

The Impacts of COVID-19 on Informal Labor Markets

Evidence from Peru

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Abstract

This paper provides new evidence on the impacts of the COVID-19 economic crisis on a labor market with a high prevalence of informality. The analysis uses a rich longitudinal household survey for Peru that contains a host of individual and job outcomes before and during the first months of the lockdown in 2020. The findings show that workers who had jobs in non-essential and informal sectors were significantly more likely to become unemployed. In contrast to developed countries, having a job amenable to working from home is not correlated with job loss when controlling for informal status. This is consistent with the high level of labor market segmentation observed in Peru,

where high-skilled occupations are disproportionately concentrated in the formal sector, which was also better targeted by policies aimed at supporting firms and job protection during the crisis. In addition, the findings show that women were more likely to lose their jobs because female-dominated sectors are more intensive in face-to-face interactions and thereby more affected by social distancing measures. Increased childcare responsibilities also help explain the worse impacts on women in rural areas. Finally, workers who depended on public transportation before the crisis were more likely to lose their jobs during the early months of the pandemic.

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The Impacts of COVID-19 on Informal Labor Markets: Evidence from Peru*

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1 Introduction

The sudden and massive decline in economic activity associated with the advent of COVID-19 led to significant job losses around the world. [ILO \(2020\)](#) reports that 114 million jobs were destroyed globally in 2020 relative to 2019. Accordingly, phone surveys conducted by the World Bank in April-May 2020 across 39 developing countries indicate that 34 percent of respondents had stopped working and 62 percent reported income losses since the implementation of lockdown measures ([Palacios-Lopez et al. 2021](#)).

However, evidence on the profile of affected workers and the channels of transmission is very scarce, particularly for developing economies. Most studies analyzing this question are focused on developed countries with very low levels of informality and higher prevalence of high skilled jobs (for example, [Adams-Prassl et al. \(2020\)](#), [Montenovo et al. \(2020\)](#)). One of their key findings is that workers whose jobs were more amenable to working from home were less likely to become unemployed. However, it is not clear to what extent teleworking would prevent job losses in developing countries, where technology use is less pervasive ([Garrote Sanchez et al. 2020](#)). In addition, the higher labor market segmentation between the informal and formal sectors observed in the developing world could also shape the impacts of the crisis in a different way than in rich countries. This is because, for example, mitigating policies are more easily targeted to formal sector jobs, which tend to be scarcer in developing countries. In addition, skilled jobs that can be done from home tend to be disproportionately concentrated in the formal sector ([Hatayama et al. 2020](#)), which could make difficult to disentangle the role of having a formal job and that of having a job amenable to working from home.

In this paper, we study the early impacts of the COVID-19 crisis on the Peruvian labor market. During the initial stages of the pandemic, the Peruvian government implemented severe social distancing mandates and a close-to-total shutdown of the economy with only

essential sectors being able to continue working. However, the spread of the virus continued and led the country to a record of 110 confirmed deaths per 100,000 people; the third highest in the world -among 192 countries- after Belgium and San Marino up to December 2020.¹ Peru has not only been among the countries hardest-hit by the disease itself, but also in terms of the economy. The decline in GDP and the fraction of people who lost their jobs during the second quarter of 2020 reached 30.2 percent and 39.5 percent, respectively, among the worst in Latin America.

We explore this question using the main household survey of Peru (the Encuesta Nacional de Hogares, ENAHO), which contains rich information on labor market dynamics. We use the wave that was collected during the second quarter of 2020, which was the time period of the most severe lockdown. We exploit its longitudinal component, as some of the households interviewed in the second quarter of 2019 were also interviewed in the second quarter of 2020. In particular, we study which job and individual characteristics played an important role in preventing declines in employment, hours of work and labor incomes. While this longitudinal subsample is nationally representative when using data for the full year and not necessarily for one quarter, we show that the evolution of labor market outcomes is very similar between this subsample and the complete one (i.e. the longitudinal and cross-sectional component combined) for one quarter. This suggests that the longitudinal component of the survey captures relatively well the overall changes in the labor market between the second quarter of 2019 and that of 2020. Nevertheless, the results should be considered as preliminary and they will be updated as more data become available.

We find that workers who had jobs amenable to working from home (WFH) and internet connectivity in 2019 were less likely to become unemployed in 2020. However, when we control for informality status—i.e. not having a written contract or Tax Identification Number (TIN)—in 2019, WFH amenability becomes statistically insignificant. The two most

¹According to data from Johns Hopkins University.

important job characteristics that helped workers remained employed were being formal or having a job in an essential sector. More specifically, those with an informal job in 2019 were 12.4 percent more likely to lose their jobs in 2020, while workers in an essential sector were 22.2 percent more likely to remain employed.

When considering demographic characteristics, we find that women were 9 percent more likely to lose their jobs. This result is consistent with the evidence for other countries and it is driven by the fact that female employment was disproportionately concentrated in occupations that are intensive in face-to-face interactions and that were particularly hit by the pandemic ([Avdiu & Nayyar 2020](#)). Having young children in the household contributes to predict job loss among women but only marginally and in rural areas only.

Lastly, we explore a channel that has received limited attention in the literature, which is the role of public transportation. Urban travel has declined all over the world since the implementation of lockdown and social-distancing measures, but it affected public transportation disproportionately ([Tirachini & Cats 2020](#)). As a result, people who could not work from home but relied on public transport to keep working may have faced a higher risk of unemployment. We test this hypothesis by constructing a measure of dependence on public transportation for each household in 2019 and estimate its link with labor market outcomes in 2020. We find that urban workers who were dependent on public transportation were about 10 percent more likely to lose their jobs.

This paper makes two important contributions to the literature. First, it highlights that the formal-informal labor market segmentation observed in developing countries is a key determinant of the labor market impacts of the COVID-19 crisis. In contrast to rich countries with a negligible share of informal jobs, workers with jobs amenable to WFH in developing countries tend to be disproportionately concentrated in the formal sector. They not only have better protection against dismissals, but also benefit directly from any government

policies supporting registered firms during a downturn. Second, it provides new evidence on a channel that, to our knowledge, has not been examined in the literature: the role of public transportation. This is important as its availability and quality will also be key during the recovery.

The remainder of the paper is organized as follows. Section 2 reviews the related literature. Section 2 describes the data and descriptive statistics. Section 4 presents the empirical analysis and estimation strategy. Section 5 describes the estimation results. The last section concludes.

2 Related Literature

The literature on the labor market impacts of the pandemic has rapidly evolved both for developed and developing countries. Several papers have assessed the impacts of the crisis using simulation or CGE models (see, for instance, [Genoni et al. \(2020\)](#), [O’Donoghue et al. \(2020\)](#), [Sologon et al. \(2018\)](#), [Cereda et al. \(2020\)](#)). For example, [Genoni et al. \(2020\)](#) document early insights into labor market impacts in Bangladesh, a country with a high share of its workers in informality.² In line with our findings, they find that urban areas would be more severely affected in job losses due to the different nature of occupations and sectors more directly hit by the crisis. Likewise, the authors document that women have been disproportionately affected with higher job losses and that they have been more likely to exit the labor market than men. Also related to our paper are the results from [Cereda et al. \(2020\)](#) who find that, in the short-term, the informal sector would be more affected by the unemployment shock given that they do not count with any mechanism to protect their income. Nevertheless, [Cereda et al. \(2020\)](#) focus most of their work on the poverty and inequality consequences of the crisis, especially when considering the generous transfer of the

²According to data from WDI, 40 percent of the employed population were salaried workers in 2019.

