Biological Gender Differences, Absenteeism, and the Earnings Gap: Comment

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May, 2009

Abstract

In a recent paper, Ichino and Moretti (2009) present evidence from a large Italian bank that much of the gap in absenteeism between women and men can be explained by absences with a 28-day cycle. These cyclical absences are interpreted as an effect of menstruation which can explain 14% of the gender earnings gap. While the health consequences of menstruation are undeniable, the general importance of menstruation in explaining gender gaps in absenteeism and earnings is unclear. In this paper, we show that 28-day cycles do not explain any of the gender gap in absences among teachers in the New York City public schools. Our results suggest that menstruation may not be an important determinant of absences for a large segment of the female labor force and that institutions greatly influence how biological gender differences affect labor market outcomes.

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* Correspondence should be sent to jonah.rockoff@columbia.edu. We thank Doug Almond, Janet Currie, Lena Edlund, Ray Fisman, and Wojciech Kopcuk for their comments and suggestions. Mariesa Hermann's work is supported by a National Science Foundation Graduate Research Fellowship. Any opinions, findings, conclusions or recommendations expressed in this study are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. All errors are our own.

The differences in wages, earnings, and occupations between men and women have been a focus of study by economists for quite some time (see Goldin (1990), Blau and Kahn (2000)). In a recent paper, Ichino and Moretti (2009), hereafter IM, conclude that gender gaps in earnings and promotions can be partly attributed to absenteeism by women during menstruation. Their primary evidence for this conclusion is that young women in a large Italian bank take an unusually high rate of absences 28 days apart, relative to men and older women.

The conclusion by IM that biology explains part of the gender earnings gap is potentially important and deserves scrutiny. Indeed, IM are careful to note that their “findings are based from only one firm and their external validity is unclear.” In this paper, we show that there is no unusual 28-day cycle of absences for women, young or old, who teach in the public schools of New York City. This suggests that menstruation may not be an important determinant of absences for a large segment of the female labor force.[2]

We believe that the simplest explanation for this difference is financial incentives. As IM note, “under Italian law, workers can take an almost unlimited number of paid sick days.” However, public school teachers in New York City typically are limited to only ten paid sick days per year. In addition, when teachers retire, they are paid for the rights to absences they earn over their careers but do not use. We also believe that teachers value student learning and are likely to internalize the effects of their presence on the educational production process, raising the non-monetary cost of an absence.

We address several alternative explanations for our findings. First, we establish that female teachers are absent more than their male colleagues, although these gender gaps are smaller than those documented by IM in their sample of bank employees. Second, teachers do

[2] In 2008, elementary and middle school teachers was the third most prevalent occupation for employed women in the United States, behind secretaries/administrative assistants and registered nurses; 3.5% of employed women worked as elementary or middle school teachers. (http://www.dol.gov/wb/stats/main.htm, accessed 5/16/2009)

not have stronger financial incentives than bank employees to avoid absences in order to secure a pay raise; their wages are set through collective bargaining and based solely on years of experience and education. Finally, we address whether our results might be driven by a reduction in the benefits of absence during menstruation due to higher prevalence of hormonal contraceptive use among women in our sample.[3] We find no evidence of 28-day absenteeism cycles during the 9-12 months before a female teacher takes maternity leave, a period during which she is highly unlikely to be using birth control.

The rest of the paper proceeds as follows. In Section 2, we describe the data and present summary statistics. Section 3 replicates the IM methodology and demonstrates the lack of any 28-day cycle in absences among female teachers. Section 4 contains our analysis of absenteeism among women who later take maternity leave. Section 5 concludes.

2. Data and Summary Statistics

New York is the largest school district in the United States and employs roughly 80,000 teachers annually to staff 1,500 schools. Teachers are employed under the same collectively bargained contract, and their job characteristics only vary to the extent that they teach different subjects or their students have different characteristics. Teachers work full time and are paid based on a salary schedule that depends only on their years of experience and level of graduate education. Each year that teachers work, they earn ten days of paid absence for illness. Teachers can take only ten days of paid absence per school year for illnesses that are "self-treated";

[3] Hormonal birth control methods are known to alleviate some of the symptoms associated with menstruation. Whether women in our sample are more likely to use hormonal contraceptives than the Italian women studied by IM is unclear. In 2002, roughly 20 percent of American women aged 15-44 were currently using hormonal contraception, and over 80 percent had used it at some point in their lives (Mosher et al. (2004)). Among *married* Italian women, roughly 14 percent used hormonal contraception in 1995. Among sexually active Italian women who wished to avoid pregnancy, about 30 percent were using hormonal contraception in 1993 (Oddens (1996)).

absence do not count towards the annual cap if a doctor completes a form certifying that an illness rendered the teacher "incapacitated for school duties." Days of absence that teachers earn but do not use during the year accumulate (up to a maximum of 200 days), and can be used in future years. Importantly, teachers are paid 1/400th of their salary for each accumulated unused day remaining when they retire or resign.

