Discrimination and Female Entrepreneurship: Evidence from Female Entrepreneurs in South Korea

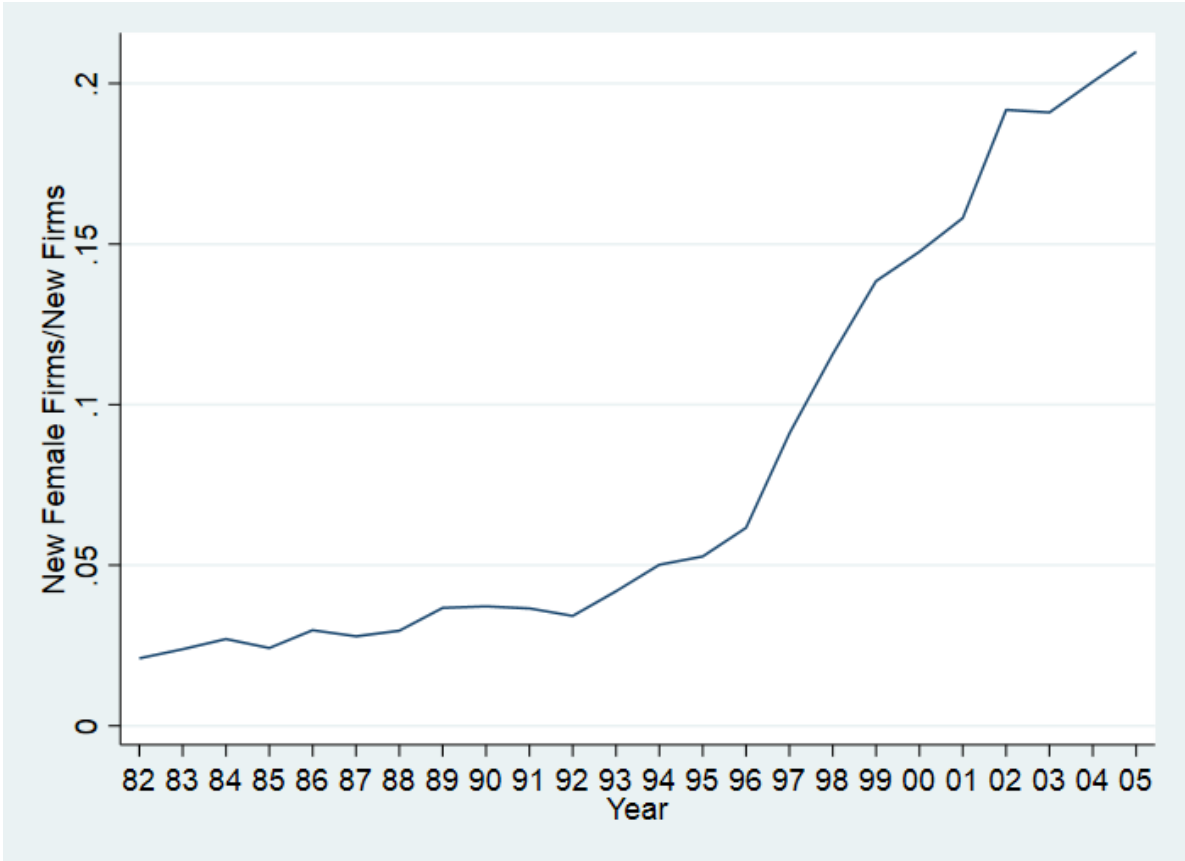
Jungho Lee and Sunha Myong

Singapore Management University

September 14, 2022

Share of Female New Entrepreneurs in South Korea

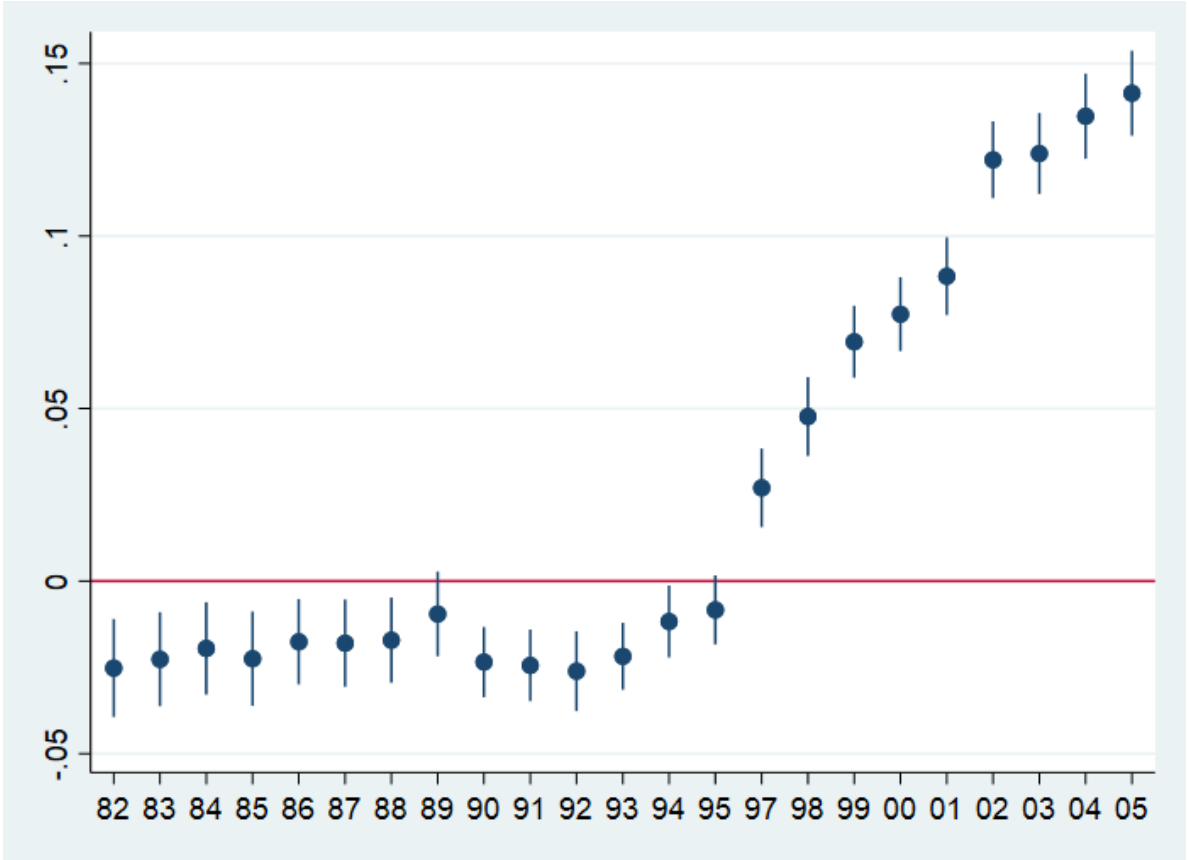
Figure 1: Share of female owned new establishments



Data: Mining and Manufacturing Survey in South Korea (1982-2005). All newly established non-incorporated manufacturing establishments with at least five employees ("transformational entrepreneurs" (Schoar [2010])). The female-new-firm share is measured by female new firms (firms owned by only female(s)) among all non-incorporated new firms.

Share of Female New Entrepreneurs in South Korea (accounting for industry fixed effect)

