DO WOMEN PAY MORE FOR CREDIT? EVIDENCE FROM ITALY

Alberto F. Alesina
Harvard University and IGIER

Francesca Lotti
Bank of Italy

Paolo Emilio Mistrulli
Bank of Italy

Abstract
By using a unique and large data set on loan contracts between banks and microfirms, we find robust evidence that women in Italy pay more for credit than men, although we do not find any evidence that women borrowers are riskier than men. The male/female differential remains even after controlling for a large number of characteristics of the type of business, the borrower, and the structure of the credit market. The result is not driven by lack of credit history, nor by women using a different type of bank than men, since the same bank charges different rates to male and female borrowers. (JEL: G21, J16, J71)

1. Introduction

In Italy there are many microfirms (defined as those with less than five employees) and they use bank overdraft facilities—or credit lines—for credit and liquidity management. Women own about 25% of all Italian microfirms.

We take advantage of a unique data set on all overdraft facilities used by Italian microfirms and we find that women pay a higher interest rate than men, after controlling for many individual characteristics of the borrower, of the businesses, and of the local credit markets. With basic controls we find that women pay almost 28 basis points

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E-mail: aalesina@harvard.edu (Alesina); francesca.lotti@bancaditalia.it (Lotti); paoloemilio.mistrulli@bancaditalia.it (Mistrulli)

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more for credit than men. Adding controls, the magnitude significantly decreases, varying from a minimum of about 9 basis points to 11. For the average credit line in the sample, which is about €60,000, this difference amounts to about €55 to €170 of additional interest charges for women per year.

An obvious explanation for this finding could be that women are riskier borrowers, but the interest rate differential is still statistically significant even after controlling for a variety of risk factors, including the length of the borrower's credit history and the sector in which it operates. In fact, female-owned businesses have gone bankrupt less often than male-owned ones, and women have a slightly better credit history. The interest rate differential remains the same when we include bank fixed effects: therefore, it cannot be explained by the fact that women use a specific type of bank. When a bank faces a high-risk borrower it asks for a guarantor and, on average, charges a higher interest to the borrower. Interestingly, we find that when a woman has a male guarantor, her interest rate goes down, rather than up, while if a female borrower has a female guarantor, her interest rate is much higher than that of a male/male pair.

In order to further investigate possible explanations for this gender-based differential, we look at characteristics of local credit markets. We find that in more concentrated markets interest rates are lower (at least up to very high level of concentration, when they begin to increase), but the gender-based differential does not disappear. We then look at proxies for the degree of information, like newspaper readership, and for social capital. These variables vary dramatically across parts of Italy, in a way which may correlate to a host of socioeconomic variables relevant for the persistence of gender differences.[1] We show that interest rates charged for these overdraft facilities are lower in places with higher social capital and newspaper readership, a result which may be of interest in its own right. The differential between female and male interest rates, however, does not disappear.

Are women then discriminated against in credit markets in Italy? Statistical discrimination would imply that lenders perceive gender as a signal of some other characteristics of the borrower which are unobservable to the econometrician, but not to the lender. These unobserved characteristics (by the econometrician) could explain this gender gap.[2] Even though we controlled as well as we could for observable risk factors, we cannot rule out this possibility.

There are two alternative explanations of our findings. One is that women are taste-discriminated against by banks: namely, banks view women as less desirable

1. Pathbreaking work by Putnam (1993) made the point, and recent work by Guiso, Sapienza, and Zingales (2008) deepened the argument in important ways. For related work on Europe, see Tabellini (2006).

2. Note that the literature on microcredit in developing countries pointed out that women are significantly more reliable borrowers than men (for a survey see Armendáriz and Morduch 2010), even though it is not clear whether these results extend outside the context of very poor countries.

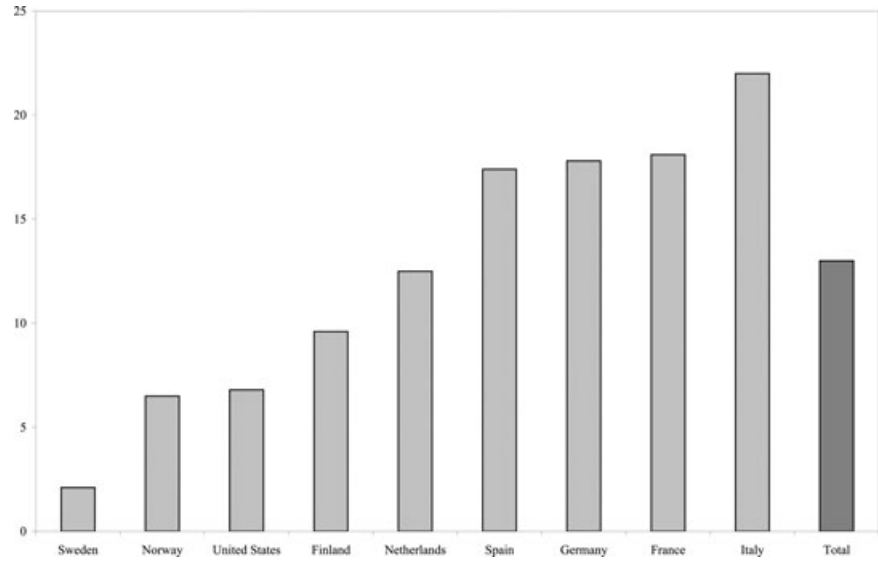

FIGURE 1. Percentage of respondents who answered "agree" or "strongly agree" to the question: "When jobs are scarce, men should have more right to a job than women." Fifth wave of the World Values Survey (2005–2008). Agree.

clients simply because they are women.[3] Amongst OECD countries, Italy is towards the extreme in terms of viewing women in a "traditional" role, and this is evident from Figure 1, where Italy shows the highest percentage of respondents who think that men have more right than women to market jobs when the latter are scarce. In addition, Alesina and Giuliano (2010) investigate the role of the strength of family ties on attitudes towards women. They find that stronger family ties imply a stricter division of labor between the husband working in the market and the wife working at home and keeping the family together, and Italy has one of the very highest level of family ties amongst OECD countries. In this respect, note that we find that the interest rate differential goes down in sectors in which the presence of firms led by women is higher: it turns against men in the retail and wholesale industry only. Conversely, the differential is higher than average in male-dominated sectors. One explanation could be that some unobservable skills differential make women less appropriate for certain sectors. Another interpretation, however, is that cultural bias (hence taste-based discriminations) is stronger when women enter in male-dominated sectors. Note that since the interest rate differential is in favor of men in every sector but one, the skill-based argument would imply that men entrepreneurs dominate women in most of the sectors. However, according to Becker (1961), if some banks discriminated against women, namely they are willing to leave expected profits on the table in order to favor men, why don't other banks enter the market and make extra profits by not

3. Unfortunately, we do not have data on credit applications, approvals, and denials, which could provide additional evidence regarding this effect.

discriminating? This effect could put a cap on the gender-based interest rate differential, and this may be the reason why the differential between male run and female run firms is statistically significant but small in magnitude.