We use data on all absences taken by all full-time public school teachers in New York City during the school years 1999-2000 through 2003-2004. We also use data on teacher characteristics (e.g., demographics, education, and experience) from employee payroll files, and data on extended leaves taken during this time period (e.g., sabbatical, maternity leave).[4] We can distinguish absences taken for a number of special reasons (e.g., jury duty, military service, funeral, or religious holiday) which teachers are permitted to take but for which they are not paid. These comprise 24 percent of absences and, to be more in line with the data used in IM, we remove them from the analysis. Absences taken for illness that are medically certified are also distinguishable, but absences for illness that are not certified cannot be separated from absences taken for other personal business.

We follow IM by separately analyzing men and women at or above the age of 45 from younger workers.[5] IM also drop "all employees who took maternity leave at any point" from their sample. In addition to dropping all teachers who ever took maternity leave, we drop all absences for the year in which a teacher took any extended leave of absence (i.e., medical, sabbatical) or left their teaching position before the end of the school year.

[4] Kane et al. (2008) and Herrmann and Rockoff (2009) provide more detail on these datasets. Although our data on absences extends through the school year 2007-2008, we lack data on extended leaves for these later years.

[5] Specifically, we assume a teacher's age equals the calendar year corresponding to the end of the school year minus the year in which he or she was born. For example, during the school year 1999-2000, a teacher born in 1955 would be classified as 45 years old.

Our dataset includes 81,994 female teachers and 30,604 male teachers. Summary statistics on teachers' characteristics and absences, separated by gender and age category, are shown in Table 1. Teaching has historically been one of the most common female professions, and it is not surprising that we see a clear majority of women among both older and younger teachers (72 and 76 percent, respectively).[6] Within age categories, teachers of both genders are similar in their average age and years of teaching experience, and females tend to be somewhat more likely to have a master's degree. Rates of absence are higher for younger women than young men (6.6 vs. 6.2 per year) and higher for older women than older men (7.0 vs. 6.7 per year). Thus, the stylized fact that (younger) women are absent more often than their male colleagues holds in this setting, although the gaps are smaller than in the Italian bank examined by IM.[7] The difference in absences among women is driven primarily by absences where a doctor has certified an illness. Indeed, the gender gaps in medically certified absences (1 day for younger teachers, 0.4 days for older teachers) are larger than the overall gender gaps.

One of the reasons why female teachers may be absent more often than their male colleagues is if they tend to work with students who themselves are more often ill and contagious. For example, teachers in elementary schools (serving younger children) are more likely to be female than teachers in high schools. In order to investigate this possibility, we examine residuals taken from a regression of teacher absences on fixed effects for a teacher's subject area and school fixed effects.[8] The differences in average "residual absences" between female and male teachers are slightly smaller, but do not change the qualitative conclusions from these comparisons (see bottom of Table 1).

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[6] A similar fraction of school principals in New York are female, though this fraction has grown significantly over the past 25 years.
[7] In their data, female employees averaged roughly 13 absences per year compared to only 8 for males.
[8] We would like to control for the grade level(s) taught by each teacher, but this information is not available.

3. Is there a 28-day Cycle in Female Absenteeism?

We first present graphical evidence of potential absenteeism due to menstruation. In Figure 1, we plot the distributions of days between consecutive absences by gender (top panel) and the difference in the distributions (bottom panel).[9] Following IM, we restrict our attention to distances between absences of 50 days or less, and our graphical analysis is restricted to periods following absences that occurred at least 50 days prior to the end of the school year. Our reading of this figure is that there is no spike in the density of distance between absences at or around 28 days for female teachers relative to male teachers. We do find that women show a higher probability of having consecutive days of absence (i.e., a distance of one day) and absences three days apart. The latter effect is driven by absences occurring on Mondays following a Friday absence; in other words, female teachers are more likely than their male colleagues to have absences that result in "long weekends."[10]

[9] It is somewhat unclear from IM whether they aggregate consecutive days of absence into spells. Although they refer to "absence spells" and "the beginning of each absence," Figures 1 and 3 in their paper contain points for absences that start one day apart, which is impossible in a spell level dataset unless one only measures the number of full days between absence spells, including the day of the start of the first absence spell (e.g., a worker absent on the 1st and 3rd of the month has only one full day between absences. However, this alternate measurement would not be in line with the 28-day average menstruation cycle. A woman who begins a 28-day cycle on January 1st will begin her next cycle on January 29th, leaving only 27 full days between the days when the cycles start. We therefore present results from our analysis of disaggregated absence data. However, we find no evidence of 28-day cycles if we aggregate based on either consecutive calendar days (i.e., only adjacent absences within the same work week) or consecutive work days (i.e., including "adjacent" absences that span work weeks, but not those that span long periods of school vacation).

