

# COVID-19, informality, and employability<sup>1</sup>

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## Abstract

The COVID-19 pandemic affected employment drastically. Using quarterly panel data from Peru for 2020, in this paper we describe how the labour market adjusted in terms of informality and employability. First, the study reconfirms that the Peruvian labour market is highly dynamic and that most transitions in the labour market occur between employment and inactivity rather than between employment and unemployment. Most transitions occur from informal employment to inactivity and vice versa, and during the lock down period the outflow to inactivity increased and the inflow from inactivity was severely limited. Second, the study also explores the longer-term effects of the pandemic as it also affected the probability of being employed (a broad measure of employability), that fell from 60% in Q1 to 30% in Q2 and then recovered to 51% in Q3 and 55% in Q4. The effect was especially hard for women, youth, older generations, and the less educated. Those with informal jobs were hit the hardest during the lockdown period and the probability of transition to a formal job was reduced and remained less than 30% below pre pandemic levels. This suggests that the pandemic might have altered the structure of the labour market in particular its capacity to generate formal jobs, which would require additional time to recover.

June 2021 (revised version)

<sup>1</sup> This document was presented at the 7<sup>th</sup> Research for Decent Work Conference organised by the ILO, Geneva. We benefited from helpful comments by Juan Manuel García, Mauricio Dierckxsens, Roxana Maurizio, Miguel Jaramillo, Javier Rodríguez, Cecilia Garavito, Vicky Leung and Johannes Weiss to a previous version. All remaining errors are the authors' alone

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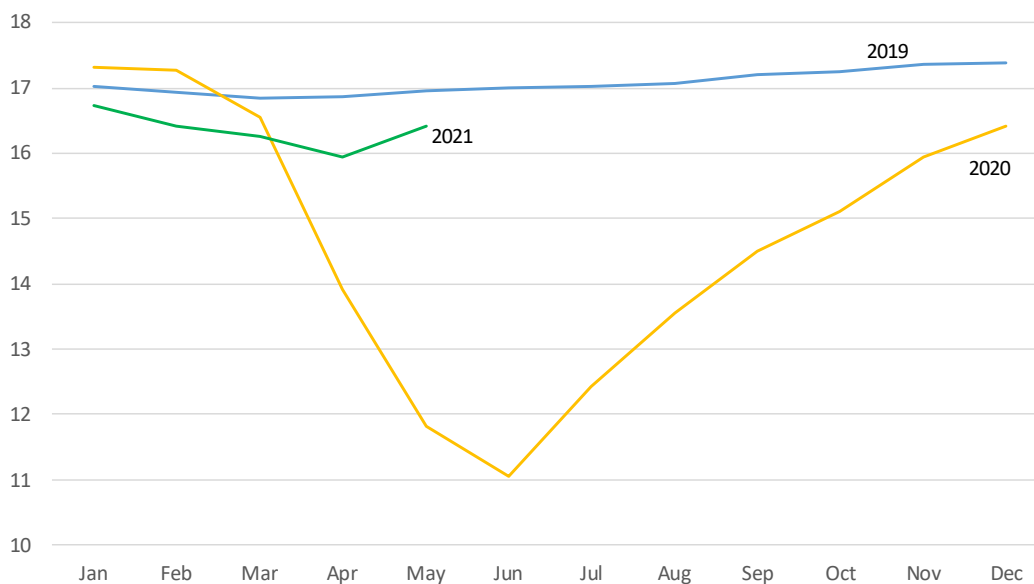
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## Introduction

The COVID-19 pandemic has affected employment drastically around the World. While trying to contain the spread of the virus many countries imposed massive restrictions to mobility, especially to work, thus generating job losses or hours of work losses. This was the case of Peru - one of the worst hit countries both in economic and sanitary terms – for the year 2020<sup>5</sup>. Peru was also one of the worst hit countries in terms of job losses.

Figure 1 shows the evolution of total employment at the national level in 2019, 2020 and 2021. Before Covid 19, total employment was slightly above 17 million workers. Covid 19 and the severe lock down measures imposed, determined that in the second quarter of 2020, employment fell some -30%. It started recovering in the third quarter of 2020 and has already almost fully recovered in the fourth quarter of 2021.

Figure 1. Peru. Evolution of total employment. Millions of persons



Source: INEI-ENAHO.

So where did all that employment go? As in many developing countries, labour markets in Peru typically does not adjust to crisis via unemployment, but rather via quality of employment. For that reason, in this document we analyse the process of adjustment to the shock caused by Covid 19, using an informal / formal disaggregation.

<sup>5</sup> The first case was reported by mid-March 2020 and by December 2020 the country had registered one of the highest number of deaths per million inhabitants in the world and it had also experienced the worst GDP decline in a hundred years of nearly -11.0% (INEI, 2021).

For this, we use data from two sources: a) the National Household Survey (ENAHO), which has a national coverage including urban and rural areas and b) the Permanent Employment Survey (EPE), with coverage only for Metropolitan Lima. The main difference between both data sets is the absence of agriculture in Metropolitan Lima, which has important implications for the adjustment process

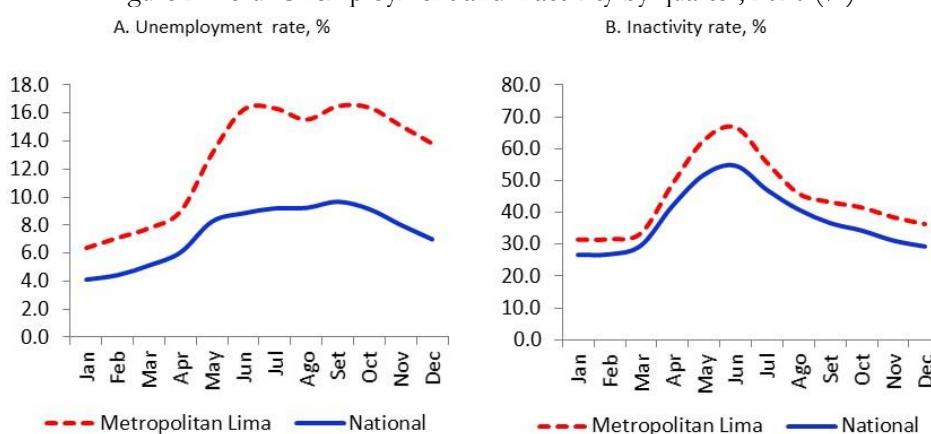
## The adjustment processes: descriptive analysis

In this section we analyse the adjustment process using aggregate data of the overall trends in the Peruvian labour market during 2020, paying special attention to the lockdown period (quarter 2) and then to the recovery period (quarters 3 and 4).

### Adjustment via quantities: unemployment and inactivity

During the lockdown the second quarter of 2020- the participation rate dropped down from over 70% to 37%, due to the fall in the employment to population ratio and the increase in the unemployment rate. In the third quarter, the restrictions to mobility were gradually lifted and a slow recovery process started. In the fourth quarter, participation rates recovered further, but remained 3% lower than in 2019, while the corresponding gap in the employment to population ratio was 7%. The unemployment rate started to decrease slowly after reaching almost 9.6% in the third quarter and the overall net loss of employment in 2020 amounted to 2.2 million jobs with respect to 2019, being nearly 1 million formal jobs and 1.2 informal jobs.

Figure 2. Peru: Unemployment and inactivity by quarter, 2020 (%)

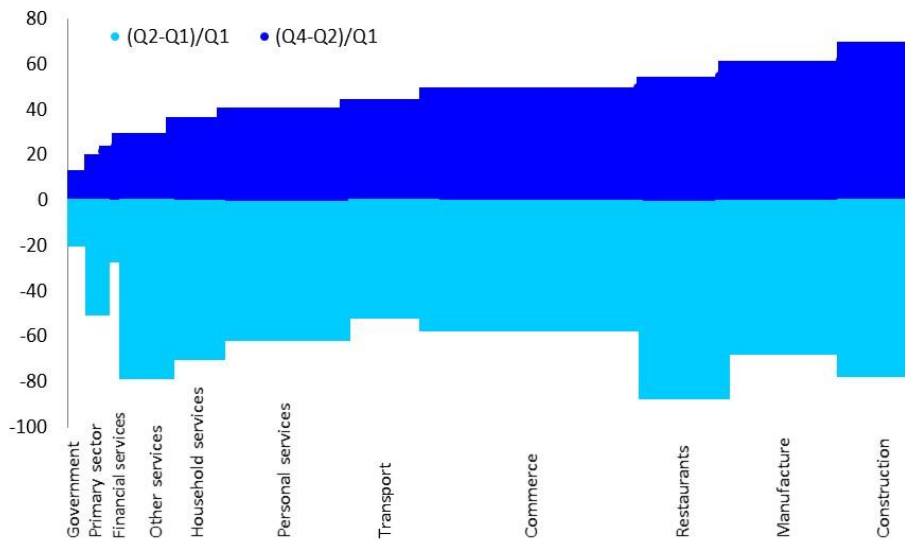


Source: INEI-ENAHO.EPE.

The impact of COVID-19 on employment has been uneven by economic sectors. In the second quarter of 2020, employment in most sectors experienced a large fall, except for those considered essential and were

allowed to continue working (agriculture, government, financial services). The recovery period however, has been very uneven. In the fourth quarter, we clearly observe different speeds of sectoral recovery, especially because restrictions remained in place for some economic sectors, such as restaurants or entertainment, etc.

Figure 3. Metropolitan Lima: Variation in employment by economic sector and cumulative share of employment in 2020, (percentage change)



Source: INEI-EPE.

Interestingly, in the period of lockdown (Q2), informal employment could not become the traditional adjustment or “cushion” mechanism observed in other crises. Due to the restrictions to mobility in this period, workers and economic units could not operate as usual, especially in some sectors – such as commerce, services, etc - that require personal contact and are intensive in informal employment.

