Labor Informality During the Pandemic: Crisis and Recovery in Mexico

La informalidad laboral en los tiempos de covid-19: crisis y recuperación en México

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Abstract

Informality is a structural feature of the Mexican labor market of great quantitative and qualitative importance. However, largely due to the confinement of the population, more than ten millions of informal jobs were lost in the first months of the pandemic. With the reactivation of the economy, a higher rate of informality than before the pandemic was registered at the end of 2021. In this article we analyze the evolution of informality during the first year of the pandemic and examine its determinants during this period using a logit model. The analysis illustrates some of the characteristics of the uneven recovery of the Mexican labor market, and the features of a phenomenon that is both a social problem and a challenge for public policy.

Keywords: Informality, jobs and wages, labor markets, crisis, pandemics.

Resumen

La informalidad laboral es un rasgo estructural del mercado de trabajo mexicano de gran importancia cuantitativa y cualitativa. Debido en buena medida al confinamiento de la población, durante los primeros meses de la pandemia por Covid-19 en 2020, se perdieron más de 10 millones de empleos informales. Con la recuperación de la economía a finales del 2021 se registró una tasa de informalidad más alta que antes de la pandemia. Ante dicho contexto, el presente artículo tiene como objetivo analizar la evolución de la informalidad durante el primer año de la pandemia, así como los cambios en

sus determinantes para dicho periodo mediante un modelo logit. El análisis ilustra algunas de las características de la desigual recuperación del mercado de trabajo mexicano y los rasgos de un fenómeno que representa un problema social y un reto para las políticas públicas.

Palabras Clave: informalidad, empleos y salarios, mercados de trabajo, crisis, pandemia.

JEL Classification / Clasificación JEL: E26; E24; J23; E32.

1. Introduction: The pandemic and the labor market in Mexico

The economic crisis stemming from the Covid-19 pandemic had serious repercussions in Mexico, especially during the second quarter of 2020, as a result of the confinement decreed by the Federal government on 30 March. This article shows the ambivalence of the recovery in Mexico following an 8.5% fall in GDP in 2020 (INEGI, 2021b). The contraction of the labor market translated into a substantial fall in the number of informal workers, among other things. The rate of informal labor fell by 8 percentage points between March and April 2020, from 55.7% to 47.7%[1]. In other words, this population decreased by 10.4 million in this period (INEGI, 2021a).

Nevertheless, the labor market has begun to recover as a result of various phenomena: a) the gradual reopening and progressive return to activities by many workers, particularly informal workers, in the second half of 2020 and during 2021; b) the partial and intermittent recovery of formal employment; c) the growth of the United States economy that has "dragged" with it companies established in Mexico that form part of international supply chains.

Within this context, the objective of this article is to analyze some of the socio-economic features determining labor informality, between the first quarter of 2020 (T1), and the T1 of 2021, that is one year into the Covid-19 pandemic. Given these determinants, the possible changes in the probability of a worker falling into labor informality will then be examined. The data for the analysis were obtained from the National Survey on Occupation and Employment (ENOE, according to its Spanish abbreviation)[2] conducted on a quarterly basis by the National Institute of Statistics and Geography (INEGI, according to its Spanish abbreviation)[3].

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[1] This figure was obtained from the telephonic survey of Occupation and Employment (ETOE, according to its Spanish abbreviation) designed by the official statistics institution in Mexico as an emerging tool in the face of the Covid-19 confinement. It is important to note that the ETOE is not strictly comparable with the surveys of occupation and employment used in this study, but is the most reliable available survey.

[2] Figures were obtained specifically from the ENOE microdata and are statistically significant with a Coefficient of Variation (CV) of less than 15%. It is worth noting that the data from T1 2021 were obtained through the ENOE New Edition, which is strictly comparable with the ENOE of the T1 of 2020.

[3] Governmental institution in Mexico, responsible for conducting surveys, developing databases, and publishing official statistics in the country on a national, state, and municipal level.

 The analysis of informality is important given that, on average, informal workers receive lower wages than the formally employed and lack the benefits stipulated by law. All the above result in particularly precarious life and work conditions.

In accordance with these objectives, this document is structured as follows: First, the most influential theoretical approaches regarding labor informality are presented. Second, we analyze a set of important variables in order to understand the phenomenon of informality and its evolution during the period mentioned. Finally, a *logit* type regression model is developed that allows us to specify which variables determine the highest or lowest probability of participating in informal activities within current economic conditions.

2. Approaches to labor informality

Labor informality in Mexico is a persistent feature of its labor markets which, with fluctuations over time, affects more than half of the employed population. Various studies have documented the characteristics of informal workers, who largely work for themselves or are employed in small enterprises, than the general population and in specific sectors are predominantly women (trade, domestic work) (Loayza and Sugawara, 2009; Bueno, 2009).

On an international level, the issue of informality, its origins and regulation, has been the object of analysis by researchers from across the world (Browley and Wilson, 2018). For example, it has been argued that informality is a resilience factor for the poor and middle classes in times of crisis; in many countries, the informal economy constitutes the main entry point into the labor market for young people and rural migrants. Furthermore, for certain people, access to various informal jobs represents an opportunity (Charmes, 2019, p.84).

Similarly, informality has been the object of debate, regulation, and measurement by international bodies such as the International Labor Organization (ILO). The ILO has highlighted that informal workers face significant deficits in terms of the four pillars of decent work: economic opportunities, labor rights, social protection, and "having a voice". The ILO also considers informal workers to have less access to adequate education, health, and infrastructural services (OIT, 2002a, cit. by Chen and Carré, 2020, p.3). Despite this, these authors note that informal workers and their activities contribute to both the reduction of poverty and to economic growth.

Thus, the literature on informality reflects the ongoing interest in a contested but prevailing concept, regardless of differences concerning its genesis, characterization, and the policies proposed to reduce it.

