Turbulence in startups: Effect of COVID-19 lockdown on creation of new firms and its capital

Camino-Mogro, Segundo

ESAI Business School - Universidad Espíritu Santo, Universidad Complutense de Madrid, Superintendencia de Compañías, Valores y Seguros

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Segundo Camino-Mogro[†]

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Abstract

Business creation is an important measure of real economic activity because it shows the dynamics with which new firms are born, create jobs, move their capital, innovate and compete with old firms. In this sense, this paper analyzes the impact of the lockdown policies implemented to stop the spread of the COVID-19 on the creation of new formal firms in Ecuador. I use a regression discontinuity in time (RDiT) design jointly with official administrative real-time data, and find an overall large decrease in the creation of new formal firms (-73%) but also in the total amount of capital coming from the new formal firms (-40%). Additionally, my results suggest that the negative impacts of the COVID-19 lockdown on creation of new formal firms do not diminish over the time, in particular after one month and a half. Finally, I show that the March 16 lockdown measures help to explain only the observed changes in creation of new formal firms occurred the day after their announcement and not other changes that predate or follow these announcements. The main conclusion is that lockdown policies have a negative impact on firm creation, result that is of high policy relevance which can be a tool to design business attraction policies.

Keywords: COVID-19; Lockdown; New firms; Regression Discontinuity; Ecuador
JEL Codes: G38; M13; M21

[†]Corresponding author. Associate Researcher at Universidad Complutense de Madrid; Associate Professor and Researcher at ESAI Business School - Universidad Espíritu Santo, and National Director of Economic Research Department at Superintendencia de Compañías, Valores y Seguros [SCVS] (Email: scaminom@supercias.gob.ec)

1   Introduction

Business creation is an important measure of real economic activity because it shows the dynamics with which new firms are born, create jobs, move their capital, innovate and compete with old firms. Foster, Haltiwanger, and Krizan (2001) argue that successful new firms grow faster than existing firms and have higher levels of productivity. This suggest that a small number of high-growth startups account for large portions of aggregate productivity, output, and employment growth (Haltiwanger, Jarmin, Kulick, & Miranda, 2016); this is particularly important in countries with low productivity growth rates (see, for example: Busso, Madrigal, & Pagés, 2013; Camino-Mogro, Armijos-Bravo, & Cornejo-Marcos, 2018; Cole, Ohanian, Riascos, & Schmitz Jr, 2005) but also with weak and bureaucratic process of creation of new firms such as in developing countries.

Interestingly, is that new firms are important for employment creation and a fall in business creation directly reduces the number of jobs created (see, for example: Duncan, León-Ledesma, & Savagar, 2020; Karimov & Konings, 2020). This happens because there is "missing generation" of firms and the firms created during a crisis or recession are less likely to grow even after the recession (Sedláček & Sterk, 2017, 2020), this consequently has a long-lasting effect in the labour market and in competition effects.

During an economic crisis or recession its is well know that business creation drops (see, for example: Clementi & Palazzo, 2016; Lee & Mukoyama, 2015; Sedláček, 2020) but also it is important to mention that the survival rate and the conditional employment growth rate of incumbent firms are highly sensitive to business cycle fluctuations (Pugsley & Șahin, 2019). Therefore, employment may fall not only due to the lack of creation of new firms but also due to the layoffs that may be caused by already established firms. Generally, the latter is cushioned (in a certain way) by the employment generated by new firms entering the market. However, when the business creation drops dramatically, this could not happen and it produces a slow recovery in the labour market but also in business dynamics.

The outbreak of the novel coronavirus (COVID-19) brought seriously affected health care and economy in different industries and regions; also population mobility sharply dropped, as a result of the quarantine policy, which led to weakened spending power and a stagnant economy and at the macro level, the COVID-19 outbreak caused the worst global recession since 1930, when the economy got absolutely creamed (Shen, Fu, Pan, Yu, & Chen, 2020). In particular, the COVID-19 pandemic has impacted Latin America and the Caribbean at a time of weak economy and macroeconomic vulnerability (BID, 2020; CEPAL, 2020).

Early indicators suggest that startup activity is heavily disrupted by the COVID-19 pandemic and the associated lockdown; additionally, at the same time, empirical evidence has shown that such disturbances may have long-lasting effects on aggregate employment (Sedláček & Sterk, 2020). In specific, Duncan et al. (2020), Karimov and Konings (2020) and Sedláček and Sterk (2020) are the only research that analyze the business creation over the COVID-19;[1] nevertheless, their investigations are in line on job losses not on how the confinement policy impact on the creation of new firms.

This paper analyzes the impact of the lockdown policies implemented to stop the spread of the

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[1]There is a consensus over the impact on job losses from the lack of creation of new firms that that employment losses can be substantial and last for more than a decade, even when the assumed slump in startup activity is only short-lived

COVID-19 on the creation of new formal firms in Ecuador. The rapid spread of the virus in Ecuador and the official declaration of the WHO as a pandemic led the Government of this country to take confinement (lockdown) measures that were decreed and implemented on March 16, 2020. This lockdown decree restricted the mobility and face-to-face work hours in non-essential economic sectors. In this path, I exploit the exogenous variation coming from the COVID-19 pandemic and its lockdown policy in Ecuador and perform a regression discontinuity in time (RDiT) design as my identification strategy. Furthermore, I analyze the impact of the lockdown policy on the total capital amount coming form new formal firms. Finally, I perform several robustness checks to support the main findings. Specifically, I use different functional forms in the estimation of the RDiT, different bandwidths around the cutoff day and finally placebo days of the official lockdown policy decree. I use a real-time data set between January 13, 2020 to May 15, 2020 of all creation of new formal firms in Ecuador from the supervisory and regulatory authority.