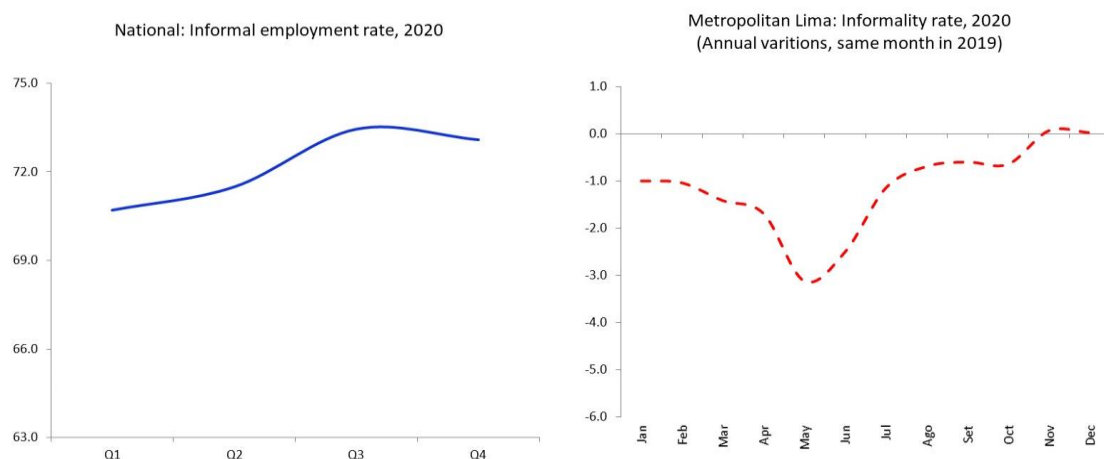
### The adjustment via quality: the formal/informal divide

Peru has always been considered a country with high informality<sup>6</sup>. And there is an important literature indicating that in this country, during crisis informality is an adjustment variable. This was also confirmed during Covid 19 but with some particular behaviour during the lockdown period. Figure 3 shows the evolution of the rate of informality both at the national level and in the capital city: Lima. As can be seen these evolutions were different. At the national level, we observed an immediate increase in informality,

<sup>6</sup> According to the National Institute of Statistics and Informatics (INEI, 2020) informal employment affected 72.7% of the national labour force in 2019: 56.9% informal employment in the informal sector and 15.8% informal employment in the formal sector. This rate was falling from the 80.0% reached in 2007 but in 2020, it has increased again, due to COVID-19 to 75.3%. On the other hand, the National Institute of Statistics (INEI 2021) estimates that 18.9% of the national GDP is produced by those 52.8% of informal workers in the informal sector; in other words, 81.1% of GDP is produced by 47.2% in the formal sector in 2020.

while in Metropolitan Lima a temporary reduction on informality was observed during lockdown, followed by an increase after the lockdown period, similar to what happened in other countries (Beccaria and Maurizio, 2020; ILO, 2020b).

Figure 4. Peru: Evolution of informality, 2020 (%)



Note: For Metropolitan Lima, formal refers to workers affiliated with ESSALUD or private health insurance.  
Source: INEI-ENAH.O.EPE.

One way to explain this divergence is the prominent role that some specific sectors such agriculture had in preserving jobs during the lockdown period, as it was considered an essential activity, and was authorised to operate normally while most of the other sectors were closed. In general, when there is a crisis (typically demand crisis) and some sectors close, the labour market tends to adapt via sectorial recompositions as workers try to migrate from decreasing sectors to those still operating. The Covid 19 crisis had this demand feature as well, but also a supply side particularity as some sectors were closed during lockdown due to sanitary measures. In this sense, the recomposition during the Covid 19 process was blocked or severely limited.

This can be seen in Tables 1 and 2 where we perform a simple shift share analysis of the rate of informality by economic sector and comparing the adjustment process in the national data (where agricultural employment represents some 31% of total employment) versus the Metropolitan Lima data where employment in agriculture is very small (2% of total employment). In table 1, we first use national data (total Peru) for Q2 and Q4 for 2020 relative the same quarters in 2019. If we focus in Q2 (the lockdown period) we observe that there is an important negative reduction in informal employment (within effect) of -6.7 pps due to reductions in most sectors (except agriculture), but that effect was more than compensated with a positive recomposition effect (“between”) of +8.3 pps basically due to the positive effect of agriculture attracting workers from other sectors. As a consequence, informal employment increased +1.7 pps

Table 1. Peru: Shift share analysis by sector, (%)

	Informality rate		Employment composition		Relative decomposition		
	Q2-2019	Q2-2020	Q2-2019	Q2-2020	Within	Between	Total
Agriculture	95.8	97.7	22.0	41.3	0.4	18.8	19.2
Fishing	86.5	91.8	0.6	0.4	0.0	-0.2	-0.2
Mining	40.7	21.4	1.0	0.8	-0.2	0.0	-0.2
Manufacture	60.7	54.4	8.7	6.7	-0.6	-1.1	-1.7
Construction	82.7	77.9	5.5	3.2	-0.3	-1.8	-2.1
Commerce	69.3	69.3	18.8	14.4	0.0	-3.0	-3.0
Transport&com	80.9	73.6	8.4	6.8	-0.6	-1.2	-1.8
Services	51.9	36.2	35.0	26.6	-5.5	-3.1	-8.5
Total	69.8	71.5	100.0	100.0	-6.7	8.3	1.7
	Q4-2019	Q4-2020	Q4-2019	Q4-2020	Within	Between	Total
Agriculture	95.9	95.6	23.0	26.3	-0.1	3.1	3.0
Fishing	86.1	90.6	0.4	0.4	0.0	0.0	0.1
Mining	40.9	53.5	1.2	1.3	0.2	0.0	0.2
Manufacture	64.0	64.3	8.6	8.8	0.0	0.2	0.2
Construction	77.4	84.7	6.2	6.7	0.4	0.5	0.9
Commerce	71.3	75.7	19.3	20.0	0.9	0.5	1.4
Transport&com	81.2	79.8	7.8	7.2	-0.1	-0.5	-0.6
Services	53.9	50.1	33.6	29.3	-1.3	-2.1	-3.4
Total	71.4	73.1	100.0	100.0	0.0	1.7	1.7

Source: INEI-ENAH0.

In table 2, we repeat the same exercise but only using data for Metropolitan Lima (the capital city), where agriculture is negligible. In this case, again in Q2 we observed an even more important negative within effect of -8.7 ppts, but the recomposition effect (between) was almost null : -0.2. For that reason, informality decrease sharply: -8.2pps in Q2. In Q4, once the restrictions where lifted, at least partially, while the negative within effect was reduce, the positive recomposition effect increased slightly and turned larger than the within effect, thus increasing informality

In other words, the main difference in the lockdown period, according to this analysis is that while in the national data there was a sector – agriculture- that could compensate the loss of employment that was occurring in other sectors, in Lima that effect was very small. Note that in Q4 informality increased both in national and Lima, due to the recomposition effects being larger than the negative reductions of employment within each sector.

Table 2. Metropolitan Lima: Shift share analysis by sector, (%)

	Informality rate		Employment composition		Relative decomposition		
	Q2-2019	Q2-2020	Q2-2019	Q2-2020	Within	Between	Total
Manufacture	32.0	21.8	13.3	10.6	-1.4	-0.6	-1.9
Commerce	36.0	33.6	19.9	23.2	-0.5	1.1	0.6
Restaurants& Hotels	40.6	23.6	7.8	2.9	-1.3	-1.2	-2.5
Transport & Com	46.2	40.5	10.7	10.8	-0.6	0.1	-0.6
Services to firms	24.6	20.5	13.1	14.5	-0.5	0.3	-0.2
Other services	28.2	16.7	35.2	38.0	-4.0	0.5	-3.6
Total	32.6	24.5	100.0	100.0	-8.3	0.2	-8.2
	Q4-2019	Q4-2020	Q4-2019	Q4-2020	Within	Between	Total
Manufacture	29.6	32.5	13.7	14.3	0.4	0.2	0.6
Commerce	34.1	35.7	20.2	23.5	0.3	1.2	1.5
Restaurants& Hotels	32.8	33.3	7.6	6.7	0.0	-0.3	-0.3
Transport & Com	42.7	38.7	10.6	10.7	-0.4	0.0	-0.4
Services to firms	21.8	24.6	13.2	13.1	0.4	0.0	0.4
Other services	25.5	22.6	34.7	31.7	-1.0	-0.7	-1.7
Total	29.7	29.8	100.0	100.0	-0.3	0.4	0.1

Source: INEI-EPE.

## Dynamics of the labour market and transition to formality

While the vast majority of studies on informality or formalization, take a static approach, the emergence and availability of longitudinal, or panel, data makes it possible to make a dynamic assessment<sup>7</sup>. In this section, we first analyse dynamic flows into and from the labour market, disaggregating transition matrices by formal and informal employment. Afterwards, we explore changes in the probability of being employed, a broad measure of employability.

### Transitions in labour market status during 2015 and 2019

One way to analyse the dynamism of the labour market is by observing changes in the labour market status (employed, unemployed or inactive). Using information from the National Household Survey (ENAHO), Table 3 shows annual transition matrices for the Peruvian labour market between employment, unemployment and inactivity. Employment is divided into two subgroups: formal and informal employment<sup>8</sup>.

The first and more general result that arises from this analysis is that, comparing one year to the next, around 1 in 4 persons changes their labour market status and 3 out of 4 remain in the same state. This does not mean that they are in the same job<sup>9</sup>, but that they are in the same status in the labour market. Second, a related result is that the proportion of those that remain in the same state as “unemployed” is nearly zero, meaning that longer term unemployment does not seem a recurrent phenomenon. In addition, most

<sup>7</sup> Some recent studies take this dynamic approach. For Latin America, Maurizio and Vasquez (2019) analyze the evolution of labour formality in 5 countries, paying special attention to the inflows to a formal job. They note that formalization can take place through two channels: (1) in situ formalization — i.e., a worker becomes formal, maintaining the same occupation between  $t$  and  $t+1$ ; and (2) transition to a formal waged job coming from a labour status other than a formal job (informal or independent job, unemployment or inactivity). They conclude that even though job-generating growth seems to have been a necessary condition for the employment formalization process, it is the interaction between that process and specific policies that ultimately determine policy effectiveness in terms of labour registration. For Peru, Morales, Rodríguez, Higa and Montes (2010) find that most transitions occur between informal employment and inactivity, and that the determinants of transitions towards formality are positively related to high incomes, high educational level, and urban residence. More recently, Jaramillo and Campos (2020) analyze flows from and into formality for employees using administrative data.

<sup>8</sup> Note that the components of the transition matrices are the probability of an individual being in state  $j$  in period  $t$  given that they were in state  $i$  in period  $t - 1$ , and can be expressed as  $P(E_{ij}) = \frac{n_{ij}}{\sum_j n_{ij}}$ ; where  $n_{ij}$  denote the number of individuals who were in state  $i$  in period  $t - 1$  and are in state  $j$  in period  $t$ . This probability can then be decomposed into two factors (Maurizio and Vasquez; 2019): on the one hand, the probability of leaving the initial state (different from  $j$ ), and on the other hand, the conditional probability of entering a state  $i$  after leaving the initial state  $j$ :  $P(E_{ij}) = P(E_j|E_i)P(E_i)$ . This decomposition allows the evaluation of the extent to which transitions to formality are associated with their relative participation in informal employment or with a higher probability of transiting to formality.

