How Has the Relationship Between Working From Home and Earnings Changed as a Result of the COVID-19 Pandemic?

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Introduction

With the large economic effect that the COVID-19 pandemic had on the labor market, research has been conducted that suggests a number of different factors that are relevant to our current study. In particular, one study conducted by Bonacini et al. found that there is a correlation between the ability one has to work from home and an increase in average labor income (2020). This makes sense as the rapid transition to at-home work necessitated by the pandemic lent itself to jobs that were easily and readily adaptable to at-home performance. The study further suggests that this easy adaptability was especially true for older males with a higher education level and already working in high paying positions (Bonacini et al., 2020). This is significant because as the demand for positions which are compatible with at-home work modalities increases, we can expect to see a similar increase of inequality within the labor market. While this study will be helpful to include in our consideration, it does have the limitation of having been performed in Italy where the labor market is different from that of the United States; however, we can use this study as a model for what we hope to do in our research.

Another recent study conducted in 2023 examines the relationship between commute time and earnings within South Carolina. This study actually examines the effects of earnings on the commute time rather than the other way around (Trela, 2023). This is counter to other types of studies that have been conducted on this subject and thus will offer an interesting insight into the relationship between commute time and earnings. The study found that because the COVID-19 pandemic caused commute time to decrease, the differential of compensation also decreased (Trela, 2023). We would expect this to occur as those who previously had to commute for work no longer had to and so the compensation for their travel decreased. This study does focus on different variables than we are looking for and does not include variables such as transportation,

location, and occupation (Trela, 2023). We hope to contribute further to this research by expanding the sample to the United States as a whole using ACS data.

Further research conducted by Bick et al. finds that not only did working from home increase dramatically during the COVID-19 pandemic, but there was a significant difference found between the amount of hours worked from home within separate demographics and industries (2021). We would expect that in the future those who are more educated will work more from home as their industries are often easily translatable into at-home work (Bick et al., 2021). This study also offers insight into a wide range of questions including the trade-offs between health and economic opportunity, the extent of supply chain disruptions across sectors, the impact on educational outcomes, gender imbalances, and the location decisions of firms and workers. The downside of this study is that it used mobility data from phones (Bick et al., 2021). This data is not generally available to the public and is difficult to find its origins. This study will be useful in our research as we are looking at different occupations and to account for any disparities that may exist between certain industries when it comes to earnings in relation to at-home work as a result of the pandemic.

Additional research suggests that there is a positive relationship between commute times and earnings (Ruppert et al., 2019). This study also finds that men seem to have a higher amount of bargaining power when it comes to the commutes that they have to make compared to women (Ruppert et al., 2019). This adds to the research included above suggesting that there are discrepancies between certain demographics such as gender. This study does have a certain deficiency in that it was conducted using an informal survey question where participants were asked to recall how long on average they commute (Ruppert et al., 2019). This could lead to a potential bias as questions of recall can be inaccurate. This study was also conducted in France

which adds another downside to the study; however, the study should be replicable and contribute good insight into our study.

Bloom (2020) found that jobs which are worked from home now account for over 60% of the labor market. As the option to work from home becomes more prevalent, it is increasingly important to understand how this is going to affect the supply and demand of jobs which will lead to change in the labor market. It is important to understand the disparities that are caused by the fact that certain job types can not be changed in order to accommodate a work from home lifestyle. Bloom (2020) gives a few different examples, facts, and figures about how the labor force has changed as we have experienced a change in work from home options due to the COVID-19 pandemic; however, it does not answer the question of changing income due to work from home possibilities. Our paper hopes to expand on this research by looking specifically at the effect that working from home has on income as a result of the pandemic. By evaluating this, we can look for inequalities and better know how to shape policies regarding working from home.

The advent of the COVID-19 pandemic in early 2020 brought with it a host of changes to the workplace. One change in particular was the wide-spread transition to remote work as opposed to in-person work as concerns with spreading the COVID-19 virus necessitated a shift in how the labor force performed their work. The COVID-19 pandemic created more opportunities for employees to work from home rather than working on site. This paper seeks to evaluate the correlation between working from home and earnings using an econometric model. By comparing earnings before and after the COVID-19 pandemic, along with work from home vs on site work rates, we hope to better understand the effect that remote work has on a person's decision to enter the job market and which fields the incoming labor force are pursuing. Our

findings will also be relevant to employers as they evaluate what a competitive wage would be depending on the availability of work from home options for a certain job.

