Why Do Women Earn Less than Men? Evidence from Bus and Train Operators

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Female workers earn $0.89 for each male-worker dollar even in a unionized workplace, where tasks, wages, and promotion schedules are identical for men and women by design. Using administrative time-card data on bus and train operators, we show that this earnings gap can be explained by female operators taking fewer hours of overtime and more hours of unpaid time off than male operators. Female operators, especially those with dependents, pursue schedule conventionality, predictability, and controllability more than male operators. While reducing schedule controllability can limit the earnings gap, it can also hurt female workers and their productivity.

I. Introduction

The past century has witnessed broad convergence in male and female earnings. The gap between male weekly earnings and female weekly earnings shrank from 38% in 1979 to 20% in 2004 but has plateaued since then at

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about 18% (Bureau of Labor Statistics 2017).[1] The reasons for the persistent gender earnings gap are many. We demonstrate that even when men and women work at precisely the same job with exactly the same incentives, women earn less. This finding underscores that gender-neutral workplace policies can still generate different outcomes for the sexes.

We study public transit operators, of whom about 30% are women. Our focus is the Massachusetts Bay Transportation Authority (MBTA), a setting that allows us to control for many traditional explanations of the earnings gap, including occupational sorting, managerial bias, the motherhood penalty, and gender differences in desire to compete and negotiate for promotions. Using administrative time-card data, we document that despite having such a controlled setting, the MBTA still has a gender earnings gap: female operators earn $0.89 for each male-operator dollar in weekly earnings.[2] Moreover, given the MBTA's defined benefit pension program, this 11% earnings gap carries over into retirement.

Mechanically, the earnings gap in our setting can be explained by the fact that male operators take 1.3 fewer unpaid hours off work (49%) and work 1.5 more overtime hours (83%) per week than their female counterparts. Female operators' choices indicate that they value time outside work more than do male operators and that they have greater demand for schedule predictability and controllability. The differences are consistent with women handling more household and childcare duties than men, contributing to women's limited availability for overtime shifts and need to take more unpaid time off (Parker, Horowitz, and Rohal 2015; Bertrand, Kamenica, and Pan 2015).

Our results provide evidence that earnings gaps can exist even in workplaces that have no explicit gender discrimination. Seniority in one's garage is the sole determinant of workplace opportunities, per the collective

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[1] The Bureau of Labor Statistics calculates this gap each year by taking the average (for men and women separately) of median usual weekly earnings for full-time wage and salary workers.

[2] This is the average weekly female earnings to male earnings ratio over the course of our sample period, 2011–17.

bargaining agreement that covers all MBTA bus and train operators.[3] Conditional on seniority, male and female operators face the same choice sets of schedules, routes, vacation days, and overtime hours, among other amenities. Nevertheless, the earnings gap persists even when we condition on seniority.

Three sets of findings help us understand the earnings gap we observe. First, female operators accept fewer overtime shifts, take more unpaid time off than men, and game the overtime system less than male operators do. Second, female operators prioritize conventional work schedules. Third, more predictable and controllable schedules have the potential to help female operators work more hours, reduce the earnings gap, and improve employee well-being.

While female operators take fewer overtime shifts than male operators, the cause of this difference is overtime opportunities that arrive on short notice and therefore require that operators are flexible about when they work. When overtime is scheduled the day before or the day of the necessary shift, male operators work almost twice as many of those hours as female operators. In contrast, when overtime hours are scheduled 3 months in advance, male operators sign up for only 7% more of them than female operators. Given that the MBTA's operators are a select group who agreed to the MBTA's job requirement of 24/7 availability, these differences in their flexibility and in their value of time could be lower bounds for the general population.

Exacerbating the disparity in overtime acceptance rates, male operators strategically substitute regular hours for higher-paying overtime hours using the Family Medical Leave Act (FMLA). Throughout our 2011–17 sample, FMLA allowed operators to take unpaid time off.[4] At the MBTA, FMLA has been nicknamed the "Friday-Monday Leave Act" for the way that operators have used it to avoid undesirable shifts. Both male and female operators take more FMLA hours when faced with undesirable shifts (e.g., a weekend or holiday shift). However, male operators also work enough overtime hours in weeks with an undesirable shift that they effectively trade off hours paid at the regular wage for overtime hours paid at 1.5 times their wage. Female operators also work more overtime hours in weeks with undesirable shifts but do not completely replace the pay lost due to FMLA leave.

Second, female operators prioritize conventional and predictable schedules. As operators move up the seniority ladder and consequently have a greater pool of schedules to pick from, female operators move away

[3] The MBTA's bus and train operators are all represented by the same union, Carmen's Local 589.

[4] Passed in 1993, FMLA is intended to allow workers facing a personal or family medical emergency to take up to 12 weeks off from work without pay and without retribution from the employer. Many use FMLA for maternity or paternity leave.

from working weekends and holidays and split shifts more than do male operators.

Female operators value time outside work and schedule predictability more than do male operators, especially when they have dependents. Female operators with dependents are considerably less likely than male operators with dependents to accept a short-notice overtime opportunity. When it comes to overtime hours worked, unmarried female operators with dependents work only 6% fewer of them than men when they are preplanned 3 months in advance but about 60% fewer of them when they are offered on short notice. Unmarried women with dependents also take the largest amount of unpaid time off with FMLA, making them the lowest earners in our setting.

Last, we study the impact of two policy changes at the MBTA on gender gaps. These changes made it harder for operators to swap regular hours for overtime hours. The first policy change, in March 2016, made it more difficult for operators to obtain FMLA certification, to use FMLA for anything other than a medical issue, and to take unpaid time off at a moment's notice. The second policy change, in July 2017, redefined overtime hours from any hours worked in excess of eight in a given day to any hours worked in excess of 40 in a given week.

These policies both reduced the gender earnings gap and hurt workers. The gender earnings gap shrank from 12% before the FMLA policy change to 9% between March 2016 and July 2017 and to 6% from July through December 2017. Yet in addition to reducing the gap, these policies also reduced schedule controllability. Those who took more unpaid time off via FMLA before the policy changes now took more unexcused leave instead, indicating that these operators still desired control over their schedules. After the policies, operators began procuring this control at a higher cost, since unexcused leave can result in suspensions and discharge from work. Because female workers have greater revealed preference for schedule controllability, these policies—particularly the first—affected female operators more negatively than they did male operators.

Our work is related to a large literature explaining the gender earnings gap. Broadly, the major explanations cluster into four categories: women tend to work in lower-paying jobs, women face workplace discrimination, women may be less willing to fight for better compensation, and women have less experience. The nature of our setting suggests that these explanations are not relevant for the earnings gap we observe.

One contributing factor to earnings gaps is that women tend to work in settings that pay less. This trend holds true if we compare male and female earnings at the occupation, industry, or firm level (Levanon, England, and Allison 2009; Blau and Kahn 2017). Likewise, 24% of women engage in part-time work, where wages have historically been lower, while 12% of men do (Blank 1990; Hirsch 2005; Bureau of Labor Statistics 2017). Our

analysis focuses on full-time workers performing the same tasks within the same occupation, eliminating this concern.[5]

Another thread of research suggests that the gender earnings gap is attributable to discrimination and managerial discretion. For example, Lazear and Rosen (1990) argue that men and women have similar earnings within very narrow job categories but are not similarly represented in those categories in part because women have a lower probability of promotion than men. In the lab, wage negotiators mislead women more than men (Kray, Kennedy, and Van Zant 2014); the gender of an employee's direct manager is predictive of the earnings gap (Hultin and Szulkin 1999, 2003; Cohen and Huffman 2007). Our context is constructed by union negotiation to be free from managerial discrimination. The union contract specifies that seniority, a gender-neutral metric, drives personnel management: wages increase at a predetermined rate, with no performance-based incentives. Shift scheduling and route allocation is likewise determined by seniority. The union advocates for workers in instances of managerial discrimination and can challenge the rare instance of an employee firing.[6] As a result, differential managerial standards for men and women likely do not explain the earnings gap in our setting.

Some research has argued that women are less willing to compete for higher-paying positions (Gneezy, Niederle, and Rustichini 2003; Niederle and Vesterlund 2007; Dohmen and Falk 2011; Reuben, Wiswall, and Zafar 2017). Our setting also removes this channel from consideration, since the collective bargaining agreement specifies that career advancement is based on tenure (the number of days that have passed since the hire date) and not on performance, competition, or negotiation.

Another factor that typically generates an earnings gap is women having less labor market experience or availability. Bertrand, Goldin, and Katz (2010) find that the earnings gap among MBAs is attributable in part to more workplace interruptions and shorter work hours. Likewise, Cook et al. (2021) find that the earnings gap among Uber drivers can be partly explained by men working for longer periods of time than women and accumulating more knowledge about the best times and places to drive. Kleven, Landais, and Sogaard (2018) find that the birth of a child creates a gender gap in earnings of about 20%, with labor force participation, hours of work, and wage rates each contributing to the gap. Angelov, Johansson, and Lindahl (2016) come to similar conclusions. Goldin (2014) notes that there are larger earnings differences in jobs that value long (uninterrupted) hours

[5] Although there are part-time MBTA operators, their contracts are sufficiently different from those of full-time operators that they are not comparable.

[6] Focus group interviews with employees further revealed that employees believe there to be minimal manager discretion.

worked or being on call. Cha and Weeden (2014) observe a gender gap in working overtime, both among hourly and salaried workers.

In our context, prior work experience is not a differentiating factor. All employees obtain the same training regardless of their prior experience, and all who meet the basic qualifications and start work on the same day receive the same wage. Moreover, even among those without dependents, the earnings gap remains at 10%. Our results do echo the literature in several important ways. First, as in Goldin (2014), our setting features a convex hours-earning relationship—the type of setting where Goldin notes earnings differences are apt to emerge. Accordingly, we document that the presence of short-notice overtime is akin to being on call in the way it can cause an earnings gap to emerge. Second, we find that demand for flexible hours is highest for those with dependents.

Finally, we also contribute to a literature on workplace amenities. Mas and Pallais (2017) find that women in their experiment are willing to forgo almost 40% of their wages to avoid irregular schedules. Likewise, they find that female workers are willing to take substantial wage cuts to avoid working evenings and weekends. Noonan, Corcoran, and Courant (2005) and Reyes (2007) support this work with evidence that women with high skills and job market prospects choose positions with fewer hours and more regular schedules. One explanation proffered by Cortes and Pan (2019) is that women have primary responsibility for household production and that outsourcing household production can be so costly as to constrain women from devoting more hours to nonhousehold work. Our findings corroborate these results: female operators put a premium on working conventional hours, consistent with managing time-inflexible duties outside work.

The two papers closest to ours are Cook et al. (2021) and Adams-Prassl (2020), both of which unpack a pay gap in settings that are designed to be gender neutral. Cook et al. (2021) find that female Uber drivers have less experience with Uber, making them less likely to know when and where to go when demand and prices peak. Conditional on driver experience, however, male and female drivers gravitate to high-demand zones and times similarly. The remaining pay disparity arises because men drive faster than women, allowing them to complete more rides and earn more in the same amount of time. Adams-Prassl (2020) considers MTurkers, finding no difference in experience or tasks performed but showing that fragmented work patterns—driven largely by women with children under 5 years old at home—account for most of the gap.

Our work complements these insights on disparate effects of gender-neutral policies, particularly when they interact with individuals' constraints outside work. While all contexts have gender-neutral policies, both the Uber and MTurk contexts allow for considerable flexibility and worker discretion. In contrast, we focus on an environment where workers have very little control over their work schedules. We thus speak to how jobs that require short-notice

schedule adjustments—including jobs in retail, service, law, and consulting—may have larger disamenities for women than for men.

