The Real Costs of Washing Away Corruption:

Evidence from Brazil's Lava Jato Investigation[1]

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Abstract

Anti-corruption investigations aim at promoting allocative efficiency and growth, but, if too disruptive, they can generate adverse economic consequences. We examine the costs of one of the world's largest anti-corruption crackdowns, Operação Lava Jato in Brazil, using unique bank-firm-worker data. We find investigated firms cut employment and wages and lose access to bank credit. Importantly, more exposed banks reduce credit also to non-investigated firms, and even more so for politically connected existing borrowers. We further document negative real and financial effects for non-investigated firms more exposed through their banks. Policy makers should consider these costs when devising anti-corruption investigations.

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1. Introduction

Corruption hampers allocative efficiency, economic growth and democracy (Shleifer and Vishny, 1993; Mauro, 1995; Svensson, 2005). However, little is known about the effects of anti-corruption policies, which can have mixed results on the economy as they prosecute and punish corrupt firms. On the one hand, getting rid of corrupt practices allow more efficient and innovative firms to grow and resources to be reallocated to new firms that do not need to be friends with the government. On the other hand, the prosecution of large corrupt firms may disrupt economic activity and generate large adverse economic consequences, which may reduce the overall support for future anti-corruption efforts. Most of the literature focuses on the benefits of anti-corruption crackdowns and the government.

In this paper, we focus on the corporate sector, the credit channel and the potential spillover effects of anti-corruption investigations. It is well known that credit acts as an amplifier of economic shocks (e.g., Khwaja and Mian, 2008; Bentolila, Jansen, and Jimenez, 2018; Amiti and Weinstein, 2018; Alfaro, García-Santana, Moral-Benito, 2021). We seek to investigate the real and financial costs of one of the largest anti-corruption crackdowns in the world, the *Operação Lava Jato* (Car Wash Operation) in Brazil. We differentiate between the direct effects on the investigated firms and the indirect effects on the rest of the economy.

Brazil provides a unique testing ground to address these questions. The *Operação Lava Jato* aimed at uncovering overbilling and bribery and quickly turned into the largest and most complex anti-corruption investigations in Latin America (Campos et al., 2021). It was a joint operation by the Brazilian Federal Police and the *Ministério Público Federal* (MPF, Federal Prosecution Office of the Public Ministry) and involved 42 billion BRL related to corruption, 6.4 billion BRL bribes directly paid to public officials, over 1 billion documents seized and more than 900 search and seizure warrants in 80 phases during 2014-2021 (e.g., Netto 2016; Campos et al. 2021). Political and economic uncertainty have increased substantially as the

investigations unfolded and the fear of contagion became eminent both in financial markets and in the real economy.

We make two important conjectures in our paper. First, we conjecture that Brazil's large bank-based financial system makes bank credit a natural candidate for the transmission of the Lava Jato scandal to the corporate sector. After the start of the investigations, the affected firms may experience increasing credit constraints and ultimately lose access to bank credit. Importantly, for a proper identification of the causal effect of Lava Jato on bank lending to investigated firms, it does not matter whether these banks ex ante knew or did not know whether some of their borrowers were involved in the corruption scheme. These banks were either "caught" or "learned the lesson", both implying a credit contraction vis-à-vis the investigated firms.

Second, the rest of the corporate sector may experience indirect effects of Lava Jato. We conjecture that banks that are ex-ante more exposed to Lava Jato firms may significantly react to the anti-corruption investigations. The identifying assumption is that these banks, because of their high ex ante credit exposure to corrupt firms, will change their lending pattern to non-investigated firms after the anti-corruption investigations became public. However, the direction of this effect is less straightforward. The highly exposed banks may grant more or less credit to other firms after the onset of the investigations due to different reasons related to the scandal. One the one hand, following the anti-corruption campaign, highly exposed banks might increase lending to "clean" non-investigated firms. Such positive indirect response would represent a reallocation of credit, resulting from the surplus generated by reduced or denied credit to corrupt firms. On the other hand, highly exposed banks may reduce credit to non-investigated firms as well because of higher expected losses on credit to Lava Jato firms and/or higher uncertainty about the scale and scope of the investigations. Furthermore, banks' reactions may also depend on concerns about other firms being caught in the scandal. They

may cut credit to likely corrupt firms they suspect to become the next targets of investigations. More exposed banks may further suffer from higher risk aversion, increased pressure from market discipline or elevated concerns about their charter values. Note that we do not differentiate between these reactions as they are not mutually exclusive. Instead, the goal of this paper is to provide an estimate of the net effect of Lava Jato on bank credit.

Our analysis is based on a rich dataset that we build from four sources. The first and main source is the Brazilian Credit Information System SCR (*Sistema de Informações de Crédito*) from the Central Bank of Brazil, containing confidential information on virtually all loans made by financial institutions in Brazil. The second one is RAIS (*Relação Annual de Informações Sociais*) from the Brazilian Ministry of Economics and Labor, which contains information on all formally employed workers. The third one comes from the TSE (*Tribunal Superior Eleitoral*) and contains detailed information on firms' connection to the government through campaign donations in federal elections. The fourth one is information about the firms that have been investigated in the *Operação Lava Jato*, according to the Public Ministry. We focus on a core set of firms from this list. These firms are large, not publicly listed, from the construction sector and with business relationships to the government. We merge the data from these four sources to obtain a firm-quarter dataset and a more detailed firm-bank-quarter dataset covering the period from 2011 to 2016.

We find four main results. First, we document that firms that were involved in the Lava-Jato corruption scandal experience significantly negative real effects on firm employment and wage bill. We show that these firms largely lose access to credit: they receive less credit, lower credit ratings and display higher loan loss provisions after the start of the investigations. We establish these results in a difference-in-difference analysis, using the start of the anti-corruption investigations as treatment variable. The results are robust to different control groups, a synthetic control algorithm, and different matched samples with similar ex-ante key

characteristics and parallel trends in the pre-period. Second, because these firms are very large and represent a significant fraction of bank's credit portfolios, we show that banks more exposed to the corruption scandal reduce credit also to non-investigated firms. Hence, there are negative spillover effects of the anti-corruption investigations to the rest of the corporate sector (but not to the household sector). Third, the reduction of credit by highly exposed banks is stronger for politically connected existing borrowers. Fourth, for non-investigated firms that borrow more from ex ante highly exposed banks, we also find negative real and financial effects. Importantly, all these results are derived from saturated panel data models that control for the macro-economic conditions in Brazil. Moreover, the effects are causal using the public announcement of the Lava Jato investigations and the banks' ex ante exposure to the later investigated firms for identification.

Our paper contributes to the literature in various ways. First, we contribute to the literature on municipality audits and the effects of blacklisting firms in Brazil. These studies focus on how firms are affected and change their behavior when their malpractices are exposed and/or they lose access to government contracts and the consequences for the local economy and the labor market.[2] Colonnelli, Lagaras, Ponticelli, Prem and Tsoutsoura (2022) investigate the direct effects on the firms involved in irregular activities according to the municipality audits. Most of these firms are located outside the audited municipalities, which is useful to properly identify the effects. Highly corrupt firms reduce their economic activity when their corruption is exposed, while less corrupt firms grow because they are able to overcome the loss of government contracts. Colonnelli and Prem (2022) focus on spillover effects. They find municipalities show an increase in the number of firms that depend on government relationships and public procurement after the audits. Politically connected firms suffer more

[2] Those random municipality audits conducted by the CGU starting in 2003 targeted the budgets of municipalities and led to political effects as well (e.g., Ferraz and Finan, 2008).

after the audits, while local credit increases. Szerman (2023) investigates the new 2013 anti-corruption law in the wake of Lava Jato crackdowns, which tightened the exclusion of government contracts for convicted firms. As a result, the study finds strong direct real effects such as a decline in employment (-47.7%) and an increase in the exit probability of the blacklisted firms. An important subset of the firms analyzed in the paper are possibly the Lava Jato firms. Importantly, all these studies do not address the role of banks. In our study, bank credit is the major transmission channel and we document next to the direct (intended) effects also the indirect (unintended) real and financial effects of anti-corruption investigations on the rest of the corporate sector.

Second, there is an increasing literature that examines specifically the strong anti-corruption crackdown in China started in 2012. The findings suggest positive effects of the Chinese anti-corruption campaign. However, we believe it is not straightforward to extrapolate the evidence from China, because of its political system and the largely state-owned economy, to other countries. The anti-corruption crackdown mostly targeted these government officials. Chen and Kung (2019) show in the corporate land market that price discounts due to corruption given to firms connected to the political elites decreased significantly after the crackdown. Giannetti, Liao, You and Yu (2020) examine mainly spillovers and show that firm performance and the allocation of capital and labor improves after the crackdown in more *ex-ante* corrupt environments. Griffin, Liu and Shu (2021) investigate the determinants of the anti-corruption investigations and show that the positive effects largely disappear when the ruling party or their officials are involved (Griffin, Liu and Shu, 2021). Li, Wang and Zhou (2022) analyze the direct effects and spillovers within the exposed industries. They document a credit reallocation away from government companies towards private companies, but they do not investigate the potential real effects.

