Female Skin in the Game: Bridging the Gender Financing Gap

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Abstract

I examine the role of skin in the game, such as paid-up equity or collateral, in narrowing the gender financing gap in entrepreneurship. I find, first, that skin in the game reduces this gap: a 10 percent increase in collateral value raises bank debt by around 4 percent for women—twice as much as for men. Similarly, a one-standard-deviation increase in the paid-up equity ratio boosts bank debt by at least 4.65 percent more for women, which is 2.2 times more than for men. Second, I find the marginal return to an additional dollar of debt is higher for women, implying that women face more significant financial constraints and forgo higher NPV projects. The economic magnitude is large: for a female-owned business with a one-standard-deviation higher leverage, the performance gap (1-2 percentage points lower ROA for females) shrinks by at least 80 percent. I confirm my findings through robustness and placebo tests and provide cross-country evidence showing that stronger collateral rights are associated with improved credit access and entrepreneurship for women. Overall, the results suggest that more equal access to collateral and wealth plays a sizeable role in narrowing the gender financing gap.

JEL Codes: G21, J16, L26

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1 Introduction

The entrepreneurial gender gap is a well-established fact. Women are underrepresented in entrepreneurship, with only 2 percent of venture capital going to women-led start-ups globally.[1] A growing body of research links much of this gap to financial frictions and to the greater challenges women face in obtaining external financing.[2] However, despite awareness and policy initiatives, progress has been slow: convergence rates suggest that parity in funding may still be decades away (Ewens, 2022).

In this paper, I examine how the personal financial stake of entrepreneurs, or their *skin in the game*, helps bridge the gender financing gap in debt provided by financial institutions (banks, hereafter). This question is important for several reasons. First, as already discussed, the funding gap is large. Second, bank financing is a major source of young business formation.[3] Finally, the results have important policy implications which I discuss in the end. As a preview, I find that increased skin in the game, either in the form of pledging more collateral or more paid-up equity, helps reduce the funding gap. This is because additional collateral or equity increases bank debt for women by roughly twice as much as for men. I argue that this stronger effect reflects a greater reduction in asymmetric information within the female cohort than within the male cohort.

What is the role of skin in the game in the gender financing gap? Theoretically, a higher financial stake can incentivize banks to increase financing. However, this effect can be stronger for women compared to men, regardless of whether the existing financing gap is due to rational reasons (Phelps, 1972; Arrow, 1973) or biased decision-making (Bohren et al., 2019; Becker, 1957). First, according to theories of statistical discrimination (Phelps, 1972; Arrow, 1973),

[1] Pitchbook reports share of start-ups founded exclusively by women was just 2 percent in 2023—lowest since 2016. Additionally, while female co-founded VC capital is increasing, it remains low at 20.7 percent of total US VC funding. See https://pitchbook.com/news/articles/female-founders-vc-year-in-review-2023). In Europe, women account only for 1 percent of venture capital investments. See European Investment Bank's 2022 March report.

[2] See for instance, Hebert (2025), Guzman and Kacperczyk (2019), Hellmann et al. (2021) for VC, and de Andrés et al. (2021), Ongena and Popov (2016) for debt. For policy discussion, see European Investment Bank https://www.eib.org/en/events/access-to-finance-for-female-entrepreneurs-creating-opportunity. For a review of academic literature, see Ewens (2022), where Table 1 in particular provides a summary of the entrepreneurship gap at the various stages of a start-up cycle.

[3] Robb and Robinson (2014) show that approximately 40% of start-up capital comes from external debt, with commercial banks being the predominant source. Berger and Udell (1998) also showed that commercial bank loans provide 19 percent of all financing for small businesses, and for comparison, venture capital investments provide 2 percent. Other major sources include principal owner's equity (31 percent) and trade credit (16 percent).

various groups can have different qualities, and in the absence of individual-level information on true qualities, observable group characteristics (such as race or gender) will determine outcomes (e.g., loan terms). It is well established that asymmetric information at the individual level can be mitigated in credit markets either by requiring *more collateral*, which signals project quality and addresses adverse selection (Bester, 1985), or by demanding *more equity*, which signals effort and mitigates moral hazard (Holmström and Tirole, 1997).[4] Second, if banks are making biased decisions, due to inaccurate statistical discrimination (Bohren et al., 2019) or taste-based discrimination (Becker, 1957), the biases result in lenders providing less funding, or they demand more equity for a given amount of funding (Ewens, 2022). Therefore, in either case we should expect stronger effects for women's cohort.

Studying the impact of skin in the game on reducing the gender financing gap is empirically challenging. First, disentangling the supply of credit from its demand is not straightforward since I do not observe credit demand directly. Second, confounding supply factors, when correlated with both skin and gender, may bias my estimates. However, in my setting this challenge is mitigated by two features. First, the richness of the data allows me to combine detailed firm- and owner-level information from administrative registries with shareholder characteristics, enabling a precise focus on an interaction term that captures how credit responds to skin in the game for each gender. Moreover, the interaction between gender and skin in the game is theoretically motivated by the aforementioned models.

Thus, my identification assumption is that there are no unmodeled unobservable factors that affect the amount of borrowed debt, are correlated with the entrepreneur's gender, and *also* with skin in the game. Put differently, conditional on the extensive set of controls, any factors correlated with skin should not influence the amount of credit in a way that is also systematically related to gender. This means that the correlation of the skin or gender alone with unobservable variables is not problematic for my identification. For instance, it is plausible that with more collateral, all entrepreneurs demand more credit, e.g. because they have more ambitious projects (unobserved); this would be problematic in a traditional study of collateral channel relating credit outcomes to collateral and absent other identification mechanisms. Similarly, it is not

[4]These mechanisms are formalized in a simple extension of those models (Holmström and Tirole, 1997; Bester, 1985) to provide the theoretical basis for my hypotheses on how collateral and paid-up equity differentially affect women's access to credit.

problematic that a borrower with a lot of equity (or housing as collateral) is more talented, resulting in bank's willingness to lend more to those borrowers due to their (unobservable) talent. My results would be biased if, in addition, the same level of wealth signals even greater talent for women than for men. Only in that case would women receive more credit with higher skin because of unobserved talent, rather than because higher skin reduces asymmetric information. In the end, I corroborate my identification by, among others, conducting a placebo test on firms that merely meet a statutory minimum equity requirement, where no gender-specific effect on debt capacity should arise since equity reflects regulatory compliance rather than signaling.

I begin by studying whether the availability of more skin in the game will increase female-led firms' bank credit *more* than for their male counterparts. I use a unique Norwegian dataset covering the universe of Norwegian firms from their year of incorporation, with their financial statements merged with shareholder registry data, which provides details on the share structure, each shareholder's gender and age information, paid-up equity at the starting and follow-up years. To measure skin in the game, I first use a proxy for pledgeable collateral, as measured by real estate in the firm. As a second measure, I use personal equity used at the initial stages of founding, that is, paid-up equity.

My first main finding is that both real estate and paid-up equity play an important role for long-term as well as total debt of young firms, but substantially more so for women. The effects are economically significant: a 10 percent increase in the value of real estate is associated with about 4 percent increase in long-term bank debt for female-owned businesses. The results are similar for total debt, while short-term debt alone is mostly insignificant. This collateral channel is about *twice as strong for women* as for men during the first three years following the establishment of a firm. Consistent with evidence that more redeployable collateral supports higher debt capacity (Benmelech and Bergman, 2011), my results show that as firms mature, real-estate collateral becomes more effective in expanding access to debt. However, the additional gender effect of the collateral (relatively) diminishes over time, consistent with a reduction in asymmetric information between lenders and borrowers.

To measure the impact of personal equity, I use *skin ratio*, or *equity ratio*: the ratio of lagged paid-

up equity to total assets. I find that for single-owned firms a one-standard-deviation increase in the equity ratio leads to at least 2.0 percent increase in total bank debt for male-owned firms in their initial three years, with a 4.65 percent additional increase in female firms' total bank debt in the first three years. Across specifications, this equity channel is about 2.2 times as strong for women as for men.

Is banks' decision to restrict the supply of funds to women rational? Statistical discrimination with rational beliefs suggests that lenders perceive gender as an indicator of certain borrower attributes (lower quality in terms of creditworthiness). According to this theory, banks provide less credit because they expect female owners to perform worse—and do so correctly. To shed light on this, I study ex-post performance: return on assets (ROA) and revenue volatility in the initial years and over firms' lifetimes. I find that female borrowers show about 1-2 percentage points lower ROA controlling for observables, and I find no evidence that their sales are more volatile compared to their male peers.

Importantly, female borrowers who receive more bank debt perform better the following year, exhibiting higher ROA without increased sales volatility. In other words, the marginal dollar of debt funds a project with a higher ROA in female-owned firms compared to a male-owned firms. Assuming no unobservable confounding factors that could increase asset returns with more borrowing, *and* more so for female-owned firms, this result means that female entrepreneurs are more constrained: the marginal project they would have carried out if they had received more credit has *higher NPV*. The economic effect is large: a one-standard-deviation higher leverage reduces the performance gap between 80 and 90 percent. Therefore, this finding is hard to reconcile with a fully rational lending and instead suggests that banks may, at least in part, underestimate the creditworthiness of female entrepreneurs. I also provide back-of-the-envelope calculations of efficiency gains from closing the observed gender leverage gap.

Next, I conduct robustness and placebo tests as well as address concerns about external validity. To make sure that my results are not driven by tiny firms with a single founder who is also the only employee, I conduct several robustness tests by leaving out candidate small firms. Specifically, I omit small single-owned firms employing only one individual, as well as firms with assets and sales falling below the 10th percentile of their respective distributions. My results

change to a negligible extent only. I also do a "leave-one-out" exercise and confirm that my results are not sensitive to the exclusion of any particular industry.

For the equity channel, I exploit as a placebo the statutory minimum share capital requirement for private limited companies in Norway. Firms that contribute only with binding minimum equity hardly use it as a discretionary signal to reveal information, while those contributing above the floor are unconstrained by regulation and thus eligible for testing my hypotheses. Consistent with this distinction, I find little evidence for the equity channel and no gender differences at the regulatory threshold, whereas among unconstrained firms additional equity is particularly effective in expanding women's access to credit.

Finally, I provide cross-country evidence to support my results. I use World Bank data on property rights, access to credit and entrepreneurship, and examine how more equal property rights enable women to own and pledge assets, expanding their borrowing capacity.[5] While I do not make causal claims here, the results align with my main finding: improvements in property rights for women are associated with easier access to credit and better entrepreneurial environment for them.

My findings have important policy implications. Around the world, banks lend less to female entrepreneurs than to male entrepreneurs (Demirgüç-Kunt et al., 2018). Discrimination by lenders can limit the supply of credit to women (Organisation for Economic Co-operation and Development (OECD), 2016). If female entrepreneurs are prohibitively credit-constrained, this can leave their talent unused and unfavorably affect productivity and growth (Hsieh et al., 2019). As long as such a gap comes from supply, policymakers can improve efficiency. More equal access to wealth and collateral between genders can be crucial when designing policies, such as property and wealth inheritance rights. Easing signaling requirements through credit subsidies, guarantee programs, and stronger rights would enhance women's ability to obtain external financing. As an additional unit of skin is more productive for women (who currently are less wealthy and have inferior property rights across the globe), progress toward equality may well increase aggregate entrepreneurship.

[5] Consistent with this mechanism, Naaraayanan (2022) shows that inheritance reforms improving women's property rights increased their access to collateral and entrepreneurship.

2 Related literature

My study is closely related to research on discrimination in business financing via bank loans. In general, banks lend less to female entrepreneurs compared to their male counterparts (Demirgüç-Kunt et al., 2018). Alesina et al. (2013) demonstrate significant disparities in credit supply (specifically, credit costs) for female entrepreneurs using data from Italy. Bellucci et al. (2010) found that female business owners in Italy face more challenges in obtaining credit compared to men, although the costs of the credit they obtain are comparable. Interestingly, examining the relationship between the genders of borrowers and loan officers, they found that male loan officers are likely to require more collateral from female borrowers. Similarly, Brock and De Haas (2023) find, through a lab-in-the-field experiment, that loan officers are 26 percent more likely to require a guarantor when the same credit application is from a female, rather than a male entrepreneur.

Relative to this literature, I shift the focus from mean differences in approval and terms to the supply elasticity of bank debt with respect to pledgeable assets and paid-up equity, documenting a markedly steeper response for women that is hard to reconcile with fully rational screening.

Using the Kauffman Firm Survey (KFS), Coleman and Robb (2009) examine financing choices at the founding stage, focusing on within-industry analysis.[6] In line with my results, they find that businesses owned by women tend to raise less debt following the starting year, and are more inclined to utilize personal financing compared to businesses owned by men. These results are also in line with findings in Fairlie and Robb (2009) and Constantinidis et al. (2006).

