Gender, credit, and the pay gap

Abstract

We test the hypothesis that the gender of firm owners affects the ratio of owner to average worker compensation (the pay gap). We use a unique and representative sample of small European firms, where the owner is the decision-maker who provides information to a bank during the loan application process. Our findings indicate that firms with female owners are associated with lower pay gaps. This effect results from both higher self-reimbursement for firm owners and lower average employee compensation. We identify access to credit and the skill/specialization of owners as key factors contributing to this relationship, highlighting the important role of R&D and innovation. Furthermore, we find that inverse proxies for business ethics, such as poor financial reporting quality, exacerbate the positive effect of male ownership on the pay gap.

Keywords: Gender of firm owners; pay gap; access to finance and credit; innovation; business ethics

JEL classification: D90; G34; J16; J31; J54

1. Introduction

Wage inequality has been increasing in many OECD economies over the last four decades (e.g., Saez and Zucman, 2020). For example, estimates of the top 1% pre-tax income share rose from approximately 10% in 1980 to more than 18% in 2020. A significant portion of this trend can be attributed to the growing pay gap between firm employees and owners of small firms. This pay gap is increasingly drawing the attention of academics, policymakers, and the media.[1] An interesting and potentially related trend is the rise in female representation among business owners of small firms. According to data from the Diligent Institute and other sources, female ownership of small firms reached record highs in 2021 in most Western economies (e.g., Frimpong, 2021).

In this paper, we establish and empirically examine the hypothesis that the gender of firm owners who are seeking bank credit to finance their firms' operations significantly affects the within-firm wage (pay) gap. We formally define the pay gap in small firms as the ratio of owner compensation to the average worker's compensation (excluding owner compensation). This measure indicates how much firm owners compensate themselves and, consequently, how they value themselves within their firms compared to their employees.

Our theoretical framework encompasses two key elements that help explain the observed variation in the pay gap. First, we propose that female owners may be more likely to accept lower personal compensation relative to firm earnings, thereby reducing the within-firm pay gap. This phenomenon could reflect differences in credit constraints, growth ambitions, and fairness preferences. In particular, constrained access to credit, whether due to external barriers or internal risk aversion, may limit the ability or willingness of female owners to extract surplus from the firm.

[1] E.g., https://www.bbc.com/news/business-61544250; Economic Policy Institute (2022); https://cupe.ca/closing-wage-gap-between-workers-and-ceos; https://fortune.com/2022/10/07/ceo-worker-pay-gap-wealth-inequality-pandemic/;

This constraint becomes especially relevant in settings where capital plays a pivotal role in scaling or profit-taking. Related to the credit constraint argument, we expect gender differences in compensation to vary with innovation intensity, such that female owners in innovation-driven firms may receive relatively higher pay. Thus, the gender-related pay gap may be attenuated in sectors or firms requiring specialized skills or greater innovation.

Second, we associate female ownership with higher-than-average worker compensation, which complements the reduced owner compensation in explaining the smaller within-firm pay gap. This tendency may stem from behavioral traits, such as greater emphasis on fairness and organizational well-being, as well as governance preferences that favor stakeholder orientation. Gender socialization theory posits that women are more inclined toward inclusive and equitable treatment, which could manifest in more generous employee pay. Evidence from corporate governance research also suggests that female leaders are less likely to prioritize shareholder wealth at the expense of employee welfare. These tendencies contribute to a flatter wage structure in female-owned firms.

We draw empirical inferences from a sample of more than 15,000 small European firms, for which we have confidential information on several characteristics of the firms and their owners (who are also the decision makers). This information is derived from the firms' applications for credit to a major (systemic) European bank. Our sample possesses two unique traits that facilitate the examination of our hypothesis. First, most existing research focuses on large public firms, leaving the pay gap in small firms relatively unexplored. However, the pay gap in small firms is equally significant, as wage differences in these firms substantially contribute to reducing economic inequality (Song, et al., 2019). Second, we have detailed information on the owners' characteristics, which greatly aids in identifying the effect of gender on the pay gap. Most importantly, we know the firms' credit scores, which encompass all available information that the bank has for the firms and their owners and thus provide substantial insulation from omitted-variable bias. This insulation is further enhanced by the long-lasting relationships these firms maintain with their bank, which limits asymmetric information.

To further safeguard our causal inferences, we examine changes in ownership from a female to a male owner, estimating a staggered differences-in-differences (DID) model by adding a firm fixed effect. The validity of this model is confirmed through relevant identification tests, such as sensitivity to the timing of the event and checks for pre-trends and/or reversals. Moreover, our results remain robust when (i) employing the model of Callaway and Sant'Anna (2021), which, like our approach, considers DID estimation robust to treatment heterogeneity in the presence of variation in treatment timing, and (ii) incorporating a triple difference by exploiting changes from a female to a male owner when the female owner has her first dependent (first child). In this latter triple differences exercise, the underlying reason for the change—a family expansion—is exogenous to the pay gap.

Our baseline results across these models show that male-owned firms have a higher pay gap of approximately 2.5% to 3.0%. This higher pay gap in male-owned firms results from both higher owner income and lower average employee income. Regarding the lower average employee income, we find that most of the effect stems from a lower number of employees in male-owned firms, although the effect is also significant when considering employee expenses. Several robustness and placebo tests support these findings, including the Honest DID test by Rambachan and Roth (2023), sliding the event window backward, and considering artificially falsified changes in gender.

Given these baseline results, we identify three mechanisms through which the gender of firm decision-makers affects the pay gap. First, we examine the premise that access to and willingness to apply for finance (primarily credit in our sample of small firms) is a key reason behind our findings. We document that male entrepreneurs have a significantly higher probability of applying for credit (ceteris paribus), which contributes to the higher pay gap in male-owned firms by triggering increased levels of investment. Next, we assess the role of firm innovation (measured by R&D expenses) as a factor through which business owners influence the pay gap. Our results indicate that the effect of gender is almost entirely reversed in innovative firms, as these companies are more likely to invest in skilled labor, regardless of the decision-maker's gender. In contrast, the gender-induced pay gap is larger in non-innovative firms. Finally, female decision-makers may exhibit more ethical behavior. Even though we do not have direct measures for business ethics, we do find a larger effect of gender on the pay gap in firms with poor financial reporting quality.

Our paper's key contribution to the literature is the examination of the role of gender in the pay gaps within small firms, along with the key mechanisms underlying this relationship. First, our paper is related to several studies on access to credit, innovation, and business ethics as mechanisms affecting decision-makers' compensation (Chen et al., 2025; Holthausen et al., 1995; Kabir et al., 2013). Ongena and Popov (2016) is the paper closest to our analysis, showing that there is a gender bias in credit access. Moreover, while some studies examine the direct interplay between access to credit and (i) pay gaps (Arabzadeh et al., 2024) and (ii) innovation (Tan et al., 2024), we utilize these variables as mechanisms in our analysis of the effect of gender on the pay gap. Additionally, the vast majority of this literature relies on evidence from large firms, likely due to data availability issues.

Second, our analysis is related to a substantial body of literature on the determinants of the pay gap between decision-makers and workers (e.g., Cheng and Zhang, 2024; Chang et al., 2022; Crawford et al., 2021; Rouen, 2020; Kong et al., 2020). This existing literature primarily focuses on large firms, particularly the CEO-to-worker pay gaps. In contrast, we concentrate on smaller firms, which contribute significantly to income inequality arising from within or between firms (Song et al., 2019). Importantly, we are not aware of any studies that specifically address the role of gender in the pay gap between decision-makers and workers.

Third, our analysis is related to several studies on the effect of gender on executive compensation and other firm outcomes (e.g., Byron and Post, 2016; Joecks et al., 2013; Liu et al., 2014; Ren and Zhu, 2010; Ruigrok et al., 2007; Terjesen et al., 2009; Wahid, 2019). These studies focus on executive compensation and firm outcomes without considering workers' compensation, and they typically analyze large firms due to data availability. Part of this literature examines the gender pay gap, which is more loosely related to our analysis and findings.

The rest of the paper proceeds as follows. Section 2 provides the conceptual framework, places our paper within the extant literature, and theoretically identifies the mechanisms through which decision makers' gender might affect the pay gap. Section 3 presents the sample, the identification method, and the empirical results. Section 4 analyzes the mechanisms supporting the baseline results. Section 5 concludes the paper.

2. Conceptual framework

A key premise in the existing literature is that the gender of firm decision-makers (here also referred to as firm owners) influences firm outcomes due to background characteristics and personality traits. These factors, in turn, may affect compensation dynamics and, consequently, the pay gap between firm decision-makers and their employees. The compensation decisions of small firm owners revolve around how much to reward employees and how much to retain as personal income. For example, if female decision-makers receive lower compensation than their male counterparts, this should be reflected in a decrease in the numerator of the pay gap (their own compensation). Conversely, if female entrepreneurs decide to compensate their employees more than male entrepreneurs, this should be reflected in the denominator of the pay gap (i.e., the average employee income).

We identify three potential mechanisms that affect the relationship between the gender of small firm owners and the pay gap. The first mechanism involves human capital, educational background, and the associated innovation intensity of the firm. The second mechanism pertains to access to credit or the willingness to apply for credit, which is a vital source of financing for small firms. The third mechanism relates to business ethics. We analyze these potential mechanisms in turn.

In general, female entrepreneurs earn less compared to male entrepreneurs. Women typically invest less in education and work experience (e.g., Tharenou, 1994). Consistent with this finding, female-owned small and medium-sized enterprises (SMEs) tend to have owners with lower educational qualifications who do not usually invest in R&D for firm expansion. Moreover, male-dominated firms may not offer women the same organizational rewards, such as training and development, which can negatively impact their future promotions and salaries. Similarly, female directors, who tend to be younger than their male counterparts, often have shorter tenures and less board experience (e.g., Singh and Vinnicombe, 2004; Ruigrok et al., 2007; Terjesen et al., 2009). This disadvantage reinforces a commonly held (but outdated) assumption that female decision-makers lack the necessary human capital (Burke, 2000).

The significance of this conjecture can be understood within the framework of human capital theory, which posits that prior experience influences decision-makers' ability to avoid out-group biases and exert influence. Since female decision-makers are presumed to have less relevant experience than their male counterparts, they are also thought to have limited influence over their firm's decisions and strategies (Westphal and Milton, 2000). Consequently, highly educated male entrepreneurs may, on average, choose to reward themselves significantly more than their employees, particularly if their education is closely related to their firm’s industry.