Third, because the Lava Jato investigations represent a significant economic shock to banks, our paper also relates to the broader literature on the diffusion of shocks through banks (e.g., Khwaja and Mian, 2008; Amiti and Weinstein, 2018; Alfaro, García-Santana and Moral-Benito, 2021; Chodorow-Reich and Falato, 2022; Gutierrez, Jaume and Tobal, 2022; Iyer, Kokas, Michaelides and Peydró, 2022).

Overall, our paper differs from the related literature in several dimensions. Most importantly, the scale of the anti-corruption investigations in Brazil as well as the size of the investigated firms are unprecedented. The related studies find generally positive effects of anti-corruption investigations on the economy, while we find significantly negative spillover effects through banks on the non-investigated firms. Moreover, there is little evidence on the credit channel after the start of anti-corruption investigations based on micro data. We are able to investigate these effects using rich micro data on labor and credit matched at the firm-bank level. Furthermore, in our setting, the anti-corruption investigations are directly observed at the firm level and not inferred from political connections or surveys, which eliminates possible measurement error about the shock. Finally, the commercial banks in our main analysis are not state-owned and they were not directly hit by the Lava Jato investigations, which helps to avoid confounding effects of corrupt banks.[3]

The remainder of this paper is organized as follows. Section 2 provides a brief overview of the institutional characteristics of the *Operação Lava Jato*. Section 3 describes the data, methodology and summary statistics. Section 4 presents our results on the impact of anti-corruption investigations on investigated firms and the rest of the corporate sector. Section 5 concludes.

[3] There are studies that investigate how corruption in bank lending and political connections influence the allocation of credit to firms (Beck, Demirgüç-Kunt and Levine, 2006; Charumilind, Kali and Wiwattanakantang, 2006; Barth, Lin, Lin, and Song, 2009; Weill, 2011; Qi and Ongena, 2019).

2. Institutional background of the Operação Lava Jato

The *Operação Lava Jato*,[4] which started in March 2014 and headed by the Federal Police and the *Ministério Público Federal*, initially investigated money laundry and bribery by a small group of black-market foreign currency dealers that were involved in money laundry, then expanded within a few months to the state-owned oil company Petrobras[5] and the largest Brazilian construction companies that served as its contractors. The operation eventually reached politicians, political parties, state governors, the congress (presidents of both chambers), the federal government of Brazil and even governments of other countries. Essentially, it investigates crimes of active and passive corruption, fraudulent exchange operation, large-scale bribery, kickbacks and an illegal campaign financing scheme of government parties. *Operação Lava Jato* was the largest anti-corruption and anti-money laundry investigations in Brazil and the largest detected corruption scandal in the history of Latin America: it issued more than one thousand warrants for search and seizure, temporary arrest, preventive detection and coercive conduct, aiming at investigating a money laundry scheme that moved billions of *Brazilian Reais* in bribes.

Initially, the operation targeted black-market foreign currency dealers who employed small businesses such as gas stations and car washes to launder money. During the investigations, prosecutors argued that the same criminals laundered money for key executives of Petrobras[6] who were linked to politicians and government parties in an intricate web of corruption. In

[4] The name *Operação Lava Jato* (Car Wash Operation) is due to a gas station that was used to move illegal values and that was investigated in the first phase of the operation, in which a black-market foreign currency dealer was arrested. Subsequently, the investigations uncovered a direct connection with the former procurement director of Petrobras, who was arrested preventively in the second phase.

[5] Intriguingly, Petrobras was previously seen as "the most autonomous and corporately coherent organization within the Brazilian state enterprise system" (Evans, 1989), an exception if compared to typical glitches of public or state-owned enterprises.

[6] According to the investigations, witnesses testified that the construction companies formed a multi-year cartel to share out contracts and pad prices, perhaps extending beyond petroleum to highway and hydropower contracts. This cartel of the contractors for Petrobras had possibly existed for at least 15 years. Considering only the decade between 2004 and 2014, the companies-maintained contracts with Petrobras, which totaled 59 billion Brazilian *Reais* (see Campos et al 2021).

November 2014, the operation hit a core set of large Brazilian construction companies, including Construtora OAS, Camargo Corrêa and Queiroz Galvão. Shortly afterwards, two further construction companies were added to the list: Andrade Gutierrez and Odebrecht, the latter known as Latin America's largest construction conglomerate (see, for details, Campos et al., 2021).

Essentially, overbilling[7] of contracts for oil refineries, oil rigs, off-shore exploration vessels and office buildings were diverted to secret accounts that shifted the pre-defined percentages of the surplus to politicians, political parties and the corporate conglomerates that were part of the scheme. Billions of U.S. dollars were paid through a web of corruption, in which private interests could acquire political concessions, leading participants to bribe officials in several countries in Latin America and Africa[8], concealing illicit funds in Europe and the United States.

The operation had a successful start and worked efficiently until 2016. At that time, its investigations gradually slowed down as it came closer and closer to politics. In 2019, the *Intercept Brazil Portal* disclosed conversations between the former head judge Sergio Moro and prosecutors that questioned the impartiality of the investigations. Afterwards, Lava Jato lost its luster and the *Procuradoria-Geral da República* (Attorney General's Office) announced the dissolution of its original core at the beginning of 2021. It is now conducted by GAECO (*Grupo de Atuação Especial de Combate ao Crime Organizado*), which is a group part of the *Ministério Público Federal* and the operation came to an end after seven years.

Among the 21 investigated construction firms that we analyze in this paper,[9] two went bankrupt (GDK and Schahin), twelve entered a judicial reorganization process (either during

[7] The construction firms and the public counterparts had formed an agreement that ensured guaranteed business on excessively lucrative terms if they agreed to channel a share of between 1% and 5% of every deal to secret funds (see Campos et al. 2021 and Netto 2016).

[8] 14 countries and some of their heads of state were involved including Argentina, Brazil, Chile, Colombia, the Dominican Republic, Ecuador, Guatemala, Mexico, Panama, Peru, and Venezuela (BBC-Brasil 2017).

[9] There are 23 construction firms under investigation but only 21 are borrowers and thus included in the credit registry of the Central Bank of Brazil.

our sample period or afterwards)[10]. Furthermore, there are only seven companies whose CEOs or other key executives were not arrested or wanted by the Federal Police. There were no interested buyers for any of the investigated firms and they were seen as "zombies" or "pariahs", suggesting that financial markets did not expect a bright future for them.

3. Data and methodology

3.1. Data sources

The empirical analyses are based on four different data sources. The main source of information comes from the Brazilian credit registry (SCR - Credit Information System), a confidential loan level database owned and managed by the Central Bank of Brazil. It contains detailed information on almost all loans in the economy at a monthly level, including loan amounts, interest rates, loan loss provisions, maturities, regulatory borrower ratings and others. Borrower-level characteristics[11], however, are relatively scarce. Therefore, to account for time-invariant or time-varying heterogeneity in firm characteristics, we use firm fixed effects or a full set of interacted firm and time fixed effects. Another strength of our firm-bank-time data is that we are able to distinguish between existing borrowers (intensive margin) and new borrowers (extensive margin) and examine whether banks behaved differently in their response to the anti-corruption investigations across these two groups.

Our second dataset is *Relação Anual de Informações Sociais* (RAIS), an administrative data set collected on an annual basis by the Brazilian Ministry of Economics and Labor, which covers all formal workers in Brazil. We restrict our sample to large firms that have more than 250 employees in 2012.

[10] The firms that entered in judicial reorganization are: Odebrecht, OAS, Queiroz Galvão, UTC Engenharia, Engevix, IESA, Mendes Junior, Galvão Engenharia, GDK, Schahin, Alumini, and Tomé Engenharia.

[11] Borrower-level information gathered from other sources is limited to firm's number of employees, wage bill, location, age, industry and whether they are publicly listed or not.

Our third dataset comes from the *Tribunal Superior Eleitoral* (TSE) and contains campaign contributions in the federal elections of 2010, with detailed information about donors' contributions and recipients. For each candidate, beyond the identification of the parts involved in the contribution, it is possible to identify the political party, the state, position of the candidate (state deputy, federal deputy, senator, governor or president) and the size of the campaign contribution in the election years.

The merged dataset comprises free-market credit[12] granted to large privately owned firms (with more than 250 employees in 2012) by privately-owned banks during the period from January 2012 to July 2016.[13] State-owned banks are excluded from the main analysis because of earmarked lending, subsidized credit programs and their well-documented countercyclical behavior (Capeleti, Garcia, Miessi, 2022). Financial firms and state-owned firms are also excluded.

3.2 Methodology

We first conduct a difference-in-difference (DID) analysis to study the direct effects of the anti-corruption investigations. The treatment group are the firms investigated in the *Operação Lava Jato* (hereinafter. Lava Jato firms). The base control group are all other firms in the credit registry of the Central Bank of Brazil with more than 250 employees.[14] We split the sample into two periods: one before the start of the investigations (2013) and one afterwards (2014, 2015, and the first 2 quarters of 2016).[15] We employ aggregate data at the firm-quarter level.