The rest of the paper is organized as follows. The next section explains the nature of work at the MBTA, and section III goes into detail on the data that we employ for our analyses. Section IV shows how the earnings gap can be explained through gender differences in overtime hours and unpaid time off. Section V documents gender differences in the value of time away from work, schedule predictability, and schedule controllability. Section VI discusses how institutional changes that reduce schedule controllability can narrow the gender earnings gap but make women worse off and decrease service quality in the process. Section VII concludes.

II. Institutional Details

A. The Operators

The MBTA serves the Boston metropolitan area with 173 bus routes and four rail lines.[7] Since the late 1970s, anyone with minimum qualifications can enter into a lottery to become a bus or train operator at the MBTA. Lotteries take place at intervals ranging from 1 to 10 years, as the need for more operators arises. At the latest lottery in 2017, candidates were required to be a high school graduate, to be at least 18 years old, to have a driver's license, and to have a clean driving record for the past 2 years. Applicants also needed to pass a criminal background check as well as customer service and driving tests and to be "available to work twenty four (24) hours per day, seven (7) days per week."[8]

When applying, a person can choose to apply to be a bus operator, a heavy rail (underground train) operator, or a light rail (aboveground train) operator. There is no difference in pay between these positions, and the minimum requirements are very similar. All operators start as part-timers who earn about $20 per hour. Part-time operators are promoted to full time as positions become available, which in most cases happens within the first few years of work.[9] Operators then see a steady annual increase in their wage to about $33 per hour over the next 4 years of work. Thereafter, wages

[7] See fig. A.1 (figs. A.1–A.14 are available online) for a map of the area served and the routes.

[8] For the 2017 job lottery postings, see figs. A.2–A.5.

[9] The most senior part-timer is the first in line to be promoted to full time. Seniority for part-timers is determined only relative to their part-time peers, and seniority for full-timers is determined only relative to their full-time peers. While one might worry that the part-time prerequisite will select for secondary earners, operators are less likely to have children and be married than high school–educated adults nationwide. Focus group conversations with operators revealed that many have additional employment during the part-time period, which is facilitated by having a schedule that is predictable within a given quarter of the year. Part-timers are not eligible for overtime.

Table 1
Comparison with American Workers Who Have a High School Diploma

	CPS		MBTA	
	Male	Female	Male	Female
Age	47.33	51.64	47.62	45.65
% married	54.15	51.74	31.00	14.00
% with child at home	33.40	39.37	15.59	28.50
Weekly hours	40.16	34.76	37.55	32.63
Hourly wage	16.04	12.76	32.66	32.72
% hourly worker	71.75	75.75	100.00	100.00
% union membership	14.34	9.31	100.00	100.00
% in labor force	60.95	45.56	100.00	100.00
% in transit occupation	.61	.42	100.00	100.00
Observations	88,271	90,884	2,086	925

NOTE.—We compare MBTA operators with individuals in the 2011–16 Current Population Survey (CPS) who have the same educational attainment as required for an MBTA operator: a high school diploma or a GED. For MBTA workers, wages reported reflect base pay, and weekly hours reflect regular work hours plus overtime (excluding paid and unpaid hours of leave).

rise at about the rate of inflation. The only other differences in wages are due to new collective bargaining agreements adjusting the starting wage of new hires.

How do MBTA operators compare to other workers throughout the United States? MBTA operators are less likely to have children and are less likely to be married than high school–educated adults nationwide (see table 1). This is consistent with MBTA workers being more flexible so as to meet the job's demands. Indeed, the MBTA has an incentive to screen for more flexible workers to limit scheduling difficulties and overtime pay. Exits from the MBTA likely skew the population of operators further toward those who find the schedule demands of the job to be less taxing.[10] Operators, though, are also compensated for their general flexibility, as their hourly pay ($32 per hour) is nearly twice as high as that of other workers of the same education level.

The vast majority of high school–educated Americans work hourly jobs (more than 74%), meaning most, like the MBTA operators, are eligible for overtime pay. While the rates of union membership are low among high school–educated Americans (12%), among all Americans, union membership was at 6.7% in the private sector and 11.1% among all workers in 2015 (Dunn and Walker 2016).[11] As another point of reference, 56% of US employees were eligible for FMLA as of 2018 (Brown et al. 2020).[12] Finally,

[10] Operators noted in conversations with us that the rigid scheduling is one of the most difficult aspects of the job.

[11] In the private sector, union membership is highest among transit and utility workers.

[12] Workers may be ineligible if they are employed at a small firm, have not been employed for more than 12 months at the firm, or work too few hours. All who are

we find that both within the MBTA and among their educational peers, men tend to work more hours than do women.

While this paper focuses on a single occupation, the relevant traits of MBTA operators are echoed in a number of other occupations. In 2017, 431,514 individuals were employed in more than 925 public transit systems in the United States. More than 270,000—63%—of these individuals were vehicle operators (Hughes-Cromwick 2019). While each system has its own unique characteristics, shift-based work and strong unions are pervasive. Many other workers likewise have shifts apportioned by seniority, including utility workers, airline pilots, flight attendants, and nurses. Additionally, overtime is a common feature of other public sector settings. Boston, Baltimore, and New York City, for example, all have seen an increase in pay inequality since 2011, in large part as a result of overtime pay (Kahn, McComas, and Ravi 2019). Further inquiry into the role that seniority and union rules play in the distribution of overtime opportunities may reveal additional similarities between MBTA operators and other public sector workers. Finally, a whole host of jobs may require schedule adjustments on short notice. Lawyers and consultants, for example, often need to meet with clients on short notice, and many service jobs have moved toward just-in-time scheduling.

B. The Work

A rail operator is responsible for taking the train out of the yard, conducting the train along the rails in accordance with the lights, making announcements through the overhead system, opening and closing doors for passengers, and resolving any problems that may occur over the course of the day on the train.

A bus operator is likewise responsible for following the prescribed route, picking up passengers at predetermined stops, helping passengers pay using the fare box, making all nonautomated announcements, and resolving any mechanical or person-related conflicts that may occur on the bus. Bus operators deal with more unpredictable traffic and have more contact with passengers than rail operators through fare collection, assisting passengers with disabilities, and answering questions.

C. Scheduling

Operators select their routes and hours every 3 months in a process called "the Pick."[13] During the Pick, the most senior ranked operator chooses which routes, days, and hours he or she would like to work. The operator's

eligible can legally be granted either intermittent (for spells of several hours or days interspersed with work) or continuous (for weeks or months at a time) FMLA.

[13] The procedures for the Pick changed in 2018. The process described here was used throughout 2011–17, the period that our data cover.

selection is subject only to the restriction that an operator must take a 10-hour break between shifts and sign up for more than 39 and fewer than 60 hours of work per week. In addition to hours and routes, certain leave days are selected at this time. Since public transit runs on the weekends and holidays, operators who do not want to work on these days must arrange their schedules and leave around them, possibly using a vacation day on a holiday that they would otherwise have to work. Once the most senior operator's selections are made, the next most senior person selects his or her schedule and vacation days for the upcoming quarter, and so on down the seniority ladder.[14]

During the Pick, overtime may be included in one's schedule. If, for example, the routes an operator selects for a given day are expected to take 8 hours and 14 minutes, those additional 14 minutes are considered "built-in overtime" and will be paid at 1.5 times the regular wage. Additionally, the MBTA may need to run extra service to help children get to school or to substitute for service on a rail line that is under repair. During the Pick, an operator can take on such pieces of extra work—called "Trippers"—and earn overtime pay for doing so. Trippers and built-in overtime are also valuable in that pay from these sources counts toward pension calculations. We collectively refer to this type of overtime as "preplanned" overtime.

A worker who clocks more than 8 hours in a given day is eligible for overtime on that day, as of the MBTA rules in place prior to July 9, 2017. Thereafter, a worker has to clock more than 40 hours in a week to be eligible for overtime. Thus, for the bulk of our observed time period, a worker could take 8 hours off on Monday, for example, work additional shifts beyond their scheduled 8-hour work day on Tuesday, and earn 1.5 times their regular wage for Tuesday's overtime shifts. We investigate such "gaming" in section V.D.

D. Short-Notice Overtime

Taking on short-notice overtime shifts, which are also paid at 1.5 times the regular wage, can generate significant extra earnings for MBTA operators. Short-notice overtime opportunities arise when an operator is not able to come to work or when a vehicle breakdown requires an additional operator to continue service on a route. The supervisor responsible for that shift will turn to "cover list" employees, whose scheduled work is to be on call, ready to run any route in a given 8-hour window. When the need exceeds the number of cover list operators, the supervisor turns to the rest of the operators in the garage for help.

[14] Detailed data from the Pick, including routes driven and exact time slots selected by each operator, are unfortunately not maintained in a systematic way. This limits our ability to study the characteristics of the schedule selections.

The collective bargaining agreement dictates that supervisors must offer these open shifts to operators within the same garage by seniority.[15] In a time-pressing situation in which there is not enough time for a person to arrive at the garage, operators who are on site may be offered overtime—again in seniority order. In some cases, overtime opportunities are posted on a bulletin board the day before they must be worked. After a time cutoff, the supervisor allocates it to the most senior operator who expressed interest in the overtime shift.[16]

Supervisor discretion in whom to call raises concerns that favoritism, instead of seniority, could determine allocation of overtime opportunities. Four facts should assuage this concern. First, seniority rankings are commonly known, allowing operators to figure out if they have been skipped for overtime. Second, the union intercedes on behalf of operators if there are issues of supervisor favoritism, but conversations with union leaders suggest that complaints of favoritism are rare. Indeed, in separate conversations with operators of all seniority levels, favoritism was not among the complaints voiced. Third, our data show senior operators working nearly twice as much overtime as low-seniority operators, further corroborating that overtime opportunities are allocated by seniority. Fourth, these observations hold across garages and parts of the week, making it unlikely that supervisor favoritism is happening at some locations and times but not others.

III. Data and Descriptive Statistics

A. Data

Our analyses are based on a set of confidential administrative data sets from the MBTA. The main data set contains the Human Resources (HR) Department's time-card data, spanning 2011–17. These data record how many hours of each type (regular work, preplanned overtime, short-notice overtime) each employee logged on each day. Additionally, the data note the number of hours an employee did not work and the reason (sick leave, vacation, FMLA leave, unexcused, etc.). We merge time-card data with HR data on individual employees, including age, gender, date of hire, garage,

[15] An operator may not work the overtime if he or she has already worked 60 hours in that week or if the operator is scheduled to work a shift during the same time as the overtime opportunity. We are able to control for whether an operator has already reached the 60-hour limit or not, but we do not observe the exact time frame of the overtime shift being offered.

[16] Our time-card data show short-notice overtime as overtime that has not been preplanned. We define a short-notice overtime opportunity as a segment of overtime pay that is at least 2 hours in length to avoid overtime segments that result from traffic delays, e.g., as opposed to an offer of a separate shift from one's supervisor. Our analyses are robust to using 1 hour instead of 2 to define a piece of short-notice overtime work.

and tenure. Seniority is determined on the basis of who has the longest tenure within a given garage.

We use federal W-4 tax forms held by HR to infer an operator's marital status and whether he or she has dependents. The number of selected allowances dictate how much money should be withheld from a paycheck in anticipation of tax liabilities. Following Internal Revenue Service (IRS) suggestions for calculating allowances, we classify operators as having dependents if they are married and put down an allowance of 3 or higher or if they are unmarried and put down an allowance of 2 or higher. We have this information for those operators who worked at the MBTA in 2017. These data, however, are available only as a snapshot for 2,318 individuals who had W-4 forms on file with the MBTA in 2017.

The allowances a person lists on a W-4 are an imperfect measure of whether that person has children or caretaking responsibilities. Prior work has shown that defaults and inertia keep people from updating their allowances upward, which results in overwithholding (Jones 2012). The IRS's underpayment penalty for having too many allowances and thus less than one's annual tax liability withheld also provides downward pressure on allowances.