Ongena and Popov (2016) use information on approximately 6,000 small business entities across 17 countries and find that in countries with more pronounced gender bias, female entrepreneurs are more inclined to abstain from even *applying* for loans and instead turn to informal financing options.[7] The authors fail to attribute the finding to discriminatory practices or differences in credit risk between businesses owned by women and men.

[6] Initiated in 2004 and continuing until 2011, the KFS tracks the development of newly established businesses in the United States.

[7] Similar results on women's relative reluctance to apply for credit was also documented in Coleman (2002).

Discrimination is also present in minority groups, such as based on ethnicity. Supporting the notion of discrimination within lending markets, Chatterji and Seamans (2012) demonstrate that external improvements in the accessibility of credit card debt result in increased entrepreneurial ventures among black entrepreneurs. In their seminal work, Blanchflower et al. (2003) pioneered empirical investigation of discriminatory practices in small business lending. Through an analysis of data procured from the 1993 and 1997 National Surveys of Small Business Finances, they examined the interplay between racial identity and expectations regarding loan rejection, as well as actual outcomes related to lending. Finally, using KFS data Fairlie et al. (2022) examine how black entrepreneurs navigate initial financing challenges over time. They find that black entrepreneurs face persistent difficulties in securing debt.

My work is related to the literature on the availability of collateral, access to credit, and entrepreneurship. Naaraayanan (2022) shows that inheritance reforms in India that expanded women's property rights relaxed financial constraints and promoted female entrepreneurship. While he analyses the effect of institutional changes in legal rights, I examine how entrepreneurs' own collateral and paid-up equity at the firm level shape access to bank credit. In addition, I show women are more financially constrained and forgo higher NPV projects compared to men, in a country with a strong commitment to gender equality.

Firm borrowing and investments can increase if collateral values increase (Chaney et al., 2012). Changes in collateral values can also trigger spillover effects and have macroeconomic implications (Campbell et al., 2011; Benmelech and Bergman, 2011). Schmalz et al. (2017) find that growth in house prices can increase external funding and encourage entrepreneurship. Similarly to my work, Kerr et al. (2022) study the impact of collateral on entrepreneurship for different groups of population based on their financial position. For individuals with financial constraints, the growth in home equity plays a crucial role in enabling more sustained business ventures. In my setting, I instead have borrowers that face different constraints based on gender, rather than a different position in their home leverage.

3 Hypotheses Development

Gender biases are one of the key reasons for differential access to finance (Ewens and Townsend, 2020). They may arise from taste-based discrimination (Becker, 1957). They may also come from beliefs about women's entrepreneurial abilities. In the latter case, statistical discrimination can result from biased priors (Bordalo et al., 2016; Ewens and Townsend, 2020). Alternatively, differential treatment across groups may be rational, as in classical statistical discrimination, where beliefs about group-level differences in quality are correct (Phelps, 1972; Arrow, 1973). Whether banks' reluctance to lend to women reflects taste based biases or (ir)rational statistical beliefs, female entrepreneurs will face tighter financial constraints.

In either case, the gap should narrow when women can commit more of their own resources to the venture, i.e., *skin in the game*. A higher personal stake can affect lenders' behavior through several mechanisms. Under taste-based discrimination, additional collateral or equity compensates for biases. Borrowing the term from psychology, Becker (1957) defines discrimination as individuals' willingness to pay, directly or indirectly, to associate with preferred groups and avoid interacting with disfavored groups. This can manifest as investing less capital, getting more collateral or more equity, charging higher interest rates, or paying lower wages.[8]

In the case of (ir)rational statistical discrimination, classical information-based theories suggest that own resources directly alleviate asymmetric information problems: Statistical discrimination itself arises precisely because lenders lack individual-level information about borrower quality and therefore rely on group-level averages, such as gender, as imperfect substitutes for private information (Phelps, 1972; Arrow, 1973). This informational limitation is what drives credit rationing and screening in asymmetric information models: when lenders cannot fully observe project quality or entrepreneurial effort, they respond by demanding signals or commitment devices that reveal hidden information (Bester, 1985; Holmström and Tirole, 1997). In Bester (1985), collateral serves as a screening device: only high-quality entrepreneurs are willing to pledge valuable assets, separating themselves from low-quality borrowers. In Holmström and Tirole (1997), higher equity improves effort incentives, reducing moral hazard and increasing the optimal debt capacity. Hence, skin in the game should expand access to credit for

[8] See discussion in Ewens (2022).

all entrepreneurs but especially for women, as long as informational frictions are more severe. In Appendix B I adapt these models to incorporate the different prior beliefs across the two cohorts, and develop my hypotheses. Based on these mechanisms, I formulate the following hypotheses:

Hypothesis 1. The impact of collateral (in the form of real estate assets) on enhancing borrowing capacity is stronger for female entrepreneurs than for their male counterparts.

Hypothesis 2. The impact of personal equity (represented by the skin or paid-up equity ratio) on enhancing borrowing capacity is stronger for female entrepreneurs than for their male counterparts.

4 Data

I use data on Norwegian firms and firm owners from 2003 to 2020. I combine information from their financial statements (P&L, balance sheet) with the Shareholder Register data from the Norwegian Tax Administration. The latter includes shareholder structure, personal information on shareholders, including age and their names, and their initial paid-up equity. The datasets are merged using a unique national firm identification number (*organisasjonsnummer*) that is consistent in all firm registries and is assigned to all firms registered in Norway as well as to their foreign institutional shareholders.

To ensure consistency and accuracy of ownership information, I removed erroneous records with ownership shares exceeding 100%. To identify the gender of the owners, I use their names, which allow me to get accurate gender information for nearly all of the population. I retained firm-year observations where identified owners collectively held more than 90% of total shares, and excluded observations with negative equity to eliminate financially distressed or misreported firms. To construct my main sample of interest, I begin by keeping single-owned firms that have been operating between 2003 and 2020 and functioned for at least three years. Finally, after excluding financial firms, my sample of interest comprises 33,183 firms with 190,501 firm-year observations.

Table 1 reports summary statistics. In the sample, only 16 percent of single-owned firms are

owned by females. These enterprises tend to be younger, are smaller in size, possess fewer real estate assets, and carry lower levels of debt from financial institutions, along with less leverage (defined as the ratio of debt to equity). Moreover, female owners of single-owned firms are typically younger, contribute a smaller absolute investment or skin in the game, yet display a higher equity-to-firm-size ratio.[9]

[Insert Table 1 about here]

To capture the different forms of financing that firms borrow from financial institutions, I use short-term (maturity below one year), long-term (maturity above one year), and total debt from financial institutions. In all regressions, these variables enter as *Log(1 + ST debt)*, *Log(1 + LT debt)*, and *Log(1 + Total debt)*, respectively, to retain firms with zero borrowing. For brevity, the tables report these variables simply as *Log(ST debt)*, *Log(LT debt)*, and *Log(Total debt)*.

By skin in the game, I refer to the initial paid-up equity of the owner or (a proxy for) pledged collateral. The *skin ratio* or *paid-up equity ratio* is defined as the ratio of the paid-up equity to the total assets of the firm. To proxy for collateral, I use the book value of the real estate owned by the firm, transformed as *Log(1 + Real estate)* to keep firms without property holdings. As most young firms do not own tangible assets that can be pledged, I separately present additional analyses restricted to firms with positive real estate holdings. This approach allows to capture the intensive margin of the collateral channel.

For owners, I use information on their age and gender. $Female$ is a dummy that takes a value of 1 if the owner of a single-owned firm is a female. For firms with multiple owners, I construct a continuous variable measuring the total share of a firm owned by female owners. I then define $Majority-female$ as a dummy that takes a value of 1 if the majority of a firm is female-owned.[10] I control for the Owner's age in all specifications.

To control for firm characteristics, I include *company age*, firm size measured by $Log(Total\ assets)$, $Log(Sales)$, profitability measured by ROA, and $Leverage$ defined as total debt divided

[9] Interestingly, very similar patterns are observed in Coleman and Robb (2009): they report lower levels of both debt and equity in initial years, with higher paid-up equity ratios.

[10] Summary statistics for firms with multiple owners are reported in Table A2.

by book equity.[11]

For external validity checks, I collect data on the rights of women, the extent of their financial independence, and entrepreneurial activity from World Bank databases: Gender Data Portal and Women, Business and the Law. The latter offers unique insights into how legal and regulatory environments affect women's economic opportunities. Specifically, I employ The Women, Business and the Law index or *WBL index*, a comprehensive measure developed by the World Bank to evaluate how laws and regulations affect women's economic opportunities in 190 economies around the world. The index is based on eight indicators that span various stages of a woman's working life: Mobility, Workplace, Pay, Marriage, Parenthood, Entrepreneurship, Assets and Pension. Each of these indicators comprises questions that assess the legal differences between men and women, scoring economies on a scale from 0 to 100, where a higher score indicates more favorable conditions for women's economic participation. In addition to that general measure, I use the WBL Entrepreneurship Indicator or *WBL Ent*, a metric ranging from 1 to 100, to assess how female-friendly the institutions are in initiating and managing a business. To proxy for gender equality in property ownership rights, I take a binary indicator, *Equal property rights*, (1 for yes; 0 for no). This metric assesses the absence of legal restrictions on property ownership and administration based on gender, including any disparities in the treatment of spousal property and cases where customary practices and judicial precedents influence legal systems.

5 Methodology

I begin by analyzing bank debt from financial institutions at the beginning of a start-up's life, focusing, in baseline specifications, on the initial three years. My baseline specification takes the following form:

$$y_{i,t} = \alpha + \beta X_{i,t-1} + \gamma Z_{i,t} + \delta Z_{i,t} \times C^{(k)}_{i,t-1} + \zeta C^{(k)}_{i,t-1} + \phi I_j + \psi Y_t + u_{i,t} \tag{1}$$

where all variables are defined for firm i in year t, and j indexes industries. The outcome $y_{i,t}$ is

[11] Because start-up equity is often very small, the distribution of leverage is highly right-skewed. As the standard deviations of debt and leverage remain large, I also present the results of my empirical analysis with 5% winsorization in Table A4.

log of one plus short-term, long-term, or total debt from financial institutions. The vector $X_{i,t-1}$ includes firm and owner characteristics that predict the debt levels (such as $Log(Total\ assets)$, $Log(Sales)$, $Leverage$, ROA, $Company\ age$). Z is a 0-1 gender indicator—a dummy taking the value of one if the firm is female-owned (for single-owned firms) or majority-female-owned (for firms with multiple owners).

$C^{(k)}_{i,t-1}$ denotes two measures of skin in the game, depending on the specification: $C^{(\text{collateral})}$ is proxied by *Log(1 + Real estate)*, while $C^{(\text{skin ratio})}$ is measured as the lagged ratio of paid-up equity to total assets. The interaction term $Z_{i,t} \times C^{(k)}_{i,t-1}$ captures whether the sensitivity of bank debt to collateral or initial paid-up equity differs by gender, that is, whether an additional unit of skin in the game translates into a larger credit response for female-owned firms.

All specifications include *Sector FE*, I_j, capturing unobserved sector-specific factors, as well as *Year FE*, Y_t, which control macroeconomic and regulatory shocks common to all firms. The results are robust to using interacted fixed effects *Sector FE* x *Year FE*, which absorb sector-specific time-varying shocks.

Identification

Identification of the supply of credit to women can generally be challenging in the presence of omitted variables. Estimating supply effects is often complicated by the fact that observed credit outcomes reflect both supply and demand decisions. However, in my setting, this challenge is mitigated by two features. First, the richness of the data allows me to combine detailed firm- and owner-level information from administrative registries with shareholder characteristics, enabling a precise focus on an interaction term that captures how the supply of credit responds to skin in the game. Second, the interaction between gender and skin in the game is theoretically motivated in which collateral and equity alleviate agency problems and can be used as credible signals of quality or commitment.

My identification assumption is that there are no unmodeled unobservable factors that simultaneously affect the amount of borrowed debt, are correlated with the entrepreneur's gender, and *also* with skin in the game. Put differently, conditional on the extensive set of controls, any factors correlated with the availability of skin should not influence the amount of credit in a

way that is also systematically related to gender. It should be noted that for the identification of the interaction coefficient δ, the correlations between the unobservables and gender or the unobservables and skin alone are not problematic; only their correlation with the interaction of gender and skin would bias the estimate. Two types of unobservable factors may threaten identification: unobserved *demand* and unobserved *supply* factors.

Unobserved demand factors. On the demand side, I do not observe credit applications or requested loan amounts. In principle, women could demand less credit because they are known to be more risk-averse, consistent with evidence in the literature, or may pursue smaller projects. Such heterogeneity would bias the estimate only if it were also correlated with the amount of skin in the game. For example, if with increasing collateral women systematically demand more credit for reasons unrelated to bank behavior. My identification assumption requires that even if all entrepreneurs with more collateral tend to demand more debt, this relationship is not stronger for women than for men.

