COVID19 Recession: Gender Layoff Gap Explodes

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Abstract: This paper uncovers robust evidence for a "gender layoff gap" as the driver of gender disparities in unemployment during the COVID19 pandemic-recession. Prior work has documented spiking raw unemployment rates for women with sparse explanation as to why this is happening. I am the first to use probit-regression analyses to look at the association between gender and layoff during the COVID19 pandemic. The gender layoff gap discussed in this paper is a distinct trend from any recent recession or any other non-recession year since 1995. During this recession, women have been ~10p.p. more likely than men to be laid off, compared to the timeframe of 1995-present. The gender layoff trends have flipped; men have always been more likely to be laid off until this recession. There is an even more dramatic propensity for mothers to be laid off. This research should be of interest to policy-makers interested in relief policies that prioritize groups, such as women or mothers, who have been disproportionately laid off during this unprecedented pandemic-recession.

Introduction

Research and news articles on working women often paint an optimistic picture of women's labor market outcomes and "progress". Headlines discussing female executives and greater diversity at companies often imply that we are nearing gender equity in the labor market but that is not the case. Pay gaps, workplace sexual harassment, and the broader glass ceiling persist. These gendered topics are all complex but are especially challenging when transformed by recessions and other economic shocks.

In economics, the gender pay gap is the topic most often studied which leaves out an important variable: layoffs. In recessions, when swaths of the population are losing their jobs, it is important to investigate if these are evenly distributed across the board or if certain demographics are bearing the brunt of newfound unemployment. Research into layoff trends is critical during the early stages of a recession because identifying trends is necessary to craft strategic and effective relief policies.

My broad research question is "How has the COVID19 recession impacted women's labor market outcomes compared to prior recessions?" and I hypothesize that women being laid off at higher rates than men during the COVID19 recession is a distinct trend from other recessionary periods. This research discusses a substantial relationship between gender and being laid off during the pandemic. Although women are usually statistically less likely than men to be laid off, during this recession, a large gender layoff gap has emerged. The gender layoff gap has grown by 10 p.p. during the COVID19 recession, compared to all time 1995-present. I will be running OLS and probit regressions on microdata obtained from the Current Population Survey to reach the aforementioned results.

To the best of my knowledge, no other researchers have looked at layoff rates during this recession by gender, using regression analyses. This research differs from other COVID19 research which has substantially focused on raw unemployment percentages across fields. My result of a growing and unprecedented gender layoff gap is simple to replicate with basic R software and knowledge of statistics.

In the sections that follow, I aim to place my research within the relevant academic landscape, explain my econometric models, illustrate my results, and conclude with a few weaknesses of my research and brief plans for future extensions.

Literature Review

There are new studies coming out every week on the economics of COVID19 as many researchers fight to understand this recession. Literature on women in the labor market and preliminary COVID19 research have informed my hypothesis and topic of interest.

Firstly, there is much research that examines gender pay gaps. According to the Pew Research Center, in 2015, wage gaps persisted with Hispanic women making an average of 12 ($2015) per hour for every 21 ($2015) made by white men (Patten, 2016). These results persist, even when controlling for level of education (Patten, 2016). In fact, women now outperform men on the majority of educational measures but this somehow never translated to changing wage ratios, pointing obviously towards gender-based discrimination (Murphy & Topel 2014).

Secondly, Hofferth and Curtin document the large impacts of maternity leave on wages (Hofferth and Curtin, 2006). Their research uses data drawn from 1984-1997 of the Panel Study of Income Dynamics (PSID). The Family and Medical Leave Act (FMLA) of 1993 radically increased the rights to parental leave after childbirth by upholding the right to *unpaid* leave for medical and family reasons, including postpartum absence. Hofferth and Curtin compare

returning wages for mothers post maternity leave, differentiating the pre and post FMLA periods. They found that after FMLA increased access to maternity leave, postpartum returning wages declined by 32% (Hofferth and Curtin, 2006). This coincides, of course, with far more people taking maternity leave. The female layoffs discussed in this paper will result in similar, gender-specific, time away from the workforce. It seems plausible that women who return to jobs after this recession could face similar (or even larger) wage losses. The timeframe of this paper will not allow a post-COVID19 analysis of returning wages but will build a strong framework of layoff information for myself and others who wish to look into returning wages in the coming years.

I would hypothesize that the increases in childcare duties from school closures have fallen on mothers more than fathers. Sevilla and Smith (2020) have examined differences in childcare duties during COVID19 school shut-downs. They use data from the UK Time Use Survey (TUS) and calculate the average time for men and women spent on childcare. Their initial results parallel Alon et al and find a roughly 40-60 allocation between men and women pre-pandemic (Sevilla and Smith, 2020). However, they find that the COVID19 childcare gap is actually smaller than pre-COVID19 childcare allocations by 10 percentage points, based on preliminary TUS data. This finding implies men are tackling a larger proportion of childcare than they were pre-pandemic. In the United States, Alon et al's (2020) working paper on gender inequality during the pandemic uses data from the American Time Use Survey (ATUS) and the Current Population Survey (CPS). They find that mothers will be shouldering an additional 12 hours per week, on average, while fathers will be responsible for far less (Alon et al.) The former study was conducted in the United Kingdom and the latter in the United States. More egalitarian leaning parenting norms in the UK, compared to the US, could explain the opposing results of

these two studies. Childcare duty statistics may currently be inconclusive but are imperative to continue to pay attention to as they are inextricably linked to women's labor market opportunities and experiences.

Looking back in time between February and March 2020 there are already robust differences between mothers and fathers emerging. Landivar et al. (2020) find gender discrepancies in the raw unemployment rates between men and women, and between mothers and non-mothers. Women who remained working through the first month of the pandemic saw reduced work hours at almost two times the rate of men's reductions (Landiver et al., 2020).

Furthermore, Sun and Russell (2020) have looked over self-report data from the US Pulse Survey for April 2020-September 2020. They find that women report "*not working* due to COVID19 related childcare issues" at around four times the rate of men (Sun & Russell, 2020). This is in line with my findings but is generally incomparable since their variable is "not working" which encompasses many causes of which being laid off is just one.