[12] Free market lending, in contrast to earmarked lending, refers to the type of credit that does not meet any public sector directions or has subsidized interest rates.

[13] Our sample period ends in the middle of 2016, which was right before the impeachment of the president Dilma Rousseff, which introduced substantial economic and political uncertainty in the country.

[14] We use various alternative control groups in further analysis. The results remain similar.

[15] In unreported robustness tests, we employ a symmetric time period that considers two years before Lava Jato (2012-2013) and two years after Lava Jato (2014-2015). The results are qualitatively similar.

To test the effects of Lava Jato on the investigated firms, we estimate the difference-in-differences model shown in equation (1):

$$C_{i,t} = \alpha + \beta_1 Lava\ Jato_i + \beta_2 Post_t + \beta_3 (Lava\ Jato_i \times Post_t) + \upsilon_i + \theta_t + \varepsilon_{i,t} \quad (1)$$

where $C_{i,t}$ stands for real or financial outcomes of firm i at time t such as wage bill, number of employees, firm growth, as well as new loans[16], borrower rating, loan loss provision, loan maturity and loan interest rate. The variable $Lava\ Jato_i$ indicates each of the 21 investigated construction firms. $Post_t$ is a dummy variable that indicates the period after the start of the anti-corruption investigations. We exclude the first quarter of 2014 because the anti-corruption investigations started in the middle of March 2014.[17] We control for time-invariant firm characteristics by including firm fixed effects υ_i and also control for common macroeconomic shocks to firms that may change over time using time fixed effects θ_t. The standard errors are clustered at the firm level.

We then investigate potential spillover effects and reallocation in the credit market. Banks with a high ex ante credit exposure to investigated firms may grant more or less credit to non-investigated borrowers after the start of the investigations. The effects depend on the surplus from denied or reduced credit to investigated firms, expected losses on outstanding credit to investigated firms and expectations about the dynamics of the anti-corruption investigations. We estimate the indirect effect of the anti-corruption investigations on non-investigated firms at the bank-quarter and bank-firm-quarter level, as shown in equation (2).

[16] When explaining new loan amounts with zero mass, we use the Poisson Pseudo Maximum Likelihood (PPML) estimator, instead of OLS to explain log(1+New Loans). Hence, PPML estimates this equation: New Loans = exp (β.X) ε with ε ~ Poisson ⇒ E(New Loans) = exp (β.X).

[17] We consider this time period (2013Q1-2016Q2, except 2014Q1) in all regression analyses of this paper.

$$C_{i,b,t} = \alpha + \beta_1 Lava\ Jato\ bank\ exposure_b + \beta_2 Post_t + \beta_3 (Lava\ Jato\ bank\ exposure_b \times Post_t) + X_{b,t-1} + \upsilon_{i,t} + \varphi_b + \varepsilon_{i,b,t} \quad (2)$$

Where $C_{i,b,t}$ is either the amount of new loans for firm *i* from bank *b* in quarter *t*, at the intensive margin, or a dummy indicating whether firm *i* received a new loan with bank *b* in quarter *t*, at the extensive margin. The variable *Lava Jato bank exposure*$_b$ is a dummy that equals one if bank *b* has a high share (upper tercile) of outstanding credit to firms in 2012 that become subsequently investigated in the *Operação Lava Jato* (see equation 3).

$$Lava\ Jato\ bank\ exposure_b = \frac{\sum Outstanding\ credit_i}{\sum Outstanding\ credit_{ni} - \sum Outstanding\ credit_i} \quad (3)$$

The computation of the *Lava Jato bank exposure* is based on data from 2012, while the estimation period for the regressions ranges from 2013 to mid-2016. A key element of our identification strategy is that we consider data on investigated firms to create the bank exposure measure and then estimate the regressions with data from non-investigated firms. The subscript *b* denotes banks, *i* stands for investigated firms, and *ni* denotes non-investigated firms. $Post_t$ refers to the period after the investigations. The key term in our analysis is the interaction term *Lava Jato bank exposure* × *Post*. The coefficient β_3 indicates the DID estimator. We include lagged bank characteristics $X_{b,t-1}$ as control variables and a set of either firm-time $\upsilon_{i,t}$ and bank fixed effects φ_b or firm-bank and time fixed effects (not shown in equation 1). Firm-time fixed effects purge all time variation in the data that at the firm-level and captures any determinants of credit demand, allowing us to isolate credit supply-side effects. Firm-bank fixed effects control for unobserved bank-firm relationship characteristics. We cluster the standard errors two way at the firm and bank level. Moreover, next to the likelihood of obtaining a new loan

or the amount of new loans, we investigate other characteristics of loans to non-investigated firms such as credit rating, interest rate, maturity and loan loss provisions.

We then augment the previous specification by interacting bank exposure with characteristics of the borrowing firms to test the heterogeneity of credit reallocations across firms, as shown in equation (4):

$$\begin{aligned} C_{i,b,t} = \alpha + \beta_1 &Lava\ Jato\ bank\ exposure_b + \beta_2 Post_t + \beta_3 Moderator_i \\ &+ \beta_4 (Lava\ Jato\ bank\ exposure_b \times Post_t) + \beta_5 (Moderator_i \times Post_t) \\ &+ \beta_6 (Lava\ Jato\ bank\ exposure_b \times Moderator_i \times Post_t) + X_{b,t-1} + \upsilon_{i,t} + \varphi_b + \varepsilon_{i,b,t} \end{aligned} \quad (4)$$

All variables are similar to the previous model, except the firm-level moderator. It considers ex-ante borrower characteristics such as the size of donations in the federal elections of 2010 (which we employ as a proxy for the connection with the government), and a dummy indicating firms with only one bank-relationship in the year 2012. This model includes lagged bank controls X, firm-time and bank fixed effects, and we cluster the standard errors two way at the firm and bank level. In an unreported analysis, we employ firm-bank and time FE and obtain similar results.

We further examine whether non-investigated firms that are indirectly through their bank relationships in the pre-period more exposed to Lava Jato suffer any real effects. Stated differently, we examine the double spillover effect here: from the investigated firms to their banks and from these banks to their non-investigated borrowers. We consider labor market outcomes *L* such as employment and wage bill. We estimate the model shown in equation (5):

$$\begin{aligned} L_{i,t} = \alpha &+ \beta_1 Lava\ Jato\ firm\ exposure_i \\ &+ \beta_2 Post_t + \beta_3 (Lava\ Jato\ firm\ exposure_i \times Post_t) + \varepsilon_{i,t} \end{aligned} \quad (5)$$

Where $L_{i,t}$ stands for wage bill and number of employees from firm *i* in year *t*. *Lava Jato firm exposure*$_i$ indicates borrower *i's* exposure to Lava Jato firms through its bank relationships in the previous period.[18] The variable, measured in 2012, is defined as follows:

$$Lava\ Jato\ firm\ exposure_i = \frac{\sum(Lava\ Jato\ bank\ exposure_b \times Outstanding\ credit_{i,b,t})}{\sum Outstanding\ credit_{i,t}} \quad (6)$$

Model (5) includes lagged firm controls. Standard errors are clustered at the firm level.

3.3. Summary statistics

Table 1 reports summary statistics of the main variables used in this paper.

(Insert Table 1 here)

For the analysis of investigated firms, *New Loans*$_{it}$ indicates that, on average, firms borrow R$20,541,316 per quarter in new loans. Alternatively, for the analysis including non-investigated firms, *New Loans*$_{ibt}$ indicates that existing borrowers borrow, on average, R$1,734,128 per bank-quarter in new loans. As expected, the median value for the latter variable is zero, since we included zeros for absent new loans in case there exists a stock of credit for that firm-bank notch (intensive margin) or included zeros for all missing new loans (extensive margin).

Additionally, the loans are on average repaid in 11 months (median: 5), rating has a moderate grade of 2 (in a scale from 1 to 4), the pre-fixed interest rate is much bigger than the mean cost of capital during the same period (mean: 47.05%, median: 19.64%), and banks

[18] Similar to the bank-level exposure to Lava Jato firms, we measure the *Firm Exposure* prior to the start of our sample period to ensure its exogeneity.

usually set aside 0.89% of their portfolio as provisions to account for future losses on loan defaults (median: 0.49%).

Non-investigated firms are large (mean: 1,035 employees; median: 485 employees) and with relatively skilled workers with wages (mean: R$ 2,098.84/month, median: R$1,745.29/month) well above the minimum wage in the country[19]. The firms donate an average of R$62.67 (median: R$0) per employee in the federal elections of 2010 and are well connected in the banking system (mean: 3.52 bank relationships in 2012).

The Lava Jato bank exposure indicate that around 2% of all privately owned banks' outstanding credit in 2012 was granted to the later investigated firms, although only about 1/10 of this exposure is on average indirectly linked to non-investigated firms.

4. Results

4.1. Impact of Lava Jato on investigated firms

We start our analysis by examining the direct effects of Lava Jato on the investigated firms. Table 2 presents the results for the real effects. Columns (1) and (3) show the main DiD results, Columns (2) and (4) the dynamic effects by year.