The results suggest that the negative impacts of the COVID-19 lockdown on creation of new formal firms an in the total amount that comes from new formal firms do not diminish over the time, in particular after one month and a half. Moreover, the placebo experiments show that the March 16 lockdown measures help to explain only the observed changes in creation of new formal firms occurred the day after their announcement and not other changes that predate or follow these announcements.

The paper contributes to the growing literature on crisis, shocks, business cycle and creation of new formal firms. In specific, the contribution relies on how the COVID-19 pandemic lockdown induced policy could affect business creation for the first time (to my knowledge). Studies on the impact of the COVID pandemic on the economy mostly focused on the macro level (see, for example: Couch, Fairlie, & Xu, 2020; Díaz-Cassou, Carrillo-Maldonado, & Moreno, 2020; ECLAC, 2020; OECD, 2020). In addition, most of the papers that analyze creation of new formal firms and crisis, shocks or over the business cycle use a Dynamic Stochastic General Equilibrium (DSGE) model; nevertheless, in this paper I exploit the exogenous characteristic of the lockdown policy induced by the COVID-19 to assess its impact on the creation of new formal firms. This analysis is novelty since is the first that use a RDiT design which is an impact evaluation policy strategy.

The reminder of the paper is organized as follows. In Section 2, I describe the theoretical background and the COVID-19 pandemic lockdown in Ecuador. In Section 3, the design and empirical strategy is shown. Section 4 presents the results and robustness checks. Finally, Section 5 concludes with policy recommendations.

2   Theoretical background: Crisis, shocks, business cycle and creation of new formal firms

It is well known in the literature that contractions are sharper than expansions (see, for example: Gourio, Messer, & Siemer, 2016; McQueen & Thorley, 1993) and this could generate severe problems in the economy. Moreover, economic contractions, crises, negative shocks (persistent or not) could generate imbalances in the labor market, in business dynamics and in social welfare (see, for example: Caballero & Hammour, 2005; Gourio et al., 2016; Sedláček, 2016, 2020). However, it is not known whether the process of firm entry and exit is quantitatively important for the response of such an

economy to macroeconomic shocks since endogenous entry and exit allow the composition of the economy to vary (Samaniego, 2008).

Several authors have investigated how the creation or entry of new firms in the market is affected by economic crises, shocks and also the relationship it has with the business cycle. The seminal paper of Campbell (1998) found that firm entry is procyclical, meaning that an increase in the GDP coincides with an increase in the firm entry rate, and a decrease of GDP coincides with a decrease of firm entry rate. Recently, Lee and Mukoyama (2015) found similar results and argue that the entry rate is much higher during booms than recessions because could exist a selection in the entry margin over the business cycle. According to the selection in the entry margin, Sedláček (2020) mention that it is possible that firms that do not enter during recessions are simply waiting until business conditions improve and they will enter in the subsequent recovery phase and in this sense startups are not lost, they are merely postponed. Nevertheless, Gourio et al. (2016) find that lower firm entry leads to persistent effects on economic activity because of a "missing generation" of firms.

On the other hand, Samaniego (2008) found that changes to firm entry rates are unlikely to play an important role in generating asymmetry in short run macroeconomic dynamics, which are in line with the idea that the process of entry may still be important for understanding lower frequency events—such as the response to structural shocks, or the process of economic growth itself. Although, Clementi and Palazzo (2016) argue that the procyclicality of firm entry and the positive association between age and firm growth deliver amplification and propagation of aggregate shocks in a plain-vanilla competitive framework. In addition, the authors show that according to their model there is a clear causal link between the exceptionally large drop in establishments during the Great Recession and the painfully low speed of the recovery from it. In this line, Sedláček and Sterk (2017) argue that the impact of entry decisions not only persists as cohorts mature, but their magnitude increases over time since firms with highly scalable businesses need time to reach their full potential; because entrants are more likely to adopt more recent vintages of capital, is likely to further enhance the amplification and propagation mechanism (Clementi & Palazzo, 2016).

In this sense, it is coherent to think that during periods of economic growth, the creation of new firms (entrants) tends to increase, but also that the entry of new firms to the market play an important role in explaining periods of fast growth (Asturias, Hur, Kehoe, & Ruhl, 2017).[2] However, on the contrary it is also reasonable to think that during bad times (economic crisis, negative shocks (permanents or not)) the creation of new firms drops. More important is that entering firms in recessions start with about 30% more workers, are about 25% larger in recessions and are about 10-20% more productive than entering firms in booms, suggesting that the selection at the entry (or "creation") margin may play an important role in explaining firm dynamics over the business cycle (Lee & Mukoyama, 2015). Nevertheless, Sedláček (2020) argues that if new (young) firms disproportionately employ a particular type of workers, older firms would not be tempted to hire from the larger unemployment pool, but also, missing entrants generate fewer older firms in the future which account for the bulk of aggregate employment.

In other words, when there is a negative shock (persistent or not) or an economic crisis, the creation of new formal firms tends to decrease and although the few new firms generate more employment than

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[2]The theory behind this explanation is done by Foster et al. (2001), Brandt, Van Biesebroeck, and Zhang (2012), Haltiwanger, Jarmin, and Miranda (2013).

if they had been created in a boom period, this employment it could be of low quality, with lower wages and in an economic sector with little added value, which has repercussions on the speedy recovery of the economy and on long-term growth.

Finally, the literature has a consensus on the creation of new formal firms over the business cycle. However, most of the analyzes have been carried out in developed countries and although the evidence is very likely to be similar for developing economies, there is scarce literature for this group of countries. More importantly, the creation of firms during the current economic crisis caused by the COVID-19 pandemic through social isolation measures and mobility restrictions has not been studied. So this paper seeks to cover these two gaps in the literature, exploiting the exogenous negative shock of COVID-19 through the lockdown policy in Ecuador.