Auxilio Emergencial program. For developed countries, [O’Donoghue et al. \(2020\)](#) construct a calibrated simulation to assess the distributional impacts of the pandemic. However, the authors do not refer to heterogeneous impacts across groups like gender or formality, but mostly emphasize changes in income for the deciles across the income distribution.

A different branch of the literature is based on ex-ante vulnerabilities. For instance, [Dingel & Neiman \(2020\)](#) use the Occupational Information Network (O*NET) from the United States to classify the feasibility of working at home for all occupations and merge this classification with employment counts. [Avdiu & Nayyar \(2020\)](#) use an index of face-to-face (F2F) based on O*NET to classify occupations by their vulnerability to social distancing measures. They find that a large share of women’s employment is accounted by occupations that are intensive in F2F interactions. While [Dingel & Neiman \(2020\)](#) and [Avdiu & Nayyar \(2020\)](#) estimate the home based work and F2F variables based on measures of the United States and the type of tasks and occupations of workers in this country, evidence shows that these tasks exhibit considerable variation across countries ([Lo Bello et al. 2019](#)). To overcome this limitation, [Hatayama et al. \(2020\)](#) use skill and household surveys from 53 countries to construct a measure of jobs’ amenability to work from home (WFH). They use not only the type of tasks embedded in jobs but also internet connectivity at home. Their approach takes into account the differences in the organization of production or in the use of technology across the 53 countries. They find that informal, male and unskilled workers are less likely to have jobs amenable to WFH.

Furthermore, another section of the *COVID economics* literature uses real data collected during the crisis to assess economic impacts. Studies such as those by [Chetty et al. \(2020\)](#) and [Montenovo et al. \(2020\)](#) show that the economic consequences of COVID-19 -in terms of job losses- have especially affected low-wage workers in affluent areas as well as individuals in occupations that require more in-person physical interaction (therefore, that cannot be performed remotely). Our results are comparable to those found by [Chetty et al.](#)

(2020) in the sense that they document that low-wage workers in the United States were the hardest hit by the crisis, while informal workers (likely less paid individuals) in Peru have also borne a higher burden from the shock. Likewise, [Montenovo et al. \(2020\)](#) find that women experienced a higher increase in unemployment between February and May 2020. In consequence, both these and our results contribute to the contemporaneous literature documenting that the gender gap in labor markets has increased in both developed and developing countries.

[Adams-Prassl et al. \(2020\)](#) is closely related to this paper, as it examines the impacts of the crisis using data collected in March and April 2020 in Germany, the United Kingdom and the United States. They find that countries with more flexible unemployment insurance systems -like Germany- may weather the crisis better than countries with more conventional ones. In the same manner, within countries, the authors find that impacts are unequal and that the crisis has exacerbated existing inequalities, especially affecting workers in occupations less amenable to WFH, those with lower levels of education and women.

Finally, the World Bank High Frequency Phone Surveys (HFPS) data collected between May and July 2020 show substantial job losses that differ across countries in Latin America. For instance, while in May 2020 only 11 percent of workers permanently lost their jobs in Argentina, nearly 27 percent of those in Colombia did (see [Figure 1](#)). This employment loss appears to be related to the informality levels pre-COVID. As such, countries like Argentina, Chile and Costa Rica had lower rates of job destruction than countries like Bolivia, Honduras or Peru. In the same manner, and consistent with other studies, the HFPS show that women experienced an even steeper decline in their labor activity during the crisis leading to increments in gender-employment gaps and exacerbating inequalities in the labor market.

3 Data and Descriptive Statistics

3.1 Data

Survey Data: The main data used in this paper come from the second quarter of the National Household Survey from 2019 and 2020 obtained through the National Statistics Office. This period of time coincides with the strictest months of the lockdown in Peru³ which led to a decline in employment of 40 percent after only essential sectors were permitted to function. This is the main household survey in Peru to measure poverty and labor market indicators. The survey uses a probabilistic sampling procedure (with a rotating panel component) and is representative at the national and regional levels when using the annual cross-section.

The cross-section quarterly data are representative at the national level. In our main specification, we use the longitudinal component that covers 1,982 households and 4,533 individuals. While this longitudinal component is not meant to be representative at the national level when using only one quarter, the main patterns of job losses are relatively similar between the longitudinal and the cross-sectional samples (see Table 1). The longitudinal sample contains individuals mostly interviewed in the second quarter of 2019 and re-interviewed in the second quarter of 2020.⁴ As such, it allows to study which pre-crisis characteristics of the individual and her job contribute to predict the changes observed in labor market outcomes in 2020.

Amenability to Work from Home: We use the amenability to work from home

³The Stringency Index from the University of Oxford, shows an average value of 92.47 between April and June 2020. This measure was highest during the strict lockdown in Peru and then declined to 65.29 in December 2020. Similarly, the Mobility Trends for places of residence by Google documents an average value of 33.65 between April and June 2020 (one of the highest in Latin America, which averaged 24.15 in the same period) and decreased to 15.32 in December 2020.

⁴Ninety-one percent of the individuals were interviewed in the second quarter of 2019, 7 percent in the first quarter of the same year and the remaining 2 percent in either July, August or November 2019.

index from [Hatayama et al. \(2020\)](#), based on data from Peru’s Survey of Adult Skills from PIAAC (Programme for the International Assessment of Adult Competencies). Since the index is continuous, we create a dummy variable equal to 1 for occupations in the top 25 percent of WFH amenability. In the regression tables, we modify this dummy variable so that to have a job amenable to WFH, the worker should also reside in a household with broadband connectivity.

Essential sectors: These economic sectors are defined following *Decreto Supremo 044-2020*. The decree was released on March 15th by the Government of Peru (GoP) in order to declare the state of emergency in the country due to COVID-19. Among several other measures, the GoP identified key sectoral activities that would continue to work on a normal basis while workers in other sectors would be restricted to stay in their homes. These sectors were: agriculture and fishing, manufacturing of food and beverages, printed media, general media, production and distribution of refined petroleum products, production and distribution of pharmaceutical products, utilities, banking, public administration and the health sector. We also included people working in the education sector, as most of the public and private institutions in the country adopted several remote learning strategies.

Broadband access: We create a proxy binary variable for broadband access, equal to one if the household reports having access to internet and at the same time either cable TV or a fixed telephone line. We follow this strategy given the lack of information regarding the type of internet subscription, and because several of the internet service providers (ISP) in Peru offer plans that include some combination of internet, TV or home phone.

Public transportation dependence. Based on the *Decreto Supremo 044-2020*, public transportation was limited to 50 percent of its capacity and firms that were interested in providing the service would have to comply with specific norms and regulations.⁵ Public

⁵More information can be found in the following [link](#).

transportation dependence is calculated as the share of pre-crisis expenditures in public transportation in total expenditures in a given household. Then, we define households in the top 50 percent of this variable as “highly dependent”.