A further, and not mutually exclusive, explanation is that women are less capable of bargaining for good deals with banks. This may especially be a problem if women have to deal with men in a stressful situations, like getting a loan. Perhaps banks run by women would be friendlier to female borrowers: we wanted to investigate this possibility, but in none of the banks in our sample there were more than two women on the board; in 95% of them, there were no women. Moreover, the share of women in managerial positions in Italian Banks is less than 10% (Tarantola and Magliocco 2007): banking is a "male-dominated" business in Italy.

The literature on discrimination in credit markets focuses mostly on race in the United States. Cavalluzzo and Cavalluzzo (1998) and Blanchflower, Levine, and Zimmerman (2003) review this debate and provide evidence consistent with discrimination against African Americans in the market for small business loans. They focus not on interest rates charged but on denials of credit applications.[4] Ravina (2008) presents evidence on US data of taste-based discrimination in the credit market: personal characteristics like beauty (in addition to race) seem to be correlated with credit conditions, even though they are not correlated with repayment records. These results are generally consistent with those of Bertrand et al. (2010) and Pope and Syndor (2011). Some evidence of discrimination is also found in labor markets.[5]

The organization of the paper is as follows. In the next section, we describe our data set and present some summary statistics. Section 3 shows results from a basic regression analysis, along with a Blinder–Oaxaca decomposition of the differential interest rates and a matching procedure. Section 4 contains additional and more detailed results on the role of personal and market characteristics. Section 5 discusses possible interpretations of the results.

2. Data

2.1. Sources

We focus upon microfirms, which are sole proprietor firms, because it is straightforward to identify the owner's gender.[6] The credit data come from two sources: (a) the Central Credit Register (Centrale dei Rischi) run by the Bank of Italy, containing detailed information on firms and individuals whose loans are above the threshold level of

4. See also Cole (1999), Calomiris, Khan, and Longhofer (1994) and Lundberg and Starz (1998).

5. See Altonji and Blank (1999) for a survey and Bertrand and Mullainhatan (2004) for some recent evidence.

6. Each firm has attached the social security number of the individual (the so-called "fiscal code card"), that allows us to identify its gender.

€75,000[7] and (b) the Bank of Italy Loan Interest Rate Survey, including quarterly information on interest rates charged on each bank loan granted by a sample of about 200 Italian Banks. These banks account for over 80% of the total lending granted to microfirms and the sample is representative of the universe in terms of bank size, category, and location.

We focus on overdraft facilities (i.e., credit lines) for three reasons.[8] First, for these very small firms, they are the main tool for credit and liquidity management. Second, since these loans are highly standardized among banks, the comparison between the cost of credit among firms should not be affected by unobservable (to the econometrician) loan-contract specific covenants. This is not the case, for instance, for mortgages. Third, overdraft facilities are loans that are granted neither for some specific purpose, as in the case for mortgages, nor on the basis of a specific trade transaction, as in the case for advances against trade credit receivables. As a consequence, according to Berger and Udell (1995), the pricing of these loans is especially dependent upon the borrower–lender relationship. After a careful cleaning procedure, we end up with a sample of 1.2 million loans to nearly 150 thousand firms for 12 quarters, from January 2004 to January 2007.[9]

2.2. Summary Statistics

Table 1 contains an overview of all the variables available and used in the present paper; a more detailed description is reported on Table A.1 in the Online Appendix. The fraction of female-owned businesses is about 18% of the total, and the fraction of loans for these businesses is slightly less, at 16%. This may be a hint of a slightly higher denial ratio for women, but unfortunately we do not have data on credit applications. The share of female-run firms is very similar between the North and South of Italy, even though there are more firms in the more-populated North. Not surprisingly, women and men are not evenly distributed in all sectors; for instance, women are almost non-existent in construction (less than 3%) but make up more than a third of the tourism industry.

7. Each bank has to report detailed information to the Credit Register whenever the total amount of lending granted to a borrower exceeds €75,000. This implies that the granted credit on a specific loan contract, may be below €75,000.

8. A credit line is a contract that allows a borrower to take advantage of a predetermined "line limit" and to repay it at the borrower's discretion with an interest rate periodically set by the bank. Whenever the drawn credit exceeds the line limit, the bank charges a penalty interest rate.

9. The original data set on credit lines (1,435,777 observations) have been trimmed to the 1–99 percentiles of the interest rate distribution, dropping 24,676 observations. Also, we excluded from the sample those firms with incomplete records (193,817) and those that are recipients of government subsidies (8,206 firms), since those firms are likely to face a subsidized interest rate. Moreover, this exclusion enables us to rule out the possibility of having those "marginal" firms that wouldn't enter the market without a subsidy and/or that may be listed in a woman's name just to receive some kind of state aid. Interestingly, the share of excluded firms is 1%, both for female and for male firms.

TABLE 1. Variable names and definitions.

