The effects of COVID-19 lockdown on Foreign Direct Investment: evidence from Ecuadorian firms

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The effects of COVID-19 lockdown on Foreign Direct Investment: evidence from Ecuadorian firms[*]

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Abstract

Foreign Direct Investment has been described as an important factor that contributes to economic growth being of particular importance in developing countries. In this sense, we assess how lockdown/ restriction policies may affect FDI inflows. For this, we exploit the exogenous variation coming from the COVID-19 pandemic and its lockdown policies in Ecuador. We use a regression discontinuity in time design, jointly with official administrative FDI data, and find an overall large decrease in FDI inflows (-63%). We also assess differences across FDI sources and find stronger effects coming from capital increases (-64%) compared to new firm constitutions. In addition, we explore heterogeneity in terms of FDI's country of origin and find that the negative effects are mostly from inflows coming from north and south American investments. We also assess whether partial re-opening of activities positively affects FDI, for this we use the two largest cities in the country where we do not find any significant effect. Our main conclusion is that lockdown policies have a negative impact on FDI inflows, result that is of high policy relevance which can be a tool to design investment attraction policies.

Keywords: COVID-19; Lockdown; Foreign Direct Investment; Regression Discontinuity; Ecuador
JEL Codes: D00; D62; D81; F21

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1 Introduction

Foreign Direct Investment (FDI), worldwide, has grown rapidly since globalization. Nevertheless, FDI flows have steadily declined over the last five years (OECD, 2020). In Latin America (LA), this behavior is similar, and has been marked by three stages of growth, the first from mid-90s to the end of year 2000, the second from 2004 to 2008 which ended with the world economic-financial crisis, and the final stage from 2011 to 2013. All of these stages of growth are related to the boom of commodities. However, in the last 5 years there has been a slowdown in FDI flows in the region[1].

The decrease of recent years and the fact that FDI is related to the boom of commodities and to the end of the super-cycle of commodities, demonstrates that FDI flows are strongly linked with external shocks, which places the countries of the region in a situation of high vulnerability (Carrillo-Maldonado & Díaz-Cassou, 2019; Díaz-Cassou, Carrillo-Maldonado, & Moreno, 2020). Specifically, the exporters of commodities, with few FDI flows and / or high external financing requirements are more vulnerable to those external shocks. All of these characteristics influence the higher or lower risk of a possible sudden stop as a result of the current COVID-19 pandemic. In this line, as a consequence of COVID-19 pandemic, the OECD (2020) mentions that FDI flows to developing countries are expected to drop even more because the sectors that have been severely impacted by the pandemic, including the primary and manufacturing sectors, are those who used to benefit, in higher shares, from FDI flows.

Moreover, before the pandemic, the region's production structure already showed great structural heterogeneity that seriously limited its economic development possibilities, and the pandemic made these weaknesses more evident, and amplified economic, social and environmental tensions (ECLAC, 2020). Hence, it would be expected a delay on the structural changes of LA economies, not only because of the fall in FDI, but also because the pandemic has had negative effects on the labor market, inequality, production, productivity and others.

Even though, FDI plays an important role in supporting economies during the economic recovery after a crisis (see, for example: Alfaro & Chen, 2012; Desai, Foley, & Forbes, 2008), unfortunately, it appears that the impact of the pandemic on FDI flows to LA economies may be particularly severe, since it is expected to experience the largest decline, with a projected drop in FDI between 40 and 55 per cent in 2020 (UNCTAD, 2020).

This paper investigates the impact of the pandemic on the Ecuadorian FDI inflows. Similar to other countries, the first cases of COVID-19 were detected in the main cities, in the case of Ecuador it was in Guayaquil on February 29, 2020, which led to a lockdown policy applicable to all the country on March 16, 2020 where in addition, mobility and face-to-face work hours were suspended. However, the flexibility of mobility and return to the face-to-face work day took place at different periods of time in each of the cities affected by the pandemic. In this sense, we exploit the exogenous variation coming from the COVID-19 pandemic and its lockdown policy in Ecuador an perform a regression discontinuity design (RDD) in time as our identification strategy. We further the analysis and assess differences across FDI sources, capital increases and constitution of new firms. We also explore heterogeneity in terms of FDI's country of origin to see which inflows are more affected. Finally, we assess whether

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[1]Data obtained from Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of official figures.

partial re-opening of activities positively affects FDI, for this we focus on the two largest cities of the country. We also undertake a number of robustness exercises that further support our findings, such as employing different time bandwidths and functional forms. To achieve the objective of the study, we use a rich firm-level real time panel data set between January 1, 2020 to May 31, 2020 with all firms that received FDI. Our empirical framework also controls for the time trend, and economic factors affecting the whole country like the country risk indicator; also considers firm-specific characteristics, such as economic sector and the province in which the firm is located.

Ecuador is particularly interesting in this setting because the largest amount of dollars that comes from FDI is through capital increases (95%) while the rest (5%) is due to the creation of new companies during 2013-2017 (Camino-Mogro, Bermudez-Barrezueta, & Avilés, 2018); nevertheless, this participation has changed during 2020, where around 57% of FDI is through capital increases and 43% is from new companies or new constitutions. In addition, there is a heterogeneous participation of inward FDI from economic activities, firm size and location, showing that natural resources and manufacturing sectors, large firms and firms located in Guayaquil, Quito, Manta and Samborondón are those with largest FDI.[2] Moreover, Ecuador is highly vulnerable to external shocks because is highly dependent on commodities prices and in particular on oil prices; also, it has high external financing requirements, due to its high fiscal deficit and limited monetary policy capacity, but it also has very low levels of FDI; so the COVID-19 pandemic could aggravate the structural problems of this country. Díaz-Cassou et al. (2020) confirm that the external shock derived from COVID-19 leads to a significant recession in Ecuador and that in 2020 and 2021 a contraction of between 7.1% and 11.4% could accumulate, generating a pro-cyclical fiscal response.

In terms of size, the Ecuadorian business environment is made up mostly of micro, small and medium-sized companies (MSMs) with a participation of 95%, while only 5% are large firms (Superintendencia de Compañías Valores y Seguros, 2018). This business dwarfism, and also, high levels of informality, poor development of the non-traditional export sector and lower financial deepening increase the symptoms of low productivity (Ruiz-Arranz & Deza, 2018), which limits the development. In addition, having a higher percentage of small firms in the economy is associated with increases in the disparities in TFP, particularly in LA economies (see, for example: Busso, Madrigal, & Pagés, 2013; Camino-Mogro, Armijos-Bravo, & Cornejo-Marcos, 2018; Cole, Ohanian, Riascos, & Schmitz Jr, 2005).