3.2 Descriptive statistics

Employment losses varied widely across countries in Latin America, and Peru was one of the hardest-hit countries. Figure 1 plots the share of workers who lost their jobs (either temporarily or permanently) against the share of salaried workers in the workforce for each country. Figure 1 reveals that employment loss shares have been high in countries with a lower percentage of their employed population working as waged workers (the correlation is 0.85). Thereby, Peru stands as one of the countries with the highest share of job losses amongst its workers, only with Bolivia on top.

Even though Peru was one of the most affected countries in Latin America, labor market outcomes differ widely across its regions. Figure 2 (a), which uses the full cross-sectional sample, reveals that job destruction rates were higher in the coastal regions and lower in the Highlands. More importantly for the purposes of this paper, we find that these patterns are relatively similar to the ones that emerge from the longitudinal sample (Figure 2 (b)).

Table 1 explores patterns of job losses, labor income and hours worked by national, urban and rural estimates. Job losses were larger in urban areas where 1 in 2 workers lost their job between April and June 2020. In rural areas, the rate of job destruction was less than half that of urban ones, at about 21 percent in the longitudinal sample. On the other hand, declines in labor income were significantly larger in rural areas. For example, according to the longitudinal sample, workers who kept their jobs experienced labor income losses of about 22 and 36 percent in urban and rural areas, respectively. Average hours of work also

declined substantially, particularly in urban areas. Finally, these patterns are roughly similar between the longitudinal and the full sample.

[Table 2](#) shows that less than 30 percent of the employed population in Peru had the ability to work from home pre-crisis. Moreover, most of these workers are concentrated in urban areas, since less than 5 percent of rural workers had this type of job. On the other hand, while broadband access is limited among the rural population (4 percent), in urban areas almost 45 percent of the workers live in households with a fixed internet connection. The share of workers in an essential sector has a different distribution: while in urban areas the percentage is 30 percent, in rural Peru it is close to 80 percent (mostly explained by workers in agricultural activities). Lastly—and in accordance with clear differences between both areas—workers who depend on public transportation are mostly concentrated in urban areas.⁶

Rows 3 and 4 of [Table 3](#) reveal that gender differences in terms of WFH amenability, broadband access and essential sectors were minimal, but female workers had higher levels of public transportation dependence. On the other hand, a wider variation is found across other groups. For instance, workers ages 25 to 34 years old were substantially more likely to have jobs amenable to WFH (41 percent) than the rest (as low as 12 percent for those 65 years or older). Likewise, broadband access is also higher for this group.

The largest disparities in WFH and broadband access are across educational attainment and formality status. For example, while 60 percent of high skilled workers had jobs amenable to WFH pre-crisis, the rate was only 7 percent for the low-skilled group. In the same manner, broadband access was higher for the high-skilled than for the low-skilled (55 percent vs. 22 percent). In addition, close to two-thirds of the workers with some type of written

⁶Figure 6 in the Appendix plots spatial disparities regarding WFH and broadband access among districts in Peru. Figure 6 (a) shows that the percentage of workers in a district with the ability to work from home increases in urban areas. Likewise, Figure 6 (b) shows that broadband access is almost exclusive to these areas with low access in the Highlands and Amazon regions.

contract or TIN had jobs that could be done from home, while the share for those in informal jobs—without a contract or TIN—was 7 percent.

Table 4 reports labor market outcomes for these groups. Women had a larger employment loss rate (49 percent) compared to that of men (39 percent). Job losses were also higher for the youngest (60 percent) and oldest (51 percent) age groups as well as for those in an informal job (54 percent). Among workers who kept their jobs during the second quarter of 2020, labor income declines were substantially higher for the low-skilled (42 percent) and the informal (43 percent), when compared to the average worker (24 percent).

4 Estimation

To estimate the determinants of job and income losses, we use the following regression:

$$\Delta L_{t,i} = \alpha + \beta \mathbf{X}_{i,t-1} + \gamma \mathbf{Z}_{i,t-1} + e \quad (1)$$

Where i denotes a worker identifier, and t is a given period, $\Delta L_{t,i}$ stands for alternative indicators of labor market status changes of individual i , specifically:

$$Pr(E_{t,i} = 0 | E_{t-1,i} = 1) \quad (2)$$

$$\ln Y_t - \ln Y_{t-1} \quad (3)$$

$$H_t - H_{t-1} \tag{4}$$

Where (2) refers to the probability of job loss in t , conditional on being employed in $t - 1$; (3) to the change in the logarithm of monthly earnings of workers employed in t and $t - 1$, and; (4) represents the change in weekly worked hours for workers employed in t and $t - 1$. X_{t-1} is a vector that includes characteristics such as being able to work from home, working in an essential sector, having broadband access at home and working in an informal job in $t - 1$. Z_{t-1} is a vector that includes individual characteristics such as age group, living in an urban or rural area, educational attainment and gender.

5 Results

5.1 Main results

As shown in column 1 of [Table 5](#), workers in essential sectors were 24 percent less likely to lose their jobs during the first months of the lockdown. Accordingly, workers in occupations more amenable to WFH were 7 percent less likely to lose their jobs.⁷ Nevertheless, once we control for informality—defined as having some type of written contract or TIN—the correlation between job loss and the ability to WFH loses significance. The results for urban and rural areas follow, in general, the same direction as national estimates. WFH amenability is not statistically significant in urban or rural areas in any of the three specifications.⁸ Moreover, despite the improvements in internet connectivity in urban areas and the presence of higher skill level occupations in these parts of the country, job retention relied more on formality

⁷Figures 4 and 5 plot the loss of employment and change in hours worked against the ability to WFH using a pseudo-panel constructed with ENAHO 2019 and 2020 (second quarter).

⁸We excluded broadband access in the regressions for rural areas as internet penetration is slightly above 2 percent in these areas and the point estimates were very noisy.

than on the possibility to work from home.

Columns (3), (6) and (9) show the estimation results once we control for individual characteristics. As in previous crises, older workers (compared to those below 25) were less likely to lose their jobs. More specifically, they were between 13 and 21 percent less likely to become unemployed (either temporarily or permanently). Likewise, women were 9 percent more likely to lose their jobs. Furthermore, the effect of job characteristics such as being employed in an essential sector or having some form of written contract or a TIN remained statistically significant at the 1 percent level, and the magnitude remained stable after adding demographic controls. However, the effect of informality on job loss loses significance in rural areas, likely reflecting the fact that non-prime age and female workers were more likely to be informal. It is important to notice that educational attainment is slightly correlated with job loss, that is, workers with at least a high school degree were 5 percent more likely to lose their jobs. This could reflect the fact that education may be a proxy variable for liquidity, and thereby those with higher levels of education could be better able to protect their consumption and health than more vulnerable workers who could not afford to stop working.

[Table 6](#) presents results for changes in labor income and hours worked, for workers who remained employed in the second quarter of 2020. In contrast to job retention, formality does not appear to have played an important role in maintaining earnings during the months of strict lockdown, among workers who were able to keep their jobs. However, being employed in an essential sector did protect earnings. For instance, among rural workers who kept their jobs, those in essential sectors had income variations substantially higher than those in other sectors.⁹ This likely reflects the informal nature of the labor market in rural areas, where several workers may still be considered employed despite having “gig” jobs with very low (if any) earnings, and those in essential sectors had more stable positions.