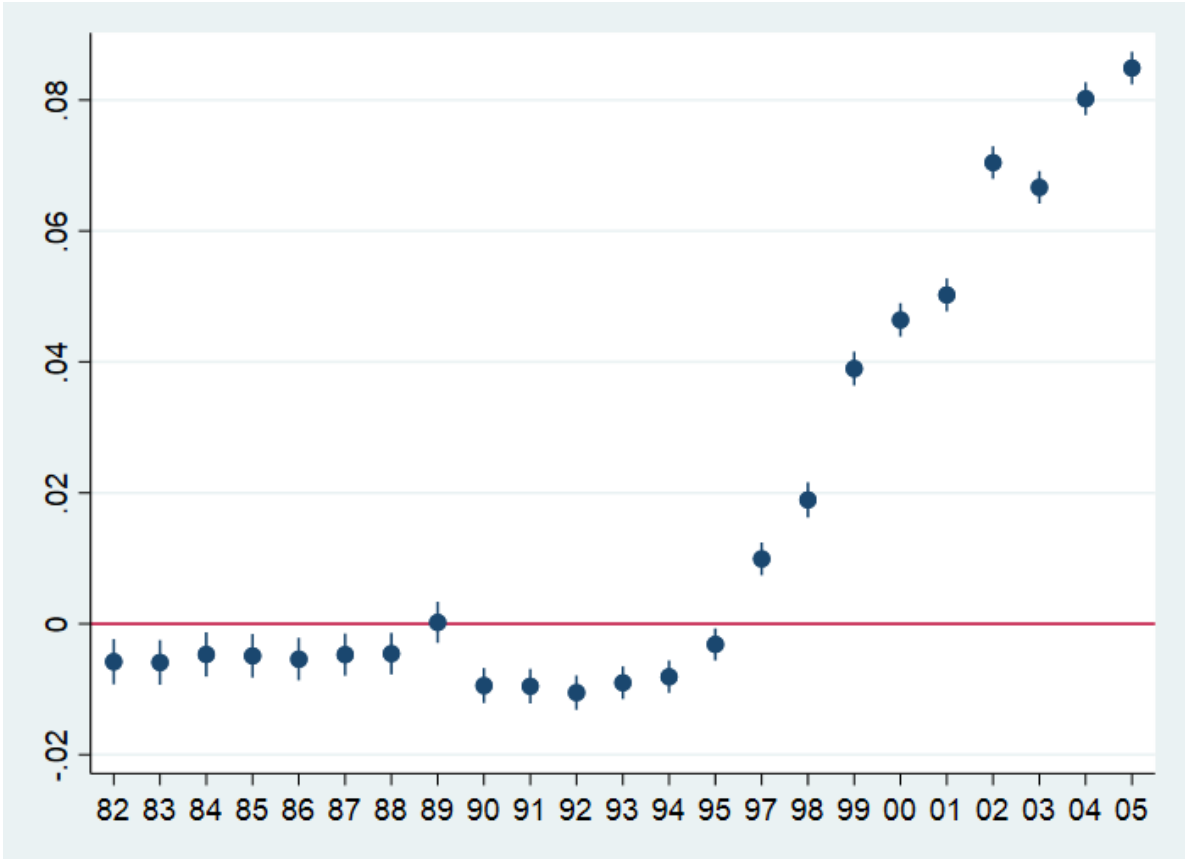
Figure 2: Share of female owned new establishments



Data: Mining and Manufacturing Survey in South Korea (1982-2005). All newly established non-incorporated manufacturing establishments with at least five employees ("transformational entrepreneurs" (Schoar [2010])). The female-new-firm share is measured by female new firms (firms owned by only female(s)) among all non-incorporated new firms.

Share of Female Entrepreneurs (both new and old firms)

Figure 3: Number of female-owned establishments



- The share of female entrepreneurs among firms with all ages also increased substantially after the crisis.
- A decomposition exercise suggests that increasing female share among new firms is the main driver.

Why Important? Economic Development and Female Entrepreneurship

- Why did the gender gap in manufacturing firm creation remain consistently high more than 15 years, and suddenly decrease after 1997?
- The incidence of South Korea's female entrepreneurship suggests the economic development does not guarantee to boost female entrepreneurship.
  - cf. other economic activities (education, labor force participation, and hourly wage) closed substantially along the economic development
- Female entrepreneurship in developing countries is low and many policy interventions were not successful in promoting it.
- Understanding this question can help us understand the types of the barriers female entrepreneurs in developing countries face and how we can remove them.

