	8.73	9.15						
Washington	WA	2013m1	9.04	9.19	2014m1	9.19	9.32	2015m1	9.32	9.47			
West Virginia	WV	2015m1	7.25	8									
County	State	Date C.1	W_{t-1}	W_t	Date C.2	W_{t-1}	W_t	Date C.3	W_{t-1}	W_t			
Bernalillo	NM	2013m7	7.5	8	2014m1	8	8.5	2015m1	8.5	8.65			
Johnson	IA	2015m11	7.25	8.2									
Montgomery	MD	2014m10	7.25	8.4									
Prince George's	MD	2014m10	7.25	8.4									
Santa Fe	NM	2014m4	7.5	10.66	2015m3	10.66	10.84						
City	State	Date C.1	W_{t-1}	W_t	Date C.2	W_{t-1}	W_t	Date C.3	W_{t-1}	W_t	Date C.4	W_{t-1}	W_t
Alburquerque	NM	2013m1	7.5	8.5	2014m1	8.5	8.6	2015m1	8.6	8.75			
Berkeley	CA	2014m10	9	10									
Las Cruces	NM	2015m1	7.5	8.4									
Oakland	CA	2015m3	9	12.25	2016m1	12.25	12.55						
Richmond	CA	2015m1	9	9.6	2016m1	9.6	11.52						
San Diego	CA	2015m1	9	9.75									
San Francisco	CA	2013m1	10.24	10.55	2014m1	10.55	10.74	2015m1	10.74	11.05	2015m5	11.05	12.25
San Jose	CA	2013m3	8	10	2014m1	10	10.15	2015m1	10.15	10.3			
Santa Fe	NM	2012m3	9.5	10.29	2013m3	10.29	10.51	2014m3	10.51	10.66	2015m3	10.66	10.84
SeaTac	WA	2013m1	9.04	9.19	2014m1	9.19	15						
Seattle	WA	2013m1	9.04	9.19	2014m1	9.19	9.32	2015m1	9.32	9.47	2015m4	9.47	11
Sunnyvale	CA	2015m1	9	10.3									
Tacoma	WA	2013m1	9.04	9.19	2014m1	9.19	9.32	2015m1	9.32	9.47			
Washington	DC	2014m7	8.25	9.5									

Notes: This table reports all state/county/city variations in statutory minimum wage from 2/1/2012 to 6/30/2015, irrespective of whether there is a store located in that state/county/city. Our identification strategy effectively leverages only a sub-sample of these changes (70 out of 89), i.e., those that affect at least one store in our sample. We do not report which ones are the 70 variations we leveraged in the paper for confidentiality reasons. W_t (W_{t-1}) refers to the minimum wage level after (before) the change.

Table B.3: Correlation between Parking Lot Occupancy Rate and Store Revenues

Dep.Var.	Store Revenues (1)	Store Revenues (2)
Parking lot occupancy rate (simple average)	25.216**	
	(9.610)	
Parking lot occupancy rate (residualized)		26.015***
		(8.927)
Observations	12,359	12,359
Units	Stores	Stores
Mean Dep.Var.	213.5	213.5
Effect occupancy rate (%)	11.81	12.18

Notes: This table presents the correlation between *Parking lot occupancy* (our proxy for demand) and *Store Revenues*. *Store Revenues* are computed by aggregating the revenues produced by all sales associates in our sample in a given month divided by the total number of hours these sales associates worked in that month (the units are hidden for confidentiality reason). *Parking lot occupancy (simple average)* is the average occupancy rate of the store's parking lot (0 means no-occupancy, 1 means full-occupancy). *Parking lot occupancy (residualized)* is the residualized average occupancy rate of the store's parking lot. *Effect occupancy rate (%)* is the percent effect of a one unit increase in occupancy rate on Store Revenues. All regressions include store fixed effects and pair-month fixed effects. Standard errors are two-way clustered at the state level and at the border-segment level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table B.4: Productivity (Sales/Hrs) For Workers in Different Wage Groups

	Wage group		
	Low-Productive ($= MW$)	Medium-Productive ($> MW$)	High-Productive ($>> MW$)
Threshold	(1)	(2)	(3)
120%	1.080	1.484	2.315
140%	1.080	1.689	2.508
160%	1.080	1.837	2.650
180%	1.080	1.940	2.727

Notes: This table reports the average worker productivity (Sales/Hrs) by worker type (low-productive, medium-productive, high-productive) and wage group. *Sales/Hrs* are the sales per hour rescaled by a factor between 1/50 and 1/150 relative to its $ value. In Row 1: *Low-Productive* refers to workers paid at the minimum wage. *Medium-Productive* refers to workers paid between the minimum wage and 120% of the minimum wage (120% threshold); *High-Productive* refers to workers paid more than 120% of the minimum wage. Row 2-Row 4 present statistics for the 140-180% thresholds. Observations are stacked as in our main specification.

Table B.5: Distribution of Workers in Different Wage Groups

	Wage group		
	Low-Productive ($= MW$)	Medium-Productive ($> MW$)	High-Productive ($>> MW$)
Threshold	(1)	(2)	(3)
120%	3.94%	21.02%	75.03%
140%	3.94%	43.93%	52.13%
160%	3.94%	60.99%	35.07%
180%	3.94%	72.36%	23.69%

Notes: This table presents the distribution of workers by worker type (low-productive, medium-productive, high-productive) and wage group. In Row 1: *Low-Productive* refers to workers paid at the minimum wage. *Medium-Productive* refers to workers paid between the minimum wage and 120% of the minimum wage (120% threshold); *High-Productive* refers to workers paid more than 120% of the minimum wage. Row 2-Row 4 present statistics for the 140-180% thresholds. Observations are stacked as in our main specification.

Table B.6: The Effect of Minimum Wage on Individual Worker Productivity for Low-, Medium- and High-Productive Workers (Based on Lagged Productivity)

Dep.Var.	Sales/Hrs.	Sales/Hrs.	Sales/Hrs.	Sales/Hrs.
Threshold	120%	140%	160%	180%
	(1)	(2)	(3)	(4)
MinW	0.209***	0.228***	0.234***	0.244***
	(0.035)	(0.035)	(0.035)	(0.042)
$\mathbb{1}(> MW)$	0.230***	0.283***	0.326***	0.354***
	(0.028)	(0.030)	(0.032)	(0.032)
$\mathbb{1}(>> MW)$	0.625***	0.870***	1.051***	1.169***
	(0.043)	(0.055)	(0.068)	(0.072)
MinW $\cdot \mathbb{1}(> MW)$	-0.099***	-0.076***	-0.075***	-0.085***
	(0.026)	(0.026)	(0.025)	(0.025)
MinW $\cdot \mathbb{1}(>> MW)$	-0.056***	-0.079***	-0.130***	-0.182***
	(0.016)	(0.021)	(0.029)	(0.032)
Observations	209,513	209,513	209,513	209,513
Units	Workers	Workers	Workers	Workers
Mean Dep.Var.	2.085	2.085	2.085	2.085
Effect for Wrkrs at MW (%)	19.33	21.13	21.67	22.56
p-value	0.000	0.000	0.000	0.000
Effect for Wrkrs > MW (%)	7.424	9.021	8.673	8.186
p-value	0.001	0.000	0.000	0.000
Effect for Wrkrs >> MW (%)	6.622	5.963	3.944	2.273
p-value	0.000	0.000	0.009	0.179

Notes: All the regressions include pair-month fixed effects, worker fixed effects and control for worker tenure, worker department and county-level unemployment. *Sales/Hrs* are the sales per hour rescaled by a factor between 1/50 and 1/150 relative to its $ value. *MinW* is the monthly predominant minimum wage (in $). $\mathbb{1}(> MW)$ is an indicator for whether the worker's total pay in month *t-1* is between the minimum wage and 120% of minimum wage (or 140%, 160%, 180%). $\mathbb{1}(>> MW)$ is an indicator for whether the worker's total pay in month *t-1* is above 120% of minimum wage (or 140%, 160%, 180%). *Effect Wrkrs at MW* is the percent effect of a $1 increase in MinW on workers "at minimum wage." *Effect for Wrkrs > MW* is the percent effect of a $1 increase in MinW on workers compensated between the minimum wage and 120% of minimum wage (or 140%, 160%, 180%). *Effect for Wrkrs >> MW* is the percent effect of a $1 increase in MinW on workers compensated more than 120% of minimum wage (or 140%, 160%, 180%). As the threshold increases (i.e., from 120% to 180%), the category of low-productive workers (at MW) remains equivalent but the top category of high-productive workers (>>MW) becomes thinner and more outstanding (see Table B.5). Standard errors are two-way clustered at the state level and at the border-segment level. *** p<0.01, ** p<0.05, * p<0.1.