We check the robustness of our results by performing the same analyses using benefits data managed by HR for employees in 2017.[17] These data report the number of dependents that each operator has on his or her medical insurance plan with the MBTA. Our results are qualitatively the same. Taken together, we believe allowances to be a noisy but unbiased measure of immediate family arrangements.

Of course, operators may have caretaking responsibilities for individuals who are not on their insurance or tax forms. The mean operator, in his or her midforties, may also be caring for aging parents or young grandchildren—both of whom might not be claimed as dependents.[18] If this is the case, we might find that people whom we mark as having no dependents may nevertheless exhibit behavior consistent with having caretaking duties that constrain their work hours.

Likewise, marital status on a W-4 is an imperfect measure of whether a person is partnered. Individuals have the option of selecting "single," "married," or "married, but withhold at higher single rate" on the form. Thus, those in our unmarried category may be unmarried, divorced, or in a partnership outside the institution of marriage. In this context as well, it is plausible that some individuals do not update W-4 forms when their domestic arrangements change.

Finally, to understand the relationship between unexcused absences and disciplinary action, we combine time-card data on unexcused leave with data on the date of discipline and type of discipline received by each operator.

[17] Results using benefits data are available on request.

[18] In 2017–18, 40.4 million people, a majority of whom were women, provided unpaid eldercare (Bureau of Labor Statistics 2019).

These data are available for 2016–17. In 2016, the MBTA introduced a new five-step discipline policy that spelled out the type of punishments that operators could face for unexcused tardies or absences. The discipline policy was aimed at leave-taking, specifically because of the connection between leave hours and lost trips.[19] Combining 2014–17 data on the number of trips lost at each garage per day with time-card data, we also measure the relationship between different types of leave and lost trips.

B. Operator Descriptives

We have information on 3,011 full-time bus and train operators in our time-card data (see table 2). About 65% of operators drive buses, 21% run light rail trains, and the remaining 14% navigate heavy rail trains.[20] Relative to male operators, female operators gravitate toward train positions: 23.2% (19.6%) of women (men) operate light rail trains, and 17.4% (12.2%) operate heavy rail trains. On average, operators are 47 years old—more than a decade older than the average age in the Boston metropolitan area. The average operator has been with the MBTA for 12.4 years and is being paid $32.68 per hour, more than three times the minimum wage in Massachusetts. About 30% of the MBTA's operators are women, and that share is fairly constant across different seniorities (see table 3; fig. A.7). Female operators tend to be about 2 years younger than male operators but on average have tenures and wages that are almost identical to those of male operators.

Only 26% of operators denote their marital status as married on their W-4 forms, and 20% report having dependents. These numbers are considerably lower than what one sees in the general US population, where 48% of adults were married in 2014 and 53% of adults aged 18–40 had at least one child in 2013 (Newport and Wilke 2013; Masci and Gecewicz 2018). They are also lower than what one sees among US adults with a high school diploma (see table 1). Female operators are less likely than male operators to be married (14% vs. 31%), although female operators are more likely than male operators to report dependents (28.5% vs. 15.6%). The latter could be driven by the fact that unmarried women are more likely than unmarried men to retain custody of their children.

Usage of FMLA leave is especially pronounced among MBTA operators.[21] Nearly 95% of operators applied for FMLA certification between 2011 and

[19] A trip, as defined by the MBTA, is a run from point A to point B and back to point A. Losing a trip means skipping a scheduled run from point A to point B and back to point A.

[20] Light rail trains generally run aboveground, while heavy rail trains generally run in underground subways.

[21] Signed into federal law in 1993, FMLA applies to workers who have been with their employers for more than 12 months and worked more than 1,250 hours in the preceding year. The employer must further have 50 or more employees within a 75-mile radius of the business. It guarantees up to 12 unpaid weeks of job-protected

Table 2
Operator Characteristics

	All Operators (1)	Male (2)	Female (3)	With Schedule Data (4)	With W-4 Data (5)
Age	47.01	47.62	45.65	46.14	45.60
	(10.6)	(10.6)	(10.3)	(9.8)	(10.0)
Female	30.72	.00	100.00	29.48	30.46
	(46.1)	(0)	(0)	(45.6)	(46.0)
Tenure	12.42	12.52	12.20	11.09	11.10
	(7.6)	(7.8)	(7.1)	(6.5)	(6.6)
Hourly wage	32.68	32.66	32.72	34.23	33.88
	(5.4)	(5.4)	(5.5)	(2.8)	(3.4)
Bus	65.53	68.26	59.35	68.78	65.36
	(47.5)	(46.6)	(49.1)	(46.4)	(47.6)
Light rail	20.69	19.56	23.24	20.10	19.93
	(40.5)	(39.7)	(42.3)	(40.1)	(40.0)
Heavy rail	13.78	12.18	17.41	11.12	14.71
	(34.5)	(32.7)	(37.9)	(31.4)	(35.4)
Ever FMLA	75.62	70.85	86.38	78.89	80.46
	(42.9)	(45.5)	(34.3)	(40.8)	(39.7)
Overtime hours per day	.36	.41	.24	.36	.36
	(.4)	(.5)	(.3)	(.4)	(.4)
FMLA hours per day	.28	.23	.37	.25	.26
	(.5)	(.5)	(.6)	(.5)	(.5)
Overtime daily hours share	.06	.07	.05	.06	.06
	(.06)	(.06)	(.05)	(.06)	(.06)
Married					26.19
					(44.0)
Dependents					19.59
					(39.7)
Observations	3,011	2,086	925	1,781	2,318

NOTE.—This table presents summary statistics for the whole sample of bus and train operators (col. 1), male operators only (col. 2), female operators only (col. 3), only the operators for whom we have detailed schedule data (col. 4), and only the operators for whom we have W-4 data on marital status and dependents (col. 5). While we do not have schedule or W-4 data for our entire sample, the subsamples for which we do have data are not considerably different than the main population. Age and tenure are denominated in years; female, bus, light rail, and heavy rail along with married and dependents show the percentage of operators with that trait; hourly wage shows dollars; ever FMLA is the percentage of operators who have ever been approved for FMLA; overtime hours per day shows scheduled plus unscheduled overtime taken on average per day; FMLA hours per day shows the average number of FMLA hours taken per day; overtime daily hours share shows the average daily overtime hours share of work hours plus overtime hours. Standard deviations are in parentheses.

2017. In that time, 75% had received FMLA certification at some point. In an average year, about 45% of operators are approved for FMLA. In contrast, the FMLA certification rate across the MBTA overall is only 18%. In a survey

leave per year. FMLA leave is intended specifically to allow the individual to address specific personal or family medical conditions without losing his or her job. Acceptable reasons for leave include employee illness, childcare, spouse care, parent care, and adoption.

Table 3
Operator Characteristics by Seniority

	All Operators (1)	Top Decile (2)	Middle Decile (3)	Bottom Decile (4)
Age	47.01	55.43	44.30	40.43
	(10.6)	(6.2)	(10.2)	(9.5)
Female	30.72	28.39	31.95	25.65
	(46.1)	(45.1)	(46.7)	(43.8)
Tenure	12.42	25.61	9.07	3.35
	(7.6)	(4.3)	(1.9)	(.9)
Hourly wage	32.68	32.34	34.31	28.81
	(5.4)	(4.9)	(4.6)	(3.2)
Bus	65.53	71.40	61.98	65.22
	(47.5)	(45.2)	(48.6)	(47.7)
Light rail	20.69	18.79	23.00	19.13
	(40.5)	(39.1)	(42.2)	(39.4)
Heavy rail	13.78	9.81	15.02	15.65
	(34.5)	(29.8)	(35.8)	(36.4)
Ever FMLA	75.62	63.26	82.43	60.00
	(42.9)	(48.3)	(38.1)	(49.1)
Overtime hours per day	.36	.60	.32	.29
	(.4)	(.6)	(.4)	(.4)
FMLA hours per day	.28	.25	.27	.19
	(.5)	(.5)	(.4)	(.6)
Overtime daily hours share	.06	.09	.05	.06
	(.06)	(.08)	(.05)	(.05)
Observations	3,011	479	313	230

NOTE.—This table shows summary statistics for the whole sample of bus and train operators (col. 1), for just those operators who are in the top seniority decile (col. 2), for just those operators who are in the 50th seniority decile (col. 3), and for just those operators who are in the bottom seniority decile (col. 4). Notably, the proportion female is fairly consistent across seniority deciles. Age and tenure are denominated in years; female, bus, light rail, and heavy rail along with married and dependents show the percentage of operators with that trait; hourly wage shows dollars; ever FMLA is the percentage of operators who have ever been approved for FMLA; overtime hours per day shows scheduled plus unscheduled overtime taken on average per day; FMLA hours per day shows the average number of FMLA hours taken per day; overtime daily hours share shows the average daily overtime hours share of work hours plus overtime hours. Standard deviations are in parentheses.

conducted by Abt Associates for the Department of Labor in 2018, 15% of employees nationwide had taken FMLA leave, and 56% of employees were entitled to FMLA leave (Waldfogel 2001; Klerman, Daley, and Pozniak 2012; Brown et al. 2020).

As we demonstrate in the sections that follow, FMLA usage among bus and train operators is likely so high because of the rigidity of their work schedules.[22] FMLA serves as a tool for schedule controllability that costs

[22] The MBTA offers all operators, regardless of seniority, 2 weeks of paid sick leave per year. Sick leave can rollover from year to year. Operators who take the most FMLA hours are predominantly those who run out of paid sick days, and those individuals are mostly female operators.

hourly earnings but allows operators to avoid being laid off for taking time off.

Since seniority serves as the mechanism by which schedules, routes, and overtime opportunities are allocated, we also explore differences in our sample across seniority (table 3). The most senior full-time operators have been with the MBTA for more than a quarter century, while the most junior have been there for 3.4 years. Bus drivers are slightly more likely to be senior. Unsurprisingly, given that overtime is distributed according to seniority, the most seasoned operators take more overtime than the least seasoned operators (0.6 vs. 0.3 hours per day). Senior operators also have slightly higher rates of FMLA certification (63.3% vs. 60.0%) and take higher amounts of FMLA-excused unpaid time off on average (0.25 vs. 0.19 hours per day) than the least senior operators.

IV. Accounting for the Earnings Gap

While the average hourly wage barely differs between male and female operators (table 2), in an average week female operators take home $0.89 for every dollar earned by a male operator.

Regressing total weekly earnings on a female dummy variable reveals that male operators earn $1,447.30 per week on average, while female operators earn $160.10 (11%) less (col. 1 of table 4).[23] Controlling for seniority, which determines potential work differences between male and female operators, results in the same gap (col. 2). Comparing male and female operators without dependents (col. 3) shrinks the gap only slightly, to 10%. The earnings gap between unmarried female operators with children and unmarried male operators with children is the largest, at 13% (col. 4).

The earnings gap exists at each seniority level (see fig. 1*A*). However, it narrows somewhat as operators become more senior and the choice sets faced by operators expand. Likewise, the earnings gap persists at each seniority level even for those without dependents (fig. 1*B*).

How does the earnings gap emerge despite identical choice sets? The key lies in differences in overtime acceptance rates and usage of unpaid time off through FMLA. Figure 2 shows an operator's scheduled earnings (the sum of their scheduled monthly work hours multiplied by their wage), adds monthly earnings from overtime work, and subtracts earnings lost from unpaid leave taken through FMLA, arriving at actual monthly earnings.

Figure 2*A* and figure 2*B* perform this exercise separately for male and female operators, showing that the wedge in take-home pay arises from overtime and unpaid leave. Male operators work about two times the overtime hours that female operators work and take about half the FMLA hours off

[23] For the specification with log earnings as the outcome variable, see table A.1 (tables A.1–A.3 are available online). We focus on the dollars specification here because it does not exclude those who work zero hours in a particular week.