Some authors have suggested that the formal / informal dichotomy is insufficient to reflect the complexity of Latin American labor markets in the era of globalization (Pérez-Sáinz, 1998, Pries, 2000). Conceptual differences are due to both the disciplinary frameworks on which they are based as well

as the analytical emphases. According to Pérez-Sainz (1998), two explanatory currents dominate the first stage, that of the Regional Employment Program for Latin America and the Caribbean (PREALC, according to its Spanish abbreviation), and the *regulationist* approach, mainly proposed by Portes. The PREALC approach is based on the idea of an excess of labor not absorbed by the modern sector, reflecting what it refers to as *heterogeneous subordination*. The informal sector is characterized by its technological backwardness in a productive fabric of oligopolistic behaviors. This dualist vision of Latin American economies is taken up in later work to analyze informality in Mexico (Puyana and Romero, 2012).

The second, regulationist approach, forms part of an evolutionary perspective of capitalism, in which informality is functional for the formal sector as it allows workers access to consumption and the payment of minimum wages through tax evasion (Castells and Portes, 1989)[4]. Pérez-Sainz (1998) situates both the ECLAC approach and the regulationist approach within the import substitution stage, which ended in the 80s when Latin American economies were inserted into global processes.

According to this author, the dualist approach does not explain changes in Latin American labor markets in the current stage. Pries (200, p.528), from a sociological perspective, argues that dual theories of informality assume an objective and subjective hierarchy according to which the formal sector systematically offers better jobs and is viewed favorably by workers, an assumption which, in practice, has not yet been proven.

Debates and disagreements about informality continue. From our point of view, this is partly due to different analytical interests. That is, one group of authors are more interested in the conditions of work (Robles and Martínez, 2015, 2018; Browley and Wilson, 2018), while others in the negative consequences of informality on economic growth and development, due to the low productivity of informal activities. Informal, unregistered businesses that do not pay taxes, subsist due to a set of policies that encourage their survival and growth. This argument is central to the study of Levy (2018), who, together with other authors such as Loayza and Sugawara (2009); David, A., Pienknagura, S., and Roldos, J. (2020), see informality as a way of avoiding labor or tax regulations that are overly onerous for certain enterprises. In contrast, Ros (2019), in his critique of Levy (2018), shows the variety of situations that exist in businesses and argues that labor informality derives from insufficient productive investment that, were it to occur, would allow for the creation of formal employment.

For some authors in Mexico, the phenomenon of informality has intensified during the neoliberal phase that fostered trade openness and the deregulation

[4] A third, influential approach, despite its questionable academic rigor, is that of Hernando de Soto. This author argues that informal workers are entrepreneurs with great initiative and audacity who, suffocated by State regulations, have a way of developing their small enterprises in informality (De Soto, 1989).

of labor markets (Medina and López, 2019). However, others have found a notable decrease following the reform of the Federal Labor Law in 2012 (Loría and Salas,2019). While the most typical figure of informality is perhaps that of a street seller, informal work encompasses a diverse group of economic and work activities that include day laborers, domestic workers, non-manual professionals (translators, software designers, digital platform workers), and professionals from the arts and culture (Guadarrama, 2019).

In some cases, informal workers are not excluded from the formal economy, but rather are those who *voluntarily* undertake informal activities as a form of *escape* as these offer greater benefits than formal work. This would be the position on which the previously cited influential work of De Soto, is based (Bromley and Wilson, 2018, p.10)[5]. An important aspect to consider is that no strict separation exists between formality and informality, but rather, informal practices are often incorporated into work considered to be formal.

Some of the critiques of the concept of informality have impacted the bodies responsible for its measurement. The National Institute of Statistics and Geography in Mexico operates according to the following definition (INEGI, 2019): informal labor is considered as: "employed population (without duplication) that is labor vulnerable due to the nature of the economic unit for which they work and/or whose labor relationship or dependency does not provide them access to social security or is not recognized by their source of work"[6]. Even with imprecisions in the characterization of informality, it is necessary to recognize the usefulness of distinguishing between formal and informal work, particularly for statistical purposes (Chen and Carré, 2020, p.5).

3. The evolution of labor informality one year after the start of the covid-19 pandemic in Mexico

Percentages of informality, one year into the pandemic, do not appear to have changed significantly. In the T1 of 2020, the informal/ formal ratio was 56% and 43.9%, while in the T1 of 2021, these ratios were 55% and 44.9%[7]. However, a view of the absolute numbers for the selected period shows a different picture, with approximately two million fewer informal workers and half a million fewer formal workers. On one hand, these figures reflect the severity of the loss of informal employment in the first months of the pandemic, while on the other, they profile the importance of informality in the labor market recovery. Within this context, it is important to examine a set of variables associated with informality.

[5] González de la Rocha and Escobar (2008) question whether informal workers voluntarily participate in these types of activities. They argue that in Mexico, informality is due to the tightness of the formal labor market.
[6] Consult INEGI regarding the methodology and measurement it adopts (2014).
[7] From here on we refer to the two periods only as 2020 and 2021, both for ease of reading and with the understanding that the reader is aware of the periods under study for each year.
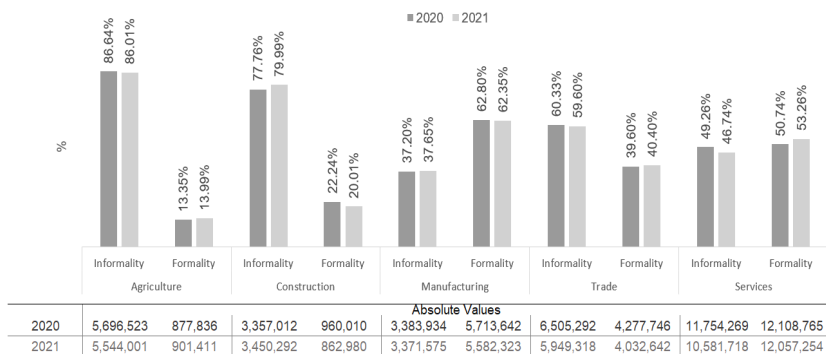
Within the urban environment, the percentage of informal workers in 2021 is slightly less than that of formal workers, 49.1% vs 50.8%. When compared with 2020, a *spurious formalization* is evident, with informal/ formal percentages of 49.6% and 50.4% respectively[8]. However, as was highlighted previously, the calculation of absolute numbers presents an alternative view of the phenomenon. In effect, this "formalization" within the urban environment is the result of 1.5 million fewer informal workers with a smaller decrease of half a million formal workers. Thus, although there was an increased proportion of formality within the working population, this was not due to the recovery of formal work, but rather, to the brutal impact of the crisis on the informal economy.