Unobserved supply factors. I focus on the theoretically constructed interaction between gender and skin to capture variation in lenders' supply. However, banks may lend more to female borrowers with higher skin for unobservable reasons, different from those theories of discrimination or asymmetric information. Such unobservable factors can include talent or quality that is observable to the bank but not captured in my data. Again, this would threaten identification only if the unobservables are correlated with both gender and the level of skin in the game. Specifically, it would have to be that additional collateral (or equity) makes banks lend more because it signals more favorable unobserved talent, and that this signaling is stronger for women than for men. This assumption is relatively mild compared to identifying single coefficients directly.

6 Results

This section presents the main findings regarding (i) the importance of collateral in reducing relative barriers to bank debt for women, (ii) the role of initial paid-up equity in access to bank debt, and (iii) performance outcomes of female- versus male-owned firms.

6.1 Collateral

Table 2 presents the results for the collateral proxied by the real estate of the firms. Panel A focuses on the intensive margin (firms with positive amount of real estate holdings), while Panel B includes all firms, including those without real estate. In this table the sample is restricted to single-owned firms, allowing precise identification of the owner's gender.

I first confirm the presence of the familiar collateral channel; for all firms, a higher value of real estate allows a firm to borrow more from its lenders. My main finding is that the collateral channel is more pronounced for female entrepreneurs. Specifically, a 10 percent increase in real estate value is associated with roughly *2.2 percentage points larger* increase in total bank debt for female-owned firms (2.3 p.p. for long-term bank debt). This effect is approximately *twice* as large as that for male-owned firms (for whom a 10 percent increase in collateral corresponds to a 2 percentage points increase in total debt). Finally, I find that collateral generally does not have an economically significant effect on short-term debt financing. This result is reassuring as a placebo test, since real estate is typically pledged to secure long-term rather than short-term credit (Jiménez et al., 2006).

[Insert Table 2 about here]

Note that in these tables, following Chaney et al. (2012), I exclude firms in the construction and real estate sectors, for which property constitutes part of core operations rather than an exogenous collateral buffer. Including them would mechanically link the real estate to production technology and can bias the interpretation of the collateral channel.

I next extend the analysis to multiple-owned firms, defining majority-female-owned firms based on absolute majority (*Majority-female*). My results are confirmed in this broader sample, too. As shown in Table 3, collateral remains strongly associated with increased long-term and total bank debt, and this relationship is significantly stronger for majority-female firms: the interaction term *Majority-female* $\times$ *Log(Real estate)* is positive and highly significant in all specifications.

[Insert Table 3 about here]

These patterns are similar to those in Table 2, and in addition corroborate the finding that real-estate collateral operates primarily through longer-maturity credit, with a steeper supply response for female-led firms. The gender differential is most pronounced in the early years after establishment and attenuates with firm age, consistent with declining information frictions throughout the relationship life-cycle.[12]

6.2 Equity

Table 4 examines the role of skin in the game in the form of paid-up equity for single-owned firms. I find that among young single-owned firms, a one-standard-deviation increase in the skin ratio (equivalent to 0.46) is associated with 2 percent (0.044*0.46) increase in total debt for male-owned firms. The effect on short-term debt is comparable, while on long-term debt alone it is not statistically significant in the short run.

The increase in total debt is more pronounced for female-owned firms and statistically significant across all specifications in the initial three years. For total debt, the difference amounts to 4.65 percent increase during the initial three years and 5.1 percent points increase in the long-term.

[Insert Table 4 about here]

In Panel B, I present the results from analogue empirical specifications for multiple-owned firms. Qualitatively, results are similar. Moreover, one can see that the effects are at least 1.2 (between 1.2 and 1.6) times more pronounced.

6.3 Performance

Could it be that banks extend less credit to women for rational reasons? For instance, one potential concern is that female-owned firms may exhibit weaker fundamentals. The analyses in this subsection provide evidence on firm performance and risk, measured by return on assets (ROA) and sales volatility respectively, allowing me to assess whether the observed gender gap

[12] Firm's dependency on collateral for access to credit diminishes over time; however, the elasticity of debt to collateral for male-owned firms (which often increases over time in most specifications) can reflect the effect of collateral quality: as firms age and accumulate more tangible, redeployable real estate, lenders view this collateral as more liquid and extend larger loans per unit of its value (Benmelech and Bergman, 2011).

in credit access reflects underlying performance differences.

In Table 5, I examine the performance of single-owned firms by the gender of the owner. Columns 1 to 3 of Panel A show that, after controlling for relevant covariates, female-owned firms underperform by 0.9 to 1.9 percentage points in terms of ROA. In all specification lagged leverage impacts negatively on ROA, possibly reflecting risk shifting by male-owned firms. However, a key result present in columns 4 to 6 is that the interaction term *Female* $\times$ *Leverage* is positive and statistically significant. This shows that female entrepreneurs exhibit higher marginal returns to additional debt: they are more constrained, and could realize *higher NPV* projects compared to their male counterparts if they were granted access to more credit.

[Insert Table 5 about here]

The effect is economically meaningful as well: a one-standard-deviation higher leverage reduces the initial performance gap by about 80 percent based on column 4 ($\frac{4.74*0.003}{0.017}$). The same number is about 90 percent based on column 6.

Then, I repeat the analysis for multiple-owned firms in Table 6. I observe qualitatively similar results for these firms. Quantitatively, since majority-female-owned firms' performance is much lower without leverage (row 1, in column 4), a one-standard-deviation increase of leverage closes a smaller percentage of the gap, specifically approximately 40 percent of it.[13]. In addition, I redo the analysis in the Appendix Table A4, by winsorizing variables at the 5 percent: standard deviation of leverage in this case drops to about 1.7, and the economic significance of the effect remains comparable.

[Insert Table 6 about here]

Next, I check if better performance is also associated with more risk-taking by female single owners. In Panel B of Table 5 I show that female-led firms are not riskier either, as measured by volatility of sales. Moreover, the interaction coefficient in columns 4-6 also shows that the marginal projects more indebted women carry out are, again, not riskier. Therefore, to the

[13] I also examine asset growth as an alternative measure of firm performance. The results in Table A3 show no significant differences in asset growth between male- and female-owned firms.

extent that the total debt gap is due to supply, this result points to the fact that banks may not be acting rationally: the marginal benefit they get from lending an additional dollar to female entrepreneurs surpasses that from lending to their male counterparts.

The back-of-the-envelope calculation of gains from closing the leverage gap is presented in Appendix C.

6.4 Robustness Checks

To address the concern that the observed differences in access to finance between female-owned and male-owned firms could be driven by inherent differences between these firms, rather than by the gender of the owner, I match firms using propensity score matching (PSM). This method allows for the comparison of firms that are similar in all observed characteristics except for the gender of the owner, thereby isolating the impact of gender on access to finance.

The propensity score is the probability of a unit being assigned to a particular treatment given a set of observed covariates. In my context, the treatment is being a female-owned firm. For the covariates, I include variables that are likely to influence both the likelihood of a firm being female-owned and its access to finance. These variables include firm size, sales, industry sector, as well as the age of the entrepreneur. I estimate the propensity scores using a logistic regression model, where the dependent variable is a binary indicator of whether the firm is female-owned. After estimating the propensity scores, I use nearest neighbor matching—originally suggested by Rosenbaum and Rubin (1983)—to pair each female-owned firm with one male-owned firm that has the closest propensity scores. This matching is done without replacement to ensure that each control firm is used only once. The matching procedure effectively balances the covariates between the treated and control groups, since the standardized differences for each covariate after matching are less than 5% (Figure A2). The reduction in standardized differences after matching demonstrates the effectiveness of the matching procedure in balancing the covariates between the treated (female-owned) and control (male-owned) firms (Figure A2).

After matching, I re-estimate the impact of collateral value and paid-up equity on access to bank debt, focusing on the matched sample. This allows for a more accurate estimation of the gender effect by comparing firms that are similar in all other observed aspects. PSM results

confirm the robustness of my initial findings—the intensity of the collateral channel is twice as large for women as for men during the first three years following a firm's establishment (Table 7). It provides strong evidence that the observed differences in access to finance between female-owned and male-owned firms are not merely driven by other observable firm characteristics. By matching firms on a comprehensive set of covariates, this analysis isolates the gender effect and reaffirms the importance of collateral in improving access to finance for female entrepreneurs.

[Insert Table 7 about here]

To ensure that my results are not driven by very small firms, I perform several robustness checks excluding candidate small firms. In particular, I exclude single-owner firms with only one employee, as well as firms whose assets and sales fall below the 10th percentile of their respective distributions. These exclusions result in only negligible changes in the main findings (Table A5). Additionally, I conduct a "leave-one-industry-out" analysis and find that the results remain stable regardless of the inclusion or exclusion of any particular industry.

As a further placebo test, I use statutory minimum share capital requirements for private limited companies (AS) in Norway. This minimum was NOK 100,000 until 2012, when a reform lowered it to NOK 30,000. Figure A3 shows the distribution of initial paid-up equity in 2011 and in 2012, with vertical lines marking the corresponding legal thresholds. Even after the reform, there remains substantial bunching around the new minimum, indicating that many firms continued to contribute only the legally required amount.[14] Figure A4 further shows that year-on-year growth in firm entry was particularly pronounced among firms contributing the minimum capital, especially those owned by women.

I categorize firms that contributed only the new statutory minimum as the placebo group, reflecting compliance with the legal floor but little discretionary signaling (i.e., not treated by underlying theories). Those contributing more are not constrained by regulatory minimum and thus are eligible for testing the discussed hypotheses concerning their equity choices (i.e.,

[14] This pattern is consistent with recent findings by Bacher et al. (2025), who also document that the 2012 reform increased entry substantially but did not change the characteristics or quality of post-reform entrants.

"treated" by the underlying theories); it is precisely this group for which additional equity should reflect an endogenous decision to signal quality or commitment.[15]

It should be noted that the coefficients on *Skinratio* and its interaction with *Female* are positive but statistically insignificant (Table 8). Firms operating exactly at the statutory minimum capital requirement primarily reflect compliance with regulation rather than discretionary signaling. Nevertheless, even among these firms, some variation in equity may still capture underlying quality or commitment, particularly for women. Hence, these firms can be viewed as "partially treated": their equity reflects both regulatory compliance and, to a limited extent, endogenous signaling motives.

[Insert Table 8 about here]

Using various definitions of control firms (exact match, ±10%, ±20% of the minimum), I find that within this placebo group, the gender gap in paid-up equity has no significant effect on outcomes, indicating that near the legal minimum, capital constraints impact male and female entrepreneurs similarly (Table 8). In contrast, among treated firms, those that contribute equity beyond the minimum and for whom skin in the game can serve as a signal, paid-up equity plays a more important role for female entrepreneurs.

Overall, these robustness and placebo tests strengthen the validity of my conclusions.

7 External Validity

For the external validity checks, I use the World Bank Group data on Women, Business, and the Law (WBL) that measures laws and regulations that affect women's economic opportunity in 190 economies. Specifically, I use the Women, Business and the Law: Entrepreneurship Indicator or *WBL Ent*, a metric ranging from 1 to 100, to assess the legal constraints faced by women in initiating and managing a business across 190 economies. This indicator is derived from an unweighted average of four key components, each contributing equally (25 points) to the overall score, thus scaling the final result to 100. These components are as follows:

[15] In unreported regressions, I also show that the results from this analysis are similar for long-term debt separately, as well as for multiple-owned firms with majority female ownership being the identifier for female-owned.

- The ability of a woman to legally sign a contract in an equivalent manner to a man, denoted as *"A woman can sign a contract."*
- The legal provision for a woman to register a business on the same terms as a man, referred to as *"A woman can register a business"* or just *"Register business."*
- The equality of opportunity for a woman to open a bank account as compared to a man, indicated by *"A woman can open a bank account"* or just *"Open account."*
- The presence of laws that explicitly prohibit discrimination in accessing credit on the basis of gender, captured by *"The law prohibits discrimination in credit access"* or just *"Get credit."*

[Insert Table 9 about here]

To study gender equality in property ownership rights, I take a binary indicator, *Equal property rights*, (1 for yes; 0 for no). This metric assesses the absence of legal restrictions on property ownership and administration based on gender, including any disparities in the treatment of spousal property and cases where customary practices and judicial precedents influence legal systems. Table 9 provides summary statistics for the variables used in my analysis in this section.

I find that in countries where women and men enjoy equal rights to immovable property—referred to as Equal property rights—there exists a more conducive environment for female entrepreneurship, as assessed by WBL index[16], WBL Ent and its components. Table 10 demonstrates my results. It shows that in countries with equal property rights, the average Women, Business and the Law: Entrepreneurship Indicator is 25 points higher, amounting to one quarter of the maximum value of WBL Ent. Countries with equal property rights for women are 44 percentage points more likely to have laws explicitly forbidding gender-based discrimination in accessing credit.

