The effects of increased price transparency in OTC equity lending markets: Evidence from a loan fee benchmark*

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Abstract

We test Duffie, Dworczak, and Zhu (2017)'s prediction that benchmarks can be beneficial to search markets. We explore a sudden improvement in the quality of a loan fee benchmark that occurred in the Brazilian OTC equity lending market in 2011. Before March 1st 2011, the Brazilian exchange publicly reported on a daily basis the average loan fee of the previous 15 trading days for each stock. On March 1st 2011, the exchange shorted this interval from 15 to 3 trading days, increasing the benchmark precision. Using difference-in-differences analysis, we show that this change reduced the loan fees paid by short-sellers, with greater effect among the ones with higher search costs.

JEL Codes: G12, G14, G19.

Keywords: OTC markets, benchmarks, loan fees, short-selling, search costs

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1 Introduction

Equity lending markets in the US and other countries are over-the-counter (OTC) and, as such, are opaque to short-sellers. As modeled by Duffie, Garleanu, and Pedersen (2002), and empirically tested by both Kolasinski, Reed, and Ringgenberg (2013) and Chague, De-Losso, De Genaro, and Giovannetti (2017), this opacity increases the loan fees short-sellers have to pay. This occurs because opacity makes it harder for short-sellers to find lenders, which ultimately allows lenders to act as local monopolists and thereby charge higher loan fees. High loan fees are not desirable since they cause stock overpricing[1] and reduce price efficiency.[2] Duffie, Dworczak, and Zhu (2017) propose the use of benchmarks to reduce the opacity in OTC markets. In this paper, we empirically study how an improvement in a publicly available loan fee benchmark reduced the opacity of the Brazilian equity lending market and affected loan fees.

Our empirical analysis takes advantage of a dataset that contains all transactions closed in the Brazilian equity lending market from January 2008 to July 2011, the same dataset used by Chague, De-Losso, De Genaro, and Giovannetti (2017). The Brazilian equity lending market is also OTC as in most countries, but all loan contracts must be registered by the brokers at a centralized platform maintained by the only stock exchange in Brazil (B3, previously BM&FBovespa, hereinafter the "Exchange")—the Exchange acts as a clearing platform and as a central counterparty in the equity lending market. Hence, although short-sellers face an opaque lending market as in other countries, the Exchange has access to market-wide data because all transactions have to be registered in its system.

In an effort to improve the transparency of the equity lending market, the Exchange began reporting on March 1st 2004, on a daily basis, a benchmark of the loan fee for each stock: the average loan fee in the previous 15 trading days across all loan deals. On March

[1] See, for instance, Danielsen and Sorescu (2001), Jones and Lamont (2002), Nagel (2005), Chang, Cheng, and Yu (2007), Stambaugh, Yu, and Yuan (2012) and Blocher, Reed, and Van Wesep (2013).

[2] See, for instance, Asquith, Pathak, and Ritter (2005), Nagel (2005), Cao, Dhaliwal, Kolasinski, and Reed (2007), Saffi and Sigurdsson (2011), Engelberg, Reed, and Ringgenberg (2012) and Boehmer and Wu (2013).

1st 2011, the Exchange improved this benchmark by shortening the interval used to compute the average loan fee from 15 to 3 trading days. This change was announced by the Exchange on February 23rd 2011 along with the following statement: "...the purpose of this change is to make the securities lending service even more transparent, in order to attract more securities lenders and borrowers and to meet the demand of institutional investors."

In this paper we run a series of panel regressions to assess how the increased transparency brought by the 2011 benchmark affected the equity lending market. The new benchmark reduced opacity overnight. Indeed, the prediction gains by using the 3-day average as opposed to the 15-day average were rather large: 65% in terms of mean square error, and 38% in terms of mean absolute error. Hence, by exploring this event in the equity lending market, we can test Duffie, Dworczak, and Zhu (2017)'s prediction that the reduction in opacity caused by benchmarks can be beneficial to search markets.

Our main findings are the following. First, the new benchmark reduced loan fees. We run deal-level panel regressions around the benchmark change and find a statistically and economically significant reduction of 0.27 (stock-specific) standard deviation in loan fees after the new benchmark is introduced. Importantly, this effect is robust to the inclusion of *investor-stock* fixed effects. That is, the new benchmark reduced the loan fee paid by a given short-seller when borrowing a given stock. We also include a time-trend and a series of control variables that capture potential changes in the demand for borrowing and the conclusions remain the same.

Second, in a difference-in-differences analysis, we show that short-sellers with higher search costs benefited the most from the increased transparency brought by the new benchmark. Retail investors and infrequent traders—who arguably have higher search costs than institutions and frequent traders—presented a further reduction of, respectively, 0.19 and 0.20 stock-specific standard deviation in their loan fees with the new benchmark. The results are the same if we proxy search costs by the lack of good connections in the equity lending market using the investor-stock-day borrower connection (BC) variable of Chague, De-Losso,

De Genaro, and Giovannetti (2017).[3]

Third, consistent with the fact that the new benchmark reduced opacity in the equity lending market, we document a reduction in the intraday loan fee dispersion across all loan deals for the same stock. We measure intraday loan fee dispersion in three different ways: i) the standard-deviation; ii) the 90th-10th percentile range and; ii) the 95th-5th percentile range of the loan fees across all loan deals for the same stock on the same a day. In a stock-day panel regressions with the full set of controls and stock fixed-effects, we find a statistically relevant and economically large reduction in dispersion after the new benchmark is introduced: 17.4%, 28.8%, and 29.6%, respectively, for the standard-deviation, 90th-10th range, and 95th-5th range, measures of dispersion.

Fourth, we focus on loan deals closed within a single brokerage house (the biggest one in terms of number of loan deals) to provide further evidence that poorly connected investors were specially benefited with the new benchmark. Chague, De-Losso, De Genaro, and Giovannetti (2017) report that poorly connected short-sellers pay higher loan fees for the same stock on the same day within this top brokerage house. In turn, we show that this price discrimination disappears after the new benchmark is introduced.

Fifth, we assess the impact of the new benchmark on equity lenders. Equity lenders vary substantially with respect to their market power in our sample. While some lenders are occasional lenders and have low market shares, others are responsible for a large fraction of the lending supply for some stocks. Therefore, large lenders should be relatively better informed about loan fees and have greater bargaining power in an opaque lending market (Duffie, Garleanu, and Pedersen, 2002 and Duffie, Gârleanu, and Pedersen, 2005). As such, large lenders were likely in a better position to influence prices before the benchmark improvement and should have been more affected by the change. Consistent with this, we find that lenders with higher market shares were the ones who suffered larger reductions in their

[3]The BC variable is a non-linear combination of five different pieces of information: i) number of borrower-dealer connections, ii) intensity of each borrower-dealer connection, iii) number of dealer-lender connections, iv) the intensity of each dealer-lender connection, v) the market-share of each lender in the stock.

loan fees.

Finally, we evaluate the overall effect of the new benchmark on the number and size of loan deals. In principle, some investors could stop lending their stocks as a result of the lower loan fees, what could negatively affect the loan quantity in equilibrium. However, we find that the number of loan deals increased by 0.257 (stock-specific) standard deviation and the average volume of the loan deal by 0.255 standard deviation.

Our main results are based on regressions using a two-month window around the benchmark change. To alleviate concerns that these results are spurious, we perform 24 placebo exercises using the two years before the benchmark change. For instance, in the first of these placebo exercises we run our baseline regression using all loan deals closed from December 2008 to January 2009, as if it had occurred a benchmark change on January 1st 2009; in the second placebo exercise we set the fictitious benchmark change on February 1st 2009; and so on. We find insignificant results in 23 out of the 24 placebo exercises and the only one significant has the opposite sign.

We contribute to the debate among regulators and practitioners about the consequences of improving transparency in financial markets, as incentivized by the 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act. In principle, more transparency may not necessarily improve overall market conditions. In the specific case of equity lending, more transparency may reduce lenders' and dealers' profits to the extent that lending supply is significantly affected (see, for instance, Evans, Ferreira, and Porras Prado, 2017, and Huszár and Prado, 2019). Our findings, however, indicate that the new benchmark had the desired impact as it reduced loan fees and loan fee dispersion and, at the same time, increased the number of loan deals and the average loan deal volume.

We also contribute to the literature that specifically discusses the effects of benchmarks on search costs in OTC markets. Duffie, Dworczak, and Zhu (2017) provide a theoretical framework to discuss the implications of introducing a benchmark for price transparency in OTC markets. Using a natural set of assumptions, they conclude that the introduction of

benchmarks can be welfare improving and reduce overall search costs by improving matching efficiency, driving high-cost dealers out of the market, and encouraging the entry of new borrowers. Moreover, Duffie, Garleanu, and Pedersen (2002) show that higher search costs in the equity markets should result in higher loan fees. Our empirical findings are consistent with both theoretical models, as the new benchmark resulted in lower loan fees by reducing search costs through improved price transparency.

The available empirical evidence on the role of benchmarks in OTC markets concentrate in the bonds market. Bessembinder, Maxwell, and Venkataraman (2006) use transaction data from some institutions (insurance companies) in the American corporate bonds market to study the impact of the publication on July 1, 2002, by the National Association of Securities Dealers, of a report containing the most recent transactions through its trade reporting and compliance engine (TRACE). The authors find that the new information in TRACE increased price transparency, resulting in large reduction of 50% in trade executions costs for bonds eligible for TRACE reporting. Goldstein, Hotchkiss, and Sirri (2006) use a controlled experiment to study the impact of the publication of the TRACE report—they match 90 BBB-rated actively traded corporate bonds to another 90 with similar characteristics that were not initially included in the report—and find that the added transparency reduced the quoted spreads. Using a complete record of all secondary trades from January 2003 and January 2005, Edwards, Harris, and Piwowar (2007) find that transaction costs fall when the TRACE system starts reporting the bond. Using an extended dataset that contains the entire corporate bond market, Asquith, Covert, and Pathak (2013) extend the findings to smaller issue size bonds and high-yield bonds. To the best of our knowledge, this is the first study about the effects of benchmarks in OTC equity lending markets.

Overall, our findings suggest that benchmarks are beneficial to equity lending markets. However, surprisingly, only few equity lending markets in the world have some version of a loan fee benchmark. We collected the institutional characteristics of eighteen different equity lending markets around the world and found that only India, Singapore, and Taiwan have

public information on loan fees. Moreover, in thirteen countries all the lending transactions have already to be registered within their financial market infrastructure, which means that they could implement a loan fee benchmark relatively easily. This analysis is presented in the last section of the paper.

The remainder of the paper is organized as follows. Section 2 describes our dataset and present some basic statistics concerning short-selling in Brazil. Section 3 presents our main empirical analyses. Section 4 presents robustness and placebo exercises. Section 5 evaluates the existence of loan fee benchmarks in other countries. Section 6 concludes.

2 Stock lending in Brazil

The securities lending market in Brazil occurs OTC. However, every lending transaction must be registered in the Exchange, which acts as the central counterparty to all lending transactions. This contrasts with other lending markets, which are decentralized and data about lending deals are only partially available. During 2011, more than US$ 400 billion were loaned in over 1.4 million transactions, corresponding to one-third of the Brazilian market's total capitalization. In that year, 290 different stocks were traded in the lending market. In Appendix A.1 we give further details of the Brazilian equity lending market.

The first equity lending transactions in Brazil occurred in the 1970's. At the time, deals were closed between borrowers and lenders without any regulations. Only in 1996 the Exchange began to act as the central counterparty in this market. Despite that, loan deals continued to occur over-the-counter with virtually no transparency to market participants in general. In the years that followed, the Exchange acted to improve the market's transparency. On March 1, 2004, a stock-level loan fee benchmark began to be publicly reported on a daily basis. The benchmark was computed as the average over the previous 15 trading days of the volume-weighted daily loan fee across all new loan contracts. On March 1, 2011, the interval used to compute the benchmark was reduced from 15 to 3 trading days in order

to increase its precision. At the time, the Exchange released a statement explaining why it decided to change the benchmark. According to the Exchange, "...the purpose of this change is to make the securities lending service even more transparent, in order to attract more securities lenders and borrowers and to meet the demand of institutional investors" (see Appendix A.2). Since our dataset begins in 2008 and we cannot study the impact of the introduction of the benchmark in 2004, we focus our analysis on the benchmark improvement that occurred in 2011.

2.1 Data set

Our dataset is the same one used by Chague, De-Losso, De Genaro, and Giovannetti (2017). It contains all the loan deals closed on the 55 most liquid stocks of the Brazilian stock market from January 2008 to July 2011, along with information about the loan quantity, loan fee, and unique (anonymous) identifications of borrowers, lenders, and brokers. We also observe the type of the investor—institution or individual. In our main analysis, we focus on one month before and one month after the benchmark change of March 1, 2011.

Among the 55 stocks used in Chague, De-Losso, De Genaro, and Giovannetti (2017), we select the 30 stocks for which there was no payment of dividends of the type "Interests on equity" in February and March 2011. The reason is that these dividend payments temporarily distort loan fees as follows. According to a Brazilian law (which was latter changed in August 2014), the tax treatment of "interest on equity" was different for different investors: individual investors had to pay a tax rate of 15%; in turn, financial institutions were exempt. As a result, on days around the ex-date of interest on equity a tax arbitrage trade between individuals and financial institutions used to occur: (i) individuals lent shares to financial institutions at a higher loan fee; (ii) financial institutions received the interest on equity, paying no taxes; (iii) financial institutions transferred to individuals the net value (i.e., excluding taxes) that individuals would receive from interest on equity; and (iv) individuals then received a higher loan fee, while financial institutions profited by 15% of the interest on equity minus the loan

fee. Since loan fees from these arbitrage deals are artificially high, we do not consider the stocks that had such an event in February and March 2011.