Table B.7: The Effect of Minimum Wage on Individual Worker Productivity for Low-, Medium- and High-Productive Workers (Based on First Month Productivity)

Dep.Var.	Sales/Hrs.	Sales/Hrs.	Sales/Hrs.	Sales/Hrs.	Sales/Hrs.
Definition of Productivity		Pay in first month			Prod.Q1
Threshold	120%	140%	160%	180%	
	(1)	(2)	(3)	(4)	(5)
MinW	0.163***	0.161***	0.162***	0.168***	0.178***
	(0.035)	(0.034)	(0.033)	(0.033)	(0.045)
MinW $\cdot\mathbb{1}(> MW)$	-0.061*	-0.078***	-0.086***	-0.104***	
	(0.032)	(0.022)	(0.022)	(0.023)	
MinW $\cdot\mathbb{1}(>> MW)$	-0.092**	-0.090*	-0.080	-0.028	
	(0.034)	(0.050)	(0.059)	(0.070)	
MinW $\cdot\mathbb{1}(Prod.Terc.2)$					-0.113**
					(0.044)
MinW $\cdot\mathbb{1}(Prod.Terc.3)$					-0.121***
					(0.026)
Observations	209,513	209,513	209,513	209,513	216,444
Units	Workers	Workers	Workers	Workers	Workers
Mean Dep.Var.	2.092	2.092	2.092	2.092	2.085
Effect for Wrkrs at MW (%)	9.428	9.332	9.369	9.709	
p-value	0.001	0.001	0.001	0.001	
Effect for Wrkrs > MW (%)	5.299	4.162	3.671	3.030	
p-value	0.037	0.007	0.019	0.06	
Effect for Wrkrs >> MW (%)	3.241	3.179	3.688	6.483	
p-value	0.039	0.169	0.172	0.043	
Eff.Terc.1 (%): Low-Prod.					9.153
p-value					0.001
Eff.Terc.2 (%): Med-Prod.					2.883
p-value					0.152
Eff.Terc.3 (%): High-Prod.					2.152
p-value					0.220

Notes: All the regressions include pair-month fixed effects, worker fixed effects and control for worker tenure, worker department and county-level unemployment. $\mathbb{1}(> MW)$ is an indicator for whether the worker's total pay in month *1* (first month in which worker appears in our dataset) is between the minimum wage and 120% of minimum wage (or 140%, 160%, 180%). $\mathbb{1}(>> MW)$ is an indicator for whether the worker's total pay in month *1* is above 120% of minimum wage (or 140%, 160%, 180%). $\mathbb{1}(Prod.Terc.2)$ *(*$\mathbb{1}(Prod.Terc.3)$*)* is an indicator for whether or not the worker's productivity in quarter *1* (first quarter in which she appears in the dataset) is in the second *(third)* tercile of the productivity distribution based on the estimated worker fixed effects. *Eff.Terc.1 (%), Eff.Terc.2 (%) and Eff.Terc.3 (%)* are the percent effects of $1 increase in MinW for workers in the first-second-third tercile of the productivity distribution. *Sales/Hrs* are the sales per hour rescaled by a factor between 1/50 and 1/150 relative to its $ value. *MinW* is the monthly predominant minimum wage (in $). Standard errors are two-way clustered at the state level and at the border-segment level. *** p<0.01, ** p<0.05, * p<0.1.

Table B.8: The Effect of Minimum Wage on Individual Worker Productivity by Unemployment Level

Dep.Var.	Sales/Hrs.	Sales/Hrs.	Sales/Hrs.	Sales/Hrs.	Sales/Hrs.
Threshold		120%	140%	160%	180%
	(1)	(2)	(3)	(4)	(5)
MinW	0.079*	0.178***	0.211***	0.220***	0.226***
	(0.040)	(0.057)	(0.056)	(0.048)	(0.050)
MinW $\cdot\mathbb{1}$(UR>P25 & UR≤ P50)	0.047	0.017	0.014	-0.005	-0.001
	(0.052)	(0.072)	(0.067)	(0.066)	(0.065)
MinW $\cdot\mathbb{1}$(UR>P50 & UR≤ P75)	0.083	0.251**	0.238***	0.248***	0.270***
	(0.056)	(0.093)	(0.085)	(0.085)	(0.090)
MinW $\cdot\mathbb{1}$(UR>P75)	0.092	0.125	0.117	0.158	0.178*
	(0.054)	(0.108)	(0.104)	(0.098)	(0.099)
MinW $\cdot\mathbb{1}(> MW)$		-0.097*	-0.075	-0.078*	-0.082*
		(0.052)	(0.045)	(0.044)	(0.042)
MinW $\cdot\mathbb{1}(> MW)\cdot\mathbb{1}$(UR>P25 & UR≤ P50)		0.023	0.035	0.040	0.032
		(0.064)	(0.060)	(0.057)	(0.056)
MinW $\cdot\mathbb{1}(> MW)\cdot\mathbb{1}$(UR>P50 & UR≤ P75)		-0.165	-0.175*	-0.178*	-0.187*
		(0.102)	(0.092)	(0.094)	(0.093)
MinW $\cdot\mathbb{1}(> MW)\cdot\mathbb{1}$(UR>P75)		-0.040	-0.041	-0.034	-0.049
		(0.117)	(0.107)	(0.097)	(0.098)
MinW $\cdot\mathbb{1}(>> MW)$		-0.039	-0.078*	-0.114**	-0.155***
		(0.043)	(0.044)	(0.047)	(0.042)
MinW $\cdot\mathbb{1}(>> MW)\cdot\mathbb{1}$(UR>P25 & UR≤ P50)		0.035	0.040	0.026	0.003
		(0.049)	(0.043)	(0.046)	(0.037)
MinW $\cdot\mathbb{1}(>> MW)\cdot\mathbb{1}$(UR>P50 & UR≤ P75)		-0.190**	-0.147*	-0.205***	-0.255***
		(0.085)	(0.081)	(0.067)	(0.067)
MinW $\cdot\mathbb{1}(>> MW)\cdot\mathbb{1}$(UR >P75)		-0.047	-0.021	-0.128	-0.185
		(0.106)	(0.104)	(0.115)	(0.113)
Observations	217,822	209,513	209,513	209,513	209,513
Units	Workers	Workers	Workers	Workers	Workers
Mean Dep.Var.	2.085	2.085	2.085	2.085	2.085

Notes: All the regressions include pair-month fixed effects, worker fixed effects and control for worker tenure, worker department and county-level unemployment. All regressions also control for 3 dummies: $\mathbb{1}$(UR >P25 & UR≤ P50), $\mathbb{1}$(UR >P50 & UR≤ P75) and $\mathbb{1}$(UR >P75), which we do not report due to space constraints (available upon request). The regressions in Col.2-5 also control for the interaction between each of these 3 dummies with $\mathbb{1}(> MW)$ and $\mathbb{1}(>> MW)$ (6 more x-variables), which are also not reported due to space constraints (available upon request). $\mathbb{1}(UR...)$ are dummies for whether or not stores are located in countries that have unemployment between 25^{th} and 50^{th}, between 50^{th} and 75^{th}, and above 75^{th} percentiles of the *within-county* unemployment rate distribution. *Sales/Hrs* are the sales per hour rescaled by a factor between 1/50 and 1/150 relative to its $ value. *MinW* is the predominant monthly minimum wage (in $). $\mathbb{1}(> MW)$ is an indicator for whether the worker's total pay in month *t-1* is between the minimum wage and 120% of minimum wage (or 140%, 160%, 180%). $\mathbb{1}(>> MW)$ is an indicator for whether the worker's total pay in month *t-1* is above 120% of minimum wage (or 140%, 160%, 180%). Standard errors are two-way clustered at the state level and at the border-segment level. *** p<0.01, ** p<0.05, * p<0.1.

Table B.9: The Effect of Minimum Wage on Hours Worked, Part-Time Status, and Assignment to a Top-Department

Dep.Var.	Tot.Hrs.	Tot.Hrs.	Tot.Hrs.	Tot.Hrs.	Tot.Hrs.	Part-time	Part-time	Part-time	Part-time	Part-time	Top-Dept.	Top-Dept.	Top-Dept.	Top-Dept.	Top-Dept.
Threshold		120%	140%	160%	180%		120%	140%	160%	180%		120%	140%	160%	180%
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
MinW	1.942	2.696	2.617	2.676	2.720	-2.395	-2.046	-2.113	-2.328	-2.291	-0.454	0.199	0.160	0.122	0.044
	(1.265)	(1.629)	(1.606)	(1.600)	(1.637)	(1.434)	(1.674)	(1.623)	(1.635)	(1.665)	(0.655)	(0.632)	(0.607)	(0.611)	(0.623)
$\mathbb{1}(> MW)$		4.107***	4.509***	4.692***	4.762***		-1.496	-1.991	-2.129	-2.220		-0.090	-0.007	-0.056	-0.092
		(0.997)	(1.114)	(1.158)	(1.181)		(1.267)	(1.366)	(1.381)	(1.392)		(0.335)	(0.287)	(0.287)	(0.283)
$\mathbb{1}(>> MW)$		5.616***	5.915***	5.702***	5.439***		-3.107*	-3.131*	-2.965*	-2.381		-0.318	-0.806***	-1.063***	-1.218***
		(1.446)	(1.566)	(1.604)	(1.549)		(1.628)	(1.659)	(1.745)	(1.768)		(0.253)	(0.265)	(0.248)	(0.265)
MinW $\cdot\mathbb{1}(> MW)$		-0.711	-0.833	-0.840	-0.856		-0.038	-0.022	-0.118	-0.028		0.128	-0.065	-0.127	-0.160
		(0.787)	(0.838)	(0.853)	(0.851)		(0.855)	(0.875)	(0.845)	(0.826)		(0.149)	(0.188)	(0.207)	(0.218)
MinW $\cdot\mathbb{1}(>> MW)$		-0.482	-0.148	-0.221	-0.240		-0.613	-0.613	0.178	0.036		-0.672**	-0.898**	-1.002**	-0.878*
		(0.896)	(0.912)	(0.971)	(1.236)		(0.810)	(0.664)	(0.652)	(0.917)		(0.329)	(0.359)	(0.445)	(0.466)
Observations	217,822	209,513	209,513	209,513	209,513	217,822	209,513	209,513	209,513	209,513	217,822	209,514	209,514	209,514	209,514
Units	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers
Mean Dep.Var.	106.5	106.5	106.5	106.5	106.5	60.25	60.25	60.25	60.25	60.25	44.29	44.29	44.29	44.29	44.29
Effect MinW (%)	1.824					-3.975					-1.024				
Effect at MW (%)		3.025	2.937	3.003	3.052		-2.760	-2.850	-3.141	-3.090		0.576	0.464	0.353	0.128
p-value		0.108	0.113	0.104	0.106		0.230	0.202	0.164	0.178		0.755	0.794	0.843	0.944
Effect > MW (%)		1.961	1.719	1.743	1.754		-3.113	-3.330	-3.928	-3.790		0.675	0.182	-0.009	-0.225
p-value		0.132	0.180	0.160	0.161		0.165	0.135	0.084	0.100		0.596	0.869	0.994	0.849
Effect >> MW (%)		2.012	2.209	2.174	2.179		-4.672	-4.964	-4.012	-4.268		-1.086	-1.939	-2.871	-3.535
p-value		0.121	0.091	0.111	0.121		0.071	0.068	0.156	0.150		0.462	0.268	0.227	0.265