We expect to find that there is a statistically significant relationship between working from home and earnings. The COVID-19 pandemic caused an increase in demand for jobs which can be done from home; we expect to see a positive correlation between working from home and earnings post-COVID. However, it could also be that the option of working from home increased the labor supply which could lead to a decrease in earnings as there is more supply for a given work from home job than what is demanded.

Data

Data for this paper was pulled from the American Community Survey (ACS) accessed via IPUMS USA. The ACS is an annual survey used to give a random sample of the US population. It contains documentation from several federal census reports and ensures accurate and updated statistics about the American population. This paper examines sample surveys of the U.S. population from 2014-2019 and 2021-2022 to show pre- and post-COVID data. The year 2020 is omitted from this data since that is the year in which COVID-19 happened. The variables used in this paper are the natural log of personal income as the dependent variable and commute time as a proxy for work from home.We also used the natural log of personal income, fixed for inflation, to show the real relationship between the shift in income from 2014 to 2022 (Table 3). We discovered that the coefficients for our models were the exact same when using the natural log of personal income fixed for inflation as the dependent variable compared to just the natural log of personal income, and future work will need to be done to address this issue. Our work from home variable is measured using a binary variable–where 1 indicates someone the respondent does not commute to work and therefore work from home, and 0 indicates they travel

more than 1 minute to get to work. Since we are using commuting time as a proxy for working from home there could be some weaknesses since we are assuming that zero travel time equals working from home.

Within this paper, we control for characteristics such as occupation and age which may confound our results (see Table 1 for summary statistics). To ensure accurate results regarding income and people actively in the labor force, we dropped those who were unemployed from our data set. However, by doing this, it could lead to limitations in our results since we may be missing important correlations between individuals who were laid off during the pandemic and the industries they belonged to. Other important variables that we cleaned and tested in this paper include the amount of education a person has received and if they are married. Our variable for marriage is a binary variable with 1 representing those who are married with their spouse present and 0 representing those who don't have a present spouse, are divorced/separated, are widowed, or have never been married. We also created a variable representing a person's experience in the workforce using the Mincer Earnings Function (visit methods section). State of employment is another important variable used in our models that shows if there are any disparities in income between state lines. This is an important factor as there were disparate responses to the COVID-19 pandemic by different state governments. In summary statistics table 1 it shows that the number of states is between 1 and 56. This is because in the data the states were not directly listed 1 through 50. So though it says the number of states goes up to 56, in actuality it only goes up to 50 in regard to the 50 states.

Methods/Empirical Strategy

In this paper, we use an interaction model to show the relationship between earnings before and after COVID based on if someone was working from home or in the office. By taking

the natural log of earnings, we are able to interpret each coefficient as a percent change in earnings for a change in the variable of interest. The variable in which we are most interested is *postcovid*wfh* which signifies the change in earnings for an individual who is working from home post-COVID. **X** represents all the demographic variables which are controlled for within our model. These variables include sex, race, marital status, education and occupation. **Z** is the fixed effect for state. By including a fixed effect for state in our model we are able to control for the different regulations that states enacted due to the COVID-19 pandemic. U is the error term within our regression.

W represents experience and experience-squared which we created using the Mincer Earnings Function. The Mincer Earnings Function is an equation created by Jacob Mincer which uses age and years of schooling as a proxy for experience (Lemieux, 2003). To use this function, we first generated a years of education variable. To do this, we categorized years of education between 10 and 18 years based on the highest grade level someone achieved. We created our experience variable by taking $age - years\ of\ education - 6$; this variable gives us an estimate for how much work experience an individual has, which can influence their earnings.

Model one represents our base model showing the interaction between COVID-19 and work from home. Model 2 is the model which we interpreted in our findings. This model includes the interaction of interest as well as all controls and a fixed effect for state.