The aforementioned findings on reduced work hours, increased unemployment for women, and perhaps more hours spent performing reproductive labor in the household for mothers appear to be interconnected. It is obvious to infer that the decreased hours may be going directly towards childcare and household care. However, Dias et al. (2020) have found that the layoffs women are facing during this pandemic have not been as voluntary as the story of trading work for "zoom babysitting" may at first seem. They look at the same dataset I use, sub-data from the Current Population Survey, and find that mass female job reductions occurred. They find no evidence of substantial voluntary reductions or women leaving the workforce (Dias et al. 2020). This puts to rest the notion that mothers have been more accepting of layoffs or decided to leave the labor market in a way that was mistakenly recorded as a layoff. This pandemic is

exacerbating workplace gender inequity, and none of these gaps appear to be driven by voluntary actions on the part of women and mothers stepping back.

The House of Commons (HC) in the United Kingdom has taken a far more holistic look into the gendered impacts of this pandemic and the ensuing recession. The HC's Women and Equalities Committee have approached this line of inquiry from numerous angles. They took oral evidence from many organizations including Maternity Action, Women's Budget Group, and the Ministry for Equalities. They find that part-time women were more likely to be laid off than all full time workers and part-time male employees. Unfortunately, my dataset does not include information on full time vs part-time. It is generally known that part-time workers experience a greater elasticity of labor demand, which is a small piece of hope for rehiring prospects. However, given the large overlap between part-time females and motherhood, this re-emphasizes the toll this recession is having on mothers in particular. Another key factor in this report was a focus on pregnancy, in addition to motherhood. An increasing number of women made redundant (laid off) during the pandemic felt their pregnancy was a significant factor, compared to prior recent years (HC). Even across different countries, with far different government relief policies, mothers and pregnant people are being utterly bashed during this time.

The pandemic has now been going on for an entire year and economists have continued to regularly push out new research. For example, Simeon Djankov and Eva Zhang (2020) have begun to examine the recovery of this recession. They have zoomed in on weeks-long micro-recoveries which have occurred during the recession. When bursts of rehiring occur, the jobs are going to men even though women shouldered the majority of job losses (Djankov & Zhang, 2020). The detection of highly biased recovery is extremely worrisome and implies that

the women who were disproportionately laid off may remain so if the recovery continues to prioritize men.

Additionally, pop-economic news on the subject has appeared on CNN, CNBC, USA Today, Forbes, ABC 7, the New Yorker, and NY Times. CNN's Annalyn Kurtz has a piece titled: "The US economy lost 140,000 jobs in December. All of them were held by women"[1]. Technically this is false; many men were also laid off. But, the article does correctly point out, using Bureau of Labor Statistics data, that in the aggregate, more men were in the labor force overall. Many of the news stories with catchy headlines surrounding gender and the pandemic fail to make rich analyses comparing this recession to the past and lack sophisticated analysis methods. Nevertheless, much of this news has brought the gender situation to the attention of millions of Americans. The results section of this paper dives into robust statistical analyses which paint a fuller picture of why these discrepancies are popping up.

This literature review highlights many dismal findings which may leave readers feeling discouraged. Alon et al. (2020) end their paper on a more positive note, pointing out some equalizers which may come from this pandemic-recession. For example, the widespread adoption of increasingly flexible work arrangements may persist and be a particular advantage to mothers (Alon et al., 2020).

Aggregated together, prior research has led to increased public acknowledgment of sexist workplace trends. This creates a strong framework for my research to build upon. I employ statistical analyses to explore why disproportionate layoffs are driving women's unemployment during this recession.

[1] https://www.cnn.com/2021/01/08/economy/women-job-losses-pandemic/index.html

Model and Data

In order to observe how women's layoffs have been impacted by the COVID19 recession, I will be running numerous multivariate probit and OLS regressions.

The data I have translates smoothly to a zero-one dummy variable for being laid off. An individual who is laid-off in June, for example, will have a layoff value of 1 for June and 0 for all other months. Someone who remains out of the workforce or in the workforce throughout the entire pandemic will have a consistent layoff=0 value. Since I am using a binary dependent variable, probit regressions are the most precise model[2]. I have computed both probit regressions and OLS regressions for my tables and charts. There are limited direct implications from probit regressions besides seeing if there is a significant relationship and its direction. After confirming that all of my trends of interest are paralleled (both in signs and statistical significance levels) in the probit regressions, I use OLS regressions in my analyses in order to draw relevant conclusions which can be applied to my research question and hypothesis in meaningful ways.

All of the data for this research was obtained as panel data from the IPUMS Current Population Survey. It includes individual level microdata from January 1995-present that most importantly includes information on layoffs, sex, and status of being a mother. I had originally planned on researching and comparing just the three most recent recessions, including the current COVID19 recession. I have expanded my timeframe to include all years from 1995 to the present for a few regressions in order to see the robustness of my findings outside the setting of a recession. With this time-frame expansion, the most expansive dataset includes 40,287,489 observations.

The layoff variable is very straightforward and indicates whether or not an individual was let go from employment during a specific month. There are many other unemployment codes

[2] Probit regressions are the standard go-to when the dependent variable is a dummy variable.

that IPUMS uses to illustrate a plethora of common unemployment situations. For example, they categorize, new-entrants, re-entrants, temporary job ends, and job leaver as other categories of unemployment.

These are the main two regressions I use to obtain my results[3]:

$$Layoff_i = \beta_0 + \beta_1 * D_{1i}^{Female} + \beta_2 * D_{2i}^{Mother} + \beta_3 * D_{3i}^{Non\text{-}White} + U_i$$

$$Layoff_i = \beta_0 + \beta_1 * D_{1i}^{Female} + \beta_2 * D_{2i}^{Mother} + \beta_3 * D_{3i}^{Non\text{-}White} + \beta_4 * D_{4i}^{Covid} + \beta_5(Female * Covid) + \beta_6 * (Mother * Covid) + \beta_7 * (Non\text{-}White * Covid) + U_i$$

[4]In the first regression, β_1 is my coefficient of interest and illustrates the percentage point difference in layoffs between men and women, while controlling for the effects of motherhood and race. This regression does not include time as a variable and is run separately over the time periods of each recession of interest.