Table 4
Gender Differences in Weekly Earnings

	(1)	(2)	(3)	(4)
Female	−160.10***	−158.70***	−145.60***	−138.20***
	(10.17)	(9.92)	(1.41)	(1.58)
Seniority decile		2.71***	3.06***	3.02***
		(.15)	(.16)	(.16)
Dependents = 1			2.76	26.82
			(16.61)	(22.95)
Married = 1				52.48***
				(13.94)
Female × dependents			−33.23	−53.57
			(25.43)	(30.76)
Female × married				−6.97
				(28.36)
Dependents × married				−71.67*
				(33.50)
Female × dependents × married				85.65
				(64.84)
Constant	1,447.30***	1,296.30***	1,316.00***	1,302.70***
	(5.86)	(9.48)	(9.71)	(10.50)
Male mean	1,447.30	1,447.30	1,447.30	1,447.30
Adjusted R^2	.025	.053	.064	.066
Observations	682,583	682,583	571,344	571,344

NOTE.—We regress total weekly earnings on operator gender, seniority decile, marital status, presence of dependents, and regressor interactions. Results are robust to including dummy variables for each decile of seniority instead of a continuous variable. Sans controls, women earn $0.89 on the male-worker dollar (col. 1). Controlling for seniority, female operators still earn $0.89 on the male-worker dollar (col. 2). Female operators without dependents earn $0.90 to the $1 earned by a male operator without dependents (col. 3). Unmarried female operators with dependents earn $0.87 compared with the $1 earned by an unmarried male operator with dependents—the biggest gap in our setting (col. 4). Standard errors are clustered at the individual level and are reported in parentheses.

* $p < .05$.

*** $p < .001$.

throughout the seniority spectrum. As a result, male operators take home more than their scheduled earnings while female operators take home less, until they get to the highest seniority levels. The results that we report in upcoming sections also suggest that with more options that increase schedule controllability, female operators work more hours and earn more.

Figure 2*C* and figure 2*D* perform the same accounting exercise for those who have dependents. Men with dependents take less unpaid time off and work more overtime than the average male operator. Female operators with and without dependents behave more similarly. These figures demonstrate visually why the earnings gap grew when dependents came into the picture in table 4.

The earnings differences we document here are present not only across seniority levels but also extend into retirement. The MBTA offers a defined benefit pension plan to its employees, with annual pension payments determined by a formula hashed out with the union in collective bargaining

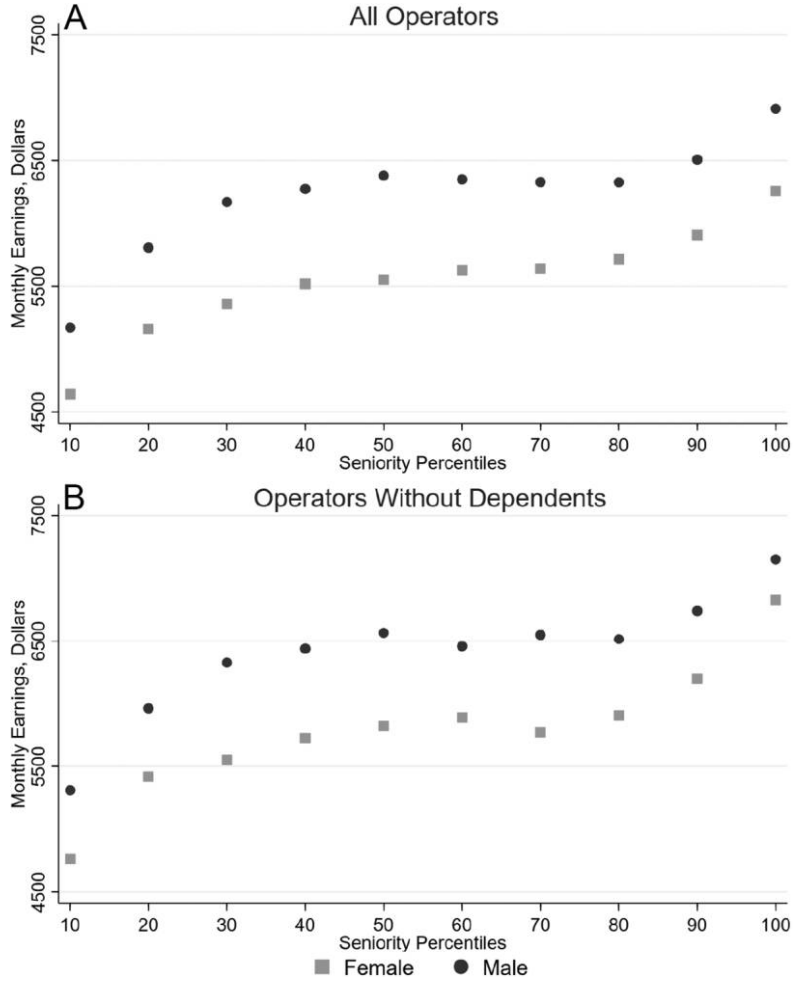

FIG. 1.—Gender earnings gap across seniority. We plot average monthly earnings (*y*-axis) for bus and train operators in each seniority decile (*x*-axis). Seniority is determined for full-time operators based on which operator has the longest tenure within his or her garage each quarter. Seniority determines the order in which routes, schedules, and holidays are picked as well as who has first access to overtime opportunities. Across the seniority spectrum, women earn less than men (*A*). At the lowest seniority level (10), women make about $4,600 per month, while men earn about $5,200 per month. At the highest seniority level (100), women make about $6,300 per month, while men earn almost $7,000 per month. *B* shows the same relationship for operators without dependents. Female operators without dependents earn less than male operators without dependents across the seniority ladder, suggesting that the presence of dependents cannot fully account for the gap in earnings. A color version of this figure is available online.

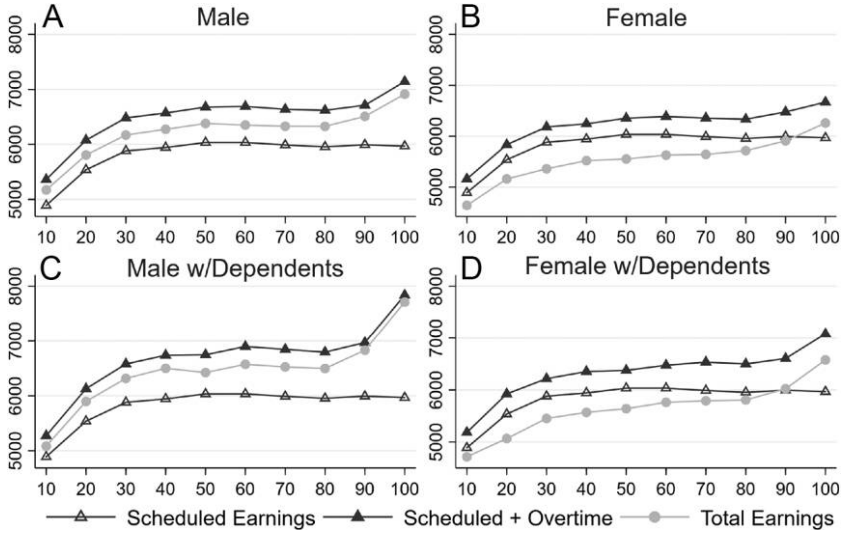

FIG. 2.—Accounting for the gender earnings gap. We perform an accounting exercise to understand the gender earnings gap. We calculate scheduled earnings based on the hours each operator is scheduled to work at his or her regular wage. We then add in the overtime hours (planned and last minute) that the operator actually works at 1.5 times his or her regular wage. Total earnings are scheduled earnings plus overtime earnings, less the earnings forgone due to unpaid leave (FMLA and unexcused). The *x*-axis shows seniority deciles, while the *y*-axis shows monthly earnings in dollars. Each point is the average for operators in a given seniority decile. *A* plots the series for male operators, *B* for female operators, *C* for male operators with dependents, and *D* for female operators with dependents. A color version of this figure is available online.

agreements. The formula takes the average of an operator's three highest earning years and multiplies it by years of service and 2.46% to arrive at the annual pension payment. Since wages are inflation adjusted each year and annual pension payments are not deflated when they are paid out, operators have an incentive to earn the most they can when most senior.

Earnings that are pension eligible include those from regularly scheduled work hours, from built-in overtime and Trippers. Despite the additional pension incentive to work more hours at the highest levels of seniority, we still see female operators working fewer pension-eligible hours than male operators. As a result, the gender earnings gap extends to pension-eligible earnings as well. It is worth noting, however, that the gap in pension-eligible earnings is smaller than it would be if earnings from short-notice overtime were also pension eligible.

We estimate the size of the pension earnings gap using the pension payment formula and average earnings right before retirement. For the average male operator who retired during the course of our sample, the annual pension

payment comes out to $46,677, while for retired female operators it is $41,419.[24] Thus, male operators' annual pension payments exceed those of female operators by $5,258, or 11% per year. Given that the earnings gap at the MBTA is an average of 11% for 2011–17, this number is mostly a reflection of the earnings gap in the workplace.

The collective bargaining agreement also states that an operator will receive 20% of the value of his or her remaining sick leave hours as a lump-sum payment upon retirement. Of those operators who retired between 2011 and 2017, the male operators had an average sick leave balance of 118 hours, while the female operators had 43 hours on average. If we take the average wage at retirement to be $32 per hour, male operators received an average lump-sum payment of $755 upon retirement, compared with $275 for female operators.

V. Roots of the Earnings Gap

The evidence we have seen so far on the earnings gap in our setting leads us to a number of testable hypotheses.

1. *Value of time.* Female operators value time away from work more than male operators.
2. *Schedule predictability.* Female operators take more overtime when it is scheduled in advance than when it is offered on short notice.
3. *Schedule conventionality.* Female operators value conventional schedules more than male operators.
4. *Response to undesirable schedules.* When faced with an unfavorable schedule, female operators are more likely than male operators to take unpaid leave. Male operators replace this lost income with overtime pay, whereas female operators do not fully replace it.

We address each of these hypotheses in the sections that follow.

A. Different Values of Time

One possible explanation for why female operators use less overtime and take more unpaid time off is that female operators may value time away from work more than male operators do. We can assess this hypothesis by looking at how operators behave when offered to work an overtime shift. The seniority structure of overtime offer rules create exogenous variation in the availability of overtime. For all but the most senior operator, the availability of overtime depends on whether more senior operators accepted a given overtime

[24] We calculate $2.46\% \times 70{,}800 \times 26.8 = \$46.677$ and $2.46\% \times 66{,}288 \times 25.4 = \$41{,}419$, respectively. Male operators work an average of 26.8 years at the MBTA prior to retirement, while female operators work 25.4. These differences further widen the pension gap.

opportunity. Assuming that no individual operator can meaningfully affect the decisions of more senior operators, we can treat the arrival of an overtime opportunity as a Poisson process. We capture gender differences in overtime acceptance rates through the following regression:

$$y_{it} = \alpha + \beta F_i + \gamma \mathbf{X}_{it} + \epsilon_{it}, \quad (1)$$

where y_{it} equals 1 if person i accepts an overtime opportunity conditional on being offered it on day t. The term F_i is a female indicator, and $\mathbf{X}_{it}$ is a vector of controls including age, tenure, seniority decile, quarter of the year dummies, and garage fixed effects.

As panel A in table 5 demonstrates, when we look at all offers to work overtime, female operators are consistently less likely to accept them than are male operators. The differences in acceptance rates are most pronounced on weekends and are the smallest on days when operators are already scheduled to work.

These results suggest that (*a*) male operators value overtime work more than female operators and/or (*b*) female operators value not having to work additional hours on top of their scheduled hours more than do male operators.[25]

We explore how family arrangements relate to the differences in propensity to accept overtime. Figure 3 shows that the difference in acceptance rates between male and female operators is higher if the operators have dependents (6.8 percentage points) than if they do not (5.7 percentage points). Male acceptance rates, meanwhile, are similar for the two groups (38.2% for male operators with dependents, 41.1% for male operators without dependents). Although dependents generate this wedge in acceptance rates among married and unmarried operators, the wedge is largest among married operators. Married men with dependents accept overtime opportunities 27.1% of the time, while married women with dependents accept them 19.6% of the time. For unmarried men with dependents the acceptance rate is 40.3%, compared with 33.6% for unmarried women with dependents.