2.1 COVID-19 pandemic lockdown and creation of new formal firms: The Ecuadorian case

Ecuador has been characterized as a producer and trader of raw materials, which does not have its own currency and is dollarized, it is less commercially and financially integrated into the global economy and this puts in a situation of high vulnerability in particular to global demand and commodity shocks (see, for example: Carrillo-Maldonado & Díaz-Cassou, 2019; Díaz-Cassou et al., 2020). In addition, the country has a large number of micro, small and medium-sized companies (MSMEs) (95%) and a few large firms (5%) (Ruiz-Arranz & Deza, 2018; Superintendencia de Compañías Valores y Seguros, 2018). These characteristics could be detrimental to a simultaneous supply and demand shock such as the economic crisis caused by COVID-19 because having a dollarized economy, with international markets practically closed, and a confinement caused by the pandemic, the economic agents cannot interact with each other and therefore many of these micro and small businesses could close due to lack of liquidity, causing problems of increased unemployment and inequality.[3]

In particular, the Ecuadorian government decree a confinement and suspends non-essential economic activities, mobilization and face-to-face work activities on March 16, 2020 to prevent the spread of the virus in the country. However, this lockdown caused by COVID-19 lasted about 3 months, where after this several cities began to take more flexible confinement measures to avoid greater damage to the economy. In this line, Bachas, Brockmeyer, Santiago, and Semelet (2020) find that only 35% of firms would remain profitable and that almost all firms in the most affected sectors would register losses. This could happen because none firms were prepared for a shock like this, for example, Carrillo-Maldonado, Deza, and Camino-Mogro (2020) mention that 50% of formal firms are operating with a median of 33 days of resistance without liquidity, that is to say about one month of operation, but also 25% of firms are highly vulnerable to quarantine or a suspension of economic activities for more than 16 days.

In this sense, a large number of formal firms were highly vulnerable to closing their businesses, which could cause a significant loss of formal employment, in fact it was. Around 270 thousand people have been separated from their jobs during the period between March 16, 2020 and the end of June 2020.[4] But the problem lies not only in the vulnerability of the companies that are operating but

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[3]Ecuador is one of the most affected economically and socially; it has been one of the most affected countries in terms of number of cases and fatalities per million inhabitants (see statistics by: Max Roser & Hasell, 2020).

[4]Data obtained form Instituto Ecuatoriano de Seguridad Social (IESS).

also in those firms that are yet to be born. In other words, the lockdown could stop the creation of new formal firms due to the same confinement but also to the uncertainty regarding the time that the pandemic will hesitate and the reopening of economic activities.

In Figure 1 the interanual growth rate between 2019 - 2020 of creation of new formal firms is shown. January 2020 compared to its similar in 2019 shows that the creation of new formal firms grew 1.45% in 2020, while in February there was a decrease of -2.43% that went to -51.84% in March 2020, where from the 16th of that month the confinement of the country and the paralysis of economic activities were decreed; additionally, in April 2020 the decrease rate was -99.35% where only 5 new formal firms were created, finally in the month of May and until the 15th of this month, only 56 companies were created in the month, which represents a decrease of -88% compared to the first 15 days of May 2019.

Also, Figure 1 shows a large decrease in the creation of new formal firms during the two months after the lockdown comparing with the same months of 2019. Moreover, the recovery is slow if we compare the months of April and May, this suggest that the creation of new formal firms in Ecuador could be very slow and the return to its trend could be delayed. In this line, Clementi and Palazzo (2016) argues that exists a causal link between the drop in establishments at the outset of a great recession and the subsequent slow recovery.

Figure 1: Interanual growth rate of creation of new formal firms in Ecuador 2019 - 2020
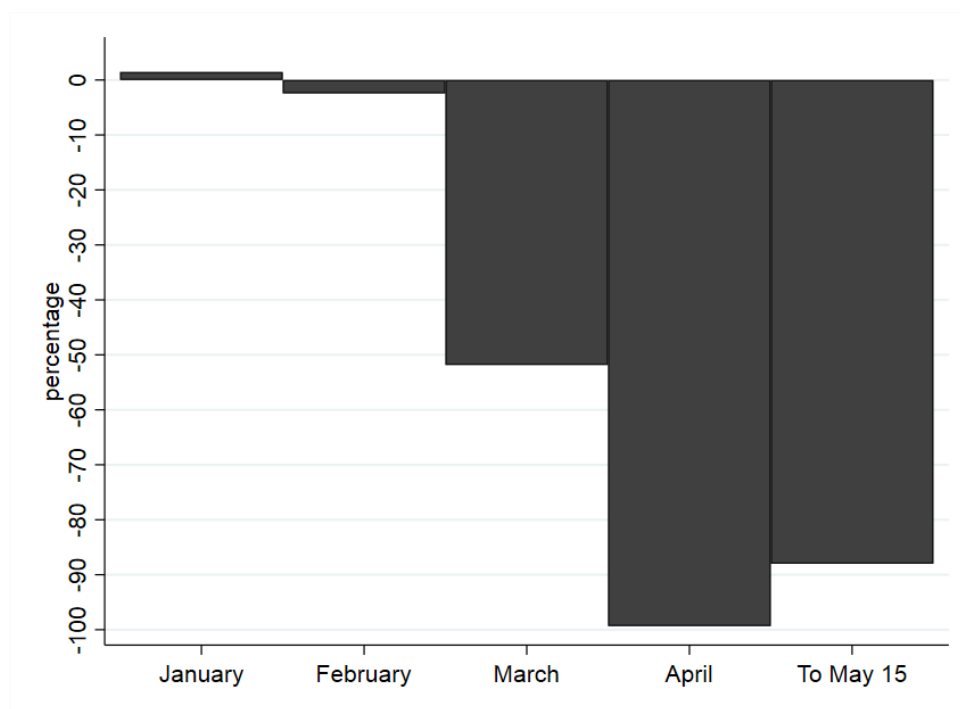
Source: Superintendencia de Compañías, Valores y Seguros.
Elaboration: Author.

