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## Article

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## Labor market transitions in Bolivia during the Covid-19 pandemic

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### ABSTRACT

In a descriptive way, this paper analyzes the transitions in the Bolivian labor market during the Covid-19 pandemic to comprehend the patterns and trends of worker transitions across states related to employment, unemployment, temporarily inactive, permanently inactive; also for employed people like salaried, self-employed, unpaid family worker, other and finally for different economic activities. The information used corresponds to the Continuous Employment Survey reported by the National Institute of Statistics of Bolivia which has the virtue of following the same individuals in more than two periods. Labor transition probabilities according to the Markov chain process between the first and third quarter for 2019 and 2020 were obtained and allowed to observe important changes in the Bolivian labor market during the Covid-19 pandemic. Particularly, unemployed persons were in a more vulnerable situation than those who were inactive; however, due to the measures implemented during the peak of the pandemic the probability to flow to inactivity was higher. On the other hand, at first the emergency reduces the possibility for self-employed people to remain in this category; nevertheless, in the following period the self-employed status was an advantageous one.

### Introduction

The Covid-19 pandemic and the sanitary emergency decreed worldwide to contain the contagion of a disease completely unknown to the world until then, represented a highly disruptive impact on the economic performance of all over the world. This was the result of rigid quarantines, mobility restrictions and the strict sanitary measures employed by individuals and companies.

In Bolivia, the Covid-19 pandemic has severely impacted the level of employment, as seriously restrictions were imposed to contain the spread of the virus. In the third quarter of 2020 the unemployment rate reached 10.8%, the highest in the last ten years, while the underemployment rate reached 16.5%. On the other hand, the Economically Inactive Population in the second quarter of 2020 reached 2 million 290 thousand people, 25.4% more than those registered in the second quarter of 2019.

Considering this scenario and employing the Continuous Employment Survey (ECE) published by the National Institute of Statistics of Bolivia (INE by its Spanish acronym), labor transition probabilities according to the Markov chain process between the first and third quarter of 2020 and 2019 were obtained. The mobility evaluated in this paper considers the transition across the statuses of employed, unemployed, temporarily inactive, permanently inactive; also for employed people like salaried, self-employed, unpaid

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family worker, other and finally the transitions for different economic activities.

The main results showed that the probability of being unemployed was higher in 2020 with respect to 2019, an aspect that evidences an important destruction of employment sources principally during the period in which the restrictions imposed in Bolivia in the face of the Covid-19 health crisis were more severe. It was also seen that, unemployed people were in a more vulnerable situation than people who were inactive; however, due to the measures implemented during the peak of the pandemic the probability to flow to inactivity was higher.

In addition, the option for workers to get a salaried job was considerably reduced and particularly for the unemployed. Variations in the probabilities of moving to salaried status from the different work categories were negative for the two study periods. The most pronounced declines were for the option to remain as salaried, showing a loss of salaried jobs that are generally in the formal sector of the economy. On the other hand, confinement affected during the first period the option of workers to remain self-employed; nevertheless, in the following period the self-employed category attracted the unemployed and the inactive, becoming a category of attraction to generate employment, unlike to what was found in documents of [Bouvier et al. \(2022\)](#), [Álvarez, Brassiolo and Toledo \(2021\)](#), [Álvarez, Brassiolo and Toledo \(2021\)](#).

This paper is structured as follows. Section 2 presents stylized facts considering the measures against Covid-19 implemented in Bolivia and a description of employment indicators for the country. Section 3 reviews the literature about transition probabilities and mainly that related with the evaluation of Covid-19 effect over employment. Section IV presents the information and methodology use for this analysis and the results. Finally, Section 5 shows the conclusions.

## Stylized facts

### *Measures against Covid-19 in Bolivia*

As in other countries, in Bolivia the Covid-19 pandemic has severely impacted the employment level since seriously restrictions were imposed in the country to contain the spread of the virus. As part of the monitoring carried out by the Bolivian Ministry of Health and Sports, the first cases of Covid-19 were confirmed in the country in March 2020. On March 17, 2020, through Supreme Decree (SD) N° 4196, a national health emergency and quarantine was declared throughout the territory of the Plurinational State of Bolivia against the outbreak of Coronavirus. According to this SD all country inhabitants should remain at home from 5:00 p.m. until 5:00 a.m., except for health and security activities; also social, cultural and sports activities were prohibited, and borders throughout the national territory were closed.

Four days later, on March 21, 2020, through SD N° 4199, a total quarantine was declared. This measure continued up to early May 2020 with the suspension of public and private activities and mobility restrictions through which only one member of the family was allowed to circulate in order to keep supply of products; the circulation of public and private motorized vehicles was also prohibited without authorization, while it was determined that the activities dedicated to the supply of products to the population would develop their activities without interruption.

As of May, conditional and dynamic quarantine was introduced, which meant that some municipalities and/or departments of Bolivia would have a less rigid quarantine and begin to work under strict security measures. The Ministry of Health and Sports was in charge of monitoring the evolution of the pandemic to determine the type of risk (high, medium or moderate). Under this new determination, and regardless of the level of risk, the activity of the industrial and agricultural sector continued. Also, a schedule for home delivery of food was determined, and mining, commerce services, and construction activities were incorporated.

The conditional and dynamic quarantine remain until August 2020 and during this period the mitigation tasks of the contingency plans against Covid-19 also began. In this context, since June and following the SD N° 4245, economic activities such as industry, manufacturing, agriculture, mining and construction continued. On the other hand, air borders continued to be closed, and public events remained suspended, as did the ban on the movement of people and vehicles at established times.

Bolivia entered to a post-confinement and community surveillance phase as of September 1. This new phase was characterized by the active search for cases by the municipal governments in each region. Also, air borders were opened, the movement of vehicles and people was permitted, and economic activities of commerce and services were allowed to operate following strict biosafety protocols and only from Monday to Friday. However, public events and festive activities, among others, remained suspended. The description previously made complements the regulations cited in [Delaporte et al. \(2021\)](#) for the Bolivian case.

Besides the disruptive scenario of the pandemic, it is important to highlight that a complex political scenario in Bolivia was faced which meant greater pressure on the performance of the labor market. During the early months of the pandemic, Bolivians had deal with the implementation of improvised policies that did not allow people to mitigate the impact of the pandemic, this setback led to a lack of public resources and biosafety implements. After almost a year of restrictions and a highly tense political scenario characterized by the resignation of three health ministers and corruption cases that harmed the health of Bolivians, on October 18, 2020 presidential elections were held to determine the new president and vice-president of the Plurinational State of Bolivia. The new president started with a more stable scheme to fight back the pandemic, which left aside restrictions and confinement and focused on the distribution of free Covid-19 tests that allowed a quick detection of this disease, and prioritized the arrival of internationally approved Covid-19 vaccines to the country.