In the second regression, my coefficient of interest is β_5 but its interpretation is less intuitive. The baseline layoff probability for males is β_0 and the baseline layoff probability for females is $\beta_0 + \beta_1$. Therefore, in non-COVID19 years, the percentage point difference between male and female layoffs is β_1. During COVID19 (my time period of interest) the layoff value for males is $\beta_0 + \beta_4$ and for females is $\beta_0 + \beta_1 + \beta_4 + \beta_5$. Hence, the percentage point gender difference in layoffs during COVID19 is $\beta_1 + \beta_5$. So, the percentage point gender layoff gap during COVID19, compared to prior years, is β_5. The critical coefficient to pay attention to from Table 4, which results from this regression, is β_5.

[3] In the appendix, the probit regression for the second equation includes state and month fixed effects (Appendix Table 5). This decision to remove these from the OLS regressions was made after observing that neither the state nor month fixed effects seemed to have significant impacts on the coefficients or their statistical significance.
[4]A detailed breakdown of the equations is included in the appendix for those who seek a more thorough explanation.

Results

The results presented in this section will build a strong case for an exploding gender layoff gap during the current COVID19 recession which explains rising female unemployment. During this recession, women have been more likely than men to be laid off which is distinct from other recent recessions where men have experienced far more layoffs. This is true even when controlling for potential omitted variables. Furthermore, when regressing across all recent recessions, instead of looking inside each recession separately, women during COVID19 maintain a vulnerability for layoffs. These results are robust to interaction variables, time fixed effects, and state fixed effects. Women still have an enormous and distinct propensity towards experiencing layoffs during this recession even when compared against all years since 1995, regardless of recession.

Tables 1 and 2 on the following page illustrate the gender layoff gaps during the Early 2000s Recession and the Great Recession[5]. These show that women were less likely to be laid off than men during both the Early 2000s Recession and the Great Recession, as illustrated by the negative coefficients on the female dummy variable. In magnitude, women are between 3 and 4 p.p. less likely to be laid off than men, even when controlling for race and whether or not a woman is a mother. These results are all statistically significant at the 1% level. At this point, it is not clear why men were more likely to be laid off during the Early 2000s recession. During the Great Recession, the financial market and others which disproportionately employ men were heavily impacted therefore that trend does not come as a surprise. This is thoroughly documented, with many researchers even referring to the Great Recession as a “mancession”.

[5] “Great Recession” refers to the large recession which took place from December 2007-June 2009

Table 1 (OLS) Impact of Gender on Layoff

	Dependent variable:			
	Layoff (During Early 2000s Recession)			
	(1)	(2)	(3)	(4)
FEMALE	-0.033***	-0.035***	-0.034***	-0.034***
	(0.004)	(0.006)	(0.006)	(0.006)
MOTHER		-0.006*	-0.006	-0.006
		(0.004)	(0.004)	(0.004)
NON-WHTE			-0.032***	-0.032***
			(0.007)	(0.007)
Constant	0.197***	0.133***	0.141***	0.141***
	(0.006)	(0.009)	(0.009)	(0.009)
Observations	29,007	8,535	8,535	8,535
Month Fixed Effects?	No	No	No	Yes
Residual Std. Error	0.355 (df = 29005)	0.276 (df = 8532)	0.275 (df = 8531)	0.275 (df = 8531)
F Statistic	63.522*** (df = 1; 29005)	17.829*** (df = 2; 8532)	19.455*** (df = 3; 8531)	19.455*** (df = 3; 8531)

Table 2 (OLS) Impact of Gender on Layoff

	Dependent variable:			
	Layoff (During the Great Recession)			
	(1)	(2)	(3)	(4)
FEMALE	-0.075***	-0.039***	-0.038***	-0.038***
	(0.002)	(0.004)	(0.004)	(0.004)
MOTHER		-0.008***	-0.008***	-0.008***
		(0.002)	(0.002)	(0.002)
NON-WHITE			-0.037***	-0.037***
			(0.004)	(0.004)
Constant	0.250***	0.138***	0.146***	0.146***
	(0.004)	(0.006)	(0.006)	(0.006)
Observations	83,853	22,392	22,392	22,392
Month Fixed Effects?	No	No	No	Yes
Residual Std. Error	0.348 (df = 83851)	0.274 (df = 22389)	0.273 (df = 22388)	0.273 (df = 22388)
F Statistic	942.647*** (df = 1; 83851)	63.064*** (df = 2; 22389)	69.286*** (df = 3; 22388)	69.286*** (df = 3; 22388)

Table 3 runs the same regression on the COVID19 recession time period. The coefficient on female is much larger than in the prior two regressions. The coefficient is also positive which represents a gender layoff gap where women are 7.8 p.p. more likely than men to be laid off (also with controls and statistically significant @ 1%).

Table 3 (OLS) Impact of Gender on Layoff

	Dependent variable:			
	Layoff (During the COVID19 Recession)			
	(1)	(2)	(3)	(4)
FEMALE	0.073***	0.078***	0.078***	0.078***
	(0.005)	(0.011)	(0.011)	(0.011)
MOTHER		0.014*	0.016**	0.016**
		(0.008)	(0.008)	(0.008)
NON-WHITE			-0.054***	-0.054***
			(0.012)	(0.012)
Constant	0.434***	0.298***	0.313***	0.313***
	(0.008)	(0.016)	(0.017)	(0.017)
Observations	35,285	8,517	8,517	8,517
Month Fixed Effects?	No	No	No	Yes
Residual Std. Error	0.497 (df = 35283)	0.491 (df = 8514)	0.490 (df = 8513)	0.490 (df = 8513)
F Statistic	189.597*** (df = 1; 35283)	28.094*** (df = 2; 8514)	25.640*** (df = 3; 8513)	25.640*** (df = 3; 8513)

[6]

The coefficient on mother parallels the female variable in sign throughout all three of these recessions. It is unexpected that the past coefficients on mother were negative because this means mothers were less likely than others to be laid off. In the Early 2000s Recession the mother coefficient was not statistically significant. Perhaps workplace discrimination against mothers does not materialize into a significant effect on layoffs because employers are sympathetic to working mothers when making layoff decisions. The effect on mothers is much

[6] R^2 are also excluded here because F-Statistic tests for joint significance are included. Coefficients of determination are included in further tables to see if addition of interaction variables increases significance of the regression more than would occur by chance.

smaller in both magnitude and statistical significance thus far but will be examined further in the Weaknesses and Future Extensions section[7].