In addition, in Figure 2 the number and capital of new formal firms are shown. In panel 3(a) the daily number of creation of new formal firms in Ecuador before and after the lockdown is presented. The worst day of creation of new formal firms was January 17, 2020 were the total number of creation was 24 companies, and the best day was January 22 and 23 were a total of 50 new formal firms born. However, the picture changes after March 16, the lockdown day; in those days, exists a large quantity of days that none formal firm was created, and the best day in terms of new formal firm born was

May 14, when 17 new companies were created. Something similar occurs in panel 3(b), with the only difference that after the lockdown, the few formal firms that were created, were born with less capital than those that were born before the lockdown; this is what several authors call the ballast of the fall of the creation of formal firms during a crisis since not only are they created in less quantity but they are created with less capital, in less productive sectors, scarce added value and create little employment.

Figure 2: Number and capital of new formal firms in Ecuador
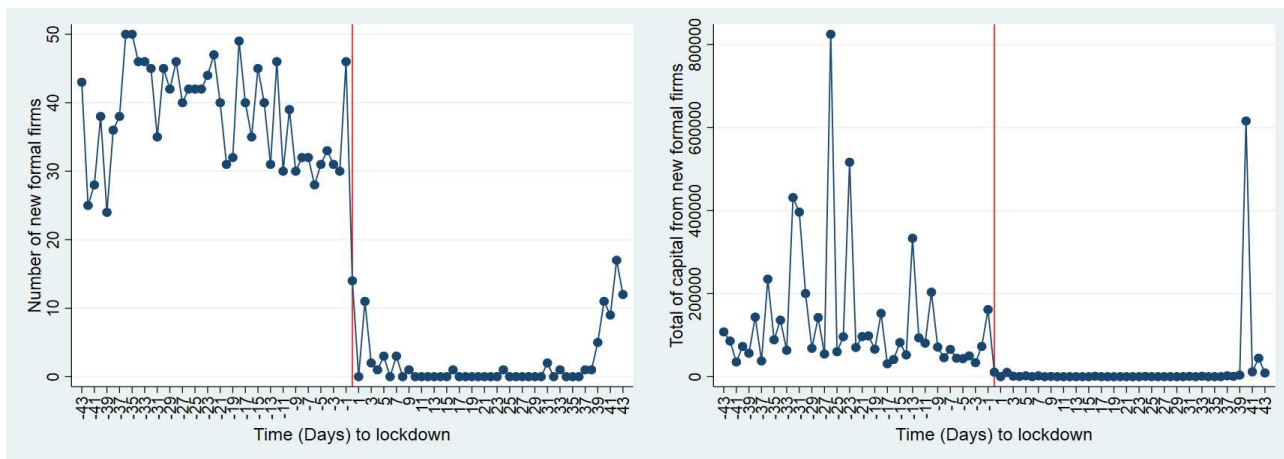
(a) Number of new formal firms   (b) Capital from new formal firms

Source: Superintendencia de Compañías, Valores y Seguros.
Elaboration: Authors.

These two figures show that the negative effect of the COVID-19 lockdown is notorious (at least descriptively) and that this effect seems to decrease very slowly with the passage of weeks or months, which could generate certain alerts in the creation of formal firms since this would delay the economic recovery.

3 Design and empirical strategy

3.1 Data

I use data from the Superintendencia de Compañías, Valores y Seguros (SCVS), which is the supervisory and regulatory institution of formal companies in Ecuador. The SCVS collects information of creation of new formal firms that are from new constitutions and establishments of foreign companies in the country. This dataset is obtained from "New Constitutions" administrative register that includes the name of the new formal firm, identification, economic activity, total amount of capital which the firm is created, geographical location and name of CEO and ownership's. More important, the SCVS daily collects this information, which constitutes an important advantage in the use of this dataset because I use a real time daily data from January 2020.

Croushore (2011) argues that real-time data analysis refers to research for which data revisions matter or for which the timing of the data releases is important in some way.[5] In this line, I use

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[5]The term "real-time analysis" was coined by Diebold and Rudebusch (1991). Rudebusch (2001) defines real-time analysis as "the use of sequential information sets that were actually available as history unfolded." The definition of Croushore (2011) is somewhat broader.

real-time data since the information is immediately available after its collection from a recent event (the creation of a new formal firm). This type of data instead of putting together information from the past, delivers insights of what is going on in the present, which could help to minimize errors in the analysis (if well collected) and establish action plans (possible changes to policies) more rapidly (Camino-Mogro & Armijos, 2020). In this sense, as argued by Croushore (2011) real-time data analysis is thus potentially important for both theory and empirical work, but also if you want to analyze policy or forecasts, you must use real-time data, or your results are irrelevant; given the existence of real-time data sets for many countries, there is no excuse for not using real-time data.[6]

I use a real real-time data from January 13, 2020 to May 15, 2020. This period of window allows me to employ a regression discontinuity in time (RDiT) using the president's order effective lockdown on March 16, 2020. This gives 43 working days on each side of the cutoff date on the base line model. In addition, I use two outcomes to be analyzed by the RDiT approach, such as the total number of creation of new formal firms in each day and the total amount of capital from new formal firms in each day before and after the COVID-19 lockdown in Ecuador. I collapse the dataset at day level of all the country because the number of creation of new formal firms by province or cities do not have the sufficient variability to capture a heterogeneous effect on each location. Moreover, I do not use a larger bandwidth because this imply that I necessarily use a date after May 15, 2020; nevertheless, the SCVS, on May 18, 2020 implemented a new modality for the creation of formal firms called S.A.S., this modality, unlike the other modalities, does not need a minimum of capital and the time in which it is constituted is much shorter than traditional constitutions.

Finally, I use 83 working days (observations) in the analysis; the daily mean of the number of creation of new formal firms before March 16, 2020 is 38.25 companies and after the lockdown is 1.91; also, the daily mean of the total amount of capital from new formal firms before and after the lockdown is 135,968.4 USD and 16,458.14 USD respectively.