(Insert Table 2 here)

Overall, we find highly significant negative real effects of the anti-corruption investigations on the wage bill and employment. Because the coefficients of interest are large and the related independent variables are discrete, the semi-elasticity is better approximated by the exponentiation of the coefficient and subtracting by one. The wage bill decreases by 59% and

[19] The minimum wage in Brazil during our sample period was R$724 in January 2014 and R$880 in July 2016.

number of employees decreases by 51% for investigated firms after the onset of the investigations, considering the estimates in Column (1) and (3).[20]

Moreover, the adverse effects increase monotonically over time, as shown in Columns (2) and (4) of Table 2. Figure 1 further illustrates this effect (where we define 2011 as the baseline year and employ different post dummies for each year afterwards). Figure 1 also shows that before 2014 there is no significance difference between investigated and non-investigated firms, consistent with the underlying DID assumption of parallel trends.

(Insert Figure 1 here)

Next, we study the financial effects of Lava Jato on the investigated firms. Table 3 Panel A shows the effects on the amount of new loans. Since the variable *New Loans* has many zeros, we estimate these regressions using Pseudo Poisson Maximum Likelihood (PPML) instead of the classic log linear estimation. This technique is fully robust to other positive distributions with even some efficiency properties. It reduces biases, provides a direct estimate of elasticities and has been widely in the gravity models literature on international trade (Santos Silva and Tenreyro, 2006) and recently in analyses of new loans in absence of loan rejection data (e.g., Jiménez, Laeven, Martinez-Miera and Peydró, 2022).

Column (1) of Table 3 shows the main result whereas columns (2), (3) and (4) show the results based on various alternative control groups and matching strategies.

(Insert Table 3 here)

[20] The economic magnitude of the effects is large and close to the results found by Szerman (2023). In additional (unreported) analyses, we find even larger effects when we augment the control group by including non-investigated construction firms.

The coefficients of the interaction terms are statistically and economically highly significant and similar in magnitude across all five models. Calculating the size of the effects by the exponentiation of the coefficient and subtracting by one, indicate that new loans decrease by almost 50% for Lava Jato firms. Figure 2 Panel A shows the interaction coefficients of the previous models split by quarter, using the 2012Q1 as the reference period.

(Insert Figure 2 here)

Figure 2 shows no differences in trends between the two groups before the start of the investigations. And although the interaction coefficients start a decreasing pattern after that, they only become significant a year later in 2015 and intensify overtime until 2016Q1, consistent with the fact that Lava Jato firms were mainly hit by the investigations by the end of 2014.

Furthermore, we perform a synthetic control estimation first aggregating new loans by industry and then proceeding to create a synthetic control based on other industries apart from construction. Appendix Table A1 provides details on the donor industries weights in the synthetic approach. Figure 2 Panel C shows that Lava Jato firms and the synthetic control show similar trends before the investigations, but there is a sizable contraction of credit to Lava Jato firms after 2014, reaching almost a full depletion of credit in the first quarter of 2016.

In Panel B of Table 3, we consider further loan characteristics as the dependent variables. We find that regulatory credit ratings that banks assign to Lava Jato firms deteriorate by almost one full notch (higher numbers indicate worse ratings), and similarly loan loss provisions increase 0.6%, which is substantial compared to its mean of 0.9% in the sample. Loan maturities tend to decrease and interest rates to increase but these effects are not statistically significant. We find similar effects if we use alternative control groups.

Overall, the results of Table 2 and 3 indicate large negative real and financial effects of Lava Jato on the investigated firms.

4.2. The effects of Lava Jato on non-investigated firms at the bank level

In the next step, we investigate the potential indirect effects of Lava Jato on non-investigated firms, using data at the bank-quarter level. Our identification strategy of the treatment effect is based on banks' ex ante credit exposure to those firms that later become targets of the Lava Jato investigations.

Figure 3 shows the *Lava Jato bank exposure*, which is the credit exposure of privately owned banks to Lava Jato firms (blue bars), and the number of firm-quarter observations of each bank (line), both measured in 2012.

(Insert Figure 3 here)

Banks are ranked by the size of their credit exposure to Lava Jato firms. There is substantial heterogeneity in the *Lava Jato bank exposure*. The three banks with the largest exposures display values between 8% and 15% of their portfolios. Moreover, the biggest banks in Brazil, as measured by the peaks in the number of firm-quarter observations in our sample, have moderate levels of Lava Jato exposures. The upper tercile of the *Lava Jato bank exposure* distribution contains the banks to the left of the dotted blue line. There is one large bank and several medium-sized banks in that group. In the following analysis, we employ three measures of the *Lava Jato bank exposures*: a dummy that equals one for the upper tercile (highest exposure), a dummy that equals one for the middle tercile (moderate exposure) and the continuous exposure measure.

(Insert Table 4 here)

Table 4 shows that banks with greater ex-ante exposure to Lava Jato firms decrease lending to non-investigated firms significantly more than other banks after the onset of the investigations. The results are robust regardless what exposure measure we consider (discrete or continuous). As the effects are concentrated in the upper tercile, we employ the corresponding dummy variable for the upper tercile in the remainder of the paper.[21]

Considering this contraction of credit to the corporate sector, it is possible that banks reallocate credit to the household sector. Using another dataset that aggregates lending by borrower sector, we show in the Appendix, Table A2 that this is not the case.[22] The only statistically significant interactions show up when the dependent variable is (log of) new loans granted to the corporate sector, as shown in columns (4) to (6). Hence, the decrease of lending by ex-ante highly exposed banks occurs vis-à-vis the corporate sector.

4.3 The effects of Lava Jato on non-investigated firms at the firm-bank level

We now perform a more granular analysis of the effects of Lava Jato on non-investigated firms, using data at the firm-bank-quarter level. We estimate the effects of the Lava Jato bank exposure on firms in the post period and interact this term with firm characteristics that might moderate the effects. We distinguish between effects at the extensive and intensive margin.

In the first analysis, we consider information about the election campaign donations for each firm as moderator. Campaign donations may serve as proxies for government connections and potentially for undetected corruption. In our sample period, when the public in Brazil was

[21] When applying this measure, banks with high vs. low Lava Jato bank exposure do not differ significantly in terms of their volume of new loans, total assets, and loans-to-total assets ratio.

[22] Because we use a different dataset, this possibly explains the different significance levels and magnitudes in comparison to the previous table.

curious to learn which firm was going to be caught next in the Lava Jato scandal, suspicion could have arisen about firms that had made large financial contributions to the election campaigns of future government representatives. Table 5 presents the results.

(Insert Table 5 here)

Table 5 confirms our earlier finding that highly exposed banks reduce credit to non-investigated firms and also uncovers different moderating effects. The results for the extensive margin indicate that new borrowers exhibit a lower likelihood of obtaining new loans from more exposed banks, regardless of the fixed effects added to the models (firm-time and bank; or firm-bank and time). The decrease in the likelihood of obtaining a new loan appears to be small but it is not, since this finding refers to all potentially new borrowers in our sample, not necessarily to those who have applied for new loan (we do not have information on loan applications).

The results at the intensive margin indicate that current borrowers also receive less credit from more exposed banks after the onset of the investigations, but those results are not statistically significant. In additional unreported analyses, we examine whether the latter results are not an artifact of the PPML estimation method. We compare the OLS and PPML results of the DID model without moderators and still find no significant results at the intensive margin.

Considering, the triple interactions with *Campaign Donations*, we find no effect at the extensive margin but a strong negative effect at the intensive margin. Ex ante highly exposed banks decrease new loans to existing borrowers after the start of the investigations. The triple interaction at the intensive margin becomes only insignificant when we saturate the model with all possible combinations of fixed effects in column (8).

In Table 6, we investigate the moderating effects of the variable *Single relationship*, indicating whether the borrowing firm had only one bank relationship in 2012. These firms are on average smaller, more informationally opaque and they therefore tend to have higher switching costs. Most of the firms in our sample have more than one bank relationship, so it is easier to interpret the relative effects from the point of view of firms that have only one bank relationship in 2012 (whose effects correspond to the opposite of the signs displayed).

(Insert Table 6 here)

We find a significant moderating effect at the extensive margin. Although highly exposed banks reduce credit to new borrowers after the investigations (double interaction, columns 2 and 3), they do not for new borrowers that previously had only one bank relationship (triple interaction, extensive margin). We believe that this finding could be an indication for either risk taking and/or suboptimal risk management and control practices of the highly exposed banks.

We found earlier that non-investigated firms experienced a contraction of new credit from ex ante more exposed banks. However, it is also possible that less exposed banks substitute away from this effect, so that the total impact at the firm level would be muted. Therefore, next we investigate indirect effects of Lava Jato on non-investigated firms at the firm level, considering aggregate credit received from each of those firms from the set of all private banks in our sample. We assume that the previously defined *Lava Jato firm exposure* contains the key transmission channel for such analysis.

(Insert Table 7 here)

Table 7, column (1), shows a sizable decline in new credit at the firm level in our sample. The average credit rating worsens and the loan loss provisions for more indirectly exposed firms increase, and also interest rate increases slightly and significantly as shown in columns (2), (3) and (5). The effects are smaller than the direct effects of Table 3, as expected, but the reduction in new credit is still substantial.