Finally, it is well known that uncertainty decreases FDI, specifically in countries with less financial development (Choi, Furceri, & Yoon, 2020), political instability and external debt burden (Lemi & Asefa, 2003), a year before a politic election (Julio & Yook, 2016). All of these characteristics are present in the Ecuadorian economic-political context. In this path, and considering the FDI environment of social and financial uncertainty imposed by the COVID-19 pandemic, it is expected the FDI flows to decrease during the lockdown, because the country has limited financial capacity to cope with the lockdown and therefore the confinement could be longer.

Our paper contributes to the growing literature on uncertainty and FDI under a lockdown perspective and partial reopening of economic activities in different cities. It also contributes to the existing gap in studies on how the COVID-19 pandemic could affect international trade, focusing on FDI flows

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[2]Recent data obtained from Superintendencia de Compañías, Valores y Seguros

in a developing economy that is highly vulnerable to international shocks. Finally, we contribute with an analysis of different geographical areas that invest in companies in the country and how the pandemic could affect these flows in a heterogeneous way, but also how the partial reopening of cities in the country could also have a heterogeneous effect at the time of receiving FDI.

The reminder of the paper is organized as follows. In Section 2.1 we describe how the COVID-19 pandemic affects FDI in all the world and also in Ecuador, we also relate the literature with uncertainty theory. We subsequently describe the database that we construct for analysis in Section 3 and discuss the empirical model. In Section 4.1 we present our results and robustness checks. Finally, Section 5 concludes with policy recommendations.

2 COVID-19 pandemic lockdown and FDI

The COVID-19 pandemic has been considered one of the most disruptive events in the world in all of history since it has been an exogenous shock that has affected not only the world's health systems but has also managed to cause serious damage to the world economy.

The damage caused to the economy has been very severe, particularly in the labor market, since to mitigate the cases of infection by this pandemic, several countries took as a policy a declaration of lockdown of almost all economic activities and also closed their borders. This caused the productive apparatus to stop for several months and unemployment began to grow, as did inequality, especially in those countries with little room for maneuver to overcome the lockdown[3].

Additionally, the COVID-19 pandemic, being a simultaneous demand and supply shock, also affected international trade where, due to the uncertainty of how markets would react to the lockdown and how long the lockdown would be in each country, FDI flows began to decline, starting in developed economies but mostly affecting developing countries.

A recent report of ECLAC (2020) mentions that COVID-19 crisis has had immediate effects on FDI and will have potentially lasting consequences since the sudden and simultaneous interaction of supply- and demand-side shocks, combined with policy reactions to the crisis around the world, is triggering a series of effects on FDI and the impact will be felt with exceptional vehemence in 2020 when the cumulative effect across all transmission mechanisms is strongest. Because, the pandemic hit at a time when FDI flows were at the second lowest level recorded since 2010 in the aftermath of the global financial crisis (OECD, 2020).

In this sense, it would be expected that the COVID-19 pandemic due to lockdown and high uncertainty will have a negative impact on FDI flows worldwide and particularly greater in developing economies due to their limited capacity to manage properly crises. ECLAC (2020) and OECD (2020) show in their figures 1 that the downturn caused by the pandemic follows several years of negative or stagnant growth; as such it compounds a longer-term declining trend; so the expected level of global FDI flows in 2021 would represent a 60 per cent decline since 2015.

In Figure 1 we show how the inward FDI of many countries decreased after the first quarter of

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[3]To mitigate the effect of the lockdown caused by the COVID-19 pandemic, several developed and developing countries decided to increase cash transfers to the poorest people, created broader unemployment insurance, suspended the collection of taxes, among others; however, countries with a high public deficit, without savings and without the ability to issue currency were in serious problems since their ability to reduce the effect of the crisis was or is almost null.

2020. It is shown in panel (a) that there was a steep decrease of inward FDI received by Germany and United Kingdom. In the same way, in panel (b) it is shown how USA had a continuous decrease since the last quarter of 2019, decreasing even more after the shock of the global health crisis. The recovery of the flows of FDI will be slow possibly because of the uncertainty of the recovery from the virus, still there is no cure for the disease or a vaccine; also, there is the possibility of another strict lockdown. All of those uncertainties joined with the high level of debts caused by the virus, could worsen the speed of recovery of the economies. Oldekop et al. (2020) mentions that the impact of the virus on the public finances of the countries is significantly negative for three main reasons: (1) the close off of new lending for low and middle-income countries which decreases the value of currencies and makes the dollar debt repayments more difficult, (2) government have had to increase their expenditure for social protection, (3) a decrease in public revenue from taxation, which rises up the debt levels. In the same line, Barbier and Burgess (2020) mention how the COVID-19 makes developing countries more vulnerable. They say that if the progress toward the Sustainable Development Goals was already lacking before the pandemic, after is worse. They propose different innovative policies to achieve those goals, still they assert it will be difficult.

Figure 1: FDI inflow in Europe and USA
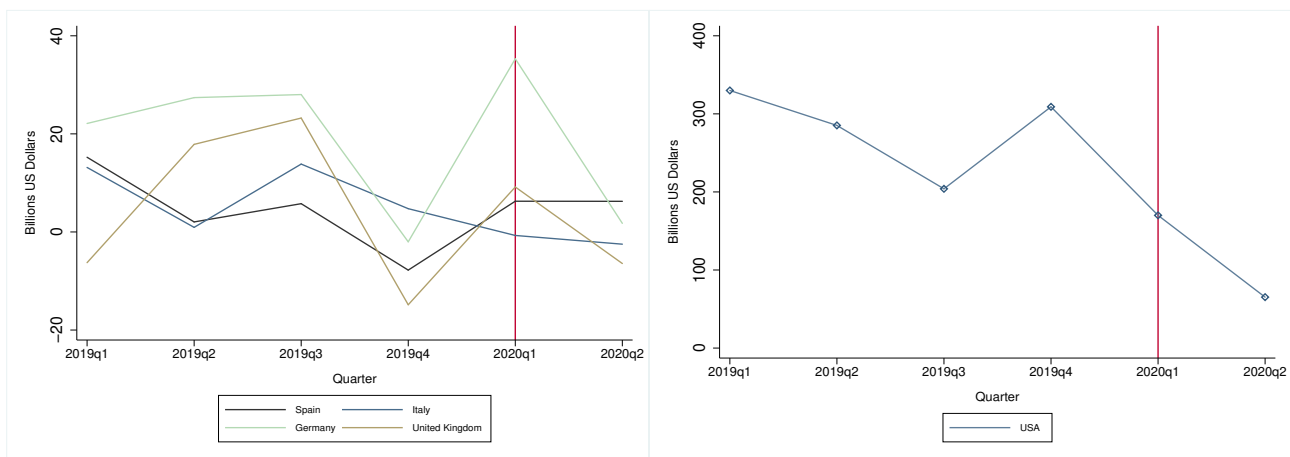
(a) FDI inflow in European Countries   (b) FDI inflow in United States of America

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

2.1   The Ecuadorian case

The COVID-19 pandemic has impacted Latin America and the Caribbean at a time of weak economy and macroeconomic vulnerability (BID, 2020; CEPAL, 2020). In particular, 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).