3.2 Empirical Strategy

To assess the direct impact of the COVID-19 lockdown on the creation and the capital of new formal firms, I design a research strategy that exploits the completely exogenous effect of COVID-19 pandemic that induces a lockdown (and resulting cessation of activities) on March 16, 2020 in Ecuador. I rely on a regression discontinuity in time (RDiT) approach whenever we have high frequent data and observe enough data points around the cutoff (Anderson, 2014; Auffhammer & Kellogg, 2011). The RDiT is a quasi-natural experimental econometric technique, but also is a special case of the classical regression discontinuity design (RDD), where time is the so-called running or forcing variable, this allow me to rigorously compare the impacts of the lockdown on the creation and the capital of new formal firms in a time window around the lockdown date.[7]

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[6]However, authors like Koenig, Dolmas, and Piger (2003) argues that real-time-vintage data sets are more complete than first-release data sets in that at each within-sample date they include revisions that would have been known at that date. For typical lag specifications (extending back a year or less), real-time-vintage data are readily available in back issues of government publications. Nevertheless, this is not the case. I review the last five years publications of total number of creation of new formal firms and the numbers change in around 10 days and with an amount of 1 new firm on each date.

[7]A naive approach to estimate the effects of the COVID-19-induced lockdown on other outcomes is to perform Ordinary Least Squares (OLS) regressions with changes on other outcomes as the dependent variable and the lockdown as the independent variable (see, for example: Barnes, Beland, Huh, & Kim, 2020; Caselli, Fracasso, & Scicchitano, 2020;

Thus, one has to account for this special feature by applying time series techniques as discussed by Hausman and Rapson (2018). In addition, and similar to Barnes et al. (2020) and Dang and Trinh (2020) where the running variable is the time of COVID-19 lockdown, but assessing other outcomes; our empirical strategy is to leverage the sharp discontinuities of creation of new formal firms when the lockdown goes into effect. For this, Cattaneo, Idrobo, and Titiunik (2020) argues that the motivation of the RDD approach is that within a relatively narrow window of time around an event (in this case the lockdown), the unobserved factors influencing the dependent variable (number of new formal firms and total amount of capital from new formal firms) are likely similar so that observations before the event provide a counterfactual group that can be compared with observations after the same event. To perform this, we formally estimate the treatment effect as the outcomes variations in Ecuadorian formal market around the lockdown date:

(1) $$\tau_{RD} = \lim_{\epsilon \downarrow 0} E[y|d = 0 + \epsilon] - \lim_{\epsilon \uparrow 0} E[y|d = 0 + \epsilon]$$

Where, d is the number of days before and after the official lockdown date. I subsequently employ an approach according to Imbens and Lemieux (2008), where one estimates the following model when adopting an RDiT approach, using March 16, 2020 as the cutoff date when the president decrees the lockdown and restriction the mobility and face-to-face work day.

(2) $$y_d = \beta_0 + \beta_1 PostLockdown_d + \beta_2 Days_d + \beta_3 Days_d * PostLockdown_d + W_d + \epsilon_d$$

Where, y_d reflects the respective outcome variable (number of new formal firms and total amount of capital from new formal firms) at day d. The parameter of interest is β_1 the (local average treatment) impacts of the lockdown on y_d, for which we obtain an unbiased estimate under the RD assumption that ϵ_d does not change discontinuously at the policy introduction (Anderson, 2014); our treatment variable is $PostLockdown$ which is a dummy variable that is equal to one for all days after the lockdown on March 16 and zero for all preceding days. We use data from January 13 to May 15, 2020 for our main specification, which allows 43 days on either side of the cutoff. Our running variable is $Days_d$ which represents the number of days since the official lockdown date; β_2 is a general, linear (quadratic) time trend for the entire observation period. $Days_d * PostLockdown_d$ is an interaction between $Days_d$ and $PostLockdown_d$ that should absorb everything that changes outcome y_d smoothly around the cutoff; β_3 indicates a potential change in the time trend for the post-intervention period.

To provide robust analysis and for comparison purposes, I use different functional forms for $Days_d$ (linear and quadratic) to flexibly control for variations in the outcomes that would have occurred in the absence of the lockdown, this also modify my interaction term $Days_d * PostLockdown_d$ into a linear and quadratic form. In addition, I use two different bandwidths (+/- 14 and +/- 30 days) before and after the lockdown date as our preferred time bandwidth,[8] but I also present results for different

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Dang & Trinh, 2020). However, it is well known that this method leads to biased estimates as a result of the correlation that exists between the observed and unobserved observations. In addition, finding causal effects using this technique is very complicated because the business environment can be correlated with the number of cases and deaths from COVID-19 (see, for instance: Cicala, Holland, Mansur, Muller, & Yates, 2020) and this could generate more rigorous measures in the lockdown.

[8]I do not use a date after May 15, 2020 because in May 18 a new policy to create new formal firms were introduced (a simplified process for create new formal firms called S.A.S.) and this policy could disturb the results of the impact of lockdown on the number of new formal firms.

bandwidths to investigate the duration of the lockdown impacts. Finally, W_d is a day-of-the-week fixed effects and ϵ_d is the error term. I report standard errors robust to heteroskedasticity, and I use a triangular kernel, and a linear polynomial approximation for the estimation procedure.