Notes: All the regressions include pair-month fixed effects, worker fixed effects and control for worker tenure, worker department (except in Cols.11-15) and county-level unemployment. *Tot.Hrs* is the total number of hours worked in a month. *Part-time* is the percent probability that an employee is a part-time employee in a given month (takes value 0 in a given month if a worker is full-time and takes value 100 if the worker is part-time). *Top-Dept.* is an indicator for being in the top (best-selling) departments (takes value 0 in a given month if a worker is not in top-departments and takes value 100 if the worker is in top-departments). *MinW* is the monthly predominant minimum wage (in $). $\mathbb{1}(> MW)$ is an indicator for whether the worker's total pay in month *t-1* is between the minimum wage and 120% of minimum wage (or 140%, 160%, 180%). $\mathbb{1}(>> MW)$ is an indicator for whether the worker's total pay in month *t-1* is above 120% of minimum wage (or 140%, 160%, 180%). *Effect MinW (%)* is the percent effect of $1 increase in MinW on the outcomes. *Effect at MW* is the percent effect of a $1 increase in MinW on workers "at minimum wage." *Effect > MW* is the percent effect of a $1 increase in MinW on workers compensated between the minimum wage and 120% of minimum wage (or 140%, 160%, 180%). *Effect >> MW* is the percent effect of a $1 increase in MinW on workers compensated more than 120% of minimum wage (or 140%, 160%, 180%). Standard errors are two-way clustered at the state level and at the border-segment level. *** p<0.01, ** p<0.05, * p<0.1.

Table B.10: The Effect of Minimum Wage on Individual Worker Productivity in the Balanced Sample of Workers

Dep.Var.	Sales/Hrs.	Sales/Hrs.	Sales/Hrs.	Sales/Hrs.	Sales/Hrs.
Sample	Balanced	Balanced	Balanced	Balanced	Balanced
Threshold		120%	140%	160%	180%
	(1)	(2)	(3)	(4)	(5)
MinW	0.137*	0.321**	0.280**	0.286**	0.264*
	(0.0675)	(0.128)	(0.125)	(0.118)	(0.135)
$\mathbb{1}(> MW)$		0.218**	0.345***	0.399***	0.413***
		(0.081)	(0.081)	(0.084)	(0.086)
$\mathbb{1}(>> MW)$		0.758***	1.055***	1.246***	1.317***
		(0.080)	(0.075)	(0.097)	(0.114)
MinW * $\mathbb{1}(> MW)$		-0.069	-0.071	-0.062	-0.060
		(0.084)	(0.084)	(0.086)	(0.083)
MinW * $\mathbb{1}(>> MW)$		-0.109	-0.092	-0.137*	-0.168**
		(0.075)	(0.078)	(0.071)	(0.080)
Observations	32,224	31,439	31,439	31,439	31,439
Units	Workers	Workers	Workers	Workers	Workers
Mean Dep.Var.	2.093	2.100	2.100	2.100	2.100
Effect MinW (%)	6.524				
Effect for Wrkrs at MW (%)		39.62	34.53	35.26	32.55
p-value		0.019	0.034	0.023	0.063
Effect for Wrkrs > MW (%)		19.23	12.98	12.36	10.55
p-value		0.009	0.005	0.001	0.002
Effect for Wrkrs >> MW (%)		9.159	7.565	5.806	3.745
p-value		0.024	0.032	0.070	0.305

Notes: The sample is restricted to workers who we observe for all the months in the data (i.e., balanced sample). All the regressions include pair-month fixed effects, worker fixed effects and control for worker tenure, worker department and county-level unemployment. *Sales/Hrs* are the sales per hour rescaled by a factor between 1/50 and 1/150 relative to its $ value. *MinW* is the monthly predominant minimum wage (in $). $\mathbb{1}(> MW)$ is an indicator for whether the worker's total pay in month *t-1* is between the minimum wage and 120% of minimum wage (or 140%, 160%, 180%). $\mathbb{1}(>> MW)$ is an indicator for whether the worker's total pay in month *t-1* is above 120% of minimum wage (or 140%, 160%, 180%). *Effect Wrkrs at MW* is the percent effect of a $1 increase in MinW on workers "at minimum wage." *Effect for Wrkrs > MW* is the percent effect of a $1 increase in MinW on workers compensated between the minimum wage and 120% of minimum wage (or 140%, 160%, 180%). *Effect for Wrkrs >> MW* is the percent effect of a $1 increase in MinW on workers compensated more than 120% of minimum wage (or 140%, 160%, 180%). Standard errors are two-way clustered at the state level and at the border-segment level. *** p<0.01, ** p<0.05, * p<0.1.

Table B.11: The Effect of Minimum Wage on Termination

Dep.Var.	Termin.	Termin.	Termin.	Termin.	Termin.
Threshold		120%	140%	160%	180%
	(1)	(2)	(3)	(4)	(5)
MinW	-0.383	-0.535	-0.622	-0.660	-0.694
	(0.549)	(0.659)	(0.640)	(0.650)	(0.637)
$\mathbb{1}(> MW)$		-0.045	0.203	0.227	0.240
		(0.675)	(0.648)	(0.674)	(0.679)
$\mathbb{1}(>> MW)$		0.560	0.430	0.495	0.533
		(0.714)	(0.812)	(0.752)	(0.735)
MinW * $\mathbb{1}(> MW)$		0.777*	0.531	0.479	0.446
		(0.452)	(0.435)	(0.450)	(0.462)
MinW * $\mathbb{1}(>> MW)$		-0.001	-0.058	-0.122	-0.119
		(0.515)	(0.532)	(0.605)	(0.576)
Observations	217,822	209,513	209,513	209,513	209,513
Units	Workers	Workers	Workers	Workers	Workers
Mean Dep.Var.	4.562	4.562	4.562	4.562	4.562
Effect MinW (%)	-8.404				
Effect for Wrkrs at MW (%)		-7.899	-9.192	-9.740	-10.24
p-value		0.423	0.338	0.318	0.284
Effect for Wrkrs > MW (%)		4.093	-1.609	-3.339	-4.776
p-value		0.712	0.872	0.756	0.668
Effect for Wrkrs >> MW (%)		-12.52	-18.16	-23.67	-27.29
p-value		0.308	0.223	0.188	0.187

Notes: All the regressions include pair-month fixed effects, worker fixed effects and control for worker tenure, worker department and county-level unemployment. *Termin.* is the probability that a worker has been terminated in a given month. *MinW* is the monthly predominant minimum wage (in $). $\mathbb{1}(> MW)$ is an indicator for whether the worker's total pay in month *t-1* is between the minimum wage and 120% of minimum wage (or 140%, 160%, 180%). $\mathbb{1}(>> MW)$ is an indicator for whether the worker's total pay in month *t-1* is above 120% of minimum wage (or 140%, 160%, 180%). *Effect Wrkrs at MW* is the percent effect of a $1 increase in MinW on workers "at minimum wage." *Effect for Wrkrs > MW* is the percent effect of a $1 increase in MinW on workers compensated between the minimum wage and 120% of minimum wage (or 140%, 160%, 180%). *Effect for Wrkrs >> MW* is the percent effect of a $1 increase in MinW on workers compensated more than 120% of minimum wage (or 140%, 160%, 180%). Standard errors are two-way clustered at the state level and at the border-segment level. *** p<0.01, ** p<0.05, * p<0.1.

Table B.12: The Effect of Minimum Wage on Work-Home Distance

Dep.Var.	Dist.	Dist.	Dist.	Dist.	Dist.	Dist.
Sample of workers	New hires	All	All	All	All	All
Threshold			120%	140%	160%	180%
	(1)	(2)	(3)	(4)	(5)	(6)
MinW	-0.309	0.409	0.074	0.053	0.054	0.052
	(0.909)	(0.573)	(0.664)	(0.657)	(0.654)	(0.653)
$\mathbb{1}(> MW)$			-0.170	-0.111	-0.047	-0.012
			(0.358)	(0.405)	(0.409)	(0.416)
$\mathbb{1}(>> MW)$			0.186	0.347	0.412	0.482
			(0.471)	(0.489)	(0.515)	(0.510)
MinW * $\mathbb{1}(> MW)$			0.498	0.454	0.456	0.442
			(0.377)	(0.420)	(0.444)	(0.441)
MinW * $\mathbb{1}(>> MW)$			0.342	0.354	0.239	0.138
			(0.460)	(0.456)	(0.416)	(0.432)
Observations	10,783	212,509	204,761	204,761	204,761	204,761
Units	Stores	Workers	Workers	Workers	Workers	Workers
Mean Dep.Var.	9.666	4.641	4.562	4.562	4.562	4.562
Effect MinW (%)	-3.201	8.820				
Effect for Wrkrs at MW (%)			1.095	0.787	0.798	0.769
p-value			0.912	0.936	0.935	0.937
Effect for Wrkrs > MW (%)			9.667	8.914	9.441	9.531
p-value			0.370	0.395	0.383	0.392
Effect for Wrkrs >> MW (%)			9.726	10.87	8.869	6.386
p-value			0.460	0.486	0.623	0.764

Notes: In Col.1: the dependent variable is the average distance between the workplace and the home zip code for all the new hired workers in the month in which they are hired. The regression includes pair-month fixed effects, store fixed effects and controls for county-level unemployment. In Cols.2-6: the dependent variable is the distance of the worker's home and the store in which she works in a given month. The regressions include pair-month fixed effects, store fixed effects and control for worker tenure, worker department and county-level unemployment. *MinW* is the monthly predominant minimum wage (in $). $\mathbb{1}(>> MW)$ is an indicator for whether the worker's total pay in month *t-1* is above 120% of minimum wage (or 140%, 160%, 180%). *Effect Wrkrs at MW* is the percent effect of a $1 increase in MinW on workers "at minimum wage." *Effect for Wrkrs > MW* is the percent effect of a $1 increase in MinW on workers compensated between the minimum wage and 120% of minimum wage (or 140%, 160%, 180%). *Effect for Wrkrs >> MW* is the percent effect of a $1 increase in MinW on workers compensated more than 120% of minimum wage (or 140%, 160%, 180%). Standard errors are two-way clustered at the state level and at the border-segment level. *** p<0.01, ** p<0.05, * p<0.1.