(Insert Table 8 here)

Table 8 reports our results on the real effects related to the unexpected credit crunch associated with the Lava Jato scandal. These effects are well-identified through the Lava Jato firm exposure measure and they are derived controlling for firm fixed effects and macro-economic conditions. We can rule out that these effects are due to the general deterioration in the macro-economy during 2015-2016. Firms more indirectly exposed to the scandal through their bank relationships reduce their wage bill by 11% and their number of employees by 8.5% after the onset of the investigations. Although such figures are smaller in magnitude from the direct effects of Table 2, of the order of 60%, but they are still economically meaningful and, as the former, they also increase over time.

4.4. Further analyses

Our main analysis is based on loan data from privately owned banks in Brazil. We now expand the sample and include state-owned banks. These banks are important in Brazil as they exhibit a market share of about 40%. They implement countercyclical state-led lending programs, are subject to government influence and exhibit a weaker governance.

The Appendix, Table A3, shows the results. We find new borrowers receive less credit from exposed banks (extensive margin), while existing borrowers receive more credit from

state-owned banks (intensive margin).The findings show that state-owned banks' response to the anti-corruption investigations is less clear than the one of privately owned banks.

5. Conclusions

In this paper, we investigate the effects of one of the world's largest anti-corruption investigations: the *Operação Lava Jato* in Brazil. We conduct a difference-in-differences analysis of the direct and indirect effects on investigated and non-investigated firms, considering the bank credit channel as transmission mechanism.

We find that anti-corruption investigations "work", i.e., they have the intended negative effects on the investigated firms. However, we also find significant negative spillovers on the rest of the corporate sector. This negative effect is stronger at the intensive margin for lending to politically connected borrowers. We further show negative real and financial effects for non-investigated firms more exposed to the Lava Jato shock through their bank relationships. These findings suggest that the economic impact of anti-corruption investigations is not as straightforward as suggested by the evidence from prior studies.

Our paper has several important implications. Governments should ex ante consider the indirect effects of anti-corruption investigations. We document negative credit spillover effects and negative real effects on labor market outcomes for non-investigated firms in Brazil. Bank supervisors and regulators should be aware of these effects and their impact on financial stability. Moreover, our findings inform firms how spillovers effects in the credit market translate into significant real effects. Firms should take measures to shield themselves against these spillover effects (e.g., corporate governance, bank-firm relationships, loan commitments, etc.). We acknowledge that our results on bank credit reallocation capture a partial equilibrium effect and likely underestimate the full effect. There might be further negative effects through trade credit chains, debarments from public procurement and credit risk contagion.

Appendix

Table A1: Donor industries weights in Synthetic Lava Jato Control Group

Industry code (CNAE)	Industry	Weight
12	Manufacture of tobacco products	.515
20	Manufacture of chemical products	.206
39	Decontamination and other waste management services	.141
91	Activities related to cultural and environmental heritage	.137
Sum		1.000

Table A2: Effects on credit by borrower sector at the bank level

This table shows the regression results of the model $C_{b,t} = \alpha + \beta_1 Lava\ Jato\ bank\ exposure_b + \beta_2 Post_t + \beta_3 (Lava\ Jato\ bank\ exposure_b \times Post_t) + \varepsilon_{b,t}$ where $C_{b,t}$ is the (log of) total new loans granted by bank b to the household sector (columns 1, 2 and 3) or corporate sector (columns 4, 5 and 6) . *Lava Jato bank exposure* is a dummy variable that equals one if the bank is in the upper tercile of the distribution of the continuous bank exposure and zero otherwise. *Post* is a dummy variable that switches to one in the period after 2014Q1; the first quarter of 2014, in which the Operation Lava Jato started, is omitted. Bank controls are *Credit/Assets*, *Log(Total Assets)*, *Capital*, *Non-performing loans*, *Liquidity* and *Return on Assets* lagged by one period. Standard errors (in parentheses) are clustered at the bank level. ***, **, * denote statistical significance at the 1%, 5% or 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)
	Household sector			Corporate sector		
Dep. Var.:	*Log(New Loans)$_{households}$*			*Log(New Loans)$_{firms}$*		
Lava Jato bank exposure × Post	-0.017	0.100	-0.008	-0.338*	-0.346*	-0.312*
	(0.168)	(0.284)	(0.167)	(0.171)	(0.187)	(0.165)
Lava Jato bank exposure	-	-0.641	-	-	0.305	-
		(0.469)			(0.287)	
Post	0.065	-	-	0.129	-	-
	(0.102)			(0.092)		
Bank controls$_{t-1}$	Yes	Yes	Yes	Yes	Yes	Yes
Bank-FE	Yes	-	-	Yes	-	-
Time-FE	-	Yes	-	-	Yes	-
Estimation	OLS	OLS	OLS	OLS	OLS	OLS
Number of observations	427	428	427	536	536	536
Adj.-R^2	0.965	0.756	0.966	0.902	0.729	0.908

Table A3: Effects on credit to investigated firms including state-owned banks

This table shows the regression results of the model $C_{i,b,t} = \alpha + \ldots + \beta_4(\textit{Lava Jato bank exposure}_b \times \textit{Post}_t) + \beta_5(\textit{Lava Jato bank exposure}_b \times \textit{State Owned Banks}_b) + \beta_6(\text{Post}_j \times \textit{State Owned Banks}_b) + \beta 7(\textit{Lava Jato bank exposure}_b \times \textit{Post}_t \times \textit{State Owned Banks}_b) + \varepsilon_{i,b,t}$ where $C_{i,b,t}$ denotes either *New Loans* [dummy] or *Log(1+New Loans)*. The analysis of the extensive margin considers only firms that did not borrow (free market lending) before 2014Q1, while the intensive margin considers only firms that did borrow (free market lending) before 2014Q1. Both analyses exclude Lava Jato firms. *Lava Jato bank exposure*, as defined in Table 1, is a dummy that equals one if the bank is in the upper tercile of the distribution of the continuous exposure and zero otherwise. *Post* is a dummy variable that switches to one in the period after 2014Q1; the first quarter of 2014, in which the Operation Lava Jato started, is omitted. Bank controls are *Credit/Assets*, *Log(Total Assets)*, *Capital*, *Non-performing loans*, *Liquidity* and *Return on Assets* lagged by one period. Standard errors (in parentheses) are clustered at the bank-level. Standard errors (in parentheses) are clustered at the bank-time level. ***, **, * denote statistical significance at the 1%, 5% or 10% level.

	(1)	(2)	(3)	(4)
	Extensive margin		Intensive margin	
Dep. Var.:	*New Loans [dummy]*	*New Loans [dummy]*	*New Loans*	*New Loans*
LJ bank exposure × Post	-0.010**	-0.009**	-0.006	-0.075
	(0.004)	(0.004)	(0.062)	(0.075)
Post x State owned banks	0.001	0.003	-0.154***	-0.173***
	(0.005)	(0.004)	(0.040)	(0.037)
LJ bank exposure × Post × State owned Banks	0.009	0.008	0.231***	0.353***
	(0.010)	(0.010)	(0.080)	(0.091)
Bank controls $_{t-1}$	Yes	Yes	Yes	Yes
Firm-Time-FE	Yes	Yes	Yes	Yes
Firm-Bank-FE	-	Yes	-	Yes
Number of observations	209,256	209,233	188,869	162,425
Estimation	OLS	OLS	PPML	PPML
Adj-R^2 or Pseudo-R^2	0.077	0.147	0.442	0.642

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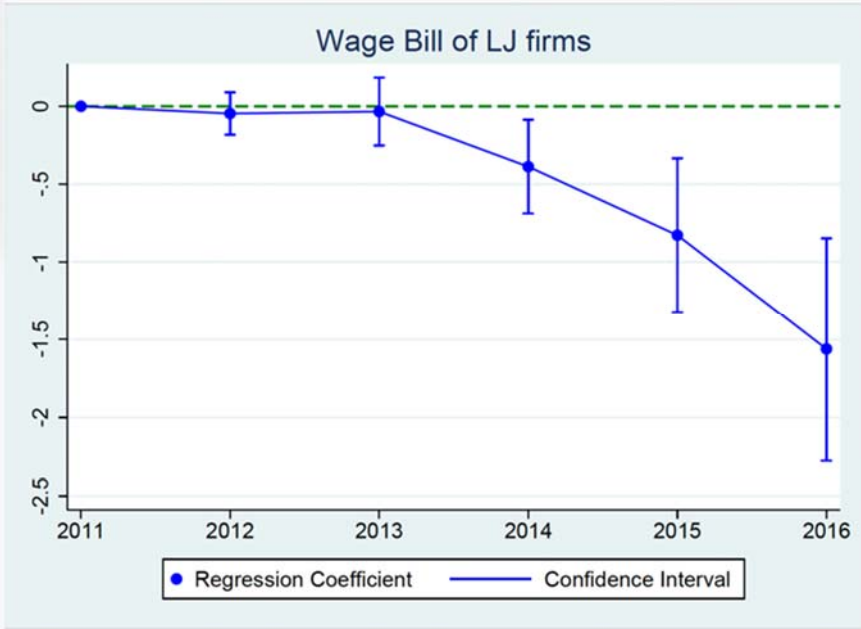
Figure 1: Real effects on Lava Jato firms

The figures display the DID estimator with confidence intervals of the model $C_{i,t} = \alpha + \beta_1 Lava\ Jato_i + \beta_2 Post_t + \beta_3(Lava\ Jato_i \times Post_t) + \varepsilon_{i,t}$, where *C* indicates either *Wage bill or Number of employees. Lava Jato* is a dummy variable that equals one for the 21 construction firms that are subject to the Lava Jato anti-corruption investigations and zero otherwise. We decompose the effect of *Post* using indicator variables for the years 2012, 2013, 2014, 2015 and 2016, with 2011 as reference year.