### *Impact of Covid-19 on the Bolivian labor market*

The report of the International Labor Organization (ILO), ([International Labour Organization 2021](#)), showed that over the course of

2020 there was a decrease in employment on a global scale of about 114 million jobs compared to 2019. This decrease resulted in a greater increase in the number of people leaving the labor force than in the number of people unemployed. In the case of Latin America and the Caribbean, job losses were estimated to reach 26 million as a result of the pandemic.

In Bolivia, the strict regulations caused considerable damage to economic activity and to the performance of the Bolivian labor market, as they severely limited production and consumption, with a very slow recovery outlook. The production of local and foreign firms was considerably affected, as sales fell sharply and the confinement made it impossible for them to carry out their operations normally. To cope with this situation, companies began making payroll adjustments by either reducing salaries or ultimately by laying off staff. Bolivia's National Chamber of Industries reported that close to 317 industrial companies had closed in 2020 in the country.

To have a clear frame of reference, the following definitions for employment will be considered in this paper and specially to evaluate the transition matrixes. According to the National Institute of Statistics of Bolivia (INE by its Spanish acronym) an unemployed person is any person who, for a given reference period, simultaneously does not have a job, is available to work and is carrying out specific steps to achieve a job. A proportion of the unemployed corresponds to: i) Unemployed with experience that is people who worked before and lost their job due to occupational mobility and ii) Unemployed without experience that is people who is looking for work for the first time.

Also, when disaggregating the Economically Inactive Population is possible to consider two sub-groups, the first one refers to people who are temporarily inactive that means people who did not carry out any economic activity and did not look for work in a certain period of time, but who worked previously; the second one refers to people who are permanently inactive, that means people who do not carry out any economic activity, did not look for work in a certain period of time and did not work previously. Finally, self-employed people are the ones who had their own company or business, without having any paid worker under their responsibility or depending on an employer; sells and/or produces goods or services with the help of family workers or apprentices or without their help.

Thus, based on the Continuous Employment Survey (ECE by its Spanish acronym)<sup>1</sup> of the INE, it was possible to see that the employed population decreased particularly during the second and third quarter of 2020, compared to what was noticed during the first quarter of 2020. Also, temporarily inactive population increased considerably in the second quarter of 2020. In this context, the employment indicators showed that the unemployment rate reached 10.8%, the highest in the last ten years, while the underemployment rate<sup>2</sup> reached 16.5% (Table 1).

The INE, through its August 2020 statistical report (National Institute of Statistics 2020), showed that in the second quarter of 2020 the Economically Active Population in the urban area decrease by of 8.18% compared to similar period of 2019. This descent was explained by the significant increase of unemployed people between the mentioned quarters of 2020 and 2019. The Economically Inactive Population, for its part, increased in 25.4% for the second quarter of 2020 compared with the second quarter of 2019.

Monthly data showed that the highest unemployment rate was reached in July 2020 (11.6%), and that the employed population decreased in 516,747 people between February (month of higher normality) and July 2020. According to the study conducted by the United Nations Development Program for Bolivia, (UNDP Latin America and the Caribbean 2020) as of July 2020, the population affected due to the measures aimed at fighting the pandemic were 698 thousand people, of which 60% were circumstantially inactive and 40% unemployed.

On the other hand, the ECE also allows to evaluate employed people according to the category in which they work, considering the following five categories: employee/worker, self-employed, employee or partner with no salary, auxiliary family member or apprentice without remuneration, and other. The data showed a noteworthy drop in the employee/worker category between the fourth quarter of 2020 and 2019. It was also noticed that, the lowest value of the employee/worker category is the one registered in the fourth quarter of 2020, which reveals the effect of the sanitary emergency. In contrast, the number self-employed people showed an increase in 2020 and in 2021 (Table 2).

Although not officially determined by the INE, the self-employed category can be an approach to the informal sector in line with the document of Canelas and Niño-Zarazua (2022), who consider the share of self-employment in total employment as a measure of informal employment. In this context, previous result could preliminarily evidence that this category might have attracted people in the employee/worker category or people who were inactive.

According to economic activity, in 2020 and compared to a previous year, the most important decrease was observed in the number of employed people in the activity of restaurants and hotels, commerce and manufacturing industry. In the first case, the number of employed people decreased on average by 39,626 persons; in the commerce activity the drop in the number of employed people was of 33,350 persons on average, and finally, in the manufacturing industry sector, the number of employed people decreased by 19,110.

In contrast, the agricultural sector showed a rise in the number of employed people which increased by 11,196 persons (Fig. 1), in line with the policy of priority supply to households during the pandemic period in Bolivia.

The statistics presented above constitute preliminary evidence of the impact of the Covid-19 pandemic in Bolivia, from which it can be deduced that, like what was observed in other countries of the world, the main variables of the labor market experienced a drastic deterioration. In effect, unemployment rose considerably as well as underemployment; likewise, the number of temporarily inactive persons also increased, and to a greater extent than the unemployed. Also, it seems that during the emergency period the self-employed

<sup>1</sup> The ECE is a Survey of recent implementation in Bolivia, which has quarterly and monthly information of the Bolivian labor market since the fourth quarter of 2015.

<sup>2</sup> In this paper the underemployment rate is defined as the ratio of people who work less than a threshold of hours per week (40 hours), they wish to work and are available to work, with respect to the total employed population. This definition corresponds to the

**Table 1**  
Bolivia – urban employment indicators.

(Population and rate) Indicator	2019Q4	2020Q1	2020Q2	2020Q3
<b>Economically Active Population (in millions)</b>	3,96	4,01	3,56	3,78
Employed (in millions)	3,77	3,78	3,26	3,38
Unemployed (in millions)	0,19	0,23	0,30	0,41
<b>Economically Inactive Population (in millions)</b>	1,82	1,80	2,29	2,10
Temporary Inactive (in millions)	1,46	1,42	1,90	1,80
Permanent Inactive (in millions)	0,36	0,38	0,39	0,31
<b>Unemployment rate (%)</b>	4,8	5,8	8,4	10,8
<b>Underemployment rate (%)</b>	5,1	5,0	12,0	16,5

Source: National Institute of Statistics - Continuous Employment Survey.