<sup>9</sup> Chacaltana (1999) using an intra annual quarterly panel for 1996 showed that 26% of individuals were unemployed at least one quarter in that year, and that the average duration of unemployment involved 16% of the annual working time. These are indicators that could complement the traditional measure of open unemployment.



transitions involving unemployment occur from inactivity to unemployment – mainly young new entrants - and from unemployment to informality. Third, as expected, within those that remain in the same state, those in informal employment are the largest group (around 40%), followed by those in inactivity (around 20%). Formal-formal status fluctuates around 15% while both informal-informal and formal-formal status increased in the last period 2018-2019, and inactivity decreased.

**Table 3. Peru: Annual transitions in status in the labour market, including formality and informality, 2015-2019 (%)**

	2015-2016	2016-2017	2017-2018	2018-2019
Total (same state + transition)	100.0	100.0	100.0	100.0
Same state	74.5	74.7	73.6	75.6
Formal-formal	14.3	15.1	14.5	16.0
Informal-informal	39.4	39.6	39.1	41.3
Unemployed-unemployed	0.4	0.2	0.0	0.3
Inactive-inactive	20.4	19.8	19.9	17.9
Transition	25.5	25.3	26.4	24.4
To formality	5.2	4.1	5.7	4.1
Informal to formal	3.6	3.0	4.1	3.0
Inactive to formal	1.1	0.7	1.2	0.9
Unemployed to formal	0.4	0.4	0.5	0.3
To informality	10.6	10.4	10.6	11.5
Formal to informal	2.7	2.8	3.2	3.1
Inactive to informal	7.3	6.8	6.7	7.2
Unemployed to informal	0.5	0.8	0.7	1.2
To inactivity	7.6	9.1	7.6	6.4
Informal to inactive	6.0	6.9	5.9	4.8
Formal to inactive	0.9	1.1	1.0	0.9
Unemployed to inactive	0.7	1.1	0.7	0.7
To unemployment	2.1	1.8	2.4	2.4
Informal to unemployed	1.0	0.5	1.0	0.7
Formal to unemployed	0.2	0.4	0.4	0.2
Inactive to unemployed	0.9	0.8	1.0	1.5

Note: Informal employment is calculated based on the ILO methodology, which includes those workers who worked in productive units that do not have a RUC registered with SUNAT or those wage earners who do not have social benefits such as health insurance paid by the employer.

Source: INEI, ENAHO panel.

Fourth, this data also confirms that transitions are more frequent between employment and inactivity than between employment and unemployment. In particular, most transitions are from informality to inactivity.

When they do not work, informal workers in Peru typically do not declare themselves as unemployed, as for example, there are no unemployment insurance or similar benefits for them<sup>10</sup>.

The transition from informal to formal or formal to informal add up approximately one in four of these transitions. The other transitions are relatively small, in particular, those from formal employment to either unemployment or inactivity.

Regarding dynamics over a longer period, Table 4 shows individuals over the entire 2015-2019 period 5-year panel that allows to analyze up to 4 transitions. Of course, the proportion of those changing status increases: the proportion of persons that remain in the same status (not necessarily in the same job<sup>11</sup>) is 54.2% and those in transition, increase to 45.8%. In this context, the same general conclusions apply: employment –particularly, in informality– is typically combined with periods of inactivity rather than with periods of unemployment (17%). Similar characteristics in the region were found (Maurizio and Monsalvo, 2021; Maurizio, Monsalvo, Catania and Martínez, 2020; Beccaria, Bertranou and Maurizio, 2020). In this period, transitions from informality to formality were more important than transitions from formality to informality, although other combinations (in and out of informality) are even more frequent, depicting an image of great mobility between sectors.

Among those that kept the same status, we further tried to identify those that stayed in the same job (same occupation, industry and occupational category) of those that changed jobs, being formal or informal. The conclusions here are even stronger: although some 14.5% remain formal in the whole period, only 2.2% did so in the same job. This means that formal workers are highly mobile but within formal jobs. The same applies for those that remained informal during the entire period with 75% of informal workers changing jobs throughout the period. The characteristics of those in some of these groups are depicted in Figure A2 of the annex. The data indicates that those that remain in formal employment over the five-year period have higher education levels and belong to families in the top quintiles of income (i.e. the wealthiest population group). On the contrary, those that remain more in informal employment have none or only primary education and belong to the poorest families. In addition, workers with more transitions out of the labour force are frequently either women or youth<sup>12</sup>.

<sup>10</sup> Chacaltana (1999) also links this process to the fact to the existence groups in the labour force, with different labour attachment. In addition, Garavito (2019) highlights the procyclical behavior of the labour force, in which both employment and unemployment decrease in periods of economic recession, and viceversa.

<sup>11</sup> We considered that a worker changes his job if, from one year to the next, it changes the economic activity in which it works, the occupation it performs in the business or activity or the occupational category.

<sup>12</sup> For a more detailed description of these transitions see Quispe (2020).

**Table 4. Peru: 4-year panel transitions, 2015-2019 (%)**

	2015-2019
Total (same state + transition)	100.0
Same State	54.2
Always formal	14.5
Different Jobs	12.3
Same job	2.2
Always informal	39.7
Different Jobs	29.5
Same Job	10.2
In transition	45.8
Always occupied	17.8
Formal to informal	3.7
Informal to formal	5.4
Other combinations	8.7
Not always occupied	28.0
Formal with periods of unemployment	0.4
Formal with periods of inactivity	1.5
Informal with periods of unemployment	1.5
Informal with periods of inactivity	17.4
Other combinations	7.2

Note: Informal employment is calculated based on the ILO methodology, which includes those workers who worked in productive units that do not have a RUC registered with SUNAT or those wage earners who do not have social benefits such as health insurance paid by the employer. It is considered to change employment if, from one year to the next, it changes the economic activity in which it works (4-digit ISIC), the occupation it performs in the business or activity (4-digit ISCO) or the occupational category.

Source: INEI, ENAHO panel.

### ***Comparing pre and after lockdown in 2020***

In this section we replicate the previous analysis, but now for the year 2020, where COVID-19 is the main element. Here, we use the quarterly panel data information from the Permanent Survey of Employment (Encuesta Permanente de Empleo, EPE) available only for Metropolitan Lima. This panel follows the same individual in the same quarter of 2019 and 2020, but not between the quarters of the same year.

The lockdown period in Peru started on March 16 and ended in May<sup>13</sup>. Therefore, we can consider the first quarter to be a pre COVID-19 period and the second quarter as the lockdown period. The process of re-opening started in the third quarter and continued into Q4. Table 5 shows annual transitions for each quarter of 2020, compared with similar quarter in 2019: In the first quarter (pre COVID-19), 66.9% of the people remained in the same state, similar to those in the third and fourth quarter (66.7% and 65.7%

<sup>13</sup> The National Emergency period began on March 16, approved by DS No. 044-2020-PCM. On May 27, economic activities were restarted as part of phase 1 of the economic reactivation plan pursuant to DS No. 080-2020-PCM.

respectively). Conversely, the proportion of those in transition in the first, third and fourth quarters were around one third.

**Table 5. Metropolitan Lima: Activity condition transitions by quarter during 2020 (%)**

	2020 (Q1)	2020 (Q2)	2020 (Q3)	2020 (Q4)
Total (same state + transition)	100.0	100.0	100.0	100.0
Same state	66.9	53.6	66.7	65.7
Formal-formal	19.4	13.3	15.8	17.4
Informal-informal	23.4	10.3	21.9	22.3
Unemployed-unemployed	1.0	0.6	1.4	1.0
Inactive-inactive	23.2	29.3	27.7	24.9
Transition	33.1	46.4	33.3	34.3
To formality	7.5	2.8	4.1	4.7
Informal to formal	4.2	1.6	2.6	2.7
Inactive to formal	2.3	0.8	1.0	1.4
Unemployed to formal	1.0	0.4	0.5	0.6
To informality	9.5	3.5	9.1	10.2
Formal to informal	3.0	2.2	6.1	4.5
Inactive to informal	4.9	1.0	2.3	4.3
Unemployed to informal	1.6	0.3	0.7	1.4
To inactivity	12.0	35.5	12.7	11.8
Informal to inactive	7.0	21.7	7.4	6.8
Formal to inactive	3.2	10.5	4.1	3.9
Unemployed to inactive	1.8	3.3	1.2	1.1
To unemployment	4.2	4.7	7.4	7.5
Informal to unemployed	1.2	2.5	3.2	2.8
Formal to unemployed	1.2	1.1	1.7	2.6
Inactive to unemployed	1.8	1.1	2.4	2.2

Note: Formal refers to workers affiliated with ESSALUD or private health insurance.

Source: INEI. Own elaboration based on a panel from EPE.

As expected, due to the mobility restrictions in the second quarter, the proportion that remained in the same state fell to 53.6%, and the percentage of those in transition increased to 46.4%. Again, the main transition is from employment to inactivity rather to unemployment. The most frequent transitions were from informality to inactivity (21.7%) and from formality to inactivity (10.5%), which is consistent with

what happened in other countries<sup>14</sup>. In the other quarters the transition from informality to inactivity was partially offset by the transition from inactivity to informality but in the lockdown period (Q2) the transition from informality increased to 21.7% and the transition from inactivity to informality fell drastically (1%). In other words, while the transitions to inactivity increased, the reverse process was limited or blocked, due to the supply side restrictions in this period.

After the lockdown period, in quarters 3 and 4, transitions to unemployment increased from below 5% to above 7%. In addition, for those that returned to work, transits from formality to informality are also higher after the lockdown period (3.0% versus 6.1% in Q3 and 4.5% in Q4); and at the same time, transitions from informality to formality are lower (4.2% in Q1, versus 2.6% and 2.7% in Q3 and Q4 respectively). This evidence suggests that, as more people returned from inactivity after the lockdown period, they found a labour market with lower opportunities, higher unemployment and lower capacity to generate formal jobs.

### ***COVID-19 and the probability of being employed (or “employability”)***

We now analyze the possible broader effects on the individual capacity of being employed, a measure of employability. We use a simple measure of the capacity of being employed: the conditional probability of being occupied in period  $t$  given the individual and labour market characteristics in both period  $t$  and period  $t-1$ <sup>15</sup>. Given that the Peruvian labour market is highly informal, we attempt to decompose that measure into its formal and informal components.

