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Effects of the Covid-19 Pandemic on the Colombian Labor Market: Disentangling the Effect of Sector-Specific Mobility Restrictions

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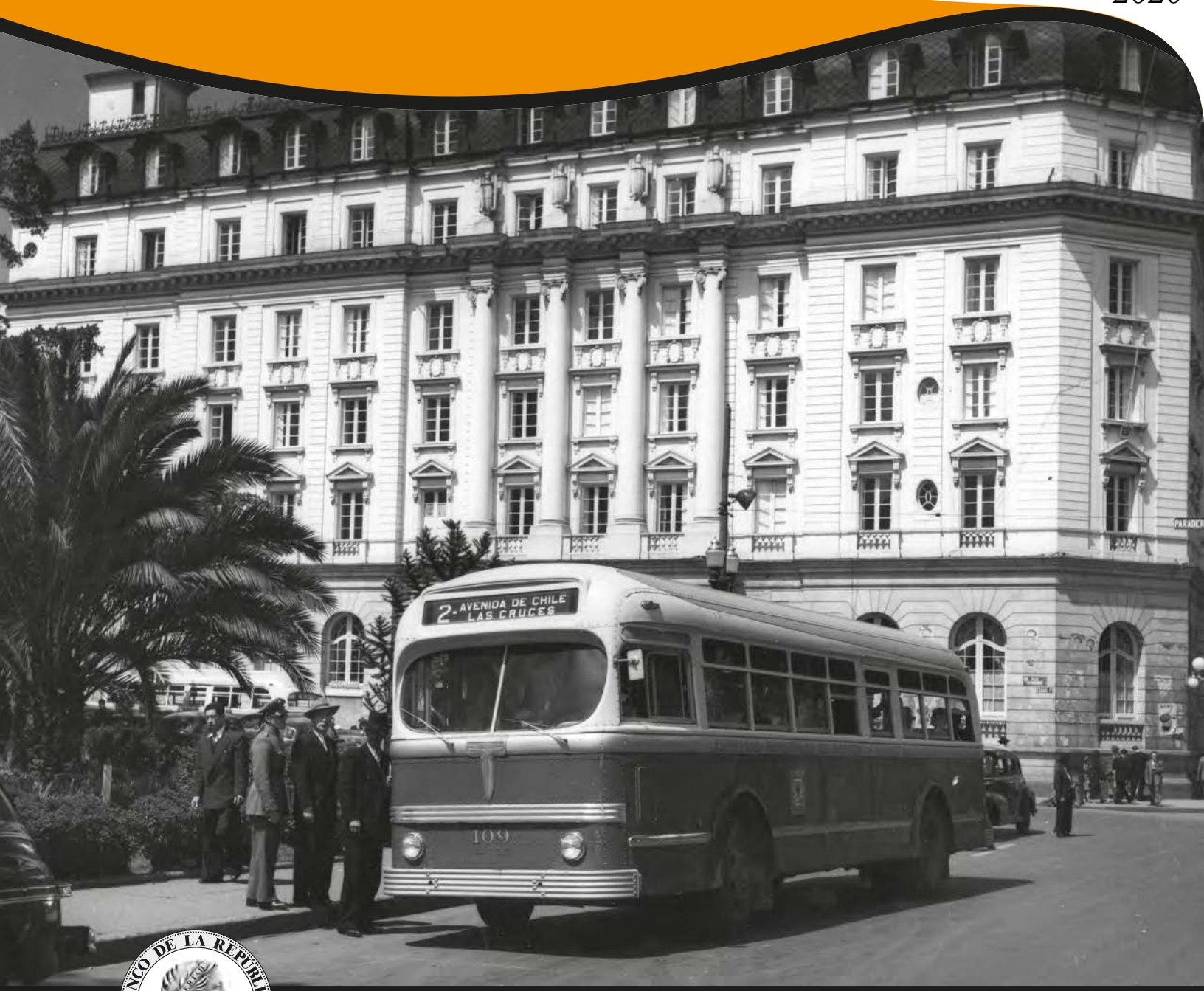

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Efectos de la pandemia por Covid-19 en el mercado laboral colombiano: identificando el impacto de las restricciones sectoriales a la movilidad

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Resumen

En este trabajo evaluamos el efecto de la pandemia de Covid-19 y las restricciones de movilidad sectoriales en el mercado laboral colombiano. Para identificar el efecto de estas políticas, explotamos la variación en el empleo y salarios en los sectores excluidos y no excluidos de las restricciones a la movilidad, así como el momento de su implementación. Las restricciones sectoriales a la movilidad tienen efectos negativos en el empleo, representando aproximadamente una cuarta parte de la pérdida total de empleo entre febrero y abril de 2020. Los patrones regionales de propagación de la enfermedad y otros componentes epidemiológicos y económicos, que afectaron al país durante este período, representan las tres cuartas partes restantes de la pérdida de empleos. Por lo tanto, debemos esperar importantes pérdidas de empleo incluso en ausencia de dichas restricciones. No encontramos un efecto significativo en el promedio de horas trabajadas o los salarios, lo que indica que la mayor parte del ajuste del mercado laboral tuvo lugar en el margen extensivo (empleos). Además, las restricciones a la movilidad sectoriales afectan principalmente a los trabajadores asalariados, mientras que el trabajo por cuenta propia responde principalmente a la propagación de la enfermedad.

Keywords: Covid-19, mobility restrictions, labor market, employment.

JEL codes: I14, I18, J21

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Abstract

We assess the effect of the Covid-19 pandemic and the lockdown of some economic sectors on the Colombian labor market. We exploit the variation between excluded and non-excluded sectors from the lockdown, as well as the timing of the restriction policies, to identify the effect of sector-specific restriction policies. These restrictions had negative effects on employment, accounting for approximately a quarter of the total job loss between February and April of 2020; the remaining three quarters of the job losses could be attributed to the regional patterns of the disease spread, and other epidemiological and economic factors affecting the whole country during this period. Therefore, we should expect important employment losses even in the absence of such restrictions. In contrast, we find no significant effect of sector-specific restrictions on average worked hours or wages, indicating that most of the adjustment of the labor market took place in the extensive margin. Moreover, sector-specific restrictions only affect salaried workers, while self-employment is more responsive to the disease spread.

Keywords: Covid-19, mobility restrictions, labor market, employment.

JEL codes: I14, I18, J21

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1. Introduction

The Covid-19 pandemic is one of the most disruptive events the world has faced in recent history. By the end of June of 2020, More than 10 million people have been infected, and almost half a million people have died worldwide and the number is still growing.[1] In order to flatten the contagion curve and improve the health system capacity, most countries had to implement lockdowns with different types of mobility restriction policies. These restrictions, along with the sanitary crisis itself, triggered an unprecedented global economic crisis, with particularly alarming effects on employment.

This paper assesses the impact of the pandemic on the colombian labor market, emphasizing the role of sector-specific mobility restrictions implied by the lockdown. As in other countries, some sectors considered essential were authorized to continue operating, while the rest faced severe restrictions. Using this source of variation, we estimate difference-in-differences and event-study models to assess the impact of these restrictions on employment, hours worked, and wages. Our empirical framework also controls for regional variation in the disease spread, time fixed effects accounting for other epidemiological and economic factors affecting the whole country, and sector and city fixed effects capturing their observed and non-observed time-invariant characteristics.

Our results indicate that sector-specific restrictions had a negative effect on employment. On average, employment fell 13.9% more in non-excluded sectors from the lockdown. A back-to-the-envelope calculation suggests this effect accounts for almost one-quarter of the total employment loss between February and April. The remaining three quarters of the job losses could be attributed to the regional patterns of the disease spread, and other epidemiological and economic factors affecting the whole country during this period. These latter factors, captured by the time fixed-effects coefficients, include all common shocks that hit the labor market during the pandemic crisis. For example, the impact of general mobility restrictions, the average impact of the fear to contagion in the behavioural responses of the agents, and the aggregate impact of external macroeconomic shocks as commodity prices, trade or remittances. The impact of sectorial mobility restrictions could generate spill-over effects affecting both excluded and affected sectors, these would be included in the time fixed effects

[1] Data from https://ourworldindata.org/.

as well. We cannot disentangle all the components captured in the time fixed effects; nevertheless, we estimate negative and significant coefficients of time dummy variables after the declaration of the pandemic. Therefore, we should expect important employment losses even in the absence of sector-specific restrictions. Furthermore, in the absence of sectoral restrictions, the spread of the disease could possibly have been greater, which in turns implies negative effects on economic activity and employment.