A suitable setting to examine this premise is innovative firms, which face the challenge of mitigating the inherent risks of corporate innovation without sacrificing long-term value. The literature indicates that male firm owners are associated with greater managerial risk-taking and overconfidence, which may lead them to pursue risky innovation projects, even those with negative net present values (e.g., Baker and Wurgler, 2013). Conversely, an excessive focus on short-term profits can cause management to reject innovative projects that are more exploratory in nature and have longer payoff periods (e.g., Graham et al., 2005). However, recent research suggests that female decision-makers can help mitigate both excessive risk-taking and an overemphasis on short-term goals in corporate innovation practices, resulting in lower-cost and more novel innovations (Griffin et al., 2021). Thus, we might expect that in innovation-intensive firms, the positive effect of gender on the pay gap will be smaller.

Access to credit is a cornerstone of small firm growth and compensation planning. While earlier studies focused on gender-based credit discrimination in developing countries (Asiedu et al., 2013), recent evidence (Delis et al., 2022) shows that in developed economies, female entrepreneurs are less likely to apply for credit, often due to lower growth ambitions, greater risk aversion, or expectations of rejection. These behavioral differences in credit-seeking create a self-imposed constraint, as highlighted in Bertrand (2011) and Croson and Gneezy (2009).

These financial constraints affect compensation decisions on both sides of the pay gap. With limited credit-driven investment, female-owned firms may distribute earnings more equitably, either due to constrained surplus or more stakeholder-focused priorities. Male owners, in contrast, who are more confident in pursuing external finance, may translate the resulting growth opportunities into increased personal compensation, amplifying the pay gap. This aligns with recent evidence on the interaction between financial frictions and compensation structure in labor markets, such as Vejlin et al. (2024), who show how wealth and portfolio decisions shape labor-market attachment and income dynamics. Furthermore, Ongena and Popov (2025) underscore the importance of gender bias in credit markets, reinforcing the argument that differential credit access is a key driver of within-firm wage disparities.

We further expect the gender of decision-makers to affect the pay gap through the differential business ethics of male and female entrepreneurs (the third mechanism). According to gender socialization theory, men and women are taught different behaviors, with women generally being more caring, compassionate, and attentive to others' needs. Empirical research shows that females are more stakeholder-oriented and are less likely to pursue personal goals that do not add shareholder value, such as mergers and acquisitions (e.g., Adams et al., 2011; Matsa and Miller, 2013). Furthermore, research on large firms demonstrates that greater representation of female directors is associated with enhanced corporate social responsibility and more ethical business practices (e.g., Byron and Post, 2016), particularly evident in their limiting effect on corporate misconduct (e.g., Liu, 2018; Wahid, 2019).

In our context, the more social and ethical behavior exhibited by female decision-makers may foster an administrative style that is more attentive to the interests of firm employees. Since salary is a key aspect of internal labor markets and significantly affects employee satisfaction (e.g., Larkin et al., 2012), we expect this administrative style to lead to an increase in average employee salaries within the firm.

This framework also aligns with behavioral corporate finance theories, where gendered traits such as overconfidence (Malmendier and Tate, 2005) and ethical orientation shape key firm decisions. Overconfident male owners may tilt compensation structures toward personal reward, while more ethical and cautious female leaders may promote equitable pay policies and refrain from aggressive self-enrichment. This integrated behavioral-finance perspective complements the human capital and access-to-finance mechanisms discussed earlier.

In summary, this framework brings together diverse strands of theory—from gender economics, behavioral corporate finance, and financial intermediation—to explain systematic differences in owner-worker pay structures by gender. It also contributes novel predictions, which are empirically testable, and aligns with the *JMCB*'s emphasis on mechanisms linking financial behavior with labor and organizational outcomes.

Hypotheses

H1: The within-firm pay gap is lower in female-owned firms.

H2: This relationship is mediated by: (a) lower human capital and innovation in female-owned firms, with the effect diminishing in high-R&D contexts; (b) reduced willingness to seek credit among female entrepreneurs, leading to lower owner compensation and a compressed pay gap;

and (c) greater ethical orientation among female owners, which reduces wage dispersion through more equitable compensation structures.

3. Empirical analysis

3.1. Data and sample selection issues

We utilize confidential and unique data from small European firms that apply for credit to a large (systemic) West European bank. Each firm is owned by a majority owner (50% or higher, most commonly 100%), who serves as the decision-maker, applies for the loan, and manages the firm. The bank verifies this ownership during the loan application process. Our focus is on majority owners of small firms because the characteristics and gender of these owners are closely linked to their firms' financial health, given that they are the ultimate decision-makers. Several studies that require unique information on small firms rely on data from a single bank (e.g., Iyer and Puri, 2012; Berg, 2018).

We have a balanced firm-year panel comprising 234,420 observations from 2002 to 2016, corresponding to 15,628 firms. The panel is balanced because the bank has information on both the firms and their owners, regardless of whether the owners applied for a loan in a given year. We have data on the owners' gender, education level, marital status, number of dependents, and personal annual income and wealth. Additionally, we observe several firm characteristics, including the number of employees and total personnel expenses, which are used to calculate the pay gap. Table 1 provides detailed information about our panel and defines the variables used in our empirical analysis, while Table 2 reports summary statistics.

[Insert Tables 1 & 2 about here]

We also have information on the firm's credit score, which is the key indicator of its financial soundness as assessed by the bank. The credit score determines whether a loan is approved; there is a sharp discontinuity at the cutoff point, above which the bank always approves the loan and below which the bank rejects it. This variable essentially encompasses all relevant characteristics of the firm and its owner, including both hard and soft information. Therefore, it plays a crucial role in our identification method (discussed below).

We find that our sample is representative of European averages across several dimensions. To examine this representativeness, we utilize information from several additional datasets, including Orbis, Compustat, the European Commission, the Survey on Access to Finance of Enterprises (SAFE)m and descriptive evidence by several studies. To maintain the flow of the text, we discuss this analysis in detail in the Appendix A1. Here, we briefly summarize that the dimensions include (i) our bank compared to other systemic European banks (data from Compustat), (ii) the percentage of female entrepreneurs compared to European averages (using data from the European Commission, 2014, and Piacentini, 2013), (iii) loan rejection rates compared to European averages (data from SAFE), (iv) our firms compared to other similarly sized European firms (collecting new data from Orbis), (v) the exclusive relationship of our firms with our bank compared to the literature, and (vi) the education levels of entrepreneurs in our sample compared to European averages. Despite this analysis, we further insulate our results from sample selection bias using a Heckman model, which employs the universe of similarly sized European firms included in Orbis (more discussion on this below). Given the above, our inferences are consistent with the premise that our sample does not suffer from sample selection issues.

3.2. Empirical model and identification

We build our empirical model in steps. First, we estimate the effect of gender on the pay gap, relying on the premise that the credit score encompasses all relevant information about applicant and firm characteristics collected by the bank to make loan origination decisions. This is because the bank solely uses the credit score to determine whether to originate a loan (the bank funds all loans above a specific cutoff point on the credit score and rejects all loans below that point). Given the bank's long-standing relationship with these firms, it is unlikely that adverse selection problems—which would appear in the stochastic term—systematically correlate with gender when controlling for the credit score. Essentially, when we use any observed firm and applicant characteristics (including gender) as standalone variables in the regression, we isolate their effects from that of the credit score.

Second, in most of our analysis, we estimate a staggered DID model, where the change in owner gender is repeated at multiple points in time for various groups of observations. This setting is useful for further mitigating concerns about omitted-variable bias. The econometric form of the model is:

$$Pay\ gap_{it} = a_i + a_t + a_1 Gender_{it} + a_2 Controls_{it} + u_{it}. \quad (1)$$

In equation 1, *Pay gap* is defined as the natural logarithm of the ratio between the total income of firm *i*'s owner in year *t* and the mean employee salary in firm *i* (which is calculated from the ratio of personnel expenses to the total number of employees). This measure is similar to those adopted in several studies examining the pay gap between, for example, CEOs and workers (e.g., Cronqvist et al., 2009; Weng and Yang, 2023, among others). The firm owner's total income is reported by the loan applicant to the bank during the loan application process and includes any dividends received. *Gender* takes the value of 1 for a male owner and 0 for a female owner. *Controls* is a vector of observables that may impact the *Pay gap*. The parameters a_i denote firm fixed effects, controlling for the treatment dummy in each event (change in ownership from female to male); a_t

denote year fixed effects, controlling for the post dummy in each event; and u_{it} is the disturbance. This is a DID model in which the treatment (a change in the gender of firm i's owner) can occur in different years, with the number of time periods being greater than 2 (as is the case in the standard DID).[2]

Based on our hypothesis, we expect that a_1 is positive and statistically significant, reflecting a causal effect. This is because it is unlikely that the treatment is nonrandom, i.e., that a *change* in firm ownership is due to compensation-related issues (for the owner, the employees, or both). Furthermore, concerns about omitted variable bias are mitigated by using the credit score in all our regressions. The credit score incorporates information on all performance characteristics that affect a firm's creditworthiness. The bank providing the loan has maintained a credit relationship with the firms in our sample for several years and can, therefore, accurately evaluate their performance, limiting informational asymmetries between the bank and the firms. Consequently, controlling for the credit score shields our model from other performance-related factors that could influence our inferences. Additionally, any other control variables we include in our estimations are essentially derived from the credit score, as the bank utilizes these variables in constructing it. In summary, controlling for the credit score means controlling for all financial and managerial characteristics of the firms in our sample.

We complement these theoretical considerations with empirical observations. Figure 1 presents a DID graph that brings all changes from female to male (dummy changes from 0 to 1) or male to female (dummy changes from 1 to 0) firm owners in the same year, *t*. This approach is based on the methodology developed by Cerulli and Ventura (2019) to overcome the heterogenous timing in treatment. The blue line plots the lag and lead coefficients (up to five years) from the

[2] This is a DID model because of a two-way fixed effects transformation across dimensions *i* and *t*, which drops the rest of the usual DID terms (e.g., Gormley and Matsa, 2011; Callaway and Sant'Anna, 2021).

model of *Pay gap* on *Gender*, and we include several confidence intervals represented by bars. The pre-treatment pattern is statistically equal to zero, as the difference from zero falls well within even the 70% confidence interval. The post-treatment pattern indicates a positive effect of changing from a female to a male owner,[3] with the value increasing from approximately 1.5% in the year of the change (year *t*) to just under 3% from *t*+2 onward. The test of parallel trends using the leads has a p-value of 0.962 (indicating a pass), while the test for parallel trends using the time trend has a p-value of 0.262 (also a pass). We observe no significant pre-treatment trends or post-treatment reversals. Moreover, the timing of the events aligns perfectly with the observed responses. Given these results, we treat the DID model in equation 1 as our baseline.