[10] It is worthwhile to note that the densities of the distributions for both men and women increase markedly for distances that are multiples of seven. This is a mechanical effect due to the fact that New York City schools are not open on weekends. Thus, conditional on the date of a prior absence, the probability that school is open seven days later (or any multiple of seven days later) is considerably higher than for any other. This is also likely driving the spikes at seven day intervals found by IM. Most Italian banks are not open on weekends, though some open for a shortened business day on Saturday. To illustrate that this is not due to any peculiarity in our data, we plot densities for simulated data on 50,000 workers, half of whom are female, who are absent on random dates during a period of 1,000 calendar days; females are absent on work days with a 5 percent probability and males are absent on work days with a 3 percent probability. This plot (Appendix Figure 1) also shows peaks on seven day intervals. In order to be sure that the increased density at multiples of seven does not drive our results, we plot densities of the distance between consecutive absences for male and female teachers (and the difference between these densities) focusing only on periods where the first absence occurred on a Wednesday (Appendix Figure 2). As expected, there are no spikes on multiples of seven, and the densities drop to zero for distances where the second absence would fall on a weekend (i.e., 3, 4, 10, 11, etc.). However, the lack of any unusual increase in female absences on 28-day intervals remains the same.

As noted by IM, examining consecutive absences may understate the degree to which absences occur on a 28-day cycle. For example, a teacher absent on the 1st, 5th, and 29th of January would only be coded as having absences at distances of 4 and 24 days. We follow IM by examining the distance between any two absences that occur within the same 50 day period. Figure 2 shows the gender difference in the distributions of absence distance, plotted separately for teachers under the age of 45 and teachers age 45 or older. Again, we see no evidence that women, young or old, have an unusual spike in absences with a distance at or near 28 days. Interestingly, when we examine all pairs of absences, consecutive absences comprise a relatively smaller portion of absences for younger female teachers than for younger male teachers.

In addition to plotting raw data, we follow IM and generate Kaplan Meier estimates of hazard rates for absences, separately for men and women of different age groups. These hazard rates (and the difference in hazards between genders) are shown in Figure 3. Again, there is no evidence of unusual gender differences at or near 28 days, and it is clear that women, particularly those under age 45, have a greater hazard than men for absences on consecutive days.

Finally, we provide estimates from Cox proportional hazard models of the importance of 28-day cycles for explaining female absences. Our specification includes an indicator for whether the teacher is female and interactions of the female indicator with indicators for absences occurring at distances of 1 day, 3 days, and each distance that is a multiple of 7. We present results for teachers in three age groups (under 45, 45 and older, and above 55), and for models with and without controls for observable teacher characteristics (i.e., age, teaching experience, having a master's degree) and day of the week.[11] These results are displayed in

[11] Note that this is more flexible than the models estimated by IM, which include interactions between a female indicator and an indicator for distances that are multiples of 7 and an interaction between a female indicator and an indicator for 28 days. Also, unlike IM, we cannot control for whether a teacher is married or whether a teacher has

Table 2. Again, female teachers (particularly those under 45) are more likely to have absences on consecutive days than their male colleagues and more likely to have absences at a distance of three days (due to the "long weekend" effect). However, in none of these specifications do our estimates indicate an unusual increase in female absenteeism due to 28-day cycles.

4. Does Birth Control Mitigate 28-Day Absence Cycles Among Teachers?

In their paper, IM speculate that 28-day cycles may be less prominent "in areas where [birth control] pill use is more widespread." Hormonal contraceptives can dampen symptoms associated with menstruation and thus might be expected to decrease the incidence of absences with a 28-day cycle. However, as noted in IM, these contraceptives also tend to make menstrual cycles more regular, so any absences due to menstruation would be more likely to occur in 28-day cycles.

Although we do not have data on the teachers' use of hormonal contraceptives, we can ask whether women highly unlikely to be using hormonal contraceptives—i.e., those who become pregnant in the near future—exhibit more evidence of a 28-day cycle than other women. Specifically, we take the first instance of maternity leave for women in our data—there are 3,697 such leaves—and examine absences that occur between 280 and 380 days prior to their maternity leave.[12] To ensure our results are not driven by the timing of pregnancies, we randomly match each of these "soon to be pregnant" teachers with a female teacher under the age of 45 in our main dataset (none of whom ever took maternity leave), and examine absences for this matched teacher during the same period of the calendar year.

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children. However, our results are quite insensitive to the controls we do include in the model, and we doubt that the addition of this information would change the qualitative nature of the estimates.

[12] Average gestation in the U.S. is estimated at 280 days (40 weeks). However, women typically start maternity leave several weeks prior to giving birth. One should therefore view our sample restriction as focusing on the 100 day period leading up to a few weeks (or days) before pregnancy.