In terms of employment, around 270 thousand people have been separated from their jobs during the period between March 16, 2020 (initial day of lockdown in Ecuador) and the end of June 2020.[4] This could have happened due to a great impact from the lockdown but also because Ecuadorian firms were not prepared to face a crisis like this, where due to the lockdown they could not have

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

economic activity. Carrillo-Maldonado, Deza, and Camino-Mogro (2020) mention that 50% of 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. Moreover, after three months of confinement, Bachas, Brockmeyer, Santiago, and Semelet (2020) estimated that only 35% of firms would remain profitable and that almost all firms in the most affected sectors would register losses.

Additionally, FDI in Ecuador decreased by 42% during the pandemic, if the same period of 2019 is compared, this means 107 million USD less that entered the country as a result of FDI. Along these lines, a 66% decrease in FDI inflows was reflected by the number of companies and 77% by capital increases.[5]

Figure 2: Inward FDI

(a) Ecuador

(b) By country of origin
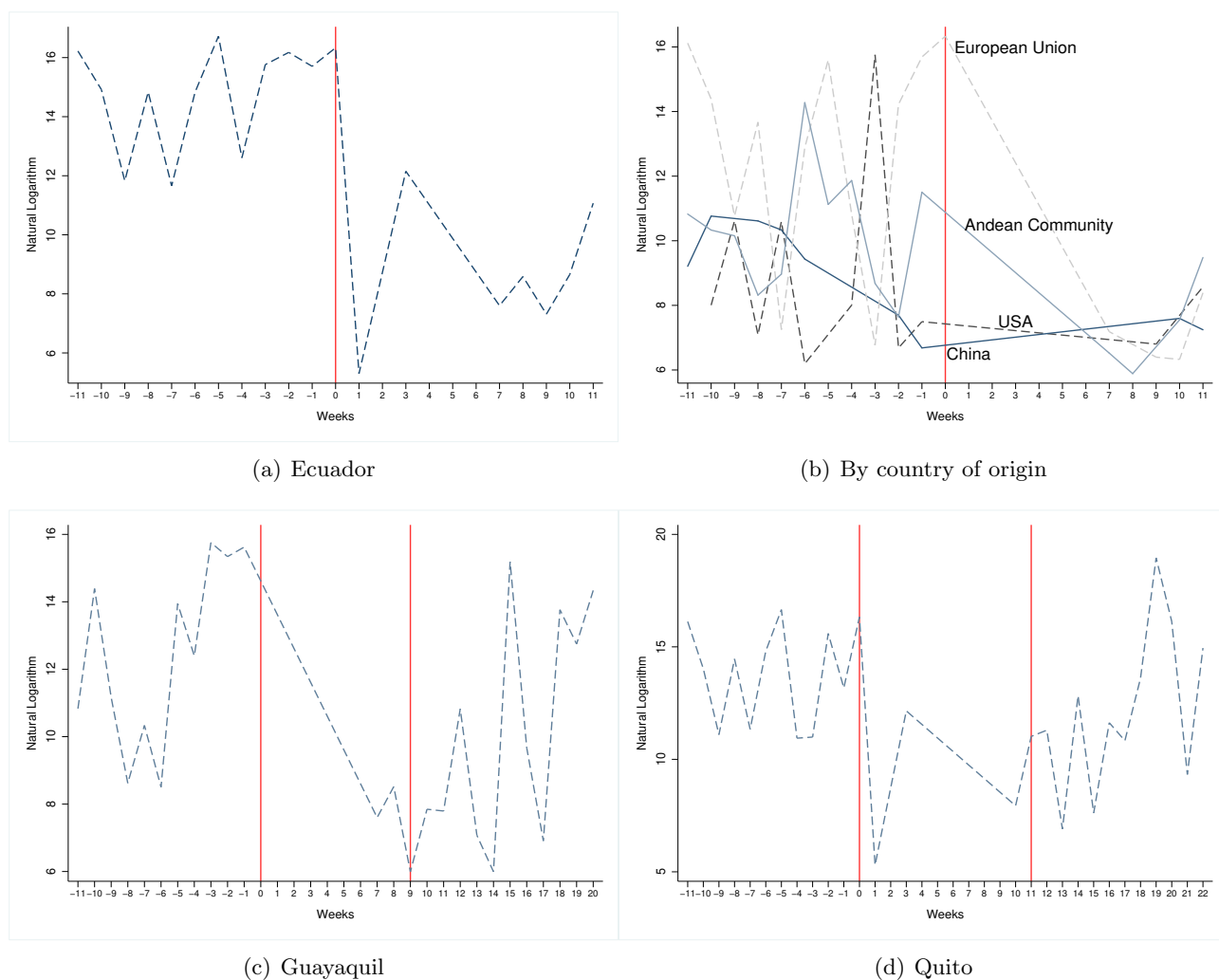
(c) Guayaquil

(d) Quito

Notes: In Guayaquil and Quito, the reopening took places in different weeks. Guayaquil implement a partial reopening on May 20, and in Quito was on June 3.
Source: Superintendencia de Compañías, Valores y Seguros.
Elaboration: Authors.

In figure 2, we show how the FDI decreased after the lockdown, shown as week 0 in subfigure (a). It is evident that the total amount of inward FDI decreased significantly the first week of lockdown, then it gradually increased but to a lower level (the maximum value is lower than the minimum value

[5]Data obtained from Superintendencia de Compañías, Valores y Seguros (SCVS).

before the lockdown). In subfigure (b) we show how the inward FDI decreased by country of origin. The FDI from China was the first to decrease, then the FDI from the Andean Community gradually decreased. The FDI from the European Union shows various ups and downs already before the week 0, but those decreases last for one week, whereas after the lockdown there was a constant decrease for almost two months. In subfigure (c) and (d) we show the behaviour of the inward FDI received by Guayas and Pichincha, the two main provinces of Ecuador. We show how the inward FDI decreased after the lockdown on the week 0 but increased after the partial reopening of the activities. In the case of Guayaquil, it was on May 20, the week 9 after the lockdown, and for Quito it was on June 3, the week 11 after the lockdown.

The effect of the pandemic is notorious in FDI in Ecuador, since it accelerated the problems that were already presenting slightly at the end of 2019, as a result of the political uncertainty where the uncertainty of how the country would react to this new economic and social crisis is now added and for which no country was prepared. However, the government's reaction through mechanisms to attract foreign direct investment to the country have been nil.

3 Design and empirical strategy

3.1 Data

We use real time data from 2020 obtained from the Superintendencia de Compañías, Valores y Seguros (SCVS), that includes the information of the investment data sheets. Those data sheets have information regarding the characteristics of the investment: name of the shareholders, the country of origin, the type of investment (if it is foreign or domestic), the amount of capital allocation, and others. The panel data is weekly and at firm level between 2019 and 2020.