**Table 2**  
Bolivia - Urban employed people according to employment category.

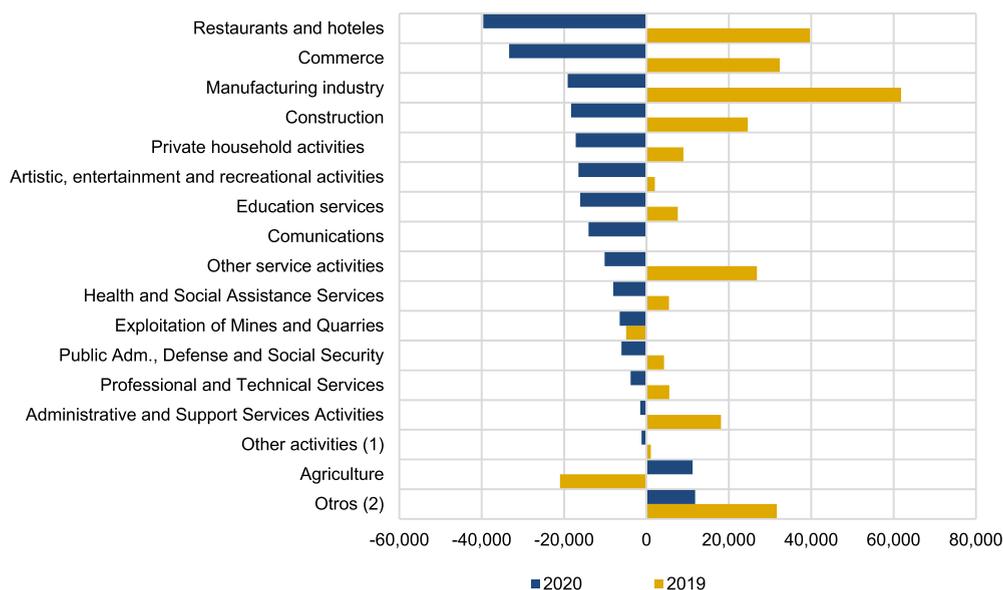
(In millions of people) Employment Category	2018Q4	2019Q4	2020Q4	2021Q4
Employee/Worker(1)	1,47	1,50	1,36	1,58
Self-employed	1,44	1,61	1,71	1,86
Employee or partner with no salary	0,20	0,17	0,14	0,19
Auxiliary Family Member or Apprentice without remuneration	0,37	0,39	0,45	0,59
Other	0,09	0,10	0,09	0,11
Total	3,57	3,77	3,76	4,32

Source: National Institute of Statistics - Continuous Employment Survey.

Note: 14 years old population or older.

1/ Includes Paid Auxiliary Family Member or Apprentice. To obtain the transition probabilities, the category is renamed to salaried.

2/ Includes mining cooperative worker and domestic worker.



**Fig. 1.** Bolivia - Urban average difference in the number of employees by economic activity (In number of people).

Note: The data for each year is the quarterly average of employed persons, and from which the difference between 2019/2018 and 2020/2019 was calculated.

Source: National Institute of Statistics - Continuous Employment Survey.

tend to attract to employed or unemployed people.

One way to deepen the descriptive analysis of the Bolivian labor market and determined the reaction of employment variables to the measures imposed due to the coronavirus pandemic, is through the matrices of transition on the labour market. Labor market transitions play an important role in current policy debates about the future of work, as pointed out in the study by [Samaniego and Viegelaahn \(2021\)](#) which evaluates for Vietnam the transitions between employment, unemployment and inactivity, between formality

and informality, between economic sectors, as well as between occupations. Similarly, (Causa et al., 2021) established that workers' transitions between jobs, and in and out of employment, are important to obtain for growth and inclusion.

Thus, the objective of this paper is to provide a descriptive analysis of the transitions in the Bolivian labor market during the most severe period of Covid19 pandemic and the de-confinement phase, to comprehend the patterns and trends of worker transitions across different employment states, by calculating transition probabilities according to the Markov chain process. The mobility evaluated in this paper considers the transition through the states related to employment, unemployment, temporarily inactive and permanently inactive. Also the movement according to the five employment categories mentioned before (employee/worker, self-employed, employee or partner with no salary, auxiliary family member or apprentice without remuneration, and other), and finally the transitions between different economic activities.

## Literature review

Labor market analysis can employ traditional statistical tools, which allow us to observe a *stock* of workers who are in different states in the labor market for a given period; however, it neglects a broader analysis of where workers will go in the next period or what initial state they come from. The latter aspect involves looking at the movements in the labor market that workers experience between different states, which allows us to see to what extent jobs have been created or destroyed between given periods or how workers moved from one state to another in response to a given event.

Understanding labor market transitions is important for gauging the extent of labor market reallocation and the negative effects of the COVID-19 crisis. (Causa et al., 2021). In Bolivia, the analysis of labor market transitions during the period of the Covi-19 pandemic has not been conducted to date, this being the first formal work for the country that evaluates the flow or transition of people between employment and unemployment, according to activity status or according to economic activity.

One of the limitations to carry out further studies on transitions was the databases available in the country, since as (Canavir-e-Bacarreza et al., 2017) point out, a limitation of labor market analysis in developing countries is the lack of adequate panel data information, in addition to the fact that household surveys are cross-sectional and do not follow individuals over time. The authors use the Quarterly Employment Survey 2010 - 2011, to overcome the aforementioned problems and construct pseudo panels for the case of Bolivia and Colombia. Among their results they show that in Bolivia and Colombia mobility between labor sectors is relatively low, which would explain a low variability of the informality rate in those countries. They also find that the number of people who move to the informal sector tends to be higher than those who escape from the informal to the formal market.

On the other hand (Andersen and Christensen 2006) use the MECOVI 2001 and 2002 survey to estimate the structural parameters of a simple extended job separation model for Bolivia, finding that skilled labor is scarce and unskilled labor is abundant. This implies that skilled employees seek alternative employment opportunities and quit their jobs when a better opportunity arises, thus the quit rate among skilled employees in the private sector is high.

Also, (Hernani-Limarino et al., 2011) analyzed the effect of temporary employment programs on employability by conducting an impact evaluation of the National Emergency Employment Plan (PLANE) implemented in Bolivia in 2001. Also using the MECOVI 2002 and the Survey of Income and Expenditures 2003 - 2004, they found that although public employment programs could be useful, social protection policies in times of recession are not good alternatives to improve the employability of the vulnerable population. Among their results they also mention that, in Bolivia, labor market regulations and labor market programs do not help to increase the size of the formal market, apparently because of rigid labor markets and labor policies based mainly on temporary employment programs.