We assume that, in time  $t$ , an individual can be either employed (formal or informal) or not employed (unemployed or inactive), subject to a set of observable variables. To estimate the probability of being employed we use a probit model for each labour market status as follows:

$$P[y_{it} = 1 | x_{it}, y_{it-1}, \beta] = \Lambda(X'_{it}\beta)$$

Where  $y_{it}$  denotes the economic status in time  $t$  which is 1 if occupied and 0 if not occupied. Furthermore,  $x_{it}$  is a vector of individual characteristics such as age, gender, education level, family status (head of household or not), geographical residence, while  $y_{it-1}$  represents the labour market status in the previous year<sup>16</sup>. It is assumed that the function  $(\Lambda_z)$  is normally distributed. Moreover, as employment is

<sup>14</sup> See for example Beccaria, Bertranou and Maurizio (2020) and ILO (2020a, 2020b).

<sup>15</sup> Part of the literature include contextual variables as determinants of employability. McQuaid and Lindsay (2005) for example include individual factors but also social circumstances of the person and also external factors (such as labour demand and supply).

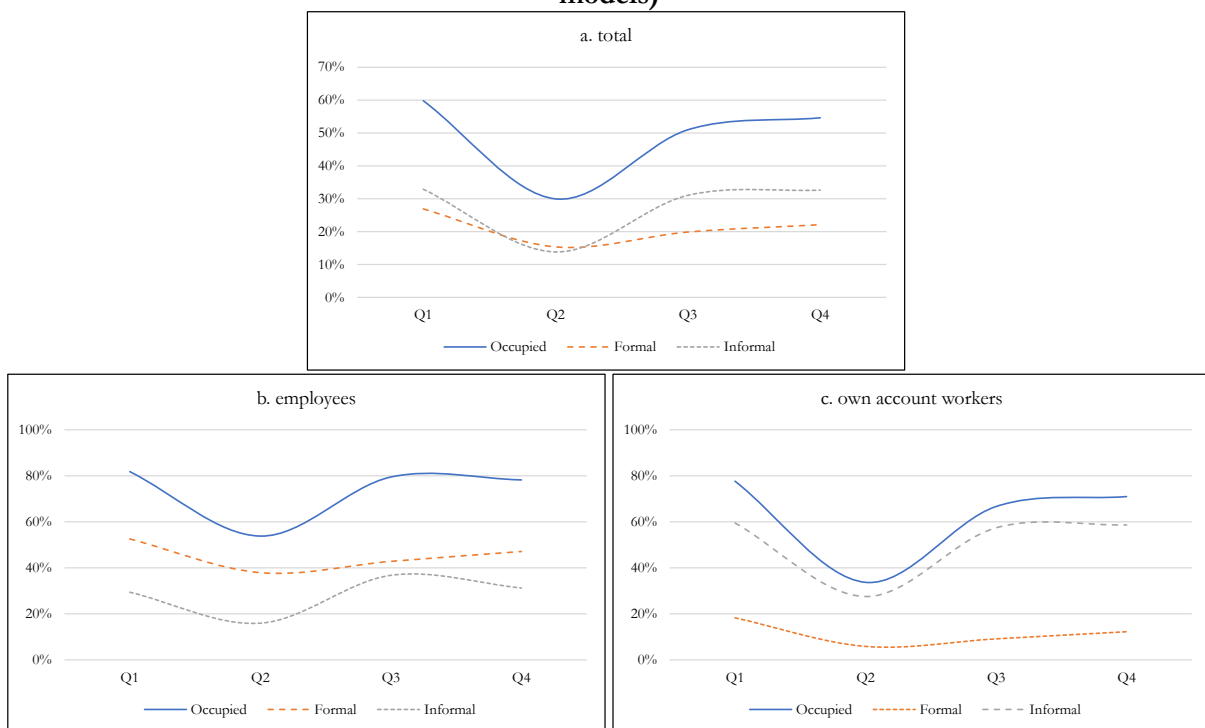
<sup>16</sup> We also estimate the same model considering the vector of individual characteristics of the previous year and we find that our results are robust. See Figure A4.

decomposed into formal and informal employment (i.e. mutually exclusive events), the probability of their union is the sum of the probabilities of each event (Newbold, Carlson and Betty, 2013). This specification allows us to decompose the overall probability of being employed into its formal and informal components, in an additive way:

$$P[y_{it} = 1 | x_{it}, y_{it-1}, \beta] = P[formal_{it} = 1 | x_{it}, y_{it-1}, \beta] + P[informal_{it} = 1 | x_{it}, y_{it-1}, \beta]$$

The purpose of this exercise is mainly to estimate average probabilities of being employed. Figure 4 and Table 5 show the main results<sup>17</sup>. Q1 is the pre lockdown period, Q2 is the lockdown period, Q3 is the start of the post lockdown period and in Q4 more restrictions were relaxed, including international travel authorization<sup>18</sup>. Recall that in all cases, we compare each quarter in 2020 with respect to the same quarter in 2019. The overall probability of being employed was 59.8% in Q1 and was reduced to 30.0% in Q2 the lockdown period (a fall of almost 50%). In Q3 and Q4, as expected, we observed a recovery with respect to Q2, but it remained still lower than Q1 (-8.8pp and -5.2pp, respectively)<sup>19</sup>.

**Figure 5. Metropolitan Lima: Estimated probabilities of being employed by quarter, 2020 (Probit models)**



Note: Pooled data regression. Formal refers to workers affiliated with ESSALUD or private health insurance. All probabilities are significant at the 1% level.

Source: INEI- EPE.

<sup>17</sup> The estimated models are presented in Figure A3 of the annex. Figure A6a of the annex provides a graphical representation of the complete distribution of probabilities.

<sup>18</sup> Q4 also includes a complex political context, as in November where Peru had 3 presidents in one month.

<sup>19</sup> A similar trend was found by WIEGO (2021).

Figure 5 also shows the decomposition of the probability of being employed in terms of its formal and informal additive components. For example, the overall probability of 59.8% observed in Q1 includes the probability of 26.9% of being employed formal and the 32.9% probability of being employed informal, showing the higher average probability of finding an informal job. In any case, in terms of trends, the probability of being employed formally fell in Q2 (and temporarily became larger than the probability of being employed informally). Then it recovered in Q3 and Q4 although not completely. On the contrary, the probability of informal employment fell sharply in Q2 and but bounced back rapidly in Q3 and in Q4 practically was in the same level of Q1. This confirms the fact that informality operates an important adjustment mechanism during crisis: it adjusts more rapidly downwards and upwards<sup>20</sup>. The concern is that formal employment is recovering at a slower pace.

If we disaggregate this analysis by employment status in 2019 (tables A5a and A5b of the annex) we observe as expected that for employees, the probability of being formal is higher than the probability of being informal and the opposite is true for own account workers. For employees the overall probabilities of being employed in Q4 had almost returned to the pre-lockdown levels, basically due to the fact that the probabilities of being employed formally had already returned to its pre lockdown level. This is not the case for own account workers, where the probability of being formal did not recover, despite the fact that the probabilities of being employed informally did recover. This is probably related to the fact that formal employment for employees have more employment smoothing mechanisms than in the case of own account work.

There is a high degree of heterogeneity in these average probabilities (see Table 6). For example, in Q2 the probabilities of being occupied fell more rapidly for men than for women, in comparison to Q1, but also recovered more rapidly in Q3 and Q4 relative to Q2, with the recovery for women progressing at a slower pace. Regarding age, the youngest (14-24 years old) and the oldest (60+ years old) appear to be the most vulnerable groups: not only did they have the lowest employability levels before the pandemic, but their probabilities of being occupied declined to a particularly large extent in Q2 in comparison to other age groups. Our estimates also indicate that recovery is slower for these groups in Q3 and Q4.

In addition, not only are the less educated less employable, but they also lost more relative to the more educated, who were more resilient in keeping their (formal) jobs. People with higher levels of education tend to work in sectors/jobs where teleworking is possible. Our estimates indicate that in Q2, the probabilities of being employed for those with primary or secondary education fell by 54% and 57% respectively, while these probabilities fell 33% for those with higher education. In addition, the probabilities

<sup>20</sup> There is a vast literature on the interrelations between the formal and informal sector. See Tokman (1978) for example, or WIEGO (2021) for a recent discussion.

of having a formal job fell 42% and 49% for those with primary or secondary education, and 32% for those with higher education.

Finally, we also estimate these probabilities conditional on their formal/ informal status in 2019. For those that were in formal employment in 2019, the probability of having a formal job decreased in Q2 and recovered in both Q3 and Q4 even though not to the levels of Q1. However, the probabilities of having an informal job increased in Q4 with respect to Q1. The opposite happens for those that had an informal job in 2019: their probabilities of having a formal job were small and reduced even further with the crisis, while the probabilities of having an informal job recovered rapidly. On average, we find that the pandemic increased overall probabilities of transition to informality from 11.5% to 15.4%, i.e. an increase of 33.9%, and reduced the probabilities of transitions to formality from 12.3% to 8.1%, which corresponds to a reduction of -34.1%. Figure A6b of the Annex shows the complete distribution of these transition probabilities.