These results are consistent with male operators doing more childcare through their pocketbooks and with female operators doing more childcare through time spent outside work. Differences in caretaking approaches and responsibilities thus appear to be a significant reason why female operators work less overtime than male operators.

It is, of course, possible that the results reflect a constrained choice more than a preference. The fact that differences in overtime acceptance rates are still quite pronounced for operators without dependents and for those who are unmarried also suggests that there is more to this story than our data are able to capture. Intrahousehold dynamics—gender norms, biases, and

[25] Panel A in table 5 also, reassuringly, shows that whether we control for age, tenure, seniority, and garage does not affect the results in a significant way.

Table 5
Probability of Accepting Overtime Opportunity, Conditional on Being Offered

	Any OT (1)	Any OT (2)	Weekend OT (3)	Working OT (4)
	A. All Overtime			
Female	−.076***	−.065***	−.050***	−.037***
	(.005)	(.005)	(.006)	(.006)
Constant	.391***	.410***	.337***	.643***
	(.003)	(.012)	(.016)	(.015)
Controls	No	Yes	Yes	Yes
Male mean		.391	.251	.588
Adjusted R^2	.005	.031	.072	.086
Observations	4,486,458	4,483,428	1,229,163	2,713,663
	B. Preplanned Overtime			
Female	−.054***	−.044***	−.025***	−.021***
	(.005)	(.005)	(.005)	(.006)
Constant	.346***	.391***	.354***	.615***
	(.003)	(.012)	(.016)	(.016)
Controls	No	Yes	Yes	Yes
Male mean		.346	.188	.551
Adjusted R^2	.003	.031	.105	.079
Observations	4,421,339	4,418,865	1,201,454	2,687,499
	C. Short-Notice Overtime			
Female	−.046***	−.043***	−.043***	−.045***
	(.003)	(.003)	(.004)	(.004)
Constant	.095***	.089***	.046***	.118***
	(.003)	(.010)	(.012)	(.012)
Controls	No	Yes	Yes	Yes
Male mean		.095	.105	.108
Adjusted R^2	.006	.012	.019	.017
Observations	3,747,826	3,747,089	995,462	2,246,614

NOTE.—Female operators are less likely to accept overtime opportunities regardless of whether the overtime shifts are offered on a weekend (col. 3) or a day they are already working (col. 4) and regardless of whether the overtime is preplanned (panel B) or short notice (panel C). Any OT reflects accepting overtime on any day, while weekend OT and working OT reflect accepting overtime on a weekend or a day the operator was already working. Preplanned overtime shifts are selected 3 months in advance, while short-notice overtime shifts are offered a day or so in advance. Since short-notice overtime can arise from being caught in traffic, for instance, we define short-notice overtime to be overtime in excess of 2 hours that was not preplanned. The dependent variable is a dummy for accepting an overtime opportunity. Controls include age, tenure, seniority decile, quarter of the year dummies, and garage fixed effects. Results are robust to continuous or dummy seniority variables as well as to additional controls for marital status and the presence of dependents. Standard errors are clustered at the individual level and are reported in parentheses. Overtime in panel A includes preplanned and short-notice overtime.

*** $p < .001$.

differing preferences—are likely keeping married female operators without dependents from accepting opportunities to work more hours at a premium rate. This is consistent with Cortes and Pan (2019), who find that women work more when substitutes for household production relieve constraints at home. The fact that relationships are more stable when the man earns more

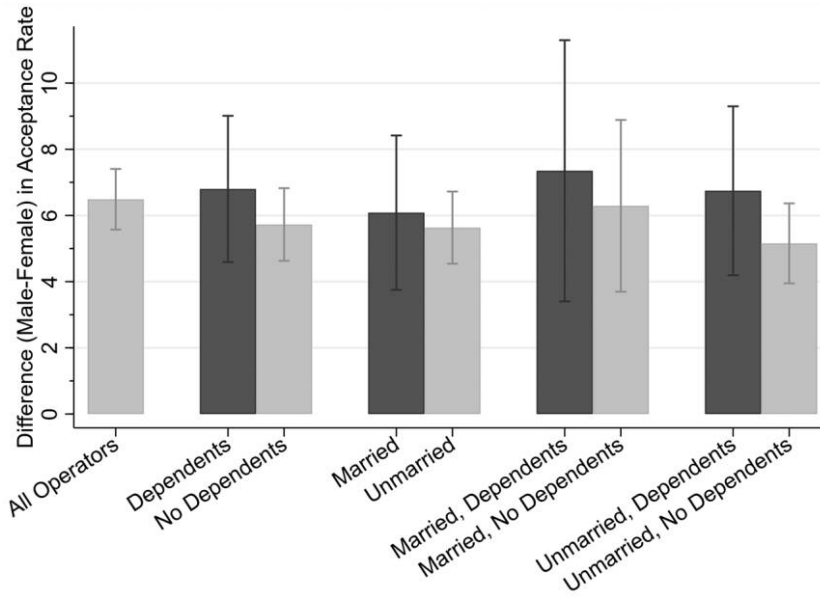

FIG. 3.—Difference between male and female operators in accepting any overtime opportunity. The arrival of overtime opportunities for any individual operator is a Poisson process, allowing us to use the seniority system by which overtime is offered to measure male and female operators' probabilities of accepting overtime. To obtain the difference between male and female operators' probabilities of accepting overtime, we regress a dummy variable for accepting overtime conditional on it being offered on a dummy variable for female and controls for age, tenure, seniority decile, quarter of the year, and garage fixed effects. Results are similar when continuous or dummy seniority variables are used. Each bar reflects the coefficient on the female dummy variable from separate regressions. Standard errors are clustered at the individual level and are used to construct the 95% confidence intervals. We find a 6.4 percentage point difference between male and female operators' acceptance rates of overtime. The difference is slightly greater for those who have dependents (6.8 percentage points). The smallest gap in acceptance rates occurs between male and female operators who are unmarried and without dependents (5.1 percentage points), and the greatest gap arises between male and female operators who are married with dependents (7.5). The male acceptance rate means for each bar are as follows: 40.1% ("All Operators"), 38.2% ("Dependents"), 41.1% ("No Dependents"), 39.5% ("Married"), 41.1% ("Unmarried"), 27.1% ("Married, Dependents"), 42.1% ("Married, No Dependents"), 40.3% ("Unmarried, Dependents"), and 41.4% ("Unmarried, No Dependents"). A color version of this figure is available online.

than the woman could also be part of the explanation (Bertrand, Kamenica, and Pan 2015). The social norm that the man in a partnership should be earning more than the woman has persisted into the 2010s and could help explain why we still see a gender earnings gap even for those who are unmarried

and without dependents (Murray-Close and Heggeness 2018). Finally, our measure of dependents may not be capturing the full set of caretaking responsibilities that land disproportionately on women. Although we do not observe whether an operator has grandchildren or ailing elderly parents, those family members could require care that effectively makes them dependents.[26]

B. Schedule Predictability

Another potential explanation for the gap in overtime hours between male and female operators lies in schedule predictability. If female operators work fewer overtime hours than male operators because they have a higher cost of working unanticipated hours, we should see a larger gap in overtime acceptance rates for short-notice overtime than for preplanned overtime. As described in sections II.C and II.IV, operators can sign up for overtime 3 months in advance at the Pick as well as for short-notice overtime just days or hours before it needs to be worked. Both types of overtime are allocated on the basis of seniority.

Using the same logic as in section V.A, we run regressions to see how male and female operators differ when it comes to working short-notice and preplanned overtime. Panel B in table 5 compares male and female acceptance rates for preplanned overtime, and panel C does the same for short-notice overtime. Male operators accept preplanned overtime opportunities about 34.6% of the time, while female operators accept them about 30.2% of the time—a 13% difference. Preplanned overtime opportunities are much more plentiful than short-notice overtime opportunities, making the results in panel B look similar to those we see for overtime opportunities overall. Results for short-notice overtime acceptance rates, however, present a different picture. Male operators accept short-notice overtime about 9.5% of the time, while women accept them about 5.2% of the time—a 45% difference.

Focusing on differences in hours worked rather than acceptance rates of overtime shifts, table 6 further illustrates the major differences between preplanned and short-notice overtime. Controlling for age, tenure, seniority decile, quarter of the year, and garage fixed effects, we see that female operators work 7.2%–10.9% fewer preplanned overtime hours per month and 40%–48% fewer short-notice overtime hours per month than male operators. The starkest difference between preplanned and short-notice overtime hours worked emerges when we look at operators who are unmarried and have dependents. Female operators who are unmarried with dependents take about 6% fewer preplanned overtime hours than unmarried male operators with dependents but about 60% fewer short-notice overtime hours (table 6, cols. 5 and 6). Schedule predictability and time away

[26] The mean and median age in the lowest-seniority decile is 37 for women and 41 for men (fig. A.8). A substantial number of the operators in our sample could thus be grandparents or have parents that require care.

Table 6
Preplanned versus Short-Notice Overtime

	Preplanned (1)	Short Notice (2)	Preplanned (3)	Short Notice (4)	Preplanned (5)	Short Notice (6)
Female	−.109***	−.480***	−.0715**	−.460***	−.0748**	−.400***
	(.0202)	(.0392)	(.0242)	(.0492)	(.0245)	(.0551)
Dependents			−.0398	.00761	−.0633	.133
			(.0257)	(.0763)	(.0353)	(.101)
Female × dependents			−.0181	−.0472	.0166	−.205
			(.0440)	(.106)	(.0503)	(.127)
Married					.0297	.213**
					(.0273)	(.0672)
Female × married					.0364	−.205
					(.0752)	(.124)
Dependents × married					.0439	−.352*
					(.0537)	(.155)
Female × dependents × married					−.120	.755**
					(.143)	(.252)
Constant	−.0447**	1.254***	−.0434	1.216***	−.0385	1.201***
	(.0505)	(.105)	(.0516)	(.117)	(.0513)	(.117)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	.146	.112	.113	.109	.113	.112
Observations	129,319	141,415	110,447	120,358	110,447	120,358

NOTE.—Women are less likely to take both preplanned and short-notice overtime. We define preplanned overtime to be log hours of preplanned overtime worked per month, where preplanned overtime is selected a quarter (3 months) in advance. Short-notice overtime captures log hours of short-notice overtime worked per month, where short-notice overtime is offered a day in advance or on the same day as the overtime shift. We restrict short-notice overtime to being 2 hours of overtime or more to ensure that it is a proper shift rather than overtime that results from being caught in traffic, for instance. Controls include age, tenure, seniority decile, quarter of the year, and garage fixed effects. Results are robust to continuous or dummy seniority variables. Standard errors are clustered at the individual level and are reported in parentheses.

* $p < .05$.
** $p < .01$.
*** $p < .001$.

from work thus appear to be more valuable to female operators, especially unmarried female operators with dependents.

C. Schedule Conventionality

If female operators are more committed to working conventional schedules than are male operators, a gap in overtime and unpaid hours could emerge as female operators opt to take unpaid leave and not to take on overtime during unconventional periods. By comparing operators' schedule selections during the Pick, we glean that while neither female nor male operators like to work unconventional schedules, female operators avoid these shifts more than men.