4   Main results

As starting point, I present graphical evidence of the effect of the COVID-19 lockdown on new formal firm creation and new capital coming from new formal firms in Ecuador during the period from mid January 2020 to mid May 2020. I run a data-driven RDiT of the number of new formal firms and the total amount of capital from new formal firms against the number of days around the lockdown date. I plot in Figure 3 the results of the RDiT which shows that the number of new formal firms in Ecuador dramatically decreases a day after the lockdown date in Ecuador. In addition, the graph shows that the amount of capital from new formal firms also decrease a day after the lockdown, but it recovers more quickly than the number of new formal firms. I find a significant discontinuity and a decrease at the cutoff date, but I also observe that the reduction of number of new formal firms and its total amount of capital decreases slightly at higher bandwidth. This evidence is particular interesting because its suggests that the impacts of the lockdown on the outcomes analyzed here may exist only in the short-run.[9]

Figure 3: Regression discontinuity plot for number and capital of new formal firms
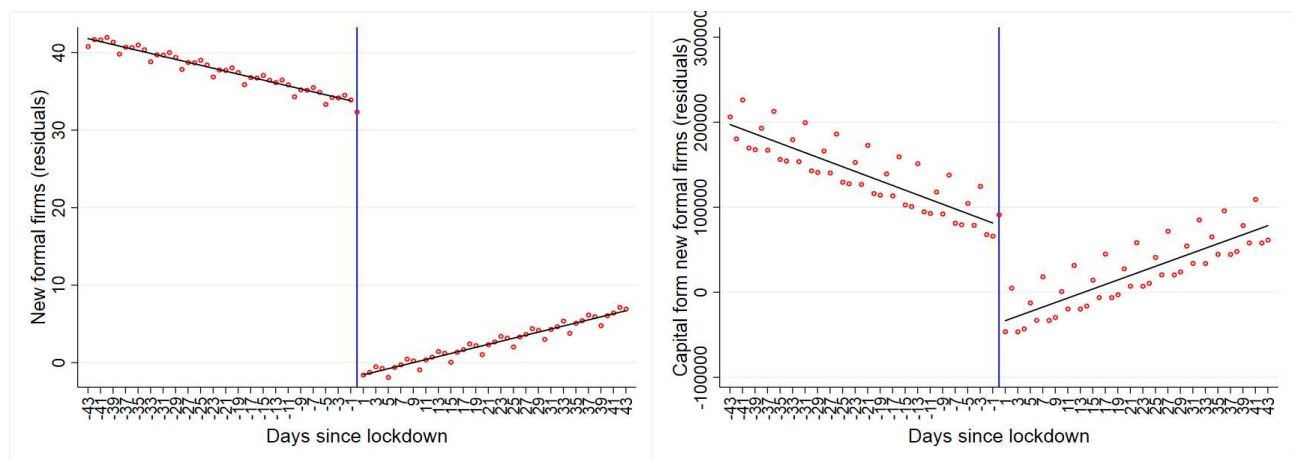
(a) Number of new formal firms   (b) Capital from new formal firms

Source: Superintendencia de Compañías, Valores y Seguros.
Elaboration: Authors.

Next, I turn to estimate the effects of the lockdown on new formal firm creation and new capital coming from new formal firms in Ecuador using equation (2) in a RDiT design. Table 1 shows the main results of the effect of COVID-19 lockdown on creation of new formal firms in Ecuador, using different bandwidths such as: +/- 14, +/- 30 and +/- 43 days. The use of different bandwidths allows me to estimate the impact on different periods of time but also to show the duration of the impact. Additionally, I present the results in columns (1), (3) and (5) without day of the week fixed effects and in the rest of the columns I use these fixed effects, in order to show the robustness of the

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[9]The residuals that are used in Figure 3, are those obtained from the results of the RDiT specified in equation (2) in a linear model; nevertheless, similar results are found with other functional forms.

model specification. The preferred models are presented in columns (2), (4) and (6). Finally, Table 1 provides four different functional forms of the running variable to demonstrate the robustness of the specification.

Overall, Table 1 suggests that the COVID-19 lockdown has strongly statistically significant impacts on creation of new formal firms at the 1 percent level. The results remains qualitatively similar, regardless of inclusion of day of week fixed effects and different functional forms of the running variable, or time bandwidths around the lockdown date. In Panel A of Table 1, I present the results of a linear model, without the interaction term of (2), and it shows a large and significant decrease in creation of new formal firms by using different bandwidths. In particular, with a bandwidth of 14 days before and after the lockdown, the creation of new formal firms decrease of about 31 new firms or -90.62% in relative terms, this effect increase when I use a larger bandwidth, with an impact of -91.61% for 30 days and -92.13% for 43 days.

Table 1: COVID-19 lockdown effects on creation of new formal firms

	+/- 14 days		+/- 30 days		+/- 43 days	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Linear model						
$PostLockdown_d = 1$	-30.97***	-31.00***	-34.84***	-34.84***	-35.24***	-35.24***
	(2.290)	(2.204)	(1.636)	(1.628)	(1.515)	(1.497)
%-Change	-90.53	-90.62	-91.61	-91.61	-92.13	-92.13
Panel B:						
Linear interaction model						
$PostLockdown_d = 1$	-23.98***	-24.10***	-26.29***	-26.26***	-28.07***	-28.07***
	(6.413)	(5.693)	(3.727)	(3.521)	(3.293)	(3.141)
%-Change	-70.09	-70.45	-69.13	-69.05	-73.38	-73.38
Panel C: Quadratic model						
$PostLockdown_d = 1$	-30.93***	-30.96***	-34.78***	-34.78***	-35.18***	-35.18***
	(2.349)	(2.235)	(1.658)	(1.646)	(1.541)	(1.521)
%-Change	-90.41	-90.50	-91.45	-91.45	-91.97	-91.97
Panel D:						
Quadratic interaction model						
$PostLockdown_d = 1$	-26.65***	-26.81***	-30.00 ***	-30.00***	-31.81***	-31.81***
	(4.214)	(3.760)	(2.491)	(2.359)	(2.245)	(2.162)
%-Change	-77.90	-78.37	-78.88	-78.88	-83.16	-83.16
Mean before lockdown	34.21	34.21	38.03	38.03	38.25	38.25
$Days_d$	Yes	Yes	Yes	Yes	Yes	Yes
Day of week FE	No	Yes	No	Yes	No	Yes
Observations	29	29	61	61	85	85

Notes: Robust standard errors in parentheses. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Running variable is number of days from the lockdown date. Panel A uses running variable in linear form, Panel B includes interaction of running variable and treatment variable, Panel C includes quadratic term of running variable and Panel D includes interaction of running variable (in quadratic form) and treatment variable.