Although these initial results are compelling, they look at each recession separately[8]. In Table 4[9] I run seven regressions that include interaction variables to increase the robustness of the results. These are run on a dataset that includes the time periods of all three recessions. State and month fixed effects are included in the relevant replicate probit regressions but have not been included in the OLS regressions. This is to avoid complicating the statistical questionability of making inferences using OLS when a probit regression fits the data more precisely. The coefficients and significance levels of the probit regressions continue to parallel those of the OLS regressions suggesting that I am not missing state or month effects that impact the direction or significance of my results. The coefficient of interest is B_5 on the Covid*Female interaction variable because it shows the percentage point change in propensity to be laid off during COVID19 from being a female (vs male), compared to other recessions. When controlling for race, motherhood, and all interactions, this table illustrates women have been 9.5 p.p. more likely than men to be laid off than they were in the prior recessions examined. Succinctly, this recession is different and women are 9.5 p.p. more likely to be laid off than during a "usual" recession. This explains the gender differences in raw labor force participation and unemployment rates which other researchers have discussed.

[7] See pages 19-23
[8] The coefficients between gender and layoff status are isolated to the time periods of each recession and use distinct datasets for exact months of each recession.
[9] See page 14 (next page)

Table 4 (OLS) Interaction of Gender on Layoffs in Recent Recessions

	Dependent variable:						
	(Layoff *During a Recession*)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Female	-0.032***	-0.014***	-0.014***	-0.016***	-0.022***	-0.021***	-0.022***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mother		0.017***	0.020***	0.009***	0.009***	-0.008***	-0.008***
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Non-White			-0.034***	-0.033***	-0.033***	-0.033***	-0.032***
			(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Covid				0.343***	0.300***	0.279***	0.287***
				(0.003)	(0.004)	(0.004)	(0.004)
Female*Covid					0.100***	0.095***	0.095***
					(0.006)	(0.006)	(0.006)
Mother*Covid						0.219***	0.221***
						(0.010)	(0.010)
Non-White*Covid							-0.028***
							(0.007)
Constant	0.162***	0.091***	0.101***	0.085***	0.087***	0.088***	0.087***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	611,573	166,603	166,603	166,603	166,603	166,603	166,603
R^2	0.002	0.001	0.004	0.076	0.077	0.080	0.080
Adjusted R^2	0.002	0.001	0.004	0.076	0.077	0.080	0.080
Residual Std. Error	0.354 (df = 611571)	0.282 (df = 166600)	0.281 (df = 166599)	0.271 (df = 166598)	0.271 (df = 166597)	0.270 (df = 166596)	0.270 (df = 166595)

In Table 5[10], I do an additional robustness check to see if this unique propensity women appear to have towards layoffs during the COVID19 recession is significant when compared to non-recessionary periods. A multivariate analysis is done on the data of all years 1995-2020. The gender layoff gap grows by 10 p.p. during COVID19, compared to all other years since 1995. Table 5 also notably finds that mothers are 21.9 p.p. more likely to be laid off during COVID19 than any other year since 1995 which is the biggest effect I have found in my research. Race is not included in this table because there were data discrepancies in the older years.

[10] See page 15 (next page)

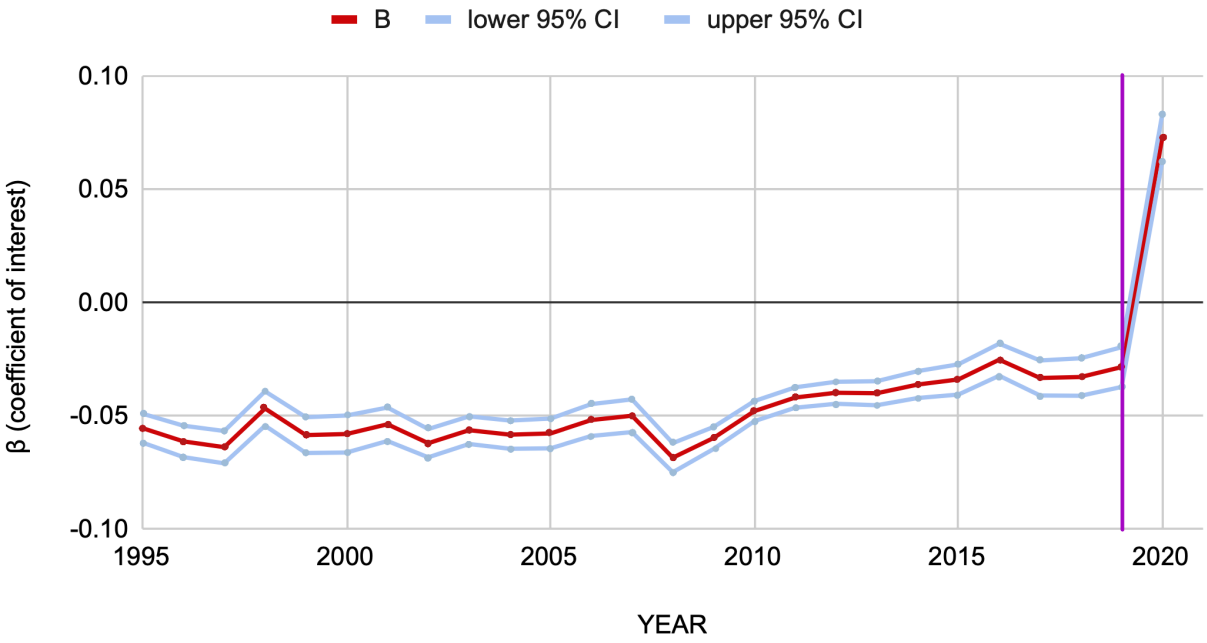
The aforementioned results from Table 5 parallel my initial findings from Tables 1-3. The 10 p.p. difference in layoffs between men and women describes the change from a roughly -0.035 coefficient on females jumping to a roughly 0.075 coefficient. It is compelling to see the links between these separate regressions which have been run on different datasets with different controls. In addition to all being significant at the 1% level, the consistency points to a relationship which is not the result of luck or a computational shortcoming.