Panel A: Wage bill



Panel B: Number of employees

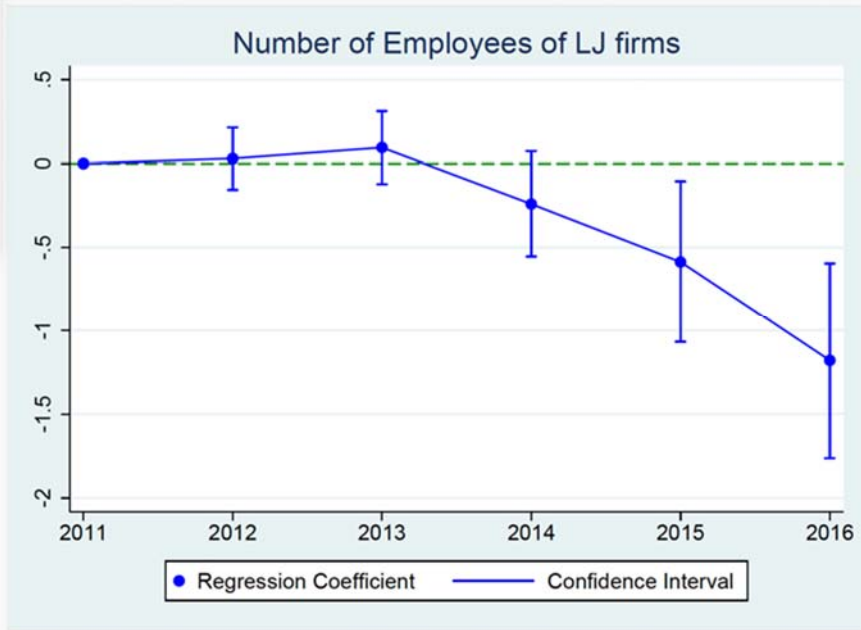
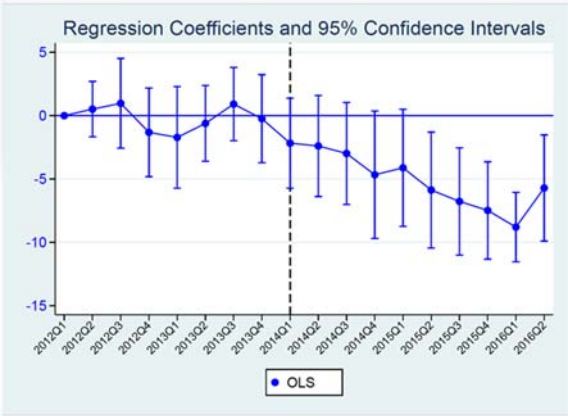


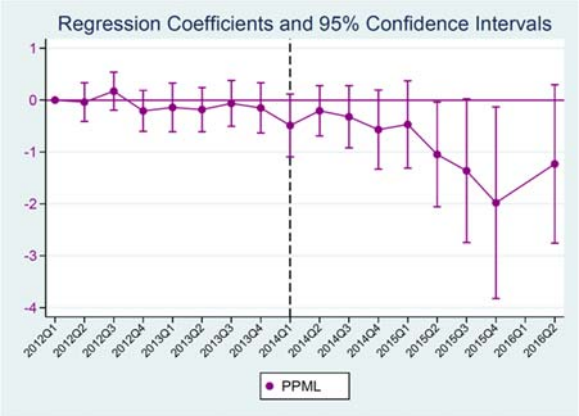
Figure 2: Effects on credit to Lava Jato firms

This figure plots the DiD estimator with confidence intervals of the model $C_{i,t} = \alpha + \beta_1 Lava\ Jato_i + \beta_2 Post_t + \beta_3(Lava\ Jato_i \times Post_t) + \varepsilon_{i,t}$, where *C* indicates either *Log(1+New Loans)* in the OLS estimation in Panel A or *New Loans* in the PPML estimation in Panel B. This analysis considers all firms with more than 250 employees and includes the 21 Lava Jato firms. Post is decomposed in quarter dummies using 2012Q1 as reference category. Panel C shows the results of a synthetic control group analysis at the industry-quarter level. The outcome variable is Log(1+New Loans), and the vector of predictor variables includes *Loan Growth, Outstanding Growth, Rating, Provision, Maturity, Mean Wage, Age* and *State of firm's location*.

Panel A: Volume of new loans (OLS)



Panel B: Volume of new loans (PPML)



Panel C: Volume of new loans with synthetic control group

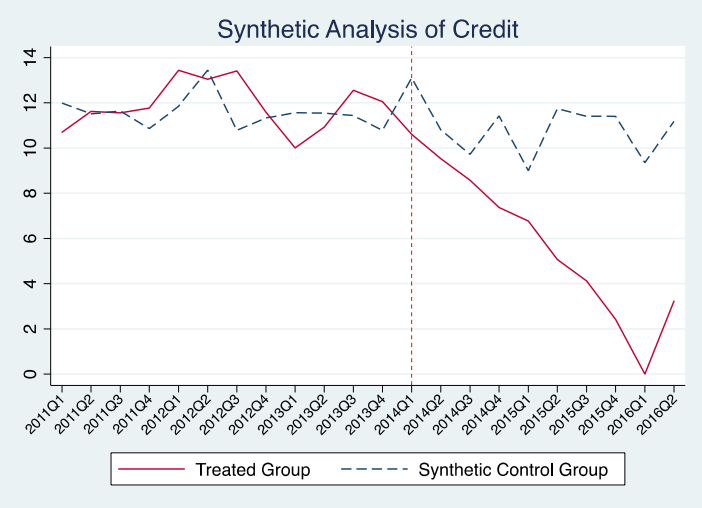


Figure 3: Bank exposure to Lava Jato firms

This figure shows the distribution of the variable *Lava Jato bank exposure*, which is the credit exposure of privately owned banks to Lava Jato firms in 2012 (bars), as well as the number of firm-quarter observations of each bank (lines). The vertical broken blue line indicates the tercile split of the sample (T3 vs. T2 and T1).

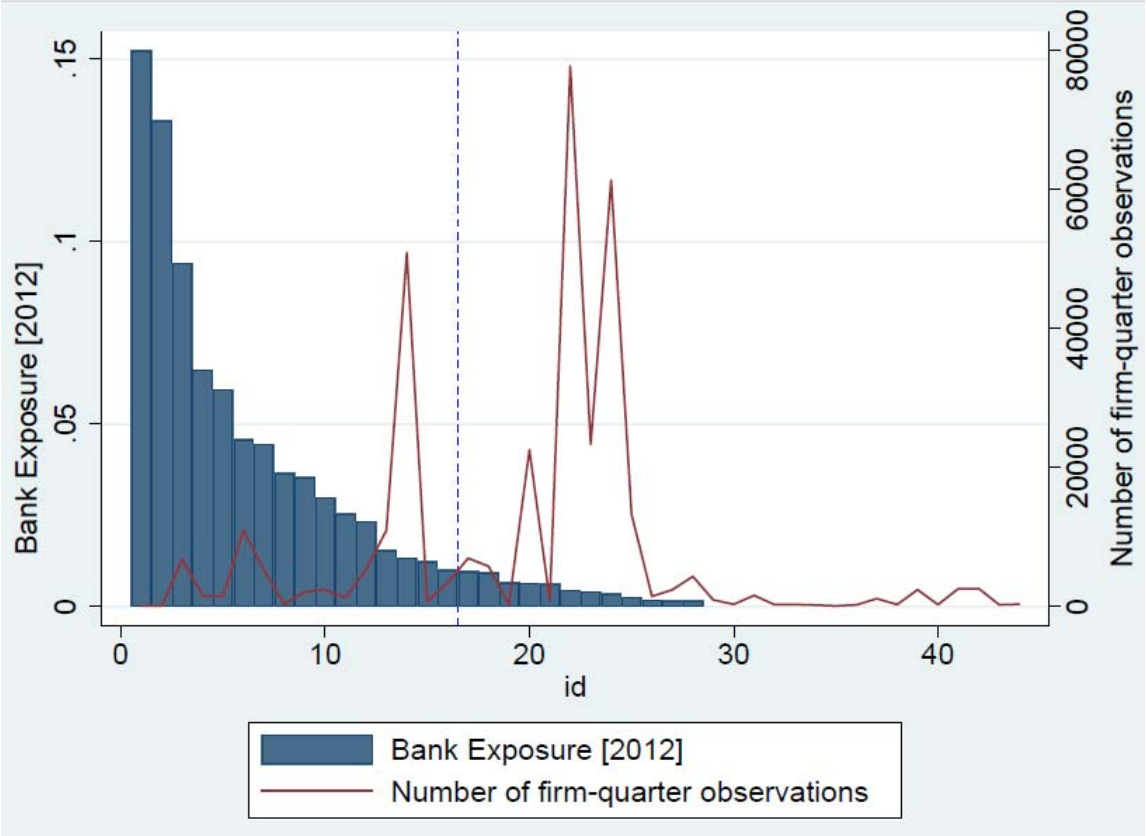


Table 1: Summary statistics

This table shows the summary statistics for the main variables used in the paper for the sample of 12,697 firms, 44 private banks and uses the period 2013Q1-2016Q2 (excluding information regarding the quarter 2014Q1). We excluded contracts with provisions above 5%, as well as negative interest rates from our sample. All the variables related to loan amount characteristics were winsorized at the 5% and 95% levels due to the presence of outliers in the original distribution.

