

Working-From-Home and Contact-Intensive Jobs in Uruguay*

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First draft: April 6, 2020

Current draft: December 2, 2020

Abstract

In this article, I estimate how many workers have jobs that can be performed at home (WFH) and jobs with close physical contact to other people (CI) in Uruguay. To identify the jobs that are WFH and CI, I adopt the methodology of [Dingel and Neiman \(2020\)](#) and [Mongey, Pilossoph and Weinberg \(2020\)](#) used for US. My baseline estimates show that around 78% of the workers in the private sector can't WFH and 22% have CI jobs. Next, I find large heterogeneity in WFH and CI propensities across the income distribution, geographical locations, age groups, education levels, and production sectors. In addition, I study the relation of WFH and CI measures with household access to social insurance, hand-to-mouth propensity, and intra-household insurance. Lastly, I show that my baseline estimates of WFH are consistent with ex-post survey estimations during the Covid-19 pandemic lockdown in Uruguay.

Keywords: COVID-19, working from home, employment

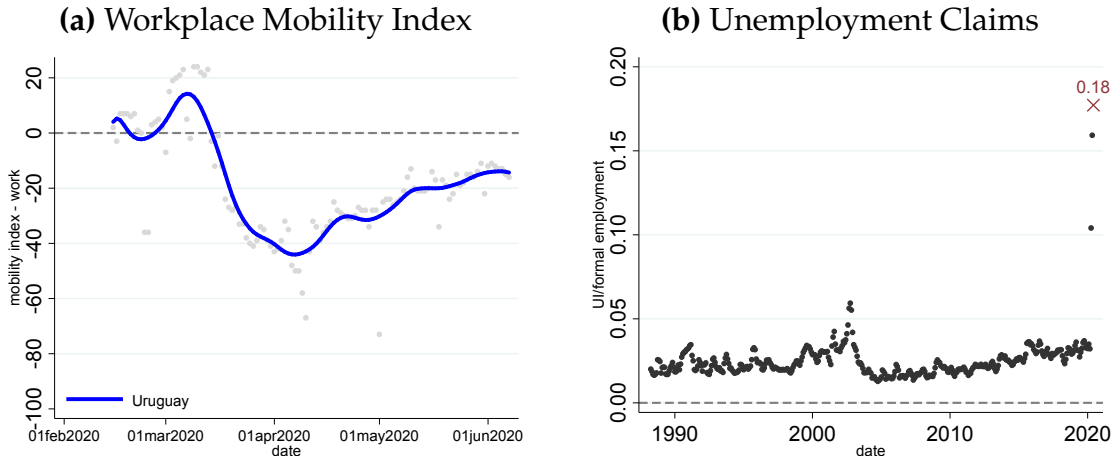
*All errors are my own. Thanks to Ana Balsa, Lucia Casal, Juan Dubra, Federico Ganz, Gonzalo Varela, Rafael Xavier and participants in the Universidad of Montevideo economics seminar. Thanks to the the Faculty of Social Sciences of UdelaR that provide me access to data from the EFHU. [Codes and data](#) are publicly available, except for the data that needs permission to be accessed.

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1 INTRODUCTION

As a response to the Covid-19 pandemic governments and individuals quickly adopted policies and changed their behavior in order to reduce the spread of the virus.¹ Uruguay was no exception. Figure 1 panel (a) shows that from mid-March to mid-April in Uruguay mobility to workplaces decreased by 40%. Simultaneously, there was a spike in the unemployment insurance claims (see Figure 1 panel (b)) which incremented by 15 p.p. in terms of the formal labor force size.

Table 1: Mobility in Workplace and Unemployment Claims in Uruguay



Notes: Panel (a) shows the mobility in workplace index relative to pre-covid levels in January and February. The solid line is the locally weighted smoother. Panel (b) shows the unemployment claims, traditional type, as a fraction of formal active workers in Uruguay. Data source: Google mobility reports BPS, various media outlets and unaimagen.uy.

The crisis doesn't impact all jobs in the same way. Jobs that can't be performed from home or usually require very close physical contact are particularly exposed to the social distancing policies. Motivated by this, in this paper I estimate the share of workers that can work-from-home (WFH) and have contact-intensive (CI) jobs in Uruguay. Moreover, I study how the WFH and CI jobs propensities vary across a large set of worker's and household's characteristics.

In order to identify which workers can WFH and have CI jobs in Uruguay, I follow closely the methodology used by [Dingel and Neiman \(2020\)](#) and [Mongey et al. \(2020\)](#) for U.S.. The methodology classifies the different occupations by WFH and CI jobs using data from several tasks per occupation. I combine the *O*NET* database that includes detailed information regarding each occupation's tasks with the *Encuesta Continua de Hogares* (ECH) of Uruguay that includes information about Uruguayan worker's characteristics and with the Survey of Household Finances of Uruguay (EFHU) that provides household's balance sheet information.

¹Throughout the text I will use the word policy interchangeably to describe individual behavior and government policies.

I document that 78% of the workers can't WFH and 22% have CI jobs. Most of the workers with CI jobs can't WFH, thus I classify them on three large subgroups: (i) workers that can WFH; (ii) workers that have CI jobs; and (iii) workers that can't WFH, but they don't have CI jobs. This provides an interesting characterization since workers in the third group are the ones whose job is very likely to be affected if they can't go physically to work, but not affected by mild workplace social distancing policies. For Uruguay I find that this group is large, about 55% of the private sector workers.

Next, to conjecture about the possible redistributive consequence of the pandemic, I estimate the share of workers that can WFH and have CI jobs across income, regions, age, education, and production sectors. The main findings are as follows: first, low income workers are significantly less likely to WFH and are more likely to have CI jobs. This disparity is exacerbated when considering inequities in internet access. Second, poorer countries, regions in Uruguay, and neighborhoods in Montevideo have lower percentages of WFH workers and higher percentages of CI jobs. Third, older and less educated workers are less likely to WFH, though there isn't much variation across age and education for CI jobs. Lastly, there is significant heterogeneity across sectors, and sectors with particularly low WFH shares and high CI jobs shares make substantial contributions to aggregate employment and GDP.

Moreover, I study the possibilities of public, private, and intra-household insurance for workers who are exposed to the pandemic (i.e., cannot WFH or have CI jobs). I document that a large fraction of those who are exposed are self-employed and informal workers, have low levels of liquid assets (i.e., are hand-to-mouth), and have low intra-household insurance (i.e., other household members are exposed too). These findings suggest that even if the reduction in their income due to the pandemic is temporary, it may still lead to significant adjustments in consumption and reductions in welfare.

Finally, I compare the paper's baseline estimates of WFH (ex-ante) with survey data collected during the Covid-19 pandemic (ex-post). I find that the ex-ante estimates are remarkably close to the ex-post estimate and consistent across various characteristics.

Contribution and Related Work. This paper provides one of the first estimates of WFH and CI jobs propensities for an emerging economy.² The methodology is based on [Dingel and Neiman \(2020\)](#), and [Mongey *et al.* \(2020\)](#) which perform similar calculations for U.S.. The literature measuring WFH and CI on a country-level sparked after the pandemic started. Several early contributions are: [Dingel and Neiman \(2020\)](#) and [Gottlieb, Grobovsek and Poschke \(2020\)](#) for a large cross-section of countries, [Kaplan, Moll and Violante \(2020\)](#), and [Leibovici, Santacreu and Famiglietti \(2020\)](#) for U.S., [Stratton \(2020\)](#) for Australia, [Boeri, Caiumi and Paccagnella \(2020\)](#) for 6 Euro-

²The first draft was shared publicly on April 4, 2020.

pean countries, [Barbieri, Basso and Scicchitano \(2020\)](#) for Italy, [Saltiel \(2020\)](#) for several emerging economies, [Albrieu \(2020\)](#) for Argentina, and [Monroy-Gomez-Franco \(2020\)](#) for Mexico, among many others. Particularly, for Uruguay there are other studies, such as [Capotale, Pereira and Zunino \(2020\)](#) and [De los Santos and Fynn \(2020\)](#), which focus on the WFH possibilities for informal and self-employed workers. I provide a thorough characterization of WFH across many relevant characteristics and extend to estimations of the CI jobs.

The goal of this paper is to contribute to the characterization of the WFH and CI in Uruguay. The characterization can be helpful as a guide to understand which households and workers across the country are likely to be the most hardly hit either by a strong lockdown policy (i.e. not WFH workers) or even a milder policies (i.e. CI workers).