Likewise, (Jiménez Zamora and Jiménez Pozo 2003) evaluate the degree of flexibility of the urban labor market and the role of the informal/traditional sector in Bolivia by analyzing occupational mobility and the determinants of transitions into and out of unemployment and/or inactivity. This analysis uses the 1994 Integrated Household Survey, and among its main conclusions is that there is an absence of occupational mobility from the informal to the formal sector and that the informal sector does not play the role of a transitory sector between unemployment and formality.

According to the literature, labor transition can be analyzed on a discrete or continuous basis. Due to the limitation of information characterized by the lack of observations on continuous labor market histories and the intervals between surveys, several studies such as (Royalty 1998) (Maloney, 1999) (Duryea et al., 2006) (Bosch and Maloney 2007) (Sabine and Stampini 2009) (Pages and Stampini 2009) (Samaniego and Viegelahn 2021) used a discrete time structure. The present work is framed within the methodology used by the aforementioned authors, and as in the case of (Bosch and Maloney 2007) evaluates mobility between different labor statuses through a process in which state changes occur at random time points, and the probabilities of movements between particular states are governed by Markov transition matrices. The cited authors estimated continuous time matrices using discrete panel data from employment and household surveys for Argentina, Brazil and Mexico and found transition patterns that suggest that a substantial part of the informal sector, particularly the selfemployed, have a voluntary entry into informality.

Additionally, (Bernabè and Stampini 2008) employed quarterly discrete data from a rotating panel of individuals and households from the Labor Force and Household Survey for Georgia, the authors were able to examine temporal transitions; female workers leaving and returning to their jobs being observed in the same state at the beginning and end of the period.

Regarding the analysis of the informal labor market (Bosch and Maloney, 2010) used panel data for Argentina, Brazil and Mexico to examine mobility between markets, characterizing individuals who chose the informal sector as their best option. The results suggest that a substantial part of the informal sector, particularly the self-employed, show a voluntary entry into the sector. Their findings show that individuals move from the informal and formal sectors to selfemployment; this third option behaves similarly to a "labor pool," where the other two-segment markets can bring their employees.

Markov transition matrices are used to analyze mobility patterns, where transition probabilities are calculated as a function of the previous state. A simple way to analyze turnover rates is to consider the instantaneous probabilities of moving from one sector or state to another. For example, an unemployed individual may be more likely to enter the informal sector, not because he or she prefers this sector but because there are more vacancies in this sector.

Although there are several studies that evaluated job transitions for different employment statuses or labor market situations in different countries by calculating probabilities in Markov transition matrices, few studies were recently identified that address the case of job transitions during the period of the Covid19 pandemic. One such paper is that of (Álvarez, Brasiolo and Toledo 2021) who calculate worker transitions between occupational statuses in the case of Chile and Peru. For Chile, high rates of transition to unemployment or inactivity are observed in the July-September quarter of 2020 with respect to what was observed in 2019. The flip side of this phenomenon was a drop in transition rates to both formal and informal employment. This decline has been more pronounced in the transition rate to informality from all states except unemployment. This has implied a decline in the informality rate in Chile since the beginning of the crisis. In Peru, higher transition rates to unemployment and inactivity were also observed as a consequence of the crisis; on the other hand, although transition rates to employment -formal and informal- fell, the transition rate to formality fell relatively more for all workers except the unemployed, in contrast to what was observed in Chile.

On the other hand, (Bouvier et al., 2022) for the case of Brazil calculated transition matrices to obtain individual transitions between different labor market states and thus measure the extent of pandemic disruption. They also show descriptive statistics to profile individuals in each transition category and monitor their evolution. Finally, they perform multinomial logistic regression to identify individual characteristics associated with transitions. The results show that the idea that in times of difficulty informality is the rule is not valid for Brazil, i.e., in many cases the role of the informal economy as an adjustment variable is often emphasized, particularly in times of crisis. The results show that adjustment to a negative shock also implies an exclusion mechanism: a significant part of the population leaves the labor market.

### Information, methodology and results

The calculation of transition probabilities using the Markov chain process was performed from the Continuous Employment Survey (ECE), to analyze transitions in two panels between the first and third quarters of 2019 and 2020. Following the document of (Bosch and Maloney 2007) y (Bernabè and Stampini 2008) the transition probabilities are calculated assuming a discrete-time mobility process that is generated by a homogeneous Markov process  $X_t$  defined on a discrete state space  $E = \{1, \dots, K\}$  where  $K$  is the number of possible states (work sectors) in which a worker could find himself/herself. With that information, a discrete-time transition matrix can be constructed  $P(t, t + n)$  where:

$$p_{ij}(t, t + n) = Pr(X(t + n) = j | X(t) = i); \text{ para } t = 0, 1, 2, \dots, \text{ y } n = 0, 1, 2, \dots,$$

From the above equation,  $p_{ij}$  is the probability of moving from state  $i$  to state  $j$  in one step ( $n$ ). Discrete time matrices are made up of maximum likelihood estimators for  $p_{ij}$  which takes the following form,  $p_{ij} = n_{ij}/n_i$  where  $n_{ij}$  the total number of transitions from state  $i$  to state  $j$  and  $n_i$  the total number of initial observations in state  $i$ .

The population under study considered people between 14 and 64 years old, for whom transition probabilities were calculated between two quarters. That means that, for 2019 the transition probabilities between the first and the second quarter were obtained (Q1/Q2), as well as the transition between the second and the third quarter (Q2/Q3). The same calculation was performed for 2020 for the same quarters. This transition probabilities were calculated according to different statuses that were mentioned in Section 2.2. Finally, from these probabilities, the variations for the periods indicated were abstracted to evaluate how the transitions evolved between 2019 and 2020.

It is important to note that, the ECE is a survey that provides monthly and quarterly statistical information on Bolivian labor market variables and is only available as of the fourth quarter of 2015. Additionally, and unlike previously elaborated surveys, one of the important characteristics of the ECE is that it follows the same people over time.

According to the methodological design of the ECE published by INE, this survey establishes the visit to households during four consecutive quarters and then leaves the sample permanently. In each quarter, four rotation panels are formed and the overlap of the samples between two consecutive quarters, that is, the sample in common, corresponds to 75%, which favors the measurement of existing changes from one quarter to another; on the other hand, 25% is renewed. It is important to emphasize that the overlap decreases its precision for an aggregation of several periods.

In this context, a panel data was constructed by appending two separated datasets, one for each quarter, and in this panel people in both quarters were identify. That means that, dataset for the first quarter of 2019 (2020) was appended with the dataset of the second quarter of 2019 (2020) and people in both quarters were selected.<sup>3</sup> After appending both datasets, the participation patten showed that the largest fraction of people was observed in both quarters.