Variable	Description
Rate	Interest rate charged to firm *i* by bank *j*, inclusive of a penalty rate in case of overdraft.
Female	Dummy variable that takes value 1 if the owner's gender is female (0 if male).
Age	Proprietor's age (in log).
Total loan size	Size of firms' total outstanding loans (in log).
Granted credit	Maximum amount of money available in each credit line (credit limit, in log).
Drawn credit	Amount of money in each credit line actually used (in log).
D. Overdraft	Dummy variable that takes value 1 if the the firm has drawn over the credit limit (0 if not).
Credit history	Length of the credit history, i.e. number of quarters since first appearance in the Central Credit Register.
D. Bad loans	Dummy variable that takes value 1 if the firm ever had bad loans (0 if not).
N. Banks	Number of lending banks.
D. Guarantor	Dummy variable that takes value 1 if the firm is required external collateral to secure its loans.
D. Female guarantor	Dummy variable that takes value 1 if the external guarantor is female.
D. Male guarantor	Dummy variable that takes value 1 if the external guarantor is male.
Province effects	Set of 103 dummy variables for each Italian province.
Industry effects	Set of 148 dummy variables for three-digit industry classification.
Duration dummies	Set of 39 dummies, one for each quarter of a firm's credit history.
Lending pool dummies	Set of 11.728 dummies, one for each possible pool of lending banks.
Female auditor	Dummy variable that takes value 1 if at least one of the bank's auditors is female.
Female managing director	Dummy variable that takes value 1 if at least one of the bank's managing directors is female.
HHI	Herfindahl–Hirschman concentration index, market shares computed on loans to enterprises.
Failure rate	Ratio of firms with an outstanding bankruptcy procedure to the total number of active firms, by province.
Newspapers	Number of newspapers (excl. sport) per th. persons, in log.
Blood donations	Number of blood donations, per th. persons, in log.
Membership in sport assoc.	Number of members of sport associations per th. persons, in log.

Table 2 shows that, on average, credit lines granted are smaller for women: €53,000 versus €61,000. We do not know whether it is a consequence of credit rationing or simply that firms headed by women are smaller. Note that women draw a slightly higher share of their lines. We looked at the number of times that the exposures breach the overdraft ceilings, which are charged with a penalty rate, and it turns out that females tend to overuse credit lines more often than males, which is consistent with (but of course does not prove) rationing. In our data set, we also have a variable to proxy for the default behavior—that is, the firm's inability to repay a loan (D Bad loan). This is an indicator variable that takes value 1 if the firm has ever had insolvency

TABLE 2. Credit lines' characteristics. Mean / standard error.

	Female	Male
Average granted credit per line in €	53,048 / 230	61,511 / 141
Average drawn credit per line in €	39,850 / 190	45,455 / 117
Credit line usage[a]	75.2 / 4.5	73.9 / 2.1
Share of overdrafts	37.5 / 0.2	34.2 / 0.1
Share of defaulted individuals	0.004 / 0.066	0.005 / 0.068
Share of secured credit lines[b]	58.7 / 0.6	53.7 / 0.3

a. The credit line usage is the ratio of drawn credit to granted credit, in percentage.
b. Secured loans are backed up by either physical and financial assets posted by a third party, which the lender can realize in case of default.

problems since its first appearance in the Central Credit Register. The share of defaulted individuals is 0.4 and 0.5% for females and males respectively, and the difference is barely significant (at 10%).

In summary, firms owned by females are roughly equally distributed as shares of the total across Italy, they obtain somewhat smaller loans, and women seem to have a better credit history than men on average and are slightly less likely to default. Women are asked to post a guarantee more often than men when they obtain a loan (59% versus 54%, see Table 2).

3. Results

3.1. Basic OLS results

Table 3 presents our basic results. The left-hand side variable is the interest rate: in the period we consider, 2004–2006, the average interest rate paid on overdraft facilities is, in our sample, around 9%.[10] As specified, we include the following fixed effects: industry, 148 dummy variables, one for each three-digit SIC code, the most disaggregated level we have data for; time, twelve variables, one for each quarter; province[11] fixed effects, 103 dummies; bank, 183 dummy variables, one for each bank in the sample and a set of "lending pool dummies", one for each combination of banks that make the loans to a firm (11,728 dummy variables), to control for the possibility that the behavior of a bank might depend on the other banks lending to the same firm.

In the first column, we control for the gender of the borrower only, in addition to time and industry fixed effects, and we find that female borrowers pay about 28 basis points more than men with the coefficient significant at the 1% level. In column (2), we

10. We repeated the analysis with the interest rate expressed as the difference between the observed interest rate and the ECB marginal rate on lending facilities. The results are unchanged.

11. A province is a locality in Italy more or less equivalent to a non-sparsely-populated county in the United States. In the period under exam, there were 103 provinces in Italy with a minimum of 89 thousand and a maximum of 3.5 million inhabitants. This is the finest geographical level at which data are available. Below this level data are not released for privacy considerations.

TABLE 3. Basic regressions: interest rates on firm, market, and bank characteristics. OLS.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Female	0.276***	0.214***	0.111***	0.105***	0.091***	0.093***	0.097***
	(0.020)	(0.020)	(0.018)	(0.018)	(0.016)	(0.016)	(0.016)
Global loan size		−0.285***	−0.167***	Spline[a]	Spline[a]	Spline[a]	Spline[a]
		(0.005)	(0.004)				
Age			−0.008***	Spline[b]	Spline[b]	Spline[b]	Spline[b]
			(0.001)				
D Bad Loans			0.800***	0.977***	0.926***	0.903***	0.905***
			(0.070)	(0.066)	(0.064)	(0.063)	(0.064)
D Overdraft			1.558***	1.581***	1.515***	1.507***	1.430***
			(0.010)	(0.010)	(0.010)	(0.009)	(0.009)
N banks			−0.016**	−0.074***	−0.031***	−0.039***	−0.033***
			(0.007)	(0.008)	(0.008)	(0.008)	(0.013)
HHI			−4.817***	−4.883***	−1.895***	−3.506***	−3.842***
			(0.166)	(0.166)	(0.183)	(0.551)	(0.558)
Failure			0.127***	0.126***	0.065***	0.027***	0.033***
			(0.003)	(0.003)	(0.003)	(0.022)	(0.022)
Credit history			−0.012***	−0.008***	−0.009***	−0.009***	−0.008***
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
D Guarantor			0.051***	0.048***	0.081***	0.086***	0.071***
			(0.011)	(0.011)	(0.011)	(0.011)	(0.010)
Newspapers			−0.453***	−0.455***	−0.308***		
			(0.014)	(0.014)	(0.017)		
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province effects	No	No	No	No	No	Yes	Yes
Bank fixed effects	No	No	No	No	Yes	Yes	No
Bank pool fixed effect	No	No	No	No	No	No	Yes
R^2	0.930	0.930	0.935	0.936	0.947	0.947	0.947
No. obs.	1,209,078	1,209,078	1,209,078	1,209,078	1,209,078	1,209,078	1,209,078

a. For the spline function of loan size, knots have been identified at the 5th, 10th, . . . , 95th percentiles of the distribution.
b. A spline function of age was included in the regression (with the following breakpoints: 30, 40, 50, 60, and 70). Standard errors are robust and clustered at the firm level. Time fixed effects are quarterly dummies (12 in total). Industry effects are 148 dummies. Province fixed effects are 103 dummies. Bank fixed effects are 183 dummy variables, while bank pool fixed effects are 11,728 dummies.
**Significant at 5%; ***significant at 1%.