Why Important? Identifying the Gender Specific Barriers

- A sudden and episodic increase in female entrepreneurship is helpful to identify the source of gender gaps in entrepreneurship.
  - Other than economic barriers, gender differences in innate ability or preferences (e.g., risk aversion) can also explain the gender gap in entrepreneurship.
  - It is difficult to distinguish two mechanisms from cross-sectional variations.
  - Even with the panel data, if the female share changes gradually over time, it is less plausible to rule out the possibility that the gender difference in innate characteristics also changed over time.
  - The increase in female entrepreneurship in South Korea occurs within a very short period (sudden and episodic change).
  - Because innate characteristics are less likely to change suddenly during the crisis, the episodic increase in female entrepreneurs in South Korea is more likely to be driven by changes in gender specific barrier to entrepreneurship.

The Korean Financial Crisis in 1997 (Before 1997)

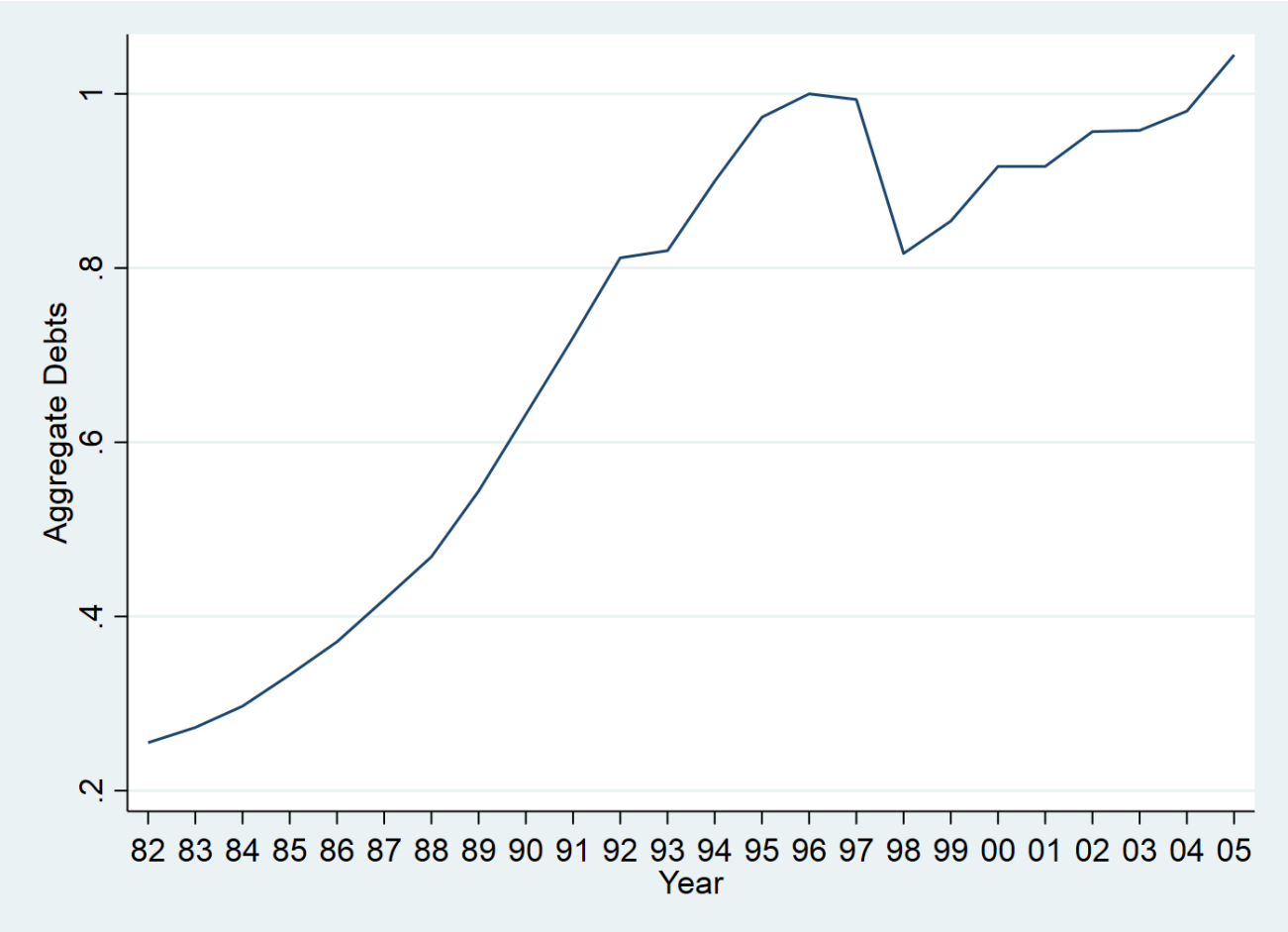
- The banks' balance sheet became comprised of a large amount of foreign short-term debts and loans to domestic companies that were typically used for long-term investment projects.
- High debt-equity ratios with low returns to assets was a pervasive problem among Korean manufacturing companies.
- Since the beginning of 1997, many Korean conglomerates (Chaebols) filed for a bankruptcy
- Concerns about the soundness of financial institutions and Chaebols made Korean banks difficult to roll over their short-term foreign liabilities.
- Bank of Korea used its foreign exchange reserves to meet the banks' need for foreign currencies.