**Table 6. Metropolitan Lima: Estimated probabilities of being employed by quarter, 2020 (Probit models estimates)**

	Status: Occupied				Status: Occupied formal				Status: Occupied informal			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Mean	0.598	0.3	0.51	0.546	0.269	0.154	0.199	0.221	0.329	0.138	0.311	0.326
Male	0.648*** (0.012)	0.326*** (0.011)	0.556*** (0.010)	0.602*** (0.009)	0.282*** (0.009)	0.175*** (0.007)	0.213*** (0.009)	0.237*** (0.007)	0.361*** (0.011)	0.15*** (0.008)	0.34*** (0.010)	0.363*** (0.010)
Female	0.556*** (0.010)	0.274*** (0.010)	0.468*** (0.009)	0.496*** (0.009)	0.256*** (0.009)	0.148*** (0.007)	0.185*** (0.007)	0.205*** (0.007)	0.301*** (0.010)	0.126*** (0.008)	0.282*** (0.009)	0.293*** (0.009)
14-24 years	0.539*** (0.018)	0.246*** (0.016)	0.459*** (0.017)	0.513*** (0.018)	0.214*** (0.013)	0.138*** (0.013)	0.158*** (0.015)	0.201*** (0.013)	0.322*** (0.017)	0.111*** (0.012)	0.296*** (0.017)	0.312*** (0.017)
25-29 years	0.635*** (0.025)	0.336*** (0.020)	0.546*** (0.023)	0.638*** (0.021)	0.263*** (0.022)	0.17*** (0.016)	0.189*** (0.015)	0.242*** (0.017)	0.375*** (0.024)	0.172*** (0.019)	0.371*** (0.022)	0.402*** (0.021)
30-39 years	0.672*** (0.019)	0.342*** (0.017)	0.63*** (0.015)	0.648*** (0.015)	0.3*** (0.013)	0.173*** (0.011)	0.226*** (0.014)	0.239*** (0.011)	0.359*** (0.018)	0.163*** (0.014)	0.39*** (0.017)	0.396*** (0.016)
40-49 years	0.683*** (0.019)	0.36*** (0.016)	0.595*** (0.015)	0.632*** (0.016)	0.299*** (0.016)	0.197*** (0.013)	0.218*** (0.013)	0.236*** (0.012)	0.371*** (0.017)	0.163*** (0.013)	0.362*** (0.016)	0.385*** (0.017)
50-59 years	0.638*** (0.019)	0.35*** (0.018)	0.472*** (0.018)	0.594*** (0.016)	0.277*** (0.014)	0.17*** (0.011)	0.229*** (0.015)	0.247*** (0.013)	0.355*** (0.017)	0.172*** (0.013)	0.24*** (0.015)	0.341*** (0.016)
60 years and older	0.479*** (0.017)	0.152*** (0.014)	0.327*** (0.019)	0.327*** (0.016)	0.267*** (0.013)	0.109*** (0.011)	0.165*** (0.013)	0.165*** (0.011)	0.213*** (0.014)	0.047*** (0.007)	0.158*** (0.016)	0.174*** (0.012)
Primary	0.547*** (0.019)	0.253*** (0.020)	0.464*** (0.019)	0.498*** (0.018)	0.178*** (0.015)	0.103*** (0.019)	0.106*** (0.017)	0.12*** (0.016)	0.363*** (0.019)	0.143*** (0.016)	0.334*** (0.020)	0.348*** (0.019)
Secondary	0.585*** (0.010)	0.249*** (0.010)	0.485*** (0.009)	0.538*** (0.009)	0.227*** (0.009)	0.116*** (0.007)	0.155*** (0.008)	0.171*** (0.007)	0.349*** (0.010)	0.128*** (0.007)	0.322*** (0.009)	0.359*** (0.009)
Tertiary (non-univ)	0.641*** (0.019)	0.333*** (0.016)	0.548*** (0.016)	0.579*** (0.016)	0.327*** (0.016)	0.18*** (0.012)	0.225*** (0.013)	0.278*** (0.013)	0.318*** (0.017)	0.148*** (0.013)	0.32*** (0.016)	0.298*** (0.014)
Tertiary (Univ)	0.628*** (0.015)	0.418*** (0.016)	0.544*** (0.014)	0.56*** (0.013)	0.358*** (0.014)	0.243*** (0.013)	0.258*** (0.014)	0.282*** (0.011)	0.269*** (0.015)	0.157*** (0.014)	0.273*** (0.015)	0.268*** (0.014)
Formal in 2019	0.798*** (0.015)	0.499*** (0.016)	0.739*** (0.015)	0.716*** (0.013)	0.66*** (0.016)	0.417*** (0.016)	0.494*** (0.020)	0.533*** (0.016)	0.115*** (0.011)	0.068*** (0.008)	0.211*** (0.013)	0.154*** (0.011)
Informal in 2019	0.752*** (0.014)	0.32*** (0.015)	0.655*** (0.013)	0.683*** (0.013)	0.123*** (0.010)	0.051*** (0.006)	0.075*** (0.008)	0.081*** (0.007)	0.625*** (0.015)	0.26*** (0.014)	0.575*** (0.015)	0.601*** (0.013)
No occupied in 2019	0.32*** (0.013)	0.094*** (0.009)	0.179*** (0.012)	0.284*** (0.012)	0.109*** (0.009)	0.04*** (0.006)	0.055*** (0.008)	0.074*** (0.007)	0.193*** (0.011)	0.051*** (0.006)	0.106*** (0.009)	0.191*** (0.011)
Not head of household	0.589*** (0.010)	0.286*** (0.009)	0.494*** (0.008)	0.524*** (0.008)	0.261*** (0.008)	0.162*** (0.006)	0.196*** (0.007)	0.215*** (0.006)	0.329*** (0.009)	0.124*** (0.007)	0.299*** (0.008)	0.313*** (0.008)
Head of household	0.618*** (0.014)	0.325*** (0.012)	0.544*** (0.013)	0.592*** (0.012)	0.283*** (0.011)	0.159*** (0.008)	0.205*** (0.009)	0.233*** (0.009)	0.329*** (0.013)	0.165*** (0.011)	0.336*** (0.013)	0.352*** (0.011)
Observations	4 543	5 774	5 646	4 871	4 543	5 774	5 646	4 871	4 543	5 774	5 646	4 871

Note: Pooled data regression. Robust standard errors in parentheses. Average estimate of the analyzed variables. Significant \*\*\* p<0.001; \*\* p<0.01; \* p<0.05. Formal refers to workers affiliated with ESSALUD or private health insurance.

Source: INEI. Own elaboration based on a panel from EPE.

## Conclusions

The COVID-19 pandemic had a drastic impact on employment around the world. In this paper, using panel data from Peru, we analysed patterns of transitions in the labour market during the year 2020.

The analysis confirm that most transitions occurred between employment and inactivity and between informality and inactivity. During the lockdown period, the transition from employment to inactivity increased and could not be offset with the usual transition from inactivity to employment since labour supply restrictions applied. When these restrictions were lifted, the inactivity to employment transition was restored. Given that most of these transitions occur from informality to inactivity and vice versa, we observed that informality was more affected during the lockdown, but also recovered more quickly afterwards and formal employment could not recover to pre pandemic levels. Unemployment increased but will probably decrease at the expense of informality, in the context of a country without formal income smoothing mechanisms such as unemployment insurance for example. Another important result is that long term unemployment is practically non-existent.

In addition, during 2020 overall probabilities of transition to informality increased while the probabilities of transition to formality decreased. These effects will probably last more time because the pandemic also affected the probability of being employed, a broad measure of employability, that fell drastically in the lockdown period and did not recover fully afterwards, affecting disproportionately some groups, such as women or young people (14-24 years), the less educated. These groups do not only have the lowest probabilities of being employed, but also faced greater losses in the probability of having a job in 2020.

A key to understanding the longer-term potential effects is that the pandemic has also affected the structure of the labour market, in particular its capacity to generate formal jobs, due to the fall in economic activity but also to the observed sectorial reallocations of labour, and this would take more time to recover. Another contributing factor may have been the fact that the digital transformation of the labour market was accentuated during the pandemic, both for wage employment and own account work, creating both new forms of informality and the need for new forms of formality.

The most important policy implication of these findings is that, apart from short term or immediate actions to promote employment recovery, countries should assess the way in which their labour market conditions have changed and promote policies to adjust to this new reality accordingly. In particular, this could be an opportunity to discuss the potential of structural transformation policies, sectoral policies and their role in formal employment generation, as well as education or training policies to assist the most adversely impacted groups in adapting to the new, more digitalized context.

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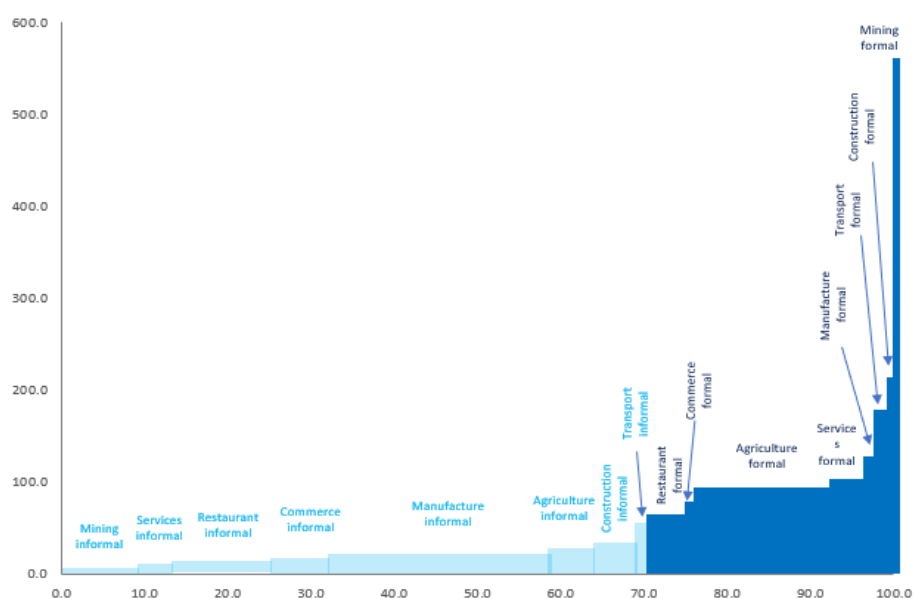
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## Annex

**Figure A1. Peru: Output per worker by economic sector and informality, 2020**



Note: x axis represents the cumulative percentage of employment.

Source INEI. ENAHO. Producción y empleo informal en el Perú. Cuenta Satélite de la Economía Informal 2007-2020.

**Table A1. Peru: Labour Market structure by economic status and informality, 2020 (%)**

	Informal employment	Formal employment	Total
Public employee	1.6	7.0	8.6
Private employee	24.0	13.9	37.8
2-10 persons	18.9	2.8	21.7
11-100 persons	3.6	4.4	8.1
100+ persons	1.4	6.6	8.1
Own account	34.7	3.5	38.2
Unpaid family work	13.7	0.0	13.7
Domestic workers	1.4	0.2	1.6
Total	75.3	24.7	100.0

Source: INEI. ENAHO

**Figure A2. Peru: Main characteristics of individuals in 4-year panel transitions, 2015-2019 (%)**

		Always formal	Always informal	Always occupied	Not always occupied
Gender	Female	39.3	43.3	39.8	64.6
	Male	60.7	56.7	60.2	35.4
Age group	Young	8.1	14.4	21.2	31.9
	Adult	79.8	66.8	67,0	45.3
	Elderly	12.1	18.9	11.8	22.8
Educational level	Non-level	2.1	28.3	7.6	23.7
	Primary	7.6	39,0	19.4	22.3
	Secondary	33.4	27.7	50.6	37.1
	Tertiary (non-univ)	14.5	3.4	11.9	6.5
	Tertiary (univ)	42.4	1.6	10.5	10.4
Quintile	Q1	0.7	36.1	5.1	21.5
	Q2	2.8	28.1	15.3	17,0
	Q3	14.1	19.7	20.1	21.9
	Q4	30.1	10.6	28.8	23.9
	Q5	52.3	5.4	30.7	15.6

Note: Informal employment is calculated based on the ILO Methodology, which includes those workers who worked in productive units that do not have a RUC registered with SUNAT or those wage earners who do not have social benefits such as health insurance paid by the employer.