3.1 Informality and branches of economic activity

The branches of economic activity with the *highest informality* in 2020 were agriculture 86.6%, construction with 77.7%, and trade with 60.3% (See Figure 1). However, in absolute numbers, services occupies first place with 11.7 million informal workers, followed by the trade sector with 6.5 million and agriculture with 5.6 million. The highest number of formal workers were concentrated in services, with 12.1 million, followed by manufacturing with 5.7 million.

Figure 1. Formal and informal employment per branch of economic activity (percentages and absolute values) 2020 and 2021

	Absolute Values									
2020	5,696,523	877,836	3,357,012	960,010	3,383,934	5,713,642	6,505,292	4,277,746	11,754,269	12,108,765
2021	5,544,001	901,411	3,450,292	862,980	3,371,575	5,582,323	5,949,318	4,032,642	10,581,718	12,057,254

Source: Own elaboration with data from ENOE, first quarter of 2020 and first quarter of 2021.

[8] This process initially suggests different effects within the rural and urban environment. It shows that, contrary to the rural environment, the urban environment has a greater decrease in percentages of informality, which, one year into the pandemic, has failed to completely recover.

What happened in the year under analysis? In the agricultural sector, percentages of informality were only marginally different between the two years. However, formal employment increased 0.65%. In absolute numbers, there were 130,000 fewer informal workers, while formal employment increased by 25,000 jobs. In construction, a further process of *informalization* is evident, which increased by more than 2%. Total employment in construction, one of the branches most affected by the crisis, subsequently increased once again, although this was due to the growth of informal employment and the loss of formal jobs, which decreased by almost 10,000.
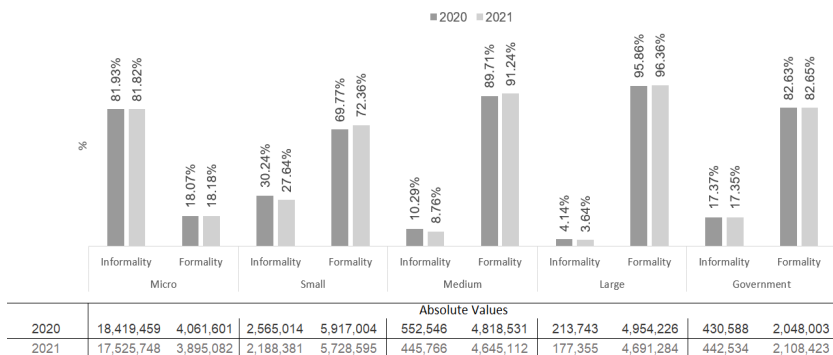
In manufacturing – the branch with the highest levels of formality – the number of informal workers dropped slightly by around 120,000, while around 130,000 formal jobs were lost. Trade, a predominately face-to-face activity before the pandemic, has been one of the most affected branches during this period as most are micro-enterprises that have only partially resorted to electronic commerce. In the year under analysis, almost 600,000 informal trading jobs were lost, in comparison with the 200,000 formal positions.

Finally, in services, the *spurious formalization* observed is due more to the significant drop in informal work, that affected more than a million workers, than to an increase in formal work, where a marginal decrease was registered in the period.

3.2. The evolution of informality by size of firm

During the year analyzed, this kind of *spurious formalization* occurred in enterprises of all sizes as a consequence of the loss of more informal employment than formal. In contrast, in the public sector, both informal employment as well as formal employment increased slightly, by 12,000 and 60,000 respectively.

Figure 2. Formal and informal employment by business size (percentages and absolute values) 2020 and 2021

	Informality	Formality	Informality	Formality	Informality	Formality	Informality	Formality	Informality	Formality
	Micro		Small		Medium		Large		Government	
Absolute Values										
2020	18,419,459	4,061,601	2,565,014	5,917,004	552,546	4,818,531	213,743	4,954,226	430,588	2,048,003
2021	17,525,748	3,895,082	2,188,381	5,728,595	445,766	4,645,112	177,355	4,691,284	442,534	2,108,423

Source: Own elaboration with data from ENOE, first quarter of 2020 and first quarter of 2021.
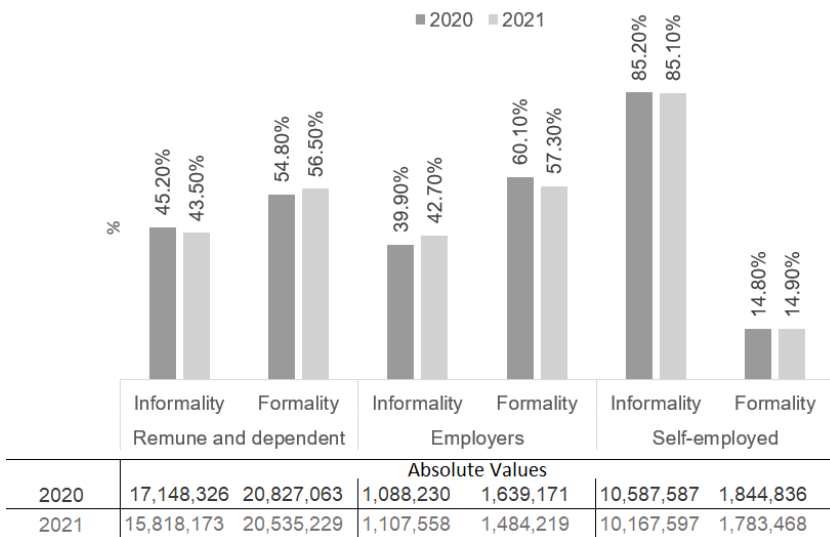
Regarding to informal work in the period under analysis, paradoxically, the fewest relative losses occurred proportionally in micro-enterprises, although in absolute figures it was there that the greatest decrease in jobs was experienced, with almost a million fewer jobs registered in the period. In absolute numbers, the decrease in formal employment occurred in descending order in large, small, medium and micro enterprises, although the differences are less than in the case of informal work (see Figure 2).