[Insert Table 10 about here]

[16]The Women, Business and the Law index or WBL index (0-100) evaluates legal impacts on women's economic opportunities, using eight indicators to score gender disparities, where higher scores signify better conditions for women's participation.

8 Discussion

I investigate gender differences in access to bank financing. The findings support the hypothesis that female entrepreneurs get more external funding with enough skin in the game. However, alternative mechanisms may underlie this pattern, which I discuss to better interpret the results.

As mentioned in the hypothesis development, three competing theories may explain gender differences in access to credit. While the evidence does not allow me to fully accept or reject any of them, I argue below that some mechanisms play a more crucial role than others.

My empirical evidence points to two robust facts. First, the gender differential in the collateral channel is strong for young firms but (relatively) declines with firm age or relationship length, indicating that lenders' reliance on collateral as a gender-specific screen fades over time (Tables 2 and 3). Second, conditional on receiving more debt, female-led firms exhibit higher marginal returns, as shown by the positive and significant coefficient on the interaction between Female and Leverage, without exhibiting higher volatility. This implies that the marginal projects financed for women have higher NPV and yet not riskier (Tables 5 and 6).

A taste-based discrimination bias alone is unlikely to explain these dynamics. Banks with taste-based bias, meaning those that simply dislike lending to women, would imply a stable and persistent wedge that remains unaffected by the length of the lending relationship. In contrast, the collateral effect for women declines as lenders observe more firm-level outcomes and learn about borrower quality. This convergence over time is therefore inconsistent with a static taste-based penalty. While a small taste component cannot be fully ruled out, it is unlikely to be the primary explanation.

My findings also challenge a model of fully rational statistical discrimination. Under rational beliefs, lenders correctly anticipate the expected performance of each group. If this were the case, and as long as it is bank supply that accounts for the key result—the differential strength of the collateral and equity channels—the marginal return on debt should be similar for women and men. Instead, I find the opposite: female-led firms achieve higher returns from an additional unit of debt while displaying no additional risk. This indicates that lenders underestimate the

quality of women's projects ex ante, contrary to what would be predicted by a purely rational expectation framework.[17]

The evidence is most consistent with a mechanism of statistical discrimination with biased priors about women's entrepreneurial ability that gradually updates with experience. Lenders begin with highly pessimistic beliefs, which translate into stricter credit constraints for women. Skin in the game, in the form of collateral or paid-up equity, works through two margins: it mitigates standard agency problems and counteracts biased priors by providing credible, entrepreneur-specific information. As banks acquire firm-specific knowledge and observe realized performance, their priors adjust, and the need for gender-contingent screening declines. This dynamic learning process explains both the attenuation of the gender gap in the collateral channel and the higher marginal returns to female borrowing.

Could other explanations be at play? Behavioral demand factors may also contribute to gender gaps in financing. Niederle and Vesterlund (2007) show that women, even when equally skilled, are less likely than men to enter competitive environments—a pattern often linked to higher risk aversion and lower confidence rather than ability differences. Similarly, Cota et al. (2025) find that women save more conservatively over the life cycle due to lower financial literacy, which could translate into more cautious borrowing behavior. Such preferences could, in principle, lead women to demand less external debt or expand credit relationships more cautiously. Hence, while gender differences in preferences and credit demand may play some role, they cannot account for the patterns observed in my analysis. The gender differential in the collateral channel declines with relationship length, and the *Female* $\times$ *Leverage* estimates show higher marginal returns to debt for women without greater risk. Moreover, the slope of credit with respect to pledgeable skin (collateral, paid-up equity) is steeper for women. Even if women demanded less debt, the fact that additional collateral or equity unlocks more credit for women than for men (only for pledgeable assets and especially at early relationships) points to a lender-side screen that relies more heavily on women's skin in the game, i.e., a supply mechanism that weakens as information accumulates.

[17] An implicit assumption here is that higher ROA for female borrowers also translates into higher returns for banks from lending to them. Consequently, the unequal marginal benefits from lending to the two groups mean an irrational supply choice by banks. This assumption is innocuous since women are more credit constrained, their bargaining power vis-à-vis banks is likely lower, not higher, so the observed differences should be attributed to women capturing a larger share of surplus.

My study indicates that a nuanced strategy tailored to gender-specific constraints is essential for policymakers. The results show that lenders rely disproportionately on women's collateral and equity as signals of creditworthiness. Policies that relax these signaling needs, such as targeted credit subsidies, collateral guarantees, or measures that strengthen women's access to wealth or collateral, can therefore improve women's ability to secure external financing.

9 Concluding Remarks

In this paper, I study the role of skin in the game in reducing the gender financing gap. My focus is on debt from financial institutions. My main finding is that providing more skin in the game—either in the form of collateral or paid-up equity—helps women to acquire *more* funds than men. This finding is also in line with my cross-country analysis of property rights changes and their impact on the entrepreneurial environment for women.

The study is important for several reasons. Firstly, the gender financing gap is substantial. Secondly, bank financing remains a key source of funding for business formation. Lastly, the results of the study highlight the need for policies that address the financial barriers faced by women in entrepreneurship, such as more equal access to wealth and inheritance, credit subsidies and property rights improvements when necessary.

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Tables

Table 1: Summary statistics

This table reports summary statistics for Norwegian single-owned firms and their owners over the period 2003–2020. *Company age* is the number of years since establishment. *Total assets* represent the sum of current and fixed assets, while *Sales* measure the total value of goods and services sold. *Real estate* denotes the book value of property owned by the firm. *ST debt* is the short-term debt to financial institutions. *LT debt* is the long-term debt to financial institutions. *Total debt* is the sum of short-term and long-term debt to financial institutions. *Leverage* is defined as the debt-to-equity ratio. *ROA* (return on assets) is net income divided by total assets. *Female-owned* is a dummy variable equal to one if the single owner is female, and zero otherwise. *Owner's age* refers to the age of the individual owner. *Paid-up equity* represents the owner's capital contribution to the firm. *Skin (paid-up equity) ratio* measures the owner's paid-up equity relative to total assets and serves as an indicator of skin in the game. All variables are winsorized at the 1% level.

Panel A: Single-owned firms

	All single-owned firms				Young firms ($\leq$ 3*yrs*)			
	Mean	Std. Dev.	Median	N	Mean	Std. Dev.	Median	N
Company age	6.28	3.70	5.00	190,501	2.49	0.50	2.00	54,331
Total assets	3,801.52	59,164.34	996.00	190,501	1,673.39	10,767.21	623.00	54,331
Sales	2,437.22	8,909.59	1,140.00	190,501	1,888.66	3,730.83	1,037.00	54,331
Real estate	459.15	2,946.32	0.00	190,501	207.22	1,772.44	0.00	54,331
ST debt	50.77	1,189.17	0.00	190,501	25.99	416.01	0.00	54,331
LT debt	555.28	8,830.63	0.00	190,501	264.25	2,680.59	0.00	54,331
Total debt	605.97	9,057.19	0.00	190,501	290.18	2,734.88	0.00	54,331
Leverage (D/E)	0.59	4.22	0.00	190,501	0.72	4.74	0.00	54,331
ROA	0.01	0.62	0.08	190,501	-0.01	0.71	0.09	54,331
Female-owned	0.16	0.36	0.00	190,501	0.17	0.38	0.00	54,331
Owner's age	49.83	10.83	50.00	190,501	46.67	11.20	46.00	54,331
Paid-up equity	279.00	1,454.52	100.00	190,501	167.67	1,061.10	30.00	54,331
Skin ratio	0.25	0.49	0.09	189,544	0.28	0.46	0.12	54,041

Panel B: Comparison of single-owned firms by gender of owner

	N_F	N_M	$Mean_F$	$Mean_M$	Difference	t-value
Company age	29986	160515	5.901	6.356	-0.455***	-20.3
Total assets	29986	160515	1895.058	4157.670	-2262.612***	-12.9
Sales	29986	160515	1834.673	2549.786	-715.113***	-22
Real estate	29986	160515	257.498	496.824	-239.327***	-20.5
Log(Real estate)	29986	160515	0.66	0.982	-0.322***	-24.3
ST debt	29986	160515	23.137	55.937	-32.8**	-3.8
LT debt	29986	160515	219.403	618.025	-398.623***	-15.6
Total debt	29986	160515	242.501	673.875	-431.375***	-15.75
Leverage	29986	160515	0.373	0.635	-0.262**	-10.8
ROA	29986	160515	-0.045	0.018	-0.064***	-14.4
Owner's age	29986	160515	48.633	50.052	-1.419***	-22.15
Paid-up equity	29986	160515	178.62	297.750	-119.132***	-15.45
Skin ratio	29986	160515	0.311	0.233	0.079***	21.25

Table 2: The effect of collateral on debt financing of single-owned firms

This table reports the effects of collateral on debt financing among single-owned firms. Panel A reports results for firms that hold positive real estate assets, excluding those in the construction sector. Panel B includes all non-construction firms, regardless of whether they own real estate. The dependent variable in column 1 is *Log(ST debt)*, where ST debt is the short-term debt to financial institutions. The dependent variable in column 2 is *Log(LT debt)*, where LT debt is the long-term debt to financial institutions. The dependent variable in columns 3-6 is *Log(Total debt)*, where Total debt is the sum of short-term and long-term debt to financial institutions. Columns 1–3 focus on young firms up to three years after establishment; column 4 (column 5) extends the window to five (ten) years; and column 6 includes firms of all ages. *Log(Real estate)* proxies for the firm's available collateral. *Female* is a dummy equal to one if the single owner is female. The interaction term *Female* × *Log(Real estate)* captures the collateral effect specific to female-owned firms. All specifications include firm- and owner-level controls, year fixed effects, and sector fixed effects. Robust standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Firms with positive real estate holdings (excluding construction)

	(1)	(2)	(3)	(4)	(5)	(6)
	Log[ST debt]	Log[LT debt]	Log[Total debt]	Log[Total debt]		
	Young firms ($\leq$ 3yrs)			$\leq$ 5yrs	$\leq$ 10yrs	All ages
Female	-0.063	-0.780*	-0.692*	-1.023***	-1.320***	-1.454***
	[0.227]	[0.414]	[0.413]	[0.296]	[0.221]	[0.204]
Log[Real estate]	0.065***	0.232***	0.203***	0.264***	0.413***	0.425***
	[0.025]	[0.047]	[0.045]	[0.031]	[0.022]	[0.020]
Female x Log[Real estate]	-0.004	0.232***	0.218***	0.239***	0.246***	0.256***
	[0.046]	[0.073]	[0.072]	[0.050]	[0.036]	[0.033]
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Owner controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1965	1965	1965	4184	8981	12209
Adjusted R^2	0.08	0.26	0.28	0.27	0.25	0.23

Panel B: All non-construction firms (including firms without real estate)

	(1)	(2)	(3)	(4)	(5)	(6)
	Log[ST debt]	Log[LT debt]	Log[Total debt]	Log[Total debt]		
	Young firms ($\leq$ 3yrs)			$\leq$ 5yrs	$\leq$ 10yrs	All ages
Female	0.001	0.002	0.006	-0.038**	-0.113***	-0.144***
	[0.011]	[0.022]	[0.024]	[0.018]	[0.015]	[0.014]
Log[Real estate]	0.069***	0.358***	0.362***	0.376***	0.388***	0.385***
	[0.009]	[0.016]	[0.016]	[0.010]	[0.007]	[0.006]
Female x Log[Real estate]	-0.014	0.084***	0.085***	0.071***	0.061***	0.055***
	[0.019]	[0.032]	[0.031]	[0.021]	[0.014]	[0.013]
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Owner controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	38212	38212	38212	68080	110666	129101
Adjusted R^2	0.04	0.24	0.24	0.25	0.26	0.26

Table 3: The effect of collateral on debt financing of firms with multiple owners

This table reports the effects of collateral on debt financing among firms with multiple owners. Panel A reports results for firms that hold positive real estate assets, excluding those in the construction sector. Panel B includes all non-construction firms, regardless of whether they own real estate. The dependent variable in column 1 is *Log(ST debt)*, where ST debt is the short-term debt to financial institutions. The dependent variable in column 2 is *Log(LT debt)*, where LT debt is the long-term debt to financial institutions. The dependent variable in columns 3-6 is *Log(Total debt)*, where Total debt is the sum of short-term and long-term debt to financial institutions. Columns 1–3 focus on young firms up to three years after establishment; column 4 (column 5) extends the window to five (ten) years; and column 6 includes firms of all ages. *Log(Real estate)* proxies for the firm's available collateral. *Majority-female* is a dummy that takes value of 1 if the majority of firm is female-owned. The *Majority-female* × *Log(Real estate)* term shows results for the value of collateral for majority-female owned firms. All specifications include firm- and owner-level controls, year fixed effects, and sector fixed effects. Robust standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Firms with positive real estate holdings (excluding construction)