Using different functional forms of the running variable (Panels B to D) results in similar estimates; nevertheless, I prefer the specification of equation (2) where I deal with a potential change in the time trend for the post-intervention period. More specific, I rely on the results of Panel B, where it is found

that the creation of new formal firms decrease of about 24 new firms or -70.45% in relative terms, this effect decrease when I use a bandwidth of 30 days (-69.05%), but larger when the bandwidth is 43 days (-73.38%). These results suggest that the negative impacts of the COVID-19 lockdown on creation of new formal firms do not diminish over the time, in particular after one month and a half.

In Table 2 the results by using other outcome like the total amount of capital from the creation of new formal firm is given. Using equation (2), I present the results in the same manner as to Table 1 (different bandwidths, day of week fixed effects and different functional forms of the running variable). In Panel A of Table 2 it is shown a large and significant decrease in the total amount of capital from new formal firms by using different bandwidths. Nevertheless, in the case of this outcome, the negative impacts of the lockdown on total amount of capital form new formal firms diminish over time. In specific, the effect of the lockdown on the total amount of capital comes from -90.76% to -86.09% in relative terms. Again, using different functional forms of the running variable (Panels B to D) results in similar estimates, but I prefer the results of Panel B, which suggest that the lockdown has strong statistically significant negative impacts on the total amount of capital from new formal firms at the 5 percent level. In particular, I find that the lockdown leads to a 40.40% reduction of total amount of capital from new formal firms using a bandwidth of 43 days; however, in smaller bandwidths the negative impact is not statistically significant at standard levels.

Table 2: COVID-19 lockdown effects on capital from new formal firms

	+/- 14 days		+/- 30 days		+/- 43 days	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Linear model						
$PostLockdown_d = 1$	-87797.4***	-87694.6***	-111968.8***	111528.7***	116777.6***	117060.0***
	(20288.7)	(21594.0)	(22057.0)	(22809.2)	(20587.5)	(21075.9)
%-Change	-90.86	-90.76	-84.93	-84.60	-85.88	-86.09
Panel B:						
Linear interaction model						
$PostLockdown_d = 1$	-36874.1	-36335.0	-39322.1	-34775.3	-55656.2**	-54934.0**
	(35424.7)	(38085.6)	(28721.6)	(32673.1)	(22532.5)	(26184.0)
%-Change	-38.16	-37.60	-29.83	-26.38	-40.93	-40.40
Panel C: Quadratic model						
$PostLockdown_d = 1$	-87156.2***	-87244.9***	-111263.8***	110841.7***	115979.1***	116234.9***
	(19885.6)	(21191.6)	(21749.8)	(22567.4)	(20428.0)	(20967.1)
%-Change	-90.20	-90.29	-84.40	-84.08	-85.30	-85.48
Panel D:						
Quadratic interaction model						
$PostLockdown_d = 1$	-49896.7**	-50330.0*	-64809.3***	-62249.4***	-85371.3***	-85147.3***
	(23927.0)	(25942.8)	(19851.5)	(22195.4)	(17827.2)	(19659.4)
%-Change	-51.64	-52.09	-49.16	-47.22	-62.78	-62.62
Mean before lockdown	96622.07	96622.07	131830.2	131830.2	135968.4	135968.4
$Days_d$	Yes	Yes	Yes	Yes	Yes	Yes
Day of week FE	No	Yes	No	Yes	No	Yes
Observations	29	29	61	61	85	85

Notes: Robust standard errors in parentheses. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Running variable is number of days from the lockdown date. Panel A uses running variable in linear form, Panel B includes interaction of running variable and treatment variable, Panel C includes quadratic term of running variable and Panel D includes interaction of running variable (in quadratic form) and treatment variable.

Different with the evidence of the effect of COVID-19 lockdown on creation of new formal firms, in this outcome I find that the effect is smaller; nevertheless, the impact seems to stay in time and not

diminish. Additionally, the creation of new formal firms begins to recover once the lockdown measures are relaxed, but also the capital with which new companies are born begins to be greater than that created at the beginning of the lockdown.

Those results can not be compared with other research since there are no studies analyzing the lockdown and creation of new formal firms. Nevertheless, Sedláček (2020) found that firm entry dropped in unprecedented fashion in the U.S. during the Great Recession and a lost generation of firms has limited impact in the short run.

Finally, I change the date of the lockdown, simulating a fake lockdown on March 2 and other on March 9,[10] in order to offer a set of placebo tests to strengthen the causal interpretation I give to the results. For this aim, I change the date of the official lockdown, simulating that it was 1 or 2 weeks before the real date. I expect not to find a significant coefficient in any of these cases or to find a positive and significant coefficient of the variable $Postlockdown_d$.

Table 3: Placebo test of fake day of COVID-19 lockdown effects

	March 2		March 9	
	(Number)	(Capital)	(Number)	(Capital)
Panel A: Linear model				
$PostLockdown_d = 1$	-0.916	-100001	19.17**	65441
	(5.874)	(65643)	(7.633)	(69690)
Panel B:				
Linear interaction model				
$PostLockdown_d = 1$	4.04	-92208	19.17***	65441
	(16.083)	(86550)	(6.813)	(69690)
Panel C: Quadratic model				
$PostLockdown_d = 1$	3.00	-100003	19.43	71398
	(6.218)	(82085)	(12.903)	(64935)
Panel D:				
Quadratic interaction model				
$PostLockdown_d = 1$	5.65	-100004	20.17	69586
	(15.504)	(100006)	(14.298)	(63074)
Mean before lockdown	39.87	155345	38.78	144340
$Days_d$	Yes	Yes	Yes	Yes
Day of week FE	Yes	Yes	Yes	Yes
Observations	67	67	77	77

Notes: Robust standard errors in parentheses. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Running variable is number of days from the lockdown date. Panel A uses running variable in linear form, Panel B includes interaction of running variable and treatment variable, Panel C includes quadratic term of running variable and Panel D includes interaction of running variable (in quadratic form) and treatment variable.