Table B.13: Robustness Checks of the Productivity Results

Dep.Var.	Sales/ Hrs.	Sales/ Hrs.	Sales/ Hrs.	Sales/ Hrs.	Sales/ Hrs.	Sales/ Hrs.	Sales/ Hrs.	Sales/ Hrs.	Sales/ Hrs.	Sales/ Hrs.	Sales/ Hrs.	Sales/ Hrs.	Sales/ Hrs.	Sales/ Hrs.
Sample	Border + Stack		Border + Stack		Border + Stack		Border (No Stack)		Border (No Stack)		All		All	
Distance	Store-border: 75km		Store-border: 37.5km		Store-border: 18.75km		County centroids: 75km				All		All	
Time effect	Pair*Month		Pair*Month		Pair*Month		State-trend		State*Month		State-trend		State*Month	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
MinW	0.094**	0.244***	0.098**	0.255***	0.088**	0.261***	0.080***	0.181***	0.090***	0.166***	0.033	0.161***	0.076***	0.169***
	(0.039)	(0.042)	(0.037)	(0.042)	(0.042)	(0.049)	(0.028)	(0.034)	(0.021)	(0.027)	(0.041)	(0.029)	(0.020)	(0.022)
$\mathbb{1}(> MW)$		0.354***		0.359***		0.370***		0.298***		0.298***		0.296***		0.295***
		(0.032)		(0.033)		(0.041)		(0.030)		(0.031)		(0.033)		(0.032)
$\mathbb{1}(>> MW)$		1.169***		1.171***		1.173***		1.180***		1.145***		1.160***		1.127***
		(0.072)		(0.073)		(0.082)		(0.058)		(0.061)		(0.054)		(0.055)
MinW $\cdot\mathbb{1}(> MW)$		-0.085***		-0.091***		-0.108***		-0.038		-0.042*		-0.060***		-0.060***
		(0.025)		(0.027)		(0.039)		(0.024)		(0.024)		(0.020)		(0.021)
MinW $\cdot\mathbb{1}(>> MW)$		-0.182***		-0.192***		-0.199***		-0.170***		-0.148***		-0.164***		-0.139***
		(0.032)		(0.034)		(0.042)		(0.031)		(0.030)		(0.029)		(0.029)
Observations	217,822	209,513	208,451	200,506	159,352	153,329	164,465	157,706	164,462	157,703	416,439	399,100	416,439	399,100
Units	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers
Mean Dep.Var.	2.085	2.085	2.089	2.089	2.077	2.077	2.138	2.144	2.138	2.144	2.196	2.204	2.196	2.204
Effect MinW %	4.485		4.701		4.234		3.737		4.217		1.486		3.450	
Effect at MW (%)		22.56		23.69		23.68		16.37		15		15.26		16.04
p-value		0.001		0.001		0.001		0.001		0.001		0.001		0.001
Effect > MW (%)		8.186		8.476		7.981		7.185		6.263		4.979		5.355
p-value		0.001		0.001		0.001		0.001		0.001		0.001		0.001
Effect >> MW (%)		2.273		2.339		2.269		0.398		0.616		-0.098		1.030
p-value		0.179		0.158		0.171		0.722		0.534		0.934		0.227

Notes: **Sample**: Cols.1-2 (3-4) [5-6] restrict the sample to stores within 75 km (37.5 km) [18.75 km] from the border, stacking the observations. Cols.7-10 restrict the sample to stores located in counties whose centroids are less than 75 km apart, without stacking the observations. Cols.11-14 include all the stores (bordering + non-bordering). **Specification**: In Cols.1-6 (7-8 and 11-12) [9-10 and 13-14], we include pair-month fixed effects (state-specific linear trends) [state-month fixed effects]. All the regressions include worker fixed effects and control for worker tenure, worker department and county-level unemployment. Standard errors are two-way clustered at the state level and border-segment level in Cols.1-6 and at the state level in Cols.7-14. *Sales/Hrs* are the sales per hour rescaled by a factor between 1/50 and 1/150 relative to its $ value. *MinW* is the monthly predominant minimum wage (in $). *Effect MinW (%)* is the percent effect of $1 increase in MinW on the outcomes. *Effect at MW* is the percent effect of a $1 increase in MinW on workers "at minimum wage." *Effect > MW* is the percent effect of a $1 increase in MinW on workers compensated between the minimum wage and 180% of minimum wage. *Effect >> MW* is the percent effect of a $1 increase in MinW on workers compensated more than 180% of minimum wage. *** p<0.01, ** p<0.05, * p<0.1.

Table B.14: The Effect of Minimum Wage on Individual Worker Productivity, Controlling for Department-Store Time Trends

Dep.Var.	Sales/Hrs.	Sales/Hrs.	Sales/Hrs.	Sales/Hrs.	Sales/Hrs.
Threshold		120%	140%	160%	180%
	(1)	(2)	(3)	(4)	(5)
MinW	0.121*	0.208***	0.233***	0.249***	0.271***
	(0.063)	(0.056)	(0.054)	(0.054)	(0.064)
$\mathbb{1}(> MW)$		0.233***	0.283***	0.322***	0.349***
		(0.028)	(0.031)	(0.032)	(0.033)
$\mathbb{1}(>> MW)$		0.621***	0.863***	1.041***	1.159***
		(0.047)	(0.059)	(0.071)	(0.071)
MinW * $\mathbb{1}(> MW)$		-0.101***	-0.077**	-0.075**	-0.085**
		(0.031)	(0.034)	(0.032)	(0.032)
MinW * $\mathbb{1}(>> MW)$		-0.036	-0.062**	-0.123***	-0.187***
		(0.023)	(0.023)	(0.031)	(0.033)
Observations	217,822	209,513	209,513	209,513	209,513
Units	Workers	Workers	Workers	Workers	Workers
Mean Dep.Var.	2.085	2.085	2.085	2.085	2.085
Effect MinW (%)	5.788				
Effect for Wrkrs at MW (%)		19.26	21.59	23.08	25.06
p-value		0.001	0.001	0.001	0.001
Effect for Wrkrs > MW (%)		7.190	9.261	9.470	9.566
p-value		0.052	0.007	0.002	0.003
Effect for Wrkrs >> MW (%)		7.420	6.831	4.756	3.074
p-value		0.003	0.005	0.051	0.236

Notes: All the regressions include *department-store* specific time-trends (unique department ID*time-trend), pair-month fixed effects, worker fixed effects, and control for worker tenure, worker department and county-level unemployment. *Sales/Hrs* are the sales per hour rescaled by a factor between 1/50 and 1/150 relative to its $ value. *MinW* is the monthly predominant minimum wage (in $). $\mathbb{1}(> MW)$ is an indicator for whether the worker's total pay in month *t-1* is between the minimum wage and 120% of minimum wage (or 140%, 160%, 180%). $\mathbb{1}(>> MW)$ is an indicator for whether the worker's total pay in month *t-1* is above 120% of minimum wage (or 140%, 160%, 180%). *Effect Wrkrs at MW* is the percent effect of a $1 increase in MinW on workers "at minimum wage." *Effect for Wrkrs > MW* is the percent effect of a $1 increase in MinW on workers compensated between the minimum wage and 120% of minimum wage (or 140%, 160%, 180%). *Effect for Wrkrs >> MW* is the percent effect of a $1 increase in MinW on workers compensated more than 120% of minimum wage (or 140%, 160%, 180%). Standard errors are two-way clustered at the state level and at the border-segment level. *** p<0.01, ** p<0.05, * p<0.1.