The real-time data is information immediately available after its collection from a recent event. In Ecuador, the SCVS receives all of the information of the FDI immediately after the transaction was done. 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, or actions to promote the investment) more rapidly. Also, authors like Malik, Sam, Hussain, and Abuarqoub (2018) mention the importance of real-time data for a more suitable way to do inference and analysis.

As the aim of this study is to evaluate the effect of the COVID-19 on the levels of inward foreign investment, we construct a database that includes the weekly amount of FDI of each firm, and include other firm-specific characteristics. The micro variables are taken from the SCVS investment data sheets, as mentioned above. The investment is transformed to logarithms to make the data more interpretable. We include demographic information, such as, the province where the firm is located. Also, we include the type of firm, if it is a limited liability company, anonymous society, and so on. Finally, we also classify the firms according to the 2 digits sectors from the ISIC Rev 4.0 classification. As macro variables, we include the country risk indicator, we calculate the week median taken from the daily data published by Ambito.[6] The oil price is extracted from the same source and we estimate the baseline model including it (without country risk), getting similar results to the ones obtained with

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[6]The data is obtained from the official web page: https://www.ambito.com/contenidos/riego-pais-ecuador.html

country risk.[7] We do not include both variables at the same time because they have a high negative correlation, which would cause multicollinearity problems. In the Appendix section, we include the Table 9 with the Pearson correlations coefficients between the variables used in the analysis. We show that there is a strong negative correlation (more than -0.90) between the two macro-variables, oil and country risk.

3.2 Identification and Methodology

We take advantage of the completely exogenous effect of COVID-19 pandemic that induces a lockdown (and resulting cessation of activities) on March 16, 2020 in Ecuador. In this path, we perform a RDD in time, a quasi-natural experimental econometric technique, that allow us to rigorously compare the impacts of the lockdown on FDI inflows in a time window around the lockdown date.[8]

In this sense, our empirical strategy is to leverage the sharp discontinuities of economic activities when the lockdown goes into effect and employ a (sharp) Regression Discontinuity Design (RDD) in time model.[9] 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 (FDI inflows) 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 FDI inflows variations in Ecuadorian firms around the lockdown date:

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

Where, w is the number of weeks before and after the official lockdown date. We subsequently estimate the following equation 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) $$FDI_{it} = \beta_0 + \beta_1 PostLockdown_{it} + f(w_t) + \theta risk_t + \rho_t + \mu_i + \pi_i + \gamma_i + \epsilon_{it}$$

Where, FDI is the FDI inflows received in firm i at week t, this is our main outcome. The parameter of interest is β_1 the (local average treatment) impacts of the lockdown on FDI; our treatment variable is $PostLockdown$ which is a dummy variable that is equal to one for all weeks after the lockdown on March 16 and zero for all preceding weeks. We use data from January 1 to May 31, 2020 for our main specification, which allows 10 weeks on either side of the cutoff. Our running variable is w_t which represents the number of weeks before and after the official lockdown date. To provide robust analysis and for comparison purposes, we let the function $f(w_t)$ has different functional forms to flexibly control for variations in FDI that would have occurred in the absence of the lockdown. This function includes a linear model and a quadratic model of (w_t); we use a bandwidth of 11 weeks

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[7]Results are available upon authors request

[8]This effect could be estimated by OLS. 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 FDI can be correlated with the number of cases and deaths from COVID-19 and this could generate more rigorous measures in the lockdown.

[9]A similar empirical strategy is used by Barnes, Beland, Huh, and Kim (2020) and Dang and Trinh (2020) where the running variable is the time of COVID-19 lockdown.

before and after the lockdown date as our preferred time bandwidth,[10] but we also present results for different bandwidths to investigate the duration of the lockdown impacts. Additionally, $risk_t$ is a country risk variable measured in logs that could influence country FDI inflows.[11] Finally, ρ_t is a time fixed effect, μ_i is a province fixed effect, π_i is a type of company fixed effect, γ_i is an industry fixed effect and ϵ_{it} is the error term. We report standard errors robust to heteroskedasticity.

We also use equation (2) to look at several sources of heterogeneity in FDI flows, such as FDI by type like new constitutions and capital increases, and by region of origin of the inward FDI. This classification allows us to estimate the impact of not only how FDI decreases with COVID-19 pandemic, but also where is the largest negative impact by type and by demographic origin.

Finally, besides the effect of lockdown imposed throughout the country, we also assess whether the partial return to activities in the two most important cities (Guayaquil and Quito) has an effect on FDI inflows. For this, we estimate the following equation:

$$(3) \qquad FDI_{ict} = \alpha_0 + \alpha_1 Return_{ict} + f(w_t) + \theta risk_t + \rho_t + \pi_i + \gamma_i + \epsilon_{it}$$

Where, our new parameter of interest is α_1, the (local average treatment) impact of the return to activities on FDI. Our treatment variable is $Return$ which is a dummy variable that is equal to one for all weeks after the partial return to activities for each city c and zero for all preceding weeks. It is important to mention that we perform this analysis only for Guayaquil and Quito which concentrate around the 75% of total FDI in Ecuador in the last ten years. More important is that these two cities have different dates of partial return to activities, and because of this, we use different time windows (and separate regressions) according to each city. We expect the partial return to activities to have a positive impact on the FDI in each city only if the global uncertainty about COVID-19 pandemic decreases[12].

4   Main results

Before showing the results of the estimates, we present graphical evidence of the effect of the COVID-19 lockdown on FDI inflows in Ecuadorian firms during the period from January 2020 to May 2020. In this path, and similar to Barnes et al. (2020) and Dang and Trinh (2020), we run a data-driven RDD regression of FDI inflows (in logs) against the number of weeks around the lockdown date. In Figure 3 we present the RDD graph which shows that FDI dramatically decreases a week after the lockdown date in Ecuador. In this sense, we find a significant discontinuity and a decrease at the cutoff date, but we also observe that the reduction of FDI inflows decreases slightly at higher bandwidth. However, the recovery of FDI several weeks after the lockdown does not reach the levels of FDI before the lockdown, suggesting that the effect of the COVID-19 lockdown is not only at short-run.

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[10]We prefer a bandwidth that starts in the first week of 2020 to clean possible effects of other exogenous events that happened in Ecuador during 2019 such as the the indigenous manifestations that began on October 3, 2019 and lasted about 15 days where economic activities were paralyzed and also generated political and economic uncertainty in the country.

[11]We also use oil prices (measured in logs) and similar results are obtained. Results with this variable are available upon authors request

[12]Some authors argue that higher uncertainty reduces the responsiveness of investment to demand shocks (see, for example: Bloom, Bond, & Van Reenen, 2007; Meinen & Röhe, 2017).