As such, our main sample consists of all loan deals closed in February and March 2011 for 30 of the most liquid stocks in the Brazilian stock market, a total of 51,411 loan deals. Table 1 presents some descriptive statistics. The stocks with the lowest market capitalization in our sample are worth US$ 1.9 billion in January 2011 (BTOW3, the online retail company B2W, and GOLL4, the Brazilian low-cost airline Gol). The largest one is worth US$ 36.2 billions (AMBV4, the preferential share of Brazilian brewing company Ambev). As a first-pass analysis of the benchmark effect, the table also presents the number of loan deals and average loan fee for each stock before (February) and after (March) the benchmark change. For 19 out of the 30 stocks, we observe an increase in the number of loan deals from February to March; across all 30 stocks, the average increase in the number of loan deals was 5%. Moreover, for 20 out of the 30 stocks we observe a decrease in the average loan fee from February to March; across all 30 stocks, the average loan fee fall was 10%.

[Table 1 about here]

2.2 The informational gain of the new benchmark

Before we proceed with the empirical analysis, we measure the informational gain of the new benchmark. The loan fee benchmark consists of a moving average of the daily loan fee, where the daily loan fee is the volume-weighted loan fee paid by borrowers across all new lending contracts of each day (excluding brokerage fees paid by the borrowers). The benchmark is updated daily and is made available to all investors with one day of delay in the Exchange website. Figure 1 shows a print of the actual webpage in 2011.[4] Apart from information

[4]The figure does not present the actual numbers, as the digital archive we used to retrieve the original webpage (Wayback Machine, http://web.archive.org) does not contain them.

about the loan fee, the webpage also shows the quantity of stocks currently on loan.

[Figure 1 about here]

To improve market transparency, the Exchange reduced the number of lags used to compute the moving average from 15 days to 3 days. The new benchmark naturally improves the prediction of current loan fees, particularly so for stocks that tend to experience rapid swings in loan fees. This is the case of stocks that are in high shorting demand and that have a binding lending supply (the so-called "hard-to-borrow" or "special" stocks).

To visually assess the differences among the two benchmarks, we reconstruct them using our data set and compare both with the actual daily average loan fee. We also compute the error incurred in using the benchmarks to predict current loan fees and accumulate the absolute error over time. To help visualization, we arbitrarily focus on 4 different stocks over the six month period prior to the implementation of the new benchmark. As figure 2 show, the 3-day benchmark clearly provides a more accurate prediction of the current loan fee when the loan fee changes rapidly and is more volatile.

[Figure 2 about here]

Next, we measure the informational gain using the sample period from July 2008 to January 2011. We construct three prediction models: i) a naive model, where the benchmark is the predictor; ii) a linear model, where we run a regression of the daily loan fee on a constant and on the benchmark; and iii) a non-linear model, where we run a regression of the daily loan fee on three lags of the benchmark as well as on the squared benchmark and its lags, and the cross products of the lags, and use the fitted values as the predictor. For each stock and prediction model, we compute the adjusted R^2, the mean square error (MSE), the mean absolute error (MAE), and the volatility of the residuals (VOL).

Table 2 shows the average and standard deviation across stocks for each one of these four measures of fit; Panel A shows the value-weighted daily loan fee as the predicting variable, Panel B the equally weighted daily loan fee. In all cases, the average of MSE, MAE, and VOL is larger when we use the 15-day benchmark as opposed to the 3-day benchmark; likewise, the average of the adjusted R^2 is higher when we use the 3-day benchmark as opposed to the 15-day benchmark. The differences in the averages are also all statistically significant; the t-statistics shown in the column *diff* of Table 2 are sufficiently high to reject the null hypothesis that the averages are equal.

[Table 2 about here]

The informational gain of the new benchmark is large. In the case of the value-weighted loan fee, the average prediction error, in terms of MAE, falls by 38% for the naive prediction ($-0.38 = 0.273/0.443 - 1$), 38% for the linear prediction ($-0.38 = 0.275/0.443 - 1$), and 27% for the non-linear prediction ($-0.27 = 0.208/0.284 - 1$). The numbers are similar for the equal-weighted case. The average prediction error falls by 21% for the naive prediction ($-0.21 = 0.327/0.416 - 1$), 22% for the linear prediction ($-0.22 = 0.326/0.419 - 1$), and 8% for the non-linear prediction ($-0.08 = 0.304/0.330 - 1$). The gain is larger when we look at the MSE, which puts more weight on outliers. For the value-weighted case, average prediction error falls by 65% for the naive prediction ($-0.65 = 0.455/1.303 - 1$), 63% for the linear prediction ($-0.63 = 0.472/1.284 - 1$), and 41% for the non-linear prediction ($-0.41 = 0.208/0.350 - 1$). For the equal-weighted loan fee, average prediction error falls by 49% for the naive prediction ($-0.49 = 0.473/0.934 - 1$), 50% for the linear prediction ($-0.50 = 0.428/0.864 - 1$), and 16% for the non-linear prediction ($-0.16 = 0.346/0.411 - 1$).

We also perform an out-of-sample analysis in order to replicate what an investor would have done in practice—in fact, only the naive model is truly feasible and, therefore, likely to be the model used by investors; the other two are based on linear regressions that have the daily loan fee as the independent variable, which is not observed even ex-post. We re-estimate

the same three prediction models, but now using lagged benchmarks as the predictors and making one step ahead predictions without the use of future data. The results are show in Table 3. Although the numbers are different than the ones of the in-sample analysis, the overall conclusion is the same. The 3-day benchmark produces more accurate predictions than the 15-day benchmark.

[Table 3 about here]

3 The effects of the new benchmark

The new benchmark reduced the opacity in the equity lending market by increasing the precision of the information available to all market participants. In this section we study the consequences of the reduced opacity on the loan deals closed.

As a first visual analysis, we plot the daily market-wide average loan fee during the two months around the benchmark change. To obtain a market-wide average loan fee we do as follows. For each stock s and day t we first compute $\left(\overline{fee_i}\right)_{s,t}$, the (equal- or volume-weighted) daily average of the loan fees considering all loan deals of stock s on day t. We then compute $std\left(\overline{fee_i}\right)_{s,t}$ by standardizing $\left(\overline{fee_i}\right)_{s,t}$ within each stock. Finally, for each day, we compute both the average and the median across all stocks of $std\left(\overline{fee_i}\right)_{s,t}$. Therefore, we end up with four time-series: (i) the cross-stocks *average* computed using *equal-weighted* daily averages; (ii) the cross-stocks *median* computed using *equal-weighted* daily averages; (iii) the cross-stocks *average* computed using *volume-weighted* daily averages; (iv) the cross-stocks *median* computed using *volume-weighted* daily averages. Figure 3 presents the evolution of these four measures in February and March of 2011, with day zero being March 1st 2011. The market-wide loan fee dynamics suggest that loan fees were reduced after the new benchmark was introduced.

[Figure 3 about here]

3.1 The reduction in loan fees

To formally test whether loan fees were reduced after the new benchmark, we run the following deal-level panel regression using all 51,411 loan deals closed in the months of February and March of 2011,

$$Fee_{i,s,t,k} = \beta_1 After_t + \beta_2 t + \boldsymbol{\beta}_3' \boldsymbol{X}_{s,t} + \gamma_{k,s} + \varepsilon_{i,s,t,k} \tag{1}$$

where $Fee_{i,s,t,k}$ is the standardized (within stock) loan fee of deal i of stock s closed on day t by short-seller k, $After_t$ is a dummy variable that equals one from March 1st 2011 onward, t is a linear time trend, $\gamma_{k,s}$ are investor-stock fixed-effects, and$\boldsymbol{X}_{s,t}$ are control variables related to stock s on day t. The controls are variables used by the literature to capture shifts in the short-selling demand (following Kolasinski, Reed, and Ringgenberg, 2013): i) a short-term stock returns over the last the 15 days, ii) the standard deviation of daily stock returns computed using the last 15 days, iii) Bollinger Up, a dummy variable that is one if the stock price is above its 10-day moving average by more than two standard deviations, and iv) Bollinger Down, a dummy variable that is one if the stock price is below its 10-day moving average by more than two standard deviations.[5] To further ensure that market conditions do not change much, we focus our analysis to one month before and one month after the benchmark change (we change this time window in the robustness section.) Table 5 presents the descriptive statistics of all variables used in the regressions.

[Table 5 about here]

[5]The Bollinger band strategy is commonly-used technical indicator that prescribes going short and long when a stock price is respectively above or below its 10-day moving average by more than two standard deviations.

The parameter of interest in equation 1 is β_1; it captures the effect of the new benchmark on the market-wide average loan fee. Table 4 presents the results. According to column (2), which includes all the control variables but no fixed effects, the average loan fee level was reduced by 0.267 (stock-specific) standard deviation after the benchmark change. The estimates in column (4), which includes stock fixed effects, do not change much in part because the loan fee is already standardized within stock. Finally, in column (6), which includes investor-stock fixed effects, we conclude that the average loan fee level was reduced in 0.252 standard error after the benchmark change. That is, the loan fee paid by *a given short-seller* to borrow *a given stock* decreased by 0.252 standard deviation with the new benchmark.

[Table 4 about here]

3.2 Difference-in-differences: loan fee reduction was greater for short-sellers with higher search costs

Different short-sellers should be affected differently by the increase in price transparency. Specifically, those for which "shopping around" for better fees is more costly should benefit more from the new benchmark. We test this hypothesis by performing a difference-in-differences analysis to see how the change in the benchmark quality affected differently the groups of high and low search cost borrowers.

Chague, De-Losso, De Genaro, and Giovannetti (2017) show that short-sellers vary a lot with respect to how well-connected they are in the equity lending market. Some short-sellers are very well-connected, in the sense that they have recently closed many loan deals with different brokers, and these broker, in turn, have recently closed many deals with important lenders. In contrast, some short-sellers have closed only a handful of deals in the recent

past with just one broker, and this broker, additionally, is not be very active in the equity lending market. Using connectedness in the equity lending markets as a proxy for search costs, Chague, De-Losso, De Genaro, and Giovannetti (2017) find that poorly connected short-sellers end up paying much higher loan fees.

We follow Chague, De-Losso, De Genaro, and Giovannetti (2017) and measure short-seller connections in three different ways. First, we use a network-based variable that Chague, De-Losso, De Genaro, and Giovannetti (2017) name BC (Borrower Connection). BC is stock-day-borrower specific; a high value of BC means that the short-seller is well-connected to brokers that are well-connected to active lenders, and is computed using our data set since 2009 (see Chague, De-Losso, De Genaro, and Giovannetti, 2017, for more details how it is constructed). Second, we use $\#Deals$, the total number of loan deals that the short-seller has made since 2009; the larger the total number of deals, the better connected should be the short-seller. Finally, we say that the investor is poorly connected if she is a retail investor; otherwise, if the short-seller is an institution, we say it is well-connected.

There is a total of 4,462 different short-sellers in the period between February and March 2011 among the 30 stocks considered. We use our connection measures to separate them into a group of poorly connected short-sellers (the treatment group) and a group of well connected short-sellers (the control group). For the BC and $\#Deals$ measures, we rank investors and split them around the median value to assign them into the groups; for the investor type measure, we simply follow the classification (there are 3,750 retail investors and 712 institutions). Table 5 presents the descriptive statistics of BC and $\#Deals$.

We then run the following panel regression,

$$Fee_{i,s,t,k} = \beta_1 After_t + \beta_2 t + \beta_3 \Psi_k + \beta_4 \Psi_k \times After_t + \beta_5 \Psi_k \times t + \boldsymbol{\beta}_6' \boldsymbol{X}_{s,t} + \gamma_{k,s} + \varepsilon_{i,s,t,k} \quad (2)$$

where, as before, $Fee_{i,s,t,k}$ is the standardized (within stock) loan fee of deal i of stock s

closed on day t by short-seller k, $After_t$ is a dummy variable that equals one from March 1st 2011 onward, t is a linear time trend, $\gamma_{k,s}$ are investor-stock fixed-effects, and $\boldsymbol{X}_{s,t}$ are control variables related to stock s on day t. Ψ_k is a dummy variable that indicates whether short-seller k is in the poorly connected group. To account for the existence of a prior trend affecting differently both groups, we include an interaction of the time trend t and Ψ. The parameter of interest is β_4; if poorly connected short-sellers benefit more from the increase transparency, we should find a negative estimate.

To mitigate concerns of biased standard errors that are typical in difference-in-difference designs (see Bertrand, Duflo, and Mullainathan, 2004, for a detailed discussion), we cluster standard errors at the highest level (the stock level) to account for both serial correlation and heteroskedasticity at the stock level. More specifically, we use the cluster-robust matrix formula of Liang and Zeger (1986) with an adjustment for small samples that improves the size of the test as shown by Brewer, Crossley, and Joyce (2018). Because the number of clusters is moderate (there are only 30 stocks), we also compute bootstrap standard errors as these were shown to have good properties when the number of clusters is small (see Cameron, Gelbach, and Miller, 2008). Table 6 presents the estimates, along with the clustered t-statistics in parenthesis, and bootstrap t-statistics in brackets.

According to column (1) of table 6, the average loan fee level was reduced in -0.351 ($-0.351 = -0.194 - 0.157$) standard error after the benchmark change for the short-sellers with BC below the median. This effect is 81% greater than the effect for the short-sellers with BC above the median, which is equal to -0.190 ($0.81 = 0.351/0.194 - 1$). According to column (2), the average loan fee level was reduced in -0.447 ($-0.447 = -0.204 - 0.243$) standard error after the benchmark change for retail short-sellers. This effect is 119% greater than the effect for institutions, which is equal to -0.204 ($1.19 = 0.447/0.204 - 1$). Finally, according to column (3), the average loan fee level was reduced in -0.438 ($-0.363 = -0.178 - 0.185$) standard error after the benchmark change for individuals. This effect is 104% greater than the effect for institutions, which is equal to -0.178 ($1.04 = 0.363/0.178 - 1$).