Table 5 (OLS) Interaction of Gender and Layoff During Recessions and Non-Recessionary Periods

	Dependent variable:				
	(Layoff *1995-2020 inclusive*)				
	(1)	(2)	(3)	(4)	(5)
Female	-0.043***	-0.021***	-0.023***	-0.026***	-0.025***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mother		0.007***	-0.0002	-0.0004	-0.010***
		(0.002)	(0.002)	(0.002)	(0.002)
Covid			0.340***	0.296***	0.274***
			(0.003)	(0.004)	(0.004)
Female*Covid				0.104***	0.099***
				(0.006)	(0.006)
Mother*Covid					0.219***
					(0.010)
Constant	0.164***	0.090***	0.082***	0.083***	0.084***
	(0.0004)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	1,128,896	315,672	315,672	315,672	315,672
R^2	0.004	0.001	0.042	0.042	0.044
Adjusted R^2	0.004	0.001	0.042	0.042	0.044
Residual Std. Error	0.351 (df = 1128894)	0.275 (df = 315669)	0.269 (df = 315668)	0.269 (df = 315667)	0.269 (df = 315666)

It is hard to understand the magnitudes of the gender layoff gap through numbers alone. The graph below plots the coefficients of female on layoff from all years 1995-2020 inclusive to examine the full picture of the gender layoff gap.

Table 6 (OLS) Evolution of Female Coefficient on Layoff (1995-2020)



This chart drives home the main finding that women are uniquely more likely than men to be laid off during this recession which explains high female unemployment levels. This is not only true when compared to prior recessions but also when compared to all time periods. Additionally, the 95% confidence intervals (in light blue) illustrate that the relationship between gender and layoffs is a robust, non-zero, relationship which never crosses 0 except when spiking to a positive coefficient in 2020. It was previously mentioned that I did not have a reasonable prediction for why there was a negative coefficient on female during the Early 2000s Recession. After seeing the bigger picture, it is clear this is what is normal. In the chart, there is also a sizable dip in the coefficient around the time of the Great Recession illustrating a propensity for men to be laid off.

Women's place in the labor market is something that has evolved dramatically since the 1960s. Since the 1960s, women's labor market participation has skyrocketed from around 45% to roughly 70%. Table 7 illustrates that women's labor force participation has been relatively

constant since 1995. Thus, this was an obvious time frame for me to choose. It would have been interesting to look at gender and layoffs further back but the outdated gender norms would render my statistical results harder to parse.

Table 7: Labor Force Participation By Gender

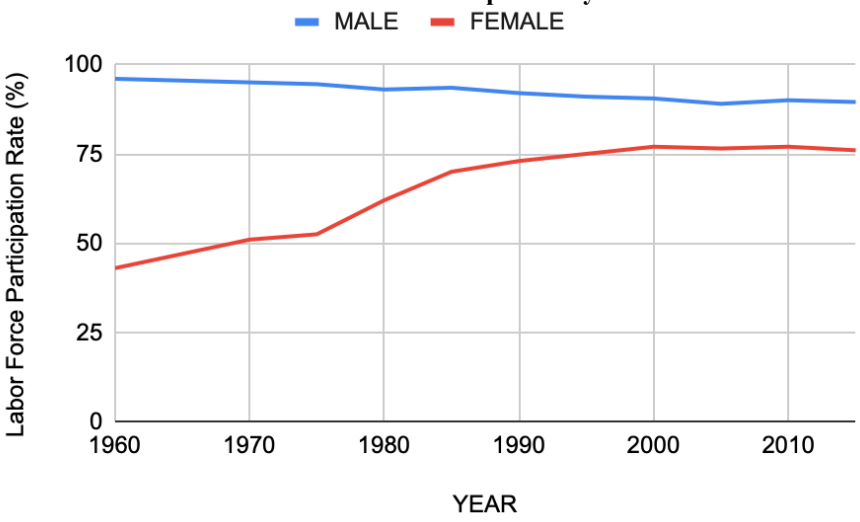
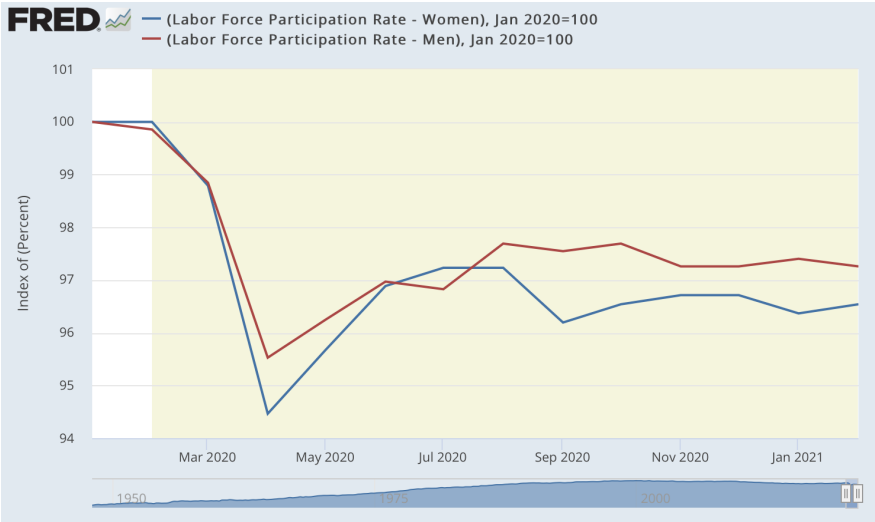