The Korean Financial Crisis in 1997

- On December 4, 1997, South Korean government and the International Monetary Funds (IMF) announced an agreement that IMF provides a financial package worth 21 billion USD under the condition that the government implements IMF-supported programs.
- During 1997 and 1998, Korean financial sector experienced an unprecedented shock induced by foreign exchange crisis, often known as the "Korean Financial Crisis of 1997." The impact of such shock is clearly visible in our data set.
- In Figure 4, we depicts the total amount of outstanding debts in the sample. The total outstanding debts reduced by 20% during the periods of 1997 and 1998, and recovered after that.

The Korean Financial Crisis in 1997

Figure 4: Changes in the Aggregate Debts



Data: Mining and Manufacturing Survey in South Korea (1982-2005). The aggregate debt is measured by the sum of debts lent to incorporated firms, because the debt information for non-incorporated firms is not available in the data.

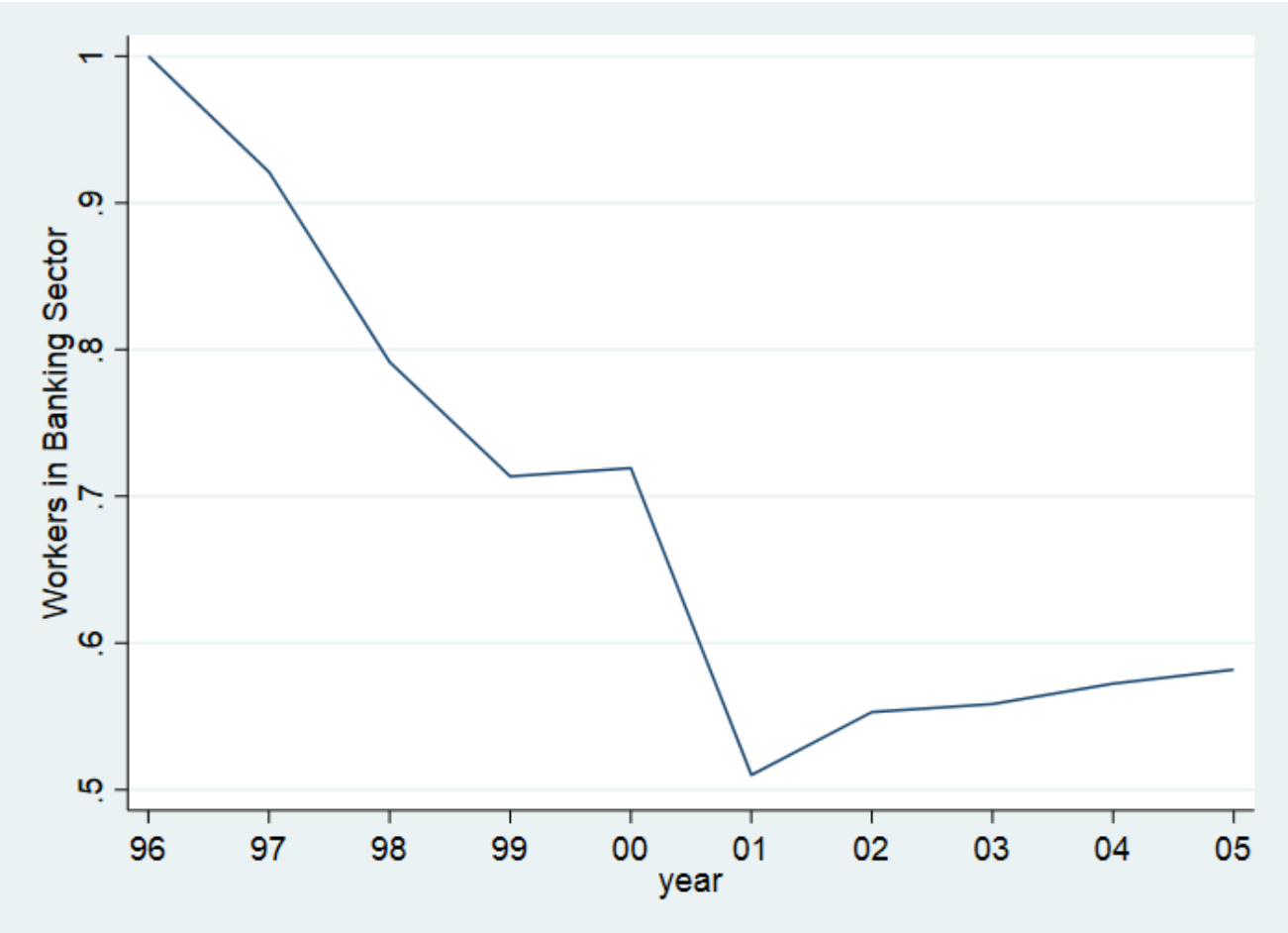
The IMF-supported programs

1. Fiscal and monetary policies that aimed at breaking a self-reinforcing cycle of capital outflows
2. Structural reform especially for financial sector
   - IMF identified financial sector vulnerability was at the root of the crisis
   - Introduce measures to facilitate corporate restructuring and strengthening governance, disclosure, and accounting standards.
   - Immediate suspension or closure of clearly nonviable institutions; recapitalization of viable institutions and restructuring potentially viable but close to insolvency.
   - Throughout the process, many banks disappeared or merged to other banks.

The Korean Financial Crisis in 1997

- Out of 26 banks, 16 banks closed after the crisis.

Figure 5: Changes in the Number of Workers in Banking Sector



Data: The census on establishment (1996-2005).

Empirical Analysis

Overview of Empirical Analysis

- Did female entrepreneurship increased significantly after the crisis? Yes.
- Possible explanations for changes in the gender gap in entrepreneurship after the crisis:
  - Financial market
  - Labor market
  - Production market
  - Intermediary goods market
  - Outside option (value of being worker)
  - Government policy
- We argue that the decreasing gender gap in entrepreneurship is mainly associated with closing gender gap in the financial market

Did Female Entrepreneurship Change Significantly After the Crisis?

$$\ln(\text{Female Share}_{d,t}) = \beta \cdot (\text{Shock}_d \cdot \text{Post}_t) + I_t + \tau_d + \epsilon_{d,t}. \quad (1)$$