Table B.15: Robustness Checks of the Termination Results

Dep.Var.	Term.	Term.	Term.	Term.	Term.	Term.	Term.	Term.	Term.	Term.	Term.	Term.	Term.	Term.
Sample	Border + Stack		Border + Stack		Border + Stack		Border (No Stack)		Border (No Stack)		All		All	
Distance	Store-border: 75 km		Store-border: 37.5 km		Store-border: 18.75 km		County centroids: 75 km				All		All	
Time effect	Pair*Month		Pair*Month		Pair*Month		State-trend		State*Month		State-trend		State*Month	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
MinW	-0.383	-0.694	-0.412	-0.776	-0.455	-0.173	-0.170	-0.417	-0.332	-0.535	0.507	0.012	-0.399*	-0.846***
	(0.549)	(0.637)	(0.575)	(0.655)	(0.526)	(0.734)	(0.243)	(0.493)	(0.277)	(0.342)	(0.368)	(0.392)	(0.215)	(0.294)
$\mathbb{1}(> MW)$		0.240		0.206		0.874		0.015		0.188		-0.003		-0.011
		(0.679)		(0.702)		(0.908)		(0.368)		(0.435)		(0.278)		(0.281)
$\mathbb{1}(>> MW)$		0.533		0.525		1.232		0.644		0.710		0.403		0.397
		(0.735)		(0.749)		(1.041)		(0.417)		(0.470)		(0.303)		(0.313)
MinW $\cdot\mathbb{1}(> MW)$		0.446		0.512		-0.134		0.507		0.368		0.739***		0.643**
		(0.462)		(0.469)		(0.634)		(0.350)		(0.281)		(0.239)		(0.273)
MinW $\cdot\mathbb{1}(>> MW)$		-0.119		-0.084		-0.700		-0.116		-0.353		0.013		-0.195
		(0.576)		(0.631)		(0.572)		(0.459)		(0.442)		(0.354)		(0.417)
Observations	217,822	209,513	208,451	200,506	159,352	153,329	199,133	187,194	164,462	157,703	416,439	399,100	416,439	399,100
Units	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers	Workers
Mean Dep.Var.	4.562	4.562	4.587	4.587	4.521	4.521	4.964	5.206	4.565	4.565	4.685	4.685	4.685	4.685
Effect MinW %	-8.404		-8.974		-10.06		-3.434		-7.278		10.82		-8.512	
Effect at MW (%)		-10.24		-11.37		-2.594		-5.375		-8.576		0.179		-12.92
p-value		0.284		0.245		0.815		0.403		0.126		0.976		0.006
Effect > MW (%)		-4.776		-5.058		-5.930		1.549		-3.310		14.46		-3.897
p-value		0.668		0.664		0.605		0.688		0.579		0.043		0.413
Effect >> MW (%)		-27.29		-28.79		-29.61		-15.67		-26.64		0.708		-29.64
p-value		0.187		0.189		0.116		0.042		0.051		0.958		0.011

Notes: **Sample**: Cols.1-2 (3-4) [5-6] restrict the sample to stores within 75 km (37.5 km) [18.75 km] from the border, stacking the observations. Cols.7-10 restrict the sample to stores located in counties whose centroids are less than 75 km apart, without stacking the observations. Cols.11-14 include all the stores (bordering + non-bordering). **Specification**: In Cols.1-6 (7-8 and 11-12) [9-10 and 13-14], we include pair-month fixed effects (state-specific linear trends) [state-month fixed effects]. All the regressions include worker fixed effects and control for worker tenure, worker department and county-level unemployment. Standard errors are two-way clustered at the state level and border-segment level in Cols.1-6 and at the state level in Cols.7-14. *Term.* is a dummy for whether a worker is terminated in a given month. *MinW* is the monthly predominant minimum wage (in $). *Effect MinW (%)* is the percent effect of $1 increase in MinW on the outcomes. *Effect at MW* is the percent effect of a $1 increase in MinW on workers "at minimum wage." *Effect > MW* is the percent effect of a $1 increase in MinW on workers compensated between the minimum wage and 180% of minimum wage. *Effect >> MW* is the percent effect of a $1 increase in MinW on workers compensated more than 180% of minimum wage. *** p<0.01, ** p<0.05, * p<0.1.

Table B.16: The Effect of Minimum Wage on Termination, Controlling for Department-Store Time Trends

Dep.Var.	Term.	Term.	Term.	Term.	Term.
Threshold		120%	140%	160%	180%
	(1)	(2)	(3)	(4)	(5)
MinW	-0.085	-0.334	-0.398	-0.433	-0.460
	(0.715)	(0.784)	(0.771)	(0.772)	(0.778)
$\mathbb{1}(> MW)$		0.052	0.285	0.312	0.325
		(0.669)	(0.642)	(0.668)	(0.673)
$\mathbb{1}(>> MW)$		0.648	0.527	0.560	0.584
		(0.697)	(0.782)	(0.708)	(0.655)
MinW * $\mathbb{1}(> MW)$		0.724	0.536	0.500	0.482
		(0.452)	(0.423)	(0.438)	(0.443)
MinW * $\mathbb{1}(>> MW)$		0.263	0.285	0.338	0.453
		(0.435)	(0.437)	(0.471)	(0.440)
Observations	217,822	209,513	209,513	209,513	209,513
Units	Workers	Workers	Workers	Workers	Workers
Mean Dep.Var.	4.562	4.822	4.822	4.822	4.822
Effect MinW (%)	-1.861				
Effect for Wrkrs at MW (%)		-4.940	-5.878	-6.401	-6.798
p-value		0.672	0.609	0.579	0.558
Effect for Wrkrs > MW (%)		6.580	2.429	1.240	0.416
p-value		0.606	0.843	0.924	0.976
Effect for Wrkrs >> MW (%)		-1.673	-3.028	-2.884	-0.249
p-value		0.921	0.878	0.902	0.992

Notes: All the regressions include *department-store* specific time-trends (unique department ID*time-trend), pair-month fixed effects, worker fixed effects, and control for worker tenure, worker department and county-level unemployment. *Term.* is a dummy for whether a worker is terminated in a given month. *MinW* is the monthly predominant minimum wage (in $). $\mathbb{1}(> MW)$ is an indicator for whether the worker's total pay in month *t-1* is between the minimum wage and 120% of minimum wage (or 140%, 160%, 180%). $\mathbb{1}(>> MW)$ is an indicator for whether the worker's total pay in month *t-1* is above 120% of minimum wage (or 140%, 160%, 180%). *Effect Wrkrs at MW* is the percent effect of a $1 increase in MinW on workers "at minimum wage." *Effect for Wrkrs > MW* is the percent effect of a $1 increase in MinW on workers compensated between the minimum wage and 120% of minimum wage (or 140%, 160%, 180%). *Effect for Wrkrs >> MW* is the percent effect of a $1 increase in MinW on workers compensated more than 120% of minimum wage (or 140%, 160%, 180%). Standard errors are two-way clustered at the state level and at the border-segment level. *** p<0.01, ** p<0.05, * p<0.1.

Table B.17: The Effect of Minimum Wage on Worker Total Pay per Hour

Dep.Var.	Tot.Pay/Hrs.	Tot.Pay/Hrs.	Tot.Pay/Hrs.	Tot.Pay/Hrs.	Tot.Pay/Hrs.
Threshold		120%	140%	160%	180%
	(1)	(2)	(3)	(4)	(5)
MinW	0.645***	0.793***	0.774***	0.788***	0.807***
	(0.172)	(0.233)	(0.215)	(0.217)	(0.225)
$\mathbb{1}(> MW)$		0.332***	0.411***	0.448***	0.469***
		(0.072)	(0.083)	(0.084)	(0.087)
$\mathbb{1}(>> MW)$		0.711***	0.865***	0.965***	1.037***
		(0.105)	(0.103)	(0.111)	(0.115)
MinW $\cdot\mathbb{1}(> MW)$		-0.078	-0.103	-0.096	-0.097
		(0.087)	(0.103)	(0.101)	(0.105)
MinW $\cdot\mathbb{1}(>> MW)$		-0.078	-0.010	-0.061	-0.141*
		(0.118)	(0.092)	(0.094)	(0.083)
Observations	217,822	209,513	209,513	209,513	209,513
Units	Workers	Workers	Workers	Workers	Workers
Mean Dep.Var.	12.51	12.51	12.51	12.51	12.51
Effect MinW (%)	5.154				
Effect for Wrkrs at MW (%)		8.005	7.813	7.963	8.146
p-value		0.002	0.001	0.001	0.002
Effect for Wrkrs > MW (%)		7.046	6.338	6.311	6.281
p-value		0.001	0.001	0.001	0.001
Effect for Wrkrs >> MW (%)		5.364	5.314	4.690	3.978
p-value		0.001	0.001	0.001	0.002

Notes: All the regressions include pair-month fixed effects, worker fixed effects, and control for worker tenure, worker department and county-level unemployment. *Tot.Pay/Hrs* is a worker's average hourly total pay over the month (in \$). *MinW* is the monthly predominant minimum wage (in \$). $\mathbb{1}(> MW)$ is an indicator for whether the worker's total pay in month *t-1* is between the minimum wage and 120% of minimum wage (or 140%, 160%, 180%). $\mathbb{1}(>> MW)$ is an indicator for whether the worker's total pay in month *t-1* is above 120% of minimum wage (or 140%, 160%, 180%). *Effect Wrkrs at MW* is the percent effect of a \$1 increase in MinW on workers "at minimum wage." *Effect for Wrkrs > MW* is the percent effect of a \$1 increase in MinW on workers compensated between the minimum wage and 120% of minimum wage (or 140%, 160%, 180%). *Effect for Wrkrs >> MW* is the percent effect of a \$1 increase in MinW on workers compensated more than 120% of minimum wage (or 140%, 160%, 180%). Standard errors are two-way clustered at the state level and at the border-segment level. *** p<0.01, ** p<0.05, * p<0.1.