Table 8: 2020 Labor Force Participation Rates
(Indexed to Jan. 2020)

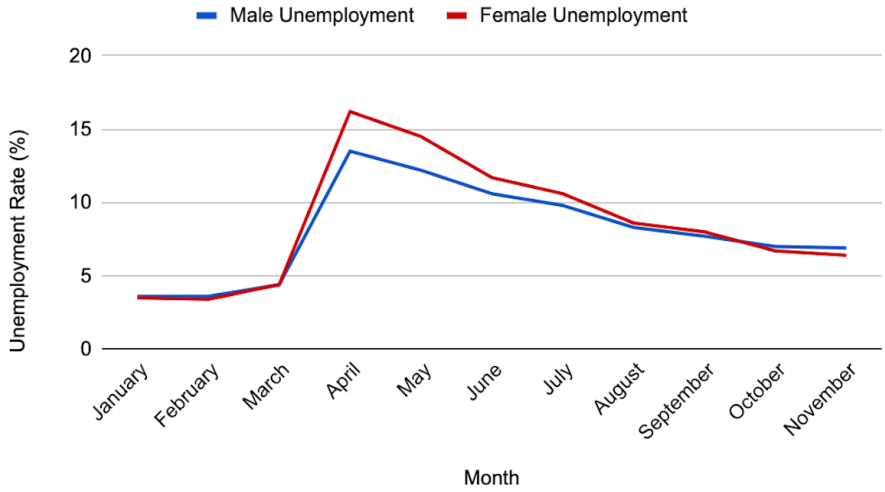


Zooming in on labor force participation rates for 2020, there are hints which point to the impact of school closures. Table 8, from the St. Louis FRED, shows a substantial dip in participation during April which is steeper for women. The latter half of the year has a second distinct dip in women's participation around August-September. This mysterious dip coincides

with the start of the school year. This lends credence to the hypothesis of school closures being a push factor towards women being out of work but the complete mechanisms at work are still fuzzy.

It is surprising that other economists who have devoted substantial time to researching this recession have not uncovered this gender layoff gap. Much attention has been given to gender disparities in raw unemployment, yet a precise comparison between recent layoffs and those in "normal" times or even "normal recessions" has not been conducted thus far. This gender gap appears less obviously in the raw unemployment data which suggests some women who are laid off do not search for work. Perhaps other economists were primarily looking at these data (Table 9). Based on unemployment data for this recession, the gender gap appears to last for only a few months and has recently closed up. My long-term regression analyses highlight how this situation has never occurred before, while unemployment data merely indicates a slight gender gap. The raw data does not sufficiently explain the magnitude and unprecedented nature of the gender layoff gap. The closing of the gap in the raw data is further explored in the next section of this paper.

Table 9: 2020 Unemployment Rates By Gender
(seasonally adjusted)



Tables 1-7 have illustrated a unique gender layoff gap that explains plummeting female unemployment and labor force participation during the COVID19 recession. The next section will examine a few imperfections and outline my plans for expanding this research.

Weaknesses and Future Extensions

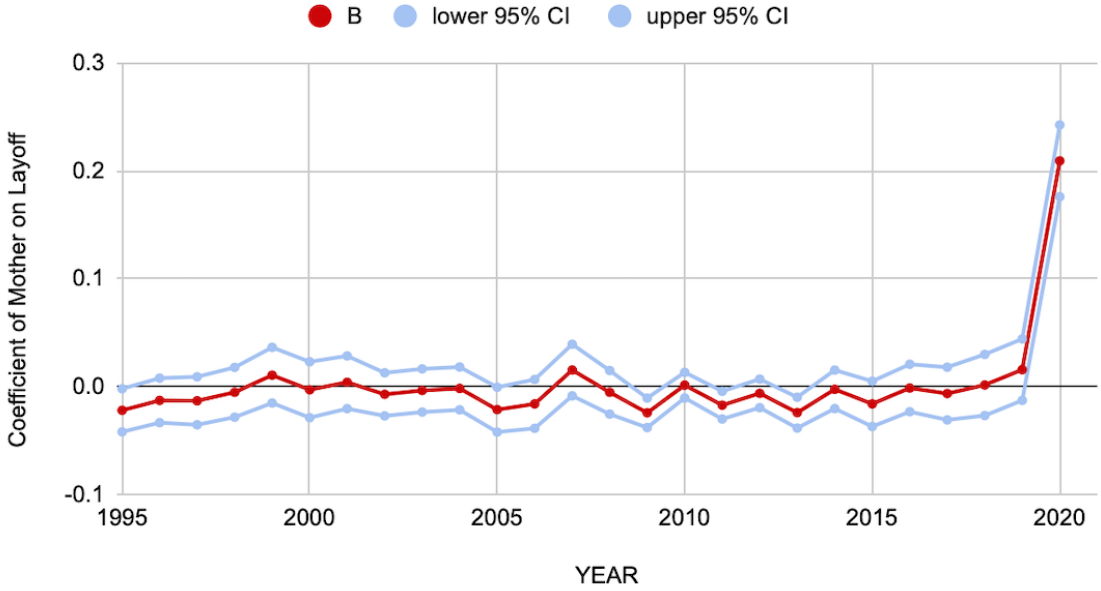
I am pleased with the support I have found for my hypothesis of a COVID19 gender layoff gap but there are a few weaknesses with my model and many directions I plan to expand in.

There is the possibility that the data are inaccurate due to the special circumstances we are all living under. Perhaps some of this data collection or reporting has been inconsistent with people facing large tragedies and uncertainty. Perhaps there are distinct populations of people who may be leaving their jobs for fear of contracting the virus in their workplace. The current categories do not have a descriptor for people who may quit jobs yet simultaneously be searching for a more covid-safe work environment. Could those workers be classified as laid-off mistakenly? More likely, they would be classified as job-leavers which still does not encompass their full employment situation.