add loan size whose coefficient is highly significant and negative, and the coefficient for female drops to about 0.21. Column (3) adds a host of other controls which make the coefficient for female fall to 0.11. Our specification follows the banking literature; see Berger and Udell (1995) and Petersen and Rajan (1995), amongst others. We use all the variables describing the characteristics of the borrowers which we have in the data set. We also include a measure of concentration of the banking sector and a

measure of newspaper readership which may capture diffusion of information and/or may proxy for social capital. We do not include province fixed effect at this time because some of the variables are province specific and do not vary over time (like newspaper readership). We explore in what follows in more detail the issue of social capital and borrowing rates. The coefficient of the borrower's age variable (Age) is negative. Age is commonly viewed both as the amount of public information available about the individual and as a proxy of individual's wealth. We also include a proxy for firm size—that is, the size of the firm's total outstanding loans (Global loan size)—and we find that larger firms pay a lower rate. A risky firm with past episodes of insolvency (D bad loans) pays a higher interest rate; the same applies to the presence of credit lines over their limit (D overdraft). Borrowing from more than one bank induces a small decrease in the interest rate, a result consistent with those of Rajan (1992). Interest rates are lower in markets with a high level of concentration, captured by the Herfindahl–Hirschman index (HHI), an issue explored in more detail in Section 4. Being located in a province with a high firm failure rate (Failure) increases the interest rate, while the length of credit history (Credit history) lowers it. All these results are consistent with our priors. Sometimes, probably when the borrower is perceived as highly risky by the bank, the latter requires a personal guarantor (D Guarantor). In these cases banks charge a higher interest rate. We explore this issue in more detail in Section 4, disentangling male from female guarantors.

Given that by adding controls the coefficient on the gender gap on interest rates goes down substantially (to about one third), we explored which of the covariates is most responsible of this drop. It turns out that the global loan size is the variable with the largest effects on its own (as hinted in column (2)): men receive larger loans presumably because they have more bargaining power and they own larger firms, and banks typically charge lower interest rates to larger firms, perhaps because they are perceived as less risky and less opaque.

In column (4) we include the same controls as in specifications (3), with a linear spline function of global loan size, with knots at the 5th, 10th, . . . , 95th percentiles of the distribution, a linear spline function of owner's age, with breakpoints at 30, 40, 50, 60, 70 years. The coefficient on female is virtually unchanged. In column (5) we add bank fixed effects. The coefficient on female slightly drops, to 0.09. This suggests that the interest rate differential charged to women does not depend on the fact that women use different banks relative to men. In column (6) we drop newspaper readership and we add province fixed effects with no change in the coefficient on female. In the last column, (7), we substitute bank pool fixed effects, for bank fixed effects, again with no change in the coefficient of interest. Given that using bank pools relative to bank fixed effects leaves the coefficient for female virtually unchanged, from now on we use column (6) of Table 3 as our benchmark specification, unless otherwise indicated.

Finally, as additional robustness checks, we estimated a few regressions with interactions, namely loan size interacted with credit history, time with industry dummies, age with industry dummies. The differential interest rate is still significant and in line with the results of the previous regressions (0.12, 0.10 and 0.11 respectively: these results are available upon request). We have also estimated the specification of

column (4) by means of quantile regression: results are shown in Table A.2 in the Online Appendix. As before, the differential interest rate is increasing with the interest rate[12] (from 7 to 13 basis points moving from the 25th to the 75th percentiles). We used many controls, but do not know whether additional controls would reduce the estimated interest rate differential even more or make it disappear, since we used all the available data we have in the data set. Of course, we acknowledge the possibility that the differential interest rate may be due to some unobservable factors we cannot control for (like reputation or skills). Following Altonji, Elder, and Taber (2005), we assume that the amount of selection on the observed explanatory variables in a model provides a guide to the amount of selection on the unobservables. We estimate the probability for a firm to be run by a female as a function of the observable variables.[13] By doing so, we first compute the amount of selection on the observed covariates, and then we compute how much selection on the unobservables would be necessary for omitted variables to completely wipe away the differential interest rate (the so-called "implied ratio"). For our benchmark specification (column (6) of Table 3), the implied ratio of selection on unobservables to selection on observables required to explain away the entire estimate of the differential interest rate is 1.4, which is large enough not to rule out the possibility that the effect obtained from the outcome equation is causal.

If it were indeed the case that women are discriminated in credit markets, why do they formally own firms? Indeed it would be easier for a women to run a firm listed on a man's name, but one should keep in mind that banks evaluate small firms' creditworthiness on the base of soft information which lenders obtain through day by day interaction with the firm. This implies that there is little room for a female entrepreneur to run a firm listed in a man's name in order to lower the cost for credit. Moreover, if women want to work outside their home, the choice is between self-employment and opening a microfirm, or being employed in a larger firm. Perhaps they would own more firms if they were not charged a higher interest than men. However, for a woman working as an employee, the expected wage gap is high if compared to the "discrimination" in credit lines suggested here. The interest rate differential we have documented is small, therefore it does not need a large wage gap to lead women to choose self-employment in preference to working in a larger firm for a salary.

3.2. The Blinder–Oaxaca Decomposition

In Table 4 we present results using the Blinder–Oaxaca methodology (Blinder 1973; Oaxaca 1973). This approach requires running two separate interest rate regressions, one for males and one for females. Let $r_m = X'_m\beta_m + \varepsilon_m$ and $r_f = X'_f\beta_f + \varepsilon_f$ be the interest rate equations for males and females respectively. The X' matrix contains

12. We had to drop bank fixed effects from the regression because the estimation algorithm did not reach convergence.

13. The probability of a firm being run by a female is estimated by means of a probit model in the spirit of column (a) of Table A.4. The variable Age is used as an exclusion restriction for the interest rate equation.

TABLE 4. Oaxaca–Blinder decomposition.