Source: INEI, ENAHO panel.

**Figure A3. Metropolitan Lima: Estimation of probit models of occupation status by quarter, 2020**

	Status: Occupied				Status: Occupied formal				Status: Occupied informal			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Female	-0.337*** (0.054)	-0.191*** (0.05)	-0.336*** (0.055)	-0.366*** (0.049)	-0.121 (0.063)	-0.176** (0.066)	-0.149* (0.061)	-0.17** (0.059)	-0.227*** (0.054)	-0.124* (0.058)	-0.219*** (0.052)	-0.253*** (0.050)
14-24 years (base)	-	-	-	-	-	-	-	-	-	-	-	-
25-29 years	0.332** (0.104)	0.326*** (0.086)	0.302*** (0.093)	0.403*** (0.088)	0.244* (0.120)	0.204 (0.125)	0.177 (0.121)	0.21 (0.107)	0.189 (0.100)	0.312** (0.098)	0.269** (0.097)	0.306*** (0.092)
30-39 years	0.465*** (0.095)	0.344*** (0.083)	0.609*** (0.081)	0.435*** (0.079)	0.411*** (0.093)	0.223 (0.116)	0.371** (0.122)	0.198* (0.094)	0.135 (0.092)	0.271** (0.098)	0.334*** (0.085)	0.286*** (0.085)
40-49 years	0.505*** (0.090)	0.405*** (0.083)	0.478*** (0.085)	0.383*** (0.081)	0.408*** (0.102)	0.357** (0.121)	0.33** (0.121)	0.181 (0.102)	0.177 (0.093)	0.272** (0.095)	0.236** (0.090)	0.249** (0.088)
50-59 years	0.344*** (0.094)	0.371*** (0.086)	0.045 (0.094)	0.257** (0.082)	0.306** (0.103)	0.206 (0.116)	0.383** (0.122)	0.236* (0.101)	0.12 (0.093)	0.314*** (0.091)	-0.219* (0.097)	0.103 (0.086)
60 a más years	-0.196* (0.088)	-0.411*** (0.098)	-0.46*** (0.100)	-0.587*** (0.083)	0.262** (0.098)	-0.217 (0.132)	0.027 (0.121)	-0.205 (0.105)	-0.445*** (0.096)	-0.519*** (0.116)	-0.6*** (0.116)	-0.567*** (0.089)
Primary (base)	-	-	-	-	-	-	-	-	-	-	-	-
Secondary	0.138 (0.073)	-0.017 (0.082)	0.08 (0.077)	0.137 (0.070)	0.259** (0.098)	0.099 (0.156)	0.328* (0.135)	0.322** (0.114)	-0.052 (0.073)	-0.077 (0.091)	-0.043 (0.079)	0.036 (0.073)
Tertiary (non-univ)	0.346*** (0.104)	0.291** (0.096)	0.324*** (0.098)	0.281*** (0.084)	0.697*** (0.113)	0.496** (0.165)	0.7*** (0.147)	0.839*** (0.123)	-0.164 (0.102)	0.029 (0.111)	-0.052 (0.108)	-0.18* (0.087)
Tertiary (Univ.)	0.297*** (0.089)	0.574*** (0.097)	0.309** (0.098)	0.212** (0.079)	0.817*** (0.101)	0.808*** (0.165)	0.849*** (0.149)	0.856*** (0.118)	-0.361*** (0.094)	0.075 (0.114)	-0.235* (0.098)	-0.299*** (0.089)
Formal in 2019 (base)	-	-	-	-	-	-	-	-	-	-	-	-
Informal in 2019	-0.174* (0.074)	-0.501*** (0.057)	-0.265*** (0.066)	-0.105 (0.057)	-1.667*** (0.072)	-1.541*** (0.077)	-1.506*** (0.082)	-1.586*** (0.069)	1.616*** (0.077)	0.882*** (0.076)	1.056*** (0.066)	1.35*** (0.061)
No occupied in 2019	-1.448*** (0.072)	-1.414*** (0.070)	-1.706*** (0.077)	-1.255*** (0.058)	-1.742*** (0.070)	-1.668*** (0.093)	-1.676*** (0.093)	-1.638*** (0.073)	0.353*** (0.081)	-0.154 (0.096)	-0.471*** (0.080)	0.153* (0.071)
Head of household	0.108 (0.067)	0.144* (0.056)	0.196** (0.064)	0.238*** (0.054)	0.103 (0.072)	-0.022 (0.070)	0.051 (0.066)	0.097 (0.059)	-0.002 (0.062)	0.213*** (0.065)	0.143* (0.065)	0.139** (0.052)
Constant	0.825*** (0.114)	-0.33 (0.171)	0.43*** (0.134)	0.467*** (0.100)	-0.167 (0.124)	-0.609** (0.228)	-0.602*** (0.188)	-0.433** (0.150)	-0.896*** (0.133)	-1.69*** (0.223)	-0.782*** (0.134)	-0.942*** (0.114)
Observations	4,543	5,774	5,646	4,871	4,543	5,774	5,646	4,871	4,543	5,774	5,646	4,871
Pseudo R <sup>2</sup>	0.291	0.2231	0.339	0.266	0.351	0.358	0.343	0.353	0.261	0.164	0.259	0.233

Note: Pooled data regression. Standard errors in parentheses. Average estimate of the analyzed variables. Significant \*\*\* p<0.001; \*\* p<0.01; \* p<0.05

Formal employment refers to workers affiliated with ESSALUD or private health insurance.

Source: INEI. Own elaboration based on a panel from EPE.

**Figure A4. Metropolitan Lima: Estimated probabilities of being employed by quarter of 2020 using covariates of 2019 (Probit models estimates)**

	Status: Occupied				Status: Occupied formal				Status: Occupied informal			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Mean	0.596*** (0.009)	0.299*** (0.008)	0.51*** (0.006)	0.546*** (0.006)	0.269*** (0.006)	0.161*** (0.005)	0.199*** (0.006)	0.221*** (0.005)	0.328*** (0.009)	0.138*** (0.006)	0.31*** (0.006)	0.326*** (0.006)
Male	0.65*** (0.013)	0.322*** (0.011)	0.554*** (0.010)	0.601*** (0.009)	0.284*** (0.009)	0.173*** (0.007)	0.213*** (0.008)	0.237*** (0.007)	0.363*** (0.012)	0.148*** (0.008)	0.338*** (0.010)	0.362*** (0.010)
Female	0.551*** (0.012)	0.277*** (0.010)	0.47*** (0.009)	0.497*** (0.009)	0.254*** (0.009)	0.15*** (0.007)	0.185*** (0.007)	0.205*** (0.007)	0.298*** (0.011)	0.128*** (0.008)	0.284*** (0.009)	0.293*** (0.009)
14-24 years	0.538*** (0.020)	0.267*** (0.017)	0.474*** (0.017)	0.534*** (0.016)	0.22*** (0.013)	0.146*** (0.012)	0.163*** (0.013)	0.211*** (0.013)	0.318*** (0.017)	0.125*** (0.014)	0.311*** (0.016)	0.323*** (0.016)
25-29 years	0.64*** (0.028)	0.341*** (0.021)	0.574*** (0.021)	0.626*** (0.022)	0.275*** (0.021)	0.182*** (0.015)	0.201*** (0.017)	0.249*** (0.016)	0.36*** (0.025)	0.158*** (0.017)	0.378*** (0.024)	0.379*** (0.022)
30-39 years	0.652*** (0.022)	0.336*** (0.017)	0.62*** (0.015)	0.646*** (0.015)	0.291*** (0.014)	0.178*** (0.012)	0.219*** (0.014)	0.234*** (0.012)	0.355*** (0.019)	0.155*** (0.014)	0.388*** (0.017)	0.399*** (0.016)
40-49 years	0.682*** (0.021)	0.344*** (0.016)	0.59*** (0.016)	0.63*** (0.017)	0.304*** (0.016)	0.18*** (0.012)	0.226*** (0.014)	0.232*** (0.012)	0.369*** (0.020)	0.162*** (0.013)	0.351*** (0.017)	0.386*** (0.017)
50-59 years	0.654*** (0.020)	0.351*** (0.018)	0.458*** (0.018)	0.583*** (0.016)	0.281*** (0.015)	0.167*** (0.011)	0.225*** (0.015)	0.25*** (0.013)	0.365*** (0.019)	0.177*** (0.014)	0.228*** (0.015)	0.328*** (0.016)
60 years and older	0.482*** (0.019)	0.14*** (0.013)	0.31*** (0.020)	0.313*** (0.016)	0.26*** (0.013)	0.101*** (0.012)	0.156*** (0.013)	0.154*** (0.012)	0.216*** (0.016)	0.044*** (0.008)	0.151*** (0.017)	0.171*** (0.012)
Primary	0.549*** (0.023)	0.241*** (0.021)	0.473*** (0.020)	0.505*** (0.019)	0.178*** (0.016)	0.109*** (0.023)	0.109*** (0.017)	0.132*** (0.018)	0.367*** (0.023)	0.128*** (0.015)	0.34*** (0.021)	0.346*** (0.019)
Secondary	0.576*** (0.013)	0.256*** (0.010)	0.483*** (0.008)	0.533*** (0.009)	0.23*** (0.008)	0.119*** (0.007)	0.154*** (0.007)	0.173*** (0.007)	0.341*** (0.012)	0.132*** (0.007)	0.321*** (0.009)	0.352*** (0.009)
Tertiary (non-univ)	0.642*** (0.021)	0.32*** (0.016)	0.546*** (0.018)	0.584*** (0.017)	0.326*** (0.018)	0.165*** (0.012)	0.221*** (0.016)	0.281*** (0.014)	0.318*** (0.018)	0.153*** (0.013)	0.324*** (0.017)	0.298*** (0.014)
Tertiary (Univ.)	0.647*** (0.016)	0.398*** (0.015)	0.55*** (0.015)	0.569*** (0.013)	0.362*** (0.015)	0.235*** (0.012)	0.266*** (0.015)	0.286*** (0.011)	0.273*** (0.016)	0.147*** (0.013)	0.271*** (0.015)	0.273*** (0.014)
Formal	0.79*** (0.018)	0.505*** (0.016)	0.737*** (0.016)	0.717*** (0.013)	0.653*** (0.018)	0.424*** (0.017)	0.491*** (0.019)	0.534*** (0.016)	0.113*** (0.012)	0.07*** (0.009)	0.211*** (0.013)	0.154*** (0.011)
Informal	0.749*** (0.017)	0.319*** (0.015)	0.658*** (0.013)	0.686*** (0.013)	0.123*** (0.010)	0.049*** (0.006)	0.076*** (0.008)	0.081*** (0.007)	0.622*** (0.017)	0.264*** (0.014)	0.58*** (0.015)	0.604*** (0.013)
No occupied	0.322*** (0.014)	0.091*** (0.008)	0.178*** (0.012)	0.281*** (0.012)	0.112*** (0.009)	0.04*** (0.006)	0.055*** (0.007)	0.073*** (0.007)	0.192*** (0.012)	0.047*** (0.006)	0.103*** (0.009)	0.187*** (0.011)
Not head of household	0.593*** (0.011)	0.285*** (0.009)	0.494*** (0.008)	0.524*** (0.008)	0.262*** (0.008)	0.16*** (0.006)	0.197*** (0.007)	0.213*** (0.006)	0.333*** (0.010)	0.126*** (0.007)	0.297*** (0.008)	0.314*** (0.008)
Head of household	0.605*** (0.017)	0.328*** (0.013)	0.546*** (0.013)	0.598*** (0.012)	0.281*** (0.011)	0.164*** (0.009)	0.203*** (0.009)	0.237*** (0.009)	0.318*** (0.015)	0.162*** (0.011)	0.34*** (0.014)	0.352*** (0.012)
Observations	4,543	5,774	5,646	4,871	4,543	5,774	5,646	4,871	4,543	5,774	5,646	4,871