	(1)	(2)	(3)	(4)	(5)	(6)
	Log[ST debt]	Log[LT debt]	Log[Total debt]	Log[Total debt]		
	Young firms ($\leq$ 3yrs)			$\leq$ 5yrs	$\leq$ 10yrs	All ages
Majority-female	0.154	-2.130***	-1.981***	-1.802***	-1.902***	-1.814***
	[0.169]	[0.305]	[0.304]	[0.233]	[0.173]	[0.152]
Log[Real estate]	0.032*	0.144***	0.106***	0.151***	0.235***	0.302***
	[0.017]	[0.030]	[0.029]	[0.021]	[0.016]	[0.014]
Majority-female x Log[Real estate]	-0.017	0.486***	0.458***	0.372***	0.361***	0.338***
	[0.030]	[0.050]	[0.049]	[0.040]	[0.029]	[0.024]
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6022	6022	6022	11924	23903	31070
Adjusted R^2	0.11	0.19	0.22	0.18	0.16	0.17

Panel B: All non-construction firms (including firms without real estate)

	(1)	(2)	(3)	(4)	(5)	(6)
	Log[ST debt]	Log[LT debt]	Log[Total debt]	Log[Total debt]		
	Young firms ($\leq$ 3yrs)			$\leq$ 5yrs	$\leq$ 10yrs	All ages
Majority-female	-0.007	-0.018	-0.032*	-0.071***	-0.127***	-0.140***
	[0.009]	[0.017]	[0.018]	[0.014]	[0.012]	[0.011]
Log[Real estate]	0.049***	0.252***	0.248***	0.268***	0.288***	0.306***
	[0.005]	[0.009]	[0.009]	[0.006]	[0.004]	[0.004]
Majority-female x Log[Real estate]	-0.007	0.181***	0.174***	0.120***	0.110***	0.105***
	[0.011]	[0.020]	[0.019]	[0.015]	[0.010]	[0.009]
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Owner controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	85030	85030	85030	141256	220934	256228
Adjusted R^2	0.05	0.23	0.24	0.25	0.25	0.26

Table 4: The effect of paid-up equity

This table reports the effects of paid-up equity on firms' bank debt. Panel A presents results for single-owned firms, and Panel B for firms with multiple owners. The dependent variable is debt to financial institutions. Columns 1 and 4 report results for *Log(ST debt)*, where ST debt denotes short-term debt to financial institutions. Columns 2 and 5 report results for *Log(LT debt)*, where LT debt denotes long-term debt to financial institutions. Columns 3 and 6 use *Log(Total debt)* as the dependent variable, where total debt equals the sum of short-term and long-term debt. Columns 1–3 focus on young firms up to three years after establishment, while columns 4–6 include firms of all ages. *Skin ratio* is defined as paid-up equity divided by total assets. *Female* equals one if the single owner is female, and *Majority-female* equals one if the majority ownership of the firm is held by women. The interaction terms *Female × Skin ratio* and *Majority-female × Skin ratio* capture gender-specific effects of paid-up equity on firms' access to debt financing. All specifications include firm- and owner-level controls, year fixed effects, and sector fixed effects. Robust standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Single-owned firms

	(1)	(2)	(3)	(4)	(5)	(6)
	Log[ST debt]	Log[LT debt]	Log[Total debt]	Log[Total debt]		
	Young firms ($\leq$ 3yrs)			$\leq$ 5yrs	$\leq$ 10yrs	All ages
Female	-0.009	-0.034	-0.027	-0.071***	-0.141***	-0.166***
	[0.013]	[0.028]	[0.029]	[0.022]	[0.018]	[0.017]
Skin ratio	0.045***	0.023	0.044**	0.058***	0.054***	0.066***
	[0.009]	[0.020]	[0.020]	[0.016]	[0.013]	[0.012]
Female x Skin ratio	0.030*	0.107***	0.101***	0.107***	0.118***	0.109***
	[0.018]	[0.030]	[0.033]	[0.026]	[0.020]	[0.019]
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Owner controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	54041	54041	54041	97061	160363	189544
Adjusted R^2	0.05	0.26	0.27	0.28	0.29	0.29

Panel B: Firms with multiple owners

	(1)	(2)	(3)	(4)	(5)	(6)
	Log[ST debt]	Log[LT debt]	Log[Total debt]	Log[Total debt]		
	Young firms ($\leq$ 3yrs)			$\leq$ 5yrs	$\leq$ 10yrs	All ages
Majority-female	-0.051***	-0.137***	-0.172***	-0.185***	-0.199***	-0.213***
	[0.015]	[0.028]	[0.029]	[0.022]	[0.018]	[0.017]
Skin ratio	0.018	0.058**	0.057**	0.068***	0.085***	0.107***
	[0.020]	[0.028]	[0.028]	[0.025]	[0.022]	[0.020]
Majority-female x Skin ratio	0.153***	0.183***	0.176***	0.155***	0.161***	0.149***
	[0.036]	[0.057]	[0.065]	[0.052]	[0.041]	[0.036]
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Owner controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	53719	53719	53719	90078	143564	168987
Adjusted R^2	0.06	0.29	0.30	0.31	0.30	0.30

Table 5: Performance of single-owned firms

This table reports the relationship between firm performance, risk, and gender ownership among single-owned firms. Panel A examines firm performance, measured by return on assets (ROA), while Panel B focuses on firm risk, measured by sales volatility. Columns 1 and 4 present results for firms up to three years after establishment; columns 2 and 5 extend the window to five years; and columns 3 and 6 include firms of all ages. *Female* is a dummy equal to one if the single owner is female. *Leverage* is defined as the firm's debt-to-equity ratio, and the interaction term *Female* × *Leverage* captures the efficiency of debt use by female-owned firms. All specifications include firm- and owner-level controls, year fixed effects, and sector fixed effects. Robust standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Profitability

	ROA					
	(1) $\leq 3yrs$	(2) $\leq 5yrs$	(3) All	(4) $\leq 3yrs$	(5) $\leq 5yrs$	(6) All
Female	-0.016*	-0.019***	-0.009**	-0.017*	-0.019***	-0.010**
	[0.009]	[0.006]	[0.004]	[0.009]	[0.006]	[0.004]
Leverage	-0.003***	-0.003***	-0.002***	-0.004***	-0.003***	-0.002***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Female x Leverage				0.003***	0.002***	0.002***
				[0.001]	[0.001]	[0.001]
Log[Real estate]	-0.050***	-0.041***	-0.028***	-0.050***	-0.041***	-0.028***
	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]	[0.000]
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Owner controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	54331	97581	190501	54331	97581	190501
Adjusted R^2	0.16	0.14	0.12	0.16	0.14	0.12

Panel B: Risk

	Sales volatility					
	(1) $\leq 3yrs$	(2) $\leq 5yrs$	(3) All	(4) $\leq 3yrs$	(5) $\leq 5yrs$	(6) All
Female	-28.312	-6.205	30.005*	-22.437	-3.452	31.382*
	[21.088]	[18.145]	[18.029]	[21.157]	[18.258]	[17.565]
Leverage	-1.318	-3.870*	-5.706**	0.324	-2.994	-5.269**
	[2.819]	[2.005]	[2.628]	[3.228]	[2.244]	[2.686]
Female x Leverage				-11.776***	-6.664**	-3.457
				[4.115]	[3.228]	[6.285]
Log[Real estate]	-94.828***	-77.958***	-58.806***	-95.103***	-78.091***	-58.815***
	[9.769]	[8.298]	[5.337]	[9.782]	[8.306]	[5.338]
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Owner controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	54311	97554	190460	54311	97554	190460
Adjusted R^2	0.09	0.09	0.03	0.09	0.09	0.03

Table 6: Performance of firms with multiple owners

This table reports the relationship between firm performance, risk, and gender ownership among firms with multiple owners. Panel A examines firm performance, measured by return on assets (ROA), while Panel B focuses on firm risk, measured by sales volatility. Columns 1 and 4 present results for firms up to three years after establishment; columns 2 and 5 extend the window to five years; and columns 3 and 6 include firms of all ages. *Majority-female* is a dummy that takes a value of 1 if the majority of firm is female-owned. *Leverage* is defined as the firm's debt-to-equity ratio. The interaction term *Majority-female* × *Leverage* captures the efficiency of debt use by firms with majority female ownership. All specifications include firm- and owner-level controls, year fixed effects, and sector fixed effects. Robust standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Profitability

	ROA					
	(1) $\leq$ 3*yrs*	(2) $\leq$ 5*yrs*	(3) All	(4) $\leq$ 3*yrs*	(5) $\leq$ 5*yrs*	(6) All
Majority-female	-0.058***	-0.034***	-0.013***	-0.061***	-0.036***	-0.014***
	[0.006]	[0.005]	[0.003]	[0.006]	[0.005]	[0.003]
Leverage	-0.002***	-0.001***	-0.001***	-0.002***	-0.002***	-0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Majority-female x Leverage				0.004***	0.002***	0.001***
				[0.000]	[0.000]	[0.000]
Log[Real estate]	-0.049***	-0.041***	-0.027***	-0.049***	-0.041***	-0.027***
	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]	[0.000]
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Owner controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	121362	203561	380740	121362	203561	380740
Adjusted R^2	0.15	0.14	0.11	0.15	0.14	0.11

Panel B: Risk

	Sales volatility					
	(1) $\leq$ 3*yrs*	(2) $\leq$ 5*yrs*	(3) All	(4) $\leq$ 3*yrs*	(5) $\leq$ 5*yrs*	(6) All
Majority-female	-112.970***	-91.599***	-74.372***	-113.360***	-92.435***	-75.188***
	[19.417]	[15.819]	[14.859]	[19.484]	[15.885]	[14.586]
Leverage	-9.902***	-9.881***	-11.322***	-9.977***	-10.057***	-11.508***
	[1.640]	[1.356]	[1.664]	[1.804]	[1.471]	[1.708]
Majority-female x Leverage				0.638	1.550	1.660
				[2.972]	[2.568]	[3.851]
Log[Real estate]	-138.916***	-115.242***	-90.007***	-138.914***	-115.236***	-90.010***
	[7.901]	[6.644]	[4.367]	[7.901]	[6.644]	[4.367]
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Owner controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	88319	148604	276789	88319	148604	276789
Adjusted R^2	0.09	0.10	0.05	0.09	0.10	0.05

Table 7: The effect of collateral for single-owned young firms: matched subsample

This table shows results for the subsample of female-owned and male-owned young firms (up to 3 years after the establishment) matched on firm size, sales, industry sector, real estate amount, as well as the age of the entrepreneur. The dependent variable is debt to financial institutions. The dependent variable in column 1 is *Log(ST debt)*, where ST debt is the short-term debt to financial institutions. The dependent variable in column 2 is *Log(LT debt)*, where LT debt is the long-term debt to financial institutions. The dependent variable in column 3 is *Log(Total debt)*, where Total debt is the sum of short-term and long-term debt to financial institutions. *Log(Real estate)* proxies for the firm's available collateral. *Female* is a dummy equal to one if the single owner is female. The interaction term *Female* × *Log(Real estate)* captures the collateral effect specific to female-owned firms. he sample includes only firms with positive real estate holdings and excludes those in the construction sector. All specifications include firm- and owner-level controls, year fixed effects, and sector fixed effects. Robust standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1) Log[ST debt]	(2) Log[LT debt]	(3) Log[Total debt]
Female	-0.087	-0.592	-0.568
	[0.274]	[0.454]	[0.461]
Log[Real estate]	0.010	0.212***	0.153**
	[0.041]	[0.076]	[0.075]
Female x Log[Real estate]	0.017	0.176**	0.172*
	[0.053]	[0.088]	[0.088]
Firm controls	Yes	Yes	Yes
Owner controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Observations	1007	1007	1007
Adjusted R^2	0.09	0.32	0.33

Table 8: Minimum capital requirement changes and the effect of paid-up equity

This table examines the role of paid-up equity in firms' debt financing using variation from Norway's minimum capital requirement law and its reform. The dependent variable is total debt from financial institutions. Control firms are those whose initial paid-up equity equals or is near the minimum capital requirement; all others are treated by my theory. Column 1 define control as firms exactly at the requirement (NOK 100,000 pre-2012; NOK 30,000 from 2012). Column 2 defines the control group as all firms below the minimum capital requirement together with firms up to 10% above the threshold ($\leqslant$ 110,000 pre-2012; $\leqslant$ 33,000 from 2012). Columns 3 defines the control group as all firms below the minimum capital requirement together with firms up to 10% above the threshold ($\leqslant$ 120,000 pre-2012; $\leqslant$ 36,000 from 2012). Firms with initial paid-up equity less than the legal requirement are dropped. Skin ratio is the ratio of the paid-up equity to total assets. Female is a dummy that takes value of 1 if the single owner of the firm is a female. The specification includes company and owner-related controls, year and sector fixed effects. Robust standard errors are in parentheses. The symbols ***, **, and * denote statistical significance at the 1%, 5% and 10% level.