⁹Up to 8,000 percent higher, i.e. $(e^{4.4} - 1) \times 100 \approx 8,045$.

In contrast to the results for job loss, educational attainment played a relevant role in labor income protection. As column (2) reports, workers in urban areas who at least graduated from high school had changes in labor incomes about 175 percent higher than their low-skilled peers. This might be correlated with the type of jobs that these workers have and the industries in which they work. However, educational attainment did not contribute to predict change in labor income in rural areas. In addition, women in both urban and rural Peru—who were able to keep their jobs—had a similar decrease in their income compared to men.

Regarding changes in hours of work, column (4) shows that people in essential sectors worked, on average, 9.1 more hours per week than the rest during the beginning of the lockdown. In contrast to the results for job loss, those in occupations amenable to WFH with broadband access in their homes worked, on average, 8.8 more hours a week than workers in other types of occupations. In addition, informality has also been important in determining changes in hours worked. Workers without a written contract or TIN worked 4.2 more hours in a week than those with a contract or TIN, but this was driven by urban areas. Since there is no statistically significant difference in the variation in total labor income between formal and informal workers (column 1), these results suggest that informal workers had to work more hours to protect their income levels. In contrast to the results for job and income losses, there are no significant gender differences in changes in hours of work among people who kept their jobs at the beginning of the lockdown.

5.2 Understanding the gender gap in job losses

As Figure 3 shows, the rate of job loss was higher for women than for men across the country, in both large and small cities. Table 7 investigates which job and individual characteristics may help explain the gender gaps in job loss. We begin with a simple specification using

only a gender indicator to predict job loss and gradually add control variables to identify which ones contribute to change the magnitude of the coefficient associated with gender.

Column (1) shows, as above, that women in Peru were 10 percent more likely to lose their jobs when compared to men. As seen in columns (2) to (5), this point estimate does not change significantly after controlling for education, gender, interview month and job characteristics. Column (7) shows that adding a binary variable for female-dominated sectors (i.e. commerce, domestic service, and hotels and restaurants) and for the presence of young children contributes to explain an important fraction of the gender gap. In particular, it declines from 9.2 to 5.2 percent in urban areas and it is no longer statistically different from zero. This is mostly driven by female-dominated sectors, since the point estimate in column (6)—which controls for the presence of young children but not for being in a female-dominated sector—is similar to the baseline value (10 percent). In rural areas, the coefficient associated with gender declines from 11.5 to 7.8 percent when controlling for female-dominated sectors and the presence of children. In contrast to urban areas, both factors contribute to explain an important fraction of the larger employment losses of women. These results go in line with the findings of [Avdiu & Nayyar \(2020\)](#) who show that a larger share of women’s employment is also accounted by occupations that are intensive in F2F interactions (and, thus, hit hard by the crisis).

5.3 The role of Public Transportation Dependency

Finally, this section explores a channel that has received limited attention in the literature, i.e. the role of public transportation in affecting patterns of job loss. Based on the *Decreto Supremo 044-2020*, public transportation was limited to 50 percent of its capacity in Lima, Callao and several other regions. Firms that were interested in continuing to provide the

service would have to comply with specific norms and regulations.¹⁰ However, a large segment of the transport sector in Peru operates informally (and with low profit margins); thus, most transport companies were unable to comply with the strict regulations (for example, reduced number of passengers or sanitary conditions) imposed by the government. Therefore, the availability of means of public transport decreased dramatically.

We define public transportation dependency as the share of pre-crisis expenditures on public transportation in total household expenditures. Then, households above the median of this variable are considered "highly dependent", and we add this control to the main equation (1). Column (1) of [Table 8](#) shows the results at the national level and documents that individuals in households highly dependent on public transportation were 12 percent more likely to lose their jobs. As workers tend to rely more on public transportation in cities in contrast to less populated locations, results are significant only for urban areas as expected. In this case, workers were 14 percent more likely to lose their jobs compared with people who depend less on public transport. Accordingly, for people who were able to keep their jobs, workers who relied more on PT before the crisis worked 3.6 fewer hours per week than those who did not depend as much on PT at the beginning of the lockdown, with the effect driven by rural areas.

¹⁰More information in the following [link](#).

6 Conclusion

This paper investigates the determinants of labor market outcomes during the first months of the lockdown associated with the COVID-19 crisis in Peru. Using a rich longitudinal household survey that was collected in 2019 and 2020, we find that workers in essential sectors and with a formal job (i.e. employees that had a written contract or employers and self-employed with a TIN) before the pandemic were less likely to experience job losses. In contrast to more advanced economies, we find that having a job amenable to WFH and broadband connectivity did not contribute to predict job protection once we control for informal status. The high degree of labor market segmentation observed in Peru—where more educated workers and jobs amenable to WFH are disproportionately concentrated in the formal sector—helps to explain why formality status played a more important role in shaping job losses than other characteristics of the worker and the job. These findings raise concerns about the impacts of the COVID-19 crisis on the labor markets of developing countries, as informal workers not only are more likely to experience worse labor market outcomes, but also are less likely to be protected by traditional social protection systems.

Consistent with findings for other countries, women were significantly more likely to lose their jobs than men. The fact that female-dominated sectors—which are more intensive in face-to-face interactions—were hit the worst and that school closures increased childcare responsibilities at home explain a substantial share of the gender gap in job losses during COVID-19.

This paper also explores the role of workers' dependence on public transportation before the crisis as a determinant of job losses. We find that workers in households that allocated a large expenditure share to public transport before the crisis were about 12 percent more likely to lose their jobs in the second quarter of 2020.

Our final comment is on avenues for future research. The release of new data from the third and fourth quarters of the year will allow us to shed light on the recovery process. More work is needed to incorporate the dynamic aspect that informality may have played during the months after the severe lockdown. Likewise, research on the role that other mitigating policies like *Reactiva Peru* may have played in the recovery process will be important to understand disparities in the dynamics between the formal and informal sectors. As such, research efforts focused on understanding the micro-structural vulnerabilities of the country and how to tackle them will be essential as Peru moves into the reactivation stage.

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Appendix

A Figures and Tables

Table 1: Change in employment, monthly labor income and weekly hours worked for the longitudinal and full samples, 2019-2020

Outcome Variations		Longitudinal Sample			Full Sample		
		(1)	(2)	(3)	(4)	(5)	(6)
		National	Urban	Rural	National	Urban	Rural
2019	Employment	3,292,054	2,532,362	759,691	16,849,317	13,082,402	3,766,915
2020	Employment	1,855,194	1,256,565	598,629	9,845,997	6,638,318	3,207,679
Δ	Employment	-44%	-50%	-21%	-42%	-49%	-15%
	N	3,201	1,939	1,262	20,559	13,483	7,176
2019	Labor income	1,359	1,754	530	1,588	1,786	706
2020	Labor income	1,036	1,368	339	1,001	1,332	315
Δ	Labor income	-24%	-22%	-36%	-37%	-25%	-55%
	N	1,997	1,006	991	12,291	6,919	5,373
2019	Hours worked	45	46	41	44	45	39
2020	Hours worked	33	33	34	32	32	33
Δ	Hours worked	-26%	-29%	-17%	-26%	-29%	-15%
	N	1,997	1,006	991	12,291	6,919	5,373

Notes: Based on data from ENAHO 2019-2020 (second quarter). Labor income is in monthly soles.