Model 1

$$ln\_earnings = \beta_0 + \beta_1 post\ covid + \beta_2 wfh + \beta_3 post\ covid * wfh + U$$

Model 2

$$ln\_earnings = \beta_0 + \beta_1 post\ covid + \beta_2 wfh + \beta_3 post\ covid * wfh + \beta'_4 X + \beta'_5 W + Z + U$$

Results

When looking at the natural log of income, we can see an overall increase of earnings in a post-COVID, working from home job. Without controlling for confounding factors such as sex, occupation, education and experience there was a 38.7% increase in earning for an individual who is working from home post-COVID compared to an individual working in the office pre-COVID. This finding is significant at the 99% level which allows us to conclude that there is a statistically significant difference in one's earnings based upon the changes in the labor market that happened after the COVID-19 virus. In our second model we control for factors which may lead to an increase in earnings including sex, occupation, education and income. When controlling for these variables we can see that there is a 29% increase in earning for an individual who is working from home post-COVID compared to an individual working in the office pre-COVID. This interaction variable is statistically significant at the 99% level. Table 1 provides a summary of these variables along with each variable's standard error and statistical significance.

When looking at the natural log of income β_1 is interpreted as a 2.86% increase in income for someone who is working in the office post-COVID compared to working in the office pre-COVID. From this we can see that there was an overall increase in earnings post-COVID compared to pre-COVID for employees who are office based. β_2 is interpreted as a 1.11% decrease in earnings for an individual who is working from home pre-COVID compared to someone who is working from home post-COVID. This tells us that people who were able to work from home after COVID experienced an increase in pay compared to those who could work from home pre-COVID.

Since we dropped all individuals within the data set that were not employed, we could be missing a correlation between industries that had to lay off employees during the COVID-19 pandemic and those industries' ability to offer work from home jobs and its effects on income.

We are also limited in that within our model we are looking at working from home as a treatment to income. Since some people never got the opportunity to work from home post-COVID, the treatment is not applicable to them which may change our interpretation. Looking at people who are not working from home pre- and post-COVID could act as a control which we could compare to people working in an office before COVID and working from home after COVID. Further studies are needed to control for this factor and verify the results.

Conclusion

In conclusion, this study found results that suggest that workers who worked from home after the COVID-19 pandemic experienced an increase in earnings compared to workers who worked in the office pre-COVID. This paper has important implications for workers in the post-COVID labor market. If laborers are able to earn more by working from home, companies will need to keep this in mind as they factor in economic and managerial decisions.

Our work within this paper is only the beginning of further research that can be done to investigate the relationship of work-from-home labor markets and a post-COVID world. As mentioned above, there are limitations to our research that will need to be addressed including the structure and interpretation of our model. Overall we did find a large and significant difference in earnings for individuals working in the office per-Covid compared to those working from home post-COVID.

Figures and Tables

Table 1

Variable	Obs	Mean	Std. dev.	Min	Max
year	11,957,326	2018.004	2.58999	2014	2022
sex	11,957,326	1.479297	.4995712	1	2
age	11,957,326	41.75429	13.39489	16	65
married	11,957,326	.5376064	.4985838	0	1
race	11,957,326	2.011914	2.131033	1	9
educ	11,957,326	7.767746	2.320038	0	11
empstat	11,957,326	1	0	1	1
occ	11,957,326	4089.45	2664.988	10	9830
ln_income	11,949,456	10.49054	1.122404	0	14.31021
ln_inflation	11,949,456	13.93256	1.122404	3.442019	17.75223
pwstate2	11,957,326	27.90486	16.02706	1	56
wfh	11,957,326	.0870553	.2819161	0	1

Table 2

	(1)	(2)
VARIABLES	inctot	inctot
postcovid	5,478***	7,095***
	[54.22]	[42.92]
wfh	13,688***	3,795***
	[115.2]	[92.21]
inter	22,231***	12,490***
	[163.2]	[132.8]
occ		-3.560***
		[0.00706]
sex		-23,833***
		[34.90]
married		9,601***
		[38.08]
educ		6,287***
		[9.231]
experience		2,259***
		[4.796]
experience2		-33.34***
		[0.105]
race		-1,036***
		[8.706]
Constant	55,553***	23,630***
	[26.02]	[111.7]
Observations	10,876,693	9,364,403
R-squared	0.014	0.212
Standard errors in brackets		
*** p<0.01, ** p<0.05, * p<0.1		

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