### Results

Quarterly transition probability matrices were obtained to observe the movement between employment and unemployment in

<sup>3</sup> In the same way, dataset for the second quarter of 2019 (2020) was appended with the dataset of the third quarter of 2019 (2020) and people in both quarters were selected.

Bolivia during the most restrictive period of the Covid-19 pandemic and the de-confinement phase. The results showed that, given that a person was employed the previous quarter, the probabilities of being unemployed in the second quarter (21.4%) and third quarter (15.5%) of 2020, were higher than those seen in 2019.

In the first period (Q1/Q2), the probability of being unemployed was higher in 2020 by about 10pp with respect to 2019, an aspect that evidences an important destruction of employment sources in this period in which the restrictions imposed in Bolivia in the face of the Covid-19 health crisis were more severe. For the second period (Q2/Q3), and despite the fact that severe restrictions were relaxed and the performance of some economic activities were made possible, the increase in the probability of unemployment conditional on being employed in a previous quarter of 2020 was maintained, but with less intensity than initially observed. Finally, it can be seen that by the end of 2020 the probability of being unemployed with respect to the probability of 2019 is significantly reduced due to the greater normality of activities in the country and a more stable political environment (Fig. 2, transition matrix in Appendix).

The probabilities for the periods (Q1/Q2) and (Q2/Q3) in 2019 and 2020 were also obtained considering the activity status of the individuals, i.e., whether they are in the employed, unemployed, temporarily inactive and permanently inactive statuses. From the previous mentioned results, variations between the transition probabilities of 2020 respect to the probabilities in 2019 were obtained. The variations allow to observe the effect that the restrictions during the pandemic in Bolivia had on the movement of people in Bolivia's labor market.

Thus, Fig. 3 shows the flow to employed status where all variations of probabilities are negative for the first period of analysis. Particularly, it is possible to see that the probability of remaining employed in the second quarter was lower by 9.8pp in 2020 compared to 2019. It is also noteworthy, the largely negative variation registered in the case of unemployed with experience and temporarily inactive in 2020 compared to 2019. These variations showed a decrease of 20.3pp. and 10.1pp., respectively (matrix in Appendix 1).

From Fig. 3 it is important to see that people in the Bolivian labor market who wanted to become employed given they were unemployed with work experience experienced broader negative impact in the Q1/Q2 period. This result surpasses the negative variation obtained for the temporarily inactive people and could be associated with the fact that, at the time the pandemic in the country, unemployed people were in a more vulnerable situation than that faced by the temporary inactive.

For the second period (Q2/Q3), i.e. for the transitions from the second to the third quarter observed in 2019 and 2020, the probability of remaining employed in 2020 continues to show an adverse scenario respect to what was observed in 2019. However, a slight recovery begins to be seen in the case of those initially in the unemployed with experience and temporarily inactive status, as in both cases the probability of being employed in the following period increases by 5.4pp. and 0.1pp., respectively. It should be noted that, although the probability of employment increases for those in the unemployed with experience condition, it does not reach the magnitude of the drop experienced during the first period (matrix in Appendix 2).

On the other hand, Fig. 4 shows the flow to temporarily inactive status from the conditions of employed, unemployed with experience and permanently inactive for the first and second transition periods of 2020 and 2019 (matrix in Appendix 2). The main results for the first period (Q1/Q2) focuses on the fact that related to 2019, the employed in 2020 increased their transition probability to become temporarily inactive by 7.2pp. Also, the temporarily inactive persons increased their likelihood of remaining in this same state by 11.0pp.; and experienced employees also tended to transition into temporary work inactivity by 11.2pp. These results would show that the measures implemented during the peak of the pandemic led people to inactivity in the labor market, rather than to a state of unemployment (matrix in Appendix 2).

In the second period of analysis (Q2/Q3), it is possible to observe that the variations are mostly negative except for the case of employed. This result implies that the probabilities that an experienced unemployed person or a temporarily inactive person will be in the next period in the temporarily inactive status decreased. The employed still showed an increase in the probability of being temporarily inactive (0.8pp.), although this is considerably lower than that observed in period one (Q1/Q2) (matrix in Appendix 2).

The same variations in the transition probabilities between 2019 and 2020 were also obtained for periods one (Q1/Q2) and two (Q2/Q3), considering the disaggregation of the employed population according to employment category. The categories for employed people were salaried, self-employed, unpaid family worker and other, also the unemployed and the inactive categories were included.

Fig. 5 shows that the variations in the probabilities of moving to salaried status from the different work categories (self-employed, unpaid family worker and other) were negative for the two study periods. The most pronounced declines are for the option to remain as salaried, showing a loss of salaried jobs that are generally in the formal sector of the economy, and for the movement from unemployment to the salaried category. In this context, it can be argued that during the first half of 2020 the option for workers to get a salaried job was considerably reduced and that particularly the unemployed saw a deeper reduction in their possibilities. This aspect is also evident in the study by (Escobar and Hurtado 2021) which points out that those most affected during the Covid-19 crisis were salaried workers who were laid off or had their contracts terminated and were unable to find a new occupation.

Finally, from Fig. 5 it can also be seen that unemployed had experienced a great reduction on its probability of becoming a salaried during period one. For inactive people, the reduction in the probability of becoming a salaried was also noteworthy. This results also confirms the fact that during the first period of the pandemic, the unemployed were the most vulnerable.

Additionally, the variations of the transition probabilities for the flow to the self-employed status from the categories, salaried, unpaid family worker, other, unemployed, and inactive (Fig. 6), were evaluated. The movements of the unemployed and inactive to self-employed status were observed to evaluate whether the unemployed have any tendency to place themselves in any of these categories the following period.

The category of self-employed is important for this study because it may reflect or include those workers who are in the informal sector of the Bolivian labor market. Informality in Bolivia amounts to more than 60% of the Economically Active Population, according to estimates by (Evia and Pacheco, 2010) and according to (Hernani-Limarino et al., 2011) in Bolivia most jobs are generated by the

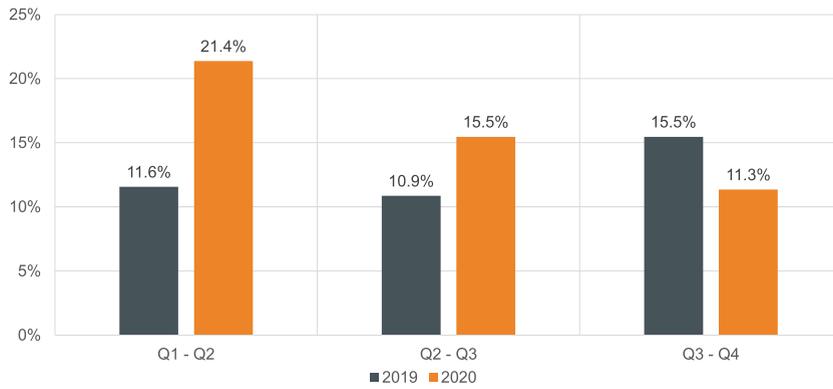


Fig. 2. Employed to Unemployed transition probabilities.