	Log[Total Debt]		
	(1)	(2)	(3)
	Min.Cap.Req.	$\pm 10\% Min.CapReq.$	$\pm 20\% Min.CapReq.$
Female	0.056	-0.037	0.061
	(0.040)	(0.038)	(0.038)
Skin ratio	0.031	0.024	0.033
	(0.028)	(0.027)	(0.027)
Female x Skin ratio	0.056	0.064	0.063
	(0.048)	(0.046)	(0.045)
Female x Treat1	0.028		
	(0.048)		
Treat1 x Skin ratio	0.062**		
	(0.030)		
Female x Skin ratio x Treat1	0.138*		
	(0.072)		
Female x Treat2		0.063*	
		(0.037)	
Treat2 x Skin ratio		0.049**	
		(0.024)	
Female x Skin ratio x Treat2		0.142*	
		(0.073)	
Female x Treat3			0.042
			(0.065)
Treat3 x Skin ratio			0.060**
			(0.029)
Female x Skin ratio x Treat3			0.149**
			(0.074)
Firm controls	Yes	Yes	Yes
Owner controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Observations	54041	54041	54041
Adjusted R^2	0.23	0.23	0.23

Table 9: Summary statistics of property rights and female entrepreneurship

This table reports summary statistics for key variables capturing women's property rights, financial independence, and entrepreneurial activity. *Equal property rights* equals one if women have the same ownership rights to immovable property as men. *WBL Entrepreneurship Indicator (WBL Ent)* measures the legal constraints faced by women in starting and managing a business. It is calculated as the unweighted average of four equally weighted components (25 points each), with scores ranging from 1 to 100. Register business measures whether a woman can legally register a business on the same terms as a man. *Open account* captures the legal right of a woman to open a bank account under the same conditions as a man. *Get credit* reflects whether laws prohibit discrimination in access to credit based on gender. *The Women, Business and the Law (WBL) Index* (0–100) assesses legal barriers to women's economic participation across eight domains, where higher scores indicate better legal conditions for women. *Number of female business owners* refers to the number of women owning at least a share in newly registered limited liability companies within a given year. *Share of female business owners* is the percentage of newly registered limited liability companies that are female-owned. *Firms with female ownership* denote the percentage of firms with at least one woman as a principal owner, while *Firms with female top manager* represent the percentage of firms with a woman as their top manager. *Women who own a house alone* refers to the share of women aged 15–49 who solely own a legally registered house, and *Women who own a house jointly* indicates shared ownership of a house within the same age group. *Women who own land alone* denotes the share of women aged 15–49 who exclusively own legally registered land in their name, and *Women who own land jointly* refers to those sharing ownership of legally registered land.

	Mean	Std. Dev.	Median	N
Equal property rights	0.86	0.35	1.00	4275
WBL Entrepreneurship Indicator	78.54	18.62	75.00	4275
A woman can sign a contract	0.28	0.45	0.00	4275
A woman can register a business	0.97	0.16	1.00	4275
A woman can open a bank account	0.95	0.22	1.00	4275
The law prohibits discrimination	0.94	0.23	1.00	4275
WBL Index	69.10	18.24	71.25	4275
Number of female business owners	8445.35	23115.92	2215.00	223
Share of female business owners	21.73	9.20	21.16	223
Firms with female ownership	33.97	14.93	33.50	317
Firms with female top manager	18.21	9.37	17.40	231
Women who own a house alone	8.25	7.30	6.70	80
Women who own a house jointly	22.27	14.35	19.70	80
Women who own land alone	7.99	6.44	6.90	75
Women who own land jointly	16.07	11.87	14.60	75

Source: World Bank's Gender Data Portal and Women, Business and the Law.

Table 10: Property rights and female entrepreneurship

The table shows the correlation between property rights of women and female entrepreneurship. The independent variable in Panel A is *Equal property rights* that takes value of 1 if women had equal ownership rights to immovable property in country i in the previous year *t-1*. The independent variable in Panel B is *Introduction* that takes value of 1 if equal property rights were introduced in that country i in the previous year *t-1*. *Women, Business and the Law: Entrepreneurship Indicator* or *WBL Ent* assesses the legal constraints faced by women in initiating and managing a business. This indicator is derived from an unweighted average of four key components, each contributing equally (25 points) to the overall score, ranging from 1 to 100. *Register business* measures the legal provision for a woman to register a business on the same terms as a man. *Open account* measures the equality of opportunity for a woman to open a bank account as compared to a man. *Get credit* measures the presence of laws that explicitly prohibit discrimination in accessing credit on the basis of gender. *The Women, Business and the Law index* or *WBL index* (0-100) evaluates legal impacts on women's economic opportunities, using eight indicators to score gender disparities, where higher scores signify better conditions for women's participation. All specifications include country and year fixed effects. Robust standard errors are in parentheses. The symbols ***, **, and * denote statistical significance at the 1%, 5% and 10% level.

Panel A: Equal property rights

	(1) WBL Ent	(2) Register business	(3) Open account	(4) Get credit	(5) WBL index
Equal property rights	24.754***	0.362***	0.345***	0.441***	11.680***
	[2.870]	[0.040]	[0.041]	[0.043]	[1.054]
Year FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Observations	4104	4104	4104	4104	4104
Adjusted R^2	0.81	0.80	0.87	0.89	0.93

Panel B: Introduction of equal property rights

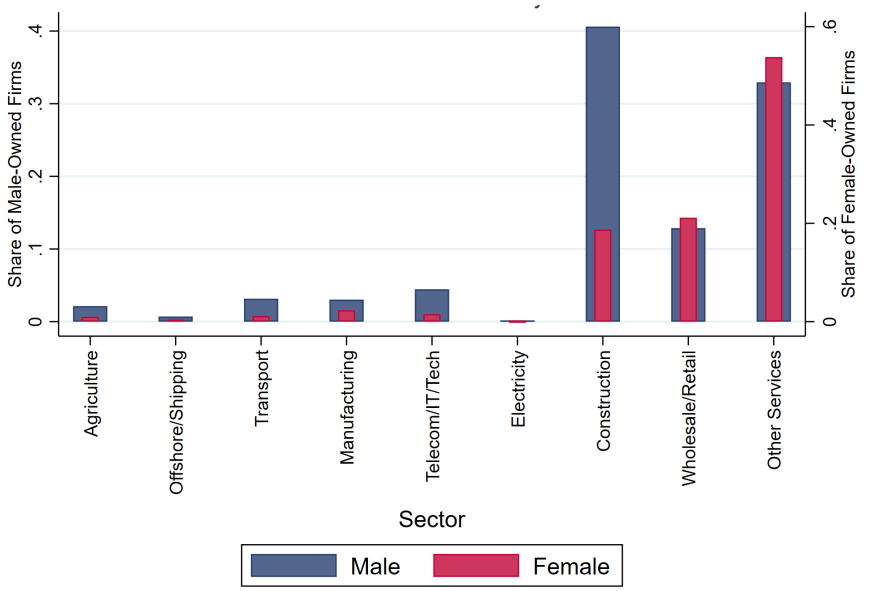
	(1) WBL Ent	(2) Register business	(3) Open account	(4) Get credit	(5) WBL index
Introduction of equal property rights	13.064***	0.122***	0.108***	0.199***	5.039**
	[3.282]	[0.046]	[0.037]	[0.065]	[2.303]
Year FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Observations	4104	4104	4104	4104	4104
Adjusted R^2	0.79	0.72	0.83	0.84	0.92

Appendix-A

Figure A1: Distribution of firms by sector and gender of the owner

Panel A displays the sectoral distribution of single-owned firms by gender, showing how male- and female-owned firms are distributed across sectors. Panel B shows the gender composition within each sector, ordered by the share of female-owned firms. Circles indicate the proportion of firms owned by women in each sector.

Panel A: Sector distribution of firms by gender



Panel B: Gender composition across sectors

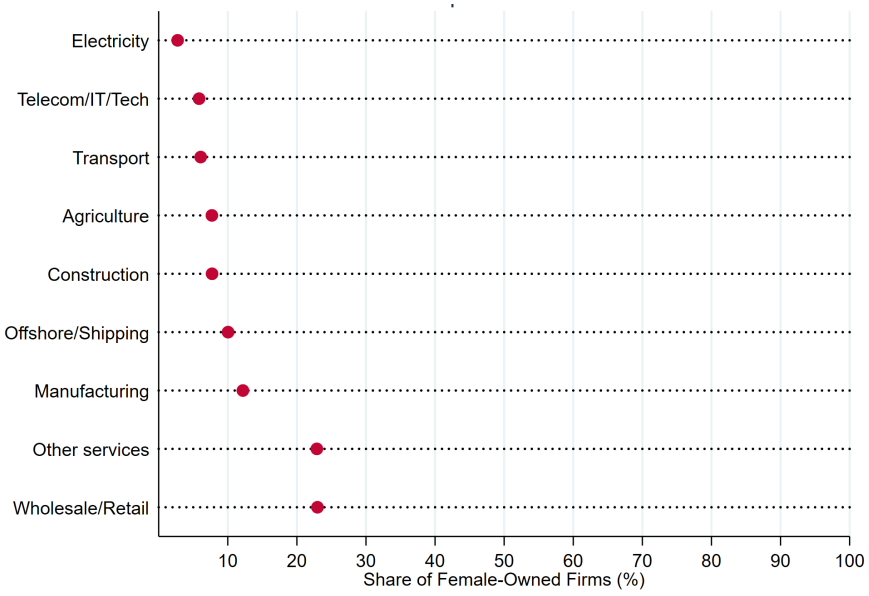
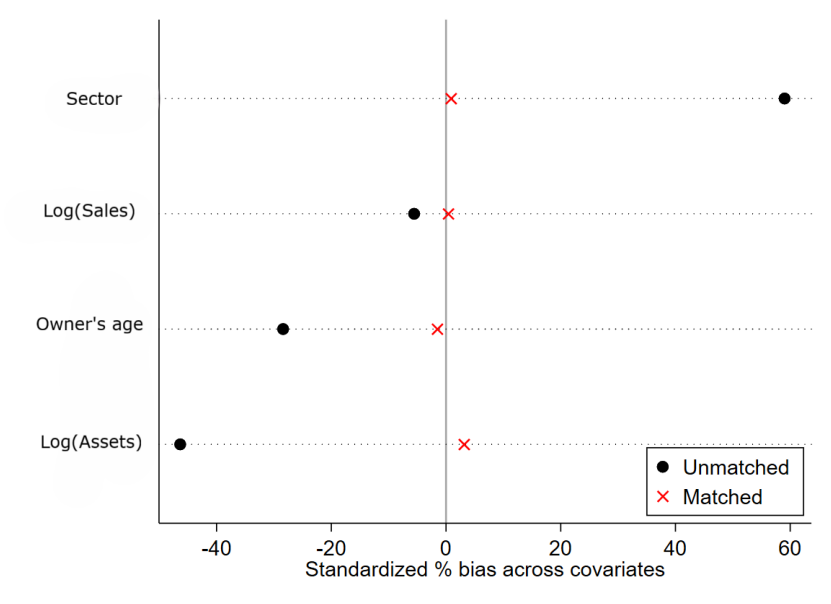


Figure A2: Balance diagnostics for propensity score matching (PSM)

Panel A displays the standardized differences for each covariate before and after propensity score matching. Black round points indicate the standardized differences before matching, while red crosses represent the differences after matching. Panel B illustrates the distribution of propensity scores for treated (female-owned) and control (male-owned) firms. The graph shows how well the propensity scores overlap between the two groups, indicating the extent to which the matching procedure has balanced the covariates across treated and control firms.