In Figure 4 (top panel), we plot the distributions of distance between absences for teachers in the days prior to pregnancy and for their matched counterparts. There is no unusual increase in absences with a 28-day cycle for either group, though the density for both groups of women is much higher for absences on consecutive days. In order to make sure the scale of the graph does not dampen any noticeable 28-day effect, we plot the same data without the point for absences on consecutive days (Figure 4 bottom panel). Again, nothing unusual happens at distances of 28 days, and the figures for the two groups look very similar.

5. Conclusion

We find that absenteeism by female teachers in New York City does not possess the 28-day cycle found by IM among female employees at an Italian bank. We interpret this to mean either that the physical effects of menstruation are milder for women in our sample or that the costs of absence are greater. We prefer the latter explanation, and provide evidence that one likely culprit for physical differences—birth control—does not explain our findings.

In our view, the simplest explanation for our results is higher financial cost of absence among teachers in New York; they face an annual cap on paid absences and they are paid for unused absences when they retire. There are, of course, other plausible mechanisms. One important channel may be that teachers internalize the impact of their presence on student achievement. When teachers are absent, their students are taught by substitutes who are generally less qualified and may not possess any prior knowledge of the lesson they are assigned to teach, and recent research finds that teacher absences have a negative impact on student achievement in the U.S. (Clotfelter et al. (2009), Miller et al. (2008), Herrmann and Rockoff (2009)) and other nations (e.g., Duflo and Hanna (2005)). It is quite likely that many teachers value student achievement and would therefore be reluctant to miss work due to menstruation unless they were in severe pain.

The results of this paper suggest that the relationship between menstruation and female employee absences documented in IM may not generalize to other settings. Of course, public school teachers, like bank employees, are merely one of the myriad occupations in which women work, and the two settings are quite different. We study highly educated women working in a female dominated occupation in the public sector and in a nation with a high female labor force participation rate. In contrast, IM study a private company whose female employees are a small minority and were unlikely to possess a college degree, located in a country with low female labor force participation.[13]

To our knowledge, women in the U.S. and Italy do not typically receive explicit support if they wish to remain home from work during menstruation. However, labor laws and labor contracts which recognize the right of women to take a "feminine day" or "menstrual leave" once per month are common in Argentina, Indonesia, Japan, South Korea, and Taiwan. Given the importance of settings and institutions, more research is needed to determine the extent to which biological gender differences, such as menstruation, explain gender gaps in absences and earnings.

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[13] Labor force participation by Italian women in 1995 was 35 percent, while the rate for American women in 2004 was 65 percent (see OECD Country Statistical Profiles, http://stats.oecd.org/nawwe/factbook09/default.html). In addition, all teachers in New York have a bachelor's degree and 37 percent have a graduate degree, while only 20 percent of the bank employees analyzed by IM—men or women—have a college degree, and females are far less likely than males to work in managerial occupations within the bank (Ichino and Maggi (2000)).

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Table 1: Summary Statistics on Teachers by Gender and Age Group

	Under Age 45		Age 45 or Older	
	Male	Female	Male	Female
Number of Observations	47,795	147,428	50,050	130,688
Age	33.9	33.0	53.5	53.3
Teaching Experience	4.3	4.4	14.0	13.4
Black	21.5%	21.8%	17.0%	21.4%
Hispanic	15.8%	16.2%	9.4%	10.7%
Masters Degree	36.3%	43.2%	24.5%	28.7%
Days Absent	6.16	6.56	6.68	6.98
Days Absent for Illness (Certified)	1.11	2.11	2.16	2.56
Residual Days Absent	-0.44	-0.09	0.07	0.24
Residual Days Absent for Illness (Certified)	-0.80	-0.05	0.15	0.29

Note: The unit of observation is a teacher-year. Days Absent only includes absences for illness (certifed or not) and personal reasons. "Residual Days" refers to the residuals from a regression of days absent on fixed effects for license area and school.