We then assess the impact of the sector-specific restrictions on the average number of hours worked and wages, finding no significant effects. This implies that most of the adjustment took place in the extensive margin. Moreover, the effects on employment are mainly driven by salaried workers, while self-employment is more responsive to the disease spread. Combined, these results suggest that rigidities in the labor market may amplify the impact of mobility restrictions.

Our paper contributes to growing literature on the labor market effects of lockdown policies. Most of the existing studies indicate that mobility restrictions account for only a fraction of labor markets weakening during the pandemic crisis. Other factors, such as the negative aggregate effect of the disease itself, play an important role (Aum, Lee, & Shin, 2020; Kahn, Lange, & Wiczer, 2020; Gupta, et al., 2020; Rojas et al., 2020; Goolsbee & Syverson, 2020). While most of the literature has focused on developed economies, this paper is, up to the best of our knowledge, the first to quantify this effect in a developing economy. The case of emerging countries is inherently interesting because several reasons. First, developing economies are characterized by a high prevalence of informality. The informal segment of the labor market is usually more flexible because official regulations are difficult to enforce, nevertheless, job quality in informal market is poor (Morales, Hermida, and Davalos, 2019), and informal jobs might be more vulnerable in the pandemic economic crisis (Eslava and Isaacs, 2020). Hence, the response of such segmented labor markets to lockdown policies may differ to a large extent from the response observed in developed countries. Second, in many emerging economies the timing of the strict lockdown policies relative to the disease spread was different with respect to the developed world. Particularly, lockdowns were implemented long before the arrival of the disease peak, a setting that could be more

favourable to isolate the effect of sector-specific mobility restrictions from the own effects of disease propagation.

The remaining of the paper is organized as follows. Section 2 summarizes the existing evidence on the pandemic, the lockdown policies, and their impact on the labor market. Section 3 briefly describes the Colombian mobility restriction policies. In Section 4, we describe our data and the empirical strategy. In Section 5, we present the results, and finally, Section 6 concludes.

2. Covid-19 pandemic, lockdown policies, and labor market

On December 31 of 2019, Chinese authorities reported to the World Health Organization (WHO) the appearance of cases of rare pneumonia in the eastern region of China; the epidemiological origins of this sickness were unknown. On January 7 of 2020, Chinese authorities reported a new virus, initially called 2019-nCoV, which caused the respiratory disease Covid-19. On January 13, the first case of Covid-19 was detected outside of China (in Thailand), and by January 31, 18 different countries had already reported the first case of Covid-19 within their borders (Kumar et al., 2020). On March 6, the first case was detected in Colombia, while on March 11, the WHO declared Covid-19 as a pandemic, at that time more than 118 thousand cases had been detected worldwide (RML, 2020). As of June 30, there were over 9 million positive cases reported worldwide, of which 505 thousand have died[2]

In order to flatten the contagion curve and improve the health system capacity, most countries have implemented different policies of lockdown over the last months. Evidence suggests that these measures have effectively reduced mobility in public places, which in turns has decreased the number of positive cases and deaths (Engle et al. 2020; Fang et al., 2020; Gleaser et al., 2020; Kraemer et al., 2020; Nuriya, 2020; Yilmazkuday, 2020). Even in countries without mandatory restrictions measures, such as Korea and Sweden, mobility has fallen, reflecting that individual also take precautionary measures to prevent contagion (Aum, Lee, & Shin, 2020).

[2] Data from https://ourworldindata.org/

Both the pandemic and lockdown policies may have negative effects on the labor market. On the one hand, the disease, and the fear of contagion, can increase work absenteeism, reducing consumption and investment, and destroying jobs. On the other hand, the lockdown policies may constrain economic activity, both on the demand and the supply side. In most countries, some sectors considered essential, such as agriculture and public utilities, were authorized to continue operating. The rest of the economy was restricted, which considerable effects on employment, as firms reduced their payroll size during the lockdown periods. Finally, there is a whole set of external macroeconomic shocks and homogeneous general equilibrium effects that might have hurt the economy as well. For instance, numerous countries were affected by a sharp reduction in international trade, remittances, as well as instability in commodity prices and exchange rates.

In the international literature on the effects of Covid-19 pandemic, there are several studies that analyze the pandemic's effect on labor market outcomes.[3] Some of these find negative effects of lockdown policies, but generally, lockdown effects explain just partially the deterioration of labor market results. For instance, Rojas et al. (2020) show that lockdown policies only partly explain the increase in unemployment in the United Sates (US). Kahn et al. (2020) argue that the collapse of US labor market is generalized, and there is weak evidence that States that implemented stay-at-home policies earlier had better labor market results. In contrast, Gupta et al. (2020), using variation in the timing of implementation of lockdown policies for different states in the US, found that per every ten days of extension in stay-at-home mandates the employment rate falls 1.7pp.

Some other studies for countries where no restriction to mobility policies were implemented document sizeable effects of the pandemic on the labor market outcomes. For instance, Aum et al. (2020) exploit the regional variation of the Covid-19 outbreak in Korea, one of the few countries that has not implemented lockdown policies. Their results indicate that, even in the absence of mobility restrictions, the outbreak still has sizeable effects on employment; an increase of 0.1 percent in infections has a causal effect of a reduction of 2 to 3 percent. Even though the effect found in Aum et al. (2020) is sizeable, it accounts for less than half the reduction in employment per 0.1 percent of increase in infections observed in the United

[3] See for instance Béland et al. (2020c); Coibion et al., 2020a; Kahn et al., (2020)

States or the United Kindom, countries in which lockdowns were implemented (Cajner et al., 2020; Tedeschi and Bui, 2020; Gardiner and Slaughter, 2020). This might imply that lockdowns might affect employment, independent of the effect of the fear of sickness itself.

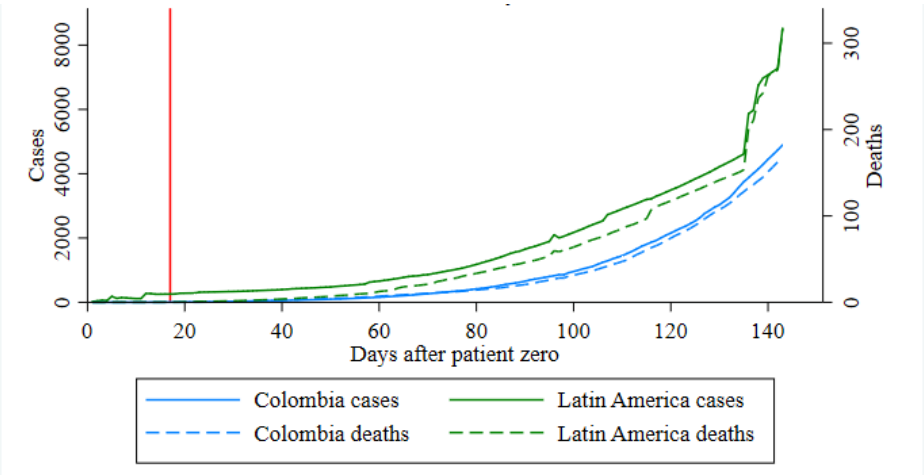
There are important additional studies, which analyze general aspects of pandemic's effects on labor markets. Adams-Prassl et al. (2020), Béland et al. (2020c), and Yasenov (2020) analyze the heterogeneity of the pandemic effects. These studies find considerably larger effects on low-skill workers and immigrants, who are more likely to have jobs that cannot be done remotely. Even though teleworking is an excellent strategy to save jobs and accomplish social distance, not all tasks might be done from home: Dingel and Neiman (2020) find that only 37% of jobs can feasibly be done from home. There is also evidence that suggests reallocations of workers from risky occupations (i.e. with face to face contact) to less risky ones, since individuals are less willing to engage in economic activities that require interaction with others (Béland, Brodeur &Wright, 2020; Goolsbee & Syverson, 2020). This structural change may imply a significant increase in frictional and long-term unemployment (Arango and Flórez, 2020) and would demand policies to improve the skills of the labor force toward digital and technological skills (Farné, 2020). For a more detailed survey on the economic literature on the pandemic's socio-economic effects, the reader might refer to Brodeur, Gray Islam, and Bhuiyan (2020).