Organization. The paper is divided in four sections. Section 2 describes the data and methodology, Section 3 presents the share of WFH workers and CI jobs in Uruguay and across various characteristics, and the insurance possibilities of exposed workers. Section 3 compares the paper’s estimations to ex-post survey data, and Section 3 concludes. The paper includes an Appendix with further details and results.

2 DATA AND METHODOLOGY

Data sources. To determine which occupations are the ones that can be performed at home (WFH) and which ones are contact-intensive (CI), I use data from O*NET which provides detailed information on 8-digit O*NET-SOC occupations’ tasks. O*NET is sponsored by the U.S. Department of Labor and collects data from surveys to a large pool of firms and workers in US. For detailed information on household’s and worker’s characteristics in Uruguay, I use the last publicly available wave, 2019, of the *Encuesta Continua de Hogares* (ECH) elaborated by the Instituto Nacional de Estadística (INE) from Uruguay. The survey samples around 40,000 households representative of the Uruguayan population. In addition, to estimate the households’ asset positions, I use household-level balance sheet data from the 2017 *Encuesta Financiera de los Hogares Uruguayos* (EFHU) elaborated by various government agencies and was gently provided by the Faculty of Social Sciences of Udelar. This survey is contained within the ECH survey for a representative sub-sample. For both surveys, the baseline estimations are for private sector workers and the sample selection impact on the sample is detailed in Table A.1. The ECH includes 412 different occupation categories. Lastly, I use cross-country data is from [Dingel and Neiman \(2020\)](#) and extend their cross-country estimates to CI jobs.

Methodology. I follow closely [Dingel and Neiman \(2020\)](#) and [Mongey *et al.* \(2020\)](#) approach to identify the workers that can WFH and have CI jobs. The variables I use are the same as those papers (see Table [A.2](#)), but the cross-walk and aggregation from 8-digit O*NET-SOC to 4-digit ISCO occupation level codes is slightly different.³ The procedure to compute the WFH and CI indicators for the Uruguayan workers is as follows:

1. For each SOC occupation I calculate the mean for the normalized O*NET task-level score using the selected tasks. Scores for each task-occupation have values from 1 to 5. The larger the score the easier to work-from-home or the more proximity to others in the workplace.
2. If an occupation has a score larger than 4 we consider the occupation can be done at home or has a close proximity to others.
3. Since the ECH and EFHU classify occupations using the ISCO code, I use the SOC-O*NET to ISCO crosswalk to aggregate for each occupation in the ECH. I use the same procedure as the one described by [Dingel and Neiman \(2020\)](#) in their methodological appendix for their cross-country estimates. For robustness, I aggregate also using the maximum and minimum.

3 RESULTS

In the following section I show the main results of the paper. First, I present aggregate estimations of WFH and CI for Uruguay. Second, I describe the heterogeneity in WFH and CI across several characteristics: income, regions, age, education, and production sectors. Lastly, I show further results that relate WFH and CI to social insurance, self-insurance, intra-family insurance and automation risk.

3.1 Aggregate WFH and CI

Applying the methodology described in Section [2](#) I can identify which occupations can be performed at home and which ones require close physical contact to be performed properly. Table [2](#) shows the share of workers that can WFH and have CI jobs in Uruguay for selected occupations. Occupations related to the information and communication technology sector and office jobs tend to have characteristics that make them easy to be performed at home and also they don't require a close contact with others. Other set of occupations, such as the ones related to retail, industrial or agriculture sectors usually require physical presence, but not necessarily require close contact

³I use the cross-walk provided online by Hardy (2016) that is based on [Acemoglu and Autor \(2011\)](#).

with customers or co-workers. On the other hand, other occupations that are in the service and health sector require both presence and close contact for their usual performance. Lastly, occupations in the educational sector are the most salient example of jobs that can be done at home and at the same time when not done at home require close contact.

Table 2: Selected Occupations in Uruguay

Occupation (2-digit ISCO-08)	WFH	CI	Examples
Information and comm. technology	1.00	0.00	software developers
General and keyboard clerks	1.00	0.00	office clerks
Administrative and commercial	0.90	0.00	commercial managers
Sales workers	0.20	0.03	retail store workers
Skilled forestry, fishery and hunting	0.00	0.00	agricultural producers
Stationary plant and machine operators	0.00	0.00	manufacturing workers
Personal service workers	0.01	0.73	waiters, hairdressers
Health professionals	0.09	0.93	medical doctors
Education professionals	0.89	0.53	teachers, professors

*Notes: data is for Uruguay in 2019. Data source: O*NET and ECH-INE Uruguay 2019.*

Table 3 shows the main aggregate results. I find that only 22% of the workers can WFH in Uruguay. Most of the WFH doesn't require close contact (20%), thus the fraction of workers that WFH and CI, which are mostly in the educational sector, compose a small fraction of the total (2%). Moreover, I find that around 22% of the worker have CI jobs, with most of them not being able to WFH (20%). Finally, a large fraction of the workers are not able to WFH, but their job doesn't require close contact (58%).⁴ This group is particularly interesting since these are workers that can potentially find their working possibilities strongly limited by a lockdown, but not necessarily if they can go to work under mild workplace social distancing policies. This suggest that considering both dimensions could gives us a hint which are the potential implications for different sets of social distancing policies.

3.2 WFH and CI Heterogeneity

In this section, I document how likely are to WFH and have CI jobs across a relevant set of characteristics. First, I look across the income distribution and extend the analysis to consider unequal Internet access. Second, I describe the share of WFH and CI across countries, Uruguayan regions and neighborhoods in Montevideo. Third, I study the

⁴In Figure A.1 I show at an occupation level the matrix using the WFH and CI scores from computed from O*NET importance scores.

Table 3: Work-From-Home and Contact-Intensive Jobs in Uruguay

	Work-from-home	Can't work-from-home
Not contact-intensive	0.20 [0.19 - 0.25]	0.58 [0.47 - 0.67]
Contact-intensive	0.02 [0.01 - 0.05]	0.20 [0.11 - 0.30]

*Notes: the table shows the proportion of private workers by characteristics. In brackets value corresponds to the upper and lower bound estimates for each category. Data source: O*NET and ECH-INE Uruguay 2019.*

share of WFH and CI across different age group and education levels. Lastly, I document the heterogeneity across sectors, and estimate the economic relevance of low WFH and high CI sectors.

3.2.1 Income

In Figure 1 I show the share of WFH (blue dots) and CI (yellow dots) across the income distribution. In the panel (a) a striking pattern emerges, income-poor workers are much less likely to have WFH jobs and much more CI jobs than income-rich workers. Suggesting that the inability to go to work would imply a larger direct impact for income-poor workers. The same follows for CI and mild workplace social distancing policies, but in a less stark fashion. Panel (b) shows the share of households across the income distribution that can't WFH and don't have CI jobs. These types of occupations are particularly frequent for income-poor workers, which suggests that mild social distancing policies are likely to be much less regressive in their direct impact than lockdown type of social distancing policies.⁵

Unequal Internet Access. One necessary condition for jobs to be performed at home is that workers have access to Internet connection. Although 74% of the workers are in households with access to Internet connection when we condition to WFH workers 90% of them have Internet access. Thus overall access to Internet is not a large impediment for WFH, differently from other emerging countries. In Figure A.2, I show that in spite of this, access to Internet is very unequal, therefore WFH is even more limited for income-poor workers than what the baseline estimates suggested.

3.2.2 Geographical Locations

Dingel and Neiman (2020) and Gottlieb *et al.* (2020) shows that there is substantial heterogeneity in WFH across countries. In the same spirit, I extend this to CI jobs across

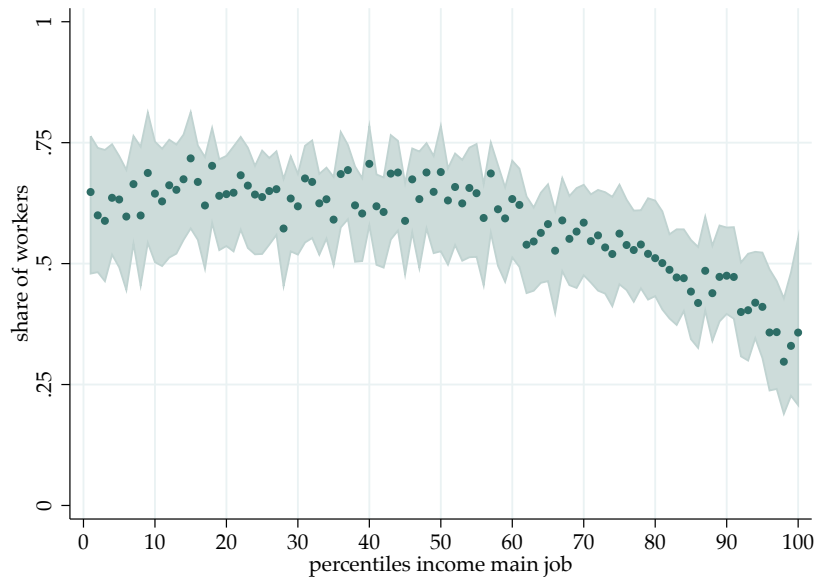
⁵In Appendix B.2 I compare these results with the ones for U.S..