Note: Pooled data regression. All covariates are based on 2019. Robust standard errors in parentheses. Average estimate of the analyzed variables. Significant \*\*\* p<0.001; \*\* p<0.01; \* p<0.05.

Formal refers to workers affiliated with ESSALUD or private health insurance.

Source: INEI. Own elaboration based on a panel from EPE.

**Figure A5a. Metropolitan Lima: Estimated probabilities of being employed for employees by quarter, 2020 (Probit models estimates)**



	Status: Occupied				Status: Occupied formal				Status: Occupied informal			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Mean	0.818*** (0.012)	0.538*** (0.013)	0.794*** (0.011)	0.782*** (0.010)	0.526*** (0.012)	0.379*** (0.011)	0.428*** (0.013)	0.471*** (0.011)	0.294*** (0.011)	0.16*** (0.011)	0.368*** (0.013)	0.313*** (0.010)
Male	0.846*** (0.015)	0.551*** (0.017)	0.827*** (0.014)	0.829*** (0.014)	0.538*** (0.016)	0.394*** (0.015)	0.434*** (0.019)	0.491*** (0.016)	0.309*** (0.015)	0.158*** (0.012)	0.395*** (0.018)	0.337*** (0.014)
Female	0.777*** (0.021)	0.522*** (0.020)	0.751*** (0.017)	0.72*** (0.018)	0.506*** (0.025)	0.361*** (0.016)	0.42*** (0.018)	0.444*** (0.017)	0.271*** (0.020)	0.161*** (0.017)	0.334*** (0.018)	0.279*** (0.018)
14-24 years	0.745*** (0.035)	0.413*** (0.032)	0.708*** (0.032)	0.676*** (0.034)	0.459*** (0.032)	0.32*** (0.033)	0.356*** (0.041)	0.43*** (0.036)	0.29*** (0.027)	0.105*** (0.019)	0.344*** (0.034)	0.252*** (0.027)
25-29 years	0.81*** (0.033)	0.503*** (0.031)	0.754*** (0.034)	0.77*** (0.028)	0.479*** (0.039)	0.324*** (0.028)	0.346*** (0.034)	0.441*** (0.029)	0.341*** (0.031)	0.187*** (0.030)	0.418*** (0.032)	0.338*** (0.029)
30-39 years	0.858*** (0.020)	0.596*** (0.026)	0.887*** (0.017)	0.837*** (0.019)	0.538*** (0.023)	0.384*** (0.021)	0.452*** (0.027)	0.48*** (0.021)	0.312*** (0.022)	0.203*** (0.023)	0.44*** (0.027)	0.352*** (0.021)
40-49 years	0.843*** (0.025)	0.617*** (0.028)	0.849*** (0.021)	0.835*** (0.021)	0.56*** (0.028)	0.434*** (0.024)	0.459*** (0.026)	0.496*** (0.023)	0.271*** (0.023)	0.178*** (0.022)	0.382*** (0.030)	0.333*** (0.021)
50-59 years	0.833*** (0.028)	0.612*** (0.032)	0.791*** (0.031)	0.834*** (0.024)	0.57*** (0.031)	0.454*** (0.025)	0.525*** (0.030)	0.542*** (0.028)	0.256*** (0.026)	0.152*** (0.024)	0.254*** (0.030)	0.291*** (0.027)
60 years and older	0.817*** (0.039)	0.364*** (0.042)	0.549*** (0.043)	0.579*** (0.042)	0.576*** (0.040)	0.34*** (0.037)	0.427*** (0.038)	0.394*** (0.038)	0.244*** (0.042)	0.008 (0.005)	0.107** (0.036)	0.209*** (0.035)
Primary	0.863*** (0.044)	0.411*** (0.066)	0.768*** (0.052)	0.658*** (0.060)	0.44*** (0.055)	0.283*** (0.058)	0.287*** (0.068)	0.231*** (0.056)	0.432*** (0.049)	0.145** (0.047)	0.481*** (0.061)	0.385*** (0.064)
Secondary	0.798*** (0.018)	0.436*** (0.021)	0.747*** (0.019)	0.787*** (0.018)	0.462*** (0.022)	0.293*** (0.017)	0.368*** (0.023)	0.376*** (0.019)	0.325*** (0.018)	0.141*** (0.013)	0.378*** (0.019)	0.403*** (0.019)
Tertiary (non-univ)	0.835*** (0.029)	0.598*** (0.028)	0.837*** (0.021)	0.81*** (0.021)	0.554*** (0.028)	0.409*** (0.025)	0.435*** (0.023)	0.554*** (0.023)	0.289*** (0.026)	0.183*** (0.023)	0.401*** (0.025)	0.254*** (0.020)
Tertiary (Univ.)	0.829*** (0.022)	0.673*** (0.023)	0.823*** (0.018)	0.768*** (0.019)	0.605*** (0.026)	0.473*** (0.024)	0.489*** (0.025)	0.524*** (0.020)	0.222*** (0.019)	0.188*** (0.024)	0.321*** (0.025)	0.231*** (0.021)
Formal in 2019	0.844*** (0.015)	0.627*** (0.017)	0.834*** (0.013)	0.809*** (0.012)	0.731*** (0.018)	0.546*** (0.018)	0.594*** (0.020)	0.64*** (0.017)	0.111*** (0.013)	0.077*** (0.011)	0.236*** (0.016)	0.165*** (0.013)
Informal in 2019	0.782*** (0.021)	0.404*** (0.021)	0.73*** (0.020)	0.735*** (0.018)	0.213*** (0.024)	0.09*** (0.013)	0.126*** (0.020)	0.151*** (0.017)	0.556*** (0.025)	0.287*** (0.021)	0.583*** (0.026)	0.563*** (0.022)
Not head of household	0.802*** (0.016)	0.514*** (0.017)	0.782*** (0.014)	0.768*** (0.014)	0.506*** (0.017)	0.383*** (0.014)	0.426*** (0.017)	0.456*** (0.015)	0.296*** (0.015)	0.134*** (0.012)	0.358*** (0.016)	0.318*** (0.014)
Head of household	0.848*** (0.022)	0.586*** (0.024)	0.824*** (0.020)	0.811*** (0.018)	0.557*** (0.024)	0.371*** (0.019)	0.433*** (0.021)	0.499*** (0.019)	0.291*** (0.019)	0.215*** (0.023)	0.393*** (0.024)	0.304*** (0.019)
Observations	1,420	1,906	1,898	1,616	1,420	1,906	1,898	1,616	1,420	1,906	1,898	1,616

Note: Pooled data regression. Standard errors in parentheses. Average estimate of the analyzed variables. Significant \*\*\* p<0.001; \*\* p<0.01; \* p<0.05

Formal employment refers to workers affiliated with ESSALUD or private health insurance.

Source: INEI. Own elaboration based on a panel from EPE.

Figure A5b. Metropolitan Lima: Estimated probabilities of being employed for own account workers by quarter, 2020 (Probit models estimates)