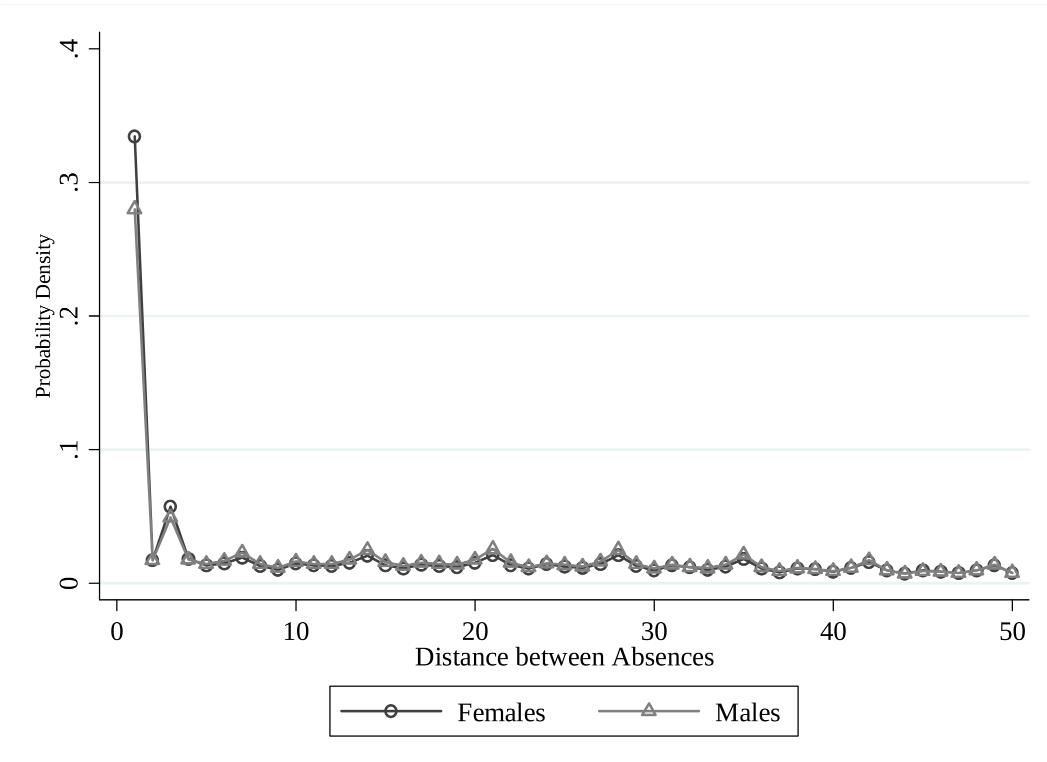
Table 2: Hazard of an Absence for Females Relative to Males and Risk of a Menstrual Cycle

	Younger than 45		45 or Older		Over 55	
	(1)	(2)	(3)	(4)	(5)	(6)
Female	0.99	0.99	0.96	0.97	0.96	0.96
	(-4.3)	(-2.5)	(-11.3)	(-9.2)	(-6.9)	(-7.0)
Female Interacted with						
Distance Equals 1	1.47	1.48	1.13	1.15	1.11	1.12
	(64.8)	(66.1)	(23.7)	(25.7)	(11.3)	(12.4)
Distance Equals 3	1.66	1.57	1.10	1.06	1.04	1.01
	(42.2)	(37.4)	(9.4)	(6.2)	(2.4)	(0.7)
Distance Equals 7	0.94	0.94	0.87	0.87	0.84	0.84
	(-3.6)	(-3.7)	(-8.8)	(-9.0)	(-6.6)	(-6.7)
Distance Equals 14	0.91	0.91	0.90	0.90	0.90	0.90
	(-6.1)	(-6.2)	(-6.4)	(-6.6)	(-3.6)	(-3.7)
Distance Equals 21	0.90	0.90	0.90	0.90	0.88	0.88
	(-6.7)	(-6.8)	(-6.2)	(-6.5)	(-4.3)	(-4.5)
Distance Equals 28	0.92	0.92	0.92	0.91	0.89	0.89
	(-4.9)	(-5.1)	(-5.2)	(-5.5)	(-3.8)	(-3.9)
Distance Equals 35	0.92	0.92	0.93	0.92	0.96	0.95
	(-4.9)	(-5.1)	(-4.0)	(-4.3)	(-1.3)	(-1.5)
Distance Equals 42	0.95	0.95	1.00	0.99	1.02	1.02
	(-2.6)	(-2.8)	(-0.1)	(-0.2)	(0.6)	(0.4)
Distance Equals 49	1.03	1.02	1.00	1.00	1.03	1.03
	(1.2)	(1.1)	(0.1)	(-0.1)	(0.7)	(0.6)
Control Variables Included		√		√		√

Note: T-ratios in parentheses. A hazard ratio of one indicates no effect. Control variables include age, teaching experience, an indicator for having a masters degree, and dummies for day of the week.