Variable	Number of obs.	Mean	Median	Std. Dev.
Loan characteristics				
New Loans$_{it}$	17,809	20,541,316	756,420	88,038,727
New Loans$_{ibt}$	235,460	1,734,128	0	11,727,121
Maturity $_{ibt}$	80,339	11.1867	5	13.7284
Interest rate $_{ibt}$	60,332	47.0572	19.64239	82.2982
Regulatory Rating $_{ibt}$	80,339	2.2642	2	1.0272
Loan loss provision $_{ibt}$	80,339	.0089	0.0049	0.0107
Firm characteristics [2012]				
Number of employees$_i$	12,697	1,035.94	485	2,440.86
Wage bill$_i$	12,697	2,174,277	846,464	6,091,897
Age$_i$	12,697	23.46	20.57	14.43
Election campaign donations$_i$	12,697	62.67	0	430.14
Number of bank-relationships$_i$	12,697	3.52	3	3.10
Bank characteristics				
Liquidity$_{bt}$	510	0.2212	0.1980	0.1391
Credit/Assets$_{bt}$	510	0.5381	0.5147	0.2205
Log(Total Assets$_{bt}$*)*	510	23.37	23.10	1.56
Capital$_{bt}$	510	0.0018	0.0016	0.0008
NPL$_{bt}$	510	0.0428	0.0386	0.0363
ROA$_{bt}$	510	0.0077	0.0101	0.0199
Lava Jato exposures [2012]				
Lava Jato bank exposure$_b$	44	0.0193	0.0041	0.0343
Lava Jato firm exposure$_i$	12,697	0.0021	0.0012	0.0027

Table 2: Real effects on Lava Jato firms

Columns (1) and (3) show the firm-level regression results of the model $C_{i,t} = \alpha + \beta_1 Lava\ Jato_i + \beta_2 Post_t + \beta_3 (Lava\ Jato_i \times Post_t) + \varepsilon_{i,t}$ where *C* indicates either Log(*Wage bill) or Log(Number of employees)*. Columns (2) and (4) show the dynamic effects by year. *Lava Jato* is a dummy variable that equals one for the 21 construction firms that are subject to anti-corruption investigations and zero otherwise. *Post* is a dummy variable that switches to one in the period after 2014Q1; the first quarter of 2014, in which the Operation Lava Jato started, is omitted. The sample period of this analysis starts in the first quarter of 2011. Standard errors (in parentheses) are clustered at the firm-level. ***, **, * denote statistical significance at the 1%, 5% or 10% level.

Dep. Var.	*Log(wage bill)* (1)	*Log(wage bill)* (2)	*Log(employees)* (3)	*Log(employees)* (4)
Lava Jato x Post	-0.975***		-0.785***	
	(0.213)		(0.196)	
Lava Jato x Post [2012]		-0.026		0.043
		(0.071)		(0.095)
Lava Jato x Post [2013]		-0.026		0.091
		(0.114)		(0.113)
Lava Jato x Post [2014]		-0.416***		-0.275*
		(0.156)		(0.162)
Lava Jato x Post [2015]		-0.894***		-0.661***
		(0.253)		(0.246)
Lava Jato x Post [2016]		-1.668***		-1.285***
		(0.364)		(0.297)
Firm-FE	Yes	Yes	Yes	Yes
Time-FE	Yes	Yes	Yes	Yes
Estimation	OLS	OLS	OLS	OLS
Number of observations	63,996	63,996	64,301	64,301
Adj.-R^2	0.775	0.775	0.718	0.718

Table 3: Effects on credit to Lava Jato firms

This table shows firm-level regression results of the model $C_{i,t} = \alpha + \beta_1 Lava\ Jato_i + \beta_2 Post_t + \beta_3 (Lava\ Jato_i \times Post_t) + \varepsilon_{i,t}$ where *C* indicates the volume of new loans *(New Loans)* (Panel A) or other loan characteristics (*Rating, Loan loss provision, Maturity* and *Interest rate*) (Panel B) for firm i at time t. This analysis considers all firms with more than 250 employees and includes the 21 investigated Lava Jato construction firms. The sample period starts in first quarter of 2012 and ends in the second quarter of 2016. *Lava Jato* is a dummy variable that equals one for the 21 investigated Lava Jato construction firms and zero otherwise. *Post* is a dummy variable that switches to one in the period after 2014Q1; the first quarter of 2014, in which the Operation Lava Jato started, is omitted.In Panel A, Column (2) excludes publicly listed firms from the control group because all Lava Jato firms are unlisted; Column (3) shows the results of the propensity score matching analysis; and Column (4) is based on data starting in 2012 instead of 2011. Standard errors (in parentheses) are clustered at the firm level. ***, **, * denote statistical significance at the 1%, 5% or 10% level.

Panel A: Volume of new loans

Dep. Var.:	*New Loans* (1)	*New Loans* (2)	*New Loans* (3)	*New Loans* (4)
Lava Jato × Post	-0.660***	-0.634**	-0.749**	-0.687***
	(0.254)	(0.253)	(0.299)	(0.241)
Firm-FE	Yes	Yes	Yes	Yes
Time-FE	Yes	Yes	Yes	Yes
Unlisted firms only	-	Yes	-	-
Matching control group	-	-	Yes	-
Sample starting in 2012	-	-	-	Yes
Estimation	PPML	PPML	PPML	PPML
Number of observations	159,955	155,958	1,436	124,769
Pseudo-R^2	0.647	0.642	0.549	0.655

Panel B: Characteristics of new loans

Dep. Var.:	*Rating* (1)	*Loan loss provision* (2)	*Maturity* (3)	*Interest rate* (4)
Lava Jato × Post	0.799***	0.006***	-0.256	4.598
	(0.197)	(0.002)	(0.340)	(8.559)
Firm-FE	Yes	Yes	Yes	Yes
Time-FE	Yes	Yes	Yes	Yes
Estimation	OLS	OLS	PPML	OLS
Number of observations	63,706	63,706	63,397	53,077
Adj.-R^2 or Pseudo-R^2	0.369	0.339	0.352	0.323

Table 4: Effects on credit to non-investigated firms at the bank level

This table shows bank-level regression results of the model $Log(New\ loans)_{b,t} = \alpha + \beta_1 Lava\ Jato\ Exposure_b + \beta_2 Post_t + \beta_3 (Lava\ Jato\ Exposure_b \times Post_t) + \varepsilon_{b,t}$ for bank b and time t. This analysis excludes Lava Jato firms. Lava Jato bank exposure is measured by tercile dummies (T_3 = upper tercile, T_2 = mid tercile) and the continuous variable. Post is a dummy variable that switches to one in the period after 2014Q1; the first quarter of 2014, in which the Operation Lava Jato started, is omitted. Bank controls are *Credit/Assets, Log(Total Assets), Capital, Non-performing loans, Liquidity* and *Return on Assets* lagged by one period. Standard errors (in parentheses) are clustered at the bank level. ***, **, * denote statistical significance at the 1%, 5% or 10% level.