Once we show that there is a discontinuity in Ecuadorian firms FDI inflows, we estimate the effect of lockdown on FDI inflows using equation (2). In Table 1, we present our main results using a bandwidth of +/- 11 weeks around the lockdown date, this allows us to analyse a window from January to May 2020. In the same table, we show the results by using all FDI inflows and also separately by capital increases and new constitution to get a detailed information of which type of FDI is more/less affected by the lockdown. In addition, we present our results comparing an estimation with and without control variables to show the robustness of our model specification. In all the cases, our preferred models are those that includes control variables as in equation (2) (models (2), (4) and (6)).

Figure 3: Regression discontinuity plot for FDI inflows analysis
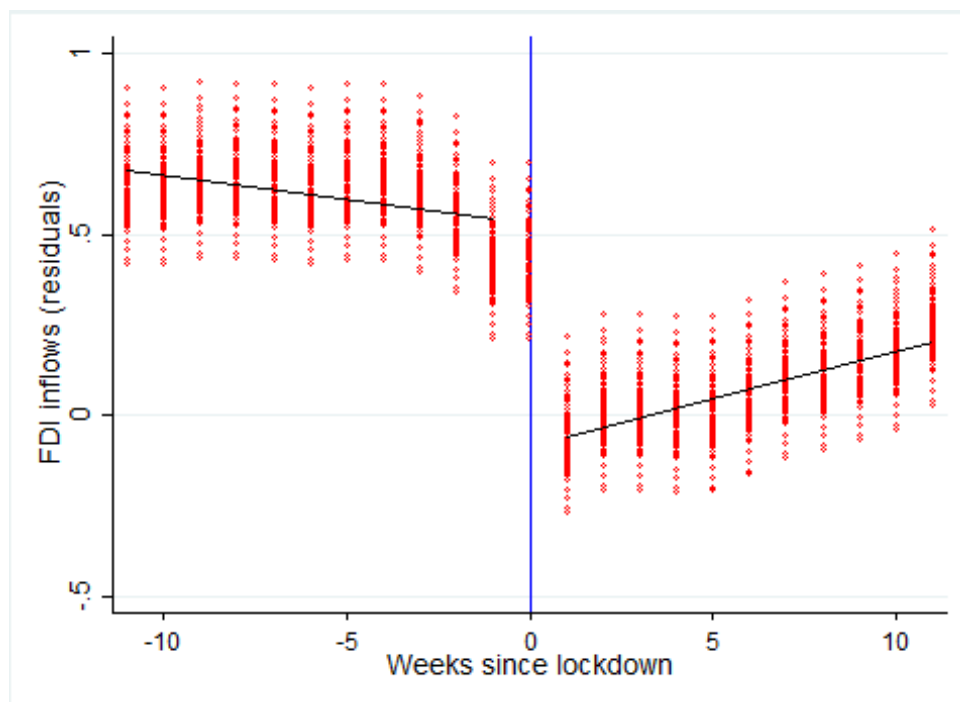
In Panel A of Table 1, we present the results of a linear model, and the results using a quadratic model (in Panel B of same table). Our results are robust to the use of a quadratic model. Overall, we find that the COVID-19 lockdown has strong statistically significant negative impacts on FDI inflows at the 1 percent level, and at 10 percent level for FDI inflows by capital increases. This evidence remains qualitatively similar, regardless of inclusion of control variables and different functional forms of the running variable. More specifically, we find that the lockdown leads to a 63% reduction of total FDI inflows in Ecuadorian firms and a 64% reduction in FDI capital increases. Nevertheless, the impact of lockdown on FDI new constitutions is around 8%, this effect is not statistically significant at standard levels. Using a different functional form of the running variable (quadratic form in Panel B) results are similar, for example, the lockdown leads to a 64% reduction of total FDI inflows and a 59% reduction in FDI capital increases.

Using the same bandwidth (+/- 11 weeks) in Table 2, we show our results by the country of origin of the FDI inflow. We present the results for North America, China, European Union and

South America regions, because they represent around the 85% of total FDI inflows in 2020. Using equation (2), we present the results in the same manner as to Table 1 (linear and quadratic model, with and without control variables). Our results suggest that the lockdown has strong statistically significant negative impacts on FDI inflow at the 1 percent level for investments from South American and North American countries (significant at 10 percent level), no impact is found for China and European Union countries FDI inflows. In particular, we find that the lockdown leads to a 84% reduction of total FDI inflows that comes form South American countries and a 74% reduction from North American countries.

Table 1: COVID-19 lockdown and FDI inflow: Bandwidth +/- 11 weeks

	Total FDI		Capital increase		New Constitution	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Linear model						
$PostLockdown_{it} = 1$	-0.540***	-0.406***	-0.186***	-0.146*	-0.095	-0.558
	(0.087)	(0.109)	(0.065)	(0.079)	(0.793)	(1.027)
$risk_t$		-0.251***		-0.067		-0.101
		(0.069)		(0.048)		(0.664)
Panel B: Quadratic model						
$PostLockdown_{it} = 1$	-0.608***	-0.410***	-0.197***	-0.135*	-0.260	-1.285
	(0.062)	(0.110)	(0.045)	(0.077)	(1.164)	(1.210)
$risk_t$		-0.192***		-0.057		-0.213
		(0.069)		(0.050)		(0.482)
Mean before lockdown	0.640	0.640	0.227	0.227	6.851	6.851
Province FE	No	Yes	No	Yes	No	Yes
Type FE	No	Yes	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,152	5,152	4,975	4,975	177	177

Notes: Robust standard errors in parentheses. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Running variable is number of weeks from the lockdown date. All regressions include weeks dummies. Control variable of uncertainty (risk) is reported. Panel A uses running variable in linear form, Panel B includes quadratic term of running variable.

This evidence goes along with the amount of FDI by country of origin that receives Ecuadorian firms. The United States (included in North American region) and the Andean Community of Nations (includes South American countries) are the main countries that invest in Ecuadorian firms, but also are the most affected by the COVID-19 pandemic, excluding China.

Overall, we find a large statistically significant negative impact of COVID-19 lockdown on FDI inflows in Ecuadorian firms. Also, our results show that country risk indicator ($risk_t$) is particularly important in our model, and shows that an increase of country risk leads to a decrease in FDI inflow.[13] Our results can not be compared with other research since there are no studies analyzing the lockdown and FDI inflows.

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[13]We use a similar specification with oil price instead of country risk and the results are similar in magnitude and significance. We decide to use country risk because this variable is more related with FDI inflows. The correlation between oil prices and country risk is -0.974 and significant at 1% level.