Figure 1: WFH and CI Across the Income Distribution

(a) WFH jobs and CI jobs



(b) Non-WFH and Non-CI jobs



Notes: in the figure dots indicate the observed proportion of the workers that WFH (blue) and CI (orange). The shadowed area show the max and min when we aggregate from SOC to ISCO from O*NET to ECH. Income percentiles are constructed using the main job labor income at February 2020 Uruguayan pesos. Estimates use the official ECH survey weights. Data source: O*NET and ECH-INE Uruguay 2019.

countries, and explore heterogeneity in WFH and CI across regions within Uruguay. In Figure 2 panel (a) and (b) I show the relation between WFH and CI across countries. Panel (a) replicates Figure 2 panel (a) in [Dingel and Neiman \(2020\)](#) and shows that richer countries have a larger fraction of workers that can WFH.⁶ I extend also to CI, panel (b) shows an ambiguous relation between income and CI possibilities. Notices that CI occupations are located in various part of the income distribution, e.g. doctors and manual workers have CI jobs.

Then I perform the same analysis within Uruguay. Panel (c) shows WFH shares across Departments. The same pattern emerges as across countries. In particular, we can observe that Montevideo, which is the richest region, has a proportion of more than 30% of their workers doing WFH jobs. On the other hand, the rest of the Departments exhibit a share of WFH lower than 20% and the poorest regions close to only 10%. On the contrary, in panel (d) we don't observe a clear relation between CI job share and income levels across Departments. Both patterns remain unchanged even when excluding rural workers, see Figure A.3. Finally, I focus on neighborhoods within Montevideo. Figure 2 panel (e-f) shows again an increasing pattern between WFH and income across neighborhoods. More than half of the workers that reside in the richest neighborhoods have the possibility to WFH, while this share is less than 10% for poor neighborhoods. Differently from panel (b) and (d) now CI have a clearly decreasing pattern with income level across neighborhoods. At least one fourth of the workers have CI jobs in poor areas and less than one tenth for richer neighborhoods. This suggests that within Montevideo we may expect a direct regressive impact of strong and mild social distancing policies across areas.

Across all the geographical units studied in this section I find that WFH shares are increasing the higher is the income in the region, this suggests a regressive impact of the pandemic spatially. On the other hand, CI only display this pattern across neighborhoods within Montevideo.

3.2.3 Age and Education

Age Groups. Recent research suggest that the pandemic has distinctive health impact across different age groups and therefore lockdown policies may be optimally targeted using different age groups. For example, [Acemoglu, Chernozhukov, Werning and Whinston \(2020\)](#) argue that people over 65 years of age have a mortality from the Covid-19 infection that is about 60 times the one of those aged between 20-49. They find using a quantitative multi-group SIR model that this heterogeneity in mortality

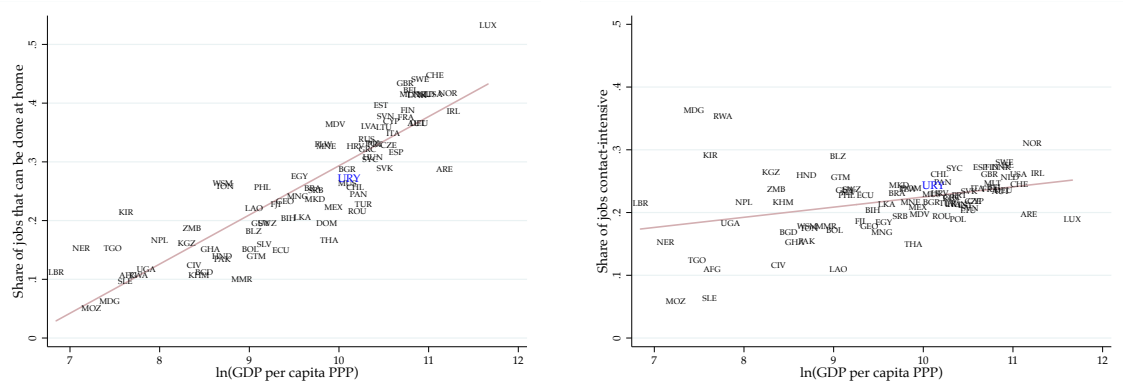
⁶[Gottlieb et al. \(2020\)](#) argue that in part this relation is driven because poor country workers in the agricultural sector as considered as non-WFH. When relaxing this they find a U-shape between income and WFH.

Figure 2: WFH and CI Across Regions in Uruguay

Countries

(a) WFH

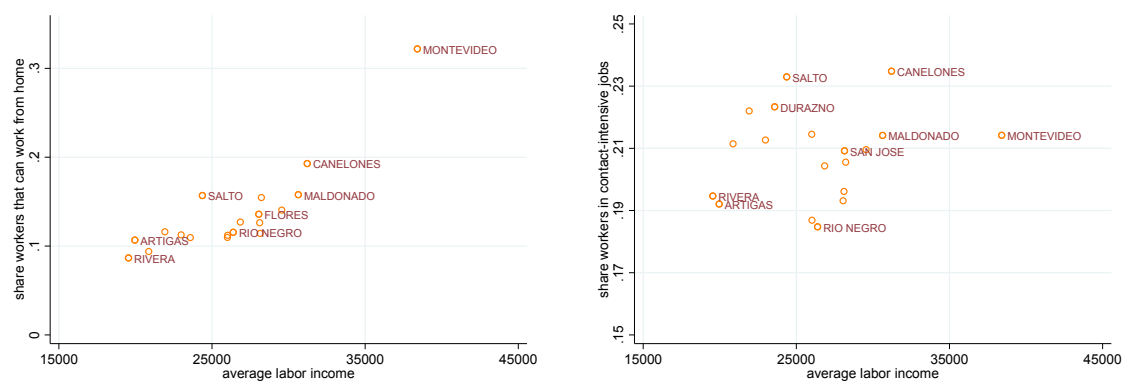
(b) CI



Departments in Uruguay

(c) WFH

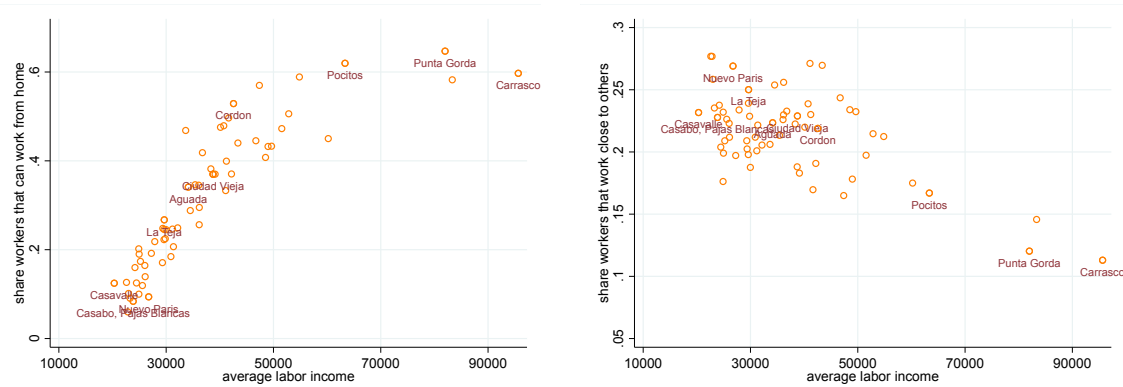
(d) CI



Neighborhoods in Montevideo

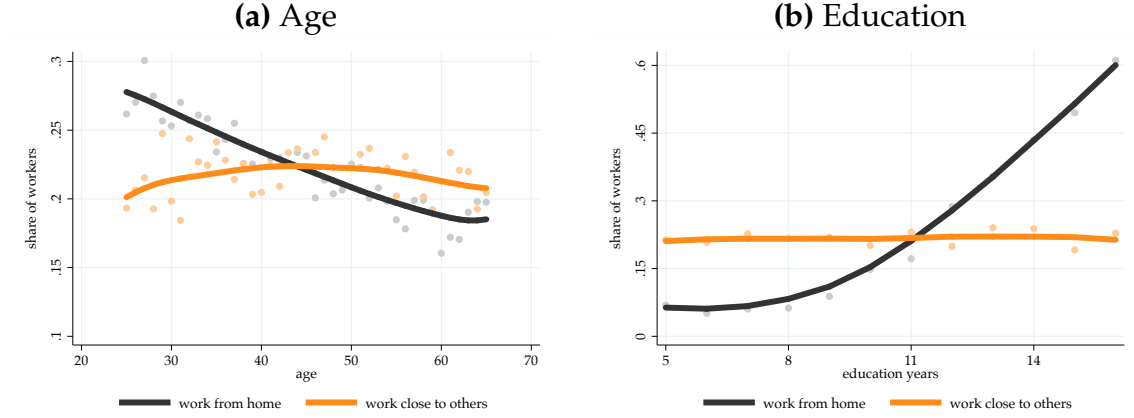
(e) WFH

(f) CI



Notes: Panel (a-b) shows the share of WFH and CI workers (includes private and public workers) across country. Panel (c-d) shows the share of WFH and CI workers by Uruguayan department. Panel (e-f) shows the share of WFH and CI workers across Montevideo's neighborhoods. Data source: O*NET and ECH-INE Uruguay 2019.