3.3. Dependent workers, employers and self-employed workers

In the period analyzed, the results regarding the percentage of formalization or informalization differ according to the position occupied in employment. In the case of remunerated dependent workers, the data again show a higher proportion of formal workers resulting from the significant decrease in informal workers, of around 1,300,000 and a smaller decrease in formal employment of 300,000.

Figure 3. Position in formal and informal work (percentages and absolute values) 2020 and 2021

	Remune and dependent		Employers		Self-employed	
Absolute Values	Informality	Formality	Informality	Formality	Informality	Formality
2020	17,148,326	20,827,063	1,088,230	1,639,171	10,587,587	1,844,836
2021	15,818,173	20,535,229	1,107,558	1,484,219	10,167,597	1,783,468

Source: Own elaboration with data from ENOE, first quarter of 2020 and first quarter of 2021.

In terms of employers, the opposite is evident with an increase in the ratio of informal employers by almost three points. This is due to an increase of 19,300 informal employers during the period, combined with a decrease of almost 200,000 formal employers. In our opinion, the data on informal

employers is significant as it reveals the nature of the recovery which occurred over the first year of the pandemic.

Finally, with regards to self-employed workers, there were almost no changes in terms of the proportion of formal and informal workers, as the decrease in figures on both categories are proportional to the total quantities, 400,000 fewer informal workers and a little more than 50,000 formal workers. In both periods, informal workers represented 85% of the total self-employed workers.

In the period, the greatest losses continue to correspond to informal work, although this should not detract from the significant decrease in formal employment. The analysis of percentages of jobs lost or recovered with respect to total jobs in each employment position, highlights interesting data. With regards to remunerated and dependent workers, the loss of informal jobs was proportionally much higher.

However, the most striking result per employment position is that of employers, reflecting the effects of the economic-health crisis in companies. In effect, almost 10% of formal employers "disappeared", or, in other words, in the first quarter of 2021, there were around 150,000 fewer formal enterprises than in 2020. Finally, it is also interesting to note the scarce relative difference between formal and informal self-employed workers, although in absolute terms, more jobs were lost by the informally self-employed.

3.4. Education, groups by age and sex

Level of schooling in labor studies is an important indicator of informality, as informal work is more frequent among workers with lower schooling levels.
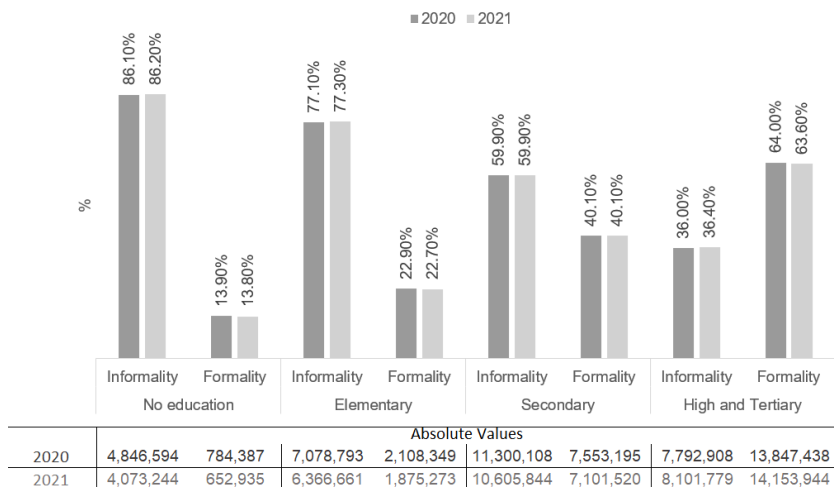
In the two lowest levels of schooling (no schooling and elementary), as expected, informal work decreased substantially. A visible sign of job recovery in the first quarter of 2021 was both for formal and informal workers with secondary and high school education levels. In these higher schooling levels, the number of informal workers increased by slightly more than 300,000, while the increase in formal workers was 306,506 (see table in Figure 4).

In relation to age, informal work in Mexico tends to be concentrated in greater proportions among young people of between 15 and 24 years of age and adults aged 65 and over. As can be seen in Figure 5, approximately 3 of every 4 employed senior citizens and more than two thirds of employed young people are informal workers, in both years.

It is noteworthy that in the youngest age group, there is a slight increase of informal workers from 67.2% to 68%. In contrast, in the over 65 group, the relative population of formally employed increased as a result of the loss of 500,000 informal jobs, with a decrease of only 40,000 formal jobs.
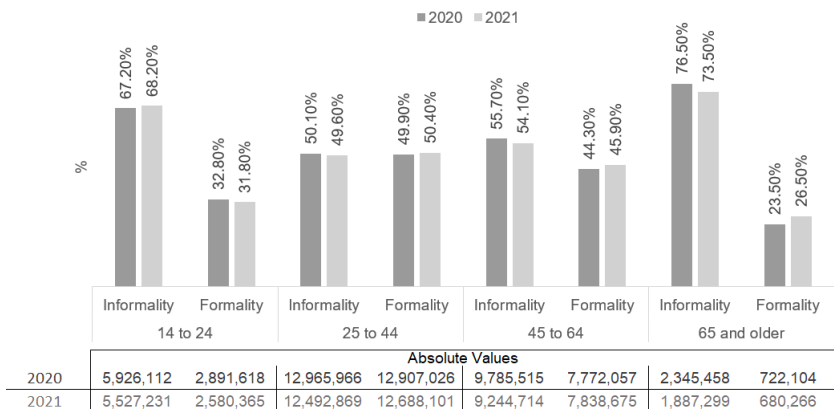
Finally, women's work has been particularly affected by the economic crisis linked to the pandemic. This is reflected strongly in the informal sector. While there were just under half a million fewer male employees in the informal sector in the first quarter of 2021 in comparison with the same quarter of 2020, the

FIGURE 4. FORMAL AND INFORMAL EMPLOYMENT BY SCHOOLING LEVEL (PERCENTAGES AND ABSOLUTE VALUES) 2020 AND 2021

	Informality	Formality	Informality	Formality	Informality	Formality	Informality	Formality
	No education		Elementary		Secondary		High and Tertiary	
Absolute Values								
2020	4,846,594	784,387	7,078,793	2,108,349	11,300,108	7,553,195	7,792,908	13,847,438
2021	4,073,244	652,935	6,366,661	1,875,273	10,605,844	7,101,520	8,101,779	14,153,944

Source: Own elaboration with data from ENOE, first quarter of 2020 and first quarter of 2021.