Table 2: Characteristics of workers pre-COVID (2019) in the employment and labor income/hours worked subsamples, by geographic area

Share of workers who can WFH, with broadband access, in essential sectors and with high PT dependence in 2019				
		(1)	(2)	(3)
Employment Sample		National	Urban	Rural
2019	WFH	27%	33%	4%
	Broadband access	34%	43%	4%
	Essential sector	41%	30%	78%
	Public transportation dependence	51%	62%	13%
	N	3,201	1,939	1,262
Labor Income - Hours Worked Sample				
2019	WFH	28%	39%	4%
	Broadband access	31%	44%	4%
	Essential sector	55%	42%	81%
	Public transportation dependence	41%	56%	12%
	N	1,997	1,006	991

Notes: Based on data from ENAHO 2019-2020 (second quarter) and [Hatayama et al. \(2020\)](#). WFH is defined for workers in the top 25 percent of the distribution, broadband access considers households with access to internet and either Cable TV or a a fixed phone connection, essential sectors are defined following *Decreto Supremo 044-2020* and public transportation dependence is defined for households at the top 50 percent of this variable.

Table 3: Characteristics of workers pre-COVID (2019) in the longitudinal sample, by demographic groups

		Workers' characteristics			
		(1)	(2)	(3)	(4)
		WFH	Broadband access	Essential sector	Public transportation dependence
	All	27%	34%	41%	51%
Gender	Men	27%	37%	41%	46%
	Women	26%	31%	41%	56%
Age group	15-24	19%	28%	34%	59%
	25-34	41%	42%	36%	58%
	35-44	24%	28%	43%	42%
	45-64	26%	38%	44%	50%
	65-more	12%	24%	53%	43%
Educational Attainment	Low skilled	7%	22%	41%	40%
	High skilled	60%	55%	41%	69%
Formality	With a contract or TIN	63%	57%	45%	70%
	Without a contract or TIN	7%	39%	22%	40%

Notes: Based on data from ENAHO 2019-2020 (second quarter) and [Hatayama et al. \(2020\)](#). WFH is defined for workers in the top 25 percent of the distribution, broadband access considers households with access to internet and either Cable TV or a a fixed phone connection, essential sectors are defined following *Decreto Supremo 044-2020* and public transportation dependence is defined for households at the top 50 percent of this variable. We define educational attainment using 11 years of education as threshold (i.e. complete secondary education in Peru) and formality for workers with some kind of written contract.

Table 4: Change in employment, monthly labor income and weekly hours worked for the longitudinal sample 2019-2020, by demographic groups

		Labor market outcome changes		
		(1)	(2)	(3)
		Employment	Labor income	Hours worked
	All	-44%	-24%	-26%
Gender	Men	-39%	-24%	-26%
	Women	-49%	-23%	-24%
Age group	15-24	-60%	-23%	2%
	25-34	-47%	-10%	-26%
	35-44	-37%	-28%	-27%
	45-64	-37%	-28%	-28%
	65-more	-51%	-29%	-36%
Educational Attainment	Low skilled	-42%	-42%	-27%
	High skilled	-46%	-11%	-22%
Formality	With a contract or TIN	-37%	-16%	-25%
	Without a contract or TIN	-47%	-43%	-26%

Notes: Based on data from ENAHO 2019-2020 (second quarter). Labor income is in monthly soles. We define educational attainment using 11 years of education as threshold (i.e. complete secondary education in Peru) and formality for employees with some kind of written contract and, employers and self-employed with a Tax Identification Number (TIN).

Table 5: Employment Loss

	Employment								
	National			Urban			Rural		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Job characteristics									
WFH (w/ broadband access)	-0.0714*	-0.000107	-0.0160	-0.0627	0.00801	-0.00794	0.000984	0.0677	-0.00452
	(0.0375)	(0.0404)	(0.0416)	(0.0383)	(0.0414)	(0.0427)	(0.0591)	(0.0685)	(0.0763)
Essential Sector	-0.242***	-0.224***	-0.222***	-0.264***	-0.236***	-0.240***	-0.154***	-0.160***	-0.140***
	(0.0255)	(0.0256)	(0.0249)	(0.0309)	(0.0316)	(0.0309)	(0.0334)	(0.0335)	(0.0323)
Informal (w/o contract or TIN)		0.137***	0.124***		0.140***	0.129***		0.102**	0.0580
		(0.0292)	(0.0299)		(0.0327)	(0.0335)		(0.0450)	(0.0451)
Individual characteristics									
25-34 years old			-0.134***			-0.116**			-0.181***
			(0.0404)			(0.0498)			(0.0515)
35-44 years old			-0.191***			-0.158***			-0.274***
			(0.0365)			(0.0478)			(0.0436)
45-64 years old			-0.205***			-0.180***			-0.272***
			(0.0340)			(0.0430)			(0.0427)
65 or more years old			-0.0365			0.000526			-0.131**
			(0.0438)			(0.0585)			(0.0530)
High skilled			0.0477*			0.0504			0.0638
			(0.0285)			(0.0314)			(0.0513)
Women			0.0940***			0.0901***			0.115***
			(0.0219)			(0.0277)			(0.0242)
Constant	0.669***	0.565***	0.659***	0.684***	0.575***	0.646***	0.368***	0.274***	0.448***
	(0.0226)	(0.0317)	(0.0462)	(0.0254)	(0.0361)	(0.0549)	(0.0380)	(0.0536)	(0.0661)
Observations	3193	3193	3193	1932	1932	1932	1261	1261	1261

Notes: Based on data from ENAHO 2019-2020 (second quarter) and [Hatayama et al. \(2020\)](#). Estimation using OLS regressions. Individual characteristics such as month of survey are omitted from this table. For columns 1 to 3, we control for rural areas as broadband access in these areas is limited, these results are omitted from this table. WFH is defined for workers in the top 25 percent of the distribution and considers individuals with broadband access (i.e. households with access to internet and either Cable TV or a fixed phone connection). Estimations for rural areas only consider WFH as access to internet is almost inexistent in these areas. Essential sectors are defined following *Decreto Supremo 044-2020*. We define educational attainment using 11 years of education as threshold Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Changes in ln Labor Income and Hours worked