[Tables 6 about here]

3.3 There occurred a reduction in loan fee dispersion

Opacity in the equity lending market leads to loan fee dispersion (Duffie, Garleanu, and Pedersen, 2002, Kolasinski, Reed, and Ringgenberg, 2013 and Chague, De-Losso, De Genaro, and Giovannetti, 2017). Hence, if the new benchmark reduced opacity, we should observe a reduction in loan fee dispersion. To evaluate this, we compute three measures of loan fee dispersion: (i) the standard deviation across loan fees (in % per year) on all deals closed on each stock-day and (ii) the loan fee range across all loan deals for each stock-day, considering the 90th and the 10th percentiles, and the 95th and the 05th percentiles. We then run stock-day panel regressions

$$Dispersion_{s,t} = \beta_1 After_t + \beta_2 t + \beta_3 X_{s,t} + \gamma_s + \varepsilon_{s,t} \tag{3}$$

where $Dispersion_{s,t}$ is one of the three measures of dispersion, $After_t$ is a dummy variable that equals one from March 1st 2011 onward, t is a linear time trend, γ_s are stock fixed-effects, and $\boldsymbol{X}_{s,t}$ are control variables related to stock s on day t.

Table 7 presents the results. According to column (2), the daily standard deviation was reduced in -0.182 percentage points, what represents a reduction of 17.4% compared to the constant (17.4% = 0.182/1.046). According to column (4), the intraday 90-10 loan fee range was reduced in -0.509 percentage points, what represents a reduction of 28.8% compared to the constant (28.8% = 0.509/1.765). According to column (5), the intraday 95-05 loan fee range was reduced in -0.658 percentage points, what represents a reduction of 29.6% compared to the constant (29.6% = 0.658/2.221). The results are consistent with the hypothesis that the new benchmark improve price transparency to all investors.

[Table 7 about here]

3.3.1 Within the top broker: increasing bargaining power of poorly connected short-sellers

Chague, De-Losso, De Genaro, and Giovannetti (2017), in their section 5.5, report that well-connected short-sellers pay lower loan fees for the same stock on the same day, even when the authors focus only on deals closed within a single brokerage house (the biggest one in terms of number of loan deals, which has a large number of retail investors as clients). That is, well-connected short-sellers are offered within this top broker significantly lower loan fees, possibly due to their greater bargaining power. Consistent with the new benchmark benefiting poorly connected short-sellers, we now show that the loan fees paid by poorly connected short-sellers (within the top broker, for the same stock, on the same day) are indeed significantly higher before the new benchmark compared to the loan fees paid by well-connected short-sellers, as shown by Chague, De-Losso, De Genaro, and Giovannetti (2017), but such a difference disappears after the new benchmark is introduced.

Considering only deals closed within the top broker (5,915 deals in February and March 2011, 12% of the total 51,411 deals), we first run two deal-by-deal panel regressions with stock-day fixed-effects, where the loan fee is the dependent variable and BC is the explanatory variable (alternatively, we use as explanatory variables dummies for low number of deals and for individuals). The first regression considers all deals closed before the benchmark change (2,756 deals), while the second regression considers all deals closed after the benchmark change (3,159). Table 8 presents the results. According to columns 1 and 2 of Table 8, the loan fees paid by short-sellers with below-median BC are significantly higher before the new benchmark (0.193% per year), but statistically the same after the new benchmark. Columns 2 to 6 show that this conclusion remains the same for the alternative explanatory variables.

[Table 8 about here]

3.4 Lenders with greater market power were more affected

How did the new benchmark affect equity lenders? To answer this question, we explore the fact the some lenders are responsible for a significant fraction of the lending supply of some stocks, while others are small lenders with low market shares. To the extent that observed market shares proxies for market power, lenders with high market shares should be able to influence prices more easily when markets are opaque (Duffie, Gârleanu, and Pedersen, 2005). Therefore, we should expect a stronger effect of the improved price transparency on the deals closed by these large lenders.

To test whether lenders with higher market shares face a larger reduction in their loan fees, we proceed as follows. There are 3,177 pairs lender-stock who closed at least one loan deal in February 2011 and one loan deal in March 2011 after the new benchmark was introduced. For each one of these 3,177 pairs, we compute the change in the average loan fee from February 2011 to March 2011 as $\Delta Fee_{l,s} = \left(\overline{Fee}_{Mar}\right)_{l,s} - \left(\overline{Fee}_{Feb}\right)_{l,s}$, where $\left(\overline{Fee}_{Mar}\right)_{l,s}$ is the average loan fee across all loan deals by lender l on stock s in March 2011 and $\left(\overline{Fee}_{Feb}\right)_{l,s}$ is the average loan fee across all loan deals by lender l on stock s in February 2011. For each one of these 3,177 pairs we also compute the respective share in the lending market in January 2011 as $Share_{l,s} = \frac{Q_{l,s}}{Q_{tot,s}}$, where $Q_{l,s}$ is the number of shares lent by lender l in January 2011 of stock s and $Q_{tot,s}$ is the total number of shares lent in January 2011 of stock s. We then regress $\Delta Fee_{l,s}$ on $Share_{l,s}$, $Share_{l,s}^2$, and stock and lender fixed-effects.

The distribution of the variable share across the lender-stock pairs is as follows. Among the 3,177 lender-stock pairs who made at least one loan in February 2011 and one loan in March 2011, 438 (14%) present share equal to zero in the January 2011 lending market, 2,117 (67%) present a positive share less or equal to 0.5%, 223 (7%) present a share between 0.5% and 1%, 283 (9%) between 1% and 5%, 71 (2%) between 5% and 10%, and 45 (1%) above 10%. That is, there is substantial variation in $Share_{l,s}$.

Table 9 presents the regression coefficients. Column (1) includes no fixed-effects, column (2) includes only stock fixed-effects, column (3) includes only lender fixed-effects, and column

(4) includes both types of fixed-effects. The qualitative conclusion is the same across all columns: the relation between $\Delta Fee_{l,s}$ and $Share_{l,s}$ is decreasing and convex. We show the estimates of column (4) in Figure 4.

[Table 9 and Figure 4 about here]

According to 4, the average loan fee change from February 2011 to March 2011 for a small lender with market share close to zero was -0.53%. In turn, the average loan fee change for a lender of a large market of around 10% was -0.70%. Overall, the results are consistent with the hypothesis that larger lenders are the ones who were taking greater advantage of the greater market opacity before the new benchmark.

3.5 Equity lending volume increased

We now evaluate whether the benchmark positively affected the quantity of loan deals. In principle, some investors could stop lending their stocks in response to the lower loan fees, what could negatively affect the loan quantity in equilibrium. This is not what we find.

To evaluate the effect of the benchmark on the number of loan deals we compute $NumDeals$, the number of loan deals for each stock-day and $AvVol$, the loan deal average volume for each stock-day. Both variables are standardized within stocks. We then estimate the stock-day panel regressions

$$NumDeals_{s,t} = \beta_1 After_t + \beta_2 t + \beta_3 X_{s,t} + \varepsilon_{s,t} \tag{4}$$

$$AvVol_{s,t} = \beta_1 After_t + \beta_2 t + \beta_3 X_{s,t} + \varepsilon_{s,t} \tag{5}$$

where all explanatory variables are the same of regression (1).

Table 10 presents the results. According to column (2), the number of loan deals increased by 0.253 standard deviation. According to column (4), the average volume of the loan deal

also increased by 0.259 standard deviation. Combining this evidence of larger quantity with the evidence of lower loan fees (from previous sections), we conclude that the lending supply curve shifted to the right with the new benchmark.

[Tables 10 about here]

3.6 Brokerage fees did not change

In this section we take a closer look at the brokerage fees paid by short-sellers—all our results until now considered only loan fees net of brokerage fees. In Brazil, brokerage fees are not regulated and are determined by each brokerage house. The fees are often a fraction of the loan fee, and sometimes vary across client even within the same brokerage house. Moreover, the new benchmark did not provide any information about the average brokerage fee paid by short-sellers, nor even indirectly. The benchmark was computed using the loan fee received by lenders plus the brokerage fees paid by lender; it did not considered the brokerage fees paid by borrowers. Therefore, the effect of the new benchmark on brokerage fees paid by short-sellers is unclear a priori.

Table 11 brings some descriptive statistics about the brokerage fees paid by short-sellers before and after the new benchmark. We show both the raw brokerage fee in percentage per year, and the fraction of the brokerage fee of the loan fee. Overall, the numbers seem to suggest a small increase in the average brokerage fee paid by short-sellers.

[Table 11 about here]

Next, we run panel regressions controlling for other characteristics of the loan deal to isolate the effect of the change in the benchmark on brokerage fees. We run the following deal-level panel regression

$$BrokerageFee_{i,s,t,k,b} = \beta_1 After_t + \beta_2 t + \boldsymbol{\beta}_3' \boldsymbol{Z} + \gamma_s + \gamma_b + \varepsilon_{i,s,t,k} \tag{6}$$

where $BrokerageFee_{i,s,t,k,b}$ is the standardized (within stock) brokerage fee paid to brokerage house b by the short-seller of deal i of stock s closed on day t by short-seller k, $After_t$ is a dummy variable that equals one from March 1st 2011 onward, t is a linear time trend, γ_s are stock fixed-effects, and $\boldsymbol{Z}$ are control variables: the natural log of the number of shares in deal i, and our three measures of a short-sellers connectedness in the equity lending market, BC, $\#Deals$, and a dummy variable whether the short-sellers is a retail investor. We also include broker fixed-effects, γ_b, in the panel regressions.

Table 12 presents the results. Overall, the β_1 estimates are not statistically different than zero, indicating that there was no change in brokerage fees.

[Table 12 about here]

4 Placebo and robustness

4.1 Placebo dates

Our analysis was based on a two-month window around the benchmark change. To alleviate concerns of spurious results, we perform our baseline analysis of section 3.1 using 24 pairs of months before the benchmark change. We proceed as follows. We first run regression 1 using all loan deals closed from December 2008 to January 2009, setting the dummy variable $After_t$ equal to one from January 1st 2009 onward; we then run regression 1 using all loan deals closed from January 2009 to February 2009, setting the dummy variable $After_t$ equal to one from February 1st 2009 onward; and so on.[6] Table 13 presents the results; the column names indicate the month where the fictitious benchmark starts.

[Table 13 about here]

[6] As discussed in section 2.1, on each sub-sample we exclude stocks with "interests on equity" payments scheduled.

The effect of the introduction of the actual benchmark on March 1, 2011, is rather strong: column 3 in Table 4 shows an estimate for $After$ of -0.257, with a corresponding a t-statistic of -4.07. In turn, there is no estimate for $After$ in Table 13 with magnitude close to -0.271 in absolute terms; the largest one is equal to 0.123 in January 2009; and the largest t-statistic is 1.85, also in January 2009.

4.2 Narrower windows

Market conditions can change fast, and the variables used to capture shifts in the short-selling demand (short-term stock returns over the last the 15 days, returns volatility in the last 15 days, and the Bollinger bands) clearly have limited control power. Hence, in principle, the narrower the window around the benchmark change, the better the identification of the benchmark effect (however, if the window is too narrow, investors may not have time to learn about the new benchmark). In this section, we replicate our main regression (equation 1) at narrower windows around the benchmark change: 15 trading days before and after the change, and 10 trading days before and after the change. Overall, results remain qualitatively the same.

Table 14 presents the results. Columns (1), (2), and (3) are estimated using all loan deals within the 15-day window. According to column (1), which includes all the control variables but no fixed effects, the average loan fee level was reduced by 0.220 (stock-specific) standard deviation after the benchmark change. According to column (2), which includes stock fixed effects, the average loan fee level was reduced by 0.225 standard deviation after the benchmark change. According to column (3), which includes investor-stock fixed effects, the average loan fee level was reduced by 0.228 standard deviation after the benchmark change. Columns (4), (5), and (6) are estimated using all loan deals within the 10-day window. According to column (4), which includes all the control variables but no fixed effects, the average loan fee level was reduced by 0.149 standard deviation after the benchmark change. According to column (5), which includes stock fixed effects, the average loan fee level was

reduced by 0.141 standard deviation after the benchmark change. According to column (6), which includes investor-stock fixed effects, the average loan fee level was reduced by 0.103 standard deviation after the benchmark change.

[Table 14 about here]

5 Loan fee benchmarks in other countries

The previous results indicate that loan fee benchmarks should be beneficial to equity lending markets, consistent with the prediction by Duffie, Dworczak, and Zhu (2017). Surprisingly, most countries do not have a loan fee benchmark for its investors.

We collected information about the Financial Market Infrastructure (FMI)[7] in 18 different countries[8] to identify whether there is either a publicly available benchmark or other disclosure regarding securities lending transactions. In only three of these 18 countries (India, Singapore, and Taiwan) short-sellers have access to some some kind of loan fee benchmark. Surprisingly, in 15 countries (Australia, Belgium, Finland, France, Germany, India, Ireland, Japan, Singapore, Sweden, Switzerland, Taiwan, and the UK) at least part of the equity lending and registration rules are standardized, defined and implemented by the FMI itself. Therefore, for these countries, it would be quite feasible for the FMI to provide to the market publicly available reference rates. Table 15 presents the details of the equity lending market in each country.

[Table 15 about here]

[7] Financial Market Infrastructure (FMI) refers to critically important institutions responsible for providing clearing, settlement and recording of monetary and other financial transactions.

[8] Australia, Belgium, Finland, France, Germany, India, Ireland, Japan, Malaysia, Netherlands, New Zealand, Singapore, South Korea, Sweden, Switzerland, Taiwan, the US, and the UK.

6 Conclusion

In recent research Duffie, Dworczak, and Zhu (2017) show that benchmarks can provide valuable pre-trade price transparency in search OTC markets. Good benchmarks mitigate search frictions by lowering informational asymmetry among market participants. In this paper we study the effects of a benchmark enhancement that occurred in the Brazilian equity lending market in 2011. We take advantage of a very detailed dataset that comprises all loan deals in the Brazilian market from January 2008 to July 2011.