Figure 1: Distance between Consecutive Spells of Absence

Distributions by Gender



Gender Differences

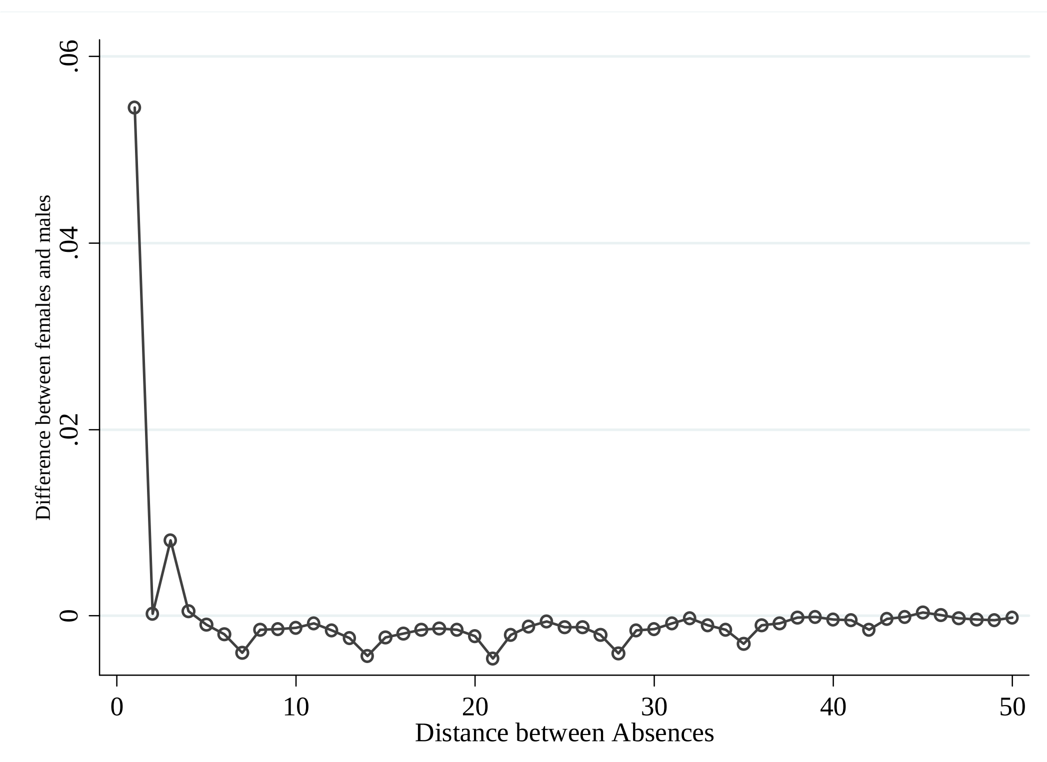


Figure 2: Distance between Spells of Absence by Gender (All Pairs within 50 Days)