	Ln Labor Income			Hours Worked		
	National (1)	Urban (2)	Rural (3)	National (4)	Urban (5)	Rural (6)
Job characteristics						
WFH (w/ broadband access)	0.0867 (0.358)	-0.121 (0.365)	-2.437 (1.607)	8.767*** (2.460)	8.287*** (2.568)	4.849 (3.885)
Essential Sector	1.781*** (0.338)	0.785** (0.387)	4.449*** (0.687)	9.081*** (1.489)	9.430*** (1.843)	8.277*** (2.367)
Informal (w/o contract or TIN)	0.181 (0.412)	-0.319 (0.464)	0.484 (0.917)	4.170* (2.214)	4.494* (2.599)	3.592 (3.755)
Individual characteristics						
High skilled	0.807* (0.413)	1.013** (0.445)	0.816 (1.091)	2.266 (2.376)	2.874 (2.782)	-4.091 (2.986)
Women	0.168 (0.316)	0.112 (0.415)	0.469 (0.474)	2.160 (1.337)	1.616 (1.871)	2.445* (1.418)
Rural	-0.590 (0.440)			4.524*** (1.531)		
Constant	-3.125*** (0.846)	-3.093*** (1.069)	-5.412*** (1.389)	-13.88*** (3.260)	-14.52*** (4.269)	-7.038 (5.253)
Observations	1990	1000	990	1990	1000	990

Notes: Based on data from ENAHO 2019-2020 (second quarter) and [Hatayama et al. \(2020\)](#). Estimation using OLS regressions. Individual characteristics such as month of survey and age are omitted from this table. For columns 1 and 4, we control for rural areas as broadband access in these areas is limited, these results are omitted from this table. WFH is defined for workers in the top 25 percent of the distribution and considers individuals with broadband access (i.e. households with access to internet and either Cable TV or a a fixed phone connection). Estimations for rural areas only consider WFH as access to internet is almost inexistent in these areas. Essential sectors are defined following *Decreto Supremo 044-2020*. We define educational attainment using 11 years of education as threshold Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Gender Gaps in Employment Loss

	Employment							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: National								
Women	0.101*** (0.0236)	0.102*** (0.0231)	0.101*** (0.0221)	0.104*** (0.0218)	0.0940*** (0.0219)	0.0860** (0.0341)	0.0528 (0.0346)	0.0618*** (0.0230)
Observations	3201	3201	3193	3193	3193	3193	3193	3193
Panel B: Urban								
Women	0.104*** (0.0290)	0.102*** (0.0283)	0.102*** (0.0275)	0.102*** (0.0275)	0.0901*** (0.0277)	0.0921** (0.0415)	0.0521 (0.0422)	0.0462 (0.0293)
Observations	1939	1939	1932	1932	1932	1932	1932	1932
Panel C: Rural								
Women	0.121*** (0.0250)	0.126*** (0.0241)	0.118*** (0.0240)	0.118*** (0.0240)	0.115*** (0.0242)	0.0888** (0.0381)	0.0785** (0.0388)	0.111*** (0.0250)
Observations	1262	1262	1261	1261	1261	1261	1261	1261
Controls								
Education, age and month		X	X	X	X	X	X	X
WFH with broadband access and essential sectors			X	X	X	X	X	X
Rural				X	X	X	X	X
Informality					X	X	X	X
Children						X	X	
Female dominated sectors							X	X

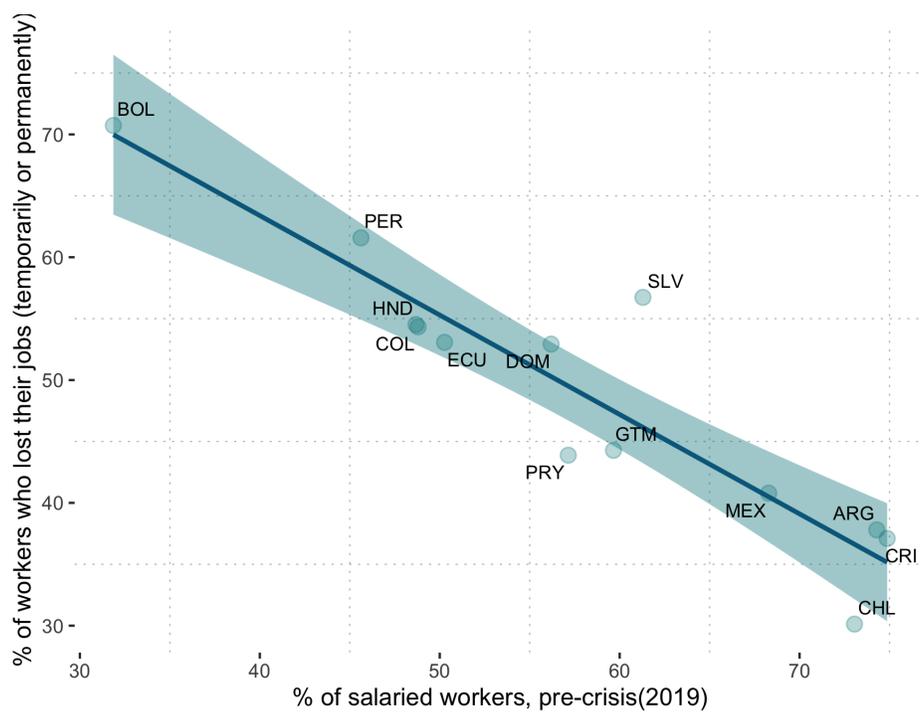
Notes: Based on data from ENAHO 2019-2020 (second quarter) and [Hatayama et al. \(2020\)](#). Estimation using OLS regressions. WFH is defined for workers in the top 25 percent of the distribution and considers individuals with broadband access (i.e. households with access to internet and either Cable TV or a a fixed phone connection). Estimations for rural areas only consider WFH as access to internet is almost inexistent in these areas. Essential sectors are defined following *Decreto Supremo 044-2020* and high skilled workers are defined for people with 11 years of education or more. Female dominated sectors consider commerce, domestic service and hotels restaurants. We define three variables of households with children i) children under 5, ii) children between 5 and 12 and iii) children above 12 up to 17. Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: Employmen Loss and changes in Hours Worked - Public Transportation Dependence

	Employment			Hours Worked		
	National	Urban	Rural	National	Urban	Rural
	(1)	(2)	(3)	(4)	(5)	(6)
High PT Dependence	0.119*** (0.0254)	0.135*** (0.0288)	0.0632 (0.0407)	-3.585** (1.745)	-3.421 (2.114)	-4.683* (2.407)
Constant	0.569*** (0.0501)	0.544*** (0.0588)	0.426*** (0.0661)	-13.02*** (3.637)	-14.38*** (4.630)	-5.686 (5.361)
Observations	3193	1932	1261	1990	1000	990