We perform diferent analyses to empirically assess how the loan fee benchmark change affected loan fees. We find that the adoption of the new benchmark reduced loan fees, with stronger effects for short-sellers with higher search costs and for stocks with greater informational gains due to the benchmark change.

Despite the potential benefits of loan fees benchmarks in equity lending markets, they are in general not available around the world. Across 18 different countries that we evaluate, in only three (India, Singapore, and Taiwan) short-sellers can take advantage of some kind of loan fee benchmark. As such, we believe that our results may be relevant for regulators and practitioners. By reducing loan fees, benchmarks can reduce stock overpricing (Danielsen and Sorescu, 2001, Jones and Lamont, 2002, Nagel, 2005, Chang, Cheng, and Yu, 2007, Stambaugh, Yu, and Yuan, 2012 and Blocher, Reed, and Van Wesep, 2013) and increase price efficiency (Asquith, Pathak, and Ritter, 2005, Nagel, 2005, Cao, Dhaliwal, Kolasinski, and Reed, 2007, Saffi and Sigurdsson, 2011, Engelberg, Reed, and Ringgenberg, 2012 and Boehmer and Wu, 2013).

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A Appendix

A.1 Equity lending in Brazil

Trading in the equity loan market in Brazil is over-the-counter (OTC), as in the US. Unlike the US, however, all loan contracts must be registered with B3, the exchange, the only stock exchange in Brazil. B3 acts as a clearing platform, and as a central counterparty. It guarantees all loan contracts and keeps track of the contract collateral. Hence, although investors face an opaque market as in the US, researchers have access to market-wide data, observing every single transaction.

The way the equity lending market works in Brazil is very similar to the US (the following information is from B3: http://www.bmfbovespa.com.br/en_us/services/securities-lending/). Securities lenders earn a freely negotiated fee for lending securities. The fee is paid to lenders net of income withholding tax. A borrower is required to pay both the lender's fee and a transaction fee owed to B3. Currently, this transaction fee is charged at a rate of 0.25% per year calculated on the loan amount, i.e., the financial value of the borrower's open interest position, provided a minimum R$10.00 fee applies. Where the automatic securities lending program is activated, the transaction fee is charged at 0.50% per year and no minimum fee applies.

There are two types of standard settlement arrangements, which are related to the contract term and right of early return or recall (if any), as follows:

- Returnable: For loans that include an early return option, settlement may take place sooner than anticipated if the borrower chooses to return equivalent securities to the lender earlier

- Returnable/recallable: For loans that include both an early return option and a recall option, settlement may take place sooner than anticipated either because the borrower chooses to exercise the early return option, or otherwise because the lender recalls equivalent securities from the borrower.

Early return by the borrower may be executed up to 7:00 p.m and including one business day prior to the expiration date. In this case, the borrower shall fully or partially settle the contract by 8:00 p.m. On the expiration date of the contract or on the expiration date of the request for early settlement by the lender, full or partial settlement shall be executed by 8:00 p.m. Early settlement by the lender follows the procedure above: for requests made up to 9:30 a.m the borrower must execute settlement of the contract by 8:00 p.m. of T+3 from the request date; for requests made after 9:30 a.m. the borrower must execute settlement by 8:00 p.m. of T+4 from the request date.

When a security is lent, the title and the ownership are transferred to the borrower, such that the issuer will not be making direct payments to the lender. However, the borrower refunds the lender (and the securities lending system is programmed to process the refund) for payouts, at the same amounts and dates as cash distributions are paid out by the issuer. This means that at the payment date set by the issuer, the system will credit the lender for the payout amount (as adjusted to account for any withholding tax charges). Based on the premise of making the lender "whole" for any corporate action event, in the case of cash distributions (e.g., interest on capital, dividends), the lender retains right to be paid cash in the equivalent of any payouts, as if the securities were not on loan. Where a corporate action event affects the number of outstanding securities of the issuer (e.g., bonus stock distributions, stock splits, reverse splits), the number of securities delivered to the lender at the end of the loan will have been adjusted to account for the effects of the relevant corporate action event. However, the voting rights inherent in shares on loan are not retained by a lender; rather, they are transferred to the borrower along with the title and ownership.

At the outset of a loan, the borrower is required to post collateral for 100% of the principal amount of the loan (value of the loaned securities) plus an amount to cover potential exposure to future fluctuations in the market price of the security. The value of such additional amount, called margin interval, depends on the outcome of risk assessments made by B3, which take into account stress scenarios estimated to the relevant security. The margin

interval, which generally ranges between 15% and 100% of the principal, represents the prospective price fluctuation of the security over two consecutive trading sessions. Clearing agents admitted as participants of B3 bear co-responsibility with customer borrowers for loan settlement. At the clearing agent's discretion, this may lead the clearing agent to require additional collateral from a customer borrower. Before taking a loan position, the lender must have placed the securities in custody at B3's Central Securities Depository. Similarly, before taking a borrowing position, the borrower must have posted the required collateral (pre-margining system). During the life of the loan, daily margin calls may be made as a result of mark-to-market adjustments to the value of the loan. For example, if the market price for the security rises, the borrower will be required to make an additional margin deposit.

A difference with respect to the US is the way loan fees are quoted in Brazil. In the US, the loan fee is implicitly given by the "rebate" rate when loans are cash-collateralized. The rebate rate is the interest rate that the lender pays the borrower in exchange for holding the cash-collateral; it is lower than the fed funds rate. The higher the difference between the rebate rate and the fed funds rate, the higher the implicit loan fee. If the borrower posts instead Treasury securities as collateral, she simply pays the lender an explicit loan fee. Since in Brazil all loan deals are collateralized with Treasury securities, there are no "rebate" rates and all loan deals are always negotiated in terms of explicit loan fees.

A.2 BMF&Bovespa External Communication

Below is a copy of the announcement of the change in the loan fee benchmark

BM&FBOVESPA
A Nova Bolsa

February 23, 2011
013/2011-DN

EXTERNAL COMMUNICATION

To: The BM&FBOVESPA (BVMF) Market Participants – Bovespa Segment

Re: **Changes to the Publication of Fees on Registered Loans at the Securities Lending Service (BTC).**

We hereby inform you that as of **March 1, 2011**, the average fees on registered loans at the BTC will be published on the internet based on a **3 (three) business day period** per security. At present the published period is for 15 (fifteen) business days.

We highlight that the purpose of this change is to make the securities lending service ever more transparent, in order to attract more securities lenders and borrowers and to meet the demand of institutional investors.

For further information about securities lending please click on www.cblc.com.br/cblc/ingles > Securities Lending Program > Consult > Registered Loan.

José Antonio Gragnani
Chief Business Development Officer

BM&FBOVESPA S.A. – Bolsa de Valores, Mercadorias e Futuros
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www.bmfbovespa.com.br

B Tables and Figures

Figure 1: Print-screen of the benchmark web-page

This figure presents a print of the actual webpage in 2011. Stocks are divided according to the ticker's initial letter. The figure does not present the actual numbers, as the digital archive we used to retrieve the original webpage (Wayback Machine, http://web.archive.org) does not contain them.

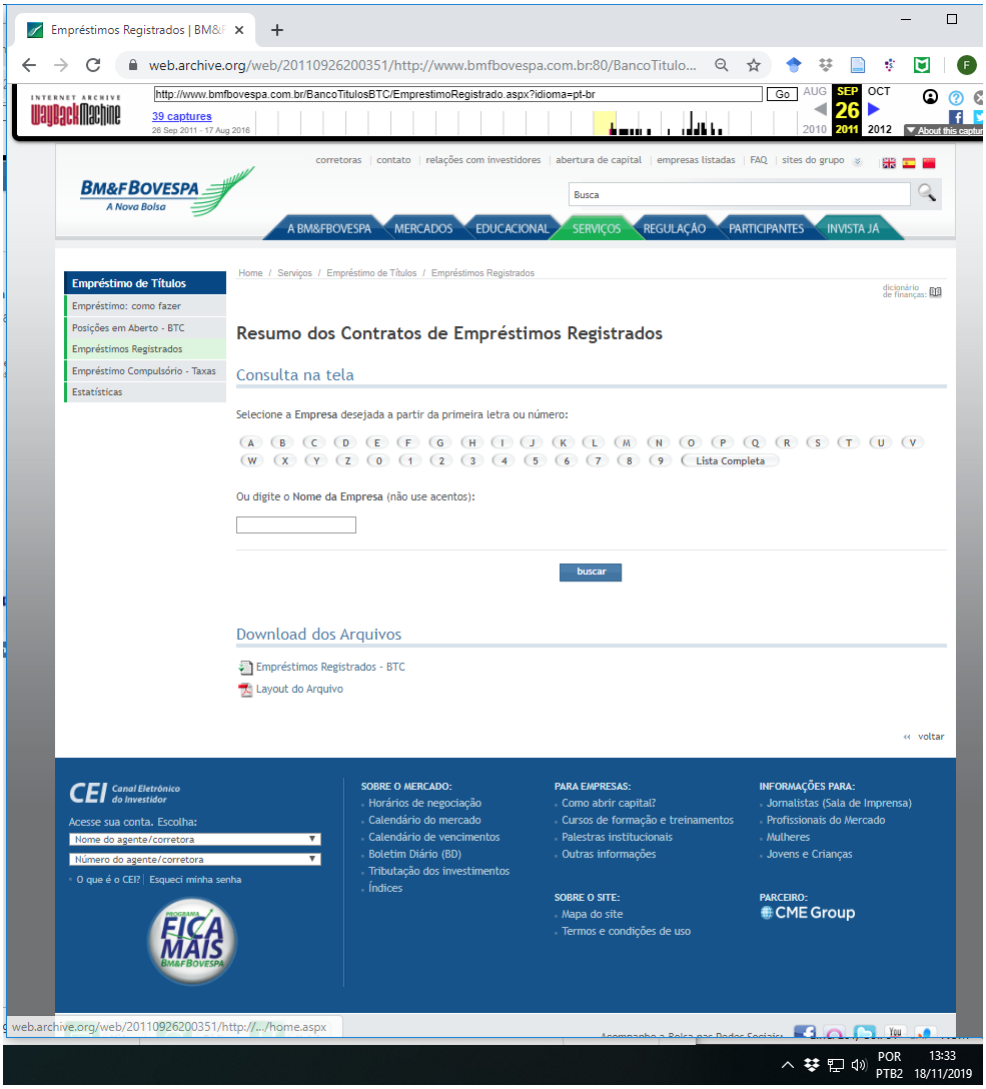
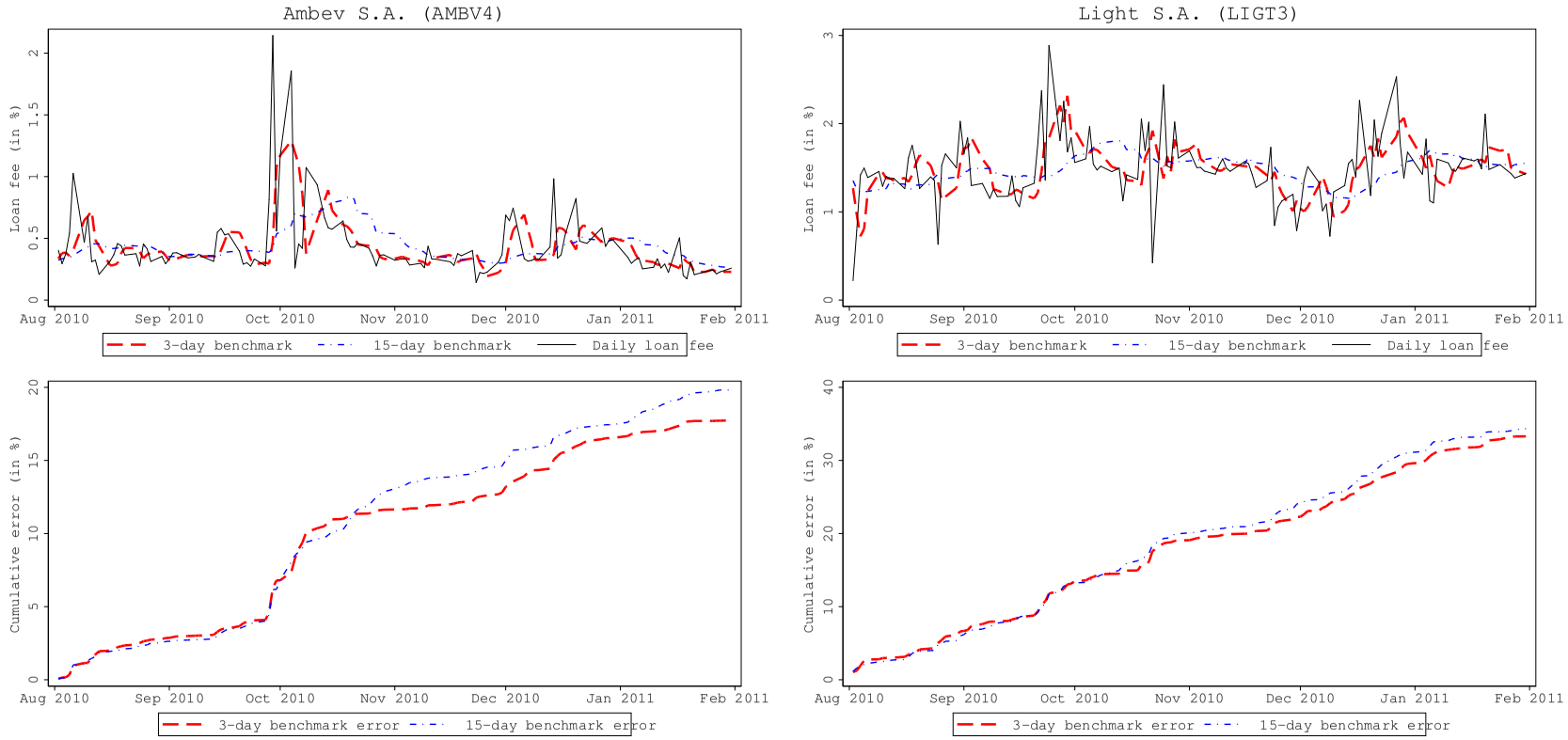
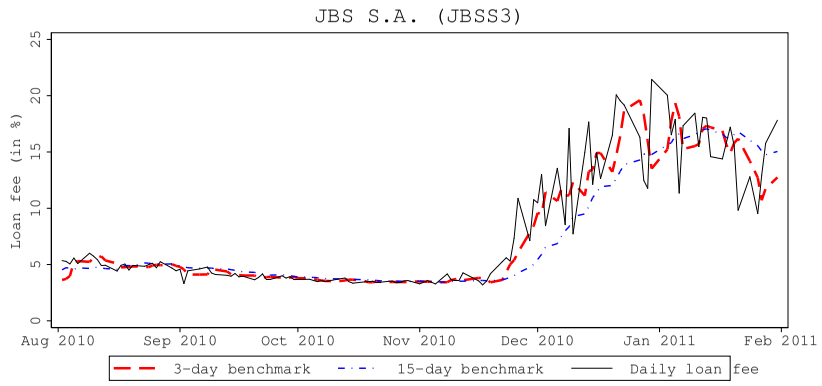