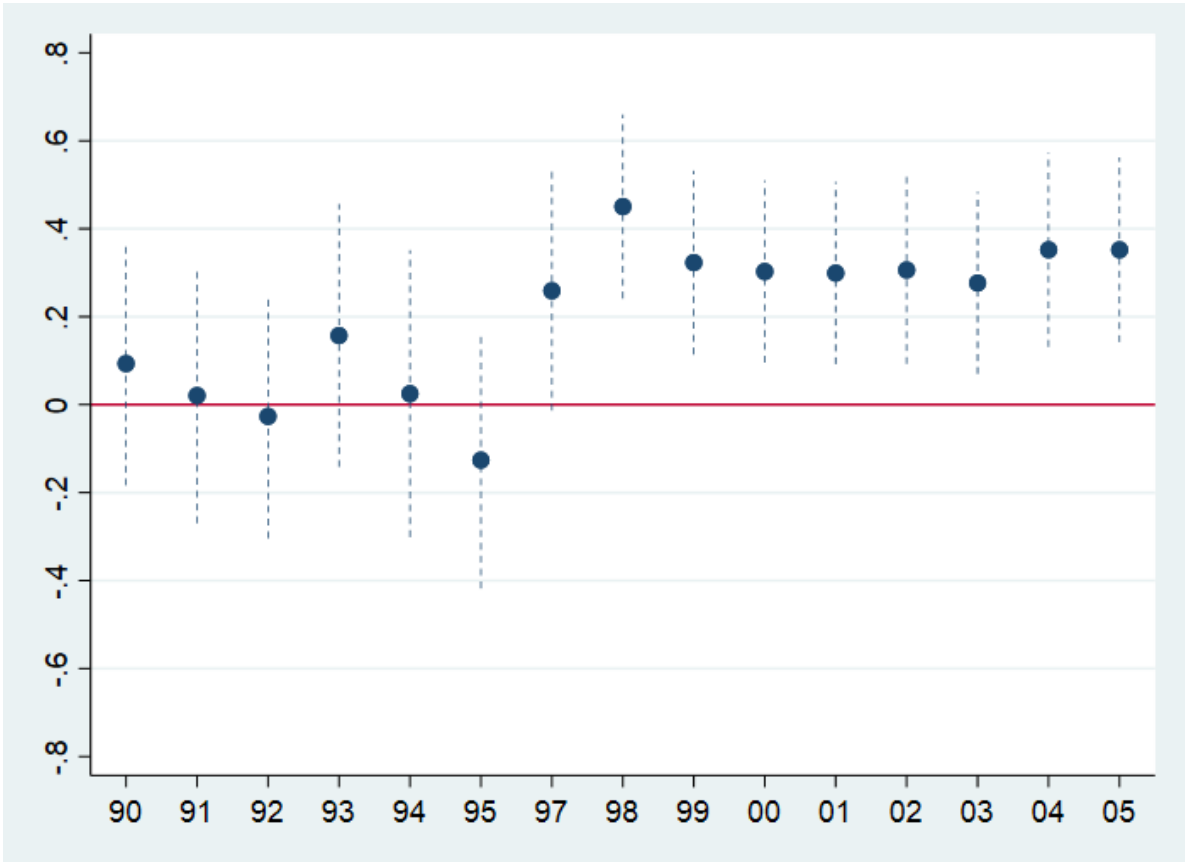
- We use industry variations to examine whether the financial crisis can explain different changes in the female share before and after the crisis.
- Female $\text{Share}_{d,t}$: female firm share among new firms for each industry d in each year t.
- $\text{Shock}_d = \left(\frac{\text{Debt}_{d,1997}}{\text{Debt}_{d,1998}}\right)$ captures the shock in the total outstanding debts in each industry during the IMF period (between at the beginning of 1997 and at the end of 1998).
- Post_t is a dummy variable that equals 1 if the year t is 1997 or after.
- I_t and τ_d are year and industry fixed effects, and $\epsilon_{d,t}$ is the error term.

Did Female Entrepreneurship Change Significantly After the Crisis?

- β captures the differential effect of the IMF shock associated with the reduction in the industry level outstanding debts.
- The estimates of β is 0.31 with the p-value being less than 0.001.
- For an industry that exhibited a 10% higher 1997-1998 debt ratio experienced a 3.1% higher increase in the female share after 1997.
- The increase in the female share is 55% higher for the industry at the 90th percentile than for the industry at the 10th percentile of 1997-1998 debt ratio.
- To check the pre-trend, we estimated equation (1) by replacing Post_t with I_t.

The Korean Financial Crisis in 1997

Figure 6: Does the crisis significantly explains the increase in female share among new entrepreneurs after the crisis?