Dep. Var.:	*Log(New Loans)* (1)	*Log(New Loans)* (2)	*Log(New Loans)* (3)
Lava Jato bank exposure (T_3) × Post	-0.541***	-0.569***	
	(0.176)	(0.185)	
Lava Jato bank exposure (T_2) × Post		-0.148	
		(0.154)	
Lava Jato bank exposure (cont.) × Post			-6.532*
			(3.307)
Bank controls$_{t-1}$	Yes	Yes	Yes
Bank-FE	Yes	Yes	Yes
Time-FE	Yes	Yes	Yes
Estimation	OLS	OLS	OLS
Number of observations	511	511	511
Adj.-R^2	0.842	0.842	0.840

Table 5: Effects on credit to non-investigated firms and election campaign donations

This table shows firm-bank level regression results of the model $C_{i,b,t} = \alpha + \ldots + \beta_4 Lava\ Jato\ bank\ exposure_b \times Post_t + \beta_5 Lava\ Jato\ bank\ exposure_b \times Campaign\ Donations_i + \beta_6 (Lava\ Jato\ bank\ exposure_b \times Campaign\ Donations_i \times Post_t) + \varepsilon_{i,b,t}$ where $C_{i,b,t}$ is $New\ Loans\ [dummy]_{i,b,t}$ for the extensive margin (columns 1-4) or $New\ Loans_{i,b,t}$ for the intensive margin (columns 5-8). Extensive margin considers only firms that did not borrow before 2014Q1, intensive margin considers only firms that did borrow before 2014Q1, both analyses exclude Lava Jato firms. *Lava Jato bank exposure* is a dummy that equals one if the bank is in the upper tercile of the distribution of the continuous measure of bank exposure and zero otherwise. *Post* is a dummy variable that switches to one in the period after 2014Q1; the first quarter of 2014, in which the Operation Lava Jato started, is omitted. The variable *Campaign Donations* is measured in 2011 and is represented by a dummy equal to one if the moderator is in the upper tercile of the distribution and zero otherwise. Bank controls are *Credit/Assets*, *Log(Total Assets)*, *Capital*, *Non-performing loans*, *Liquidity* and *Return on Assets* lagged by one period. Standard errors (in parentheses) are clustered two way at the firm and bank level. ***, **, * denote statistical significance at the 1%, 5% or 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Extensive margin				Intensive margin			
Dep. Var.:	*Dummy [New Loans > 0]*				*New Loans*			
Lava Jato bank exposure × Post	-0.011**	-0.010**	-	-	-0.006	-0.074	-	-
	(0.005)	(0.005)			(0.081)	(0.093)		
Lava Jato bank exposure × Post × Donations	0.005	0.005	0.004	0.004	-0.118**	-0.125**	-0.102*	-0.084
	(0.005)	(0.005)	(0.005)	(0.005)	(0.049)	(0.062)	(0.053)	(0.062)
Other interactions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank controls $_{t-1}$	Yes	Yes	-	-	Yes	Yes	-	-
Bank FE	Yes	-	-	-	Yes	-	-	-
Firm-Time-FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Bank-FE	-	Yes	-	Yes	-	Yes	-	Yes
Bank-Time-FE	-	-	Yes	Yes	-	-	Yes	Yes
Estimation	OLS	OLS	OLS	OLS	PPML	PPML	PPML	PPML
Number of observations	154,105	154,086	154,105	154,086	130,054	110,209	129,978	110,132
Adj.-R^2 or Pseudo-R^2	0.076	0.148	0.079	0.151	0.442	0.642	0.451	0.651

Table 6: Effects on credit to non-investigated firms and single bank relationships

This table shows firm-bank level regression results of the model $C_{i,b,t} = \alpha + \ldots + \beta_4 Lava\ Jato\ bank\ exposure_b \times Post_t + \beta_5 Lava\ Jato\ bank\ exposure_b \times Single\ Relationship_i + \beta_6 (Lava\ Jato\ bank\ exposure_b \times Single\ Relationship_i \times Post_t) + \varepsilon_{i,b,t}$ where $C_{i,b,t}$ is $New\ Loans\ [dummy]_{i,b,t}$ for the extensive margin or $New\ Loans_{i,b,t}$ for the intensive margin.. Extensive margin considers only firms that did not borrow before 2014Q1 (columns 1-4), intensive margin considers only firms that did borrow before 2014Q1 (columns 5-8), both analyses exclude Lava Jato firms. *Lava Jato bank exposure* is a dummy that equals one if the bank is in the upper tercile of the distribution of the continuous measure of bank exposure and zero otherwise. *Post* is a dummy variable that switches to one in the period after 2014Q1; the first quarter of 2014, in which the Operation Lava Jato started, is omitted. $Single\ Relationship_i$ is a dummy equal to one if the firm had exactly one bank relationship in 2012 and zero otherwise. Bank controls are *Credit/Assets*, *Log(Total Assets)*, *Capital*, *Non-performing loans*, *Liquidity* and *Return on Assets* lagged by one period. Standard errors (in parentheses) are clustered two-way at the firm and bank level. ***, **, * denote statistical significance at the 1%, 5% or 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Extensive margin				Intensive margin			
Dep. Var.:	*Dummy [New Loans > 0]*				*New Loans*			
Lava Jato bank exposure × Post	-0.013**	-0.011**		-	-0.050	-0.122	-	-
	(0.005)	(0.005)			(0.078)	(0.094)		
Lava Jato bank exposure × Post × Single Relationship	0.016***	0.011**	0.017***	0.016***	0.214	-0.079	0.231	-0.073
	(0.005)	(0.005)	(0.004)	(0.004)	(0.347)	(0.483)	(0.348)	(0.484)
							(0.209)	
Other interactions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank controls $_{t-1}$	Yes	Yes	-	-	Yes	Yes	-	-
Bank FE	Yes	-	-	-	Yes	-	-	-
Firm-Time-FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Bank-FE	-	Yes	-	Yes	-	Yes	-	Yes
Bank-Time-FE	-	-	Yes	Yes	-	-	Yes	Yes
Estimation	OLS	OLS	OLS	OLS	PPML	PPML	PPML	PPML
Number of observations	140,749	140,730	140,749	140,730	129,856	110,085	129,779	110,008
Adj.-R^2 or Pseudo-R^2	0.076	0.150	0.080	0.154	0.441	0.642	0.450	0.651

Table 7: Effects on credit and credit characteristics to non-investigated firms

This table shows firm-level regression results of the model $C_{i,t} = \alpha + \beta_1 Lava\ Jato\ firm\ exposure_i + \beta_2 Post_t + \beta_3 (Lava\ Jato\ firm\ exposure_i \times Post_t) + \varepsilon_{i,t}$ where *C* indicates *New loans, Rating, Loan loss provision, Maturity* and *Interest rate* from for i at time t. Apart from *New loans*, which are the sum over all banks, all other variables are weighted averages. This analysis considers all firms with more than 250 employees and includes the 21 construction firms cited by the Lava Jato investigations. The sample period of this analysis starts in the first quarter of 2013 and goes until the second quarter of 2016. *Lava Jato firm exposure* is a dummy that equals one if the firm is in the upper tercile of the distribution of the continuous indirect exposure and zero otherwise. *Post* is a dummy variable that switches to one in the period after 2014Q1; the first quarter of 2014, in which the Operation Lava Jato started, is omitted. Standard errors (in parentheses) are clustered at the firm level. ***, **, * denote statistical significance at the 1%, 5% or 10% level.

Dep. Var.:	*New Loans*	*Rating*	*Loan Loss Provision*	*Maturity*	*Interest Rate*
	(1)	(2)	(3)	(4)	(5)
Lava Jato firm exposure × Post	-0.185***	0.085***	0.001***	0.048**	1.309**
	(0.031)	(0.020)	(0.000)	(0.022)	(0.587)
Firm-FE	Yes	Yes	Yes	Yes	Yes
Time-FE	Yes	Yes	Yes	Yes	Yes
Estimation	PPML	OLS	OLS	PPML	OLS
Number of observations	102,430	50,056	50,056	49,786	41,430
Adj.-R^2	0.659	0.404	0.377	0.368	0.333

Table 8: Real effects on non-investigated firms through firm indirect exposure to Lava Jato

Models (1) and (2) show firm-level regression results of the model $C_{i,t} = \alpha + \beta_1 Lava\ Jato\ firm\ exposure_i + \beta_2 Post_t + \beta_3 (Lava\ Jato\ firm\ exposure_i \times Post_t) + \varepsilon_{i,t}$ where *C* indicates either Log(*Wage bill) or Log(Number of employees)*. *Lava Jato firm exposure* is a dummy that equals one if the firm is in the upper tercile of the distribution of the continuous indirect exposure in 2012 and zero otherwise. *Post* is a dummy variable that switches to one in the period after 2014. Models (3) and (4) decompose the effect of the post period in 2014, 2015 and 2016. Standard errors (in parentheses) are clustered at the firm-level. ***, **, * denote statistical significance at the 1%, 5% or 10% level.

Dep. Var.:	*Log(Wage bill)* (1)	*Log(Employees)* (2)	*Log(Wage bill)* (3)	*Log(Employees)* (4)
Lava Jato firm exposure × Post	-0.108***	-0.084***		
	(0.017)	(0.016)		
Lava Jato firm exposure × Post [2014]			-0.070***	-0.053***
			(0.015)	(0.014)
Lava Jato firm exposure × Post [2015]			-0.115***	-0.089***
			(0.020)	(0.018)
Lava Jato firm exposure × Post [2016]			-0.141***	-0.111***
			(0.025)	(0.023)
Firm-FE	Yes	Yes	Yes	Yes
Time-FE	Yes	Yes	Yes	Yes
Estimation	OLS	OLS	OLS	OLS
Number of observations	47,595	47,595	48,069	48,069
Adj.-R^2	0.813	0.813	0.788	0.788