FIGURE 5. FORMAL AND INFORMAL WORKERS BY AGE GROUP (PERCENTAGE AND ABSOLUTE VALUES) 2020 AND 2021

	Informality	Formality	Informality	Formality	Informality	Formality	Informality	Formality
	14 to 24		25 to 44		45 to 64		65 and older	
Absolute Values								
2020	5,926,112	2,891,618	12,965,966	12,907,026	9,785,515	7,772,057	2,345,458	722,104
2021	5,527,231	2,580,365	12,492,869	12,688,101	9,244,714	7,838,675	1,887,299	680,266

Source: Own elaboration with data from ENOE, first quarter 2020 and first quarter 2021.

number of women workers decreased by almost 1,400,000 over the same period (see table in Figure 6).

FIGURE 6. FORMAL AND INFORMAL EMPLOYMENT BY SEX (PERCENTAGES AND ABSOLUTE VALUES) 2020 AND 2021 AND VARIATION IN THE PERIOD
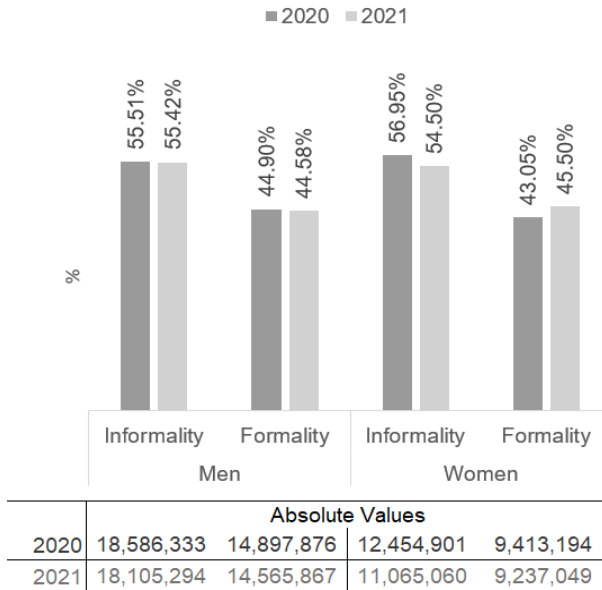
	Informality	Formality	Informality	Formality
	Men		Women	
	Absolute Values			
2020	18,586,333	14,897,876	12,454,901	9,413,194
2021	18,105,294	14,565,867	11,065,060	9,237,049

Source: Own elaboration with data from ENOE, first quarter of 2020 and first quarter of 2021.

### 3.5. TOWARDS GREATER INCOME AND WAGE INEQUALITY

Data regarding income and real wages show few changes when analyzing wages per hour, for both informal and formal workers. Income of informal workers remained practically stagnant, while the most notable difference in that of formal workers, was the relative increase in the salary of the self-employed.

In terms of monthly income, wages of informal workers generally decreased, except for those self-employed, who experienced a slight increase in income. Among the formally employed, salaries of the self-employed increased, as did the income of waged workers, although in the latter case, this was only slight. In contrast, salaries of employers decreased.

Differences between wages per hour and monthly salaries may be due to a shorter working day in the case of formal, self-employed workers, who

experienced a reduction from 48 to 46 hours and, to a lesser degree, of those self-employed in informality, whose work week decreased from 37 to 36 hours.

Figure 7. Average income by month and position of employment (mexican pesos by constant prices) 2020 and 2021
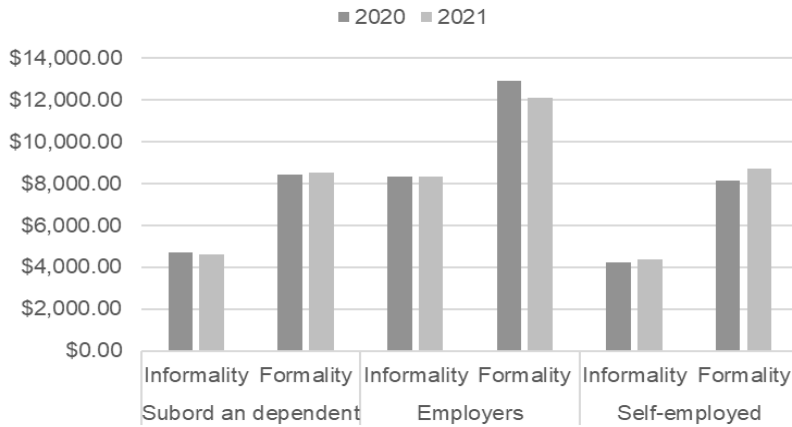
Source: Own elaboration with data from ENOE, first quarter of 2020 and first quarter of 2021.

Figure 8. Average income by hour and position of employment (mexican pesos by constant prices) 2020 and 2021
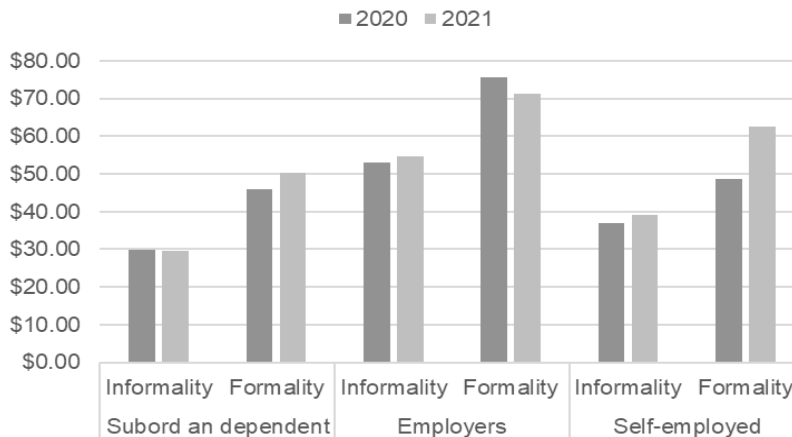
Source: Own elaboration with data from ENOE, first quarter of 2020 and first quarter of 2021.
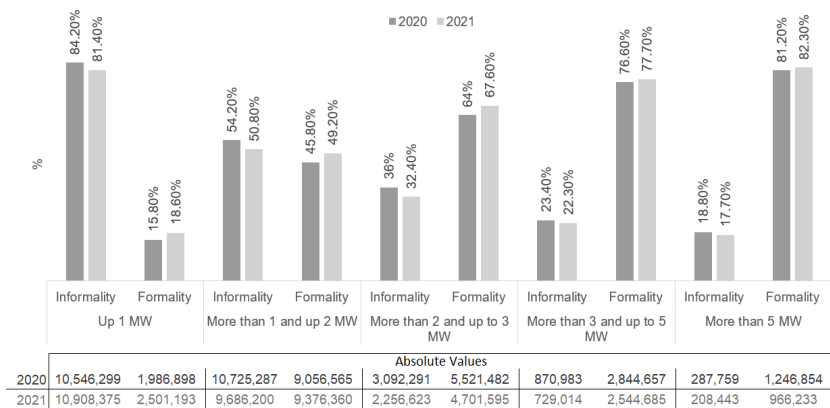
The above data show an evolution that contrasts with the crisis that Mexico continued to experience in the first quarter of 2021. It is possible that the