Figure 3: WFH and CI Across Age and Education



Notes: Panel (a) shows the share of WFH and CI workers (includes private and public workers) across age groups. Panel (b) shows the share of WFH and CI workers across years of education completed by the workers. Data source: O*NET and ECH-INE Uruguay 2019.

rates leads to an optimal policy with stronger lockdown policies over the old aged. Motivated by these, I find particularly interesting to explore how many WFH and CI are in Uruguay across age groups. Figure 3 panel (a) shows that there is a stark decreasing pattern in WFH share across age of the workers. At least one out of four young workers can WFH, and less than one out of five close to retirement aged workers. This suggests that also old aged workers may be more affected by strong lockdown policies. On the other hand, CI have a slightly inverted U-shaped pattern across age, but mostly the differences seem not to be economically relevant.

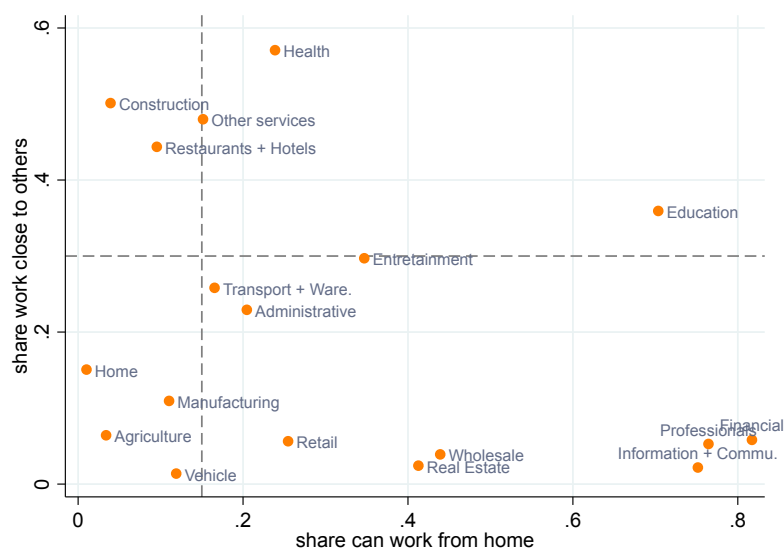
Education Levels. Intuitively we expect that more educated workers do proportionally more WFH jobs, but as we observed in Table 2 some well paid jobs such as doctors have are CI and not WFH. Figure 3 panel (b) quantifies this relation. We find that highly educated workers are more likely to have WFH and workers with few years of education mostly have jobs that require to be performed in person. This pattern is not surprising since education is usually a good predictor of future income. Moreover, I explore using a simple regression setup which are the best predictors of WFH. I find that education explains most of the predictable variability of WFH. Results are summarized in Figure A.3. Lastly, the relation of CI and education is flat. The lack of heterogeneity of CI is consistent with various of the previous results.

3.2.4 Production Sectors

Other relevant aspect is the sector level impact of the crisis. For example, in principle an accountant that can WFH is likely not be directly impacted by physical impediments to go to work, but an accountant that works for a firm in the manufacturing sector,

which is a sector where most of the worker's are required to be physically present, may be indirectly impacted by lockdown policies.

Figure 4: WFH and CI Across Production Sectors



Notes: the figure shows on a 4-digit level sector categories the share of WFH and CI. Data source: O*NET and ECH-INE Uruguay 2019.

Figure 4 shows the share of WFH and CI across sectors. There is large heterogeneity. Sectors such as the manufacturing, agriculture, restaurants and hotels, and construction among others have very low WFH shares, but not necessarily a large share of CI. On the opposite side, other sectors have very low levels of CI and high WFH shares. These sectors are mostly related to professional and technological services. With two notable exceptions, the health sector, which is essential during the pandemic, and educational sector, which can also be performed at home. Lastly, sectors with high levels of CI (more than 30%) have a share of 29% of GDP and 31% of aggregate employment. Moreover, sectors with low levels of WFH (less than 15%) have a share of 45% of GDP and 38% of aggregate employment. Therefore, sectors highly exposed, through these channels, are relevant in the aggregate economy.

3.3 Exposed Workers' Insurance

Workers hit by the pandemic may be able to smooth consumption and have lower welfare consequences if they have ample access to several forms of insurance. In this section, I quantify how many of the workers that can't WFH and have CI jobs lack public insurance, self-insurance, and intra-familial insurance.

3.3.1 Vulnerable

As shown in Figure 1 panel (b) there was an abnormal spike in UI claims. Workers that can claim the UI are able to access to a transfer that compensates temporarily for the labor income losses. Not every worker is able to access those benefits and even if they access the benefits would be very small (e.g. very low income workers) to provide a subsistence level of income. In the following exercise, I will try to quantify how many workers that are vulnerable can't work-from-home and have contact-intensive jobs. Where vulnerable workers are those that before the pandemic were informal, self-employed, low income, or unemployed. Table 4 shows the results. Between 40%-50% of the workers are particularly vulnerable to this crisis. This number is close to a similar exercise done by Capotale *et al.* (2020). The quantitative relevance of these numbers suggest that the welfare effects of the pandemic in the short term could be sizable if these households are not insured through new public insurance mechanisms, or through other channels such as self- and intra-household insurance (both studied in the following subsections).

Table 4: Vulnerable Workers that can't WFH and have CI jobs

	Not WFH	CI	All
Workers (private)	1,055,002	290,961	1,350,471
Informal	343,944	106,485	391,421
Self-employed	301,763	102,233	383,009
Low Income	241,180	61,932	267,464
Unemployed	117,724	27,866	137,452
Vulnerable (w/o unemployed)	523,432	147,203	622,061
Vulnerable (w/ unemployed)	641,156	175,069	759,513

*Notes: low income workers are those with an income lower than 1.5 times the poverty line. Informal workers are those that don't contribute to social insurance. Self-employed workers exclude business owners with workers. Unemployed workers include, both, those who are not employed and seeking for a job or not. Data source: O*NET and ECH-INE Uruguay 2019.*

3.3.2 Hand-to-Mouth

Other source of insurance is self-insurance through the accumulation of liquid assets. In Uruguay access to credit is very limited for the households, private credit account for only around 20% of GDP. Tight credit conditions precludes households, that hold few liquid assets, from smoothing consumption when having a negative transitory shock to income. This implies that if a large fraction of the households have low levels of liquid assets during the Covid-19 crisis we would expect a large contraction of ag-

gregate consumption, even if the crisis is temporary. A sharp reduction in aggregate demand through this mechanism may spillover to a prior unaffected sectors as argue by [Guerrieri, Lorenzoni, Straub and the \(2020\)](#).

To characterize the workers that have low levels of liquid assets, i.e. hand-to-mouth, we use data regarding the balance sheet of the households collected in the EFHU. Using this survey I identify the hand-to-mouth workers as those who hold less liquid asset than two weeks of their income.⁷ I find that 77% of the households are hand-to-mouth under this definition in Uruguay. Moreover, I find that around 64% of the households are hand-to-mouth and can't WFH, and 17% have CI jobs and are hand-to-mouth. This combined with the fact that credit markets in Uruguay are very underdeveloped suggest a sharp contraction of aggregate consumption through this channel. Lastly, if we explore across the income distribution, see Figure [A.4](#), we can find that hand-to-mouth households are dis-proportionally income- and wealth-poor households. A large fraction of poor hand-to-mouth households suggest that also low income households lack self-insurance, and welfare consequences could be potentially large in the case of a strict lockdown policy.