The previously mentioned finding that mothers have been 21.9 p.p. more likely to be laid off during the COVID19 recession than any other year since 1995 warrants further probing. This comparison is made between mothers in prior years and mothers during COVID19. As mentioned in the Literature Review section, this effect is not driven by voluntary leavers of the workforce. Within the COVID19 recession, mothers are only 1.6 p.p. more likely than other women to be laid off (at the 10% level). Without my expansion to the non-recessionary setting, I would not have realized how robust the effect on mothers was when compared to “normal years". The coefficients of female and motherhood statuses on layoffs are recorded for all years

1995-2020 inclusive. Similar to the method used in Table 6, Table 9 plots the evolution of the mother coefficient on layoff.

Table 9: Evolution of the Mother Coefficient on Layoff (1995-2020)



The 95% confidence intervals in light blue illustrate that in almost every year the coefficient lies within the plausible range of being zero. This is in contrast to the findings on the female coefficient which was consistently negative before this recession; motherhood does not seem to have any significant interaction with experiences of layoffs in prior years. In 2020, however, the coefficient on mother is significant at the 1% level and skyrockets to a large positive. This means the COVID19 recession is unique in that mothers are having any difference from non-mothers in layoff rates. In order to confirm the causality of school closures, I would need to add data on school closures to my regression and an interaction variable. Unfortunately, the necessary data is not currently available.

Data was pursued which could describe the level of school closure within a state for each month of this recession to see if the mother's layoffs were driven by school closures but in the end, was infeasible. There have not been federal regulations on school closures and this has

widely been handled at the state and county level. Unfortunately, states vary greatly in how they have handled the pandemic. In addition, local school boards and superintendents are the ones crafting the specific re-opening schedules for their districts once the state-level requirements have been met. In my home school district (Palo Alto Unified School District) there has been plenty of confusion surrounding reopening schedules which I am certain is paralleled in most other districts. The re-opening has been staggered by grade level, even within the elementary schools. On March 9th the schools in Palo Alto reopened, as one of the first to do so in the Bay Area. Gov. Gavin Newsom visited Hoover Elementary School in Palo Alto at the beginning of March to encourage other California public school districts to look to Palo Alto as a model for a promising reopening. The district will be experimenting with a "zoom from the room" approach where students who go to class in person will zoom-in from their desks so the teacher can interact with all students via zoom instead of juggling in-person and chat-based questions simultaneously. Palo Alto is not requiring students to commit to distance learning or in-person. Thus, a student can show up whenever they please and zoom in from home whenever their caretakers will allow them to do so. The reopening plans sound as alien as the idea of a pandemic in the first place.

Further complicating things, The CPS data does not include information on the age of a mother's children. It would be impossible to ascertain the relationship between school opening and layoff without having microdata on the age of every child for every mother and the weeks in which that specific state-country-district-grade were either remote or in person. Concisely, even within a state, the level of reopening will vary by county, by school district, by grade and is further complicated by the option many districts are offering for parents to remain in fully virtual

learning or switch back and forth. Many instruments for school re-opening were brainstormed but none met the instrument exogeneity requirement.

This weakness of over-complication can also be seen as an opportunity to create a natural experiment. As more schools open up across the country through 2021, there will inevitably be comparable counties that make diverging reopening plans. If one district decides to reopen while an otherwise similar district remains in virtual learning mode, there is a great opportunity to compare the outcomes of these schools and the employment of the associated mothers. Prior data on school closures is also available for analysis. School reopenings are an area of interest for further study, especially this fall when I anticipate very few will elect to remain closed.

One glaring weakness in my research is the non-white variable. It originally seemed like an important variable to include in order to see how race interacts with labor market outcomes. This was a pretty reductive variable to encapsulate all the experiences of all minority groups. It is outside the scope of this research which aims to primarily focus on gender differences to regress every racial category (over fifteen in my CPS data) and ignores mixed-race combinations. This variable is something that many other researchers have focussed on and which I plan to pursue more directly in the future.

Finally, this study is not able to explain the mechanisms driving this gender layoff gap. I could theorize many possibilities for why this occurs but I choose to avoid that. It is reductive to the personal experiences of women and mothers to try to figure out such a complex situation using just the numbers. The CPS data I manipulate in this study does not have sufficient information for me to conjecture about the root of this issue. To answer the “why”, the study must be opened up to interviews and responses from the public. The House of Commons research mentioned in the Literature Review section includes numerous responses from the

public which are used to look at similar gender gaps. In the future, instead of blindly guessing, I hope to interview laid off women and mothers to weed apart the nuances of this gender layoff gap and investigate the impact of school closures.

Conclusion

Despite the hopeful rhetoric around women in the labor market, this paper has uncovered a huge gender layoff gap unique to the current COVID19 recession. The gender gap in layoff probability has grown by 9.5 p.p., compared to other recent recessions. Furthermore, this recession remains unique when compared against non-recessionary years; women have been ~10 p.p. more likely to be laid off during this recession than they have been during any other period since 1995. In all prior years analyzed, men have been more likely to be laid off and now the reverse is true. There has not been a positive female gender layoff gap in other recent recessions or any non-recessionary year. These results which appear to disadvantage women in the labor market greatly are not merely a continuation of past gender biases being elevated by the recession. The results presented in this paper are highly statistically significant (1% level) even when controlling for race, motherhood status, time fixed effects, and state fixed effects. The gender layoff gap is superior to the raw data in explaining the magnitude of gender-based workplace inequity during this recession.

Mothers have also been hit particularly hard during this recession and have been more likely than non-mother females to be laid off. The preliminary results point to unprecedented labor market hardship for mothers which is potentially impacted by the school closures caused by the pandemic. The largest effect rendered from my research is that mothers have been 21.9 p.p. more likely to be laid off during COVID19 than any other year since 1995.

Politicians and leaders worldwide need to pay attention to the large gender gaps which are exploding during this recession and take the necessary steps to address them compassionately.