increase in the minimum wage helped to contain the fall in formal wages. Another possible explanation is that the massive exodus of workers from the Economically Active Population could mainly be accounted for by the lowest paid groups of workers. Finally, it should be noted, that in the relatively short period analyzed, macroeconomic stability was maintained.

These data are complemented with those regarding distribution according to ranges of minimum wages. In these terms, the absolute number of informal workers increases in the range of those who earn a minimum wage and decreases in all other ranges. That is, informal workers experienced a deterioration of income during the period analyzed.

A similar phenomenon can be seen for formal workers. The number of formal workers earning between up to one minimum wage and between one and two minimum wages increased, with a decrease in all other ranges. However, the decrease in the highest wage bracket is less for formal workers than for informal workers (see Figure 9).

FIGURE 9. FORMAL AND INFORMAL EMPLOYMENT BY SALARY RANGE (PERCENTAGE AND ABSOLUTE VALUES) 2020 AND 2021

	Informality	Formality	Informality	Formality	Informality	Formality	Informality	Formality	Informality	Formality
	Up 1 MW		More than 1 and up 2 MW		More than 2 and up to 3 MW		More than 3 and up to 5 MW		More than 5 MW	
Absolute Values										
2020	10,546,299	1,986,898	10,725,287	9,056,565	3,092,291	5,521,482	870,983	2,844,657	287,759	1,246,854
2021	10,908,375	2,501,193	9,686,200	9,376,360	2,256,623	4,701,595	729,014	2,544,685	208,443	966,233

Source: Own elaboration with data from ENOE, first quarter of 2020 and first quarter of 2021.

4. DETERMINANTS OF INFORMALITY BASED ON A LOGIT MODEL

Given that this article seeks to analyze the evolution of informality during the economic crisis that derived from the Covid-19 health emergency, we look at *possible changes in some of the socio-economic determinants most cited in the literature on informal labor, one year on from the start of the pandemic*. The analysis is conducted in three stages:

1. Identification of the determining factors associated with informality of greatest interest at this time in the Mexican labor market (Ibarra-Olivo, Acuña y Espejo, 2021).
2. Treatment of data using an econometric model in which we use a Logit type regression technique. For this statistical exercise, we rely principally on Robles and Martinez (2018), using the ENOE microdata for the period of analysis corresponding to the first quarter of 2020 compared with the first quarter of 2021.
3. Description of the goodness of fit and results obtained from the model for the variables used, complemented by descriptive statistics for the indicated period.

4.1. IDENTIFICATION OF DETERMINING FACTORS OF LABOR INFORMALITY

According to Ibarra-Olivo, Acuña and Espejo (2021, pp.29-32), literature regarding the determinants of informality is divided into two broad groups. On one hand, are the micro determinants, referring to the individual characteristics of workers, as well as the those of their households, which impact their propensity towards informality. On the other, are the macro determinants, referring to the macro-economic and institutional conditions associated with the presence of an informal sector.

With regards to the micro determinants, these refer to socio-demographic aspects of workers, such as gender, schooling, and age; while household characteristics are associated with income level and number of children in the case of women, among others.

Macro determinants are macro-economic conditions and characteristics of the institutional framework of a country or region. The macro-economic conditions are reflected in labor force qualifications and size of enterprises, among other things. Institutional elements include the regulatory framework and application of the law, as well as the tax burden and contributions to social security.

The so-called "vulnerable groups" that is, those with a greater propensity to be employed informally, can be identified through the micro and macro determinants.

Micro Determinants
a) Individuals: Women, people with low schooling levels, young people, and senior citizens.
b) Household: Low-income households, married couples or people in consensual unions, and women with children.
Macro Determinants
c) Macro-economic: Agriculture or construction, small and micro enterprises, and low qualifications.
d) Institutional: Poor monitoring and enforcement of the law, non-existent social security, and low tax burden.

This article looks at 7 variables of analysis associated with socio-economic problems of a structural nature, based on what we refer to as the "most

vulnerable groups in the case of the Covid-19 crisis". These variables are presented in the following section.

4.2. Econometric model approach

This section presents the econometric method through which the differences in the determinants of labor informality were estimated, based on the factors previously identified as associated with the phenomenon.

It is common for the social sciences to study phenomena that require modelling with discrete and non-continuous variables. This occurs when attempting to understand the qualitative characteristics of a phenomenon under study, and therefore requiring an econometric model that allows for the use of categorical variables that account for the determinants in the behavior of the phenomenon. In this regard, the models used for the analysis of discrete variables are those that consider the existing relationship between one dichotomous or multinomial variable and one or more categorical explanatory variables. Among the most well-known models used to describe this relationship between categorical variables, are the Logit and Probit models.

According to Ucedo (2013), both the Logit and the Probit model are able to infer for the same phenomenon of study. However, particular care should be taken when comparing the resulting estimates of the two, as they differ mathematically (natural logarithm of odds, and the inverse of the standard normal cumulative distribution, respectively), and therefore no coincidence in the estimates should be expected. Nevertheless, there is an important similarity between the models, namely that both the Probit standard normal cumulative distribution as well as the Logit logistic curve have an elongated S shape, and while the normal cumulative has a slightly greater slope, in general, the differences are minimal.