Industry	Difference in the interest rate $(F - M)$	Decomposition		Share of credit lines held by females
		Endowments	Unexplained	
Manufacturing	0.361***	0.118***	0.243***	24.96
	(0.036)	(0.015)	(0.053)	
Construction	0.734***	0.327***	0.407***	2.99
	(0.095)	(0.046)	(0.089)	
Retail and wholesale trade	−0.119***	0.115***	−0.234***	50.30
	(0.028)	(0.012)	(0.025)	
Hotels and restaurants	0.136***	−0.005	0.141***	11.80
	(0.064)	(0.034)	(0.055)	
Credit and insurance interm. (excl. banks)	0.550***	0.253***	0.298***	2.40
	(0.105)	(0.057)	(0.097)	
Business services	0.621***	0.153***	0.468***	7.55
	(0.062)	(0.027)	(0.059)	
Total	0.093***	0.027***	0.066***	16.25
	(0.016)	(0.011)	(0.016)	

Notes: The "endowments" effect is the part of the differential interest rate due to differences in average characteristics between men and women ($[E(X_f) - E(X_m)]'\beta^*$) and the "unexplained "part (or residual), used as a proxy for discrimination, is $E(X_f)'(\beta_f - \beta^*) + E(X_m)'(\beta^* - \beta_m)$. Standard errors are robust and clustered at the firm level. The underlying regressions, reported on Table A.3 in the Online Appendix, control for the following variables: a spline function of loan size and age (as in column (6) of Table 3), D Bad Loans, D Overdraft, N banks, HHI, Failure, Credit history, D Guarantor, time, industry, province and bank fixed effects.
***Significant at 1%.

the same set of variables as in column (6) of Table 3. The differential interest rate is 0.093. This difference in the average interest rates ($r_f - r_m$) is then decomposed into a part that represents: (i) the outcome differential explained by group differences in the predictors ("endowments" effect, i.e. the part of the differential interest rate due to differences in average characteristics between men and women),

$$[E(X_f) - E(X_m)]'\beta^*$$

and (ii) a residual part

$$E(X_f)'(\beta_f - \beta^*) + E(X_m)'(\beta^* - \beta_m).$$

This residual, or unexplained part is used as a proxy for discrimination, where β^* represents the "nondiscriminatory" coefficient, obtained from a pooled regression of the following kind $r = Z'\beta^* + \varepsilon$, with Z' including the same regressors as X' plus the gender indicator. The first column of Table 4 contains the difference in the average interest rate charged to females and males: it ranges between −0.12 basis points to 0.73, a point which we address in what follows. According to this decomposition, on average, nearly 71% of the observed differential interest rate (i.e. the ratio of the "unexplained" part to the total differential) does not depend on the different observable characteristics of firms owned by males or females.[14]

14. However, as suggested by one referee, we acknowledge that using alternative weighting schemes, like the share of loans to female-owned firms or the share of credit lines held by females or the share of

TABLE 5. The matching procedure: average treatment effect.

	Entire sample		Trimmed sample[a]	
No. of controls matched	Average treatment effect (ATT)	Standard error	Average treatment effect (ATT)	Standard error
$n = 1$	0.234***	0.011	0.197***	0.012
$n = 4$	0.220***	0.008	0.183***	0.009
$n = 8$	0.215***	0.008	0.180***	0.009

Notes: Results for the propensity score estimates (i.e. the probability of being run by a female) given a set of observable covariates, are reported in panel (a) of Table A.4 in the Online Appendix. For this probit model we adopt the same specification as column (6) of Table 3 with standard errors robust and clustered at the firm level. Standard errors of the ATT are bootstrapped.
a. The sample is trimmed such that the propensity score is between 0.1 and 0.9.
***Significant at 1%.

3.3. The Matching Procedure

The idea of matching on propensity score (Rosenbaum and Rubin 1983) is to compare male- and female-owned firms which are ex ante very close in terms of all the observable characteristics, like size, location, sector of activity, amount of loans, type of banks, whether they have bad loans, and so on. If we assume that there are no significant differences in unobservable variables between the two matched groups of firms, the observed differential interest rate can be attributed to the effect of having received the treatment, in this case to being owned by a woman. Following Dehejia and Wahba (2002), we match the firms based on the nearest neighbor with replacement propensity score methodology and compare the interest rate charged to the two groups. Table 5 contains the average treatment effect (ATT) in which we match treated firms with one, four, and eight corresponding nontreated firms. Propensity score, defined in this case as the probability of being run by a female, given a set of observable covariates, is estimated by means of a probit model. We adopt, as always, our base specification, namely column (6) of Table 3.[15] The results show that for a firm, on average, the effect of being held by a female induces a rise of 21–23 basis points in the interest rate. If we restrict the analysis to those firms with a propensity score between 0.1 and 0.9, the differential is lower (18–20 basis points, the "trimmed sample" in Table 5).

We also computed the average treatment effect separately for sub-intervals of the propensity score distribution. Results are reported graphically in Figure 2 and in panel (b) of Table A.4 in the Online Appendix. The difference in favor of men is higher for those firms less likely to be owned by females. The interest rate differential is not significant for firms with a high propensity score for female ownership. We can think of two nonmutually exclusive explanations for this. One is that women are discriminated

firms by sector, the "unexplained" part is still positive, but smaller in magnitude, ranging from 0.013 to 0.023.

15. The results are reported in panel (a) of Table A.4 in the Online Appendix.

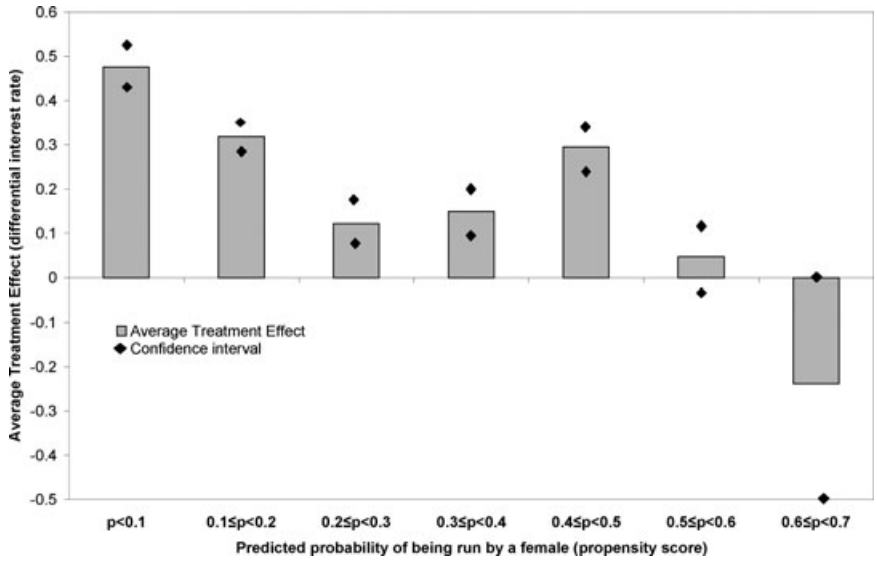

FIGURE 2. Average treatment effects by the propensity of a firm to be run by a female. The class $p > 0.7$ was excluded form the graph because of a small number of observations.