Both male and female operators avoid unconventional shifts, such as weekend shifts, shifts on holidays, and split shifts.[27] We deduce preference for conventional shifts from the fact that those who can avoid unconventional shifts do so: the most senior operators, who pick their schedules first, have much lower incidence of these types of shifts relative to operators who choose their schedules later. While 95% of the least senior operators get stuck with a weekend shift on their schedules, only 28% (female operators) to 35% (male operators) of the most senior operators do (fig. 4*A*). The same pattern holds true for holiday shifts and split shifts.[28]

Female operators avoid scheduling weekend, holiday, and split shifts more successfully than male operators throughout the seniority spectrum. Indeed, female operators are on average about 2.5 percentage points less likely to select a weekend shift than are male operators. The gap is 3 and 4 percentage points for holiday and split shifts, respectively.

D. Responding to Undesirable Schedules

Differences in how male and female operators value schedule conventionality translate into behaviors that exacerbate the earnings gap. While all operators take more leave in weeks when they have an undesirable shift, male operators compensate with enough overtime to make more in those weeks than in weeks without undesirable shifts. In contrast, female operators make up some of their lost earnings with overtime, but not all of them.

We consider within-person behavior changes as the desirability of their schedule changes. We regress the number of hours of FMLA leave an operator takes in a week on a dummy variable for whether the operator has, say, a weekend shift scheduled in that week. Figure 5*A* reports the coefficient on the weekend shift dummy variable in regressions that we run for male and female operators separately, including controls for age, tenure, and seniority.

Both male and female operators take more unpaid FMLA leave during weeks where they have to work weekend shifts compared with weeks without weekend shifts. The increase for female operators, however, is substantially larger than it is for male operators. Female operators see an increase of 0.85 hours per week, which represents a 34% increase off of an average of 2.5 hours of FMLA leave taken in non-weekend-shift weeks. Meanwhile male operators take an additional 0.4 hours of leave per week, representing a 28.6% increase off of an average of 1.4 hours of FMLA leave taken in non-weekend-shift weeks. Male operators perfectly offset their FMLA hours

[27] Split shifts are those in which an operator does not work 8 hours straight but instead works a few hours (usually during morning rush hour), has an unpaid break of several hours, and then works the remaining hours (usually during the evening rush hour).

[28] The data that allow us to identify split shifts are only available for July through December 2017.

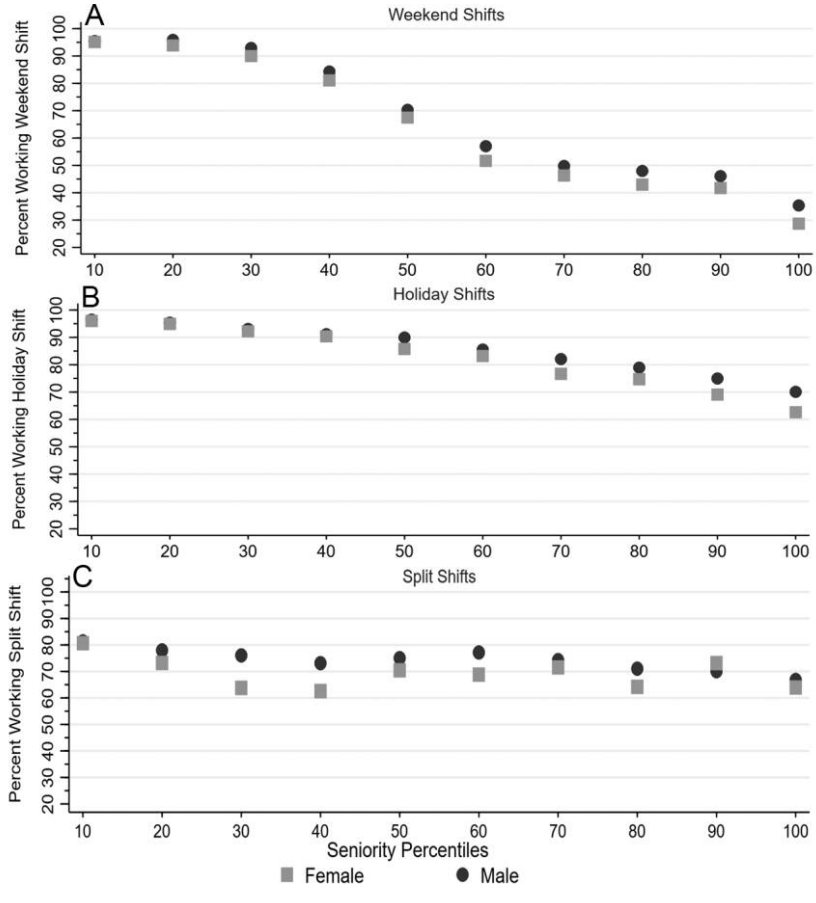

FIG. 4.—Unconventional shifts for male and female operators. The binscatters display the percentage of operators who have to work an unconventional shift (y-axis) for each seniority decile (x-axis). *A* shows this relationship for weekend shifts. *B* shows the relationship for holiday shifts at some point over the 2011–17 period, and *C* shows it for split shifts in any given day. The least senior operators are most likely to schedule themselves one of these unconventional shifts, while the most senior operators, around the 100th percentile, are the least likely to have one of these shifts. These patterns suggest that weekend, holiday, and split shifts are unconventional. Conditional on seniority, which is the same as conditioning on the same choice set of schedules and routes, female operators try to avoid scheduling these shifts more than men. Data for the split shift chart are available only for July through December 2017. A color version of this figure is available online.

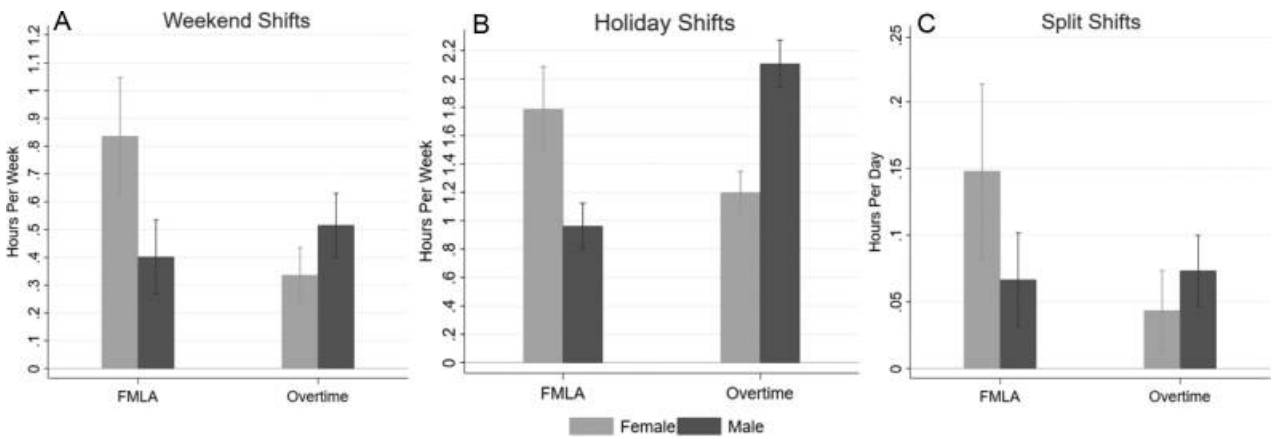

FIG. 5.—Difference in behavior between unconventional and conventional shifts. This chart shows how FMLA and overtime hours taken by male and female operators differ in weeks when they are scheduled to work an unconventional shift from weeks when they are not scheduled to work an unconventional shift. For *A* and *B* we run person-week regressions of FMLA hours taken per week on a dummy variable for whether a weekend or holiday shift was scheduled in a particular week as well as controls for age, tenure, seniority, and operator and month fixed effects. For *C* we do the same, but at the day level. We run these regressions separately for male and female operators. Point estimates for the coefficient on the dummy variable and 95% confidence intervals, using standard errors clustered at the individual level, are presented here. The chart shows that during weeks with unconventional shifts, male operators take more unpaid FMLA hours off and work similarly more overtime, in essence substituting pay at base wage for pay at the overtime rate of 1.5 times the base wage. Female operators take considerably more unpaid FMLA hours of leave during weeks/days with unconventional shifts. While they also work more overtime, the additional unpaid time off exceeds the additional overtime. Thus, during weeks/days with unconventional shifts, male operators earn more than during weeks without unconventional shifts, while female operators earn less. A color version of this figure is available online.

with additional overtime hours. Female operators, on the other hand, fall short of making up lost earnings with overtime hours in weekend shift weeks.[29] By affecting male and female behavior differently, weekend shifts exacerbate the gender earnings gap.

A similar trend occurs with both holiday and split shifts (fig. 5*B*, 5*C*). In weeks where an operator is scheduled to work on a holiday, male operators take an average of one more hour of FMLA leave in those weeks than in weeks without a holiday shift. They also work an average of two more hours of overtime in holiday shift weeks. Female operators take 1.8 more hours of FMLA leave in weeks with a holiday shift and work 1.2 more hours of overtime. On split shift days, male operators take on average 0.07 more hours of FMLA leave and work 0.07 more hours of overtime. Female operators, on the other hand, increase FMLA leave by 0.15 hours—fully three times their increase in overtime hours on split shift days.

Female operators' avoidance of unconventional schedules during the Pick and, when avoiding them during the Pick is not possible, during a particular week demonstrates that female operators prize schedule conventionality more than male operators. We cannot fully determine whether preferences or personal life constraints are driving the choices we observe. However, our evidence shows that increasing the predictability of overtime opportunities and boosting work schedule controllability and conventionality can help female operators work more hours and thereby reduce the earnings gap.

In the following section, we discuss the effects of two policy changes at the MBTA on the earnings gap and suggest other approaches that are grounded in our findings.

VI. Altering Institutional Features

The gender earnings gap observed in our setting emerges because men and women respond differently to the same institutional environment. Consequently, we consider how changing aspects of this environment can affect the gap. Specifically, we focus on two major policy changes undertaken by the MBTA in 2016–17, both with the objective of saving money and reducing absenteeism. One policy made it harder to take FMLA leave, while the other changed which hours qualified as overtime.

A. FMLA

In March 2016, the MBTA hired UPMC Work Partners to be a third-party administrator in charge of making sure that FMLA certification was obtained

[29] Saturday, Friday, and Sunday, in that order, are the likeliest of all days of the week to see an operator take unpaid time off. We are not aware of reasons why family medical emergencies would be more likely to happen on those days of the week than on other days, suggesting that operators are using FMLA to avoid undesirable schedules.

and used properly. UPMC was tasked with ensuring that (1) doctor's notes certifying FMLA eligibility were legitimate and (2) on a day-to-day basis, operators took FMLA leave in the way prescribed by their doctor. In particular, the latter role requires UPMC to ensure that operators who were only certified to take continuous FMLA leave (for weeks or months at a time) did not instead take it intermittently (for spells of several hours or days interspersed with work).