The best way of deciding between the models is to review the adjustment measures of each, starting from the same sample size, the same number of parameters to be estimated, as well as the same explanatory and explained variables. That said, this model uses a dichotomous approach for the dependent variable which assumes values of 1 and 0, referring to the possibility of a worker being formally or informally employed, respectively; the independent or explanatory variables (Figure 9) are categorically ordered with values from 1 to N [9].

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[9] For a better fit, specific variables were transformed into Dummy variables.

R
E
M

Table 1. Variables and categories[10] of factors associated with labor informality, selected for the analysis[11]

Dependent Variable			
Informality*		0	
Formality		1	
Explanatory Variables			
Micro		Categorical order	Expected effects of propensity to informality
Sex	Women	1*	(+) High
	Men	2	(-) Low
Age	15 to 24	1*	(+) High
	25 to 44	2	(-) Low
	45 to 64	3	(-) Low
	65 and over	4	(+) High
Schooling	No education	1*	(+) High
	Up to elementary	2	(+) High
	Up to secondary	3	(-) Low
	High and tertiary	4	(-) Low
Income	1 to 3 MW	1*	(+) High
	3 to 5 MV	2	(-) Low
	More than 5 MW	3	(-) Low
Position of Employment	Remune and dependent	1	(-) Low
	Employer	2	(-) Low
	Self-employed	3*	(+) High
Macro			
Sector of Economic Activity	Agriculture	1*	(+) High
	Construction	2	(+) High
	Manufacturing	3	(-) Low
	Trade	4	(-) Low
	Services	5	(-) Low
Size of Economic Unit	Micro-enterprises	1*	(+) High
	Small enterprises	2	(+) High
	Medium enterprises	3	(-) Low
	Large enterprises	4	(-) Low
	Government	5	(-) Low

*Categories to be taken in the model as a base or reference.
Source: Own elaboration with variables selected from the ENOE.

Once the adjustment measure had been calculated for both models under the same criteria, we concluded that no significant difference existed between them. However, the Logit model had a slightly better fit regarding the percentage of correctly performed predictions, as well as a sensitivity of the

[10] The selection of categories of reference is associated with better conditions of labor informality. These categories will be analyzed with respect to contrast categories.
[11] The meaning and relationship of the independent variables with respect to the two categories of the dependent variable will be determined based on the coefficients of the model. Positive coefficients reflect greater association between the reference category of the dependent variable and the reference category of the independent variables with respect to the contrast categories. Negative coefficients show less association between these.

Receiver Operating Characteristic (ROC) curve, which approached 1. We thus decided to use a Logit model for our phenomenon under study.

Based on the numerous studies on the determinants of informality, a high degree of association was expected between *vulnerable groups* and the phenomenon under consideration (Cuevas, de la Torre y Regala, 2016). However, it is also feasible to observe the increase or decrease of some determinants.

In sum, a Logit type probabilistic model was applied, coinciding with numerous studies on informal labor in which this model had been used due to its flexibility of interpretation and simplicity of application.

We seek to predict the estimated probability that the dependent variable "Y" has one of the two possible values, based on the different values adopted by the set of independent variables ((Ibarra-Olivo, Acuña and Espejo, 2021).

$$y_i = \begin{cases} 1 \; if \; Ii \; > \; 0 \; that \; occurs \; when \; XI \; \beta + \varepsilon i \; > 0 \\ 0 \; if \; Ii \; < \; 0 \; that \; occurs \; when \; XI \; \beta + \varepsilon i \; > 0 \end{cases} \tag{1}$$

Where can have a value of 0 and 1 with probabilities of 1- y respectively. This can be presented as:

$$p_i = X'i\beta \tag{2}$$

Where X is a vector and the estimated coefficients. However, presented like this, the equation would be linear, and thus must be transformed:

$$p_i = \frac{1}{1 + e^{-(Xi\beta)}} \tag{3}$$

Or, equal to:

$$p_i = \frac{1}{1 + e^{-(Z_t)}} = \frac{e^z}{1 + e^z} \tag{4}$$

The equation (4) is the function of the cumulative logistic distribution (Robles and Martínez, 2018). However, it requires linearization to obtain the following:

$$\frac{p_i}{1 - p_i} = \frac{1 + e^{Z_t}}{1 + e^{-Z_t}} = e^{Z_t} \tag{5}$$

Where /(1-) is the odds ratio with respect to the possibility of being an informal worker. That is, it refers to the quotient of probability that represents the estimated proportion of the occurrence of an event $P = (Y = 1)$, divided by the complementary property $P (Y = 0)$, or, in other words, it refers to the number of times that something can occur compared to the times when it cannot occur (Ibarra-Olivo, Acuña and Espejo, 2021). Thus, the proposed model is:

$$p = \frac{1}{1 + e^{-(\alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_k X_k}} \tag{6}$$

Where p is the probability of the event of interest occurring, and , are the parameters of the regression, and are the explanatory variables.

4.3. DESCRIPTION OF THE OBTAINED RESULTS

The results obtained from the estimations of the econometric modelling are presented below.

TABLE 2. ECONOMETRIC RESULTS OF THE MODEL: COEFFICIENTS AND ODDS RATIOS[12] OF LABOR INFORMALITY IN MEXICO, 2020T1 AND 2021T1