Table B.18: The Dynamic Effect of Minimum Wage on Individual Worker Productivity

Dep.Var.	Sales/Hrs.	Sales/Hrs.	Sales/Hrs.	Sales/Hrs.
Threshold	120%	140%	160%	180%
	(1)	(2)	(3)	(4)
$\Delta MinW_{t+3}$	-0.010	-0.004	-0.025	-0.021
	(0.058)	(0.055)	(0.043)	(0.056)
$\Delta MinW_{t+2}$	-0.003	-0.003	-0.006	-0.001
	(0.120)	(0.129)	(0.124)	(0.114)
$\Delta MinW_{t+1}$	-0.270	-0.265	-0.261*	-0.229
	(0.192)	(0.164)	(0.145)	(0.139)
$\Delta MinW_{t}$	-0.091	-0.119	-0.131	-0.152
	(0.219)	(0.223)	(0.210)	(0.218)
$\Delta MinW_{t-1}$	0.159	0.170*	0.155*	0.148
	(0.102)	(0.100)	(0.084)	(0.093)
$\Delta MinW_{t-2}$	-0.033	0.008	-0.011	-0.026
	(0.079)	(0.084)	(0.079)	(0.080)
$\Delta MinW_{t-3}$	0.194*	0.166*	0.175*	0.164*
	(0.100)	(0.089)	(0.092)	(0.096)
$\Delta MinW_{t-4}$	0.226**	0.191*	0.211**	0.226**
	(0.093)	(0.098)	(0.088)	(0.084)
$\Delta MinW_{t-5}$	0.122	0.128	0.160	0.152
	(0.129)	(0.154)	(0.155)	(0.144)
$MinW_{t-6}$	0.159*	0.145*	0.145*	0.166*
	(0.090)	(0.085)	(0.080)	(0.091)
$\Delta MinW_{t+3} \cdot \mathbb{1}(> MW)$	0.262*	0.145	0.129	0.072
	(0.136)	(0.097)	(0.098)	(0.104)
$\Delta MinW_{t+2} \cdot \mathbb{1}(> MW)$	0.122*	-0.019	-0.032	-0.048
	(0.070)	(0.068)	(0.068)	(0.064)
$\Delta MinW_{t+1} \cdot \mathbb{1}(> MW)$	0.097	0.197*	0.223**	0.233**
	(0.098)	(0.102)	(0.108)	(0.103)
$\Delta MinW_{t} \cdot \mathbb{1}(> MW)$	0.117	0.159	0.196	0.216
	(0.089)	(0.124)	(0.141)	(0.159)
$\Delta MinW_{t-1} \cdot \mathbb{1}(> MW)$	0.132***	0.084	0.069	0.067**
	(0.046)	(0.052)	(0.046)	(0.031)
$\Delta MinW_{t-2} \cdot \mathbb{1}(> MW)$	0.144***	0.096**	0.072*	0.080**
	(0.030)	(0.036)	(0.037)	(0.036)
$\Delta MinW_{t-3} \cdot \mathbb{1}(> MW)$	0.002	0.032	0.027	0.015
	(0.057)	(0.064)	(0.074)	(0.074)
$\Delta MinW_{t-4} \cdot \mathbb{1}(> MW)$	0.004	0.026	0.016	-0.009
	(0.019)	(0.028)	(0.040)	(0.042)
$\Delta MinW_{t-5} \cdot \mathbb{1}(> MW)$	-0.154**	-0.115	-0.090	-0.044
	(0.069)	(0.105)	(0.107)	(0.091)
$MinW_{t-6} \cdot \mathbb{1}(> MW)$	0.005	-0.005	-0.016	-0.033*
	(0.022)	(0.021)	(0.020)	(0.019)
$\Delta MinW_{t+3} \cdot \mathbb{1}(>> MW)$	-0.086	-0.136**	-0.173***	-0.149**
	(0.061)	(0.055)	(0.052)	(0.055)
$\Delta MinW_{t+2} \cdot \mathbb{1}(>> MW)$	-0.161**	-0.181**	-0.257***	-0.262**
	(0.074)	(0.088)	(0.092)	(0.107)
$\Delta MinW_{t+1} \cdot \mathbb{1}(>> MW)$	0.320**	0.338***	0.358***	0.374***
	(0.146)	(0.115)	(0.104)	(0.112)
$\Delta MinW_{t} \cdot \mathbb{1}(>> MW)$	0.117	0.081	0.055	0.034
	(0.184)	(0.209)	(0.215)	(0.207)
$\Delta MinW_{t-1} \cdot \mathbb{1}(>> MW)$	-0.050	-0.076	-0.088	-0.066
	(0.054)	(0.049)	(0.056)	(0.055)
$\Delta MinW_{t-2} \cdot \mathbb{1}(>> MW)$	0.121*	0.210**	0.213**	0.197*
	(0.065)	(0.084)	(0.103)	(0.113)
$\Delta MinW_{t-3} \cdot \mathbb{1}(>> MW)$	-0.047	-0.027	-0.071	-0.104
	(0.057)	(0.059)	(0.081)	(0.096)
$\Delta MinW_{t-4} \cdot \mathbb{1}(>> MW)$	-0.031	-0.044	0.013	0.023
	(0.053)	(0.070)	(0.098)	(0.105)
$\Delta MinW_{t-5} \cdot \mathbb{1}(>> MW)$	0.051	0.079	0.073	0.060
	(0.074)	(0.088)	(0.098)	(0.089)
$MinW_{t-6} \cdot \mathbb{1}(>> MW)$	-0.047	-0.087**	-0.158***	-0.209***
	(0.031)	(0.039)	(0.038)	(0.032)
Observations	118,282	118,282	118,282	118,282

Notes: $MinW_{t-6}$ is the 6-month cumulated effect of a change in minimum wage on Sales/Hrs for low productive workers. $MinW_{t-6} \cdot \mathbb{1}(>> MW)$ is the difference in the 6-month cumulated effect for high- vs. low-productive workers. All the regressions control for $\mathbb{1}(> MW)$ and $\mathbb{1}(>> MW)$ (not reported due to space constraints), and include pair-month fixed effects, worker fixed effects, worker tenure, worker department and county-level unemployment. Standard errors are two-way clustered at the state level and at the border-segment level.*** p<0.01, ** p<0.05, * p<0.1.

Table B.19: The Dynamic Effect of Minimum Wage on Individual Worker Productivity (cont'd)

Dep.Var.	Sales/Hrs.	Sales/Hrs.	Sales/Hrs.	Sales/Hrs.
Threshold	120%	140%.	160%.	180%
	(1)	(2)	(3)	(4)
	Effects (%) for Low Productive Workers			
Lead 3 for Wrks at MW ($m = -3$)	-1.1	-.42	-2.7	-2.3
p-value	.86	.94	.57	.71
Lead 2 for Wrks at MW ($m = -2$)	-.3	-.37	-.63	-.017
p-value	.98	.98	.96	.99
Lead 1 for Wrks at MW ($m = -1$)	-29	-29	-28	-25
p-value	.17	.12	.08	.11
ContempEffect for Wrks at MW ($m = 0$)	-9.9	-13	-14	-17
p-value	.68	.6	.54	.49
Lag 1 for Wrks at MW ($m = +1$)	17	19	17	16
p-value	.13	.10	.07	.12
Lag 2 for Wrks at MW ($m = +2$)	-3.6	.92	-1.2	-2.9
p-value	.67	.92	.89	.75
Lag 3 for Wrks at MW ($m = +3$)	21	18	19	18
p-value	.06	.07	.07	.10
Lag 4 for Wrks at MW ($m = +4$)	25	21	23	25
p-value	.02	.06	.03	.01
Lag 5 for Wrks at MW ($m = +5$)	13	14	17	17
p-value	.35	.41	.31	.3
Lag 6 for Wrks at MW ($m = +6$)	17	16	16	18
p-value	.09	.10	.08	.08
	Effects (%) for Medium Productive Workers			
Lead 3 for Wrks > MW ($m = -3$)	14	7.6	5.6	2.8
p-value	.08	.2	.29	.6
Lead 2 for Wrks > MW ($m = -2$)	6.4	-1.2	-2.1	-2.6
p-value	.37	.83	.7	.61
Lead 1 for Wrks > MW ($m = -1$)	-9.3	-3.7	-2	.2
p-value	.26	.62	.75	.98
ContempEffect for Wrks > MW ($m = 0$)	1.4	2.2	3.5	3.5
p-value	.86	.76	.51	.51
Lag 1 for Wrks > MW ($m = +1$)	16	14	12	12
p-value	.01	.03	.02	.03
Lag 2 for Wrks > MW ($m = +2$)	6	5.7	3.3	3
p-value	.14	.17	.35	.42
Lag 3 for Wrks > MW ($m = +3$)	11	11	11	9.9
p-value	.01	.01	.01	.01
Lag 4 for Wrks > MW ($m = +4$)	12	12	12	12
p-value	.01	.02	.01	.01
Lag 5 for Wrks > MW ($m = +5$)	-1.7	.75	3.8	5.9
p-value	.79	.9	.47	.26
Lag 6 for Wrks > MW ($m = +6$)	8.8	7.6	7	7.3
p-value	.045	.08	.11	.14
	Effects (%) for High Productive Workers			
Lead 3 for Wrks >> MW ($m = -3$)	-3.7	-5.4	-7.6	-6.5
p-value	.17	.02	.01	.02
Lead 2 for Wrks >> MW ($m = -2$)	-6.3	-7	-10	-10
p-value	.06	.03	.01	.01
Lead 1 for Wrks >> MW ($m = -1$)	1.9	2.8	3.7	5.5
p-value	.74	.63	.51	.37
ContempEffect for Wrks >> MW ($m = 0$)	1	-1.5	-2.9	-4.5
p-value	.79	.7	.34	.29
Lag 1 for Wrks >> MW ($m = +1$)	4.2	3.6	2.6	3.1
p-value	.32	.39	.48	.48
Lag 2 for Wrks >> MW ($m = +2$)	3.4	8.4	7.7	6.5
p-value	.25	.01	.04	.12
Lag 3 for Wrks >> MW ($m = +3$)	5.6	5.3	4	2.3
p-value	.04	.07	.33	.63
Lag 4 for Wrks >> MW ($m = +4$)	7.4	5.6	8.5	9.5
p-value	.05	.22	.07	.06
Lag 5 for Wrks >> MW ($m = +5$)	6.6	7.9	8.9	8.1
p-value	.12	.1	.05	.07
Lag 6 for Wrks >> MW ($m = +6$)	4.3	2.2	-.48	-1.7
p-value	.25	.56	.9	.69

Notes: Estimated effects (%) of 1$ increase in the minimum wage on Sales/Hrs obtained from the coefficients reported in Table B.18. *Lag 6 for Wrks at MW ($m = +6$) (Lag 6 for Wrks >> MW ($m = +6$))* represents the 6-months cumulated effects (in %) of $1 increase in minimum wage for low-productive (*high-productive*) workers. *p-value* reports the statistical significance of the effect. See Section 7 for details on the specification and the interpretation of each coefficient.