3. The Colombian Case

By the end of June, in Colombia, approximately 95 thousand positive cases have been detected, and 3200 deaths have been reported. Comparatively, Colombia has fewer cases and deaths per million inhabitants than the average for the Latin American region (see Figure 1). As most countries in the region, Colombia implemented a lockdown policy relatively early in the disease spread. The first set of restrictions to mobility began in March 25th of 2020 (Decree 457 of 2020), when there were only 378 reported positive cases and 3 deaths. The government introduced a quarantine for all individuals except those working in a small set of sectors classified as essential, which were authorized to continue working under distance and protection measures. These include public administration, the finance sector, agriculture, and the public utilities sector, among others. In Figure 2, we show a measure of the intensity

of the lockdown based on the employment size of non-excluded sub-sectors from the policy; sectors as hotels, restaurants, and artistic activities were utterly isolated.

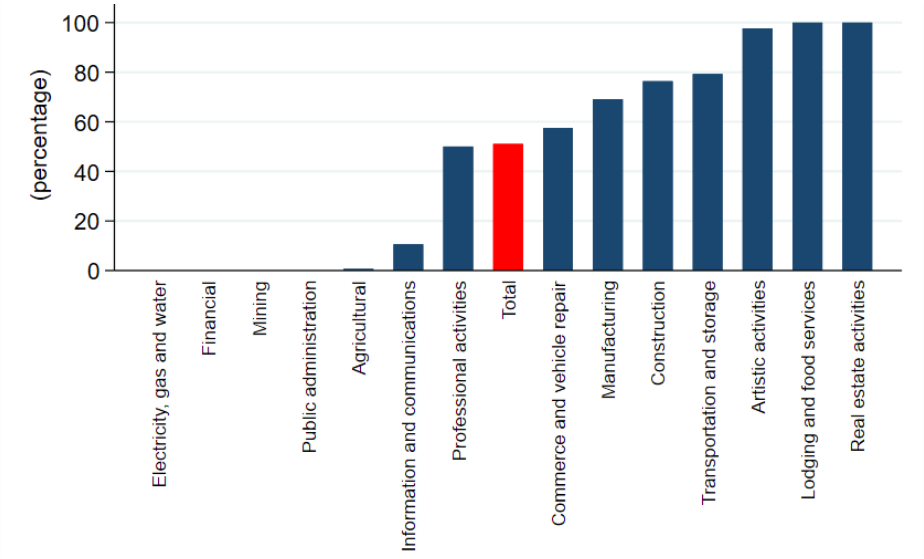
Figure 1: Covid-19 cases and deaths in Colombia and Latin American average



Notes: Cases and deaths per million. Red line indicates the beginning of the lockdown policies in Colombia.

Source: Our World in Data https://ourworldindata.org/.

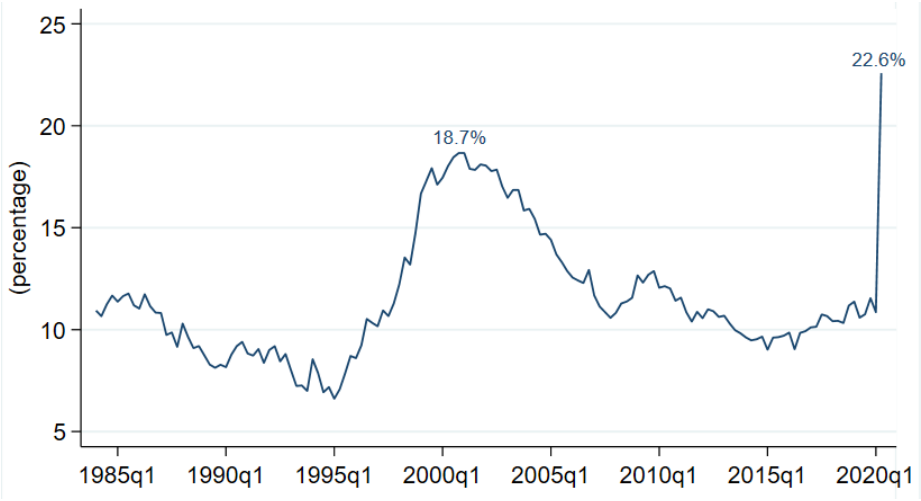
Figure 2. Intensity of lockdown



Source: Calculations by the authors based on data from DANE (GEIH).

The pandemic and the mobility restrictions on the economy have had a large impact on the economy. The prediction of the Colombian Central Bank for GDP growth for 2020 is in a range between -2.6% and -7% (Banco de la República, 2020), which reveals that the Covid-19 crisis could derive in the worst economic depression in modern Colombian history. In the second quarter of 2020, the country registered its highest urban unemployment rate in recent history, 24.6% (Figure 3).

Figure 3. Seven largest cities Unemployment Rate.



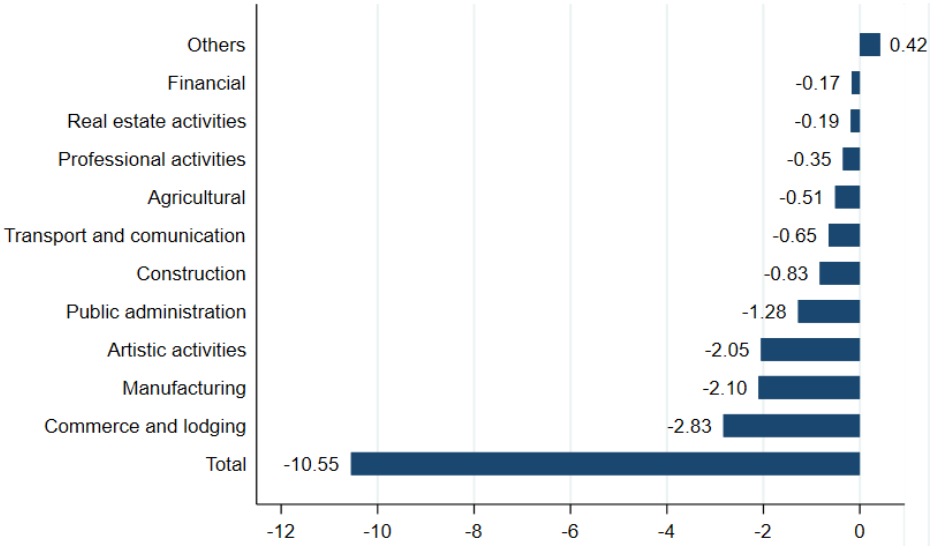
Notes: the data for the second quarter of 2020 corresponds to the April-May average. Seasonally adjusted quarterly moving average. The seven cities are: Bogotá, Cali, Medellín, Barranquilla, Bucaramanga, Manizales and Pasto.

Source: Calculation by the authors based on data from DANE (GEIH).

Figure 4 shows the contribution of each sector to the total annual growth change in employment in April 2020 (-10.55%). Sectors with more (less) subsectors excluded from the lockdown are the ones with the smaller (higher) contribution to the reduction in employment. For example, the highest contribution to the reduction was observed in the sector of hotels and trade, one of the most intensely affected by the isolation policies. In Figure 5, we present the distribution of the employment growth rate between February and April 2020 for

excluded and non-excluded subsectors. There is a larger mass of negative growth realizations in the case of excluded sub-segments than for non-excluded ones. Finally, in Figure 6, we show box plots for the employment growth rate of February-April 2020; in each of the 23 main metropolitan areas in Colombia, hereafter referred as cities. The excluded sub-sectors experience more significant employment reductions, which is the case for almost all cities.