3.3.3 Intra-Familiar Diversification

Insurance may also come from other household members. For example, it may be the case that even if a worker can't WFH other member of the household can. In the same fashion as [Albanesi, Gihleb, Kim and Huo \(2020\)](#), I analyze the share of households that are exposed and diversified, and those which are exposed and not diversified.

Table 5: Intra-Familiar Diversification in Uruguay

# WFH						# CI				All
0123+						0123+				
# HH members	1	0.33	0.15	-	-	0.40	0.09	-	-	0.49
	2	0.20	0.14	0.08	-	0.29	0.11	0.02	-	0.42
	3+	0.04	0.03	0.02	0.01	0.05	0.03	0.01	0.00	0.09
	total	0.57	0.32	0.10	0.01	0.74	0.23	0.03	0.00	1.00

Notes: Numbers indicate the share of households over the total population of households with workers. Number of members refers to the number of members that work, # WFH corresponds to the numbers of HH members that work and can WFH, and # CI refers to the number of household members that work and have CI jobs. Data source: own estimates, INE Uruguay and Equipos Consultores.

In Table 5 shows the results. I find that in 57% of the households non of it's members can't WFH, and in 11% of them all their members have CI jobs. Also in figure [A.5](#) I

⁷Results are qualitatively aligned with [Kaplan et al. \(2020\)](#) that find that exposed households are much more likely to be hand-to-mouth.

explore the intra-household insurance by their share in income instead of number of workers, i.e. is how much of the labor income within households is exposed. I find that the share of households with a worker that can't WFH with at least 20% of their income exposed is close to 90%, this number is around 60% for households with at least one worker that has a CI occupation. Overall we have that a large fraction of the households are non-diversified in case of a strict lockdown, naturally the fraction is lower if CI jobs are the only ones directly affected.

3.4 Further Results

This section includes additional results related to automation exposure and a detailed comparison with U.S.

Automation Exposure. Even though the impact of the pandemic which is related to the nature of the jobs may disappear once social distancing policies are over and the vaccine is widely available, there is some speculation that those jobs affected by the pandemic may be replaced sooner than before because of an acceleration of the automation process.⁸ Motivated by this I analyze the relation of WFH and CI with the measures of automation risk elaborate by [Webb \(2020\)](#). The risk measures are on an occupation level and for different kinds of technologies, i.e. robots, software and AI. Figure [B.1](#) shows the relation between automation, and the possibilities of WFH and CI. Two patterns emerge, panel (a) shows that jobs that are less likely to be performed at home have a higher risk of being substituted by robot type of technologies. These technologies substitute usually jobs that have a high manual component which naturally are very likely to be necessarily performed in-person. On the other hand, panel (b) shows that less CI jobs are more likely to be substituted by AI technologies. This last result is consistent with the fact that high CI jobs such as the ones related to medical and educational services which tend to be non-routine are the ones exposed to AI as shown by [Webb \(2020\)](#). The last suggests non-trivial effects of an apparent acceleration of the automation process over the most disrupted jobs during the pandemic.

U.S. vs Uruguay. I study the within country pattern of WFH and CI across the income distribution for U.S. and compare it to the one in Uruguay. Figure [B.2](#) panel (a-b) show that qualitatively the same pattern emerges for U.S. and Uruguay. In both, WFH is increasing with income, and CI decreasing with income. Also there are some differences. WFH shows a much higher level for the same position across the income distribution for U.S. relative to Uruguay. For example, workers in the 70th percentile of

⁸See for example this [article](#).

income in Uruguay have the same share of WFH than the bottom 10 of the U.S. income distribution. Moreover, top incomes in U.S. are much more likely to have WFH than in Uruguay. On the contrary, CI decreasing pattern is starker in U.S. than in Uruguay. Low income workers in U.S. are much more likely to have CI jobs than low income workers in Uruguay, this relation reverses the higher the income. Moreover, in Figure B.2 panel (c-d) I sort workers by their years of education and find that for both countries display the same pattern, qualitatively and quantitatively.⁹ This suggests that workers with the same educational level in Uruguay and U.S. have jobs with similar possibilities to WFH. On the other hand, a similar pattern is observed for CI jobs, slightly increasing in U.S. and mostly flat in Uruguay. Overall, this suggests that differences in the educational level may explain a large fraction of the differences between U.S. and Uruguay in WFH, less so for CI.

4 COMPARISON WITH EX-POST SURVEY ESTIMATES

In this final section I will compare some publicly available ex-post survey measures of WFH during the Covid-19 pandemic in Uruguay and the estimates in this paper. Table 6 shows the comparison between the baseline estimates for WFH with effective WFH during the pandemic estimated in two waves by the polling firm Equipos Consultores and the ECH 2020 preliminary aggregate estimates.¹⁰ The estimates for WFH are very close to ex-post survey estimates. Moreover, Figure A.6 compares the paper's WFH to those done by Equipos across various characteristics. The share of WFH across characteristics is distributed in a very similar way across both measures.¹¹

Table 6: WFH in Uruguay: Ex-Post Surveys Comparisons

	Guntin (2020)	Equipos	Equipos	INE
Previously	-	0.04	0.05	0.05
New	-	0.20	0.17	0.14
All	0.26	0.24	0.22	0.19
Date survey	-	03/2020	05/2020	04/2020

Notes: Workers are from the private and public sector. Previously are the share of workers that WFH before March 2020, New are the ones that started WFH after March 2020. Data source: own estimates, INE Uruguay and Equipos Consultores.

⁹I focus on education because Figure A.3 shows that one of the main predictors of WFH is education.

¹⁰For the 2020 wave the INE included questions related to WFH.

¹¹Moreover, more recent estimates from the INE across characteristics are consistent qualitatively and quantitatively with the findings of this paper. See [link](#)

5 FINAL REMARKS

The social distancing policies adopted to limit the spread of the Covid-19 virus implied a significant disruption of certain economic activities. This abrupt change in behavior have direct consequences on jobs that can't be done at home and require close physical contact.

In this descriptive analysis for Uruguay, I showed that stricter policies that precludes workers from going to work physically could let to significant aggregate and redistributive consequences through the nature of the worker's jobs. Moreover, milder social distancing policies that disrupt only contact-intensive jobs might have significantly weaker aggregate and redistributive consequences.

This analysis is purely descriptive which may be suggestive about certain aspects of the social distancing polices, but is not indicative of the desirability of different policies. For a normative analysis it is necessary to consider the proper trade-offs. In this spirit, a large body of research has approached the normative aspects of the pandemic by considering health and economic aspects jointly.

The main caveats of the estimations in this paper are: (i) the occupation classification is done using U.S. data, instead of Uruguayan. This may led to certain errors if for the same occupation the nature of job is significantly different in Uruguay relative to U.S.; (ii) other characteristics apart from Internet access of the households may prevent workers from WFH; (iii) for some jobs rapid technological advances, e.g. in the medical sector, and labor mobility across occupations may have diminish the role of the nature of the jobs in affecting the possibilities of WFH and CI. This is outside the scope of this work.

Finally, the main purpose of this analysis is to serve as an input to other studies and contribute to a growing body of work trying to estimate the potential costs of the Covid-19 pandemic.¹²

¹²Notable examples are [Brum and De Rosa \(2020\)](#) who use the measures of WFH and CI elaborated in this paper as part of their input to study the short-term impact of the Covid-19 pandemic on poverty in Uruguay, and [Díaz, Fossati and Trajtenberg \(2022\)](#) who use the measures to study the dynamics and geographical patterns of local crime during Covid.

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APPENDICES

A Additional Figures and Tables

Table A.1: Sample Selection ECH 2019

Category	Observations
All	107,871
Worker	49,036
Private sector	40,714

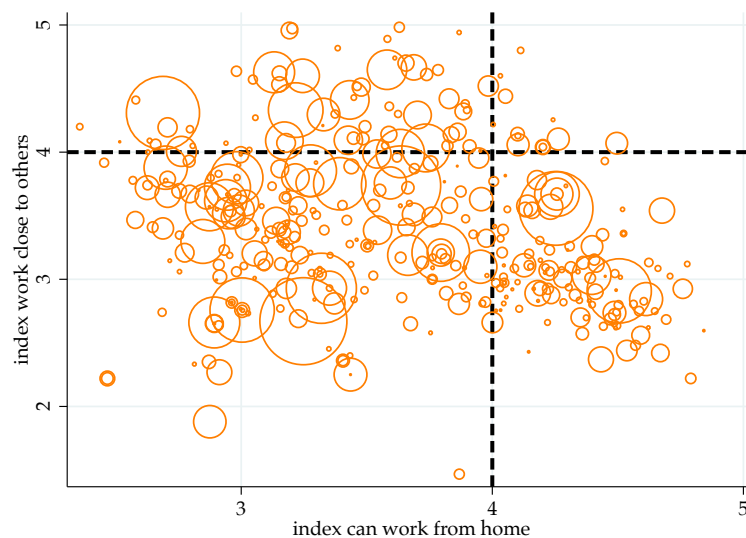
Notes: Private sector excludes unpaid workers. Data source: O*NET and ECH-INE Uruguay 2019.