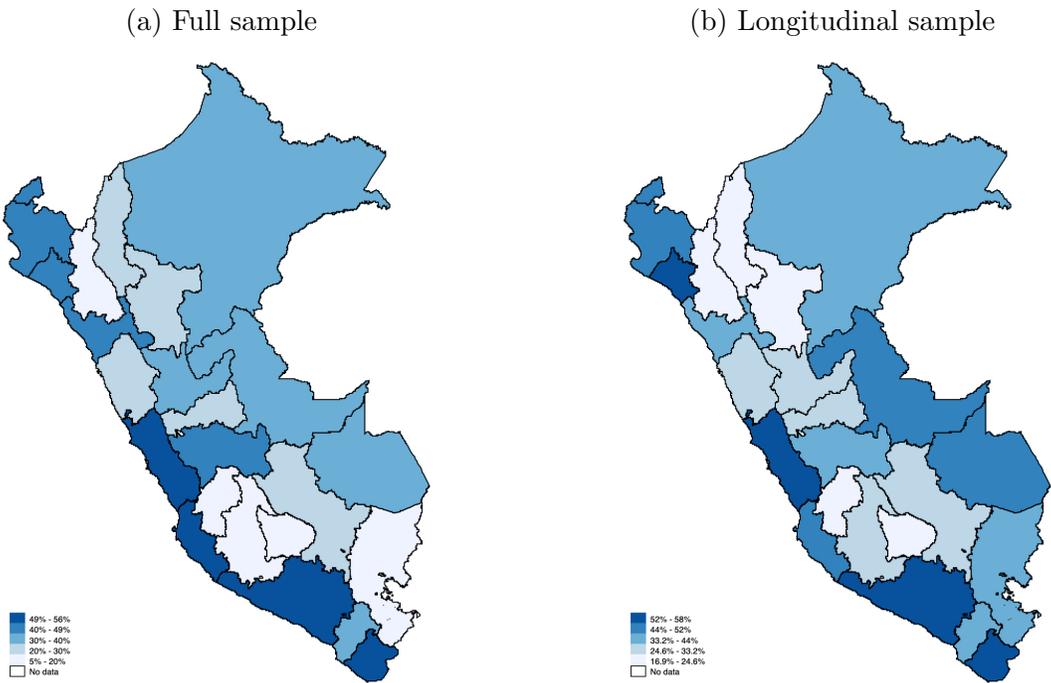
Notes: Based on data from ENAHO 2019-2020 (second quarter) and [Hatayama et al. \(2020\)](#). Estimation using OLS regressions. Job and individual characteristics such as WFH with broadband access, essential sector, informality, month, age, educational attainment and gender are omitted from this table. Public transportation dependence is a dummy variable equal to 1 for households whose public transportation share of total expenditures in 2019 is above the median. Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 1: Employment loss after COVID-19 hit (May 2020) and percentage of workers in wage employment (pre-crisis)



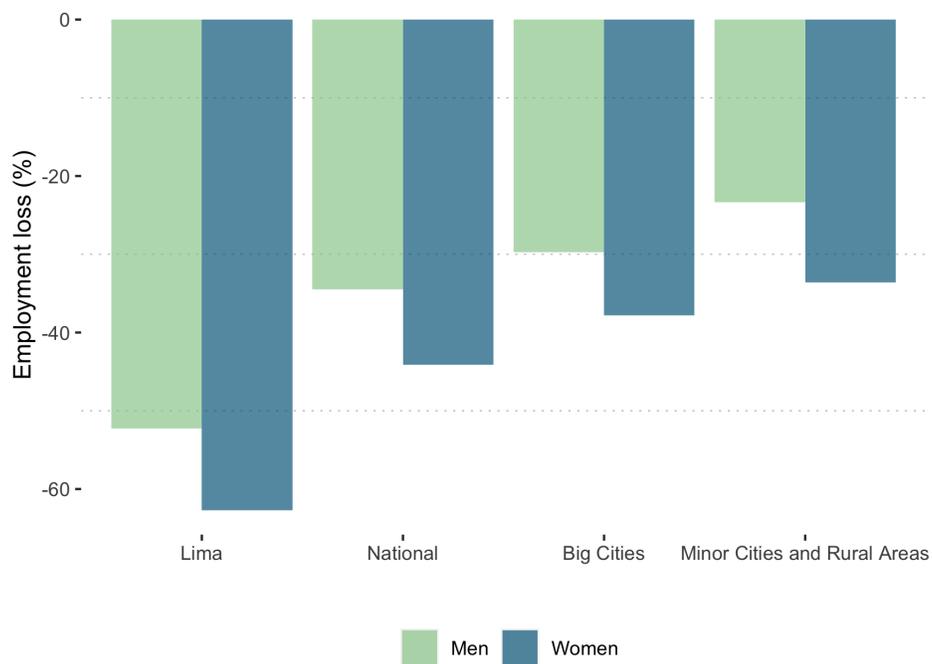
Notes: Own elaboration based on data from the World Bank High Frequency Phone Surveys (May 2020) and World Development Indicators. The percentage of salaried workers is a modeled ILO estimate. Employment loss reference period is a 7-day calendar week.

Figure 2: Job losing in longitudinal and full sample (2019-2020), percentages by department



Notes: Own elaboration based on ENAHO 2019-2020. These figures show the percentage of workers who lost their jobs during the second quarter of 2020 relative to 2019. Darker shades of blue encode higher rates of employment losing.

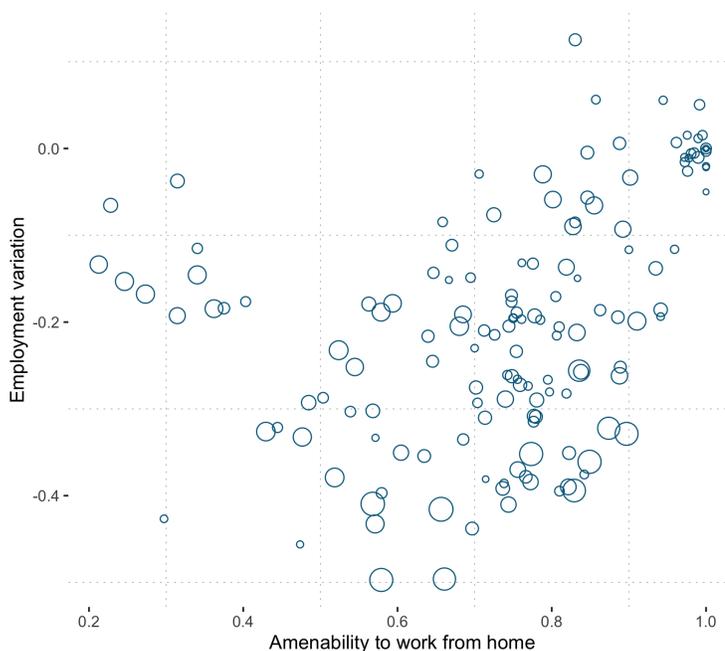
Figure 3: Variation in employed population (2019-2020 second quarter), by gender and region



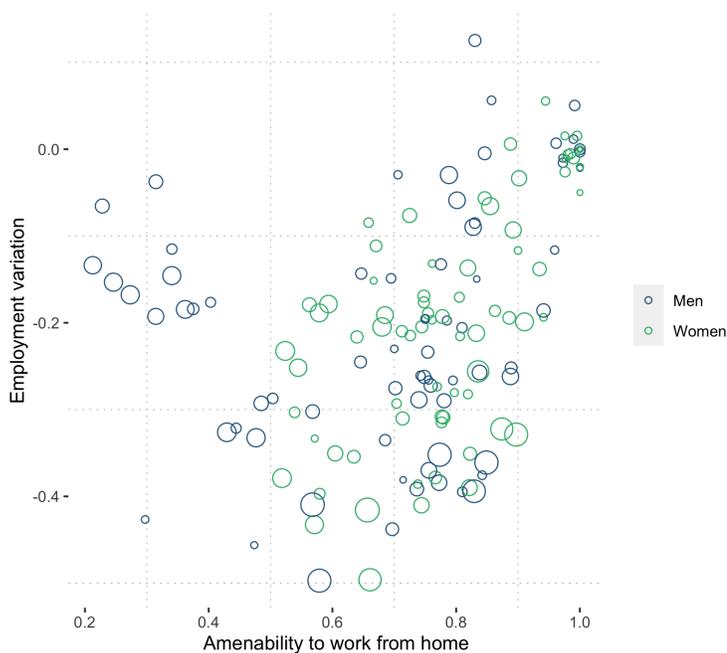
Notes: Based on ENAHO 2019-2020. The figure shows the percentage of workers who lost their jobs during the second quarter of 2020 relative to 2019. Lima estimates include Metropolitan Lima and Callao. Big cities estimates do not consider Lima.