Panel A: Standardized bias plot before and after matching



Panel B: Propensity score histogram by treatment status

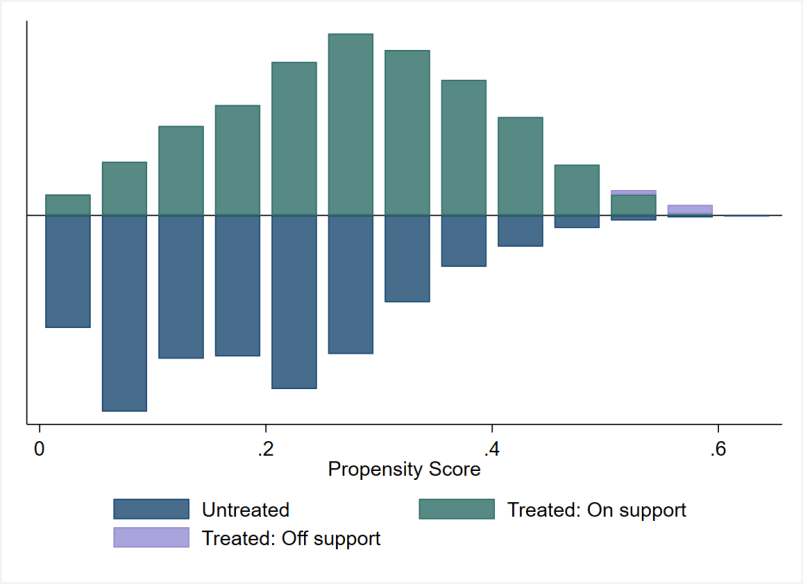


Figure A3: Distribution of initial paid-up equity in 2011 vs 2012

The figure shows the distribution of initial paid-up equity in 2011 and 2012. The vertical lines indicate the capital requirements for 2011 (NOK 100,000 = 11.5 log points) and 2012 (NOK 30,000 = 10.3 log points), respectively. For readability, observations outside the visible range are dropped.

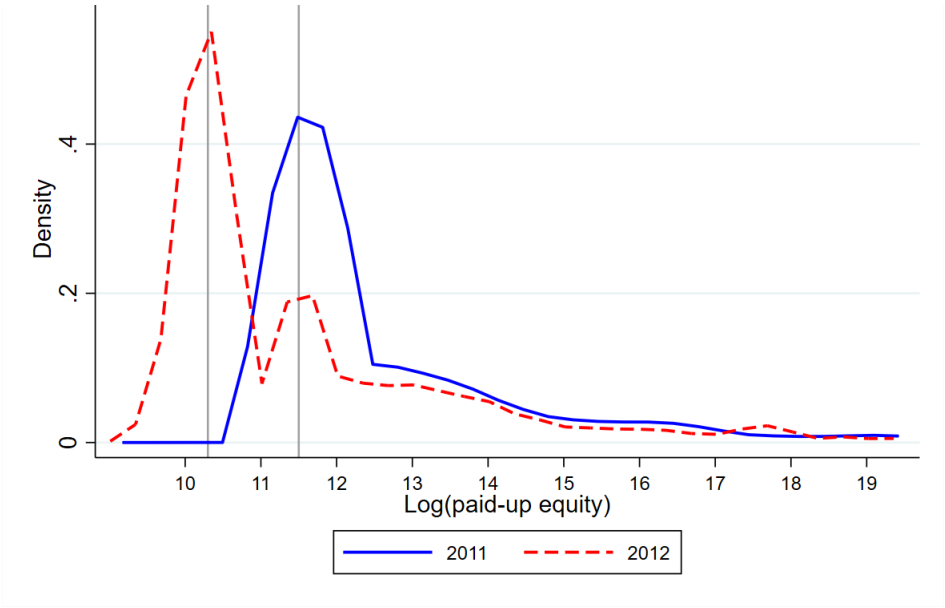


Figure A4: Growth in the number of new firms, 2010–2012

This figure shows the growth in the number of new firms between 2010 and 2012. The solid blue line represents all male-owned firms, and the dashed blue line represents male-owned firms whose initial paid-up equity equals the legal minimum capital requirement. The solid red line represents all female-owned firms, and the dashed red line represents female-owned firms with the minimum paid-up equity required by law.

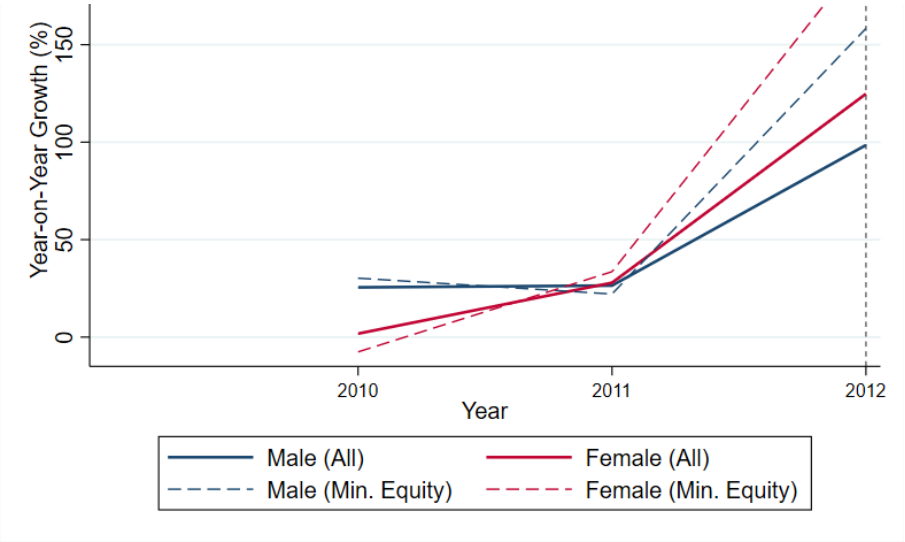


Table A1: Key variable definitions

Variable	Definition
Company age	Number of years since the firm's establishment.
Equal property rights	Dummy variable equal to 1 if women have equal ownership rights to immovable property in a given country.
Female	Dummy variable equal to 1 if the owner of the firm is female.
Leverage	Debt-to-equity ratio of the firm, indicating financial risk.
Log(LT debt)	Log of one plus the amount of long-term debt (maturity above one year) obtained from financial institutions.
Log(Real estate)	Log of one plus the book value of real estate owned by the firm; proxy for collateral.
Log(ST debt)	Log of one plus the amount of short-term debt (maturity below one year) obtained from financial institutions.
Log(Total debt)	Log of one plus the total (short-term plus long-term) debt obtained from financial institutions.
Majority-female	Dummy variable equal to 1 if the firm is majority-owned by women.
Owner's age	Age of the firm's owner.
Paid-up equity	Amount of the owner's paid-up equity in the firm.
Real estate	Book value of real estate owned by the firm; used as collateral.
ROA (Return on Assets)	Profitability measure, calculated as net income divided by total assets.
Sales	Total value of goods and services sold by the firm.
Sales volatility	The within-firm standard deviation of annual sales around the firm's mean sales.
Skin (paid-up equity) ratio	Ratio of the owner's paid-up equity to total assets; indicator of "skin in the game."
Total assets	Sum of current and fixed assets of the firm.
WBL Entrepreneurship Indicator	Composite score (0–100) assessing legal constraints on women in initiating and managing businesses.

Table A2: Summary statistics for firms with multiple owners

This table reports summary statistics for Norwegian firms with multiple owners and their owners over the period 2003–2020. *Company age* is the number of years since establishment. *Total assets* represent the sum of current and fixed assets, while *Sales* measure the total value of goods and services sold. *Real estate* denotes the book value of property owned by the firm. *ST debt* is the short-term debt to financial institutions. *LT debt* is the long-term debt to financial institutions. *Total debt* is the sum of short-term and long-term debt to financial institutions. *Leverage* is defined as the debt-to-equity ratio. *ROA* (return on assets) is net income divided by total assets. *Owner's age* refers to the age of the individual owner. *Paid-up equity* represents the average capital contribution per owner. *Skin (paid-up equity) ratio* measures the average owner's paid-up equity relative to total assets and serves as an indicator of skin in the game. All variables are winsorized at the 1% level.

Variable	Mean	Std. Dev.	Median	N
Company age	6.06	4.00	5.00	374,158
Total assets	4515.46	70,016	1,119	374,158
Sales	3121.52	8,197	1,337	374,158
Real estate	632.06	3,222	0.00	374,158
Log(Real estate)	1.17	3.00	0.00	374,158
ST debt	64.68	1,303	0.00	374,158
LT debt	736.83	7,760	0.00	374,158
Total debt	801.29	7,976	0.00	374,158
Leverage	0.78	5.00	0.00	374,158
ROA	-0.01	1.00	0.00	374,158
Owner's age	48.51	12.00	48.00	374,158
Paid-up equity	215.88	1,286	50.00	374,158
Skin (paid-up equity) ratio	0.19	0.00	0.00	374,158

Table A3: Growth of single-owned firms

This table reports the relationship between firm performance and gender ownership among single-owned firms, using asset growth as an alternative measure of performance. Columns 1 and 4 show results for firms up to 3 years after the establishment. Columns 2 and 5 show results for firms up to 5 years after the establishment. Columns 3 and 6 show results for firms of all ages. Female is a dummy that takes value of 1 if the single owner of the firm is a female. Leverage is defined as firm's debt-to-equity ratio. Female*Leverage term shows the efficiency of debt usage by female-owned firms. The specification includes company related controls, year and sector fixed effects. Robust standard errors are in parentheses. The symbols ***, **, and * denote statistical significance at the 1%, 5% and 10% level.

	Assets growth					
	(1)	(2)	(3)	(4)	(5)	(6)
	$\leq$ 3	$\leq$ 5	All	$\leq$ 3	$\leq$ 5	All
Female	0.029	0.152	-0.057	0.027	0.150	-0.062
	[0.174]	[0.328]	[0.158]	[0.174]	[0.324]	[0.156]
Leverage	-0.028	-0.020	0.003	-0.029	-0.021	0.001
	[0.035]	[0.036]	[0.019]	[0.040]	[0.039]	[0.021]
Female*Leverage				0.004	0.005	0.014
				[0.043]	[0.036]	[0.024]
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Owner controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	54331	97581	190501	54331	97581	190501
Adjusted R^2	0.01	0.00	0.00	0.01	0.00	0.00

Table A4: The effect of collateral and performance of single-owned firms: subsample winsorized at 5%

This table reports the effects of collateral on debt financing among single-owned firms using the subsample winsorized at the 5% level. Panel A presents estimates for the collateral channel, restricted to firms with strictly positive real estate values and excluding those in the construction sector. Panel B reports estimates for the equity channel. In Panels A and B, the dependent variable in column 1 is *Log(ST debt)*, where ST debt is the short-term debt to financial institutions. The dependent variable in column 2 is *Log(LT debt)*, where LT debt is the long-term debt to financial institutions. The dependent variable in columns 3-6 is *Log(Total debt)*, where Total debt is the sum of short-term and long-term debt to financial institutions. Columns 1–3 focus on young firms up to three years after establishment; column 4 (column 5) extends the window to five (ten) years; and column 6 includes firms of all ages. Panel C reports results for firm performance, measured by return on assets (ROA). Columns 1 and 4 present results for firms up to three years after establishment; columns 2 and 5 extend the window to five years; and columns 3 and 6 include firms of all ages. Log(Real estate) is used as a proxy for available collateral for the firm. Female is a dummy equal to 1 if the single owner of the firm is a female. The interaction term Female*Log(Real estate) captures the collateral effect specific to female-owned firms. *Skin ratio* is defined as paid-up equity divided by total assets. The interaction term *Female × Skin ratio* captures gender-specific effects of paid-up equity on firms' access to debt financing. *Leverage* is defined as the firm's debt-to-equity ratio, and the interaction term *Female × Leverage* captures the efficiency of debt use by female-owned firms. All specifications include firm-level and owner-level controls, year fixed effects, and sector fixed effects. Robust standard errors are in parentheses. The symbols ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A: Collateral channel

	(1)	(2)	(3)	(4)	(5)	(6)
	Log[ST debt]	Log[LT debt]	Log[Total debt]	Log[Total debt]		
	Young firms ($\leq$ 3yrs)			$\leq$ 5yrs	$\leq$ 10yrs	All ages
Female	-0.058	-0.722*	-0.633	-0.950***	-1.229***	-1.359***
	[0.229]	[0.413]	[0.413]	[0.295]	[0.220]	[0.203]
Log[Real estate]	0.066***	0.224***	0.193***	0.257***	0.402***	0.412***
	[0.025]	[0.047]	[0.045]	[0.032]	[0.022]	[0.020]
Female*Log[Real estate]	-0.003	0.215***	0.204***	0.225***	0.226***	0.237***
	[0.046]	[0.073]	[0.073]	[0.050]	[0.036]	[0.033]
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Owner controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1965	1965	1965	4184	8981	12209
Adjusted R^2	0.08	0.27	0.29	0.28	0.25	0.24

Panel B: Equity channel

	(1) Log[ST debt]	(2) Log[LT debt]	(3) Log[Total debt]	(4)	(5) Log[Total debt]	(6)
	Young firms ($\leq$ 3yrs)			$\leq$ 5yrs	$\leq$ 10yrs	All ages
Female	-0.009	-0.034	-0.026	-0.070***	-0.141***	-0.166***
	[0.013]	[0.028]	[0.029]	[0.022]	[0.018]	[0.017]
Skin ratio	0.045***	0.018	0.031	0.042**	0.074***	0.106***
	[0.009]	[0.020]	[0.022]	[0.016]	[0.013]	[0.012]
Female*Skin ratio	0.030*	0.107***	0.121***	0.127***	0.158***	0.169***
	[0.018]	[0.030]	[0.033]	[0.026]	[0.020]	[0.019]
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Owner controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	54041	54041	54041	97061	160363	189544
Adjusted R^2	0.05	0.26	0.27	0.28	0.29	0.29