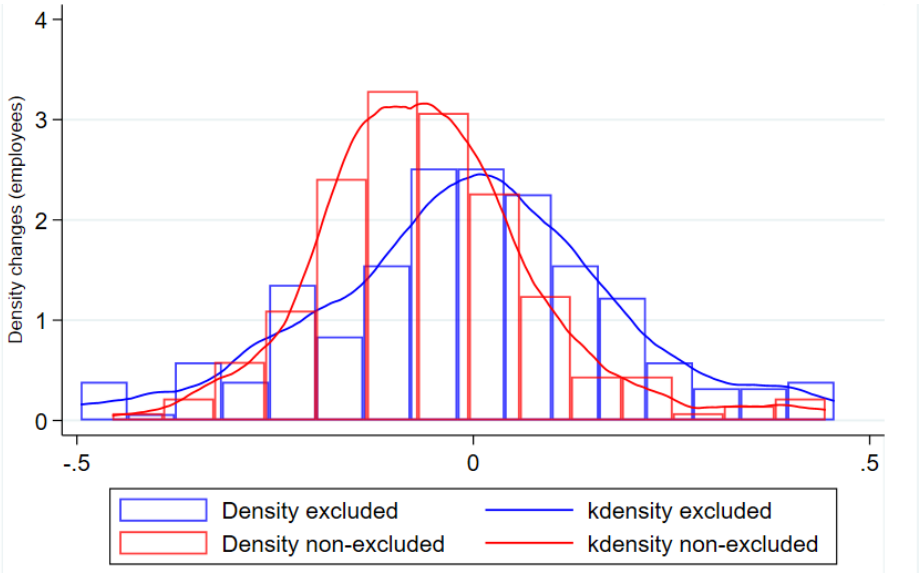
Figure 4. Contribution to the total employment annual growth change (apr. 2019 – apr.2020)



Notes: Seasonally adjusted quarterly moving average.

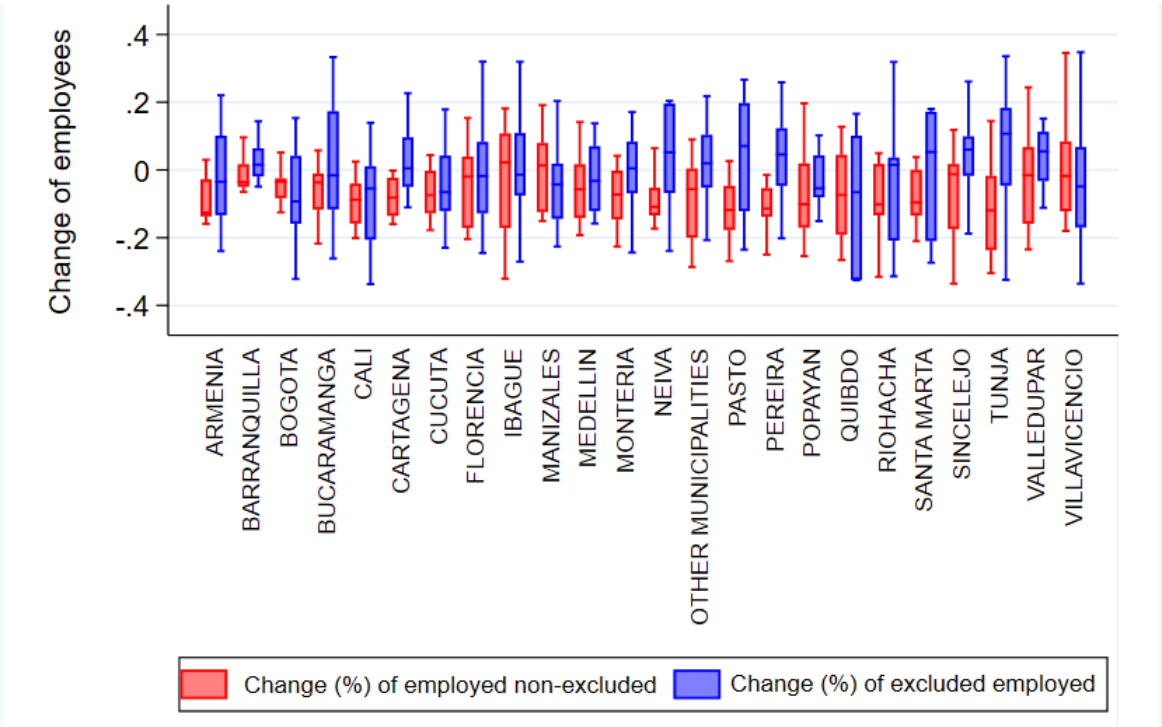
Source: Calculations by the authors based on data from DANE (GEIH)

Figure 5. Growth (%) density of employees by non-excluded and excluded sectors



Source: Calculations by the authors based on data from DANE (GEIH).

Figure 6. Change (%) of employees by non-excluded and excluded sector in each city.



Source: Calculations by the authors based on data from DANE (GEIH).

4. Data and empirical strategy

4.1. Data

Our analysis is based on data from the Colombian National Household Survey (GEIH) collected by the Bureau of National Statistics (DANE) on a monthly basis. This survey is the official source for the computation of the unemployment rate, and any other labor market statistics in Colombia; it is representative of the 23 cities in Colombia, and other municipalities and rural areas. The survey is also representative of a broad aggregation of economic activities. For the primary analysis in this paper, we classify 4-digit ISIC activities between excluded and non-excluded from the lockdown policy and add up their employment for each of the 23 cities and an aggregate of the rest of small municipalities and rural areas. We aggregate the data using 2-months moving averages to avoid representativeness problems. In our robustness checks, we show that our main results hold when we use monthly data or aggregate data using 3-months moving averages.

Table 1 presents the summary statistics of the sample we use for our estimations. The unit of study is an economic subsector in a given city; the subsector is the result of dividing a 2-digit ISIC sector in its excluded and non-excluded (by the lockdown policy) components. Summary statistics show that around 45% of the subsectors were non-excluded of the mobility restrictions. On average, hourly wages were 4365 COP in January (1.3 USD) and by April, hourly wages were roughly the same. In contrast, average subsector employment in February was 42398 employees, and by April, it had reduced to 37255. Finally, Table 1 shows that in February, there were not Covid-19 cases or deaths in Colombia.

Our measures of Covid-19 evolution, contagions and deaths, come from the Colombian Health National Institution (INS acronym in Spanish). Throughout the INS, the Colombian government publishes daily updates on the positive cases and deaths, both at a national and a regional level, and the media regularly report these statistics. We should, therefore, expect individuals to incorporate this information into their decision-making process. By April, the cases and deaths per million of the working-age population were 161.3 and 9.4.

Table 1. Summary Statistics

	Observations	Mean	Std. Dev.	Min.	Max.
A. January (2020)					
Hourly Wage	528	4365,24	2343,69	0,00	20962,73
Employment	528	42398,90	180309,80	0,00	3413215
Non-excluded	528	0,45	0,50	0,00	1,00
% workers 25-45	528	38,28	1,48	35,38	41,12
Deaths per million in working age population	528	0,00	0,00	0,00	0,00
Cases per million in working age population	528	0,00	0,00	0,00	0,00
B. February (2020)					
Hourly Wage	528	4440,19	2526,23	0,00	26606,48
Employment	528	41850,50	176916,50	0,00	3359006
Non-excluded	528	0,45	0,50	0,00	1,00
% workers 25-45	528	38,21	1,48	35,41	40,57
Deaths per million in working age population	528	0,00	0,00	0,00	0,00
Cases per million in working age population	528	0,00	0,00	0,00	0,00
C. March (2020)					
Hourly Wage	528	4505,86	2574,06	0,00	24337,96
Employment	528	40435,66	169897,50	0,00	3207393
Non-excluded	528	0,45	0,50	0,00	1,00
% workers 25-45	528	38,04	1,63	35,29	41,10
Deaths per million in working age population	528	1,14	1,82	0,00	6,07
Cases per million in working age population	528	25,94	21,04	0,00	77,04
D. April (2020)					
Hourly Wage	528	4411,23	2829,28	0,00	27138,89
Employment	528	37255,13	162010,40	0,00	3111209
Non-excluded	528	0,45	0,50	0,00	1,00
% workers 25-45	528	37,92	1,64	35,33	41,07
Deaths per million in working age population	528	9,47	8,49	0,00	30,45
Cases per million in working age population	528	161,38	178,88	0,00	833,14

Source: Calculations by the authors based on data from DANE (GEIH).