Table A.2: Tasks used to identify WFH and CI

Category	Variable	Type
Distance	Inspecting Equipment, Structures, or Material	Activities
	Performing General Physical Activities	
	Handling and Moving Objects	
	Controlling Machines and Processes	
	Operating Vehicles, Mechanized Devices, or Equipment	
	Repairing and Maintaining Mechanical Equipment	
	Repairing and Maintaining Electronic Equipment	
	Performing for or Working Directly with the Public	
	Electronic Mail (-)	
	Deal With Physically Aggressive People	
Context	Outdoors, Exposed to Weather	Context
	Outdoors, Under Cover	
	Exposed to Disease or Infections	
	Exposed to Minor Burns, Cuts, Bites, or Stings	
	Spend Time Walking and Running	
	Wear Common Protective or Safety Equipment	
	Wear Specialized Protective or Safety Equipment	
Proximity	Physical Proximity	Context

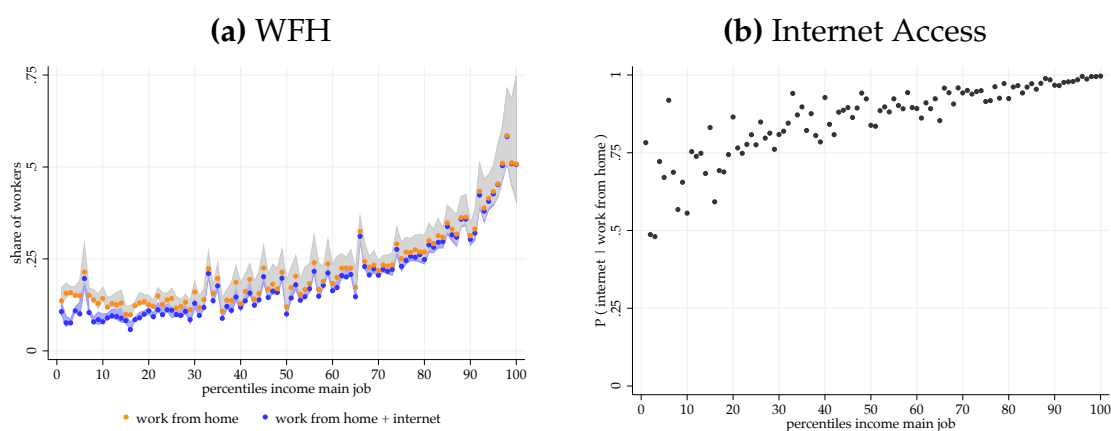
Data source: based on [Dingel and Neiman \(2020\)](#) and [Mongey et al. \(2020\)](#).

Figure A.1: Relation between WFH and CI



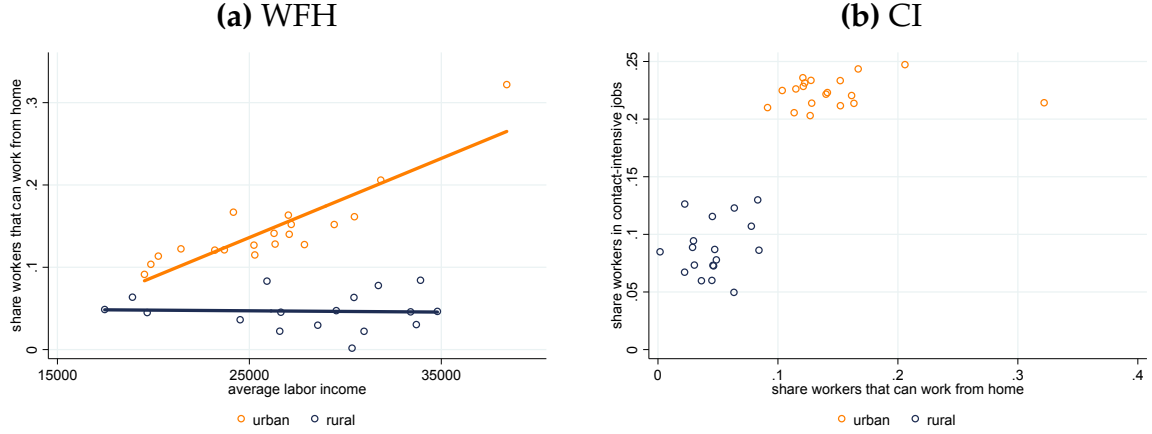
Notes: the figure shows for each occupation the WFH and CI index constructed as an average of the task importance scores of O*NET. The size of the circles represent the amount of workers in Uruguay for each occupation. The black dashed lines indicate the cut-off used to define an occupation as WFH or CI. Data source: O*NET and ECH-INE Uruguay 2019.

Figure A.2: WFH and CI Across the Income Distribution



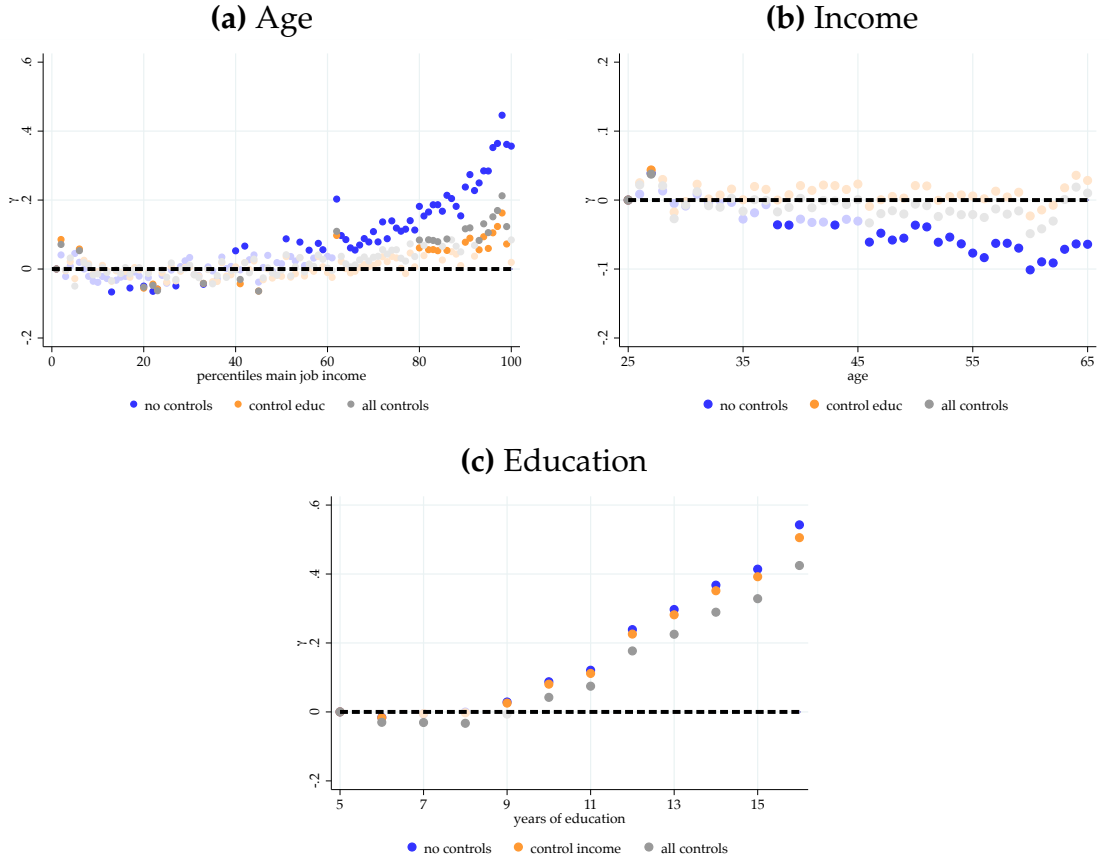
Notes: Panel (a) shows the observed proportion of the workers that WFH with access to Internet (blue dots) and WFH baselines estimates (orange dots). The shadowed area show the max and min when we aggregate from SOC to ISCO from O*NET to ECH. Panel (b) shows the proportion of workers that have internet access at home. Income percentiles are constructed using the main job labor income at February 2020 Uruguayan pesos. Estimates use the official ECH survey weights. Data source: O*NET and ECH-INE Uruguay 2019.