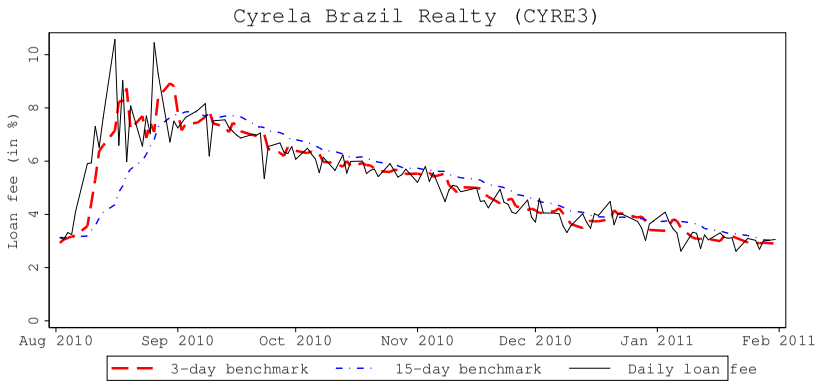
Figure 2: Time series of loan fees (continues on next page...)

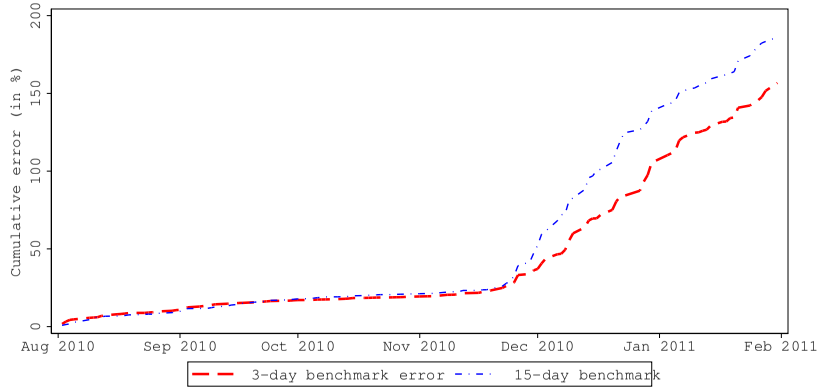
This figure presents a comparison between the old benchmark (based on the previous 15 trading days) and the new benchmark (based on the previous 3 days). We reconstruct them using our data set and compare both with the actual daily average loan fee. The bottom plots present the error incurred in using the benchmarks to predict current loan fees and accumulate the absolute error over time. To help visualization, we arbitrarily focus on 4 different stocks over the six month period prior to the implementation of the new benchmark (continues on next page...).



(...continued from previous page)







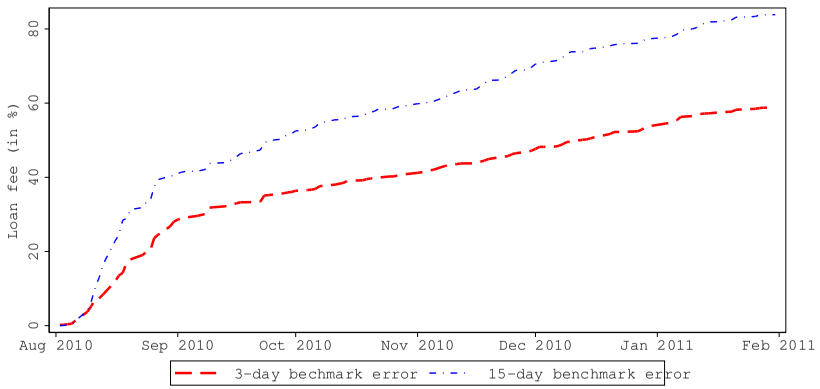


Figure 3: Loan fees around benchmark change

This figure presents the market-wide daily loan fee 20 days before and 20 days after the change in the benchmark. To obtain a market-wide loan fee, for each stock s and day t we first compute $\left(\overline{fee_i}\right)_{s,t}$, the (equal- or volume-weighted) daily average of the loan fees considering all loan deals of stock s on day t. We then compute $std\left(\overline{fee_i}\right)_{s,t}$ by standardizing $\left(\overline{fee_i}\right)_{s,t}$ within each stock. Finally, for each day, we compute both the average and the median across all stocks of $std\left(\overline{fee_i}\right)_{s,t}$. Therefore, we end up with four time-series: (i) the cross-stocks *average* of $std\left(\overline{fee_i}\right)_{s,t}$, where $\left(\overline{fee_i}\right)_{s,t}$ is computed as the *equal-weighted* daily average of the loan fees considering all loan deals of stock s on day t (top-right plot); (ii) the cross-stocks *median* of $std\left(\overline{fee_i}\right)_{s,t}$, where $\left(\overline{fee_i}\right)_{s,t}$ is computed as the *equal-weighted* daily average of the loan fees considering all loan deals of stock s on day t (bottom-right plot); (ii) the cross-stocks *average* of $std\left(\overline{fee_i}\right)_{s,t}$, where $\left(\overline{fee_i}\right)_{s,t}$ is computed as the *volume-weighted* daily average of the loan fees considering all loan deals of stock s on day t (top-left plot); and (iv) the cross-stocks *median* of $std\left(\overline{fee_i}\right)_{s,t}$, where $\left(\overline{fee_i}\right)_{s,t}$ is computed as the *volume-weighted* daily average of the loan fees considering all loan deals of stock s on day t (bottom-left plot).

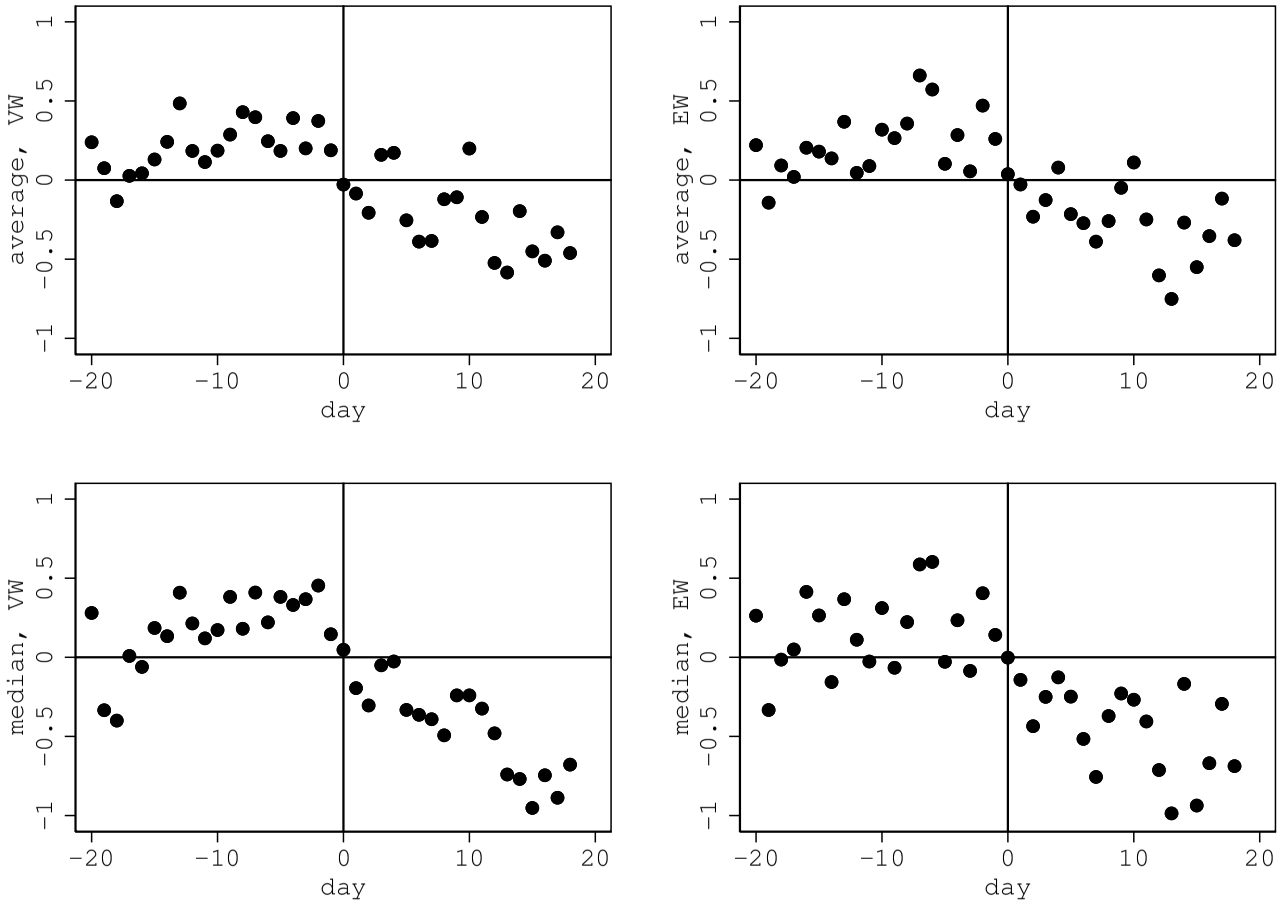


Figure 4: Benchmark effect as a function of market share

This figure presents the estimated effect from the benchmark change on lenders with different market shares. To estimate this, we use the 3,177 pairs lender-stock who presented at least one loan deal in Feb 2011 and one loan deal in Mar 2011. For each of these 3,177 pairs, we compute the change in the average loan fee from February 2011 to March 2011 as $\Delta Fee_{l,s} = \left(\overline{Fee}_{Mar}\right)_{l,s} - \left(\overline{Fee}_{Feb}\right)_{l,s}$, where $\left(\overline{Fee}_{Mar}\right)_{l,s}$ is the average loan fee across all loan deals by lender l on stock s in March 2011 and $\left(\overline{Fee}_{Feb}\right)_{l,s}$ is the average loan fee across all loan deals by lender l on stock s in February 2011. For each of these 3,177 pairs we also compute the respective share in the lending market in January 2011 as $Share_{l,s} = \frac{Q_{l,s}}{Q_{tot,s}}$, where $Q_{l,s}$ is the number of shares lent by lender l in January 2011 of stock s and $Q_{tot,s}$ is the total number of shares lent in January 2011 of stock s. We then regress $\Delta Fee_{l,s}$ on $Share_{l,s}$, $Share_{l,s}^2$, and stock and lender fixed-effects. Estimated parameters are presented in Table 9.

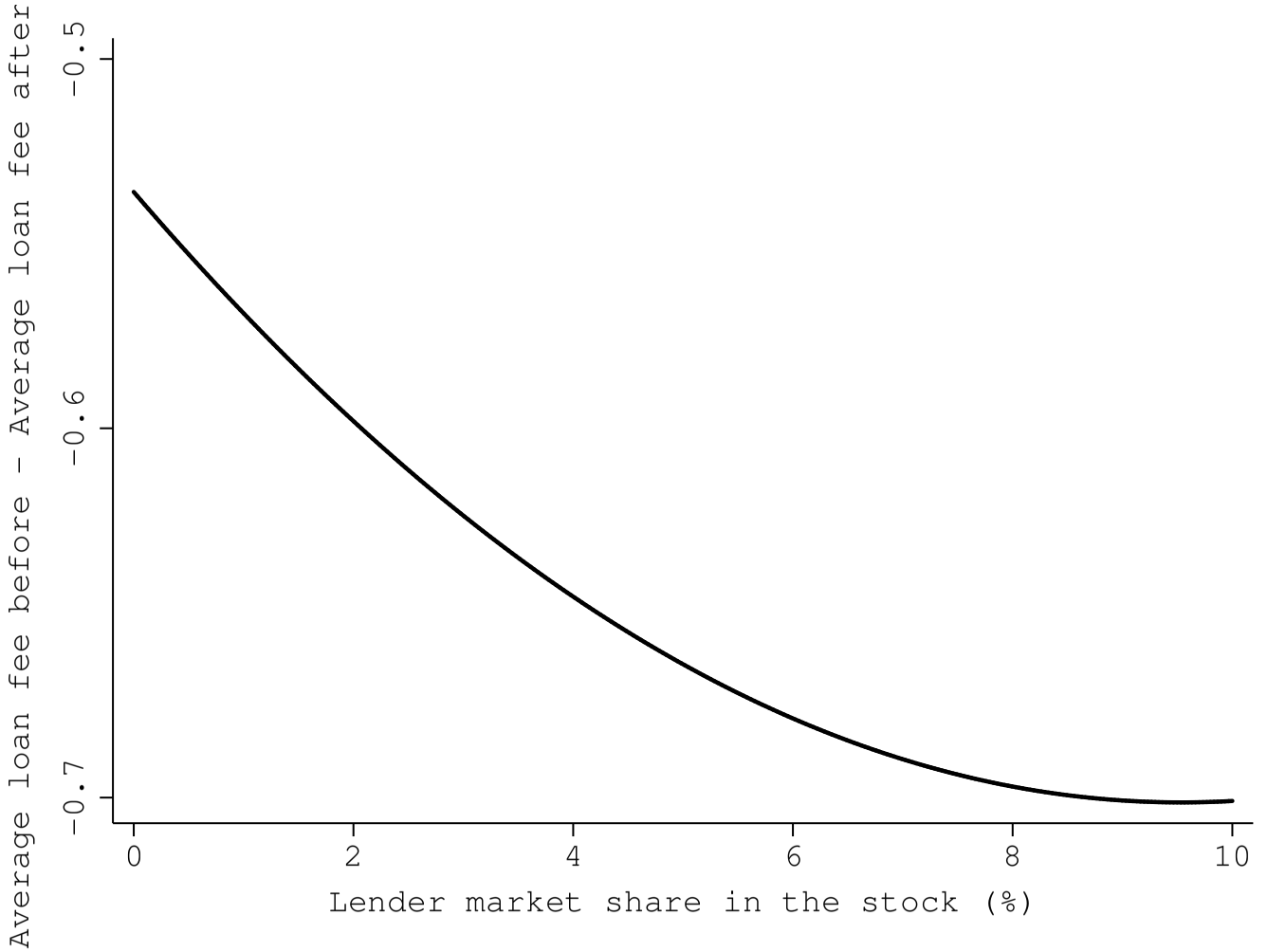


Table 1: Descriptive statistics

This table presents the following descriptive statistics for each stock: market capitalization (US$ billion), number of loan deals before and after the benchmark change, and average loan fee before and after the benchmark change. "# of pos." is the number of positive values in the column. "# of neg." is the number of negative values in the column. "average" is the average value in the column.