Variables of analysis	Base or reference categories	Comparative or contrast categories	2020T1			2021T1		
			Coeff.	P>Z	Odds ratio	Coeff.	P>Z	Odds ratio
Sex	Women	Men	-0.270	0.000	0.763	-0.200	0.000	0.819
Age	15 to 24	25 to 44	-0.906	0.000	0.404	-0.911	0.000	0.402
		45 to 64	-1.223	0.000	0.294	-1.302	0.000	0.272
		65 and over	-1.048	0.000	0.351	-1.297	0.000	0.273
Schooling	No Education	Elementary	-0.406	0.000	0.666	-0.427	0.000	0.652
		Secondary	-0.923	0.000	0.397	-0.908	0.000	0.403
		High and Tertiary	-1.580	0.000	0.206	-1.598	0.000	0.202
Income	1 to 3 mw	3 to 5 mw	-0.845	0.000	0.429	-0.892	0.000	0.410
		More than 5 mw	-0.967	0.000	0.380	-0.968	0.000	0.380
Position of Employment	Self-employed	Remue. and Depend.	-0.222	0.000	0.801	-0.301	0.000	0.740
		Employer	-1.533	0.000	0.216	-1.482	0.000	0.227
Sector of Economic Activity	Agriculture	Construction	0.363	0.000	1.437	0.693	0.000	2.001
		Manufacturing	-0.705	0.000	0.494	-0.380	0.000	0.684
		Trade	-0.561	0.000	0.570	-0.234	0.020	0.791
		Services	-0.207	0.003	0.813	-0.014	0.085	0.987
Size of Economic Unit	Micro-enterprises	Small	-2.378	0.000	0.093	-2.431	0.000	0.088
		Medium	-3.605	0.000	0.027	-3.764	0.000	0.023
		Large	-4.488	0.000	0.011	-4.716	0.000	0.009
		Government	-2.927	0.000	0.054	-2.821	0.000	0.060
Constant			4.213	0.000	67.563	4.008	0.000	55.050
N				159,315			128,060	
Pseudo R2				0.4235			0.4368	

Source: Own elaboration with ENOE microdata in Stata 16.

As has been mentioned, an econometric model was done for each year under analysis. Both models presented an adequate goodness of fit, with a Pseudo R2 of 0.42 for 2020T1 and 0.43 for 2021T1. The Hausman and Wise test shows a low correlation coefficient, close to zero, and thus the possible

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[12] A better interpretation of the odds ratios, with values less than 1, requires the calculation of the inverse, obtained by dividing the unit by the obtained odds ratio. This would provide the number of times in which the probability of occurrence of the independent variable decreases or increases.

presence of endogeneity was discarded. Finally, it is noted that all variables were statistically significant and had the expected sign.

In general terms, the results show consistency with the micro and macro determinants of labor informality, even a year into the Covid-19 health emergency, in terms of both the expected sign and the literature, as the characteristics that increase the probability of informal work are those corresponding to the base or reference categories. The micro determinants are: being a woman, aged between 15 and 24, uneducated, income of between 1 and 3 minimum wages, and self-employed worker. The macro characteristics include: work in the agricultural or construction sector and work in micro enterprises.

The odds ratio analysis reflects the behavior between the *contrast categories* and the degree to which they reduce the probability of informality, with *respect* to the *base categories* presented above. No relevant changes are observed in the *micro* characteristics during the period of analysis, and thus, on average, both years have the same probabilities:

· The categories that most decrease the probability of informality in both years are: higher education levels (4.8 times) in comparison with no education; being an employer (4.5 times) rather than a self-employed worker; being between 45-64 years of age or over 65 (between 3.5 and 3.2 times, respectively) in comparison with young people between the ages of 15 and 24.

· Characteristics that are least likely to decrease the probability of informality are: being a man (1.2 times) rather than a woman; having a primary or secondary education level (between 1.5 and 2.4 times) rather than no education; an income of more than 3 minimum wages (2.5 times) in comparison with an income of between 1 and 3 minimum wages; being a dependent, remunerated worker (1.2 times) rather than a self-employed worker.

With regards to the macro determinants, specifically those related to the size of the economic unit, these show a high probability of reducing informality, with respect to the reference category. In addition, they demonstrate significant differences between the two years. Below, categories with important changes are presented for both years, while data without significant changes will remain rounded:

· The categories that most decrease the probability of informality are those that refer to the size of the economic unit: belonging to a large enterprise increases from 88.96 times in 2020 to 111.69 times in 2021, that is, from one year to the next, large companies are 22.73 times less likely to fall into informality compared to micro enterprises; medium businesses increased from 36.77 times in 2020 to 43.11 times in 2021, that is, they were 6.34 times less likely to be informal than micro-enterprises in the period.

· Characteristics that were least likely to decrease this probability in both years were: belonging to micro-enterprises and the government (between 11 and 17.7 times) in comparison to small enterprises; participating in

manufacturing, trade, and services (1.7, 1.5 and 1.1 times, respectively) in comparison to agriculture.

· In the only special case, the characteristic that increased the probability of informal labor was participating in construction in comparison to agriculture, by 1.44 times in 2020 and by 2 in 2021. That is, this characteristic demonstrated an increase of 0.5 times the probability of informal work in comparison with agriculture.

In conclusion, the results obtained from the econometric model show that one year into the Covid-19 health crisis, the determinants of labor informality in Mexico generally show no substantive changes in terms of micro characteristics, with some important changes in macro characteristics.

It has been demonstrated that so-called vulnerable groups (women, young people -15-24 years-, uneducated workers, self-employed workers, and those earning less than 3 minimum wages) have a greater probability of informal work in comparison with the rest of the categories, with no changes between the two years under study.

However, the results do show some important changes in structural macro characteristics. Workers in large and medium sized enterprises decreased their probability of informal labor in comparison with micro enterprises during the period under analysis, suggesting a greater resilience of the former within the context of the crisis. No major changes were evident between one year and the next by branch of employment with the exception of construction, which showed an increased probability of informality compared with agriculture in 2021.

FINAL REFLECTIONS

The analysis shows that the recovery of work and employment in Mexico during the first year of the crisis resulting from the Covid-19 pandemic was still affected by the severe impact of the confinement. This is reflected in the situation which we refer to as a spurious *formalization* given that the loss of informal jobs was greater than those of formal employment.

Some of the variables linked to workers' attributes show that the most vulnerable groups- young people, women, and those with low schooling levels- were most affected by the economic crisis, both in terms of employment levels as well as regarding their income.

The logit model shows continuity on the micro level and certain changes on the macro level, essentially reflecting the greater resilience of large enterprises.

These results should, however, be taken with caution as with the application of different methodologies, additional complementary results may be obtained.

The most important challenge in the immediate future will be the creation of better paid jobs that include benefits, that is, formal employment which, in the period under analysis, increased intermittently without fully recovering all that had been lost. In contrast, in July 2021, labor informality had exceeded the percentages of March 2020, increasing during this period from 55.7% to 56.4%.

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