Following Cullen and Perez-Truglia (2023), we conduct an equivalent test in which the event is a dummy variable that equals 1 when there is a change in ownership (and 0 otherwise), interacted with the gender dummy. This approach allows us to include firms that change ownership but retain the same gender as a control variable. We report the results in Figure 2, which closely resembles Figure 1. This indicates that the effect arises from a change in the owner's gender, rather than from a change in ownership itself.

[Insert Figures 1 & 2 about here]

To completely rule out the possibility that the treatment is nonrandom, we also employ triple differences (difference-in-differences-in-differences). Specifically, we hypothesize that the effect of Gender on the Pay gap will be larger for firms sold, for example, from female to male entrepreneurs after the female owner's family has its first dependent (where the variable First dependent equals 1 and 0 otherwise).[4] The functional form of the triple differences model is:

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[3] We generally refer to the change from female to male owner to analyze the economic interpretation of our findings, but we also consider the opposite scenario (i.e., changes from male to female owners).

[4] This primarily reflects the birth of the first child. We note that we mostly use the term "selling from female to male entrepreneurs after the female owner's family has its first dependent" because there are only five cases in the opposite

$$Pay\ gap_{it} = a_i + a_t + a_1 Gender_{it} + a_2 First\ dependent_{it} + a_3 Gender_{it} \times First\ dependent_{it} + a_4 Controls_{it} + u_{it}. \tag{2}$$

Consistent with the discussion of equation 1, we expect a_1 to remain positive and statistically significant; we also expect that a_3 is positive and statistically significant, amplifying the effect of a_1 .

The randomness in the triple-differences setting arises from the fact that the decision to have a child should be uncorrelated with considerations of the within-firm pay gap. In fact, the pairwise correlation coefficient between the number of dependents and the pay gap is less than 0.001. This supports the conditional correlation of the number of dependents (*Dependents*) in our empirical analysis, where the coefficient on Dependents is consistently close to 0, both statistically and economically. We will further analyze this issue in our subsequent discussion of the empirical results.

3.3. Baseline results

Table 3 reports the baseline results from the estimation of equation 1, consistent with our first hypothesis. The first three specifications show the importance of the credit score as a control variable. Using the credit score alone as a control variable, the estimate of gender decreases from 0.068 (unreported regression) to 0.029 (column 1). Additionally, adding other observables in column 2—essentially extracting these from the credit score since the bank uses them to calculate it—does not affect the coefficient of gender.[5]

direction (selling from male to female when the male owner's family has its first dependent). These five observations are also included in the analysis.

We include firm fixed effects starting from specification 3, which allows us to identify changes from firms with a change in owner gender using the DID model of equation 1. The coefficient on *Gender*, statistically significant at the 1% level, indicates that a change from female to male ownership increases the *Pay gap* by 2.8%. This value is consistent with the estimates in the first two specifications, which do not include firm fixed effects. Adding control variables in specification 4 or additional fixed effects in specifications 5 and 6 has minimal impact on the estimate for *Gender* or the adjusted R-squared of the regression. Thus, as discussed in section 3.2 and illustrated in Figure 1, the stability of the coefficient on *Gender*, its standard error and the adjusted R-squared across specifications is informative and supports the validity of our DID approach (e.g., Oster, 2019).

[Insert Table 3 about here]

Given the issues highlighted in staggered DID models, such as the one estimated so far (e.g., Baker, Larcker, and Wang, 2022), we employ an additional model as a robustness test. Specifically, we use the model developed by Callaway and Sant'Anna (2021), which considers DID estimation robust to treatment heterogeneity in the presence of variation in treatment timing, particularly when the "parallel trends assumption" holds only after conditioning on observed covariates. We report the results in specifications 7 (which replicates specification 3 without controls) and 8 (which replicates specification 4 with controls). The results are fully consistent with our baseline, indicating that treatment heterogeneity does not bias our main results.

Next, despite demonstrating in section 3.1 and appendix A.1 that the characteristics of our bank and the firms in our sample are very similar to those of other major European banks and small

[5] The adjusted R-squared substantially increases from the unreported specification without the credit score (R-squared = 0.018) to 0.658 in specification 1, also reflecting the importance of the credit score.

firms, we take additional steps to safeguard our analysis against sample selection bias by employing Heckman (1979) regressions. In the first stage (probit model), we use data from all small and micro firms in the countries (17 in total) where our bank is an active retail lender to examine the probability that a firm obtains credit from our bank (data sourced from Orbis). Our sample in the first stage includes all firms, regardless of whether they have a relationship with our bank, yielding 531,128 observations.

The explanatory variables in the probit model include the firm characteristics listed in Table 1, along with two exogenous instruments derived from Dass and Massa (2011) and Delis et al. (2025).These instruments are the number of bank branches in the firm's region and the distance from the firm's location to the closest branch. We find that these variables significantly explain the probability that a firm associates with our bank, while their correlation with loan outcomes and the pay gap in our sample is statistically equal to zero. Intuitively, the exclusion condition states that any effect of the number of bank branches or the distance to the nearest branch influences the pay gap only through the matching probability.

The second stage includes equation 1 along with the inverse Mills ratio. The results in the final specification of Table 3 indicate that Heckman's Lambda is statistically insignificant, providing evidence against sample selection bias in our sample. Moreover, all the second-stage estimates closely resemble those of the previous specifications reported in Table 3.

3.4. Selling to male owners after observing a first dependent

Table 4 reports the results from the estimation of the triple differences model outlined in equation 2. The main term for *Gender* remains positive and statistically significant, indicating a positive effect of *Gender* that is consistent across groups with and without a *First dependent*. The estimate is stable across all four specifications, which vary based on the inclusion of control variables and fixed effects. The main term for *First dependent* is statistically insignificant, suggesting that firms whose owners transition from having no dependents to having a dependent do not differ systematically in terms of *Pay gap*. This contributes to the discussion in the previous subsection regarding why *Pay gap* is exogenous to the presence of a first dependent.

[Insert Table 4 about here]

As noted in section 3.2, the coefficient on the interaction term *Gender* × *First dependent* is of key importance. Consistent with our expectations, this coefficient is positive and statistically significant at the 1% level. Based on the results of specification 2, a female owner selling her firm to a male when the first dependent is added to her family results in an additional 1.5% increase in the *Pay gap*, on top of the 1.4% level effect (the coefficient on the main term for *Gender*). Thus, the results from the triple-differences equation 2 are fully consistent with those from the double-differences equation 1, as adding the coefficients produces the results shown in Table 3.

In Table 5, we report the results from placebo tests to demonstrate that our findings in Tables 3 and 4 do not artificially capture other effects related to ownership change or the dynamics of our data. Following the relevant literature (e.g., Gormley and Matsa, 2011), we first generate *Gender* to take the value 1 in the year (or two years) prior to the actual ownership change. This constitutes a placebo test in which the ownership change is assumed to have occurred in a previous period. We report the results in the first two specifications of Table 5, showing that the estimates for *Gender* become statistically insignificant.

Next, in specification 3, we drop the firm fixed effects and consider a falsified Gender = 1 when there is an ownership change but the gender remains the same (Gender = 0 when there is no ownership change or when the ownership change involves an actual change in the owner's gender). This placebo test uses an artificial Gender indicator that falsely classifies ownership changes as female-to-male cases, even though these changes occur between owners of the same gender. Again, we find that the coefficient on Gender becomes statistically insignificant. In specifications 4 to 6 of Table 5, we repeat the same three placebo tests (as in columns 1 to 3) but for the triple differences analysis, reflecting the results of Table 4. We find that none of the main terms or the interaction terms are statistically significant. These tests further support the conclusion that the observed effects are caused by a change in the owner's gender.

[Insert Table 5 about here]

Last but not least, in Figure 3, we present the results from the sensitivity analysis of the Honest DID approach by Rambachan and Roth (2023), applied to our baseline results in Table 3. This approach is based on the idea that statistical violations of parallel trends in the post-treatment period cannot be significantly larger than those in the pre-treatment period. The statistic for violations is estimated for different bounds on relative magnitudes (Mbar), with the values represented on the horizontal axis. For example, Mbar = 1 indicates that the post-treatment violation of parallel trends is no larger than the worst pre-treatment violation of parallel trends (between consecutive periods). Mbar = 2 represents an extreme violation, implying that the post-treatment violation of parallel trends is no more than twice the maximum violation in the pre-treatment period. In all cases, the figure shows a robust confidence interval up to Mbar = 2, meaning that our significant result is robust to violations of parallel trends up to twice as large as the maximum violation in the pre-treatment period.

3.5. Components of the pay gap

Having established a positive effect of Gender on the Pay gap, this section examines whether the effect arises from the owner's compensation (the numerator of the pay gap), the employee's average compensation (the denominator of the pay gap), or from both. The relevant results are reported in Table 6. The first column displays the results from equation 1, where the dependent variable changes from *Pay gap* to *Owner's income*. The estimate indicates that a change from a female to a male owner increases the owner's income by 4%. In column 2, the equivalent effect on the *Average employee income* is -3%. Both coefficients are statistically significant at the 1% level. Therefore, we find that *Gender* affects both the numerator and the denominator of the pay gap.

We observe a similar pattern when considering the equivalent results from the triple-difference model in columns 3 and 4. In column 3, the effect shown for *Gender* is amplified for firms where the former owner had a first dependent in the same year. The two coefficients sum to 4.5%, which is fully consistent with the result in column 1. In column 4, we find negative and statistically significant coefficients for both *Gender* and *Gender* × *First dependent*. These estimates total 2.9%, which is comparable to the 3% found in column 2. Taken together, the results suggest that our baseline findings in Tables 3 and 4 arise from both an increase in the owner's income (the numerator of *Pay gap*) and a decrease in the *Average employee income* (the denominator of *Pay gap*).

These results further raise the question of whether the effect on *Average employee income* stems from male-owned firms providing less compensation to their employees or from having fewer employees. In columns 5 and 6 of Table 6, we address this question by using *Personnel expenses* and *Number of employees* as outcome variables, respectively. Both variables are presented in natural logs. The results indicate that both employee expenses and the number of employees are significantly lower in male-owned firms, with the economic significance being greater in the regression of the number of employees. These findings are consistent with our theoretical conjectures regarding women being more caring and attentive to their employees, possibly at the expense of value maximization.