Source: Continuous Employment Survey.

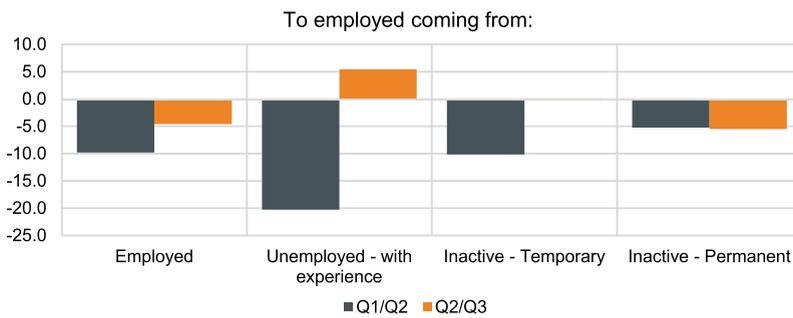


Fig. 3. Transition probability variations for period Q1/Q2 (2020 - 2019) and Q2/Q3 (2020-2019) - Flow toward employed. (Percentual points).

Source: Continuous Employment Survey.

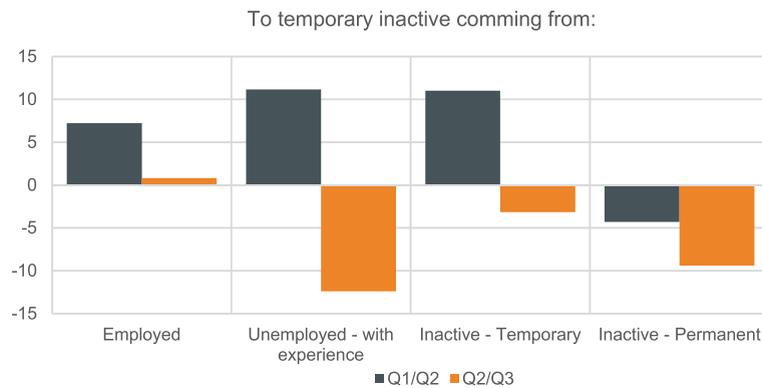


Fig. 4. Transition probability variations for period Q1/Q2 (2020 - 2019) and Q2/Q3 (2020-2019) - Flow toward "Temporary inactive". (Percentual points)

Source: Continuous Employment Survey.

informal sector, and in urban areas the informal sector represents 80% of total employment. For its part, the report by (Azuara et al., 2021) of the Inter-American Development Bank, in 2020, points out that because of the confinements, informal employment decreased more than formal employment, in relation to other crises experienced in the region, so that two out of every three jobs lost were informal.

The first result obtained shows that salaried workers in period one (Q1/Q2) had a lower probability of becoming self-employed; however, in the following period (Q2/Q3) this behavior is reversed and the probability of transitioning to self-employed increases by 0.2pp. Regarding this last category, it was observed that the probability of remaining in the same category for both periods has

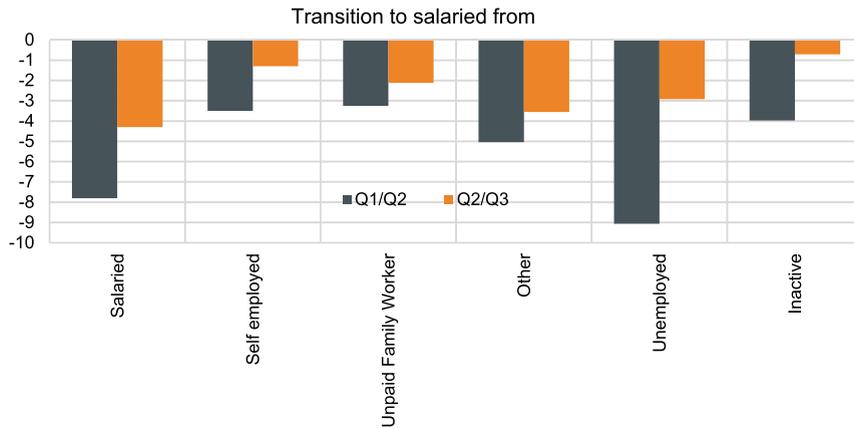


Fig. 5. Transition probability variations for period Q1/Q2 (2020 - 2019) and Q2/Q3 (2020–2019) - Flow toward "salaried". (Percentual points)  
Source: Continuous Employment Survey.

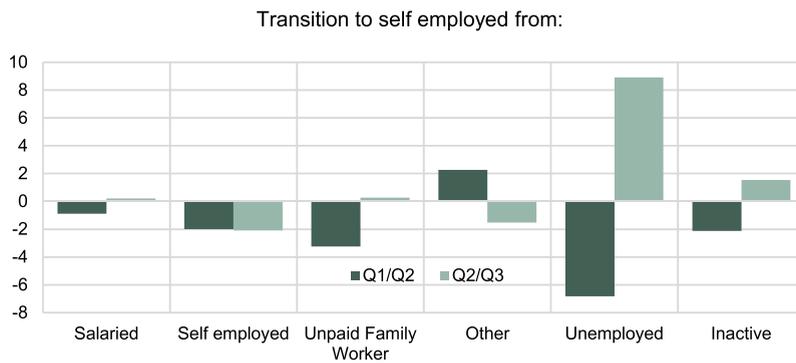


Fig. 6. Transition probability variations for period Q1/Q2 (2020 - 2019) and Q2/Q3 (2020–2019) - Flow toward "self-employed". (Percentual points).  
Source: Own elaboration based on the Continuous Employment Survey.