4.2. Empirical Strategy

We exploit the variation in the excluded and non-excluded sectors, as well as the timing of the restriction policies, to disentangle the effect of sector-specific restriction policies from regional variations in disease spread, and all other aggregate shocks related to the pandemic. Our baseline specification is the following difference-in-differences model:

$$y_{jct} = \beta q_j * post_t + \gamma d_{ct} + \delta_t + \phi_{jc} + u_{jct} \qquad (1)$$

Where y_{jct} is the labor market outcome of sector j, in city c, and period t. The differential effect of sector-specific restrictions is captured by β, the coefficient of the interaction between q_j, which takes value 1 if sector j is restricted, and $post_t$, which is equal to 1 starting March 2020. Controls include d_{ct}, a time-varying measure of the regional variation in disease spread (positive cases or deaths per million) in city c and period t, and time fixed-effects (δ_t), hereafter referred as the aggregate shock, which account for any epidemiologic and economic factor that homogeneously affects the country's labor market in each period. These factors include: *i*) The impact of general mobility restrictions, as well as any multiplier effects affecting excluded and non-excluded sectors; *ii)* The average impact of the disease itself on work absenteeism, consumption, and investment decisions; *iii)* The impact of other external macroeconomic shocks related to the pandemic, including sharp variations in commodity prices, trade, and remittances. Since the sanitary crisis began in March in Colombia, we use February as the reference period. Finally, the models also control for sector-city fixed-effects (ϕ_{jc}), which account for the time-invariant observed and unobserved characteristics of each labor market. Errors are clustered at the sector-city level.

As a complementary analysis, we use events-study models to estimate the differential effect of the sector-specific restrictions in each period. Instead of interacting the restriction term with a post-treatment dummy, we interact it with a set of time dummy variables, excluding February. The estimated equation can be represented as:

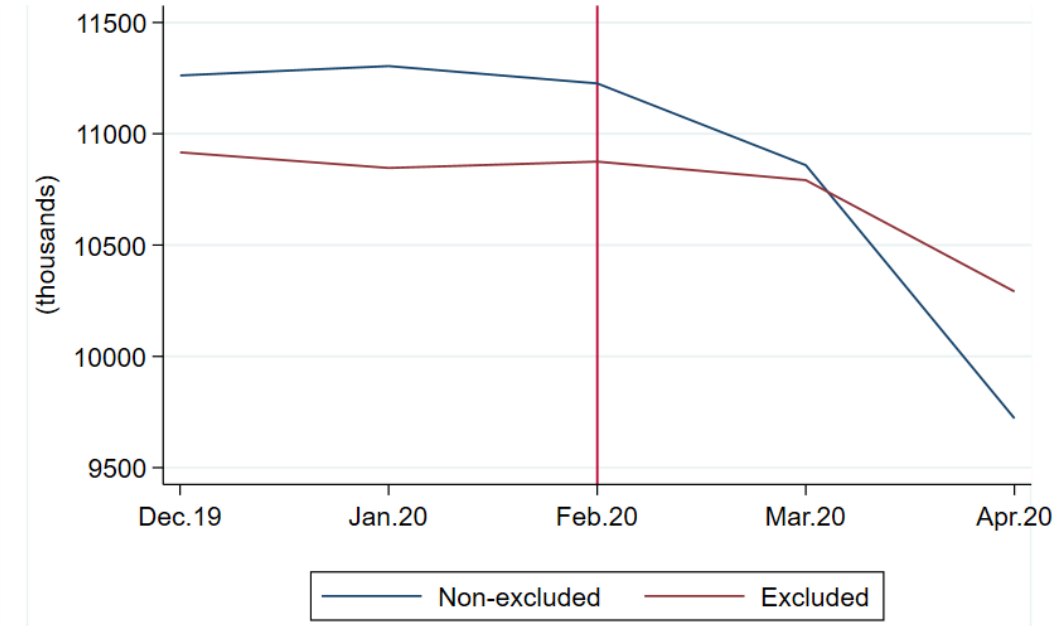
$$y_{jct} = \beta_t q_j * 1\{period = t\}_t + \gamma d_{ct} + \delta_t + \phi_{jc} + u_{jct} \qquad (2)$$

where, $1\{period = t\}$ is a dummy variable that is equal to one in the respective period and zero otherwise.

The effect of the sector-specific restrictions can be interpreted as causal as long as the common trends assumption is satisfied, i.e. the excluded and non-excluded sectors have similar employment trends before the policy was implemented. Figure 7 suggests that this is the case. In fact, employment in excluded and non-excluded sectors show parallel trends until February, and the difference between them grows in the following months. We provide further confirmation of the common trends assumption with the event study models presented

in the following section, which show no significant differences in employment between excluded and non-excluded sectors before February.

Figure 7. Level of employment



Notes: Seasonally adjusted quarterly moving average

Source: Calculations by the authors based on data from DANE (GEIH)

We identify at least two sources of potential bias for the regional variation in disease spread. First, virus testing capacity may vary by region, which could lead to serious measurement error, whether we use the positive confirmed cases or deaths metrics. Second, it is reasonable to assume that more active labor markets can contribute to the spread of the virus, which would lead to reverse causality. While we are not able to make causal claims, results do suggest that at least part of the shock is driven by the regional variation in the disease spread. Likewise, the aggregate impact of the broader set of mobility restrictions implied by the lockdown cannot be fully identified from other sources of variation. While it is reasonable to assume that general mobility restrictions have a direct negative effect on employment, they may also slow down the disease spread, which may in turn benefit the economy.

5. Results

We begin our analysis with the impact on employment in Table 2. In the first column, we focus on the aggregate shock, including only time and sector-city fixed-effects (equation (1)). The time fixed-effects are negatively and statistically significant for March and April, with estimated coefficients of -0.058 and -0.287. This is equivalent to an average job loss of 33.2% between February and April. In column 2, we add in the regression the interaction of our interest. While time fixed effects are now smaller and statistically insignificant in March, the coefficient that measures the effect of sector-specific restrictions is negative and significant. The estimated coefficient is -0.13, equivalent to 13.9% additional jobs loss in the non-excluded sectors relative to the excluded sectors. In a back-to-the-envelope calculation, we approximate the total impact of the sector-specific restrictions by multiplying the estimated coefficient by the share of the labor force in restricted sectors in February (51%).[4] Our results suggest that sector-specific restrictions are responsible for approximately 6.6 pp, less than a quarter of the total February-April job losses.

In columns 3 and 4, we include the regional variation of the disease spread, measured with city-level indicators of Covid-19 confirmed cases and deaths. We consistently find that the time fixed-effects coefficients are smaller in magnitude and significance, while the disease coefficients are negative and significant. The change in the time fixed-effect coefficient is considerably larger when we use the deaths measure, suggesting that labor markets are more responsive to deaths than positive cases. When we multiply the estimated coefficients for deaths by the average deaths in April (5.3), we find that the regional variation of the disease spread accounts for approximately 7 pp. While these results cannot be interpreted causally, they suggest that a non-trivial part of the pandemic effects on employment is related to the disease itself, which implies that controlling the virus should have positive effects on employment.

In the last two columns, we include all the variables in the model, finding similar coefficients for the sector-specific restrictions and the regional variation in the disease spread. While the time fixed-effects are considerably smaller, with estimated coefficients for April between -

[4] Recent literature warns about calculations that extrapolate from well-identified elasticities to aggregates, because the economic channels and shocks at the level of the variations used to identify the elasticities can differ from the ones present at the aggregate level (Beraja, Hust and Ospina, 2019). For this reason, we consider this calculation as a very approximate decomposition.

0.101 and -0.174, they still account for most of the variation in employment during this period.

Overall, results suggest that we should expect important employment losses even in the absence of sector-specific restrictions. These findings are consistent with recent papers showing modest effect of the lockdown policies compared to those of the disease itself and other economic factors related to the pandemic (Aum, Lee, & Shin, 2020; Kahn, Lange, & Wiczer, 2020; Gupta, et al., 2020; Rojas et al., 2020; Goolsbee & Syverson, 2020).

Our estimates are robust to alternative specifications of the model. In Appendix Table A, we use February's employment share as weights. While the estimated coefficients for the time fixed-effects and the sector-specific restrictions are smaller in magnitude, they are similar in terms of significance and relative contribution to the total change in employment. We also estimate the model using monthly and 3-month moving averages employment measures in Appendix Tables B and C. As expected, the magnitude of the aggregate effect decreases as we smooth our employment measures, and so does the sector-specific restriction coefficient. However, the significance and relative contribution to the total change in employment is similar across specifications. In contrast, the effect of the regional disease spread is no longer significant in the models using monthly measures.