[Insert Table 6 about here]

4. Mechanisms

In this section, we examine the mechanisms behind the negative effect of firm ownership by female entrepreneurs on the pay gap. Consistent with our second hypothesis outline in section 2, we identify access to credit, confidence in applying for credit, corporate innovation, and business ethics as potential key characteristics that affect the relationship between gender and the pay gap.

4.1. Credit

We first conduct preliminary work on the probability to apply for credit and access to credit by examining the effect of gender on the two variables: *Apply for credit* and *Access to credit*. These variables (thoroughly defined in Table 1) are dummy variables that indicate whether an entrepreneur's loan application is accepted or denied and whether the entrepreneur applies for a loan in a given year. We estimate empirical models of the form:

$$Apply\ for\ (Access\ to)\ credit_{it} = a'_0 + a'_1 Gender_i + a'_2 Controls_{it} + u'_{it}. \quad (3)$$

In the first two specifications of Table 7, we report the results for *Apply for credit*, first for the full sample and then for the restricted sample around the zero cutoff point on *Credit score* (above which the loan is always originated and below which the loan is always rejected). The credit score creates a sharp discontinuity in the bank's loan decision (accept or partially accept vs. reject), allowing us to effectively determine whether the entrepreneur has access to credit in all years of our sample. This restriction implies an analysis using observations for which the control variables are statistically equal around this cutoff point.[6] Given that the credit score encompasses all known

[6] Delis et al. (2022) provide more information on this issue and here we essentially replicate their results for a different sample.

hard and soft information about the entrepreneur and the firm, the results can be interpreted as reflecting either the fear of rejection (the opposite of confidence) or the rejection probability itself. The validity of this exercise can be tested under the premises that firms cannot manipulate their credit score, the other covariates are smooth at the cutoff point, and the density of the credit score does not reflect an abnormal pattern at the cutoff. We show all these in Appendix A.2 and Figures A4 to A6, replicating the analysis by Delis et al. (2022).

Our findings in the first two columns of Table 7 indicate that male applicants are more likely to apply for a loan, ceteris paribus, which aligns with the prediction that male entrepreneurs tend to be more confident. In contrast, specification 3 shows that the impact of *Gender* is statistically insignificant, indicating that gender does not influence the probability of the bank originating the loan.[7]

[Insert Table 7 about here]

Having established significant relationships for equation 3, we next introduce access to credit and application probability as important factors affecting the relationship between gender and the pay gap. We achieve this by using interaction terms between *Gender* and the predicted values obtained from specifications 2 and 3 of Table 7. The results in specification 1 of Table 8 show that *Gender* retains its positive coefficient, albeit with a smaller value (1.8% compared to 2.8%). Importantly, firms led by male entrepreneurs exhibit an additional 2.4% higher *Pay gap* when they have a greater probability of accessing credit. This serves as an initial indication that a significant portion of our baseline findings stems from the bank's decision to provide credit.

However, as highlighted in section 2, access to credit in Western economies is not generally driven by gender. Instead, it is largely influenced by the different behavioral characteristics of

[7] The analysis in column 3 is carried out only on the sample around the cutoff point because *Credit score* perfectly predicts the probability of loan origination.

female entrepreneurs, who tend to have fewer profit-maximizing incentives and a lower likelihood of applying for credit, especially after being rejected (Delis et al., 2022). This suggests a form of partial self-exclusion of female entrepreneurs from the credit market, stemming from a reduced desire to invest in their firms' growth. We examine whether this finding affects our results by considering the role of the probability of applying for credit, conditional on the firm's credit score.

The results in column 2 of Table 8 highlight the significant role of the probability of applying for credit. Specifically, the main term on *Gender* loses a considerable portion of its statistical and economic significance, which is transferred to the interaction term *Gender* × *Apply for credit*. The coefficient on the interaction term indicates that firms led by male entrepreneurs experience a 3.8% higher *Pay gap* when their probability of application is higher. This suggests that firms with a higher likelihood of seeking credit—consistent with the main term on *Apply for credit*—are predominantly those of male entrepreneurs, resulting in a larger pay gap. Aligned with our conceptual framework, this channel is the most critical in our analysis.

4.2. Education and innovation

Following our second hypothesis, important theoretical mechanisms via which gender can affect the pay gap are education and the associated tendency to innovate. In specification 3 of Table 8, we introduce an interaction term between *Gender* and *Higher education*, where *Higher education* is a dummy variable equal to 1 if the firm owner holds a university degree (and 0 otherwise). We expect that owners with a higher level of education may, on average, increase their own compensation as a means to value their expertise. The effect of *Gender* is 2.2%, a slight decrease from the 2.7% observed in the baseline specification, but it remains statistically significant at conventional levels. The interaction term contributes an additional 1.2% to that effect, which is statistically significant at the 1% level.[8] This finding is first indication that expertise is important in the relation between *Gender* and *Pay gap*.

In specification 4, we demonstrate that an important determinant of the relationship between *Gender* and *Pay gap* is innovation. Specifically, the interaction term between *Gender* and *Firm R&D* (a dummy variable equal to 1 if R&D expenses are above the sample median, and 0 otherwise) is negative and statistically significant, while the main term on *Gender* remains positive and significant. These estimates indicate that the positive effect of *Gender* reverses for firms with high R&D expenses, suggesting more similar behavior between male and female decision-makers in innovation-intensive firms. Importantly, we find that this effect primarily arises from the denominator of *Pay gap* (average employee income). This serves as a strong indication that high R&D firms invest in skilled labor, thereby reducing the within-firm pay gap.

In specification 5, we show that the triple interaction term *Gender* × *Higher education* × *R&D* enters with a negative and significant coefficient. This specification indicates that the positive effect of a change from female to male owners with higher education totals 3.8% (2.8% + 1.0%). However, this effect reverses for high R&D firms, decreasing by 1.6%. This negative impact is more pronounced when the firm's owner has a higher education level and the firm is R&D-intensive. Consequently, the overall marginal effect of *Gender* reduces to 1.5%. This finding is consistent with that in specification 4, as the positive effect of Gender reverses for firms engaged in innovation-related activities that require more skilled labor.

[Insert Table 8 about here]

4.3. Business ethics

[8] In unreported results, we find that this effect mainly emanates from an increase in the owner's income (and not so much from a decrease in average employee compensation).

Given the theoretical premise that female decision-makers are more likely to exercise ethical behavior, we next turn to the role of business ethics in the nexus between gender and the pay gap. Identifying measures of business ethics for small firms is challenging, especially when targeted survey data are not available. We resort to two accounting-based measures.[9] The first measure is the performance-adjusted discretionary accruals, as developed by Kothari et al. (2005). Specifically, we estimate a model of total accruals scaled by lagged total assets as a function of the annual change in revenues over total assets, fixed assets over total assets, and ROA. We use the residuals from this model, multiplied by -1, as our firm-year measure of discretionary accruals. To improve the expositional brevity of our results, we construct a binary variable termed *High firm accruals*, when the measure is above the upper tercile and 0 otherwise.

The second measure is the probability that the firm revises certain measures on its financial statements in a given year. Specifically, we estimate a model of the probability that a firm revises one of the variables listed in Table 2 as a function of these variables and use the prediction of this regression as our second firm-year measure. Similar to the previous measure, we construct a dummy variable based on the upper tercile, termed *Accounting revision*. Overall, we assume that firms displaying *High firm accruals* and a high probability of *Accounting revision* have a lower level of business ethics.

Both measures significantly enhance the positive effect of *Gender* on *Pay gap*. In specific, the positive effect of *Gender* is by 1.2% stronger for firms with high values of discretionary accruals (the top tercile of our sample). This represents approximately 40% of the main effect attributed to the *Gender* term (the coefficient on *Gender* × *High firm accruals* and *Gender,* respectively, in specification 6 of Table 8). This effect increases to 53% for firms with a high

[9] Several studies note a highly significant correlation between financial-reporting quality and business ethics, suggesting that the former is a good proxy for the latter (e.g., Labelle et al., 2010; Wang et al., 2018).

probability of revising their financial statements (specification 7). Thus, our findings are fully consistent with our theoretical conjecture that stronger business ethics of female entrepreneurs lower the positive effect of *Gender* on the pay gap.

5. Conclusions

In this paper, we examine the effect of the gender of firms' owners/decision makers on the within-firm pay gap between the owners and employees. We analyze unique data on small European firms, with information on owners' gender, the pay gap, and the firms' credit score by their bank. According to our estimates, female owners exert a negative and significant effect on the pay gap. This easing effect materializes through both components of pay gap, namely lower compensation for decision makers and increases in the average salary of company employees. Importantly, this effect survives several identification methods and robustness tests.

We pinpoint three mechanisms at work. First, we find evidence that financial constraints play a very important role: self-imposed financial constraints in female-owned firms (in the sense that female entrepreneurs apply for credit with a significantly lower probability) explain the largest part of our baseline findings. Second, we find that the impact of gender on the pay gap is larger for entrepreneurs that behave less ethically, as measured from their firms' financial reporting quality. Third, we find an important role for firm innovation (using R&D expenses). Specifically, results show that the easing effect of gender diversity is almost entirely reversed for innovative firms, as these firms are more likely to invest in skilled labor, thereby reducing the within-firm pay gap.

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Figure 1. Change in the owner's gender and pay gap

The figure plots the lags and leads coefficients with confidence intervals. *Pay gap* is represented on the vertical axis and years on the horizontal axis. Treatment (change in *Gender*) is placed on the same year *t*, even though it takes place in different years for different firms during our panel's period. The post-treatment pattern shows the positive effect of treatment, wheras the pre-treatment pattern lays very close to zero.