The policy also required operators to bring in new doctor's notes and to recertify their eligibility for FMLA. This policy change took the active FMLA certification rate at the MBTA down from 45% of operators in 2015 to 27% of operators at the end of 2016. FMLA usage among female operators went down from an average of about 35 hours per quarter to 25 hours per quarter—a decrease of 28% (fig. 6). Male operators saw a drop from 20 hours per quarter to about 15 hours per quarter—a decrease of 25%. Additionally, the pretrends here are fairly flat for both male and

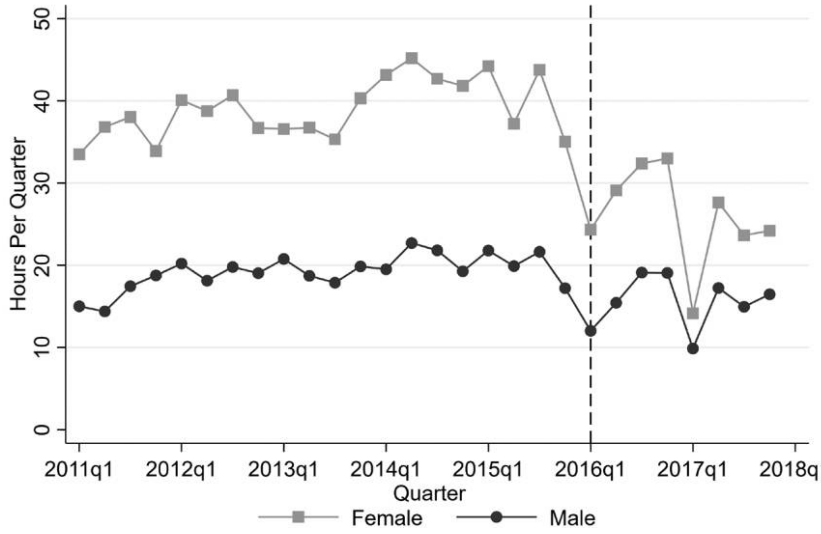

FIG. 6.—Number of FMLA hours, per quarter. The average number of hours that operators take of FMLA leave per quarter is fairly constant from 2011 through 2016. In March 2016 (vertical dashed line), the MBTA hired UPMC Work Partners to be a third-party administrator in charge of making sure that FMLA certification was obtained and used properly. UPMC ensures that doctor's notes certifying FMLA eligibility are legitimate and that operators take FMLA leave in the way that the doctor deemed necessary. This policy change took the active FMLA certification rate at the MBTA down from 45% to 27% of all operators. As the chart shows, the drop in FMLA usage was most pronounced for female operators but was also present for male operators. A color version of this figure is available online.

female operators, suggesting that the drops are associated with the policy change.

Another consequence of the policy was an increase, especially among female operators, in unexcused leave. Figure 7 illustrates vividly how the FMLA policy has led to a spike in unexcused leave, with female operators going from taking an average of 2 hours per quarter to an average of 16 hours in 2017q3 (fig. 7*A*). Male operators increase unexcused leave from 2 hours per quarter to about 6. The flat pretrends here as well, at 2 hours per quarter for both men and women, suggest that we are capturing the effect of the policy on operator behavior. Moreover, in line with our earlier finding that the presence of dependents exacerbates the earnings gap but does not explain all of it, the increase in unexcused leave is slightly steeper for those with dependents than for those without dependents (fig. 7*B*, 7*C*).

Those who took more FMLA leave in 2015, before the policy change, were the ones who saw the biggest increase in unexcused leave in 2017, after the policy change (fig. 8*B*). In contrast, the relationship between earlier years' FMLA usage and subsequent years' unexcused leave is flat (fig. 8*A*).

Exits increased after the policy change.[30] Beforehand, 7.4 people exited per month. Afterward, 10.3 people exited per month. Additionally, after the policy change, more of the exiting operators were women: before the March 2016 policy change, 29.8% of the operators exiting were female. From March 2016 through 2017, that figure was 32.7%. This aligns with our assessment that women were more affected than men by the policy change. While the female operators who exit after the policy change are more likely to have dependents (29.2%) than the male operators who exit (12.7%), these numbers are fairly representative of our sample overall—28.5% of the female operators and 15.6% of the male operators in our entire sample have dependents (table A.2).

Although there was some substitution from FMLA leave to unexcused leave—1 FMLA hour transformed into 0.1 unexcused hours—in total there was still a reduction in the amount of leave taken by both male and female operators. This incomplete conversion reflects the fact that unexcused leave is considerably costlier to take than FMLA leave.[31] Whereas FMLA leave is protected under federal law and is no questions asked, unexcused leave can result in warnings, suspensions, limits on ability to work overtime, and ultimately recommendations for discharge. The fact that operators, particularly

[30] We cannot distinguish firings from voluntary exits in our data.

[31] An explicit policy explaining the relationship between unexcused leave and disciplinary actions went into effect at the same time as the FMLA policy change. See fig. A.9 for the relationship between unexcused leave and disciplinary actions in 2016–17. Unexcused leave was likely costlier than FMLA even before the policy change, since operators mostly used FMLA, and not unexcused leave, to avoid undesirable schedules.

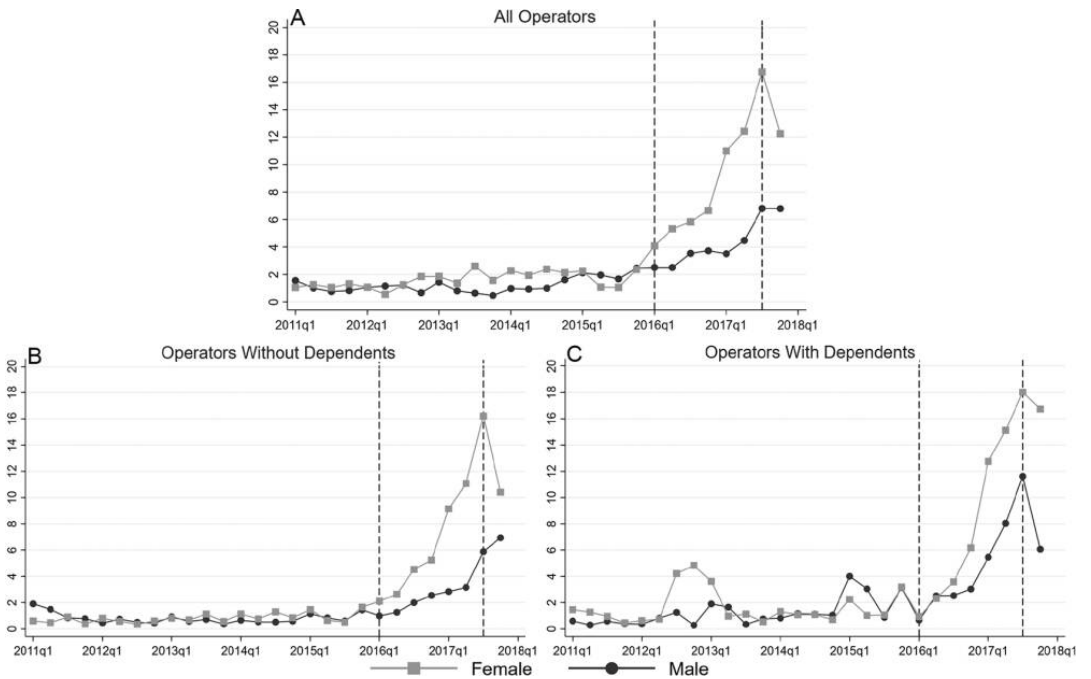

FIG. 7.—Hours of unexcused leave, by quarter and gender. *A* shows the average number of hours of unexcused leave taken by operators of each gender from the first quarter of 2011 to the last quarter of 2017. The leftmost dashed vertical line denotes the introduction of the FMLA policy (March 2016), and the rightmost dashed vertical line denotes the introduction of the overtime policy (July 2017). *B* plots the series for male and female operators without dependents. *C* depicts male and female operators with dependents. A color version of this figure is available online.

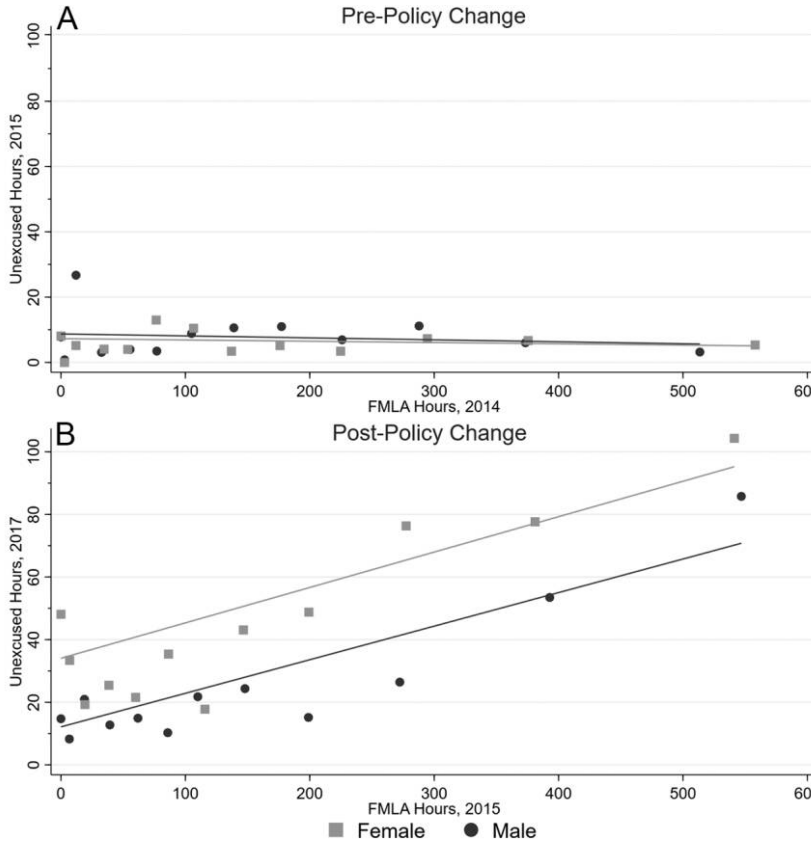

FIG. 8.—FMLA leave versus unexcused leave, before and after policy change. We explore whether there is a relationship between the amount of FMLA leave an individual takes in a given year and how much unexcused leave they take in a subsequent year. Between 2014 and 2015, when there is no intervening policy change, there is no relationship between FMLA leave and subsequent unexcused leave taken in the following year (*A*). In contrast, those who took more FMLA leave in 2015 tended to take more unexcused leave in 2017, the year following the MBTA's policy change (*B*), suggesting that there is substitution from FMLA to unexcused leave. Observations are at the person-year level. A color version of this figure is available online.

female operators, are nevertheless willing to take unexcused leave reaffirms how much they value schedule controllability.

While the policy reduced absenteeism, its impact on overtime and service provision was more tepid. By being more predictable and more easily substituted by operators on the cover list at regular wages, FMLA leave translates into fewer lost trips than does unexcused leave. As figure 9 shows, 0.18 trips are lost per FMLA hour on average, versus 0.27 trips per unexcused

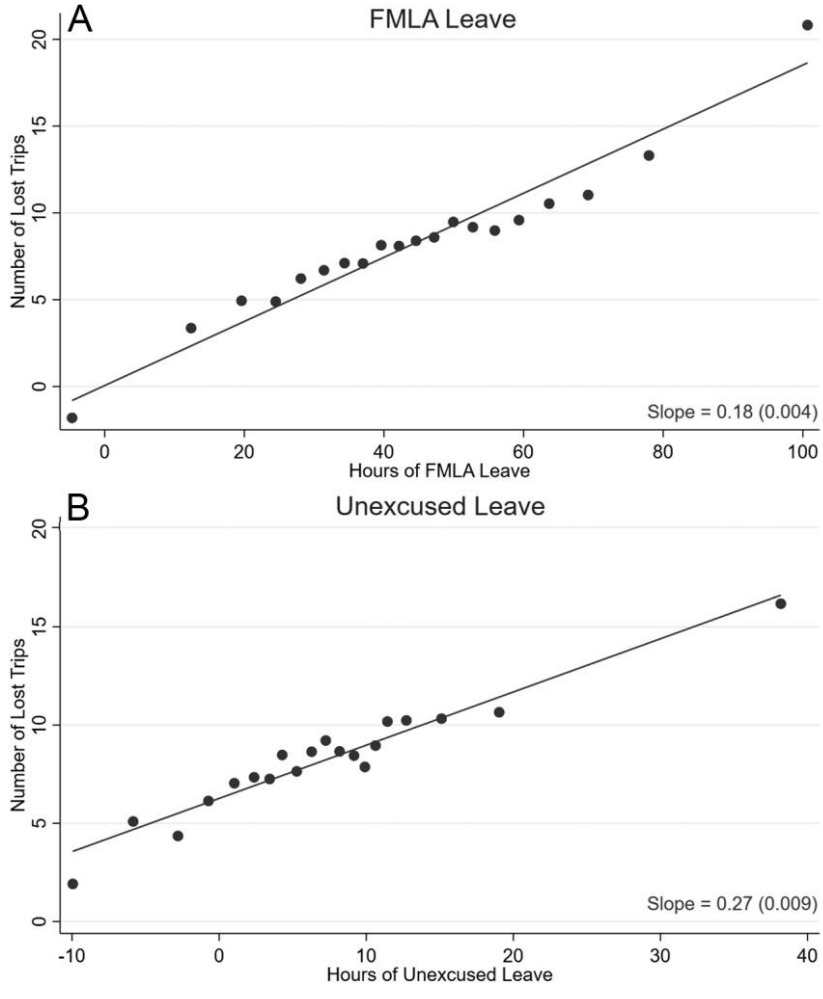

FIG. 9.—Lost trips and leave-taking. Unexcused leave tends to result in a greater number of lost trips than FMLA leave in part because they are harder for supervisors to plan for. The number of lost trips as a result of operator absence (*y*-axis) is related to the total number of hours of leave taken by operators in the same garage on the same day (*x*-axis). One hour of FMLA leave results in 0.18 of a lost trip (*A*), whereas one hour of unexcused leave results in 0.27 of a lost trip (*B*). Displayed are the residualized relationships (controlling for week and garage fixed effects), so some of the points show negative hours. The slopes of the unconditional relationships are similar. Standard errors are in parentheses. Lost-trip data are available for 2014–17. A color version of this figure is available online.

hour. By pushing operators to substitute toward leave that is harder for supervisors to manage and accommodate, the policy achieved only a muted improvement in service provision.