Table 2: COVID-19 lockdown and FDI inflow by region: Bandwidth +/- 11 weeks

	North America		China		European Union		South America	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A:								
Linear model								
$PostLockdown_{it} = 1$	-0.674***	-0.444*	-0.145	0.127	-0.457*	-0.370	-0.617***	-0.505***
	(0.215)	(0.241)	(0.228)	(0.278)	(0.265)	(0.365)	(0.116)	(0.142)
$risk_t$		-0.430**		-0.509**		-0.163		-0.209**
		(0.175)		(0.200)		(0.220)		(0.091)
Panel B:								
Quadratic model								
$PostLockdown_{it} = 1$	-0.726***	-0.449*	-0.570***	-0.058	-0.614***	-0.406	-0.599***	-0.473***
	(0.170)	(0.237)	(0.172)	(0.266)	(0.169)	(0.379)	(0.083)	(0.144)
$risk_t$		-0.268*		-0.496**		-0.202		-0.122
		(0.155)		(0.202)		(0.235)		(0.089)
Mean before lockdown	0.602	0.602	0.556	0.556	0.753	0.753	0.601	0.601
Province FE	No	Yes	No	Yes	No	Yes	No	Yes
Type FE	No	Yes	No	Yes	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes	No	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	736	736	483	483	897	897	2,392	2,392

Notes: Robust standard errors in parentheses. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Running variable is number of weeks from the lockdown date. All regressions include weeks dummies. Control variable of uncertainty (risk) is reported. Panel A uses running variable in linear form, Panel B includes quadratic term of running variable.

4.1 Robustness checks: different bandwidths and placebos of fake lockdown dates

In this subsection we present several robustness checks for our main results. First, we change the main bandwidth (+/- 11 weeks) to +/- 5 and +/- 8 weeks. Second, we change the date of the lockdown, simulating a fake lockdown 1 to 3 weeks before the real lockdown week in Ecuador.

In Table 3, we show our results with a bandwidth of +/5 weeks of the COVID-19 lockdown by using equation (2). Again our results suggest that the COVID-19 lockdown has strong statistically significant impacts on decreasing FDI inflow at the 5 percent level. Nevertheless, when we divide the FDI inflows by capital increases and new constitutions, none of these types have a significant result as a consequence of the lockdown. We find that the lockdown leads to a 37% reduction of total FDI inflows when we use this new bandwidth, we also show that our results are robust to the inclusion of control variables and different functional forms of the running variable (see Panel B). In addition, in Table 4, we present the results of FDI inflows by country of origin, we show that the impact is large and statistically significant at 10 per cent level for China, this evidence suggests that the lockdown has a -157% impact on FDI inflows received from China. For the other regions, the impact of the lockdown is not statistically significant at standard levels.

In Table 5 we present the results with a bandwidth of +/- 8 weeks of the COVID-19 lockdown. Our evidence are similar to main results, the COVID-19 lockdown has a strong statistically significant negative impact on FDI inflows at the 1 percent level, and at 10 percent level for FDI inflows of capital increases. We find that the lockdown leads to a 90% reduction of total FDI inflows in Ecuadorian firms and a 70% reduction in FDI capital increases. This evidence is robust to other functional forms.

Moreover, in Table 6, we show the impact of lockdown on FDI inflows by country of origin with a bandwidth of +/- 8 weeks form the cutoff. The results show that there is a negative impact of the lockdown by -112% on FDI flows received from the North American region and -107% decrease of FDI inflows that comes form South American countries. Again or results show that FDI inflows coming from countries in North and South America have the largest impact of inward FDI.

Table 3: COVID-19 lockdown and FDI inflow: Bandwidth +/- 5 weeks

	Total FDI		Capital increase		New Constitution	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Linear model						
$PostLockdown_{it} = 1$	-0.575**	-0.581**	-0.163	-0.147	-1.816***	-0.745
	(0.293)	(0.291)	(0.239)	(0.238)	(0.661)	(1.662)
$risk_t$		-0.230		-0.220		0.171
		(0.326)		(0.253)		(3.038)
Panel B: Quadratic model						
$PostLockdown_{it} = 1$	-0.823***	-0.665***	-0.323**	-0.194	-2.065**	-0.309
	(0.191)	(0.266)	(0.150)	(0.215)	(0.917)	(5.313)
$risk_t$		-0.477		-0.309		0.908
		(0.297)		(0.246)		(7.350)
Mean before lockdown	1.566	1.566	0.637	0.637	6.789	6.789
Province FE	No	Yes	No	Yes	No	Yes
Type FE	No	Yes	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	990	990	921	921	69	69

Notes: Robust standard errors in parentheses. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$.
Running variable is number of weeks from the lockdown date. All regressions include weeks dummies. Control variable of uncertainty (risk) is reported. Panel A uses running variable in linear form, Panel B includes quadratic term of running variable.

Additionally, we show that the negative impact of COVID-19 lockdown increases after the first weeks of confinement and it begins to decrease more slowly from week 11 after the lockdown. However, the impact is still quite large, which shows that its effect is persistent over time and that it is not only a short-run effect. 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.

Finally, we offer a set of placebo tests to strengthen the causal interpretation we give to our results. In this path, we change the date of the official lockdown, simulating that it was 1, 2 or 3 weeks before the real date. We expect not to find a significant coefficient in any of these cases or to find a positive and significant coefficient. In Table 7, columns (2), (4) and (6) present the results of estimates of equation (2) with the same fixed effects and control variables as the baseline equation, our results of estimates with full fixed effects support our main identification strategy.[14]

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[14]something similar is done by Caselli, Fracasso, and Scicchitano (2020) in a context of individual mobility in Italy

Table 4: COVID-19 lockdown and FDI inflow by region: Bandwidth +/- 5 weeks

	North America		China		European Union		South America	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A:								
Linear model								
$PostLockdown_{it} = 1$	-0.679	-0.715	-2.110*	-2.099*	-1.220	-1.190	-0.393	-0.403
	(0.581)	(0.582)	(1.118)	(1.141)	(1.331)	(1.338)	(0.339)	(0.342)
$risk_t$		-1.299		0.405		1.084		-0.341
		(0.796)		(1.106)		(1.317)		(0.419)
Panel B:								
Quadratic model								
$PostLockdown_{it} = 1$	-0.805**	-0.498	-1.446*	-1.737*	-1.640*	-1.679	-0.643***	-0.458
	(0.368)	(0.486)	(0.750)	(1.002)	(0.890)	(1.273)	(0.223)	(0.310)
$risk_t$		-0.927		0.877		0.116		-0.556
		(0.661)		(0.859)		(1.253)		(0.369)
Mean before lockdown	1.652	1.652	1.331	1.331	1.898	1.898	1.456	1.456
Province FE	No	Yes	No	Yes	No	Yes	No	Yes
Type FE	No	Yes	No	Yes	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes	No	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	143	143	44	44	132	132	517	517

Notes: Robust standard errors in parentheses. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Running variable is number of weeks from the lockdown date. All regressions include weeks dummies. Control variable of uncertainty (risk) is reported. Panel A uses running variable in linear form, Panel B includes quadratic term of running variable.