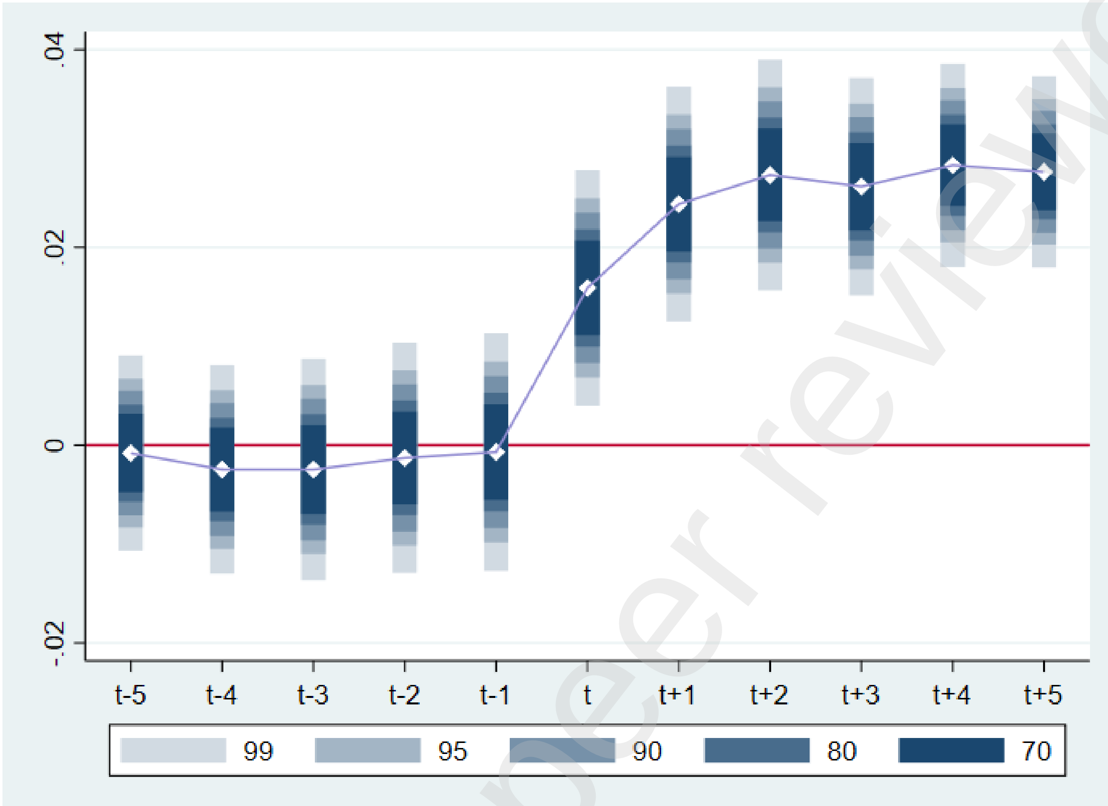


Figure 2. Change in the owner's gender (interacted with changing owner) and pay gap

The figure plots the lags and leads coefficients with confidence intervals. *Pay gap* is represented on the vertical axis and years on the horizontal axis. Treatment (gender interacted with a changing owner dummy to keep firms that change owner but with same gender as a control variable) is placed on the same year *t*, even though it takes place in different years for different firms during our panel's period. The post-treatment pattern shows the positive effect of treatment, wheras the pre-treatment pattern lays very close to zero.

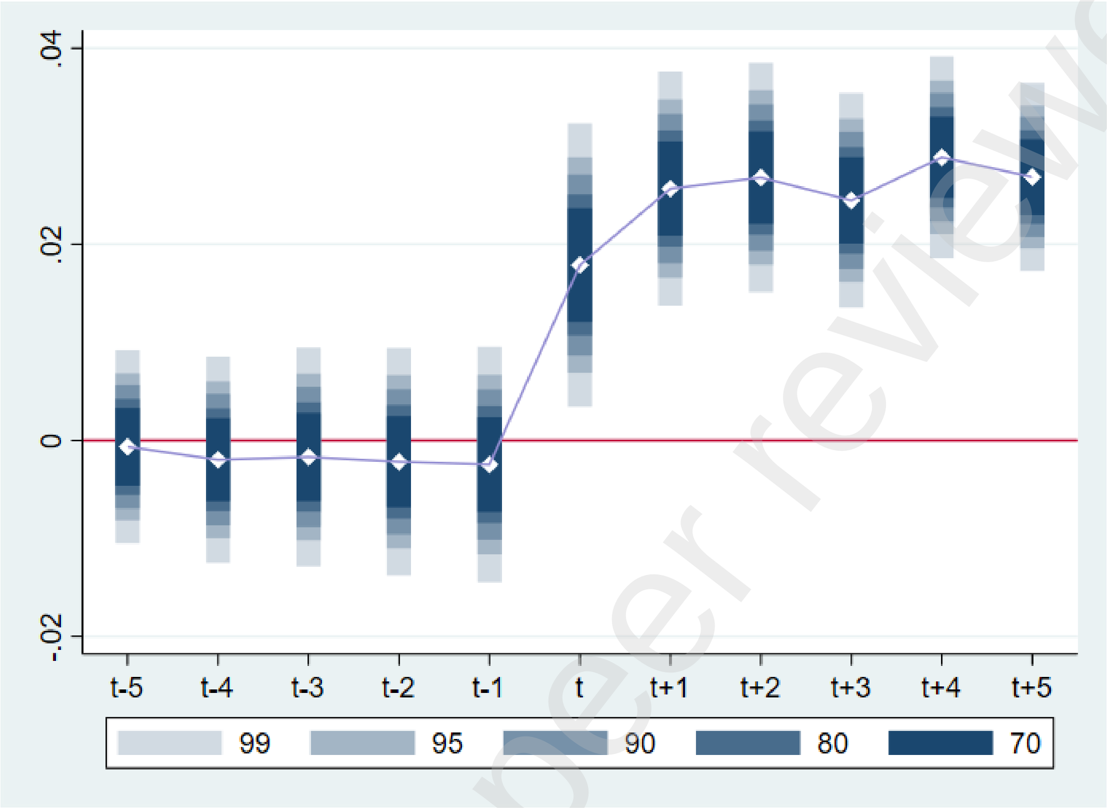


Figure 3. Honest DID test

The figure plots the results from the Honest DID sensitivity approach of Rambachan and Roth (2023). The figure formalizes the idea that statistical violations of parallel trends in the post-treatment period cannot be much bigger than in the pre-treatment period. The Mbar on the horizontal axis is the constant reflecting the "much bigger" test. For example, Mbar = 1 imposes that the post-treatment violation of parallel trends is no longer than the worst pre-treatment violation of parallel trends (between consecutive periods). Mbar = 2, implies that the post-treatment violation of parallel trends is no more than twice that in the pre-treatment period. In all cases, the figure shows a robust confidence interval up to Mbar = 2, meaning that the significant result is robust violations of parallel trends up to twice as big as the max violation in the pre-treatment period, which is generally considered an extreme violation.

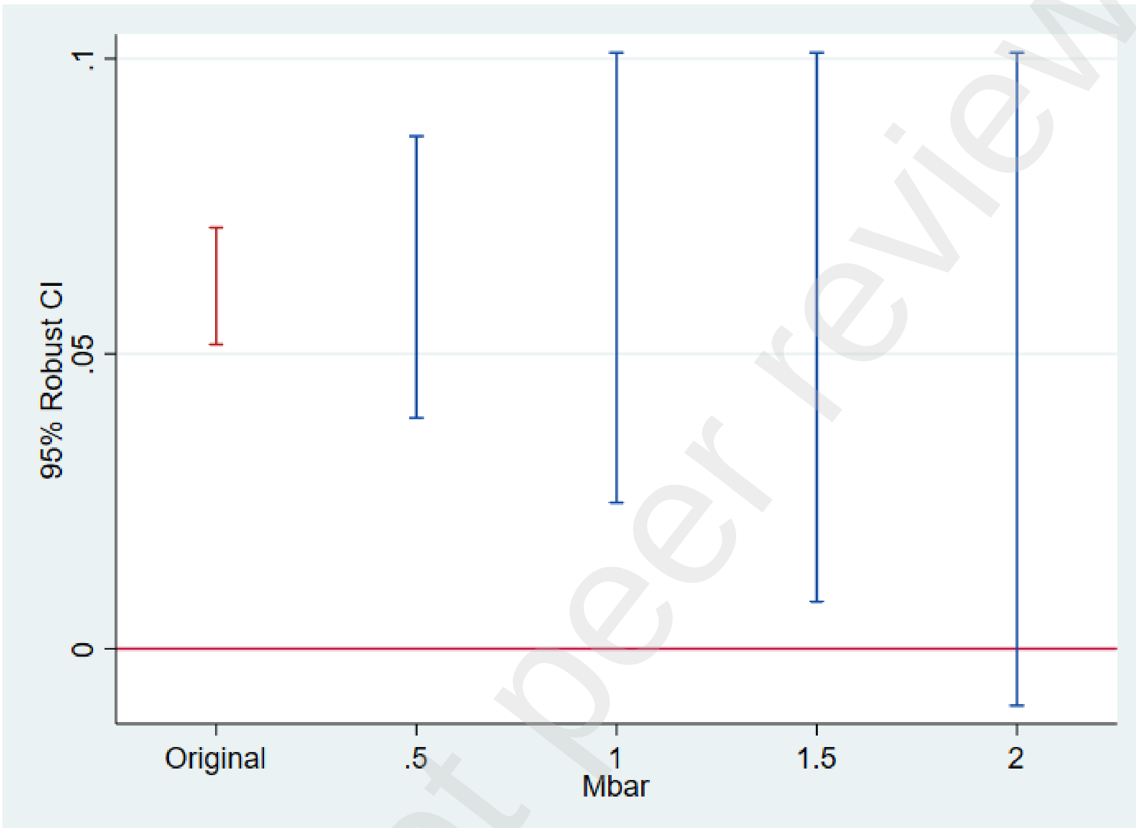


Table 1. Data and variable definitions

Variable	Description
A. Dimension of the data	
Entrepreneurs	Loan applicants who have an exclusive relationship with the bank, are majority owners (own more than 50%) of a firm, and personally manage their firms. They apply to the bank for one or more business loans during the period 2002-2016 and the loan is either originated or denied. Due to the exclusive relationship, the bank holds information on the applicants even outside the year of loan application.
Firms	The firms that individuals are majority owners and sole managers (these firms do not have a board of directors). A 28% of these firms are owned and managed by female entrepreneurs. We observe 511 cases in our sample, where there is a change in the owner's gender. The panel of firms is balanced.
Year	The years covering the period 2002-2016.
B. Variables	
Pay gap	The natural logarithm of the ratio between the salary of the firm i's owner in year t (named *Owner's income*) and the mean employee salary in firm i calculated from the ratio of personnel expenses to the total number of employees (named *Average employee income*). The owner's total income is reported by the loan applicant to the bank and includes dividends (if any). The mean employee salary comes from the financial statements of the firm, as also reported to the bank.
Gender	A binary variable equal to one if the firm's owner is male, and zero if the firm's owner is female.
Owner's wealth	The natural logarithm of the euro amount of the firm's owner total wealth other than the assets of the firm and minus total debt.
Education	An ordinal variable ranging between 0 and 5 if the individual completed the following education. 0: No secondary; 1: Secondary; 2: Post-secondary, non-tertiary; 3: Tertiary; 4: MSc, PhD or MBA.
Higher education	A binary variable equal to one if the firm's owner has tertiary education and higher, and zero otherwise.
Age	The owner's age.
Dependents	The owner's number of dependents.
Married	A binary variable equal to one if the owner is married, and zero otherwise.
Credit score	The credit score of the applicant, as calculated by the bank. There is a 0 cutoff: positive values indicate that the loan is granted and negative values indicate that the loan is denied. The credit score includes both hard and soft information on the firm, facilitating the bank's decision to grant the loan or not.
Access to credit	A binary variable equal to one if the loan is originated (positive credit score), and zero if the loan is potentially rejected (negative credit score).
Apply for credit	A binary variable equal to one if an entrepreneur observed in our sample applies for credit in year t and zero if he/she does not apply for credit in that year.
Firm size	The natural logarithm of total firm's assets.
Firm leverage	The ratio of firm's total debt to total assets.
Firm capital	The ratio of firm's total capital expenditure to total sales.
Firm ROA	The ratio of firm's after- tax profits to total assets.
Firm tangibility	The ratio of firm's tangible assets to total assets.
Firm R&D	A binary variable equal to one if the firm's R&D expenses to total expenses are above the sample's median, and zero otherwise.