Figure 4: Employment loss and amenability to work from home

(a) Full sample



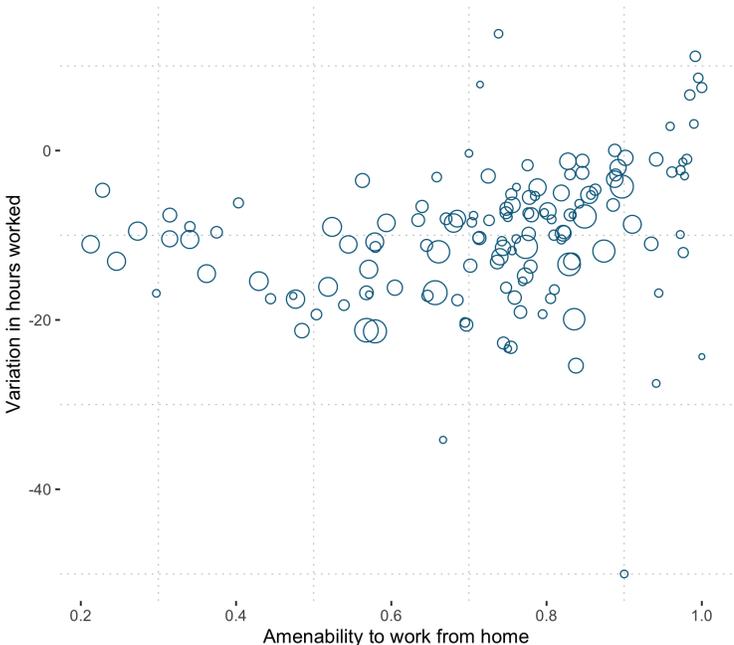
(b) By gender



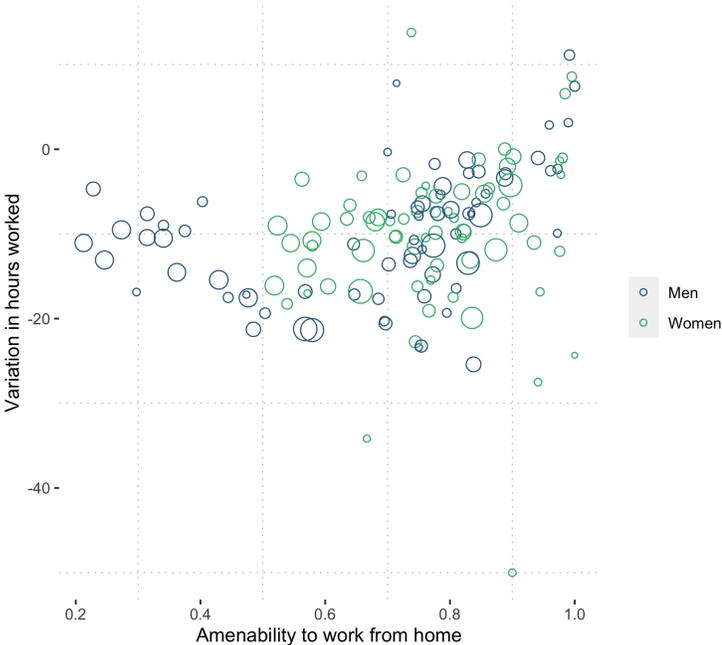
Notes: Based on data from ENAHO 2019-2020 (second quarter) and [Hatayama et al. \(2020\)](#). Each observation represents the number of people per cohort (defined as region, gender, age group, and educational level within a pseudo panel for 2019-2020). The possibility of working from home was defined for values of this variable above the median of the full pseudo-panel sample.

Figure 5: Variation in hours worked and amenability to work from home

(a) Full sample



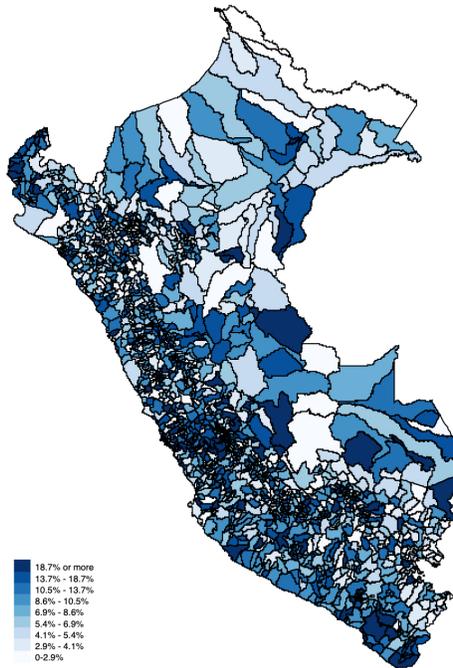
(b) By gender



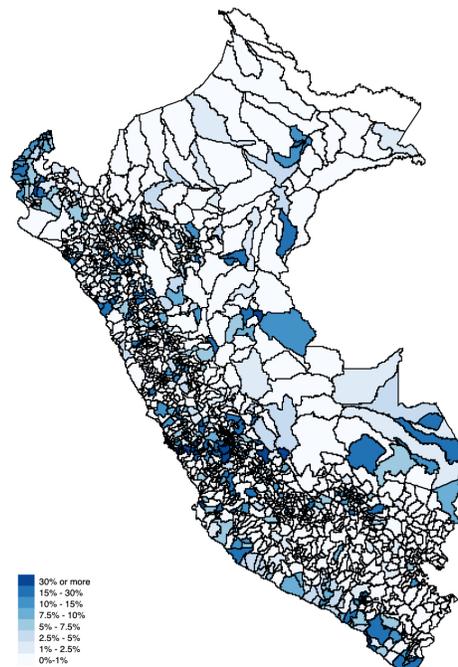
Notes: Based on data from ENAHO 2019-2020 (second quarter) and [Hatayama et al. \(2020\)](#). Each observation represents the number of people per cohort (defined as region, gender, age group, and educational level within a pseudo panel for 2019-2020). The possibility of working from home was defined for values of this variable above the median of the full pseudo-panel sample.

Figure 6: 2019 amenability to work from home and broadband access, percentage of workers by district

(a) Amenability to work from home



(b) Broadband access



Notes: Based on data from the 2017 Peru Census and [Hatayama et al. \(2020\)](#). The possibility of working from home was defined for workers in the top 25 percent of the distribution of this variable. Broadband access was defined for households with access to internet and either Cable TV or a fixed phone connection.