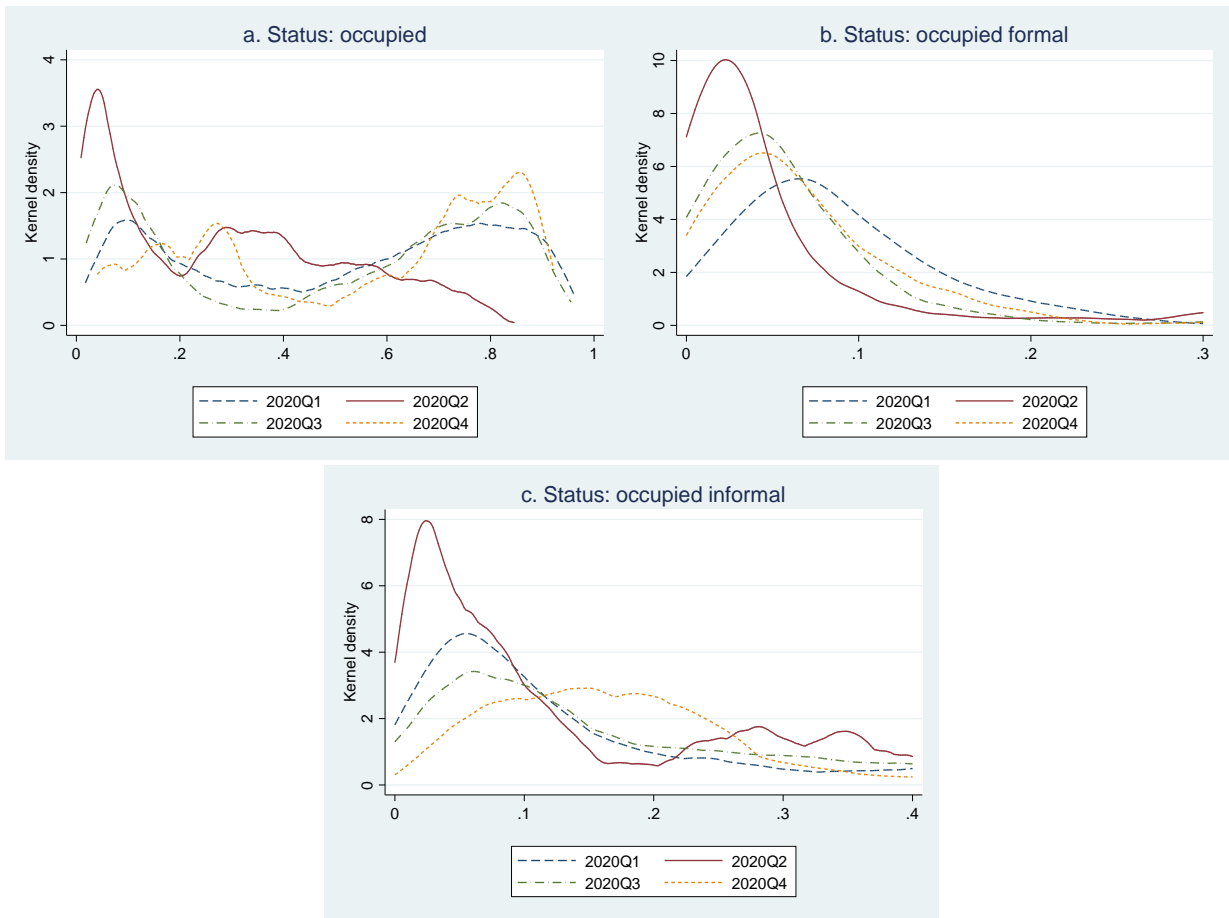
	Status: Occupied				Status: Occupied formal				Status: Occupied informal			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Mean	0.776*** (0.015)	0.337*** (0.018)	0.666*** (0.017)	0.71*** (0.013)	0.183*** (0.011)	0.061*** (0.008)	0.091*** (0.010)	0.122*** (0.009)	0.595*** (0.015)	0.276*** (0.017)	0.574*** (0.016)	0.587*** (0.014)
Male	0.837*** (0.020)	0.381*** (0.027)	0.73*** (0.026)	0.804*** (0.019)	0.177*** (0.016)	0.081*** (0.014)	0.114*** (0.016)	0.129*** (0.014)	0.656*** (0.022)	0.3*** (0.025)	0.615*** (0.025)	0.671*** (0.020)
Female	0.717*** (0.024)	0.29*** (0.022)	0.604*** (0.025)	0.621*** (0.021)	0.187*** (0.016)	0.043*** (0.008)	0.071*** (0.011)	0.117*** (0.012)	0.534*** (0.024)	0.249*** (0.021)	0.532*** (0.023)	0.507*** (0.021)
14-24 years	0.628*** (0.071)	0.207*** (0.062)	0.6*** (0.076)	0.596*** (0.063)	0.08* (0.035)	0.068 (0.036)	0.059 (0.032)	0.106** (0.035)	0.563*** (0.066)	0.159** (0.053)	0.534*** (0.072)	0.505*** (0.059)
25-29 years	0.866*** (0.050)	0.433*** (0.071)	0.729*** (0.065)	0.853*** (0.046)	0.17*** (0.047)	0.066 (0.043)	0.063* (0.027)	0.196*** (0.052)	0.694*** (0.057)	0.356*** (0.061)	0.672*** (0.064)	0.67*** (0.061)
30-39 years	0.78*** (0.031)	0.335*** (0.041)	0.81*** (0.034)	0.779*** (0.029)	0.178*** (0.027)	0.06*** (0.018)	0.098*** (0.021)	0.118*** (0.021)	0.603*** (0.033)	0.274*** (0.040)	0.71*** (0.035)	0.658*** (0.032)
40-49 years	0.791*** (0.032)	0.409*** (0.033)	0.775*** (0.028)	0.761*** (0.029)	0.173*** (0.024)	0.081*** (0.016)	0.103*** (0.021)	0.121*** (0.017)	0.619*** (0.032)	0.331*** (0.032)	0.668*** (0.030)	0.634*** (0.030)
50-59 years	0.804*** (0.030)	0.407*** (0.036)	0.566*** (0.037)	0.763*** (0.029)	0.19*** (0.024)	0.061*** (0.016)	0.105*** (0.022)	0.125*** (0.019)	0.608*** (0.032)	0.344*** (0.033)	0.457*** (0.037)	0.633*** (0.030)
60 years and older	0.746*** (0.034)	0.18*** (0.028)	0.472*** (0.043)	0.528*** (0.035)	0.227*** (0.025)	0.041*** (0.010)	0.078*** (0.017)	0.11*** (0.019)	0.513*** (0.037)	0.139*** (0.026)	0.389*** (0.044)	0.416*** (0.031)
Primary	0.71*** (0.040)	0.35*** (0.045)	0.62*** (0.044)	0.75*** (0.033)	0.136*** (0.025)	0.052* (0.022)	0.04* (0.015)	0.066*** (0.018)	0.577*** (0.039)	0.299*** (0.042)	0.565*** (0.044)	0.681*** (0.032)
Secondary	0.789*** (0.020)	0.304*** (0.022)	0.673*** (0.023)	0.708*** (0.017)	0.156*** (0.013)	0.042*** (0.008)	0.067*** (0.011)	0.098*** (0.011)	0.627*** (0.020)	0.261*** (0.020)	0.602*** (0.023)	0.606*** (0.019)
Tertiary (non-univ)	0.772*** (0.037)	0.34*** (0.045)	0.673*** (0.040)	0.699*** (0.033)	0.246*** (0.035)	0.081*** (0.021)	0.131*** (0.032)	0.122*** (0.021)	0.523*** (0.041)	0.257*** (0.041)	0.531*** (0.040)	0.576*** (0.033)
Tertiary (Univ.)	0.829*** (0.036)	0.469*** (0.052)	0.675*** (0.050)	0.682*** (0.040)	0.273*** (0.040)	0.118*** (0.028)	0.138*** (0.027)	0.251*** (0.037)	0.553*** (0.051)	0.34*** (0.057)	0.519*** (0.052)	0.407*** (0.044)
Formal in 2019	0.715*** (0.038)	0.327*** (0.041)	0.596*** (0.048)	0.66*** (0.032)	0.501*** (0.040)	0.227*** (0.046)	0.283*** (0.044)	0.39*** (0.037)	0.191*** (0.028)	0.105*** (0.025)	0.274*** (0.042)	0.249*** (0.036)
Informal in 2019	0.792*** (0.016)	0.339*** (0.020)	0.681*** (0.018)	0.723*** (0.016)	0.093*** (0.012)	0.021*** (0.004)	0.05*** (0.009)	0.054*** (0.008)	0.698*** (0.019)	0.318*** (0.020)	0.627*** (0.019)	0.665*** (0.016)
Not head of household	0.79*** (0.020)	0.328*** (0.026)	0.629*** (0.027)	0.695*** (0.021)	0.175*** (0.016)	0.059*** (0.011)	0.087*** (0.012)	0.116*** (0.012)	0.616*** (0.021)	0.269*** (0.025)	0.543*** (0.025)	0.578*** (0.021)
Head of household	0.761*** (0.023)	0.346*** (0.024)	0.708*** (0.024)	0.725*** (0.022)	0.191*** (0.016)	0.063*** (0.011)	0.096*** (0.015)	0.13*** (0.014)	0.572*** (0.023)	0.283*** (0.022)	0.607*** (0.024)	0.596*** (0.022)
Observations	959	1,247	1,163	1,018	959	1,247	1,163	1,018	959	1,247	1,163	1,018

Note: Pooled data regression. Standard errors in parentheses. Average estimate of the analyzed variables. Significant \*\*\* p<0.001; \*\* p<0.01; \* p<0.05

Formal employment refers to workers affiliated with ESSALUD or private health insurance.

Source: Own elaboration based on a panel from EPE.

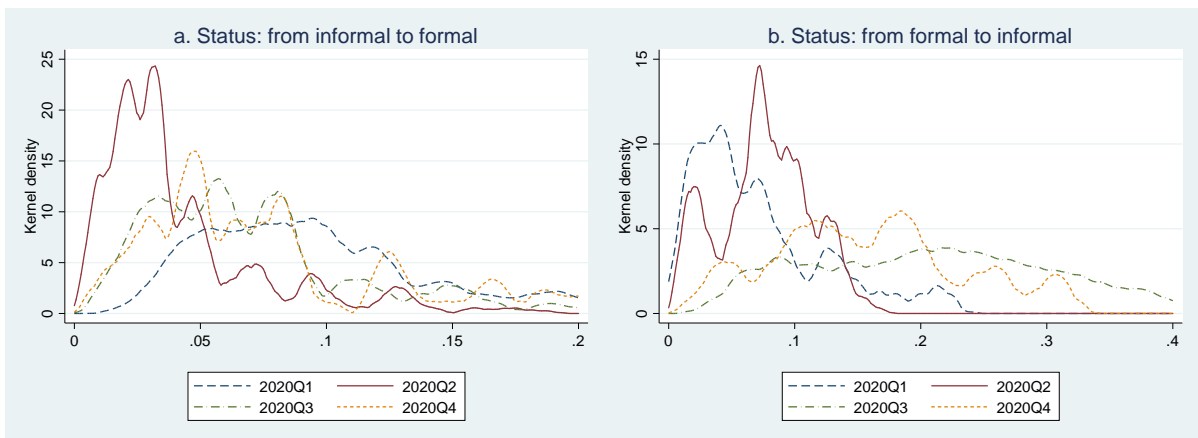
**Figure A6a. Probability distribution functions of occupation status by quarter, 2020**



Note: Pooled data regression. Average estimate of the analyzed variables. Formal refers to workers affiliated with ESSALUD or private health insurance.

Source: INEI. Own elaboration based on a panel from EPE.

**Figure A6b. Metropolitan Lima: Change in the probability distribution functions of occupation status (formal or informal) by quarter, 2020**



Note: Pooled data regression. Average estimate of the analyzed variables. Formal refers to workers affiliated with ESSALUD or private health insurance.

Source: INEI. Own elaboration based on a panel from EPE.