Table 2. Summary statistics

The table reports summary statistics (number of observations, mean, standard deviation, minimum and maximum values) for all variables used in the estimations concerning the SMEs sample. All variables are defined in Table 1.

	Obs.	Mean	Std. dev.	Min.	Max.
Pay gap	234,420	0.63	0.72	-0.09	1.96
Gender	234,420	0.72	0.45	0.00	1.00
Owner's income	234,420	11.07	1.40	9.80	12.74
Average employee income	234,420	10.44	2.11	9.33	13.04
Wealth	218,792	12.18	0.56	7.80	14.29
Education	234,420	2.96	1.01	0.00	5.00
Higher education	234,420	0.491	0.47	0.00	1.00
Age	234,420	48.98	15.88	21.82	76.04
Dependents	234,420	3.49	2.29	0.00	7.00
Married	234,420	0.47	0.50	0.00	1.00
Credit score	234,420	0.70	1.36	-2.95	2.10
Access to credit	234,420	0.83	0.37	0.00	1.00
Apply for credit	234,420	0.25	0.43	0.00	1.00
Firm size	234,420	9.83	0.80	2.50	12.32
Firm leverage	234,420	0.21	0.02	0.13	0.92
Firm capital	234,420	0.101	0.242	0.00	1.83
Firm ROA	234,420	0.08	0.10	-0.39	0.53
Firm tangibility	234,420	0.56	0.14	0.24	0.84
Firm R&D	234,420	0.21	0.29	0.00	1.00

Table 3. The effect of owner's gender on the pay gap: Baseline results

The table reports coefficients and standard errors (in parentheses) from the estimation of equation 1. The dependent variable is *Pay gap* and all variables are defined in Table 1. The estimation method is OLS with standard errors clustered by firm. Specifications 1 to 6 have different controls and fixed effects. Specifications 7 and 8 replicate specifications 3 and 4 but estimated with the model of Callaway and Sant'Anna (2021) and reports the average treatment effect (results on the control variables in specification 8 not reported, as Stata does not report them), as well as the p-value of the test for pre-trends (the null being that all pre-treatment equal to zero). Specification 9 replicates specification 4 using the Heckman's (1979) model described in the text. Each specification includes the fixed effects given in the lower part of the table. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Gender	0.029***	0.029***	0.028***	0.027***	0.026***	0.025***	0.030***	0.029***	0.033***
	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.012)
Education		0.029***		0.024***	0.026***	0.022***			0.026***
		(0.006)		(0.005)	(0.005)	(0.005)			(0.005)
Age		0.008***		0.007***	0.007***	0.007***			0.007***
		(0.002)		(0.002)	(0.002)	(0.002)			(0.002)
Dependents		-0.000		-0.000	0.000	0.000			-0.000
		(0.000)		(0.000)	(0.000)	(0.000)			(0.000)
Married		-0.002		-0.001	-0.002	-0.001			-0.001
		(0.002)		(0.001)	(0.002)	(0.001)			(0.001)
Wealth		0.019***		0.016***	0.018***	0.015***			0.018***
		(0.004)		(0.004)	(0.004)	(0.004)			(0.005)
Credit score	0.087***	0.084***	0.072***	0.069***	0.076***	0.064***			0.074***
	(0.021)	(0.020)	(0.020)	(0.019)	(0.020)	(0.019)			(0.020)
Firm size		0.012***		0.009***	0.011***	0.009***			0.010***
		(0.003)		(0.002)	(0.003)	(0.002)			(0.003)
Firm ROA		0.119***		0.086***	0.110***	0.082***			0.094***
		(0.028)		(0.027)	(0.028)	(0.026)			(0.030)
Firm leverage		3.343***		2.761***	3.033***	2.555***			2.857***
		(1.074)		(1.063)	(1.168)	(0.859)			(1.113)
Firm tangibility		0.114***		0.096***	0.103***	0.089***			0.091***
		(0.025)		(0.025)	(0.026)	(0.018)			(0.027)
Lambda									-0.157
									(0.222)
Observations	234,420	234,420	234,420	234,420	234,420	234,420	234,420	234,420	234,420
Adj. R-squared	0.658	0.664	0.694	0.695	0.701	0.699			
P-value							0.233	0.233	
Year effects	Y	Y	Y	Y	N	N	Y	Y	Y
Firm effects	N	N	Y	Y	Y	Y	Y	Y	Y
Year × industry effects	N	N	N	N	Y	N	N	N	N
Year × region effects	N	N	N	N	N	Y	N	N	N

Table 4. Triple difference regressions:
Selling to male owners after observing a first dependent

The table reports coefficients and standard errors (in parentheses) from the estimation of equation 2. The dependent variable is *Pay gap* and all variables are defined in Table 1. The estimation method is OLS with standard errors clustered by firm. Each specification includes the control variables in Table 2 and fixed effects given in the lower part of the table. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Gender	0.015***	0.014***	0.014***	0.013***
	(0.005)	(0.005)	(0.005)	(0.005)
First dependent	0.009	0.007	0.007	0.006
	(0.010)	(0.010)	(0.009)	(0.009)
Gender × First dependent	0.015***	0.015***	0.015***	0.014***
	(0.003)	(0.003)	(0.003)	(0.003)
Observations	234,420	234,420	234,420	234,420
Adj. R-squared	0.582	0.700	0.710	0.705
Control variables	N	Y	Y	Y
Year effects	Y	Y	N	N
Firm effects	Y	Y	Y	Y
Year × industry effects	N	N	Y	N
Year × region effects	N	N	N	Y

Table 5. The effect of owner's gender on pay gap: Placebo tests

The table reports coefficients and standard errors (in parentheses) from the estimation of equation 1, employing placebo tests on our baseline results reported in Tables 3 and 4. The dependent variable is *Pay gap* and all variables are defined in Table 1. The estimation method is OLS with standard errors clustered by firm. In specifications 1 and 2, we artificially lag the changes in *Gender* by 1 year and 2 years. In specification 3, we drop the firm fixed effects and consider falsified *Gender* = 1 when there is an ownership change but gender states the same (*Gender* = 0 otherwise). In specifications 4 to 6, we conduct similar exercises to the previous three specifications using the triple differences model. Each specification includes the control variables of column 2 Table 3, and the fixed effects given in the lower part of the table. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Gender	0.013	0.003	0.010	0.005	0.001	0.004
	(0.009)	(0.009)	(0.008)	(0.005)	(0.005)	(0.006)
First dependent				0.008	0.004	0.002
				(0.010)	(0.010)	(0.010)
Gender × First dependent				0.003	-0.001	0.000
				(0.003)	(0.003)	(0.003)
Observations	234,420	234,420	234,420	234,420	234,420	234,420
Adj. R-squared	0.650	0.641	0.648	0.645	0.637	0.632
Controls	Y	Y	Y	Y	Y	Y
Year effects	Y	Y	Y	Y	Y	Y
Firm effects	Y	Y	N	Y	Y	N

Table 6. Components of pay gap

The table reports coefficients and standard errors (in parentheses) from the estimation of equation 1 (first two specifications) or equation 2 (last two specifications). The dependent variable is *Pay gap* and all variables are defined in Table 1. The estimation method is OLS with standard errors clustered by firm. Each specification includes the fixed effects and the control variables given in the lower part of the table. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1) Owners' income	(2) Average employee income	(3) Owners' income	(4) Average employee income	(5) Employee expenses	(6) Number of employees
Gender	0.040***	-0.030**	0.036***	-0.021***	-0.014**	-0.026***
	(0.017)	(0.008)	(0.014)	(0.007)	(0.007)	(0.011)
First dependent			0.006*	-0.001		
			(0.004)	(0.003)		
Gender × First dependent			0.009**	-0.008***		
			(0.004)	(0.003)		
Observations	234,420	234,420	234,420	234,420	234,420	234,420
Adj. R-squared	0.628	0.744	0.630	0.744	0.611	0.807
Control variables	Y	Y	Y	Y	Y	Y
Year effects	Y	Y	Y	Y	Y	Y
Firm effects	Y	Y	Y	Y	Y	Y

Table 7. Access to credit and probability of loan application

The table reports marginal effects and standard errors clustered by individual (in parentheses) from the estimation of the probability that individuals apply for a loan during our sample period. Dependent variable is the binary variable *Apply for credit*, and all variables are defined in Table 1. The first two specifications are a regression discontinuity design. Both specifications are estimated using a linear probability model. The second specification uses only observations around the 0 cutoff point of the credit score, obtained from cross validation. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% levels.