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Appendix

Appendix: Table 1 (probit)

	Dependent variable:		
	(Layoff, during Early 2000s Recession)		
	(1)	(2)	(3)
Female	-0.145***	-0.238***	-0.236***
	(0.018)	(0.042)	(0.042)
Mother		-0.048*	-0.042
		(0.027)	(0.027)
Non-White			-0.228***
			(0.048)
Constant	-0.833***	-1.054***	-1.003***
	(0.028)	(0.059)	(0.060)
Observations	29,007	8,535	8,535

Appendix: Table 2 (probit)

	Dependent variable:		
	(Layoff, during the Great Recession)		
	(1)	(2)	(3)
Female	-0.344***	-0.278***	-0.272***
	(0.011)	(0.027)	(0.027)
Mother		-0.070***	-0.067***
		(0.017)	(0.017)
Non-White			-0.278***
			(0.030)
Constant	-0.589***	-1.011***	-0.957***
	(0.016)	(0.037)	(0.037)
Observations	83,853	22,392	22,392

Appendix: Table 3 (probit)

	Dependent variable:		
	(Layoff, during the COVID19 Recession)		
	(1)	(2)	(3)
Female	0.184***	0.200***	0.201***
	(0.013)	(0.028)	(0.028)
Mother		0.037*	0.041**
		(0.021)	(0.021)
Non-White			-0.140***
			(0.031)
Constant	-0.168***	-0.515***	-0.479***
	(0.021)	(0.042)	(0.043)
Observations	35,285	8,517	8,517

Appendix Tables 1-3 are probit replications of Tables 1-3 presented in the Results section of the paper. Appendix Table 4 aggregates the coefficients on female from the probit regressions.

Appendix: Table 4 (probit)

	Dependent variable:		
	Layoff (During Specified Recession)		
	(Early 00s)	(Great)	(COVID19)
Female	-0.236***	-0.272***	0.201***
	(0.042)	(0.027)	(0.028)
Observations	29,007	83,853	35,285

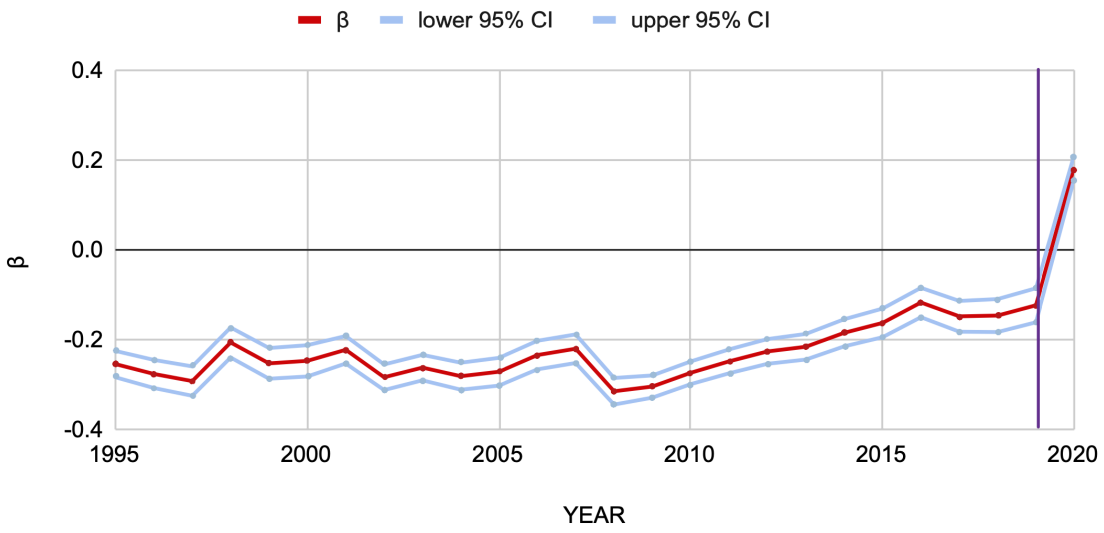
Appendix: Table 5 (probit)

	Dependent variable:						
	(LAYOFF)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Female	-0.142***	-0.093***	-0.088***	-0.125***	-0.169***	-0.168***	-0.167***
	(0.004)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)
Mother		0.105***	0.122***	0.041**	0.040**	-0.064***	-6.063***
		(0.016)	(0.017)	(0.018)	(0.018)	(0.020)	(0.020)
Non-White			-0.234***	-0.249***	-0.249***	-0.249***	-0.262***
			(0.010)	(0.011)	(0.011)	(0.011)	(0.012)
Covid				1.272***	1.115***	1.056***	1.030***
				(0.015)	(0.019)	(0.020)	(0.022)
Female*Covid					0.371***	0.361***	0.359***
					(0.030)	(0.030)	(0.030)
Mother*Covid						0.616***	0.608***
						(0.049)	(0.049)
Non-White*Covid							0.105***
							(0.033)
Constant	-0.985***	-1.333***	-1.276***	-1.375***	-1.360***	-1.354***	-1.351***
	(0.003)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
Observations	611,573	166,603	166,603	166,603	166,603	166,603	166,603
Month FE?	No	No	No	Yes	Yes	Yes	Yes
State FE?	No	No	No	Yes	Yes	Yes	Yes

Appendix Table 5 runs the multivariate regression seen in Tables 4-5 in the paper.

Appendix: Table 6 (probit)

Evolution of Coefficient on Female 1995-2020



Appendix Table 6 illustrates that the coefficients on female rendered from a probit regression are consistent with the visual aid presented in the Results section in Table 6's illustration.

Additional Description of Model and Variables:

$$Layoff_i = \beta_0 + \beta_1 * D_{1i}^{Female} + \beta_2 * D_{2i}^{Mother} + \beta_3 * D_{3i}^{Non\text{-}White} + \beta_4 * D_{4i}^{Covid} + \beta_5(Female * Covid) + \beta_6 * (Mother * Covid) + \beta_7 * (Non\text{-}White * Covid) + U_i$$

β_0 : Intercept

β_1 : Interaction between gender and layoff status

β_2 : Interaction between motherhood status and layoff

β_3 : Interaction between non-white dummy variable and layoff

β_4 :Association between COVID19 recession time frame and layoff

β_5 : Increased probability of women to be laid off, during covid19, compared to men, and on top of the baseline recessionary effects

β_6 : Increased probability of mothers to be laid off, during covid19, compared to all others, and on top of the baseline recessionary effects

β_7 : Impact of being non-white on layoff variable during the recession