more when they enter male-dominated sectors or type of firms, perhaps because of cultural views concerning "where women belong". The other one is that women have certain specific skills which favor them in certain sectors or type of firms and not in others; the interest rate differential would capture this difference in skills. Note, however, that while in the "male-dominated" type of firms the interest rate differential in favor of men is relative large, in firms with the highest probability of being run by a women (with $\hat{p}$ greater than 0.5) the differential interest rate is not significantly different from zero. If the explanation was only skill differential we would have to conclude that men are much better than females in certain types of firms and just as good as them in others, so basically men (almost) weakly dominate women as small entrepreneurs.

4. Interest Rates, Borrower and Market Characteristics

4.1. Personal Guarantors and Credit History

When banks are particularly worried about the solvency of the borrower, they demand a guarantor.[16] However, his or her presence may not be enough to compensate for a borrower's greater riskiness, and banks may charge a higher interest rate. This is in fact what we found in Table 3. Table 6 investigates in more detail the role of personal

16. In the banking literature, these contractual agreements are known as suretyships (Berger and Udell 1990).

TABLE 6. Interest rates and personal characteristics. OLS.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Female	0.093***	0.175***	0.167***	0.104***	0.093***	0.119***	0.074***	0.108***
	(0.016)	(0.024)	(0.021)	(0.019)	(0.016)	(0.018)	(0.030)	(0.026)
Guarantor	0.086***	0.069***						
	(0.011)	(0.012)						
Male guarantor			0.037					
			(0.025)					
Female guarantor				−0.004				
				(0.013)				
Female ∗ guarantor		−0.114***						
		(0.030)						
Female ∗			−0.101***					
Male guarantor			(0.038)					
Female ∗				0.193***				
Female guarantor				(0.059)				
Length of credit history					−0.009***		−0.013***	
					(0.001)		(0.001)	
Dummy (credit history > 3 yrs)						−0.209***		−0.229***
						(0.014)		(0.015)
Female ∗							0.003***	
Length of credit history							(0.001)	
Female ∗								0.109***
Dummy (credit history > 3 yrs)								(0.031)
Global loan size[a]	Spline	Spline	Spline	Spline	Spline	Spline	Spline	Spline
Age[b]	Spline	Spline	Spline	Spline	Spline	Spline	Spline	Spline
R^2	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947
No. obs.	1,209,078	1,209,078	1,209,078	1,209,078	1,209,078	1,209,078	1,209,078	1,209,078

a. For the spline function of loan size, knots have been identified at the 5th, 10th , . . . , 95th percentiles of the distribution.
b. A spline function of age was included in the regression (with the following breakpoints: 30, 40, 50, 60, and 70). All regressions control for D Bad Loans, D Overdraft, N banks, HHI, Credit history, D Guarantor and Failure, in addition to industry, time, province and bank fixed effects. Standard errors are robust and clustered at the firm level. Time fixed effects are quarterly dummies (12 in total). Industry effects are 148 dummies. Province fixed effects are 103 dummies. Bank fixed effects are 183 dummy variables.
***Significant at 1%.

guarantors and their gender building upon our base specification. Column (1) shows that with a personal guarantee, borrowers pay higher interest rates. Interestingly, column (2) shows a differential effect of the presence of a guarantor for males and females: on average, men pay more if they have a guarantor, but females with a guarantor pay less. This suggests that, while a man with a guarantor is considered more risky, a woman is considered less risky. Columns (3) and (4) show that when a female borrower has a male guarantor, she pays substantially less, but when a female borrower has a female guarantor, she pays a lot more. That is, a female borrower with a female guarantor is viewed by the banks as the worst type of customer. A female borrower guaranteed by a female pays nearly 30 basis points more than a nonguaranteed man and 20 basis points more than a woman guaranteed by a man.

This differential effect may be attributed to the fact that, on average, male guarantors are more trustworthy than females simply because they may be wealthier. Unfortunately, we do not have data for testing this hypothesis directly but we can use guarantor's age as a proxy for her/his wealth.[17] Results of these regressions, available from the authors upon request, indicate that for women, having an older guarantor lowers interest rates, but only if the latter is male.

Columns (5)–(8) of Table 6 show some additional results on credit history. Even after controlling for the length of credit history, the differential interest rate is between 9 basis points (column (5)) and 12 (column (6)). The impact of credit history on interest rates is negative, around 1 basis point less per quarter. As an alternative, we use a dummy variable for a credit history longer than three years (column (6)); after that time, firms pay a lower interest rate (21 basis points less).

The next question is whether this beneficial effect is the same for male- and female-owned firms. In order to test this hypothesis we interacted the credit history variables with the dummy for women-owned firms: in both specifications (columns (7) and (8)), the coefficient of the interaction is positive and significant, suggesting that credit history reduces interest rates for all borrowers but more for men than for women.

4.2. Market Structure

In Table 7, we investigate the effect of the structure of lending markets, defined as provinces, providing more sensitivity analysis building upon our base specification. In column (1), we introduce in addition to the HHI, its square. Interest rates are lowest in markets with a high level of concentration but not at the highest level. This finding is consistent with the empirical results provided by Petersen and Rajan (1995) and by Degryse and Ongena (2007). In highly competitive markets, banks have a lower incentive to acquire information on their potential borrowers—they rank them as risky, charging high interest rates. When the degree of concentration increases, banks are more prone to establish long-term relationships with borrowers, and this lowers interest rates. The interest rate reaches its minimum around the 94th percentile of the

17. Note that using Italian data, Jappelli and Modigliani (1998) show that individual's wealth is strongly positively correlated to age, at least until retirement.