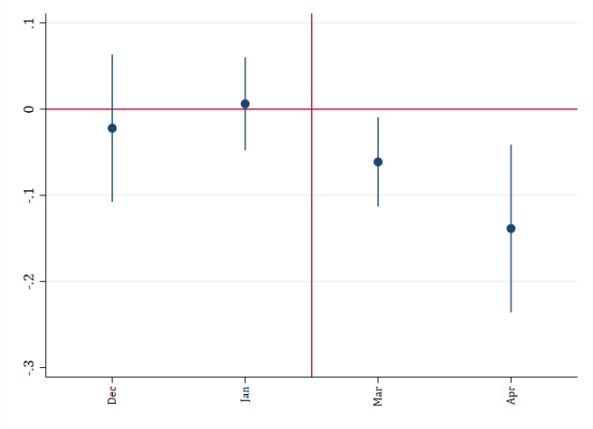
We further explore the dynamic impact of sector-specific restriction policies using an event study design that interacts q_j with the time fixed-effect variables (equation 2), in Figure 8 (Regression results are presented in Appendix Table D). The first thing to be noticed is that the estimated effects are small in magnitude and statistically insignificant before the policy was enacted. This confirms that there are common trends, and the model assumptions hold. The sector-specific restrictions effects are particularly large in April, with estimated coefficients oscillating between -0.07 and -0.15 depending on the model specification. The coefficients are also negative in March, although smaller in magnitude and significance, reflecting that the policy was only in place during the last days of the month.

Table 2: Log of Employment Regressions

	Log. Employment	Log. Employment	Log. Employment	Log. Employment	Log. Employment	Log. Employment
Restricted x Post		-0.1305**			-0.1305**	-0.1305**
		(0.0584)			(0.0583)	(0.0581)
Share reported deaths				-0.0133***		-0.0133***
				(0.0044)		(0.0043)
Share reported cases			-0.0003**		-0.0003**	
			(0.0002)		(0.0001)	
December (2019)	-0.0194	-0.0194	-0.0194	-0.0194	-0.0194	-0.0194
	(0.0376)	(0.0376)	(0.0376)	(0.0376)	(0.0376)	(0.0376)
January (2020)	-0.0382	-0.0382	-0.0382	-0.0382	-0.0382	-0.0382
	(0.0351)	(0.0351)	(0.0351)	(0.0351)	(0.0351)	(0.0351)
March (2020)	-0.0589**	0.0004	-0.0503*	-0.0437*	0.0090	0.0156
	(0.0249)	(0.0339)	(0.0256)	(0.0255)	(0.0346)	(0.0342)
April (2020)	-0.2870***	-0.2277***	-0.2334***	-0.1608***	-0.1741***	-0.1015*
	(0.0469)	(0.0506)	(0.0508)	(0.0546)	(0.0550)	(0.0568)
Constant	8.4915***	8.4915***	8.4915***	8.4915***	8.4915***	8.4915***
	(0.0225)	(0.0225)	(0.0225)	(0.0224)	(0.0225)	(0.0224)
Observations	2,640	2,640	2,640	2,640	2,640	2,640
R-squared	0.9535	0.9536	0.9536	0.9538	0.9537	0.9539

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. The variable Restricted x Post represents the interaction between q_j, which takes value 1 if sector j is restricted, and $post_t$, which is equal to 1 starting in March 2020. Share report deaths and Share report cases stand for reported deaths and cases per one million working-age population in each city, respectively. In the fixed-effects by period our base month is February (2020). Standard errors are presented in parentheses and clustered at the city-sector level.

Figure 8. Event Study coefficients log of employment



Notes: Dots represent the point estimate, with a 99% confidence interval. The regression is weighted by the share of employment of each sector in total employment.

Worked Hours and wages

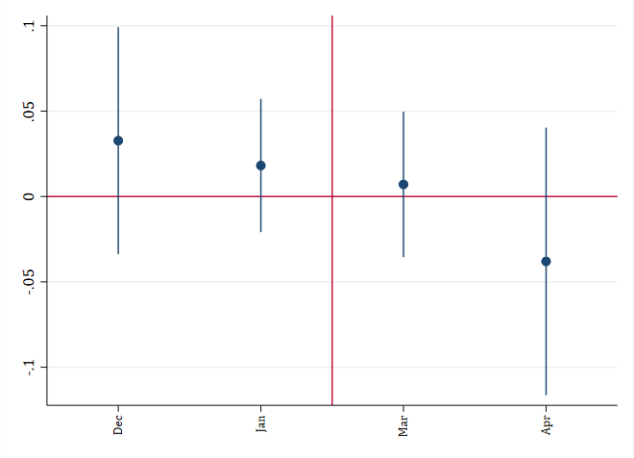
We assess whether the sanitary crisis and the sector-specific restrictions also affect the number of hours worked. Table 3 presents the effect on average hours worked, where each column presents the results from the same specifications used for employment. We find that the aggregated shock and the regional deaths measure have negative, although smaller effects. However, the sector-specific restrictions are smaller in magnitude and no longer significant. We estimate the impact on wages in Table 4, finding similar results. While the aggregate shock and the regional covid-related deaths have large, negative effects on wages, the sector-specific restrictions coefficients are in comparison small and statistically insignificant. When we explore the dynamic impact of sector-specific restriction policies using an event study design (see Figures 9 and 10), the coefficients are statistically insignificant in all periods. These results suggest that most of the impact of the sector-specific restrictions took place in the extensive margin, with no effects on average worked hours or wages.

Table 3. Average worked hours regressions.

	Log. Average hours	Log. Average hours	Log. Average hours	Log. Average hours	Log. Average hours	Log. Average hours
Restricted x Post		-0.0283			-0.0283	-0.0283
		(0.0366)			(0.0366)	(0.0365)
Share reported deaths				-0.0069**		-0.0069**
				(0.0030)		(0.0030)
Share reported cases			-0.0001		-0.0001	
			(0.0001)		(0.0001)	
December (2019)	-0.0208	-0.0208	-0.0208	-0.0208	-0.0208	-0.0208
	(0.0204)	(0.0204)	(0.0204)	(0.0204)	(0.0204)	(0.0204)
January (2020)	-0.0204	-0.0204	-0.0204	-0.0204	-0.0204	-0.0204
	(0.0188)	(0.0188)	(0.0188)	(0.0188)	(0.0188)	(0.0188)
March (2020)	-0.0215	-0.0086	-0.0186	-0.0136	-0.0057	-0.0008
	(0.0149)	(0.0197)	(0.0154)	(0.0154)	(0.0202)	(0.0205)
April (2020)	-0.0799***	-0.0671**	-0.0617**	-0.0146	-0.0489	-0.0017
	(0.0279)	(0.0283)	(0.0312)	(0.0348)	(0.0321)	(0.0368)
Constant	3.6767***	3.6767***	3.6767***	3.6767***	3.6767***	3.6767***
	(0.0125)	(0.0125)	(0.0125)	(0.0124)	(0.0125)	(0.0124)
Observations	2,640	2,640	2,640	2,640	2,640	2,640
R-squared	0.8278	0.8279	0.8279	0.8287	0.8280	0.8288

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. The variable Restricted x Post represents the interaction between q_j, which takes value 1 if sector j is restricted, and $post_t$, which is equal to 1 starting in March 2020. Share report deaths and Share report cases stand for reported deaths and cases per one million working-age population in each city, respectively. In the fixed-effects by period our base month is February (2020). Standard errors are presented in parentheses and clustered at the city-sector level.

Figure 9. Event Study coefficients log of average worked hours



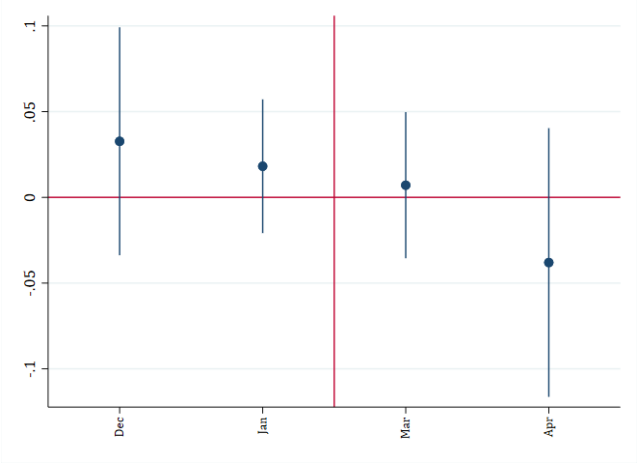
Notes: Dots represent the point estimate, with a 99% confidence interval. The regression is weighted by the share of employment of each sector in total employment.