Table A.3: Departments: Urban and Rural Locations



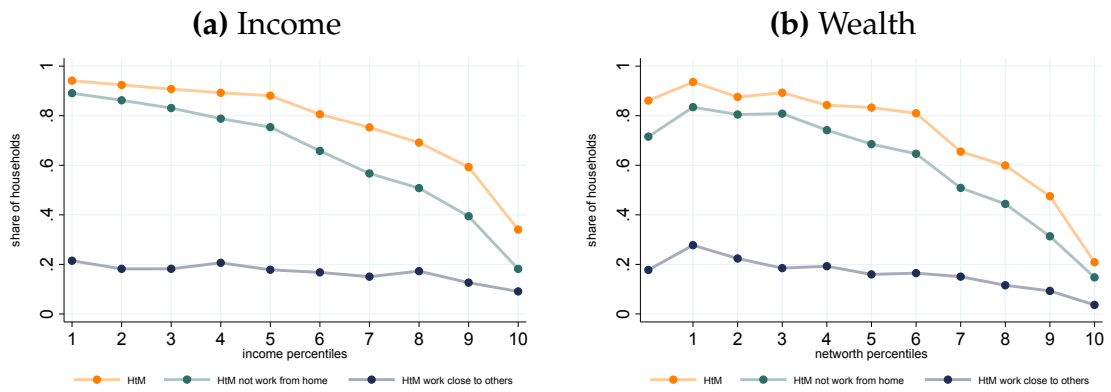
Notes: Figure indicates proportion workers that WFH and CI by Department and conditional on rural (blue) and urban (orange) locations. Data source: O*NET and ECH-INE Uruguay 2019.

Figure A.3: Predictors of WFH



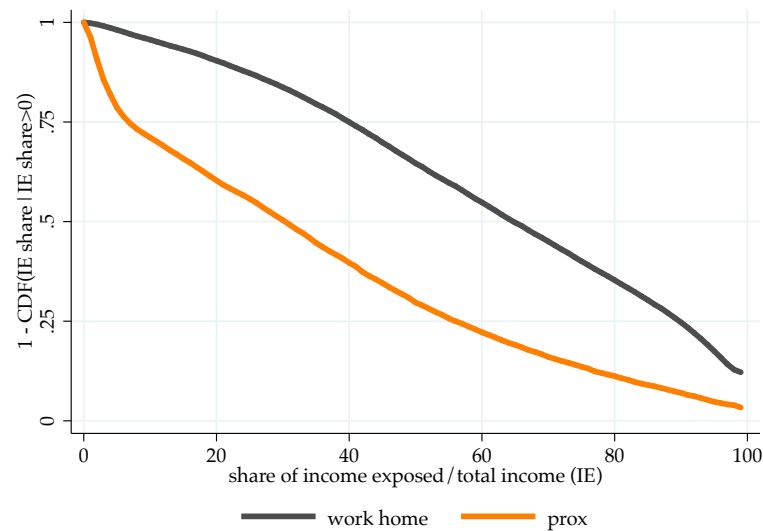
Notes: For each predictor z_i we run the following regression $y_i = \gamma z_i + \beta X_i + \epsilon_i$ where y_i is an indicator if worker i WFH, X_i are the control variables and γ the prediction over WFH. Panel (a) shows the γ with z_i being age and including different controls (specified in the legend of the figure). Panel (b) shows the γ with z_i being income level and including different controls (specified in the legend of the figure). Panel (c) shows the γ with z_i being education level and including different controls (specified in the legend of the figure). Estimates use the official ECH survey weights. Data source: O*NET and ECH-INE Uruguay 2019.

Figure A.4: Hand-to-Mouth, and WFH and CI across the Income and Wealth Distribution



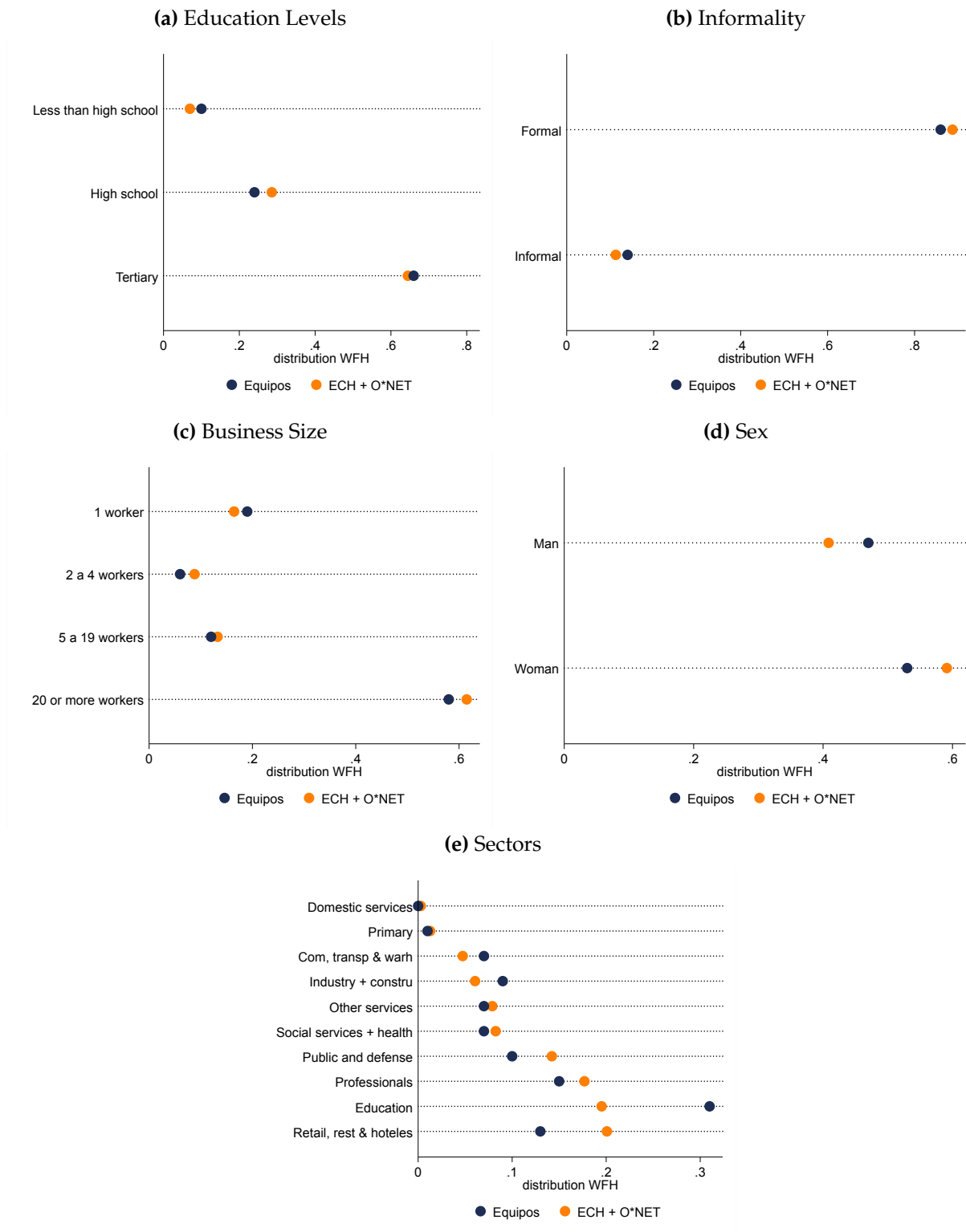
Notes: Panels (a-b) shows the observed proportion of the workers that are hand-to-mouth (orange), hand-to-mouth that can't WFH (green) and hand-to-mouth that have CI jobs (blue) across the income and wealth distribution. Data source: O*NET and ECH-INE Uruguay 2019.

Figure A.5: Income Diversification, and WFH and CI



Notes: the figure shows the accumulative proportion of households according to their income exposed to not WFH and CI. Data source: O*NET and ECH-INE Uruguay 2019.