	Apply for credit 1	Apply for credit 2	Access to credit 3
Income	0.032***	0.036***	0.268***
	(0.004)	(0.004)	(0.006)
Wealth	-0.002	-0.002*	0.013***
	(0.002)	(0.001)	(0.003)
Education	0.029***	0.031***	0.025**
	(0.007)	(0.008)	(0.012)
Age	0.003***	0.003***	0.000
	(0.000)	(0.000)	(0.000)
Dependents	0.001	0.002	0.001
	(0.003)	(0.003)	(0.002)
Firm size	0.006***	0.007***	-0.001
	(0.002)	(0.002)	(0.003)
Leverage	0.317***	0.389***	-0.147***
	(0.052)	(0.061)	(0.041)
ROA	0.024**	0.026***	0.069***
	(0.010)	(0.009)	(0.015)
Cash	-0.946***	-1.035***	0.765**
	(0.311)	(0.307)	(0.315)
Applications	0.002***	0.002***	0.057***
	(0.000)	(0.000)	(0.007)
Credit score	0.298***		
	(0.029)		
Gender	0.012***	0.014***	-0.005
	(0.002)	(0.003)	(0.004)
Year fixed effects	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes
Observations	234,420	5,040	5,040

Table 8. Mechanisms

The table reports coefficients and standard errors (in parentheses). The dependent variable is *Pay gap* and all variables are defined in Table 1. The estimation method is OLS with standard errors clustered by firm. Specification 1 uses *Access to credit* as a key explanatory variable and specification 2 uses *Apply for credit*. Each specification includes the fixed effects and the control variables given in the lower part of the table. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Gender	0.018**	0.015*	0.022**	0.032***	0.028***	0.023***	0.022***
	(0.008)	(0.008)	(0.009)	(0.010)	(0.010)	(0.007)	(0.007)
Access to credit (Apply for credit)	0.062***	0.071***					
	(0.011)	(0.015)					
Higher education			0.014***		0.016***		
			(0.003)		(0.004)		
Firm R&D				0.024***	0.017***		
				(0.005)	(0.006)		
Discretionary accruals						0.007	
						(0.006)	
Accounting revisions							0.009*
							(0.005)
Gender × Access to credit (Apply for credit)	0.024***	0.038***					
	(0.007)	(0.010)					
Gender × Higher education			0.012***		0.010**		
			(0.004)		(0.005)		
Gender × Firm R&D				-0.019***	-0.016***		
				(0.005)	(0.005)		
Gender × Higher education × Firm R&D					-0.007***		
					(0.002)		
Gender × High firm accruals						0.012**	
						(0.005)	
Gender × Accounting revisions							0.016***
							(0.006)
Observations	234,420	234,320	234,420	234,420	234,420	234,420	234,420
Adj. R-squared	0.762	0.814	0.697	0.698	0.699	0.698	0.696
Control variables	Y	Y	Y	Y	Y	Y	Y
Year effects	Y	Y	Y	Y	Y	Y	Y
Firm effects	Y	Y	Y	Y	Y	Y	Y

Internet Appendix

Gender, credit, and the pay gap

A.1. Sample representativeness

This Appendix provides a discussion mitigating the probability of sample selection issues by establishing the comparability of our sample to European averages for systemic banks and comparable firms. We run several checks across four main dimensions to maintain that our sample resembles European averages. To do this, we collect new data from several additional sources.

First, our bank is very similar to other systemic West European banks. Specifically, we collect Compustat data for the 32 systemic European banks (according to the definition by the European Banking Authority) for the period 2002 to 2016. Using the ratio of liquid assets (cash plus short-term securities) to total assets, the ratio of market value to book value, and profitability (before tax return on assets), we find very high time-series correlations with our bank's equivalent measures (significant at the 1% level). We report relevant graphs in Figure A1.

Second, the percentage of female entrepreneurs in our panel is 28% of the total number, which is almost the same to the 29% reported in 2012 across Western Europe (European Commission, 2014). Moreover, Piacentini (2013) suggests that the proportion of female employers was fairly stable during the 2000s at around 25%. We also document similar differences in the earnings of female and male entrepreneurs with those reported by the OECD (2017).

Third, we collect data from the Survey on Access to Finance of Enterprises (SAFE), which provides representative information on the financial situation of firms and covers the euro area countries since 2009. These data show a very similar loan rejection rate faced by SAFE firms compared with our sample, both in terms of mean values and in terms of the time trend (see Figure A2). They also show a very similar level of majority ownership in firms that are similarly sized.

Fourth, we collect data from Orbis on small firms (the same average size as in our panel) from core Western European countries (Austria, Belgium, Denmark, France, Germany and the Netherlands), and find that average leverage, and profitability ratios are similar to those in our panel (Figures A1 to A3). On average, the firms in our sample have only a 1.1% lower leverage ratio and 0.76% higher ROA. Other firm ratios (reflecting operating expenses, capital expenses, etc.) are also at levels that are very similar to firms in our panel.

Fifth, for small firms, having an exclusive relationship with a bank is common. This is the case for 65% of the firms in our full sample (the original sample before the filters applied). This figure is fully consistent with previous studies on multiple or exclusive lending relationships. Berger and Schaeck (2011) document a 71% exclusive relationship between banks and SMEs in three European countries (Germany, Italy, and the UK), but this is less often the case in the United States (Berger et al., 2014, document a 57% rate). Farinha and Santos (2002) report similar statistics for Portugal (70% of firms with fewer than 10 employees have one bank relationship). More recently, Bonfim at al. (2018) report a mean value of two banks for small Portuguese firms, but the Portuguese banking sector is much less concentrated compared to our bank's country. Essentially, the available evidence suggests that the percentage of exclusive relationships in our sample is comparable to previous papers on relationship banking.

A final important issue is the representativeness of business owners with respect to their education levels. In our sample, highly educated entrepreneurs are 50.3% of all loan applicants. An exploration of the EU Labor Force Survey (EU-LFS) Q4 2020, for similar European countries shows that 47.1% of self-employed individuals have higher levels of educational attainment (i.e., tertiary, bachelors, masters, and PhD). These countries, namely Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Netherlands, and the UK, range from 35% to 56% of highly educated self-employed individuals.

Figure A1
Our bank versus other systemic European banks

Figure A1a shows a scatter plot and a linear fit of the annual liquidity ratio of our bank against the annual average of liquidity ratios of 32 European systemic banks over the period 1985-2018. Figures A1b and A1c show similar scatter plots and regressions for the market-to-book value ratio and ROA. The coefficient estimates of all three lines are statistically significant at the 1% level and correlation coefficients are 0.34, 0.43, and 0.35, respectively.

Figure A1a

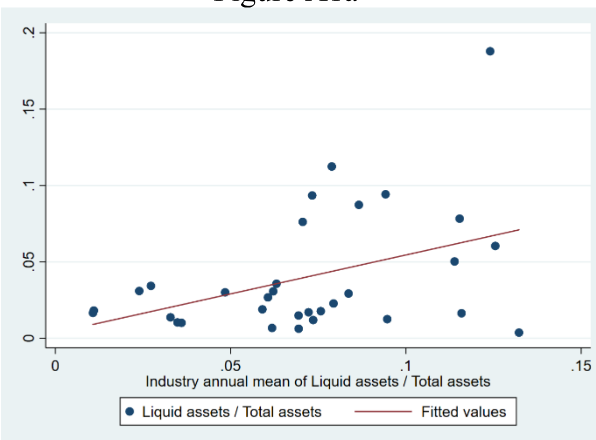


Figure A1b

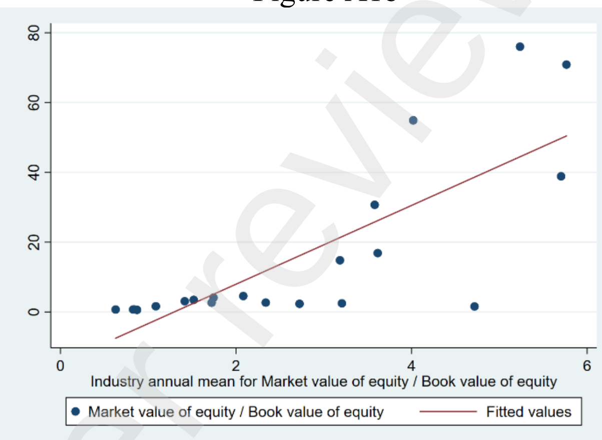


Figure A1c

Figure A2

Percent of rejected loans to small and micro firms in the euro area and by our bank

The figure plots the annual average (in percent) of rejected loan applications to small and micro firms in the euro area, obtained from the (SAFE), and the rejection rate (in percent) for the 61,863 loan applications in our sample.

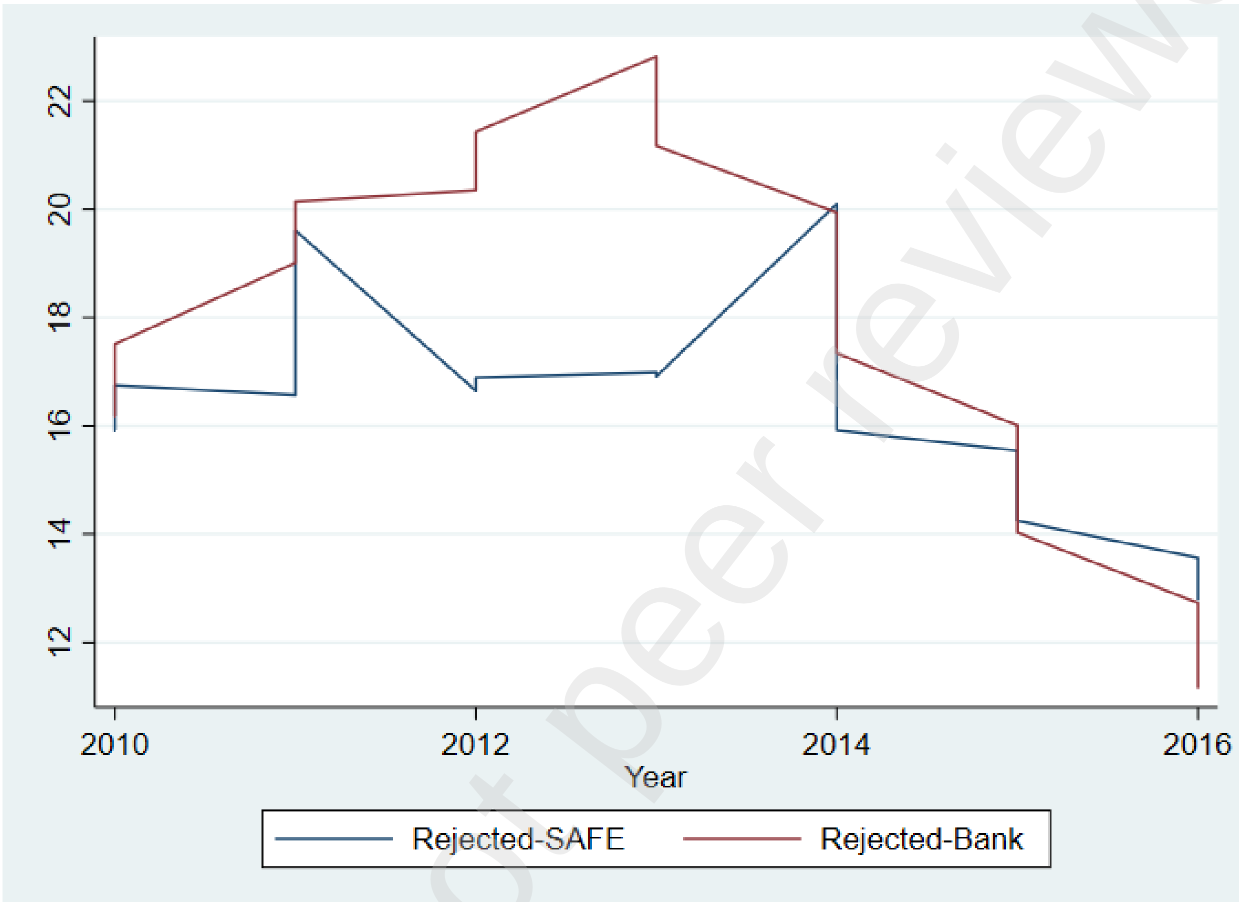


Figure A3

Leverage and ROA of North European small firms versus small firms in our sample

The figure plots the annual average of leverage (Figure A3a) and ROA (Figure A3b) of small and micro firms in Austria, Belgium, Denmark, France, Germany, and the Netherlands (blue lines) and the equivalent for the 15,628 firms in our sample (red lines).