		# of loan deals			average loan fee		
stock	mkt cap	before (Feb)	after (Mar)	change (%)	before (Feb)	after (Mar)	change (%)
AMBV4	36.2	1002	793	-21	0.28	0.30	8
BBDC4	34.7	2468	2689	9	0.56	0.60	7
BRAP4	6.3	354	392	11	0.39	0.28	-30
BRKM5	4.4	1246	1333	7	1.29	1.43	11
BRML3	3.8	350	609	74	3.01	2.70	-10
BTOW3	1.9	383	441	15	2.54	2.05	-19
CCRO3	12.4	522	578	11	0.90	0.71	-21
CESP6	3.6	329	311	-5	1.00	0.73	-27
CMIG4	6.2	1085	1377	27	2.02	2.53	25
CPFE3	11.9	1015	1024	1	5.95	6.29	6
CPLE6	3.2	450	278	-38	1.54	0.67	-56
CSAN3	6.5	550	674	23	0.86	0.87	2
CSNA3	24.7	894	1028	15	0.51	0.35	-31
CYRE3	4.8	1044	892	-15	2.65	1.44	-46
ELET3	14.6	579	294	-49	2.46	1.31	-47
ELET6	4.3	1184	1142	-4	5.28	6.58	25
ENBR3	3.5	63	84	33	5.22	4.69	-10
GFSA3	2.7	924	949	3	0.82	1.21	47
GGBR4	13.4	2906	2545	-12	1.60	2.65	66
GOAU4	4.3	282	182	-35	0.27	0.23	-14
GOLL4	1.9	381	368	-3	0.86	0.80	-7
JBSS3	9.6	982	979	0	12.09	6.71	-45
KLBN4	2.0	1455	1304	-10	2.10	2.00	-5
LIGT3	3.2	822	845	3	1.76	2.18	24
MRVE3	4.3	809	1044	29	6.31	4.60	-27
RDCD3	8.1	1639	1430	-13	4.69	3.50	-25
RSID3	2.2	735	1088	48	1.76	1.41	-20
SBSP3	5.7	458	476	4	3.85	2.33	-40
SUZB5	2.3	244	330	35	4.07	3.97	-2
TAMM4	2.2	350	427	22	3.00	1.98	-34
			# of pos.	19		# of pos.	10
			# of neg.	11		# of neg.	20
			average	5		average	-10

Table 2: Informational Gain of the New Benchmark (in-sample)

This table presents different measures of goodness of fit obtained by three in-sample prediction models of the daily loan fee that use the 15-day benchmark and the 3-day benchmark as predictors. The sample period is from July 2008 to January 2011. The prediction models are the following: i) $Fee_{s,t} = benchmark_{s,t} + \epsilon_{s,t}$ (naive model); ii) $Fee_{s,t} = a + b \times benchmark_{s,t} + \epsilon_{s,t}$ (linear model); and iii) $Fee_{s,t} = f(benchmark_{s,t}, benchmark_{s,t-1}, benchmark_{s,t-2}) + \epsilon_{s,t}$ (non-linear model), where $f()$ consists of the three lags of the benchmark as well as their squared values cross products. $benchmark_{s,t}$ can be the 15-day or 3-day benchmarks. We fit the model for each stock and compute the adjusted R^2, the mean square error (MSE), the mean absolute error (MAE), and the volatility of the residuals (VOL). The table shows the mean and std. dev. of these measures across stocks. The column *diff* shows the difference of the 3-day benchmark mean and the 15-day benchmark mean, and the corresponding t-statistic in parenthesis.

Panel A: Value-weighted loan fee

		Naive prediction			Linear prediction			Non-linear prediction		
	Benchmark	mean	std. dev.	*diff*	mean	std. dev.	*diff*	mean	std. dev.	*diff*
MSE	3-day	0.455	0.477	*-0.848*	0.472	0.493	*-0.812*	0.208	0.241	*-0.141*
	15-day	1.303	1.597	*(-3.82)*	1.284	1.528	*(-3.91)*	0.350	0.363	*(-4.36)*
MAE	3-day	0.273	0.174	*-0.167*	0.275	0.174	*-0.168*	0.208	0.131	*-0.077*
	15-day	0.443	0.325	*(-5.50)*	0.443	0.321	*(-5.49)*	0.284	0.181	*(-6.97)*
VOL	3-day	0.577	0.356	*-0.362*	0.590	0.359	*-0.352*	0.386	0.249	*-0.121*
	15-day	0.940	0.660	*(-5.61)*	0.942	0.642	*(-5.71)*	0.507	0.311	*(-5.47)*
R2	3-day	0.861	0.115	*0.174*	0.861	0.115	*0.174*	0.945	0.041	*0.049*
	15-day	0.687	0.213	*(6.96)*	0.686	0.213	*(6.96)*	0.896	0.101	*(3.23)*

Panel B: Equal-weighted loan fee

		Naive prediction			Linear prediction			Non-linear prediction		
	Benchmark	mean	std. dev.	*diff*	mean	std. dev.	*diff*	mean	std. dev.	*diff*
MSE	3-day	0.473	0.429	*-0.461*	0.428	0.390	*-0.437*	0.346	0.336	*-0.065*
	15-day	0.934	1.038	*(-3.61)*	0.864	0.961	*(-3.68)*	0.411	0.396	*(-3.81)*
MAE	3-day	0.327	0.183	*-0.089*	0.326	0.178	*-0.09*	0.304	0.167	*-0.026*
	15-day	0.416	0.258	*(-5.04)*	0.419	0.259	*(-5.01)*	0.330	0.183	*(-4.57)*
VOL	3-day	0.596	0.319	*-0.216*	0.582	0.304	*-0.21*	0.518	0.283	*-0.046*
	15-day	0.813	0.515	*(-4.59)*	0.791	0.498	*(-4.62)*	0.564	0.310	*(-4.34)*
R2	3-day	0.821	0.150	*0.114*	0.820	0.150	*0.114*	0.863	0.115	*0.023*
	15-day	0.707	0.223	*(5.25)*	0.707	0.223	*(5.25)*	0.839	0.138	*(2.96)*

Table 3: Informational Gain of the New Benchmark (out-of-sample)

This table presents different measures of goodness of fit obtained by three out-of-sample prediction models of the daily loan fee that use the 15-day benchmark and the 3-day benchmark as predictors. The sample period is from July 2008 to January 2011. The prediction models are the following: i) $Fee_{s,t} = benchmark_{s,t-1} + \epsilon_{s,t}$ (naive model); ii) $Fee_{s,t} = a + b \times benchmark_{s,t-1} + \epsilon_{s,t}$ (linear model); and iii) $Fee_{s,t} = f(benchmark_{s,t-1}, benchmark_{s,t-2}, benchmark_{s,t-3}) + \epsilon_{s,t}$ (non-linear model), where $f()$ consists of the three lags of the benchmark as well as their squared values cross products. $benchmark_{s,t-1}$ can be the 15-day or 3-day benchmarks with one day of lag (as it is made available to investors). We fit the model for each stock using all observations from the beginning of our sample until time t and compute the adjusted R^2, the mean square error (MSE), the mean absolute error (MAE), and the volatility of the residuals (VOL). The table shows the mean and std. dev. of these measures across stocks. The column *diff* shows the difference of the 3-day benchmark mean and the 15-day benchmark mean, and the corresponding t-statistic in parenthesis.

Panel A: Value-weighted loan fee

		Naive prediction			Linear prediction			Non-linear prediction		
	Benchmark	mean	std. dev.	*diff*	mean	std. dev.	*diff*	mean	std. dev.	*diff*
MSE	3-day	0.982	1.009	*-0.582*	0.924	0.966	*-0.547*	0.691	0.776	*-0.062*
	15-day	1.564	1.935	*(-2.79)*	1.471	1.792	*(-2.88)*	0.754	0.848	*(-2.94)*
MAE	3-day	0.405	0.259	*-0.080*	0.436	0.277	*-0.068*	0.382	0.249	*-0.020*
	15-day	0.485	0.361	*(-3.08)*	0.505	0.387	*(-2.06)*	0.402	0.265	*(-3.33)*
VOL	3-day	0.850	0.519	*-0.177*	0.817	0.502	*-0.177*	0.702	0.449	*-0.032*
	15-day	1.027	0.727	*(-3.31)*	0.994	0.689	*(-3.62)*	0.734	0.468	*(-3.56)*
R2	3-day	0.714	0.217	*0.078*	0.580	0.310	0.036	0.611	0.298	*0.003*
	15-day	0.636	0.237	*(3.36)*	0.544	0.268	(2.28)	0.608	0.294	*(0.61)*

Panel B: Equal-weighted loan fee

		Naive prediction			Linear prediction			Non-linear prediction		
	Benchmark	mean	std. dev.	*diff*	mean	std. dev.	*diff*	mean	std. dev.	*diff*
MSE	3-day	0.719	0.667	*-0.400*	0.637	0.603	*-0.383*	0.483	0.486	*-0.042*
	15-day	1.119	1.278	*(-2.92)*	1.020	1.157	*(-3.06)*	0.526	0.536	*(-3.47)*
MAE	3-day	0.398	0.227	*-0.053*	0.419	0.235	*-0.050*	0.361	0.211	*-0.013*
	15-day	0.451	0.287	*(-2.96)*	0.469	0.314	*(-2.13)*	0.373	0.221	*(-2.88)*
VOL	3-day	0.737	0.404	*-0.148*	0.697	0.385	*-0.15*	0.604	0.345	*-0.026*
	15-day	0.885	0.574	*(-3.26)*	0.848	0.541	*(-3.63)*	0.630	0.361	*(-3.97)*
R2	3-day	0.742	0.213	*0.074*	0.613	0.313	*0.013*	0.653	0.295	*0.002*
	15-day	0.667	0.243	*(3.48)*	0.600	0.274	*(0.70)*	0.651	0.292	*(0.27)*

Table 4: Benchmark effect on the loan fee level

This table presents the deal-level panel regression

$$Fee_{i,s,t,k} = \beta_1 After_t + \beta_2 t + \beta_3 X_{s,t} + \gamma_{k,s} + \varepsilon_{i,s,t,k}$$

where $Fee_{i,s,t,k}$ is the standardized (within stock) loan fee of deal i of stock s closed on day t by short-seller k, $After_t$ is a dummy variable that equals one from March 1st 2011 onward, t is a linear time trend, $X_{s,t}$ are control variables related to stock s on day t, and $\gamma_{k,s}$ are investor-stock fixed-effects. We include the following variables in $X_{s,t}$: i) a short-term stock returns over the last the 15 days, ii) the standard deviation of daily stock returns computed using the last 15 days, iii) Bollinger Up, a dummy variable that is one if the stock price is above its 10-day moving average by more than two standard deviations, and iv) Bollinger Down, a dummy variable that is one if the stock price is below its 10-day moving average by more than two standard deviations. We use all loan deals in the months of February and March of 2011. Standard errors are clustered by stock and t-statistics are presented in parentheses.

	Loan fee at the deal level (standardized by stock)					
	(1)	(2)	(3)	(4)	(5)	(6)
After	-0.271	-0.267	-0.274	-0.267	-0.257	-0.252
	(-4.41)	(-4.12)	(-4.39)	(-4.17)	(-4.07)	(-3.74)
Trend	0.005	0.005	0.005	0.005	0.003	0.004
	(0.72)	(0.50)	(0.72)	(0.49)	(0.33)	(0.35)
Past return		0.002		0.002		-0.005
		(0.22)		(0.18)		(-0.37)
Past volatility		0.041		0.033		0.108
		(1.47)		(0.52)		(1.41)
Bollinger up		0.024		-0.027		0.065
		(0.36)		(-0.37)		(1.08)
Bollinger down		-0.033		0.120		-0.009
		(-0.49)		(1.57)		(-0.10)
Constant	0.027	-0.042	-0.027	-0.199	0.069	-0.172
	(0.20)	(-0.26)	(0.20)	(-0.81)	(0.43)	(-0.66)
Fixed effects	No	No	stock	stock	stock-id	stock-id
Observations	51,411	51,411	51,411	51,411	51,411	51,411
R2	0.83%	0.91%	0.78%	0.98%	40.0%	40.2%

Table 5: Descriptive statistics

This table presents descriptive statistics of the variables in the deal-level panel regressions that use all loan deals from February to March of 2011. *Fee* is the standardized (within stock) loan fee, *Past return* is the stock returns over the last the 15 days, *Past volatility* is the standard deviation of daily stock returns computed using the last 15 days, *Bollinger Up* is a dummy variable that is one if the stock price is above its 10-day moving average by more than two standard deviations, *Bollinger Down* is a dummy variable that is one if the stock price is below its 10-day moving average by more than two standard deviations. BC is a investor-stock-day network-based measure of borrower connection BC constructed by Chague, De-Losso, De Genaro, and Giovannetti (2017), # *Deals* is the number of lending deals closed by the borrower since 2009.