Figure 3: Hazard Rates, by Gender and Age Group

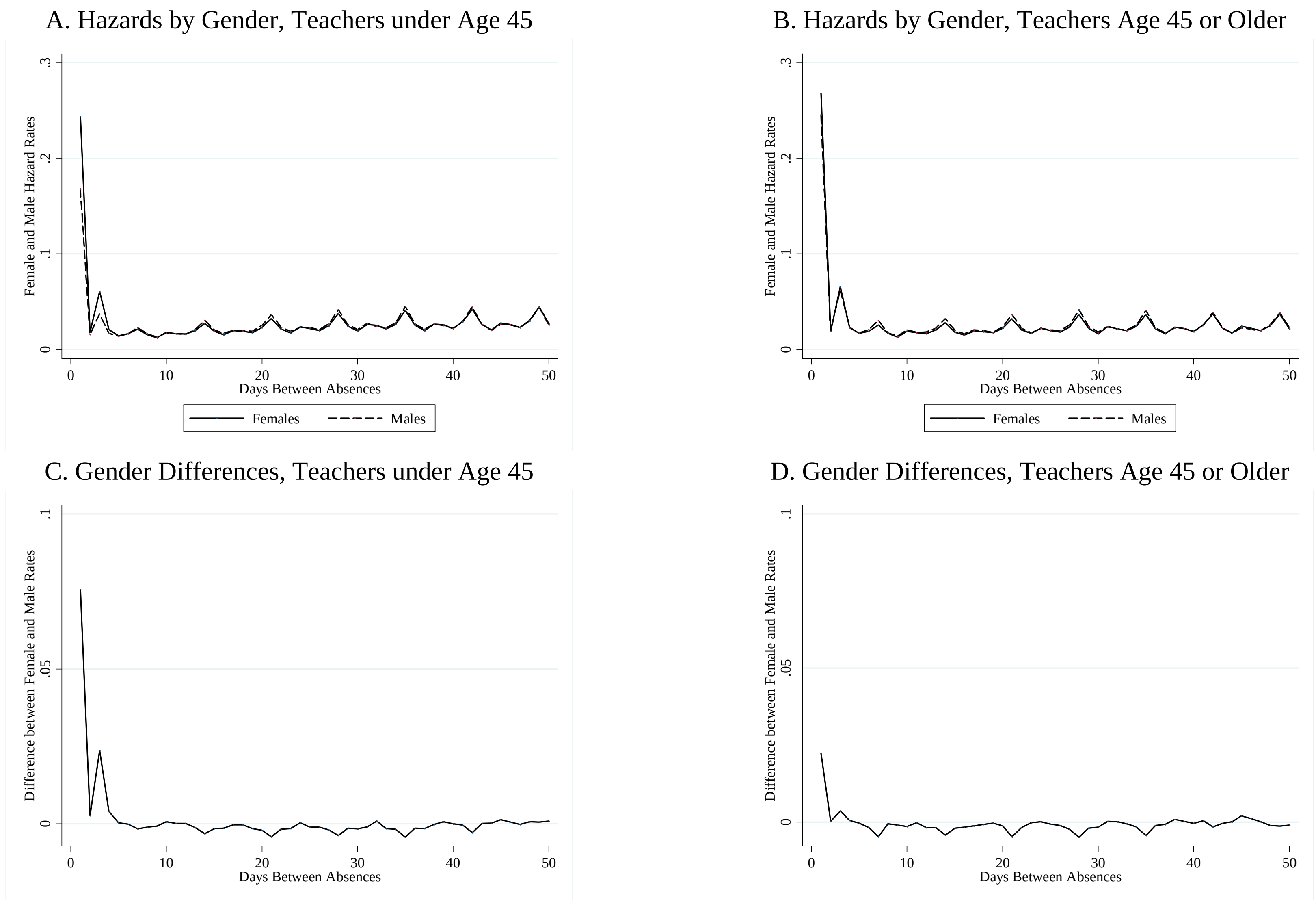
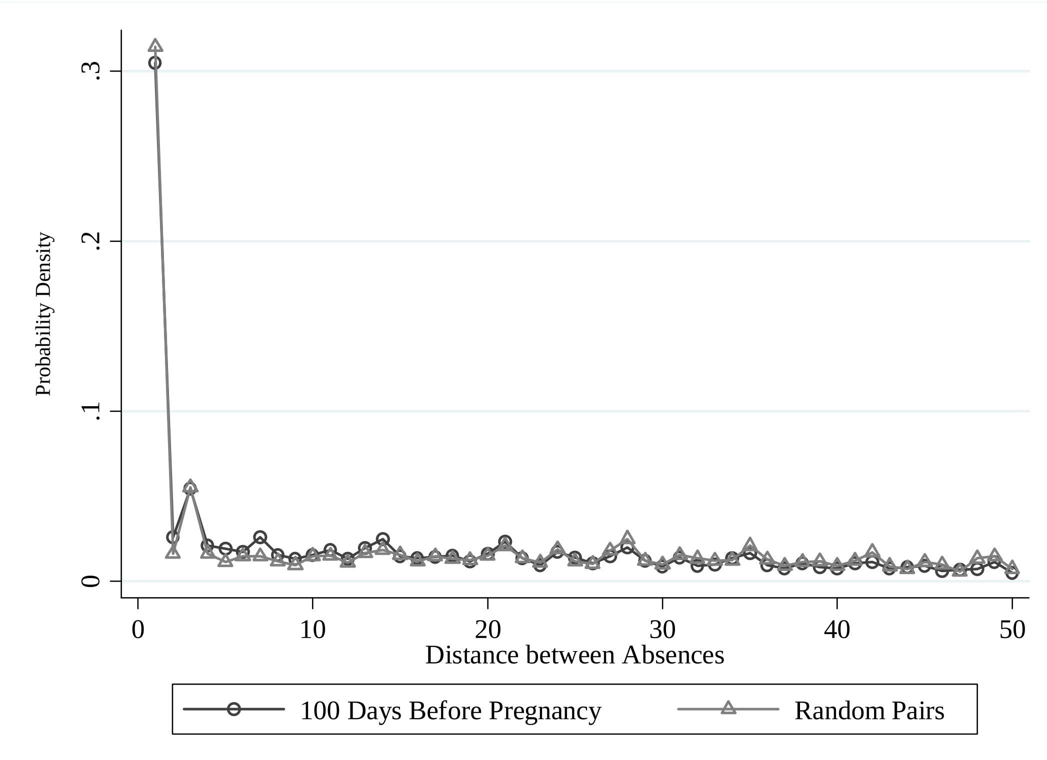
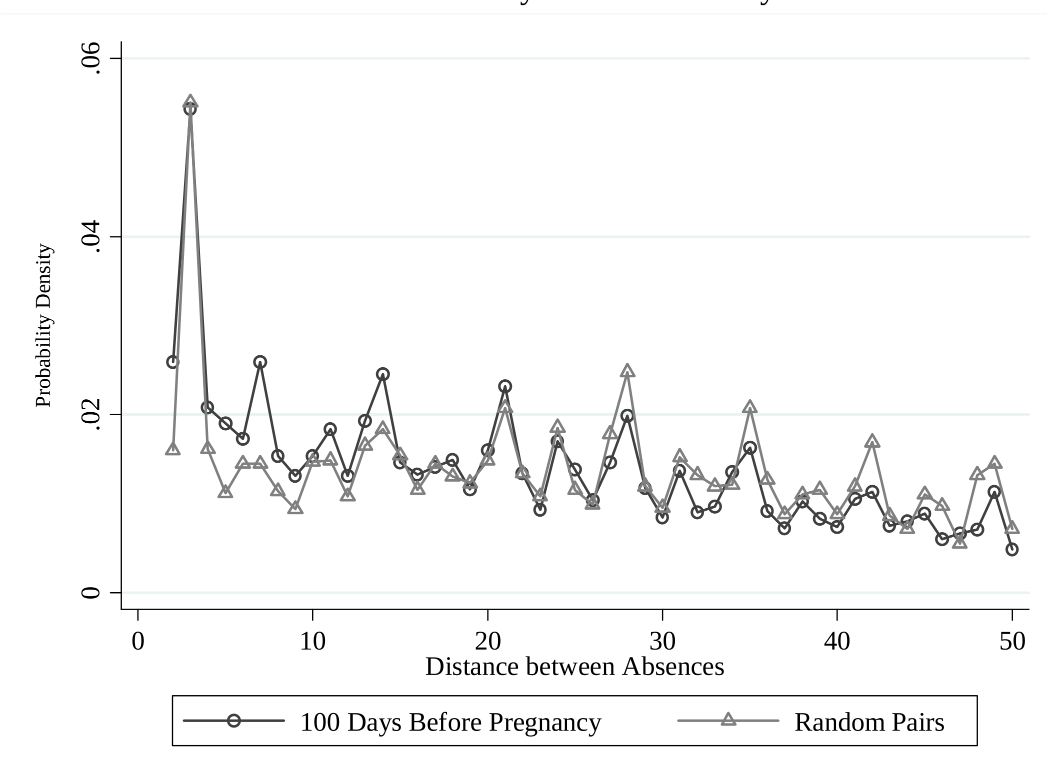