Figure A.6: WFH Distribution by Characteristics: Comparison with Ex-Post Surveys



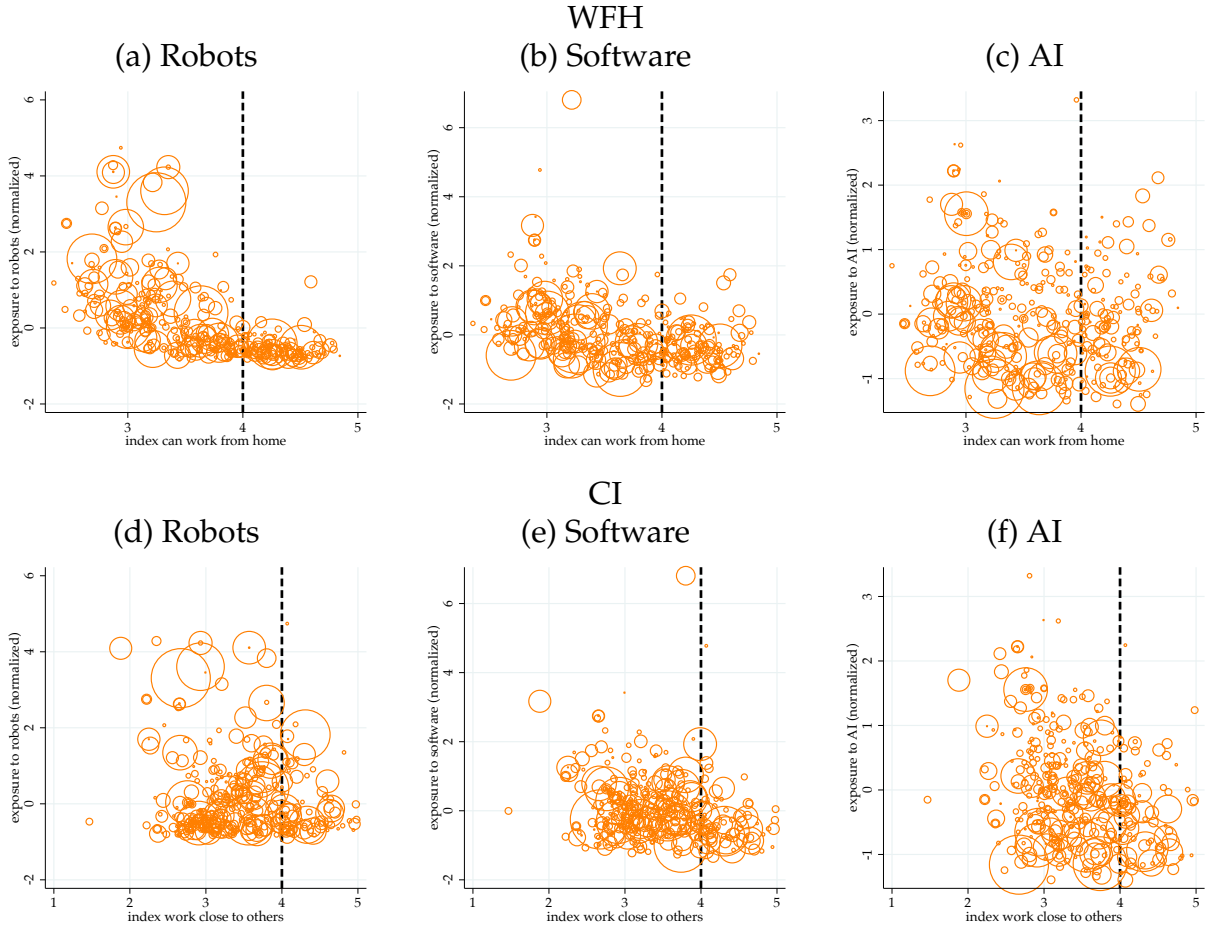
Notes: as aggregate rates are slightly different for exposition purposes I normalize $WFH_i / \sum_{i=1}^n WFH_i$ so we can compare the distribution of WFH between my estimates and Equipos estimates. Data source: own estimates and Equipos Consultores May Labor Market Survey.

B Additional Analysis

B.1 Automation Exposure

The exposure to automation data is from [Webb \(2020\)](#). This database consists of occupation level scores of the exposure to automation for various technologies (AI, software and robots). The data is available [online](#) upon request.

Figure B.1: WFH and CI, and Automation Risk



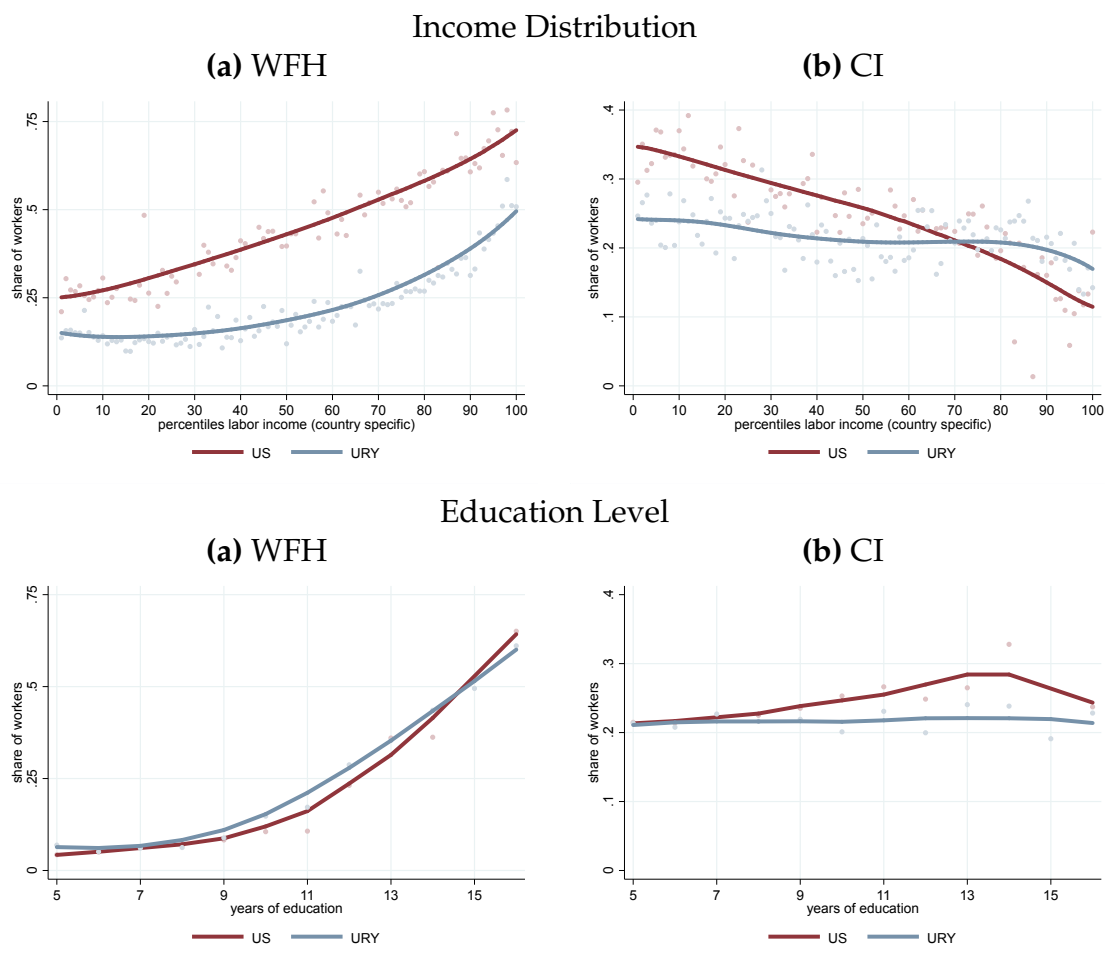
Notes: the figures shows the relation between the WFH and CI index, and the index of automation risk exposition for each occupation. The size of the circles indicate the share of workers in Uruguay. Data source: O*NET and ECH-INE Uruguay 2019.

B.2 Case Study: U.S. and Uruguay

The WFH and CI indicators for U.S. are elaborated following [Dingel and Neiman \(2020\)](#) and household characteristics are from the 2019 March Current Population Survey cleaned data from [Mongey et al. \(2020\)](#).¹³ WFH and CI indicators, and households characteristics for Uruguay are the same as the ones used in Section 3.

¹³Also the cross-walks between O*NET, SOC and OCC occupation codes are from [Mongey et al. \(2020\)](#).

Figure B.2: Case Study: U.S. and Uruguay



Notes: in the figure dots indicate the observed proportion of the workers that WFH and CI. Solid lines are the locally weighted smoother of the data points. For Uruguay income percentiles are constructed using the main job labor income at February 2020 Uruguayan pesos. For U.S. they are constructed using total wage and salary income. Estimates use the official survey weights for both countries. Data source: O*NET, CPS, [Dingel and Neiman \(2020\)](#), [Mongey et al. \(2020\)](#) and ECH-INE Uruguay 2019.