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[10]On Saturday, February 29, 2020, the first confirmed case of COVID-19 in Ecuador was confirmed by a press conference of the Minister of Health. It is taken as the first day of work after the confirmation of the case on March 2, 2020; In addition, it is analyzed a week later to show if the announcement of the COVID-19 cases before the lockdown had an effect on the creation of new formal firms

Table 3 presents the results of estimates of equation (2) with day of week fixed effects and different functional forms of the running variable for the two outcomes (number of new formal firms and total amount of capital from new formal firms). The results of estimates with full fixed effects support the main identification strategy.[11] These placebo experiments show that the March 16 lockdown measures help to explain only the observed changes in creation of new formal firms occurred the day after their announcement and not other changes that predate or follow these announcements.

Overall, I find that COVID-19 lockdown has a large negative impact on creation of new formal firms but also in the total amount from new formal firms. Although these results cannot be compared with other studies that analyze these outcomes in other economies, they can be added to the different negative effects of the pandemic within the economy. Additionally, it can be mentioned that for Ecuador, Camino-Mogro and Armijos (2020) found a similar negative effect in magnitude for foreign direct investment using a database from Superintendencia de Compañias, Valores y Seguros.

5   Conclusions

The studies that analyze how the creation of new firms decrease immediately after a crisis are several. However, the effects of COVID-19 lockdown on creation of new formal firms are not still analyzed. In this paper, I quantify the impact of COVID-19 lockdown on creation of new formal firms and the total amount of capital from new formal firms in Ecuador, by using a real time dataset of companies creation from the supervisory and regulatory institution of companies: Superintendencia de Compañías, Valores y Seguros (SCVS). In this aim, I exploit the completely exogenous effect of COVID-19 lockdown on the outcomes by using a regression discontinuity in time (RDiT) design.

The unexpected lockdown applied in all the country on March 16, 2020 gives the opportunity to investigate how creation of new formal firms changes in response to lockdown policies. The empirical results reveals that the COVID-19 lockdown significantly decrease the creation of new formal firms and the total amount of capital from new formal firms in Ecuador. I find a large decrease in the creation of new formal firms that comes from -70.45% in 14 days after lockdown to -73.38% after 43 days of lockdown. Something similar happens, but in less percentage, with the effect on the total amount of capital from new formal firms that comes from -37.6% in 14 days after lockdown to -40.4% after 43 days of lockdown. The effect could remain in time due to the uncertainty generated by the pandemic, and by the policies that might be implemented to cope with a possible outbreak that could generate a new lockdown (Camino-Mogro & Armijos, 2020).

In order to show the robustness of the model specification, I use different test such as a linear, linear interaction, quadratic and quadratic interaction models of the running variable, changes in the bandwidth and a placebo lockdown date. The conclusion of different model specifications are the same. More important, using the placebo experiments I find that the March 16 lockdown measures help to explain only the observed changes in creation of new formal firms occurred the day after their announcement and not other changes that predate or follow these announcements.

In addition, the evidence suggest that the creation of new formal firms and the total amount of capital form new formal firms are not recovery quickly.[12] This could happen due to the uncertainty

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[11]Something similar is done by Caselli et al. (2020) in a context of individual mobility in Italy

[12]Something similar is found by Camino-Mogro and Armijos (2020) on Foreign Direct Investment.

created by the pandemic but also by the negative expectations on short-run economy recovery. In this line, Adam, Henstridge, and Lee (2020) mention that the difficulties of re-starting economies, the impact of the global recession, and the risks that lockdown measures just delay rather than suppress the virus; and a second-wave lockdown would dramatically increase the burden of adjusting to a second economic shock just as economies seek to exit the present one.

Because this is the first research to analyze the impact of the COVID-19 lockdown on the creation of new formal firms, comparison with other studies is not possible; however, Sedláček (2020) found that the number of startups in the US reached a record low at the end of the Great Recession in 2010 (31% below its pre-crisis level). This result then shows that other economic crises have had a negative impact on the creation of new firms, but this impact is now greater in part due to uncertainty and, on the other hand, due to the lack of room for maneuver of governments, especially those countries in the process of developing. development with high levels of debt and no savings to cope with these international shocks.

I contribute to the empirical literature and the policy debate in various aspects. First, a fall in the number of new formal firms directly reduces the number of new formal jobs created by startups. Gourio et al. (2016) and Sedláček (2020) argues that this 'lost generation' of firms then creates a persistent dent in aggregate employment as subsequent years are characterised by a lower number of young firms. For this, it is important to generate facilities for the creation of new formal firms, from the reduction of days it takes to create one (using technology as a support in this matter) to the decrease of the minimum capital to formalize a company. Second, improve the business conditions of the few formal firms that were born during the pandemic, but also that these conditions are a stimulus for the creation of new companies. These stimuli can range from a corporate tax exemption for more periods, to improving credit conditions in these new formal firms, during their first years. This is particularly important since Sedláček and Sterk (2017) show that firms born during recessions not only start smaller but also tend to stay smaller in future years even when the aggregate economy recovers. Third, I show that induced-lockdown policies has a negative impact on creation of new formal firms and the total amount of capital form new formal firms; this effect could be full-blown recession if governments do not apply mechanisms to revert this situation that could be a drag on the economy.

This paper opens the debate on the effects of the COVID-19 lockdown on the creation of new formal firms, so future research could study the impact in a broader time window to analyze medium and long-run effects, but also in different economic sectors and in the effects on firm bankruptcy, which added to an analysis of job loss, will show a total effect of damage in the economy.

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