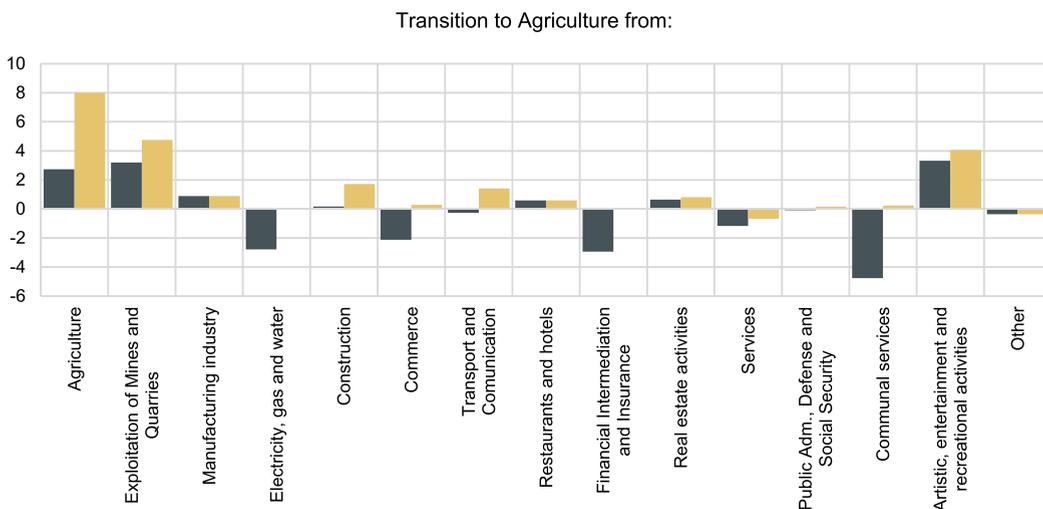


Fig. 7. Transition probability variations for the flow toward "Agriculture" 2020–2019.  
Source: Continuous Employment Survey.



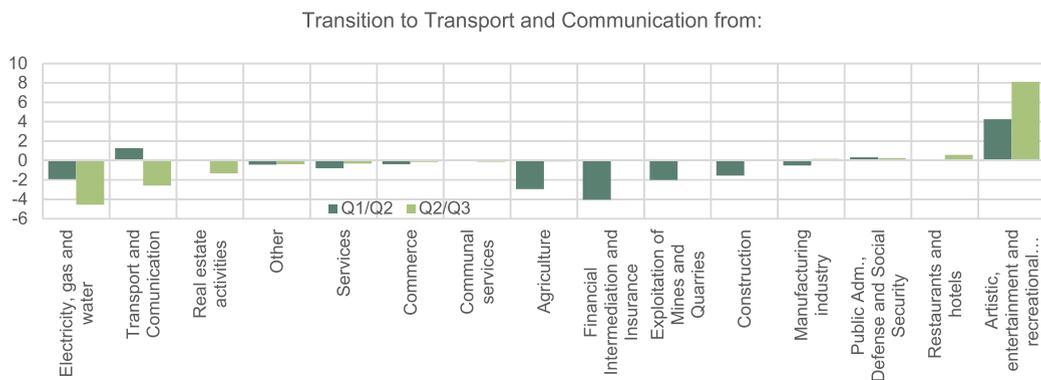
**Fig. 8.** Transition probability variations for the flow toward "Commerce" 2020–2019. Source: Own elaboration based on the Continuous Employment Survey (ECE).

decreased. On the other hand, it is also possible to see that people in unemployment or inactivity during the first period of the pandemic had a lower probability of being self-employed, but for the second period this probability increased in both cases and particularly for the unemployed, showing that people in unemployment may have found a place of work in the informal sector (matrix in Appendix 3).

This last result reflects important aspects of what happened in the labor market during the pandemic. From the analysis of transitions carried out, it is possible to say that in Bolivia confinement affected the option of workers to remain self-employed, but in the following period this category was the one that attracted the unemployed and the inactive, becoming in this sense a category of attraction to generate employment, unlike to what was found in other studies (Bouvier et al., 2022), (Álvarez, Brassiolo and Toledo 2021) (Álvarez, Brassiolo and Toledo 2021).

One of the strongest impacts of the Covid-19 pandemic in Bolivia and the world was on the performance of economic activity. In Bolivia, Gross Domestic Product (GDP) growth was reduced by 8.7% in 2020, and the largest decline was observed in the case of mining, transportation, construction and service activities; it should be noted that the agricultural sector showed favorable growth in line with the momentum it received during the periods of strict and dynamic quarantine. In this context, the flow of employed persons according to economic activity was affected by the pandemic in different ways, so the variations of the transition probabilities were also calculated, between 2019 and 2020 and for the periods Q1/Q2 and Q2/Q3, in this case.

The results for the activities with the most important results are shown below. Initially, the differences in the transition probabilities for the agriculture sector were evaluated (Fig. 7), and it is possible to observe that the transition to this sector from the rest of the activities was important. Initially, it is seen that farmers increased their probability of remaining in this activity in both the first and second periods; on the other hand, workers in the mining and extractive sector had a higher probability of moving to agricultural activity, considering the largely negative impact faced by mining. It was also observed that those employed in industry and in artistic and entertainment activities had a greater probability of moving to work in agriculture.



**Fig. 9.** Transition probability variations for the flow toward "Transport and Communication" 2020–2019. Source: Own elaboration based on the Continuous Employment Survey (ECE).

The importance of the agricultural sector is evident, since during the pandemic this activity was essential for households that had to comply with the restrictive measures that kept them in their homes and required essential products for survival. The transition to the agricultural sector of those employed in mining and artistic activities is noteworthy, since in Bolivia it was these sectors that received a significant negative impact in terms of growth and for which the restrictions implied the complete cessation of activities.

According to (Weller 2020) the containment measures against Covid-19 affected employment in commerce, restaurants and hotels and manufacturing industry. In Bolivia, in Fig. 8 it is possible to see that Commerce attracted those employed in entertainment activities, restaurants and hotels and services, mainly in the second period of analysis (Q2/Q3). Also, the probability of those employed in commerce to remain in this activity was positive, both in the first and second periods, implying that in the case of the country, commerce became a relevant option for workers who were already in this category and for those in other activities. Commerce in Bolivia would contrast with an important informal component in the country, which would have absorbed workers who were released or expelled from other activities, particularly services and entertainment (Fig. 8).

Finally, I evaluated the differences in the transition probabilities of the transportation activity which, had to reduce its economic activity in the face of reduced mobility during the pandemic period. For transportation, it was possible to see that the probability of remaining in this activity decreased particularly during the second period (Q2/Q3) in line with a deeper decrease in this activity during the third quarter of 2020. Likewise, those employed in agriculture, mining and quarrying, construction and manufacturing industry had a lower probability of moving to the transportation activity, mainly during the first period, showing negative variations (Fig. 9). As in the Commerce sector, it is possible to see that persons in the entertainment services tend to move to this sector.