TABLE 7. Interest rates and market characteristics. OLS.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Female	0.112***	0.136***	0.221***	0.091***	0.108***	0.110***	0.122***	0.108***	0.110***
	(0.018)	(0.038)	(0.036)	(0.016)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
HHI	−6.054***	−4.766***							
	(0.552)	(0.179)							
HHI sq.	4.914**								
	(1.928)								
Failure rate			0.132***						
			(0.003)						
Female ∗		−0.328							
HHI		(0.436)							
Female ∗			−0.025***						
Failure rate			(0.007)						
No. of newspapers				−0.308***			−0.464***		
				(0.017)			(0.015)		
Blood donations					−0.450***			−0.468***	
					(0.021)			(0.023)	
Members of						−0.114***			−0.124***
sport associations						(0.013)			(0.015)
Female ∗							0.062***		
No. of newspapers							(0.026)		
Female ∗								0.101*	
Blood donations								(0.052)	
Female ∗									0.060**
Sport associations									(0.033)
Global loan size[a]	Spline	Spline	Spline	Spline	Spline	Spline	Spline	Spline	Spline
Age[b]	Spline	Spline	Spline	Spline	Spline	Spline	Spline	Spline	Spline
R^2	0.935	0.935	0.935	0.935	0.935	0.935	0.935	0.935	0.935
No. obs.	1,209,078	1,209,078	1,209,078	1,209,078	1,209,078	1,209,078	1,209,078	1,209,078	1,209,078

a. For the spline function of loan size, knots have been identified at the 5th, 10th , . . . , 95th percentiles of the distribution.
b. A spline function of age was included in the regression (with the following breakpoints: 30, 40, 50, 60, and 70). All regressions control for D Bad Loans, D Overdraft, N banks, HHI, Credit history, D Guarantor, Failure, and alternative indicators of social capital (in columns (4)–(9) they have all been centered), in addition to industry, time and bank fixed effects. Standard errors are robust and clustered at the firm level. Province fixed effects included in column (1) only. Standard errors are robust and clustered at the firm level. Time fixed effects are quarterly dummies (12 in total). Industry effects are 148 dummies. Bank fixed effects are 183 dummy variables. Province fixed effects are 103 dummies.
* = significant at 10%, ** = significant at 5%, *** = significant at 1%.

HHI distribution. In very highly concentrated credit markets, it grows again, probably because of monopoly power. The interaction of the HHI and females is negative (column (2)), showing that women actually pay less in more concentrated markets, but it is statistically insignificant.[18] For women, moving from the 25th to the 75th percentile of the HHI distribution (i.e., for increasing levels of market concentration), the interest rate decreases, on average, by 11 basis points.

In column (3), we control for the business failure rate at the provincial level. Women still pay a higher interest rate, but the interaction of failure rates and female borrowers is negative, indicating that women pay a lower differential relative to men in provinces with higher failures. This result is somewhat hard to interpret, because if one believes that females generally pay more because they are considered riskier, above and beyond all the controls which we have in these regressions, one might expect that, in a riskier environment, the differential between male and female borrowers should go up, not down.

Banks charge higher interest rates to borrowers which exhibit a greater expected loss in case of default. Thus, lenders might charge higher interest rates to female firms because they are presumably less wealthy than men, even if males and females do not exhibit different default probabilities. To address this issue we examine data on noncollectible debt—that is, those bad loans that banks remove from their balance sheets since those loans are considered totally unrecoverable (write-offs). It turns out that, in the period under exam (2004–2006), computing the share of write-offs (in euros) over the total amount of outstanding debt, the figure is higher for males (6.2% versus 4.8%), and this difference is statistically significant.

4.3. Social Capital

Differences in the level of social capital and trust within Italy have been the subject of a lively literature.[19] Social capital and trust may be associated with more "secure" relationships between a borrower and a bank. Thus, in a place with higher trust, a bank may charge lower interest rates. In addition, cultural variables (like social capital) may be correlated with different views about the role of women in society (see Alesina and Giuliano 2010). Thus it is important to control for proxies of social capital.

Columns (4)–(9) of Table 7 include three indicators of social capital. Remember that when we use measures of social capital at the provincial level we cannot include province fixed effects, so we use as our base specification column (5) of Table 3 which in fact is here reproduced as column (4) of Table 7. Thus column (4) includes the (log) number of newspapers per thousand individuals, a variable which may capture not only social capital but also the level of education and information diffusion. In column (5) we use the (log) number of blood donations per thousand individuals, while column (6) is based upon (log) memberships in sport associations, per thousand persons. These

18. In this specification, we did not include the quadratic term on the HHI to facilitate the interpretation of the interaction term.

19. The "classic" treatment is in Putnam (1993).

are widely used measures of social capital in the literature.[20] All three measures of social capital, which have been demeaned to ease interpretation, enter negatively in the regressions. More social capital and trust are associated with lower interest rates. Moving from the 25th percentile of the social capital distribution to the 75th, the interest rates decrease by approximately 20 basis points. If the female/male differential were driven mostly or exclusively by female-owned firms disproportionately being located in provinces with low social capital, the coefficient on the female dummy should go down when we control for social capital. It does not. However, when we include an interaction term between measures of social capital and female ownership (columns (7), (8), and (9)), the interaction is positive: social capital reduces rates on all borrowers but more on men than on women. Note also that in places with less social capital there might be more cheating and opaque practices. For instance, some businesses may be listed in the name of women because, in the past, their husbands or relatives had credit problems or a business bankruptcy.[21] If these "gray" practices are more likely to occur in places with lower social capital, we should observe that the differential between male and female in interest rates should be concentrated in those places. This is not the case. As a further check, we have excluded from the sample those firms whose proprietor has co-signed a loan with someone who has defaulted in our sample period and one year before. Results from these regressions, not reported but available, are virtually unchanged.