Table 5: COVID-19 lockdown and FDI inflow: Bandwidth +/- 8 weeks

	Total FDI		Capital increase		New Constitution	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Linear model						
$PostLockdown_{it} = 1$	-0.877***	-0.859***	-0.274**	-0.245*	-0.337	-0.232
	(0.153)	(0.242)	(0.117)	(0.141)	(0.926)	(1.296)
$risk_t$		0.029		-0.029		-0.035
		(0.184)		(0.132)		(1.006)
Panel B: Quadratic model						
$PostLockdown_{it} = 1$	-0.902***	-0.902***	-0.277***	-0.230*	-1.106	-0.661
	(0.106)	(0.243)	(0.084)	(0.132)	(1.143)	(1.004)
$risk_t$		0.001		-0.039		-0.182
		(0.179)		(0.130)		(0.706)
Mean before lockdown	0.958	0.958	0.351	0.351	6.783	6.783
Province FE	No	Yes	No	Yes	No	Yes
Type FE	No	Yes	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,635	2,635	2,514	2,514	121	121

Notes: Robust standard errors in parentheses. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Running variable is number of weeks from the lockdown date. All regressions include weeks dummies. Control variable of uncertainty (risk) is reported. Panel A uses running variable in linear form, Panel B includes quadratic term of running variable.

Table 6: COVID-19 lockdown and FDI inflow by region: Bandwidth +/- 8 weeks

	North America		China		European Union		South America	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A:								
Linear model								
$PostLockdown_{it} = 1$	-1.160***	-1.120*	-0.571	-0.655	-0.483	-0.461	-0.941***	-0.974***
	(0.408)	(0.589)	(0.549)	(0.919)	(0.480)	(0.769)	(0.194)	(0.315)
$risk_t$		-0.062		0.133		-0.036		0.052
		(0.411)		(0.634)		(0.585)		(0.243)
Panel B:								
Quadratic model								
$PostLockdown_{it} = 1$	-1.045***	-1.082*	-0.895***	-0.774	-0.712*	-0.490	-0.905***	-0.968***
	(0.259)	(0.573)	(0.323)	(0.888)	(0.364)	(0.780)	(0.128)	(0.314)
$risk_t$		0.038		-0.122		-0.226		0.063
		(0.417)		(0.709)		(0.561)		(0.234)
Mean before lockdown	0.994	0.994	0.976	0.976	1.038	1.038	0.905	0.905
Province FE	No	Yes	No	Yes	No	Yes	No	Yes
Type FE	No	Yes	No	Yes	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes	No	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	340	340	153	153	459	459	1,309	1,309

Notes: Robust standard errors in parentheses. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Running variable is number of weeks from the lockdown date. All regressions include weeks dummies. Control variable of uncertainty (risk) is reported. Panel A uses running variable in linear form, Panel B includes quadratic term of running variable.

Table 7: COVID-19 lockdown and FDI inflow: Placebo of fake week of lockdown

|	-1 week		-2 weeks		-3 weeks	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Linear model						
$PostLockdown_{it} = 1$	-0.396***	-0.319	-0.101	0.372*	-0.149	0.014
	(0.112)	(0.225)	(0.127)	(0.221)	(0.140)	(0.153)
$risk_t$		-0.080		-0.624***		-0.454***
		(0.146)		(0.132)		(1.006)
Panel B: Quadratic model						
$PostLockdown_{it} = 1$	-0.374***	-0.258	-0.076	0.297	-0.051	-0.025
	(0.087)	(0.233)	(0.107)	(0.217)	(0.116)	(0.154)
$risk_t$		-0.095		-0.396***		-0.052
		(0.147)		(0.146)		(0.139)
Mean before lockdown	0.633	0.633	0.626	0.626	0.659	0.659
Province FE	No	Yes	No	Yes	No	Yes
Type FE	No	Yes	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,704	4,704	4,256	4,256	3,808	3,808

Notes: Robust standard errors in parentheses. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Running variable is number of weeks from the fake lockdown date. All regressions include weeks dummies. Control variable of uncertainty (risk) is reported. Panel A uses running variable in linear form, Panel B includes quadratic term of running variable.

4.2 Reopening activities in Guayaquil and Quito

In this subsection we analyse how the partial reopening activities (May 20 and June 3 2020) could impact the FDI inflows in the two most important cities in Ecuador (Guayaquil and Quito). We start our analysis by showing a graphical evidence of the effect of the partial return to activities (reopening) on Ecuadorian FDI inflows in Guayaquil and Quito. We plot in Figure 4 the results for each city, which shows that FDI inflows increase after a week of the partial return to activities in each city (as expected). Moreover, we show that the effect is larger in Guayaquil compared to Quito. Nevertheless, the increase of FDI inflows in each city seems to be weak after several weeks of the reopening. This suggests that the impact of reopening policies in each city do not generate a strong enough effect to recover the losses in terms of FDI. This could occur due to the uncertainty created by the pandemic and that despite a partial reopening, investors have negative expectations of the Ecuadorian market regarding the handling of the pandemic.[15]

Figure 4: Regression discontinuity plot for FDI inflows analysis of partial reopening activities in Guayaquil and Quito
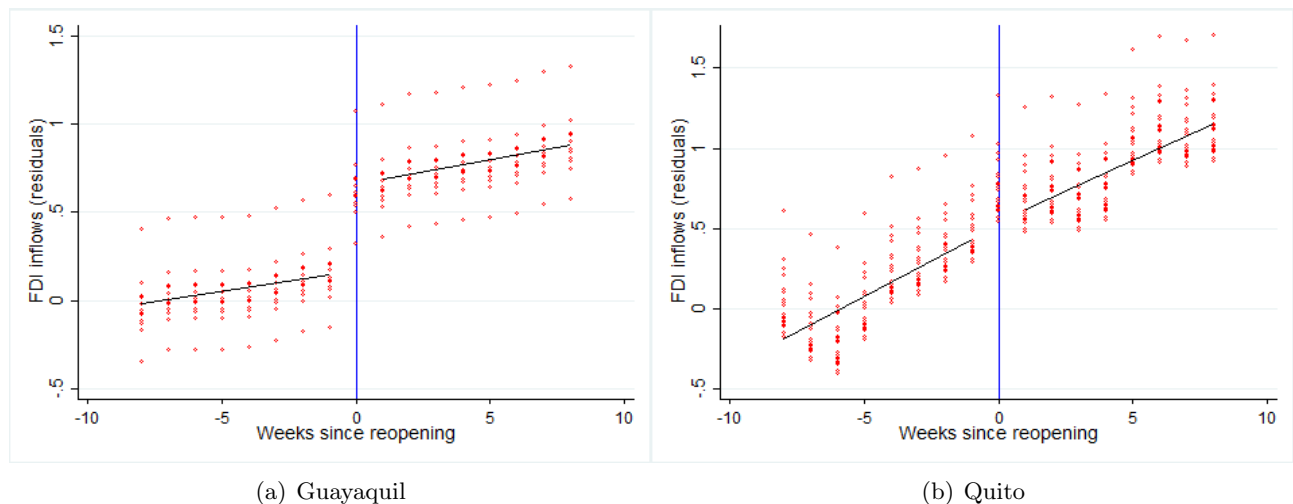
(a) Guayaquil   (b) Quito