## Conclusion

This paper examined labor transition probabilities according to the Markov chain process between the first and third quarter of 2020 and 2019 using the Continuous Employment Survey (ECE) published by the National Institute of Statistics of Bolivia (INE by its Spanish acronym). The mobility evaluated considered the transition across the statuses of employed, unemployed, temporarily inactive, permanently inactive; also for employed people like salaried, self-employed, unpaid family worker, other and finally the transitions for different economic activities.

The data suggested that unemployed people in Bolivia were in a more vulnerable situation than that faced by temporarily inactive people; likewise, the destruction of employment was reflected in the decrease of the probability of remaining employed considering the restrictions and distortions during the health crisis period. While this result shows that the unemployed suffer a bigger loss, it has also been seen that the measures implemented during the peak of the pandemic led people to inactivity, rather than to a state of unemployment.

The probability transitions were also calculated to see the movements toward a salaried status, and through the calculation of the difference of the probabilities between 2020 and 2019, it was possible to see that workers' probability to pass to this status was considerably reduced in 2020. Particularly the unemployed saw a deeper reduction in their possibilities. On the other hand, when the flow to self-employed category was analyzed, the results permitted to note that in Bolivia confinement affected the option of workers to remain self-employed particularly during the first shock of the pandemic in which the mobility restrictions severe. However, in the following period it was possible to see that this category was the one that attracted the unemployed and inactive people, becoming a category of attraction to generate employment and unlike to what was found in other documents as (Bouvier et al., 2022), (Álvarez, Brassiolo and Toledo 2021) (Álvarez, Brassiolo and Toledo 2021).

One of the strongest impacts of the Covid-19 pandemic in Bolivia was over the performance of economic activity. In Bolivia, Gross Domestic Product (GDP) growth was reduced by 8.7% in 2020 and important activities were affected like mining, transportation, construction, and service activities. However, the Agriculture sector reported a remarkable growth despite the restrictive scenario during the pandemic.

The differences in the transition probabilities were obtained for the agriculture sector and showed that in 2020 the transition to this sector from the rest of the activities was important. Indeed, people increased their probability of remaining in this activity; meanwhile, workers in the mining and extractive sector had a higher probability of moving to agriculture. As to commerce, it was observed that this activity attracted those employed in entertainment activities, restaurants and hotels and services, mainly in the second period of analysis. Commerce in Bolivia is a particular activity since it concentrates an important part of the informal employment in the country and according to the results the sector would have absorbed workers who were released or expelled from other activities. In that sense commerce became a relevant option for workers who were already in this category and for those in other activities.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix

## 1. Transition probabilities for employed and unemployed.

Endline status \ Baseline status	Employed	Unemployed
<b>Employed</b>	88,4%	11,6%
	89,1%	10,9%
	84,5%	15,5%
	78,6%	21,4%
	84,5%	15,5%
	88,7%	11,3%
<b>Unemployed</b>	25,3%	74,7%
	24,2%	75,8%
	26,2%	73,8%
	15,7%	84,3%
	26,2%	73,8%
	32,8%	67,2%

Source: Continuous Employment Survey.

Note: dark green = 2019q1–2019q2, medium green = 2019q2–2019q3, light green = 2019q3–2019q4, dark blue = 2020q1–2020q2, medium blue = 2020q2–2020q3, light blue = 2020q3–2020q4

## 1. Transition probabilities according to activity condition.

Endline status \ Baseline status	Employed	Unemployed - with experience	Unemployed - with not experience	Inactive - Temporary	Inactive - Permanent
<b>Employed</b>	88,44	2,45	0	9,12	0
	89,14	2,3	0	8,56	0
	78,63	5,03	0	16,34	0
	84,54	6,08	0	9,38	0
<b>Unemployed - with experience</b>	53,8	16,16	0	30,04	0
	48,5	20,51	0	30,99	0
	33,54	25,27	0	41,19	0
	53,93	27,47	0	18,6	0
<b>Unemployed - with not experience</b>	28,77	9,59	13,7	26,03	21,92
	48,5	20,51	0	30,99	0
	13,51	2,7	18,92	35,14	29,73
	15,38	15,38	23,08	30,77	15,38
<b>Inactive - Temporary</b>	26,63	4,33	0	69,04	0
	26,11	3,2	0	70,69	0
	16,49	3,47	0	80,04	0
	26,23	6,23	0	67,53	0,02
<b>Inactive - Permanent</b>	9,54	0,59	0,86	25,62	63,4
	10,16	0,62	0,39	26,88	61,95
	4,31	0,32	0,72	21,33	73,32
	4,63	0,97	0,68	17,47	76,25

Source: Continuous Employment Survey.

Note: dark green = 2019q1–2019q2, light green = 2019q2–2019q3, dark blue = 2020q1–2020q2, light blue = 2020q2–2020q3

## 1. Transition probabilities according to category of job.

Endline status \ Baseline status	Salaried	Self employed	Unpaid Family Worker	Other	Unemployed	Inactive
Salaried	78,54	7,69	1,43	1,74	3,01	7,59
	80,94	7,36	1,09	1,75	2,8	6,07
	70,74	6,81	1,45	1,13	6,94	12,93
	76,65	7,57	1,25	1,02	7,25	6,26
Self employed	8,89	74,17	2,89	4,82	2,09	7,13
	7,3	76,38	1,95	4,76	2,04	7,57
	5,39	72,18	2,44	2,13	3,79	14,07
	6	74,29	3,02	2,53	5,38	8,78
Unpaid Family Worker	7,53	11,44	54,09	1,16	1,45	24,33
	6,91	11,47	53,77	2,78	1,35	23,72
	4,28	8,2	45,01	1,43	2,41	38,68
	4,79	11,74	54,85	1,48	3,08	24,06
Other	12,06	24,58	3,25	49,91	2,69	7,51
	10,88	24,98	1,61	52,9	2,23	7,4
	7,02	26,85	1,72	42,61	5,17	16,63
	7,32	23,45	2,06	48,22	8,63	10,32
Unemployed	26,61	17,74	3,88	3,55	16,74	31,49
	24,79	14,54	3,32	4,16	21,05	32,13
	17,55	10,91	2,36	1,62	25,07	42,48
	21,87	23,46	4,18	3,81	27,64	19,04
Inactive	7,01	7,68	5,58	1,2	3,46	75,07
	6,81	7,13	6,22	1,38	2,57	75,88
	3,04	5,56	3,92	0,78	2,83	83,88
	6,1	8,67	6,15	1,55	5,43	72,11

Source: Continuous Employment Survey.

Note: dark green = 2019q1–2019q2, light green = 2019q2–2019q3, dark blue = 2020q1–2020q2, light blue = 2020q2–2020q3

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