Figure 4: Distance between Consecutive Absences Prior to Pregnancy

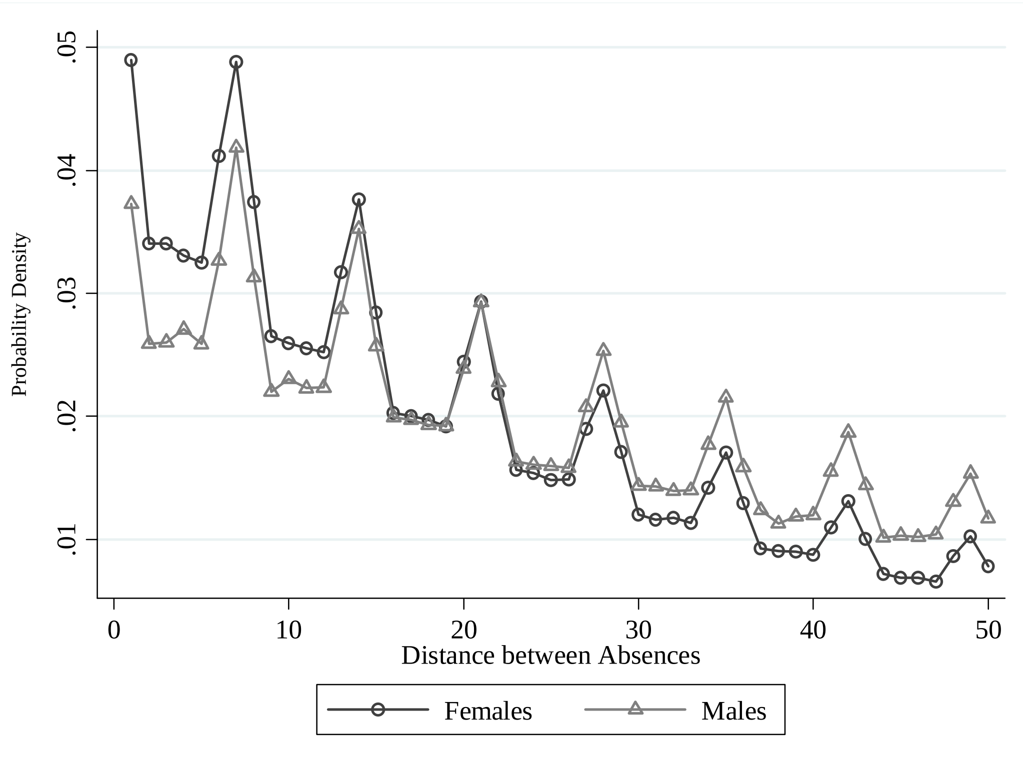
Absences within 50 Days



Absences after 1 day but within 50 Days



Appendix Figure 1: Distance Between Consecutive Absences for Simulated Data



Note: This figure plots the distribution of distance in days between absences from simulated data. The simulation generates 25,000 employees of each gender and follows them for 1,000 calendar days. Females are absent on work days (Monday through Friday) with a 5 percent probability; males are absent on work days with a 3 percent probability.

Appendix Figure 2: Distance between Consecutive Spells of Absence, Wednesdays Only