Figure A3a

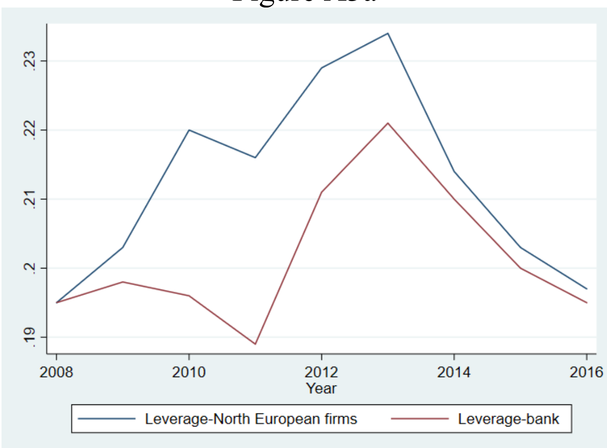
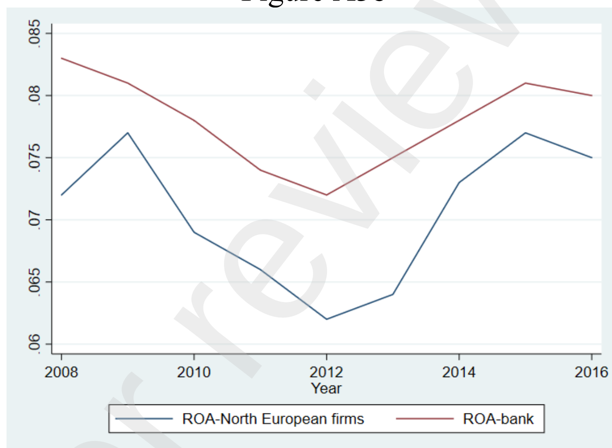


Figure A3b



A.2. Validity of the discontinuity analysis in Table 7

Figure A4
Manipulation test

The figure reports results from the manipulation testing procedure using the local polynomial density estimator proposed by Cattaneo et al. (2018). To perform this test, we rely on the local quadratic estimator with cubic bias-correction and triangular kernel.

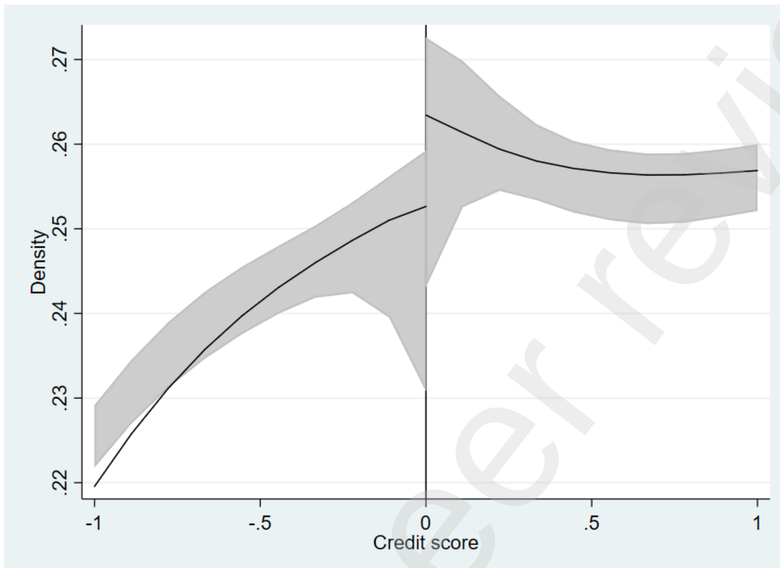


Figure A5
Density of the credit score

The figure reports the probability density for the assignment variable Credit score.

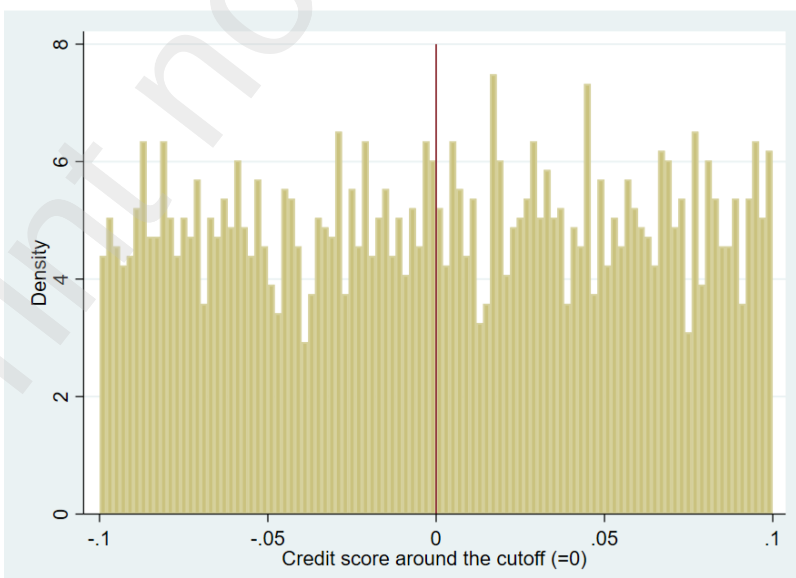
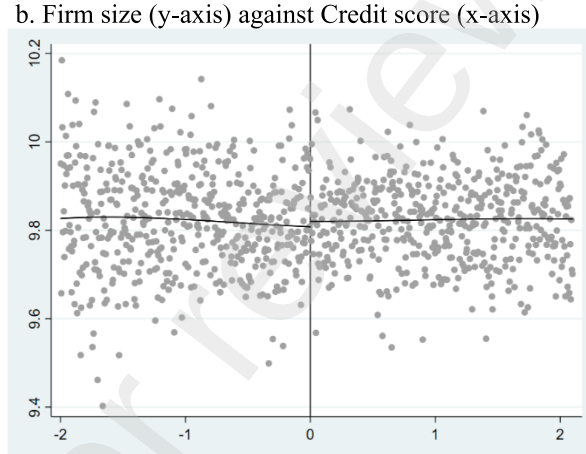


Figure A6
Covariates around the cutoff

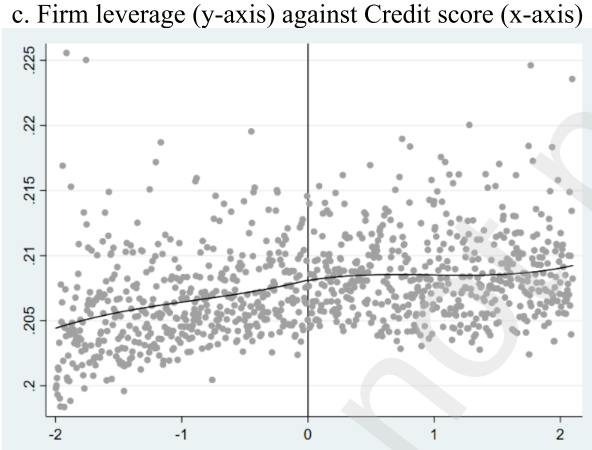
The figure reports a plot for each control variable against the Credit score. The covariates include Education, Firm size, Firm leverage, Loan amount, Maturity and Wealth (first instance of wealth before the loan application). The continuous line represents a fourth order polynomial fit used to approximate the conditional mean of each covariate below and above the cutoff.

a. Education (y-axis) against Credit score (x-axis)

b. Firm size (y-axis) against Credit score (x-axis)

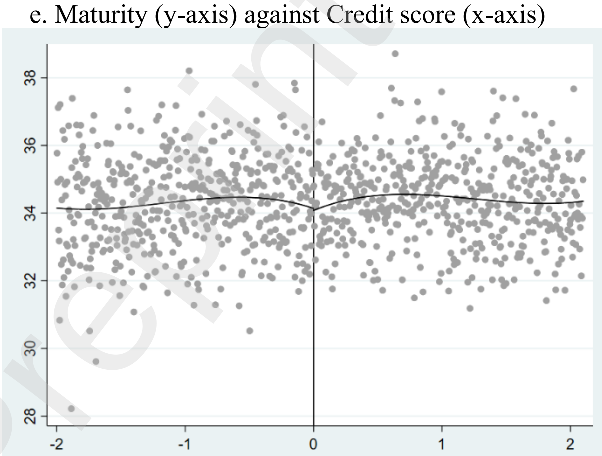


c. Firm leverage (y-axis) against Credit score (x-axis)

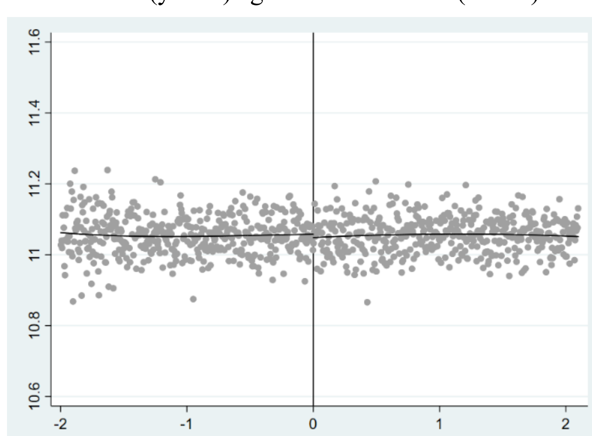


d. Loan amount (y-axis) against Credit score (x-axis)

e. Maturity (y-axis) against Credit score (x-axis)



f. Income t-1 (y-axis) against Credit score (x-axis)



g. Wealth t-5 (y-axis) against Credit score (x-axis)