Table 4. Hourly wage regressions

	Log. Hourly wage	Log. Hourly wage	Log. Hourly wage	Log. Hourly wage	Log. Hourly wage	Log. Hourly wage
Restricted x Post		-0.0368			-0.0368	-0.0368
		(0.0810)			(0.0810)	(0.0807)
Share reported deaths				-0.0162**		-0.0162**
				(0.0070)		(0.0070)
Share reported cases			-0.0003		-0.0003	
			(0.0002)		(0.0002)	
December (2019)	-0.0894*	-0.0894*	-0.0894*	-0.0894*	-0.0894*	-0.0894*
	(0.0517)	(0.0517)	(0.0517)	(0.0517)	(0.0518)	(0.0518)
January (2020)	-0.0792*	-0.0792*	-0.0792*	-0.0792*	-0.0792*	-0.0792*
	(0.0443)	(0.0443)	(0.0443)	(0.0443)	(0.0443)	(0.0443)
March (2020)	-0.0195	-0.0028	-0.0120	-0.0011	0.0047	0.0156
	(0.0328)	(0.0443)	(0.0337)	(0.0338)	(0.0451)	(0.0459)
April (2020)	-0.2277***	-0.2110***	-0.1804**	-0.0741	-0.1637**	-0.0574
	(0.0664)	(0.0676)	(0.0720)	(0.0806)	(0.0737)	(0.0855)
Constant	8.0091***	8.0091***	8.0091***	8.0091***	8.0091***	8.0091***
	(0.0299)	(0.0299)	(0.0298)	(0.0297)	(0.0298)	(0.0297)
Observations	2,640	2,640	2,640	2,640	2,640	2,640
R-squared	0.8025	0.8025	0.8027	0.8035	0.8027	0.8035

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. The variable Restricted x Post represents the interaction between q_j, which takes value 1 if sector j is restricted, and $post_t$, which is equal to 1 starting in March 2020. Share report deaths and Share report cases stand for reported deaths and cases per one million working-age population in each city, respectively. In the fixed-effects by period our base month is February (2020). Standard errors are presented in parentheses and clustered at the city-sector level.

Figure 10. Event Study coefficients for hourly wages



Notes: Dots represent the point estimate, with a 99% confidence interval. The regression is weighted by the share of employment of each sector in total employment.

Salaried and self-employed workers

Colombia has a particularly segmented labor market, in which there is a strong correlation between informality and self-employment[5]. Previous literature has argued that labor market regulation in developing economies might increase rigidity of the formal segment (Blanchard and Portugal, 2001; Flórez, Morales, Medina, Lobo, 2020). Given that self-employed workers face considerably less regulations, we should expect the sector-specific measures to be less binding in this segment. We test this hypothesis in Table 5, where we estimate the impact on salaried and self-employed employment. As expected, the impact of sector-specific restrictions on employment is entirely driven by the salaried segment, with estimated coefficients of -0.147. When we multiply the estimated coefficient by the share of the labor force in restricted sectors in February (48%), we find that sector-specific restrictions account for approximately 8pp of the total job loss in this labor market segment. In contrast, sector-specific restrictions have no effect on self-employment. These results, along with the lack of intensive margin effects, suggest that labor market rigidities, affecting mainly salaried workers, might be amplifying the effect of mobility restrictions.

[5] Approximately 80% of the self-employed workers do not pay mandatory social security contributions, and given the informal nature of their work they are not prone to strict compliance with labor regulation.

Interestingly, the regional variation in the disease spread is particularly relevant for self-employed workers, while the coefficient is smaller and statistically insignificant in the salaried segment. This may reflect that self-employed workers have more flexible jobs, in terms of for instance working hours, allowing them to further restrict mobility when local contagion increases.

Table 5. Employment Effects for Salaried and Self-employed Workers

	Log. Employment	Log. Employment	Log. Employment	Log. Employment	Log. Employment	Log. Employment
A. Salaried						
Restricted x Post		-0.1474**			-0.1474**	-0.1474**
		(0.0672)			(0.0672)	(0.0672)
Share reported deaths				-0.0075		-0.0075
				(0.0047)		(0.0047)
Share reported cases			-0.0001		-0.0001	
			(0.0002)		(0.0002)	
December (2019)	-0.0137	-0.0137	-0.0137	-0.0137	-0.0137	-0.0137
	(0.0397)	(0.0397)	(0.0397)	(0.0397)	(0.0397)	(0.0397)
January (2020)	-0.0184	-0.0184	-0.0184	-0.0184	-0.0184	-0.0184
	(0.0303)	(0.0303)	(0.0303)	(0.0303)	(0.0303)	(0.0303)
March (2020)	-0.0949***	-0.0278	-0.0925**	-0.0864**	-0.0255	-0.0194
	(0.0363)	(0.0483)	(0.0374)	(0.0367)	(0.0491)	(0.0484)
April (2020)	-0.2922***	-0.2252***	-0.2776***	-0.2217***	-0.2106***	-0.1547**
	(0.0456)	(0.0527)	(0.0555)	(0.0627)	(0.0615)	(0.0666)
Constant	7.6343***	7.6343***	7.6343***	7.6343***	7.6343***	7.6343***
	(0.0213)	(0.0213)	(0.0213)	(0.0213)	(0.0213)	(0.0213)
Observations	2,640	2,640	2,640	2,640	2,640	2,640
R-squared	0.9468	0.9469	0.9468	0.9469	0.9470	0.9470
B. Self-employed						
Restricted x Post		-0.0866			-0.0866	-0.0866
		(0.0843)			(0.0841)	(0.0841)
Share reported deaths				-0.0130**		-0.0130**
				(0.0057)		(0.0057)
Share reported cases			-0.0004**		-0.0004**	
			(0.0002)		(0.0002)	
December (2019)	-0.0343	-0.0343	-0.0343	-0.0343	-0.0343	-0.0343
	(0.0662)	(0.0662)	(0.0662)	(0.0662)	(0.0662)	(0.0662)
January (2020)	0.0154	0.0154	0.0154	0.0154	0.0154	0.0154
	(0.0498)	(0.0498)	(0.0498)	(0.0498)	(0.0498)	(0.0498)
March (2020)	-0.1144**	-0.0751	-0.1030**	-0.0996**	-0.0637	-0.0603
	(0.0501)	(0.0620)	(0.0501)	(0.0503)	(0.0619)	(0.0613)
April (2020)	-0.2524***	-0.2130***	-0.1815**	-0.1291	-0.1422*	-0.0898
	(0.0623)	(0.0718)	(0.0721)	(0.0800)	(0.0804)	(0.0825)
Constant	7.4193***	7.4193***	7.4193***	7.4193***	7.4193***	7.4193***
	(0.0366)	(0.0367)	(0.0366)	(0.0365)	(0.0366)	(0.0366)
Observations	2,640	2,640	2,640	2,640	2,640	2,640
R-squared	0.9217	0.9218	0.9218	0.9220	0.9219	0.9220

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. The variable Restricted x Post represents the interaction between q_j, which takes value 1 if sector j is restricted, and $post_t$, which is equal to 1 starting in March 2020. Share report deaths and Share report cases stand for reported deaths and cases per one million working-age population in each city, respectively. In the fixed-effects by period our base month is February (2020). Standard errors are presented in parentheses and clustered at the city-sector level.

6. Conclusions

Both the Covid-19 pandemic and the lockdowns required to flatten the contagion curve triggered a global economic crisis with particularly large effects on the labor markets. We assess the effect of the lockdown of some sectors in Colombia, a country characterized by a high prevalence of informality and an early implementation of the lockdown, common features with many other emerging economies. We identify the effect of the sector-specific mobility restrictions implied by the lockdown with difference-in-differences and event-study models that exploit the variation in the excluded and non-excluded sectors, as well as the timing of the restriction policies.

We find that sector-specific restrictions had a negative effect on employment, accounting for approximately one-quarter of the total employment losses between February and April. Therefore, we should expect important employment losses even in the absence of such restrictions. The remaining three quarters of the variation is plausibly explained by the regional patterns of the disease spread and other epidemiological and economic factors homogeneously affecting the country during this period, captured by the time fixed-effects coefficients. Even though we are not able to make causal claims about these two factors, we find that the regional variation of the disease spread may explain about a fourth of the total employment variations, suggesting that containing the disease would have important positive effects on employment. Overall, our findings are consistent with previous literature showing modest impact of lockdown measures in developed economies compared to the aggregate shocks implied by the pandemic (Aum, Lee, & Shin, 2020; Kahn, Lange, & Wiczer, 2020; Gupta, et al., 2020; Rojas et al., 2020; Goolsbee & Syverson, 2020).