Panel C: Performance

	ROA					
	(1) $\leq$ 3yrs	(2) $\leq$ 5yrs	(3) All	(4) $\leq$ 3yrs	(5) $\leq$ 5yrs	(6) All
Female	-0.015*	-0.019***	-0.009**	-0.022**	-0.024***	-0.014***
	[0.009]	[0.006]	[0.004]	[0.009]	[0.007]	[0.005]
Leverage	-0.018***	-0.014***	-0.009***	-0.021***	-0.016***	-0.011***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Female*Leverage				0.016***	0.014***	0.012***
				[0.003]	[0.002]	[0.002]
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Owner controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	54331	97581	190501	54331	97581	190501
Adjusted R^2	0.16	0.15	0.12	0.16	0.15	0.12

Table A5: The effects of collateral and paid-up equity for medium and large single-owned firms and their performance

This table examines the effects of collateral and paid-up equity on debt financing and performance among medium and large single-owned firms. I exclude small single-owned firms employing only one individual, as well as firms with assets or sales below the 10th percentile of their respective distributions. Panel A presents estimates for the collateral channel, restricted to firms with strictly positive real estate values and excluding those in the construction sector. Panel B reports estimates for the equity channel. The dependent variable in column 1 is *Log(ST debt)*, where ST debt is the short-term debt to financial institutions. The dependent variable in column 2 is *Log(LT debt)*, where LT debt is the long-term debt to financial institutions. The dependent variable in columns 3-6 is *Log(Total debt)*, where Total debt is the sum of short-term and long-term debt to financial institutions. Columns 1–3 focus on young firms up to three years after establishment; column 4 (column 5) extends the window to five (ten) years; and column 6 includes firms of all ages. *Log(Real estate)* proxies for the firm's available collateral. *Female* is a dummy equal to one if the single owner is female. The interaction term *Female* × *Log(Real estate)* captures the collateral effect specific to female-owned firms. *Skin ratio* is defined as paid-up equity divided by total assets. The interaction term *Female* × *Skin ratio* captures gender-specific effects of paid-up equity on firms' access to debt financing. All specifications include firm- and owner-level controls, year fixed effects, and sector fixed effects. Robust standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Collateral channel

	(1)	(2)	(3)	(4)	(5)	(6)
	Log[ST debt]	Log[LT debt]	Log[Total debt]	Log[Total debt]		
	Young firms ($\leq$ 3yrs)			$\leq$ 5yrs	$\leq$ 10yrs	All ages
Female	0.060	-0.678	-0.582	-0.985***	-1.225***	-1.407***
	[0.243]	[0.468]	[0.465]	[0.329]	[0.251]	[0.232]
Log[Real estate]	0.030	0.359***	0.322***	0.318***	0.419***	0.439***
	[0.028]	[0.047]	[0.047]	[0.032]	[0.022]	[0.019]
Female*Log[Real estate]	-0.045	0.192**	0.179**	0.232***	0.231***	0.240***
	[0.044]	[0.077]	[0.077]	[0.053]	[0.039]	[0.036]
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Owner controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2032	2032	2032	4183	8546	11547
Adjusted R^2	0.08	0.21	0.22	0.23	0.23	0.22

Panel B: Paid-up equity channel

	(1) Log[ST debt]	(2) Log[LT debt]	(3) Log[Total debt]	(4)	(5) Log[Total debt]	(6)
	Young firms ($\leq$ 3yrs)			$\leq$ 5yrs	$\leq$ 10yrs	All ages
Female	-0.072**	0.019	-0.003	-0.053	-0.187***	-0.240***
	[0.031]	[0.062]	[0.063]	[0.046]	[0.035]	[0.032]
Skin ratio	0.041	-0.510***	-0.449***	-0.393***	-0.236***	-0.111***
	[0.039]	[0.077]	[0.079]	[0.057]	[0.045]	[0.041]
Female*Skin ratio	0.233**	0.311*	0.438**	0.406***	0.452***	0.482***
	[0.106]	[0.179]	[0.177]	[0.138]	[0.102]	[0.096]
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Owner controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	19102	19102	19102	35005	59348	71365
Adjusted R^2	0.07	0.22	0.23	0.23	0.24	0.24

Appendix-B

Model: Moral Hazard with Equity

In this section, I provide a theoretical explanation for my hypotheses development. I present here only two of the cases (moral hazard with equity and adverse selection with collateral), while the rest of the solutions can be found in the link provided at the end of this section.

Entrepreneurs

This set-up is based on Holmström and Tirole (1997). We assume a continuum of entrepreneurs, each of whom needs I at $t = 0$ to carry out a project. Projects are identical and yield y or 0 at $t = 1$. Entrepreneurs can shirk, enjoying a private benefit B, or exert effort (cost B).

- Success probabilities: $p_H = 1$ with effort, and $p_L < 1$ without effort. Define $\Delta p = p_H - p_L = 1 - p_L$.
- Entrepreneurs are risk neutral.

Banks

Banks raise funds at cost R, are risk neutral, compete with marginal cost pricing, and cannot observe effort. Incentive compatibility is ensured by requiring sufficient skin in the game.

Contracts

- Banks lend $I - E$ to entrepreneurs.
- Entrepreneurs repay d_b if the project succeeds, keeping d_e.
- Bank participation constraint (PC):

$$p_H d_b \geq R(I - E),$$

  which holds with equality under perfect competition and marginal cost pricing.

- Entrepreneur PC:

$$p_H d_e \geq RE,$$

  When bank's PC holds, this is automatically satisfied with inequality as soon as projects

have positive NPV: $p_H y > RI$ (as seen directly from the next constraint).

- Financing constraint: $d_b + d_e = y$.
- Incentive compatibility (IC) for the entrepreneur's effort:

$$p_H d_e \geq p_L d_e + B \Rightarrow \Delta p d_e \geq B \Rightarrow d_e \geq \frac{B}{\Delta p}.$$

Intuition: expected payoff from working hard ($\Delta p d_e$) must exceed private benefit from shirking (B). Or, entrepreneur's skin must be *high enough* to make them work ($d_e \geq \frac{B}{\Delta p}$).

Because entrepreneur's share has to be high enough, the bank's share from the project has to be low enough ($y - d_e$, or $y - \frac{B}{\Delta p}$). And therefore the bank will initially invest low enough, as can be seen from:

- combining with bank PC

$$p_H \left(y - \frac{B}{\Delta p} \right) = R(I - E),$$

so the bank's PC implies a maximum feasible lending level:

$$I - E \;=\; \bar{L}(p_L) \;=\; \frac{1}{R}\left(y - \frac{B}{p_H - p_L} \right).$$

Thereby,

$$E \;=\; I - \frac{p_H}{R}\left(y - \frac{B}{p_H - p_L} \right) \equiv \bar{E}(p_L).$$

That is, entrepreneurs need to invest at least $\bar{E}(p_L)$ to signal their commitment to work hard. As $\partial \bar{E}/\partial p_L > 0$, lower p_L implies a smaller threshold.

We now distinguish between male and female cohorts by assuming that female entrepreneurs face a lower probability of success under low effort than men:

$$p_L^F < p_L^M.$$

The idea here is to capture higher moral hazard, and WLOG we can assume $p_H = 1$.[18] Then,

$$\bar{L}(p_L^F) \;=\; \frac{1}{R}\left(y - \frac{B}{1-p_L^F}\right),$$

$$\bar{L}(p_L^M) \;=\; \frac{1}{R}\left(y - \frac{B}{1-p_L^M}\right).$$

Since $p_L^F < p_L^M$ implies $\frac{1}{1-p_L^F} < \frac{1}{1-p_L^M}$, it follows that

$$\bar{L}(p_L^F) \;>\; \bar{L}(p_L^M)$$

and

$$\bar{E}(p_L^F) \;<\; \bar{E}(p_L^M)$$

Failing to pledge the minimum level of equity above, entrepreneurs would receive 0 credit. Thus,

$$\frac{\Delta\bar{L}(p_L^F)}{\Delta\bar{E}(p_L^F)} = \frac{\bar{L}(p_L^F)}{\bar{E}(p_L^F)} \;>\; \frac{\bar{L}(p_L^M)}{\bar{E}(p_L^M)} = \frac{\Delta\bar{L}(p_L^M)}{\Delta\bar{E}(p_L^M)}$$

Because entrepreneurs either meet the minimum equity requirement and obtain the full lending limit $\bar{L}$, or provide no equity and receive zero credit, there are no interior solutions with partial equity contributions. Hence, the relevant changes coincide with their levels:

$$\Delta E(p_L^i) = E(\bar{p}_L^i), \qquad \Delta\bar{L}(p_L^i) = \bar{L}(p_L^i), \qquad i \in \{F, M\}.$$

and thus,

$$\frac{\Delta\bar{L}(p_L^F)}{\Delta E(p_L^F)} > \frac{\Delta\bar{L}(p_L^M)}{\Delta E(p_L^M)}.$$

The IC constraint is looser when p_L is lower. Thus, with the same project payoff y and private benefit B, women (with lower p_L) can support bank lending with lower amount of equity than men. Equivalently, the marginal increase in debt capacity per unit of additional equity is larger for women, implying a stronger sensitivity of credit to equity, precisely what is estimated in

[18] Similarly, one could assume that women also face a lower probability of success under high effort. However, as long as projects remain creditworthy with high effort, which is a necessary condition for lenders to issue positive credit, the precise level of the upper-tail cash flows is irrelevant, since the residual profit accrues to equity holders, not to the bank.

Table 4.

The framework can be generalized to a continuum of male and female borrower types (e.g., based on experience, age, industry groups), generating continuous rather than purely corner outcomes. As long as the distribution of women's project success probabilities is first-order stochastically dominated by that of men, additional equity will increase bank lending more for female borrowers than for male borrowers.

Model: Adverse Selection with Collateral

Now, consider adverse selection with collateral. Competition again sets the bank's participation constraint (PC) with equality:

$$p_H d_b + (1 - p_H)C = RI.$$

To deter low-type borrowers, the incentive constraint requires

$$p_L d_e - (1 - p_L)C \leq 0 \quad \Rightarrow \quad d_e = \frac{1 - p_L}{p_L} C.$$

Using $d_b + d_e = y$ and substituting into the bank's PC, the equilibrium collateral threshold is

$$C = p_L \cdot \frac{p_H y - RI}{p_H - p_L}.$$

Hence, as in the equity case, $\partial C / \partial p_L > 0$: collateral must increase with p_L, so with a lower p_L (i.e., when the group faces greater informational frictions) a *lower* unit of collateral relaxes credit constraints. This delivers the main empirical prediction that the collateral channel is stronger for women.

Rest of the cases

The rest of the model solutions can be found here.

Appendix-C

Back-of-the-envelope gains from closing the leverage gap (first three years)

My results indicate that additional leverage is *more productive* for female entrepreneurs: the coefficient on *Female*×*Leverage* in the ROA regression is positive for young firms (Table 5). Conceptually, this interaction captures how a marginal unit of leverage translates into *net* profitability for women relative to men. If women face tighter supply-side constraints (e.g., greater reliance on collateral to overcome informational frictions), then a thought experiment that closes the observed leverage gap between women and men provides a clean, policy-relevant magnitude for the profits forgone due to limited access to debt.

Let β denote the *Female*×*Leverage* slope in the ROA regression, and let ΔLev be the observed female-male leverage difference in the data. The implied change in women's ROA from closing the gap is

$$\Delta\text{ROA} \;=\; \beta \cdot \Delta\text{Lev}.$$

To convert ΔROA into NOK, I simply multiply by a representative asset base. Throughout, I use *mean total assets* for the relevant group.[19]

Let us suppose we implement a policy targeting at closing 50 percent of the ROA gap for young single-owned firms (reported in Table 5, Panel A, column 4) via encouraging bank supply. The interaction term must account for half of the female dummy, that is $0.5 \times 0.017 = 0.0085$. Given the estimated $\beta = 0.016$, the required zero-sum reallocation of credit is $\Delta\text{Lev} = \frac{0.0085}{0.003} = 2.8$, which corresponds to transferring 2.8 units of leverage from men to women, and is roughly 0.6 times the standard deviation of young female-owned firms' leverage.

The aggregate ROA gain from such a reallocation equals $\beta \times \Delta$Lev and is about 0.85 percentage points. Multiplying this by the average asset base of single-owned firms (3,801,520 NOK) implies an annual efficiency gain of approximately 32,500 NOK per firm-year (approximately 5,000 USD for an average exchange rate of 6.5 NOK over the time period).

[19] In the tables, monetary units are thousand NOK; below I convert to NOK for readability.