				Percentiles					
	mean	std. dev.	min.	5%	25%	50%	75%	95%	max.
Fee	0.00	1.00	-4.57	-1.01	-0.42	-0.24	0.21	1.67	49.30
Past return	-0.50	6.94	-22.49	-11.44	-5.50	-0.66	4.49	10.82	21.90
Past volatility	1.92	0.66	0.34	0.97	1.45	1.81	2.38	3.15	3.96
Bollinger up	0.10	0.30	0	0	0	0	0	1	1
Bollinger down	0.07	0.25	0	0	0	0	0	1	1
BC	0.50	1.14	0.00	0.00	0.00	0.09	0.46	2.51	11.44
# Deals	264.79	385.00	1	2	15	107	382	1038	1821

Table 6: Difference-in-differences: heterogeneous effects across short-sellers on loan fee level

This table presents the same deal-level panel regression from Table 4 but allowing for heterogeneous effects of the benchmark across different short-sellers (difference-in-differences analysis). We interact both the trend variable t and the variable $After$ with Ψ, a dummy variable that identifies poorly connected short-sellers. We construct Ψ based on three different proxies for connection. The first is the same network-based variable used by Chague, De-Losso, De Genaro, and Giovannetti (2017), namely, BC (borrower connection). Variable BC is high if a short-seller is well-connected to brokers that are well-connected to active lenders, and is computed using our full dataset since 2009. In this case, $\Psi = 1$ if the short-seller displays a BC below the median borrower. The second proxy for connection is the total number of loan deals that the short-seller has made since 2009; the larger the total number of deals, the better connected should be the short-seller. In this case, $\Psi = 1$ if the short-seller's total number of loan deals is below the median. Finally, $\Psi = 1$ simply if the short-seller is an individual investor. Standard errors are clustered by stock and t-statistics are presented in parentheses. We also show the t-statistics computed using wild cluster bootstrap in brackets.

	Loan fee at the deal level (standardized by stock)		
	$\Psi = 1$ if low BC	$\Psi = 1$ if individual	$\Psi = 1$ if low # of deals
	(1)	(2)	(3)
After	-0.194	-0.204	-0.178
	(-2.96)	(-3.13)	(-2.94)
	[-2.84]	[-2.94]	[-2.75]
After $\times$ Ψ	-0.157	-0.243	-0.185
	(-1.75)	(-1.85)	(-2.15)
	[-1.72]	[-1.83]	[-2.16]
Trend	0.001	0.001	0.001
	(0.07)	(0.14)	(0.01)
	[0.04]	[0.09]	[-0.06]
Trend $\times$ Ψ	0.009	0.016	0.011
	(2.30)	(2.66)	(2.56)
	[2.21]	[-2.55]	[2.49]
Ψ	0.253	0.376	0.247
	(4.19)	(4.26)	(3.57)
	[4.37]	[4.20]	[3.51]
Constant	-0.339	-0.283	-0.330
	(-1.44)	(-1.20)	(-1.45)
Controls	Yes	Yes	Yes
Fixed effects	stock	stock	stock
Observations	51,411	51,411	51,411
R2	0.04	0.07	0.05

Table 7: Benchmark effect on the loan fee dispersion: stock-day panel

This table presents the results of stock-day panel regressions with three different measures of loan fee dispersion as the dependent variable: the standard deviation across loan fees (in % per year) on all deals closed on each stock-day and the loan fee range across all loan deals for each stock-day, considering the 90th and the 10th percentiles, and the 95th and the 05th percentiles. We run the stock-day panel regression

$$Dispersion_{s,t} = \beta_1 After_t + \beta_2 t + \beta_3 X_{s,t} + \gamma_s + \varepsilon_{s,t}$$

where $Dispersion_{s,t}$ is one of the three proxies of dispersion and the right-hand side variables are the same ones described in Table 4. Standard errors are clustered by stock and t-statistics are presented in parentheses.

	intraday std. dev.		intraday range (90-10)		intraday range (95-05)	
	(1)	(2)	(3)	(4)	(5)	(6)
After	-0.177	-0.182	-0.493	-0.509	-0.654	-0.658
	(-1.63)	(-1.65)	(-1.74)	(-1.72)	(-1.99)	(-1.97)
Trend	0.001	0.001	0.005	0.006	0.014	0.014
	(0.13)	(0.13)	(0.30)	(0.31)	(0.62)	(0.55)
Past return		-0.002		-0.004		-0.004
		(-0.19)		(-0.19)		(-0.12)
Past volatility		-0.029		-0.013		0.162
		(-0.23)		(-0.05)		(0.47)
Bollinger up		0.108		0.506		0.372
		(1.24)		(2.52)		(1.55)
Bollinger down		-0.118		0.053		-0.243
		(-1.76)		(0.30)		(-1.02)
Constant	0.993	1.046	1.796	1.765	2.559	2.221
	(7.93)	(4.08)	(6.04)	(3.03)	(6.89)	(3.02)
Fixed effects	stock	stock	stock	stock	stock	stock
Observations	1,163	1,163	1,163	1,163	1,163	1,163
R2	0.27	0.28	0.32	0.32	0.30	0.30

Table 8: Loan fees within the top broker for a given stock on a given day

This table presents the results of deal-level panel regressions that evaluate whether short-sellers with poor connections in the equity lending market ($\Psi = 1$) have to pay higher loan fees when borrowing a given stock on a given day within a given broker (the biggest one in terms of number of loan deals), relatively to better connected short-sellers ($\Psi = 0$). Regressions include stock-day fixed effects and are run separated for the month before and the month after the benchmark change. We construct Ψ based on three different proxies for connection. The first is the same network-based variable used by Chague, De-Losso, De Genaro, and Giovannetti (2017), namely, BC (borrower connection). Variable BC is high if a short-seller is well-connected to brokers that are well-connected to active lenders, and is computed using our full dataset since 2009. In this case, $\Psi = 1$ if the short-seller displays a BC below the median borrower. The second proxy for connection is the total number of loan deals that the short-seller has made since 2009; the larger the total number of deals, the better connected should be the short-seller. In this case, $\Psi = 1$ if the short-seller's total number of loan deals is below the median. Finally, $\Psi = 1$ simply if the short-seller is an individual investor. Standard errors are clustered by stock and t-statistics are presented in parentheses.

	Loan fee at the deal level (%, per year)					
	$\Psi = 1$ if low BC		$\Psi = 1$ if individual		$\Psi = 1$ if low # of deals	
	Before	After	Before	After	Before	After
	(1)	(2)	(3)	(4)	(5)	(6)
Ψ	0.193	0.034	0.266	0.046	0.575	0.138
	(2.00)	(0.46)	(2.34)	(0.59)	(3.05)	(1.16)
Constant	2.659	2.518	2.608	2.509	2.275	2.421
	(54.08)	(67.37)	(42.32)	(58.55)	(14.56)	(24.71)
Fixed effects	stock-day	stock-day	stock-day	stock-day	stock-day	stock-day
Observations	2,756	3,159	2,756	3,159	2,756	3,159
R2	0.86	0.83	0.86	0.83	0.86	0.83

Table 9: Heterogeneity across lenders

This table presents the results of panel regressions that evaluate whether the effects of the benchmark on loan fees vary across lenders with different market powers. There are 3,177 pairs lender-stock who presented at least one loan deal in Feb 2011 and one loan deal in Mar 2011. For each of these 3,177 pairs, we compute the change in the average loan fee from February 2011 to March 2011 as $\Delta Fee_{l,s} = \left(\overline{Fee}_{Mar}\right)_{l,s} - \left(\overline{Fee}_{Feb}\right)_{l,s}$, where $\left(\overline{Fee}_{Mar}\right)_{l,s}$ is the average loan fee across all loan deals by lender l on stock s in March 2011 and $\left(\overline{Fee}_{Feb}\right)_{l,s}$ is the average loan fee across all loan deals by lender l on stock s in February 2011. For each of these 3,177 pairs we also compute the respective share in the lending market in January 2011 as $Share_{l,s} = \frac{Q_{l,s}}{Q_{tot,s}}$, where $Q_{l,s}$ is the number of shares lent by lender l in January 2011 of stock s and $Q_{tot,s}$ is the total number of shares lent in January 2011 of stock s. We then regress $\Delta Fee_{l,s}$ on $Share_{l,s}$, $Share^2_{l,s}$, and stock and lender fixed-effects. Standard errors are clustered by stock and t-statistics are presented in parentheses. The relation between $\Delta Fee_{l,s}$ and $Share_{l,s}$, based on column 4, is plotted in Figure 4.

	ΔFee			
	(1)	(2)	(3)	(4)
Share	-0.056	-0.030	-0.089	-0.035
	(-2.99)	(-2.19)	(-2.20)	(-1.82)
Share2	0.003	0.002	0.003	0.002
	(4.34)	(4.46)	(2.65)	(2.83)
Constant	-0.290	-0.391	-0.269	-0.536
	(-1.07)	(-35.32)	(-1.73)	(-3.91)
Stock F.E.	No	Yes	No	Yes
Lender F.E.	No	No	Yes	Yes
Observations	3,177	3,177	3,177	3,177
R2	0.01	0.46	0.53	0.54

Table 10: Benchmark effect on loan quantity: stock-day panel

This table presents the results of stock-day panel regressions with $NumDeals$, the number of loan deals for each stock-day and $AvVol$, the loan deal average volume for each stoch-day, as dependent variables (both variables are standardized within stocks). The right-hand side variables are the same ones described in Table 4. Standard errors are clustered by stock and t-statistics are presented in parentheses.

	Number of loan deals (standardized by stock)		Average deal volume (standardized by stock)	
	(1)	(2)	(3)	(4)
After	0.265	0.253	0.252	0.260
	(1.64)	(1.62)	(2.48)	(2.57)
Trend	-0.016	-0.025	-0.006	-0.002
	(-2.22)	(-3.46)	(-1.07)	(-0.08)
Past return		0.037		-0.026
		(5.45)		(-4.75)
Past volatility		0.133		-0.054
		(1.34)		(-0.65)
Bollinger up		0.044		0.091
		(0.42)		(0.91)
Bollinger down		0.045		0.081
		(0.35)		(0.47)
Constant	0.194	0.162	0.005	-0.063
	(2.32)	(0.74)	(0.06)	(-0.31)
Stock F.E.	Yes	Yes	Yes	Yes
Observations	1,163	1,163	1,161	1,161
R2	0.01	0.04	0.01	0.02

Table 11: Descriptive statistics of brokerage fees paid by short-sellers

This table presents descriptive statistics of the brokerage fees paid by short-sellers during February and March of 2011.

					Percentiles					
		mean	std. dev.	min.	5%	25%	50%	75%	95%	max.
Before benchmark	Raw brokerage fee	0.18	0.50	0.00	0.00	0.00	0.00	0.2	0.75	36
	Brokerage fee fraction	0.12	0.32	0.00	0.00	0.00	0.00	0.11	0.50	9.00
After benchmark	Raw brokerage fee	0.21	0.49	0.00	0.00	0.00	0.05	0.22	0.9	11
	Brokerage fee fraction	0.17	0.68	0.00	0.00	0.00	0.02	0.15	0.61	14.50

# deals	Zero fees	Non-zero fees	Total
Before benchmark	12,866	14,097	26,963
After benchmark	12,978	11,470	24,224
Total	25,844	25,567	51,411

Table 12: Benchmark effect on short-sellers' brokerage fees

This table presents the estimates of the deal-level panel regression

$$BrokerageFee_{i,s,t,k,b} = \beta_1 After_t + \beta_2 t + \boldsymbol{\beta}_3' \boldsymbol{Z} + \gamma_s + \gamma_b + \varepsilon_{i,s,t,k}$$

where $BrokerageFee_{i,s,t,k,b}$ is the standardized (within stock) brokerage fee paid to brokerage house b by the short-seller of deal i of stock s closed on day t by short-seller k, $After_t$ is a dummy variable that equals one from March 1st 2011 onward, t is a linear time trend, γ_s are stock fixed-effects, and $\boldsymbol{Z}$ are control variables: the natural log of the number of shares in deal i, and our three measures of a short-sellers connectedness in the equity lending market, BC, $\#Deals$, and a dummy variable whether the short-sellers is a retail investor. We also include broker fixed-effects, γ_b, in the panel regressions. We use all loan deals in the months of February and March of 2011. Standard errors are clustered by stock and t-statistics are presented in parentheses.