Table B.20: The Dynamic Effect of Minimum Wage on Worker Total Pay per Hour

Dep.Var.	Tot.Pay/Hrs.	Tot.Pay/Hrs.	Tot.Pay/Hrs.	Tot.Pay/Hrs.
Threshold	120%	140%.	160%.	180%
	(1)	(2)	(3)	(4)
$\Delta MinW_{t+3}$	-0.082	-0.059	-0.064	-0.071
	(0.979)	(1.007)	(0.984)	(0.968)
$\Delta MinW_{t+2}$	-0.062	-0.070	-0.057	-0.039
	(0.756)	(0.757)	(0.758)	(0.758)
$\Delta MinW_{t+1}$	-0.437	-0.412	-0.385	-0.398
	(1.008)	(1.005)	(0.997)	(0.971)
$\Delta MinW_{t}$	0.925	0.907	0.919	0.926
	(0.626)	(0.606)	(0.608)	(0.613)
$\Delta MinW_{t-1}$	1.001**	0.998**	0.987**	0.999**
	(0.458)	(0.463)	(0.453)	(0.459)
$\Delta MinW_{t-2}$	0.935***	0.970***	0.986***	0.988***
	(0.324)	(0.283)	(0.282)	(0.279)
$\Delta MinW_{t-3}$	1.322***	1.255***	1.269***	1.252***
	(0.332)	(0.325)	(0.319)	(0.307)
$\Delta MinW_{t-4}$	-0.209	-0.144	-0.050	0.021
	(0.590)	(0.578)	(0.552)	(0.522)
$\Delta MinW_{t-5}$	0.804*	0.796*	0.715*	0.693
	(0.455)	(0.425)	(0.414)	(0.427)
$MinW_{t-6}$	1.323***	1.293***	1.319***	1.334***
	(0.456)	(0.430)	(0.447)	(0.449)
$\Delta MinW_{t+3} \cdot \mathbb{1}(> MW)$	0.530	0.327	0.239	0.116
	(0.426)	(0.453)	(0.466)	(0.518)
$\Delta MinW_{t+2} \cdot \mathbb{1}(> MW)$	-0.442	-0.487	-0.335	-0.313
	(0.427)	(0.455)	(0.477)	(0.486)
$\Delta MinW_{t+1} \cdot \mathbb{1}(> MW)$	0.569	0.510	0.532	0.535
	(0.693)	(0.806)	(0.785)	(0.767)
$\Delta MinW_{t} \cdot \mathbb{1}(> MW)$	-0.610*	-0.584	-0.632*	-0.599
	(0.321)	(0.346)	(0.327)	(0.382)
$\Delta MinW_{t-1} \cdot \mathbb{1}(> MW)$	-0.564**	-0.698**	-0.575	-0.605
	(0.239)	(0.268)	(0.408)	(0.441)
$\Delta MinW_{t-2} \cdot \mathbb{1}(> MW)$	-0.370**	-0.460***	-0.441***	-0.422***
	(0.139)	(0.144)	(0.136)	(0.133)
$\Delta MinW_{t-3} \cdot \mathbb{1}(> MW)$	-0.354*	-0.421*	-0.445	-0.408
	(0.179)	(0.236)	(0.309)	(0.278)
$\Delta MinW_{t-4} \cdot \mathbb{1}(> MW)$	-0.137	0.014	0.275	0.352
	(0.326)	(0.387)	(0.425)	(0.469)
$\Delta MinW_{t-5} \cdot \mathbb{1}(> MW)$	0.453	0.418	0.330	0.231
	(0.325)	(0.342)	(0.292)	(0.257)
$MinW_{t-6} \cdot \mathbb{1}(> MW)$	-0.189**	-0.242**	-0.248***	-0.259**
	(0.085)	(0.093)	(0.088)	(0.095)
$\Delta MinW_{t+3} \cdot \mathbb{1}(>> MW)$	-0.311	-0.541	-0.792	-0.889
	(0.715)	(0.886)	(1.034)	(1.152)
$\Delta MinW_{t+2} \cdot \mathbb{1}(>> MW)$	-0.144	0.061	-0.002	0.076
	(0.526)	(0.544)	(0.562)	(0.565)
$\Delta MinW_{t+1} \cdot \mathbb{1}(>> MW)$	0.143	-0.003	-0.262	-0.591
	(0.917)	(0.977)	(1.027)	(1.151)
$\Delta MinW_{t} \cdot \mathbb{1}(>> MW)$	-0.423	-0.384	-0.298	-0.179
	(0.408)	(0.403)	(0.487)	(0.466)
$\Delta MinW_{t-1} \cdot \mathbb{1}(>> MW)$	-0.803	-0.757	-0.979	-1.037
	(0.656)	(0.842)	(0.724)	(0.827)
$\Delta MinW_{t-2} \cdot \mathbb{1}(>> MW)$	-0.163	0.038	0.041	0.094
	(0.343)	(0.424)	(0.528)	(0.531)
$\Delta MinW_{t-3} \cdot \mathbb{1}(>> MW)$	-0.761**	-0.800*	-0.958**	-1.264**
	(0.323)	(0.402)	(0.382)	(0.462)
$\Delta MinW_{t-4} \cdot \mathbb{1}(>> MW)$	1.271	1.607*	1.762*	1.935**
	(0.779)	(0.862)	(0.923)	(0.875)
$\Delta MinW_{t-5} \cdot \mathbb{1}(>> MW)$	-0.846***	-1.279***	-1.758***	-2.354***
	(0.249)	(0.378)	(0.428)	(0.332)
$MinW_{t-6} \cdot \mathbb{1}(>> MW)$	-0.268**	-0.215**	-0.304***	-0.323**
	(0.107)	(0.096)	(0.107)	(0.120)
Observations	118,282	118,282	118,282	118,282

Notes: $MinW_{t-6}$ is the 6-month cumulated effect of a change in minimum wage on Sales/Hrs for low productive workers. $MinW_{t-6} \cdot \mathbb{1}(>> MW)$ is the difference in the 6-month cumulated effect for high- vs. low-productive workers. All the regressions control for $\mathbb{1}(> MW)$ and $\mathbb{1}(>> MW)$ (not reported due to space constraints), and include pair-month fixed effects, worker fixed effects, worker tenure, worker department and county-level unemployment. Standard errors are two-way clustered at the state level and at the border-segment level.*** p<0.01, ** p<0.05, * p<0.1.

Table B.21: The Dynamic Effect of Minimum Wage on Worker Total Pay per Hour (cont'd)

Dep.Var.	Tot.Pay/Hrs.	Tot.Pay/Hrs.	Tot.Pay/Hrs.	Tot.Pay/Hrs.
Threshold	120%	140%.	160%.	180%
	(1)	(2)	(3)	(4)
	Effects (%) for Low Productive Workers			
Lead 3 for Wrks at MW ($m = -3$)	-.83	-.59	-.65	-.71
p-value	.93	.95	.95	.94
Lead 2 for Wrks at MW ($m = -2$)	-.63	-.7	-.57	-.39
p-value	.93	.93	.94	.96
Lead 1 for Wrks at MW ($m = -1$)	-4.4	-4.2	-3.9	-4
p-value	.67	.68	.7	.68
Contemp.Effect for Wrks at MW ($m = 0$)	9.3	9.1	9.3	9.3
p-value	.15	.14	.14	.14
Lag 1 for Wrks at MW ($m = +1$)	10	10	9.9	10
p-value	.037	.039	.037	.037
Lag 2 for Wrks at MW ($m = +2$)	9.4	9.8	9.9	10
p-value	.01	.01	.01	.01
Lag 3 for Wrks at MW ($m = +3$)	13	13	13	13
p-value	.01	.01	.01	.01
Lag 4 for Wrks at MW ($m = +4$)	-2.1	-1.4	-.5	.21
p-value	.73	.81	.93	.97
Lag 5 for Wrks at MW ($m = +5$)	8.1	8	7.2	7
p-value	.087	.071	.094	.11
Lag 6 for Wrks at MW ($m = +6$)	13	13	13	13
p-value	.01	.01	.01	.01
	Effects (%) for Medium Productive Workers			
Lead 3 for Wrks > MW ($m = -3$)	3.9	2.3	1.5	.4
p-value	.53	.69	.79	.94
Lead 2 for Wrks > MW ($m = -2$)	-4.4	-4.9	-3.4	-3.1
p-value	.31	.22	.38	.41
Lead 1 for Wrks > MW ($m = -1$)	1.2	.85	1.3	1.2
p-value	.74	.76	.61	.6
Contemp.Effect for Wrks > MW ($m = 0$)	2.7	2.8	2.5	2.9
p-value	.34	.3	.39	.32
Lag 1 for Wrks > MW ($m = +1$)	3.8	2.6	3.6	3.5
p-value	.13	.28	.18	.22
Lag 2 for Wrks > MW ($m = +2$)	4.9	4.5	4.8	5
p-value	.08	.04	.03	.01
Lag 3 for Wrks > MW ($m = +3$)	8.5	7.3	7.2	7.4
p-value	.01	.04	.07	.05
Lag 4 for Wrks > MW ($m = +4$)	-3	-1.1	2	3.3
p-value	.37	.71	.52	.23
Lag 5 for Wrks > MW ($m = +5$)	11	11	9.1	8.1
p-value	.06	.06	.08	.11
Lag 6 for Wrks > MW ($m = +6$)	9.9	9.2	9.4	9.4
p-value	.01	.01	.01	.01
	Effects (%) for High Productive Workers			
Lead 3 for Wrks >> MW ($m = -3$)	-2.3	-3.5	-4.9	-5.5
p-value	.22	.03	.01	.07
Lead 2 for Wrks >> MW ($m = -2$)	-1.2	-.052	-.34	.22
p-value	.61	.98	.88	.93
Lead 1 for Wrks >> MW ($m = -1$)	-1.7	-2.4	-3.7	-5.7
p-value	.35	.34	.2	.17
Contemp.Effect for Wrks >> MW ($m = 0$)	2.9	3	3.6	4.3
p-value	.26	.3	.27	.28
Lag 1 for Wrks >> MW ($m = +1$)	1.1	1.4	.05	-.22
p-value	.68	.7	.99	.95
Lag 2 for Wrks >> MW ($m = +2$)	4.5	5.8	5.9	6.2
p-value	.01	.01	.04	.02
Lag 3 for Wrks >> MW ($m = +3$)	3.2	2.6	1.8	-.068
p-value	.24	.38	.52	.98
Lag 4 for Wrks >> MW ($m = +4$)	6.1	8.5	9.9	11
p-value	.01	.01	.01	.01
Lag 5 for Wrks >> MW ($m = +5$)	-.24	-2.8	-6	-9.6
p-value	.93	.35	.06	.01
Lag 6 for Wrks >> MW ($m = +6$)	6.1	6.2	5.9	5.8
p-value	.01	.01	.01	.02