In contrast, sector-specific restrictions have no significant effects on the number of average worked hours or wages, which indicates that most of the adjustment due to lockdowns of some sectors took place in the extensive margin. Moreover, our results show that the impact of the sector-specific restrictions on employment losses was mainly driven by salaried jobs, which suggests that labor market rigidities may be amplifying the effect of sectoral lockdowns. This result has implications for the future recovery of employment, because in

emerging economies such as Colombia there are important job creation costs for the salaried segment.

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Appendix

Table A. Log of Employment (weighted regression)

	Log. Employment	Log. Employment	Log. Employment	Log. Employment	Log. Employment	Log. Employment
Restricted x Post		-0.0991***			-0.0936***	-0.0942***
		(0.0222)			(0.0230)	(0.0227)
Share reported deaths				-0.0058***		-0.0051***
				(0.0021)		(0.0018)
Share reported cases			-0.0003***		-0.0003***	
			(0.0001)		(0.0001)	
December (2019)	0.0359**	0.0359**	0.0359**	0.0359**	0.0359**	0.0359**
	(0.0176)	(0.0176)	(0.0176)	(0.0176)	(0.0176)	(0.0176)
January (2020)	0.0114	0.0114	0.0114	0.0114	0.0114	0.0114
	(0.0100)	(0.0100)	(0.0100)	(0.0100)	(0.0100)	(0.0100)
March (2020)	-0.0302**	0.0212	-0.0229*	-0.0258**	0.0248	0.0225
	(0.0126)	(0.0159)	(0.0133)	(0.0130)	(0.0163)	(0.0161)
April (2020)	-0.1823***	-0.1309***	-0.1380***	-0.1370***	-0.0947***	-0.0937***
	(0.0271)	(0.0234)	(0.0333)	(0.0345)	(0.0261)	(0.0270)
Constant	12.4242***	12.4242***	12.4242***	12.4242***	12.4242***	12.4242***
	(0.0120)	(0.0098)	(0.0113)	(0.0114)	(0.0094)	(0.0095)
Observations	2,640	2,640	2,640	2,640	2,640	2,640
R-squared	0.9965	0.9966	0.9965	0.9965	0.9967	0.9967

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. The regression is weighted by the share of employment of each sector in total employment. The variable Restricted x Post represents the interaction between q_j, which takes value 1 if sector j is restricted, and $post_t$, which is equal to 1 starting in March 2020. Share report deaths and Share report cases stand for reported deaths and cases per one million working-age population in each city, respectively. In the fixed-effects by period our base month is February (2020). Standard errors are presented in parentheses and clustered at the city-sector level.

Table B. Log of Employment (monthly regression)

	Log. Employment	Log. Employment	Log. Employment	Log. Employment	Log. Employment	Log. Employment
Restricted x Post		-0.1713**			-0.1713**	-0.1713**
		(0.0771)			(0.0769)	(0.0768)
Share reported deaths				-0.0072		-0.0072
				(0.0053)		(0.0053)
Share reported cases			-0.0003		-0.0003	
			(0.0003)		(0.0003)	
December (2019)	-0.0713	-0.0713	-0.0713	-0.0713	-0.0713	-0.0713
	(0.0549)	(0.0549)	(0.0549)	(0.0549)	(0.0549)	(0.0549)
January (2020)	-0.0345	-0.0345	-0.0345	-0.0345	-0.0345	-0.0345
	(0.0555)	(0.0555)	(0.0555)	(0.0555)	(0.0555)	(0.0555)
March (2020)	-0.2253***	-0.1475**	-0.2163***	-0.2172***	-0.1385*	-0.1393*
	(0.0641)	(0.0721)	(0.0645)	(0.0635)	(0.0724)	(0.0712)
April (2020)	-0.4522***	-0.3743***	-0.3964***	-0.3843***	-0.3185***	-0.3065***
	(0.0592)	(0.0644)	(0.0721)	(0.0742)	(0.0760)	(0.0748)
Constant	8.3952***	8.3952***	8.3952***	8.3952***	8.3952***	8.3952***
	(0.0374)	(0.0374)	(0.0373)	(0.0373)	(0.0374)	(0.0374)
Observations	2,640	2,640	2,640	2,640	2,640	2,640
R-squared	0.9117	0.9119	0.9117	0.9117	0.9120	0.9120

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. The variable Restricted x Post represents the interaction between q_j, which takes value 1 if sector j is restricted, and $post_t$, which is equal to 1 starting in March 2020. Share report deaths and Share report cases stand for reported deaths and cases per one million working-age population in each city, respectively. In the fixed-effects by period our base month is February (2020). Standard errors are presented in parentheses and clustered at the city-sector level.

Table C. Log of Employment (three-month moving average regression)

	Log. Employment	Log. Employment	Log. Employment	Log. Employment	Log. Employment	Log. Employment
Restricted x Post		-0.0822			-0.0822	-0.0822
		(0.0517)			(0.0517)	(0.0517)
Share reported deaths				-0.0021		-0.0021
				(0.0037)		(0.0037)
Share reported cases			-0.0001		-0.0001	
			(0.0001)		(0.0001)	
December (2019)	-0.0050	-0.0050	-0.0050	-0.0050	-0.0050	-0.0050
	(0.0260)	(0.0260)	(0.0260)	(0.0260)	(0.0260)	(0.0260)
January (2020)	-0.0234	-0.0234	-0.0234	-0.0234	-0.0234	-0.0234
	(0.0232)	(0.0232)	(0.0232)	(0.0232)	(0.0232)	(0.0232)
March (2020)	-0.0402**	-0.0028	-0.0368**	-0.0378**	0.0005	-0.0005
	(0.0174)	(0.0231)	(0.0177)	(0.0182)	(0.0243)	(0.0251)
April (2020)	-0.1409***	-0.1036***	-0.1201***	-0.1211***	-0.0827**	-0.0838
	(0.0283)	(0.0289)	(0.0374)	(0.0447)	(0.0416)	(0.0509)
Constant	8.5244***	8.5244***	8.5244***	8.5244***	8.5244***	8.5244***
	(0.0129)	(0.0129)	(0.0129)	(0.0129)	(0.0129)	(0.0129)
Observations	2,640	2,640	2,640	2,640	2,640	2,640
R-squared	0.9742	0.9742	0.9742	0.9742	0.9742	0.9742

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. The variable Restricted x Post represents the interaction between q_j, which takes value 1 if sector j is restricted, and $post_t$, which is equal to 1 starting in March 2020. Share report deaths and Share report cases stand for reported deaths and cases per one million working-age population in each city, respectively. In the fixed-effects by period our base month is February (2020). Standard errors are presented in parentheses and clustered at the city-sector level.

Table D. Event-study regressions

	Log. Employment	Log. Average hours	Log. Hourly wage
Share reported deaths	-0.0047***	-0.0000	0.0008
	(0.0018)	(0.0005)	(0.0013)
December (2019)	0.0474*	-0.0045	-0.0556**
	(0.0248)	(0.0049)	(0.0218)
January (2020)	0.0082	-0.0031	-0.0346***
	(0.0175)	(0.0047)	(0.0116)
March (2020)	0.0051	0.0072	-0.0251*
	(0.0152)	(0.0055)	(0.0139)
April (2020)	-0.0736***	0.0066	-0.0819***
	(0.0280)	(0.0079)	(0.0285)
Restricted x December (2019)	-0.0221	0.0030	0.0327
	(0.0331)	(0.0063)	(0.0257)
Restricted x January (2020)	0.0061	0.0031	0.0181
	(0.0209)	(0.0058)	(0.0151)
Restricted x March (2020)	-0.0613***	-0.0127*	0.0071
	(0.0200)	(0.0070)	(0.0165)
Restricted x April (2019)	-0.1385***	-0.0178*	-0.0380
	(0.0377)	(0.0103)	(0.0303)
Constant	12.4242***	3.8150***	8.1914***
	(0.0093)	(0.0022)	(0.0074)
Observations	2,640	2,640	2,640
R-squared	0.9968	0.8895	0.9455

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. The variable Share report deaths represents reported deaths per one million working-age population in each city. February (2020) is the base level. Standard errors are presented in parentheses and clustered at the city-sector level.


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