	Loan fee at the deal level (standardized by stock)			
	(1)	(2)	(3)	(4)
After	0.042	0.045	0.046	0.042
	(0.84)	(1.00)	(1.09)	(0.97)
Trend	0.001	0.001	0.000	0.001
	(0.44)	(0.59)	(0.35)	(0.49)
Ln(quantity)			0.006	0.009
			(0.77)	(1.26)
BC			0.014	0.016
			(1.03)	(1.15)
# Deals			-0.007	-0.004
			(-1.65)	(-1.18)
Individual			0.203	0.103
			(5.31)	(3.39)
Constant	0.106	0.105	0.028	-0.055
	(3.90)	(9.19)	(0.47)	(-1.00)
Fixed effects	No	stock	stock	stock / broker
Observations	51,411	51,411	51,411	51,411
R2	0.31%	4.52%	7.48%	13.54%

Table 13: Benchmark effect on the loan fee level: placebo regressions

This table present the results of placebo regressions. We run the same deal-level panel regression from Table 4 (column 3) using 24 pairs of months before the benchmark change. We proceed as follows. We first use all loan deals closed from December 2008 to January 2009, setting the dummy variable $After_t$ equal to one from January 1st 2009 onward; we then use all loan deals closed from January 2009 to February 2009, setting the dummy variable $After_t$ equal to one from February 1st 2009 onward; and so on. As discussed in section 2.1, on each sub-sample we exclude stocks with "interests on equity" payments scheduled. The column names indicate the month where the fictitious benchmark starts. Standard errors are clustered by stock and t-statistics are presented in parentheses.

	Loan fee at the deal level (standardized by stock)											
	Jan 09	Feb 09	Mar 09	Apr 09	May 09	Jun 09	Jul 09	Aug 09	Sep 09	Oct 09	Nov 09	Dec 09
After	0.175	-0.064	0.001	-0.074	0.004	0.019	-0.087	-0.087	-0.026	0.013	-0.025	-0.063
	(2.76)	(-1.09)	(0.01)	(-0.94)	(0.07)	(0.26)	(-0.99)	(-1.42)	(-0.47)	(0.22)	(-0.37)	(-0.58)
Trend	-0.014	-0.006	0.007	0.007	-0.004	0.008	0.006	-0.003	-0.005	-0.012	-0.007	0.005
	(-3.24)	(-0.88)	(0.91)	(0.98)	(-0.69)	(1.27)	(1.34)	(-0.50)	(-0.90)	(-2.91)	(-1.10)	(0.39)
Constant	0.212	0.142	-0.129	-0.105	0.072	-0.178	-0.094	0.110	0.114	0.258	0.164	-0.062
	(2.55)	(1.30)	(-1.14)	(-0.88)	(0.82)	(-1.40)	(-1.29)	(0.99)	(1.14)	(3.41)	(1.29)	(-0.28)
Investor-stock F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	33,702	33,639	43,294	41,854	42,468	35,363	35,419	37,293	28,677	26,829	21,550	24,159
R2	0.70	0.61	0.63	0.65	0.68	0.61	0.64	0.63	0.58	0.61	0.60	0.60

	Loan fee at the deal level (standardized by stock)											
	Jan 10	Feb 10	Mar 10	Apr 10	May 10	Jun 10	Jul 10	Aug 10	Sep 10	Oct 10	Nov 10	Dec 10
After	-0.010	0.027	0.017	-0.058	-0.017	0.062	0.046	0.007	-0.026	0.028	-0.073	0.006
	(-0.14)	(0.32)	(0.31)	(-0.75)	(-0.25)	(0.57)	(1.05)	(0.27)	(-0.22)	(0.50)	(-0.83)	(0.09)
Trend	0.000	0.001	-0.008	-0.012	-0.004	-0.004	-0.009	-0.010	-0.010	-0.011	-0.001	0.001
	(-0.04)	(0.16)	(-1.33)	(-1.42)	(-0.93)	(-0.73)	(-1.81)	(-1.86)	(-1.24)	(-2.08)	(-0.06)	(0.16)
Constant	0.012	-0.032	0.156	0.295	0.094	0.053	0.177	0.218	0.223	0.230	0.048	-0.031
	(0.09)	(-0.31)	(1.33)	(1.78)	(1.37)	(0.51)	(1.65)	(1.89)	(1.62)	(2.12)	(0.32)	(-0.19)
Investor-stock F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	32,249	29,274	37,406	35,567	33,655	38,075	42,561	51,261	39,488	32,836	24,251	27,957
R2	0.63	0.61	0.61	0.66	0.65	0.62	0.67	0.68	0.60	0.64	0.67	0.62

Table 14: Benchmark effect on the loan fee level - narrower windows

This table presents the same deal-level panel regression

$$Fee_{i,s,t,k} = \beta_1 After_t + \beta_2 t + \beta_3 X_{s,t} + \gamma_{k,s} + \varepsilon_{i,s,t,k}$$

reported in Table 4, but using narrower windows around the benchmark change: 15 trading days before and after the change, and 10 trading days before and after the change. $Fee_{i,s,t,k}$ is the standardized (within stock) loan fee of deal i of stock s closed on day t by short-seller k, $After_t$ is a dummy variable that equals one from March 1st 2011 onward, t is a linear time trend, $X_{s,t}$ are control variables related to stock s on day t, and $\gamma_{k,s}$ are investor-stock fixed-effects. We include the following variables in $X_{s,t}$: i) a short-term stock returns over the last the 15 days, ii) the standard deviation of daily stock returns computed using the last 15 days, iii) Bollinger Up, a dummy variable that is one if the stock price is above its 10-day moving average by more than two standard deviations, and iv) Bollinger Down, a dummy variable that is one if the stock price is below its 10-day moving average by more than two standard deviations. Standard errors are clustered by stock and t-statistics are presented in parentheses.

	Loan fee at the deal level (standardized by stock)					
	window: [-15; +15]			window: [-10; +10]		
	(1)	(2)	(3)	(4)	(5)	(6)
After	-0.220	-0.225	-0.228	-0.149	-0.141	-0.103
	(-3.04)	(-3.25)	(-2.86)	(-2.23)	(-2.36)	(-1.51)
Trend	-0.001	0.001	0.003	-0.013	-0.012	-0.017
	(-0.08)	(0.09)	(0.21)	(-1.30)	(-1.33)	(-1.91)
Past return	0.007	0.007	-0.004	0.014	0.011	0.001
	(1.02)	(0.78)	(-0.36)	(2.64)	(1.78)	(0.09)
Past volatility	-0.022	0.085	0.130	-0.056	0.061	0.091
	(-0.81)	(0.82)	(1.15)	(-1.46)	(0.68)	(1.04)
Bollinger up	-0.067	-0.056	0.016	-0.127	-0.114	-0.087
	(-0.95)	(-0.80)	(0.28)	(-1.64)	(-1.54)	(-1.19)
Bollinger down	0.010	0.043	0.059	-0.084	0.018	-0.017
	(0.12)	(0.45)	(0.46)	(-1.13)	(0.42)	(-0.44)
Constant	0.191	-0.055	-0.182	0.484	0.221	0.272
	(0.96)	(-0.16)	(-0.47)	(2.41)	(1.14)	(1.55)
Fixed effects	No	stock	stock-id	No	stock	stock-id
Observations	38,327	38,327	38,327	25,878	25,878	25,878
R2	1.33%	2.04%	57.29%	2.74%	5.60%	68.25%

Table 15: Equity lending markets and loan fee benchmarks

This table describes the equity lending market in 18 different countries (Australia, Belgium, Finland, France, Germany, India, Ireland, Japan, Malaysia, Netherlands, New Zealand, Singapore, South Korea, Sweden, Switzerland, Taiwan, the US, and the UK.) and identifies whether there is either a publicly available benchmark or fully disclosure information regarding securities lending transactions. The sources of information are Huszár and Prado (2019) and the institutions websites indicated below.

Exchange	Country	Description of the lending market	Benchmark
SGX	Singapore	The Central Depository (CDP) is a subsidiary of the Singapore Stock Exchange (SGX). It offers clearing, settlement, depository, securities, investment strategies, financial planning, and advisory services. The Securities Borrowing and Lending (SBL) service has over 80% of the total listed stocks on SGX available for lending and borrowing via Central Depository. All the loan fees are standardized (4% to lenders and 6% to borrowers). Starting 2 Dec 2019, these fees will vary according to factors such as the supply and demand of the securities. Lenders will get a fixed 70% of the borrowing fee, which is higher than the current 66.67%. (source: SGX website https://www1.cdp.sgx.com/sgx-cdp-web/lendingpool/show)	Yes, all the standardized loan fees are available online.
TWSE	Taiwan	The Taiwan Stock Exchange acts as the clearinghouse for all trades executed in the TWSE's market. The TWSE centralized SBL system provides three types of transactions: fixed-rate, competitive bid and negotiated transaction. The negotiated transaction mode accounted for 72.5% of all transactions in 2017. (sources: TWSE SBL System Overview & Publications https://www.twse.com.tw/en/page /products/sbl/edu.html, https://mis.twse.com.tw/stock/sblInquiry.jsp and https://www.twse.com.tw/en/page/trading/SBL/t13sa710.html)	Yes, the TWSE has a Market Information System with real time volume available for SBL and within market quotes there is the SBL fees transacted.
NSE	India	The National Stock Exchange of India (NSE) offers SBL through the clearing corporation/clearing house of stock exchanges. Lending & Borrowing is facilitated on an automated screen-based platform where the order matching is on price time priority. The participant needs to quote the lending fee per share on the order matching platform. (source: NSE website https://www.nseindia.com/products/content/ equities/slbs/slbs.htm)	Yes, NSE provides on a daily basis information regarding loan fees, number of trades and financial amount.

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Exchange	Country	Description of the lending market	Benchmark
Clearstream Eurex Clearing	Germany, Switzerland	Eurex Clearing and Clearstream jointly offer a centrally cleared securities lending product. Clearstream arranges the loans between the borrower and the lender as a neutral agent. While the bilateral negotiation is managed by Clearstream, the actual trading is done anonymously on the electronic Eurex Repo platform. On the clearing side, the central counterparty Eurex Clearing then novates the trade and performs the exchange of the loan against the collateral. In doing so, Eurex Clearing is the legal counterparty to the clearing members on the borrowing and the lending side at loan level. Clearstream then manages the collateral in its function as a neutral triparty collateral agent. (source: Eurex clearing website, https://www.eurexclearing.com/clearing-en/about-us/company-profile)	No.
OCC	USA	The Options Clearing Corporation (OCC) makes two stock loan programs available to its Clearing Members; the OCC Stock Loan/Hedge Program and the OCC Market Loan Program. The first was created in 1993 by OCC to clear and guarantee, because OCC acts as a central counterparty ("CCP"), stock loan transactions between Clearing Members. In the second, OCC currently clears securities lending transactions for Automated Equity Finance Markets, Inc., a wholly owned subsidiary of EquiLend Clearing LLC (ECS). ECS matches lenders and borrowers in an exchange-like platform using automated liquidity and price discovery mechanisms. (sources: OCC Website, https://www.theocc.com/clearing/clearing-services/stock-loan.jsp and https://www.theocc.com/webapps /stock-loan-volume)	No, there is only information for the loan transaction volume.
Bursa Malaysia	Malaysia	Bursa Malaysia offers two models of Securities Borrowing and Lending (SBL): the Central Lending Agency (CLA) and the Negotiated Transaction (NT). In the first, Bursa Malaysia acts as the CLA for all SBL transactions between lenders and borrowers, which must comply with Bursa Clearing's Terms and Conditions. In the second, approved lenders and borrowers can agree to their own SBL terms and conditions and report such transactions to Bursa Malaysia. (source: Bursa Malaysia website http://www.bursamalaysia.com/market/products-services/securities-borrowing-lending-sbl/#)	No.

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Exchange	Country	Description of the lending market	Benchmark
NZCDC	New Zealand	New Zealand Clearing and Depository Corporation Limited (NZCDC) offers a securities lending facility for Depository Participants. The Clearing House acts as the central counterparty for all securities lending transactions initiated through the Depository. The securities lending facility provides Depository Participants an opportunity to lend securities held in the Depository. Clearing Participants, given the provision of adequate collateral, are eligible to borrow securities from the lending pool. (source: NZCDC website, https://www.nzx.com/services/nzx-clearing/faq)	No.
ASX	Australia	The Central Securities Depository (CSD) is one of Australia's most important settlement and depository systems, holding more than 95% of Australian fixed income securities and more than 85% of commercial paper. ASX Collateral, ASX's Centralized Securities Depository (CSD) tri-party collateral management service, is the only live, fixed income, tri-party repo securities lending and collateral management service provider in Australia that mobilizes collateral directly within the CSD. The service collateralizes exposures across a range of products, including SBL. (source: ASX website, https://www.asx.com.au/services/information-services/securities-lending-disclosure.htm)	No, the ASX has a "Securities lending disclosure" section with a variety of reports, but no information on loan fees transacted.
KSD	South Korea	In 1996, the securities lending began through Korea Securities Depository (KSD). The Korean Market environment is clearly divided into lenders, borrowers and intermediaries. Intermediaries manage securities and collateral, which include KSD, Korea Securities Finance Corporation (KSFC), and some securities companies. Domestic stock lending is usually made through KSD, while bond lending is usually made through KSFC. The borrower and the lender choose the type of transaction and enter application details (quantity, fees, etc.) into web-based KSD SLB system, which acts as the intermediary of the whole transaction. (source: KSD website, https://ksd.or.kr/eng/static/EB050200 0000.home?-menuNo=69 and http://freesis.kofia.or.kr/)	No, there is only information for the loan transaction volume published by the Korea Financial Investment Association (KOFIA).

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Exchange	Country	Description of the lending market	Benchmark
Euroclear	UK, Ireland, Belgium, Finland, Nether-lands, France, Sweden.	Euroclear's offers a securities lending and borrowing program. In it, there is no direct relationship between lenders and borrowers. Instead, participants have a contractual relationship with Euroclear, which takes the exposure risk. The name and positions of the counterparties are not disclosed. Lenders' positions are aggregated into an anonymous 'lending pool' from which securities are allocated to borrowers. (source: Euroclear Website, https://www.euroclear.com/services/en/securities-lending-and-borrowing.html)	No.
JSF	Japan	The Japan Securities Finance Co. (JSF) acts as an intermediary in the lending stock business. The intermediation between stock lenders and stock borrowers is done through the JSF which centralizes the stock transfers, the collateral and the negotiated fee.	No fully publicly available, but there is a third-party paid solution (Apex JSFC Trade Manager) sponsored by the JSFC which provides the previous five days fee paid for the same security.