Notes: Estimated effects (%) of 1$ increase in the minimum wage on Sales/Hrs obtained from the coefficients reported in Table B.20. *Lag 6 for Wrks at MW ($m = +6$) (Lag 6 for Wrks >> MW ($m = +6$))* represents the 6-months cumulated effects (in %) of $1 increase in minimum wage for low-productive (*high-productive*) workers. *p-value* reports the statistical significance of the effect. See Section 7 for details on the specification and the interpretation of each coefficient.

Table B.22: No Pre-Trends in Store Profits and Employment

Sample	Sales associates			All workers		
Dep.Var.	Net Rev./Hrs	N.Workers	Hrs/N.Workers	EBITDA/Hrs	N.Workers	Hrs/N.Workers
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: 1 year trend					
η_{12}	-0.476	0.092	-1.971	0.946	-2.024	1.097
	(1.191)	(0.341)	(1.346)	(1.157)	(1.768)	(0.931)
η_4	-3.113	-0.077	-0.365	1.249	-1.887	2.296
	(3.221)	(0.550)	(3.116)	(2.524)	(1.995)	(1.596)
$\beta = \eta_4 - \eta_{12}$	-2.637	-0.169	1.606	0.303	0.137	1.199
	(2.248)	(0.392)	(2.036)	(1.513)	(1.579)	(1.529)
Observations	11,771	11,771	11,771	11,771	11,771	11,771
	Panel B: 6 months trend					
η_6	-0.344	0.235	-3.331	2.761**	-0.523	0.768
	(1.427)	(0.481)	(2.157)	(1.278)	(1.228)	(0.759)
η_2	-4.405	-0.347	2.240	0.394	-1.455	3.059*
	(4.079)	(0.506)	(2.690)	(3.589)	(1.823)	(1.530)
$\beta = \eta_2 - \eta_6$	-4.061	-0.582	5.571***	-2.367	-0.932	2.291*
	(3.349)	(0.372)	(1.333)	(2.678)	(1.001)	(1.199)
Observations	12,080	12,080	12,080	12,080	12,080	12,080
Units	Stores	Stores	Stores	Stores	Stores	Stores
Mean Dep.Var.	51.39	16.81	107.5	5.985	118	80.70

Notes: Notes: All the regressions include pair-month fixed effects, store fixed effects and control for county-level unemployment. Col.1: *Net Rev./Hrs* is the total monthly net revenues (revenues*profit margin minus wage bill) generated by all sales associates in our sample divided by the total number of hours worked by sales associates. Col.2: *N.Workers* is the total number of sales associates in the store. Col.3: *Hrs/N.Workers* is the number of hours worked in the store per sales associate. Col.4: *EBITDA/Hrs* are equal to earnings before interest, tax, depreciation and amortization, divided by total hours worked in the store. Col.5: *N.Workers* is the total number of workers in the store. Col.6: *Hrs/N.Workers* is the number of hours worked in the store per worker. In Panel A, η_{12} and η_4 are the leading coefficients and capture twelve and four months variations in Y *before* each change in the minimum wage; $\beta = \eta_4 - \eta_{12}$ is the pre-trend (standard errors) between $t-12$ and $t-4$. In Panel B, η_6 and η_2 capture six and four months variations in Y *before* each change in the minimum wage; $\beta = \eta_2 - \eta_6$ is the pre-trend (standard errors) between $t-6$ and $t-2$. The number of observations in Panel A (Panel B) corresponds to the sample of stores that we observe in the data for at least 12 (6) consecutive months before the change in minimum wage. See Section 5 for details on the specification and the interpretation of each coefficient. Standard errors are two-way clustered at the state level and at the border-segment level. *** p<0.01, ** p<0.05, * p<0.1.

Table B.23: The Dynamic Effect of Minimum Wage on Store-Level Employment

Sample	**Sales associates**			**All workers**		
Dep.Var.	Net Rev./Hrs (1)	N.Workers (2)	Hrs/N.Workers (3)	EBITDA/Hrs (4)	N.Workers (5)	Hrs/N.Workers (6)
$\Delta MinW_{t+3}$	-2.000	0.237	-0.501	0.685	-0.070	1.258
	(2.354)	(0.370)	(3.124)	(1.511)	(1.637)	(1.183)
$\Delta MinW_{t+2}$	-1.808	-0.343	2.279	-2.719	-0.125	2.494*
	(2.396)	(0.304)	(3.214)	(5.067)	(2.046)	(1.414)
$\Delta MinW_{t+1}$	-7.234	-0.514	2.606	1.963	-1.274	2.158
	(5.574)	(0.528)	(2.440)	(2.059)	(1.671)	(1.883)
$\Delta MinW_{t}$	-2.467	-0.500	-1.792	-1.233	0.877	-0.180
	(2.535)	(0.453)	(2.369)	(3.442)	(1.919)	(1.975)
$\Delta MinW_{t-1}$	-0.989	-0.782	0.203	2.199	-0.108	0.961
	(2.060)	(0.538)	(2.048)	(1.790)	(2.600)	(1.786)
$\Delta MinW_{t-2}$	-1.865	-0.407	-1.232	0.874	0.743	-1.199
	(2.654)	(0.560)	(2.458)	(2.096)	(2.613)	(1.704)
$\Delta MinW_{t-3}$	4.061**	-0.374	2.832	1.470	1.471	-0.317
	(1.775)	(0.363)	(2.208)	(1.182)	(2.625)	(2.016)
$\Delta MinW_{t-4}$	4.918**	-0.754*	2.119	2.942**	1.446	0.551
	(1.886)	(0.420)	(2.617)	(1.219)	(2.757)	(1.849)
$\Delta MinW_{t-5}$	2.252	0.043	-2.158	0.202	2.938	1.207
	(2.187)	(0.585)	(2.699)	(1.864)	(2.919)	(2.067)
$MinW_{t-6}$	1.035	0.153	-3.289*	1.380	5.774**	0.336
	(2.089)	(0.781)	(1.894)	(1.908)	(2.714)	(1.494)
Observations	10,288	10,288	10,288	10,288	10,288	10,288
Units	Stores	Stores	Stores	Stores	Stores	Stores

Notes: All the regressions include pair-month fixed effects, store fixed effects and control for county-level unemployment. Col.1: *Net Rev./Hrs* is the total monthly net revenues (revenues*profit margin minus wage bill) generated by all sales associates in our sample divided by the total number of hours worked by sales associates. Col.2: *N.Workers* is the total number of sales associates in the store. Col.3: *Hrs/N.Workers* is the number of hours worked in the store per sales associate. Col.4: *EBITDA/Hrs* are equal to earnings before interest, tax, depreciation and amortization, divided by total hours worked in the store. Col.5: *N.Workers* is the total number of workers in the store. Col.6: *Hrs/N.Workers* is the number of hours worked in the store per worker. $MinW_{t-6}$ is the 6-month lagged effect of a change in minimum wage at time t on store-level outcomes. $\Delta MinW_{j,t-m}$ are the 9 month-to-month difference operators, with m ranging from -3,...,+5. $\Delta MinW_{j,t+3}...\Delta MinW_{j,t+1}$ are the leading terms used to test for pre-trends at the store level; $\Delta MinW_{j,t}...\Delta MinW_{j,t-5}$ are the lagged terms used to estimate treatment effects after the change in minimum wage. See Section 7 for details on the specification and the interpretation of each coefficient. Standard errors are two-way clustered at the state level and at the border-segment level. *** p<0.01, ** p<0.05, * p<0.1.