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

We then estimate the effects of the partial reopening activities on FDI inflows in Guayaquil and Quito using the sharp RDD model presented in Equation (3). We use a bandwidth of +/- 8 weeks for each city, we also control for country risk and type of the company, industry and time fixed effects. In addition, we present our results using a linear and quadratic model of the running variable. In Table 7, we show the results of the impact of partial reopening activities on FDI flows in Guayaquil and Quito, we prefer the linear model and with all controls (columns (2) and (4)). Our evidence suggests that the partial reopening activities in Guayaquil has a positive impact on FDI flows but it is not statistically significant at standard levels. On the other hand, the partial reopening activities in Quito have a negative impact on FDI flows but it is not statistically significant at standard levels.

Overall, we expected a significant impact of reopening policies on FDI inflows. Nevertheless, this

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[15]The policy of reopening economic activities in each of these cities was based on the management of the pandemic after the lockdown; however, the FDI inflow could be affected by the uncertainty created by the central government regarding the non-coordination of communicational messages and the lack of information on infections and deaths caused by COVID-19 in each city.

is not found in the two largest city of Ecuador. This evidence supports that the recession caused by the pandemic could be more difficult to reverse, and that the effect it has caused on FDI is not a short-run shock and that despite reopening the economy, FDI has not been positively impacted due to these policies, which could be due to the uncertainty of another longer and more severe lockdown or even a pronounced recession in Ecuador.

Table 8: Partial reopening activities and FDI inflow: Guayaquil and Quito

	Guayaquil		Quito	
	(1)	(2)	(3)	(4)
Panel A: Linear model				
$Return_{it} = 1$	0.474*	0.451	0.118	-0.122
	(0.287)	(0.307)	(0.346)	(0.346)
$risk_t$		-0.214		-1.795
		(0.797)		(1.304)
Panel B: Quadratic model				
$Return_{it} = 1$	0.582**	0.501	0.102	-0.119
	(0.281)	(0.333)	(0.347)	(0.342)
$risk_t$		-0.610		-1.053
		(1.098)		(0.958)
Mean before lockdown	0.065	0.065	0.123	0.123
Type FE	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes
Observations	527	527	646	646

Notes: Robust standard errors in parentheses. $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. Running variable is number of weeks from the fake lockdown date. All regressions include weeks dummies. Control variable of uncertainty (risk) is reported. Panel A uses running variable in linear form, Panel B includes quadratic term of running variable.

5 Conclusions

In this paper, we present for the first time the impact of the COVID-19 lockdown on FDI flows received by firms. For this purpose we use a regression discontinuity in time design based on real-time data of FDI registered by Ecuadorian firms in the supervisory and regulatory institution of companies: Superintendencia de Compañías, Valores y Seguros (SCVS). Also, we analyse the impact of the lockdown on two different types of FDI and by country of origin. Additionally, we study the impact of partial reopening activities in the two most important cities in the country on FDI inflows.

By exploiting the unexpected lockdown applied in all the country on March 16, our empirical analysis reveals that the COVID-19 lockdown significantly reduces FDI inflows in Ecuador. Our results show a large decrease in FDI inflows (-63 percent), including FDI capital increases (-64 percent). We also find evidence that the lockdown effects are greater for FDI inflows from North and South American countries, where the impact is a large decrease of 84 percent and 74 percent of FDI, respectively. Our

results are robust to a set of different test such as a linear or a quadratic model of the running variable, changes in the bandwidth and a placebo lockdown date. In addition, our results suggest that the COVID-19 lockdown impact on FDI inflows in Ecuadorian firms is not a short-run effect since with a short bandwidth the negative impact is -37%; when we amplify the bandwidth to +/- 8 weeks the impact on FDI inflows is -90% and finally with a bandwidth of +/- 11 weeks the impact is -63%. This suggests that FDI inflows into the country are not recovering quickly, and this effect may occur due to the uncertainty generated by the pandemic regarding the markets. 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. This could delay the structural change, particularly in developing countries.

Finally, we assess the impact of partial reopening activities on FDI inflows of Guayaquil and Quito. Our findings suggest that the partial reopening activities in these two cities has no impact on the recovery of FDI inflows. Again, the uncertainty may play an important role on the slowness of the recovery of the FDI in the two largest cities of Ecuador. Specifically, the management of the pandemic crisis and the chaos generated in each city might have affected the recovery of FDI inflows in each city.

Being the first empirical work that assesses the impact of a lockdown and a partial reopening activities on FDI inflows, our findings contribute to various strands of the literature as well as to the policy debate. We contribute with evidence of how the lockdown has a negative impact on FDI, so closing borders, restricting mobility could be negative signs for foreign investors, even more so if we are talking about a small and developing economy. Furthermore, our results contribute to a context of global uncertainty, a possible mismanagement of an economic and social crisis can also be a bad sign for international investors and this can slow down the arrival of fresh capital. Moreover, our results bear on policymakers on two dimensions. First, reopening the economy quickly without having properly managed the pandemic does not ensure that FDI flows arrive faster, so public policy makers should focus their efforts on adequately managing the pandemic, providing reliable information and reopening priority economic activities. Second, mechanisms should be sought so that FDI reaches the country quickly after this economic and social crisis, in this sense, tax exemptions to the new company constitutions and the reinvestment of multinational profits should be a priority, contributing to job creation lessening the shock in the labor market.

We believe that this paper could be the beginning of future works that analyze how the impact of isolation policies, in different settings, may affect FDI and other outcomes of international trade. In addition, future research might be conducted extending the time horizon, when the data is available, to assess long-run effects and also assessing the impact on other outcomes such as firm exports and imports.

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6   Appendix

Table 9: Correlation matrix

	FDI(log)	type of company	province	activity	oil	risk
FDI (log)	1.00					
type of company	-0.01	1.00				
	(0.71)					
province	0.01	0.22***	1.00			
	(0.44)	(0.00)				
activity	-0.01	0.08***	0.10***	1.00		
	(0.41)	(0.00)	(0.00)			
oil	0.15***	0.00	-0.00	0.00	1.00	
	(0.00)	(1.00)	(1.00)	(1.00)		
risk	-0.15***	-0.00	0.00	0.00	-0.93***	1.00
	(0.00)	(1.00)	(1.00)	(1.00)	(0.00)	

Table of Pearson correlations coefficients. p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$