Thus, two takeaways emerge from this policy change. First, while unexcused leave is costlier than FMLA leave, operators use it nonetheless, revealing that they need a mechanism that provides some control over their schedules. By forcing them to use a costlier option for such control, the policy change made operators, especially female operators, worse off. Second, while absences and overtime went down, service provision failed to improve. Unexcused leave, unlike excused leave, entails no advance warning from the employee, making it harder for supervisors to manage. The productivity of operators that now resort to unexcused leave has consequently declined.

B. Overtime

The second policy change was announced at the end of 2016 with the new collective bargaining agreement but did not go into effect until July 9, 2017.[32] Overtime went from being defined as any time in excess of 8 hours worked in a day to any time worked in excess of 40 hours in a week. The result, as we can see in figure 10, was a drop in the average number of overtime hours worked by male operators from about 40 hours per quarter to about 10 hours per quarter. Female overtime hours dropped, from about 20 hours to about 10 hours per quarter.[33] The pretrends are fairly flat from 2011, through the FMLA policy change in 2016, and up to the third quarter of 2017, when the overtime policy actually took effect.[34]

On their own, the FMLA policy curtailed operators' ability to take leave, while the overtime policy limited operators' opportunities for additional earnings. In conjunction, the policies made it harder for operators to engage in the kind of gaming we discuss in section V.D, in which operators take regular pay hours off and make them up with overtime hours at premium pay. Indeed, the percentage of male operators who took FMLA leave and overtime in the same week dropped after the policy changes by 41% (from 22% to 13%). Similarly, the percentage of female operators who took both FMLA leave and overtime in the same week dropped by 37% (from 16% to 10%). While reducing gaming by both sexes, the policies also reduced operator ability to shift their work hours around, effectively eliminating the hack operators used to have more control over their schedules.

[32] The policy was supposed to go into effect on January 1, 2017, but a software issue delayed the rollout until July 9, 2017.

[33] Here, overtime refers to both preplanned and short-notice overtime.

[34] The fact that the announcement of the policy at the end of 2016 does not have an immediate impact on overtime hours is evidence that either (*a*) operators have no control over when they are offered overtime or (*b*) operators do not find loading up on overtime in advance to be worthwhile. Our results and our conversations with MBTA personnel suggest that the former is the most likely explanation.

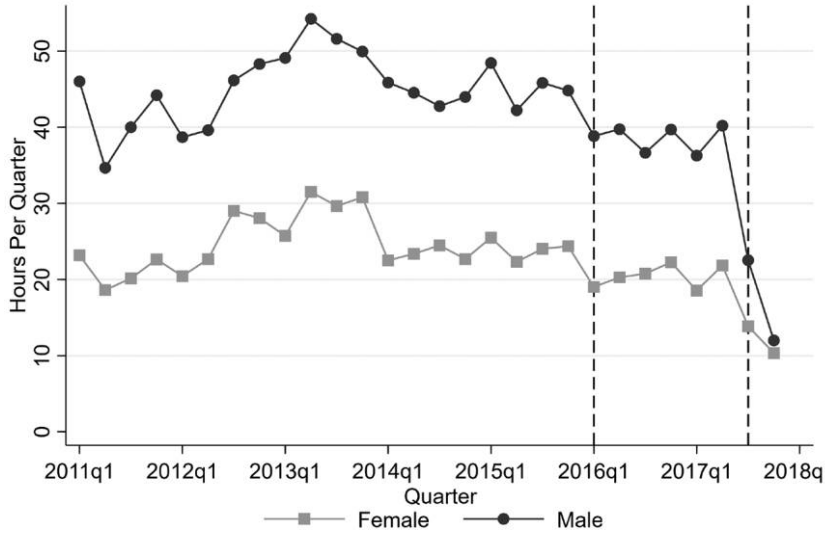

FIG. 10.—Number of overtime hours, per quarter. This chart shows how the average number of hours that operators take of overtime per quarter changes throughout our sample, from 2011 through 2017. The vertical dashed line at 2016q1 represents the MBTA's policy change on FMLA. In March 2016, the MBTA hired UPMC Work Partners to be a third-party administrator in charge of making sure that FMLA certification was obtained and used properly. UPMC would now ensure that doctor's notes certifying FMLA eligibility were legitimate and that, on a day-to-day basis, operators took FMLA leave in the way that the doctor deemed might be necessary. This policy change took the active FMLA certification rate at the MBTA down from 45% to 27% of all operators. The dashed line at 2017q3 shows the timing of the introduction of the MBTA's new policy on overtime. Overtime went from being defined as any time in excess of 8 hours worked in a day to any time in excess of 40 hours worked in a week. The result was a drop in the average number of overtime hours worked by male operators from 40 hours per quarter to about 10 hours per quarter. Female hours dropped as well, but by a considerably smaller amount. A color version of this figure is available online.

Since male operators had been engaging in these trade-offs more than female operators, the reduction in gaming capacity was mostly felt by the former. This is illustrated in the narrowing of the differences in leave-taking and overtime patterns between weeks with weekend shifts and weeks without. Figure 11 shows the differences in 2011–15, prior to the policy change, and in 2016–17, after it. Differences in 2016–17 between weeks with and without weekend shifts are considerably smaller than the differences we see in 2011–15. To the small extent that operators are continuing to cover their FMLA hours with overtime hours, there is now essentially no difference in the way that male and female operators do so. As a result of the policy changes, weekend shifts no longer contribute to the gender earnings gap.

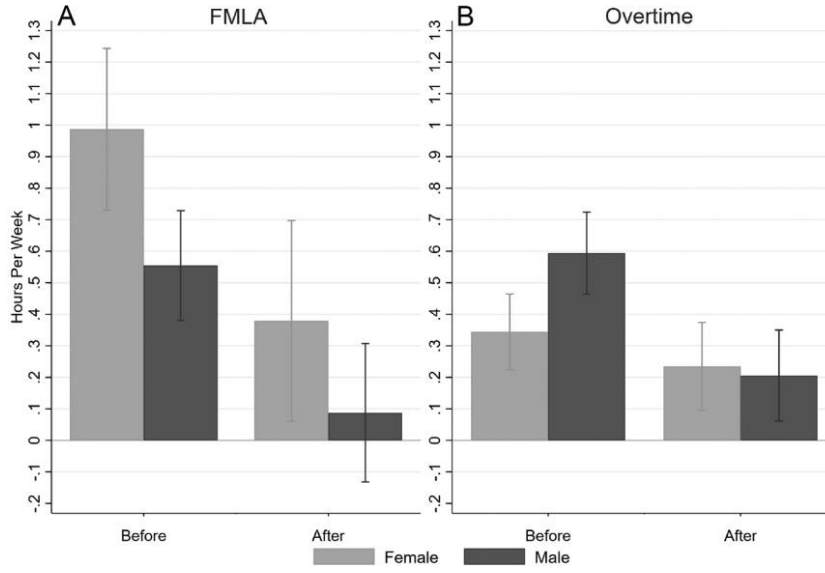

FIG. 11.—Weeks with weekend shifts versus no weekend shifts, before versus after policy changes. The policy changes enacted by the MBTA reduced how much control operators could exercise over their schedules using FMLA and overtime hours. After the policy changes, weekend shifts played a smaller role in exacerbating the earnings gap. In 2011–15 ("Before"), prior to the policy change, operators who had weekend shifts took considerably more FMLA and overtime hours in those weeks than in 2016–17 ("After"), after the policy change. These graphs reflect the coefficients from person-week regressions of FMLA (overtime) hours taken per week on a dummy variable for whether the operator had a weekend shift scheduled as well as controls for age, tenure, seniority, and operator and month fixed effects. We run these regressions separately for male and female operators, clustering standard errors at the individual level. We display the coefficients on the dummy variable in this chart, along with 95% confidence intervals. A color version of this figure is available online.

The policies discussed above were aimed at reducing absenteeism at the MBTA, but they also narrowed the earnings gap, from $0.89 in 2015 to $0.94 in 2017. The policies illustrate, however, that not all ways of shrinking the gender earnings gap are created equal, and some affect different workers differently. The increased oversight over FMLA usage has decreased female operator well-being by reducing their schedule controllability. The decrease in overtime hours decreased male operator well-being by decreasing the value of the extra work hours they previously wanted to work. The impact on the public is likewise mixed. While operators are now taking less leave and the MBTA is spending less on overtime, saving taxpayers dollars, service provision did not see the desired effect of reduced absenteeism. More unexcused leave is harder to plan around, and less overtime availability exacerbates the difficulty in filling shifts.

VII. Conclusion

We show that a gender earnings gap can exist even in an environment where work tasks are similar, wages are identical, and tenure dictates promotions. The 11% earnings gap in our setting arises from female operators taking fewer overtime hours and more unpaid time off than do male operators. Consequently, we observe that gender-neutral policies can have differential effects on the two sexes.

We find that female operators value time as well as schedule controllability, conventionality, and predictability more than male operators. Male and female operators choose to work similar hours of overtime when they are scheduled months in advance, but male operators work nearly twice as many overtime hours when they are scheduled on short notice. Moreover, male operators game the overtime system more than female operators: when faced with an undesirable schedule, male operators take unpaid time off but also work more overtime during the rest of the week, resulting in an increase over base income. These results are consistent with female operators having less flexibility in their personal lives than male operators.

In an effort to reduce absenteeism and overtime expenditures, the MBTA implemented two policy changes: one that made it harder to take unpaid time off with FMLA, and another that made it harder to be paid at the overtime rate. While the policy changes reduced the gender earnings gap from 11% to 6%, they also decreased both male and female operators' well-being. Constraining work schedule controllability disproportionately reduced female operators' well-being and productivity; reducing overtime hours disproportionately lowered male operators' well-being while increasing their productivity. Because men and women face different personal life preferences and constraints, workplace policies, even if gender neutral by construction, can affect male and female workers differently.

We suggest that workplaces—especially those that involve shift work or have seniority-apportioned amenities—can improve their employees' satisfaction and reduce gender earnings gaps by increasing schedule predictability and controllability. Shift sharing and dynamic cover lists are some of the ways of achieving these improvements. Workplaces that provide defined benefit pension plans will also see the gender pension gap narrow. The changes should allow female workers to work more hours, reducing absenteeism and overtime pay and improving the reliability of service provision.

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