4.4. Multiple Lending and Unobserved Risk

Banks may have different attitudes and abilities towards gathering information about borrowers and, consequently, they may charge different interest rates to borrowers who seem equivalent, based upon publicly available information. In other words, some banks may have more nonpublicly observable information than others.[22] One would expect that the more opaque a firm, the higher the interest rate dispersion. Instead, if the same group of banks charges the same interest rate to the same firm, we can infer that there is no unobserved risk—that is, no bank has an "informational" advantage over the others and the pricing is based on publicly observable information only. To derive a test for the presence of unobserved risk we rely on the sub-sample of firms with multiple banking relationships (around 40% of the total). For each borrower and for each quarter we compute the standard deviation of the interest rate: then we run a simple regression of the standard deviation on the dummy for female run firms and a set of dummy variables, one for each pool of lending banks. Results are reported on Table A.5 in the Online Appendix. The coefficient of female is negative, but not statistically different from zero, meaning that, on average, the dispersion of interest rates is the same for men and women. This simple test suggests that, on average,

20. See, for instance, Guiso, Sapienza, and Zingales (2008) and Cartocci (2007).

21. In Italy, until 2006, the bankruptcy law prevented the owner of a failed business from restarting a firm for a period of up to five years.

22. See Berger et al. (2005).

female-owned firms do not show characteristics which would make them look more opaque than those owned by men.

5. Interpretation and Conclusions

Women pay a little more for credit than men in Italy, around 9 basis points on average, according to our base specification. One explanation could be statistical discrimination, namely being a female run firm is correlated with some risk factor not observable by the econometrician but by the lender. The test based on multiple lending, although performed on a subsample of firms, indicates that female-run firms are not more opaque than those run by men. What other explanations could we give? We can think of two possibilities. One is "taste-based discrimination" in the sense that lenders do not see women as appropriate and capable as borrowers and as entrepreneurs especially in some sectors of the economy; therefore they look at them with a combination of aversion and suspicion. The second one is that women are not as good as men at bargaining for better deals from banks, especially since in most cases women face a male loan officer.

5.1. The Role of Italian Women in the Economy

In Italy, more than in other OECD countries, women's role is seen as that of housewives and therefore loan officers (typically males) may not see women as fit for market activities. Alesina and Giuliano (2010) propose a measure of family ties with appropriate answers from the World Values Survey[23]. Figure 1 from that paper (p. 97), shows that the level of family ties in Italy is much higher than that of any other OECD country in the sample. These authors point out that, in cultures where family ties are strong (as they are in Italy), we observe traditional roles of the husband working in the market and the wife running the household. Alesina and Giuliano (2010) show that the strength of family ties is strongly negatively correlated to the participation of women in the labor force. In 2006, the last year of our sample, the participation of women in the labor market in Italy was 46%, one of the lowest in the OECD countries.

A question from the World Values Survey is especially indicative of society's attitude towards women and men working in the market. The question is the following: "When jobs are scarce men should have more right to a job than women." Respondents are asked to strongly agree, agree, disagree or strongly disagree with the statement.[24]

23. The three questions used and combined in a single indicator. The first question asks the respondent the importance of their family in his or her life. The second question asks the respondent to agree or disagree with the following statement: "Regardless of what the qualities and faults of one parents' are one must always love and respect them." The third question asks the respondent to agree or disagree with the following statements: (1) Parents have a life of their own and should not be asked to sacrifice their own well being for the sake of their children; or (2) It is the parents' duty to do their best for their children even at the expense of their own well being.

24. Alesina and Giuliano (2010) show that this variable is strongly correlated with the strength of family ties using micro data.

We aggregated agree and disagree in two categories and plotted the results in Figure 1 for a sample of countries which include, in addition to Italy, the United States, Spain, the Netherlands, Scandinavian countries, (with the highest participation of women in the labor force), plus Germany and France. Italy has the highest percentage of respondents who agree with the statement that men have more right than women to market jobs when the latter are scarce. Thus, one possible explanation for our finding is that in Italy (male) loan officers do not see women in their appropriate "role" when applying for a loan, and therefore look at them suspiciously and/or with less sympathy than they would look at men in the same situation.

5.2. The Bargaining Power of Women

A recent strand of behavioral research has focused on the innate differences between men and women with respect to economic decisions. Croson and Gneezy (2009) survey the experimental evidence which shows that relative to males, females are more risk averse, their social preferences are more "malleable", they are more averse to competition, and are worse at bargaining. Thus, females may be less likely to bargain with a loan officer while asking for credit.[25] Gneezy, Niederle, and Rustichini (2003) show that in controlled experiments women perform less well than men only under stress. Paserman (2010) shows similar results using evidence from professional tennis games. Getting a loan from a bank and bargaining for it is a stressful situation, especially if a female applicant is dealing with a male loan officer.

One interesting way of testing this hypothesis would be to check whether women get better deals when they deal with banks run by women. In fact we looked at whether banks with a significant presence of females on their boards are less prone to charge female clients more. However, the presence of females in banks' boards is extremely limited. A very small fraction of loans is made by banks in which the number of females on their boards goes beyond two or three, clearly a small minority. A large fraction of loans (more than 71%) is made by banks with an all-male board. When we run our regressions adding a dummy for banks with at least one or more female members on the board, we get mixed evidence.[26] Even outside of boards, women are not numerous in banking in Italy: in 2005 the number of women at the managerial level was less than 10% of the total.[27] Banking is a male-dominated job in Italy.

25. An interesting piece of evidence along similar lines comes from the political arena and it is due to Gagliarducci and Paserman (2009). These authors show that in the council of local city governments in Italy, when the mayor is a woman and the council is mostly composed of men, the local government is less stable. The authors convincingly argue that the explanation is that men do not "like" to be led by women and that causes government collapses.

26. Results are available from the authors upon request.

27. See Tarantola and Magliocco 2007. In a recent work based on data from a major Italian bank, Bellucci, Borisov, and Zazzaro (2010) find that female loan officers seem to be more risk averse, as they tend to restrict credit availability to non-established borrowers with respect to their male counterparts. Moreover, female officers tend to exhibit some solidarity with female borrowers as they ask for collateral less often.

Supporting Information

Additional Supporting Information may be found in the online version of this article:

Table A.1. Variable names, definitions and summary statistics on the pooled sample.
Table A.2. Table A.1 - (cont.) Variable names, definitions and summary statistics on the pooled sample.
Table A.3. Basic regressions: interest rates on firm, market and bank characteristics. Quantile regressions.
Table A.4. Interest rate regression underlying the Oaxaca-Blinder decomposition of Table 4.
Table A.5. Results from estimation of the propensity score (panel (a)) and local effects of the average treatment effect (panel (b)).
Table A.6. Test based on multiple lending. Standard deviation of the interest rate regressed on the gender indicator and fixed effects.

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