- To check the pre-trend, we replace Post_t with I_t.

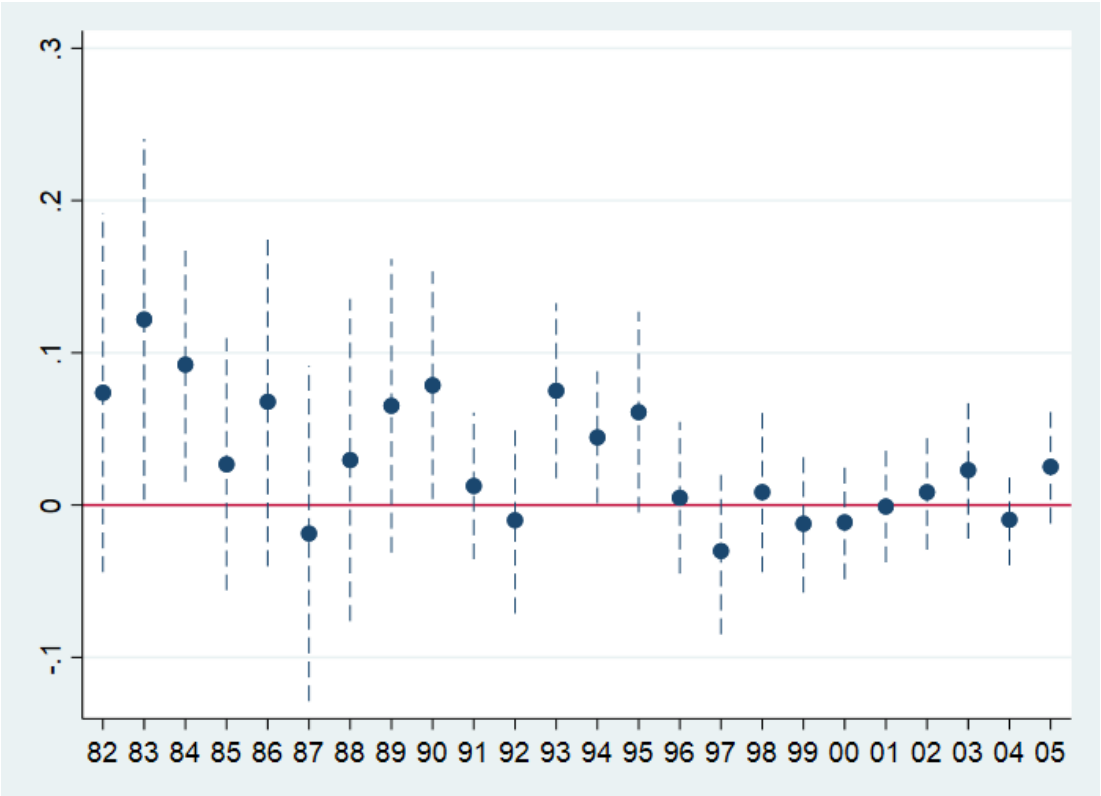
Mechanisms: Financial Market

$$\ln\left(\frac{\text{Revenue}_{i,t}}{\text{Capital}_{i,t}}\right) = \gamma_0 \cdot \text{Female}_i \cdot I_{t\leq 1996} + \gamma_1 \cdot \text{Female}_i \cdot I_{t\geq 1997} + I_t + \text{Age}_{i,t} + \tau_d + \epsilon_{i,t},$$

- Hsieh and Klenow [2009] show gaps in revenue per capital may reflect misallocation (Morazzoni and Sy [2022]).
- The estimated γ_0 is 0.04, indicating revenues per asset for female firms was 4% higher than non-female firms on average before 1997. On the other hand, the estimated γ_1 is 0.003, showing the difference in revenues on asset disappeared after 1997.

Mechanisms: Gender Gap in Financial Market

Figure 7: Changes in the gender gap in the revenue per capital



- Female firms had higher revenue per capital before the crisis, but the gender gap disappeared after the crisis.
- Female firms had less capital allocation than male firms before the crisis.

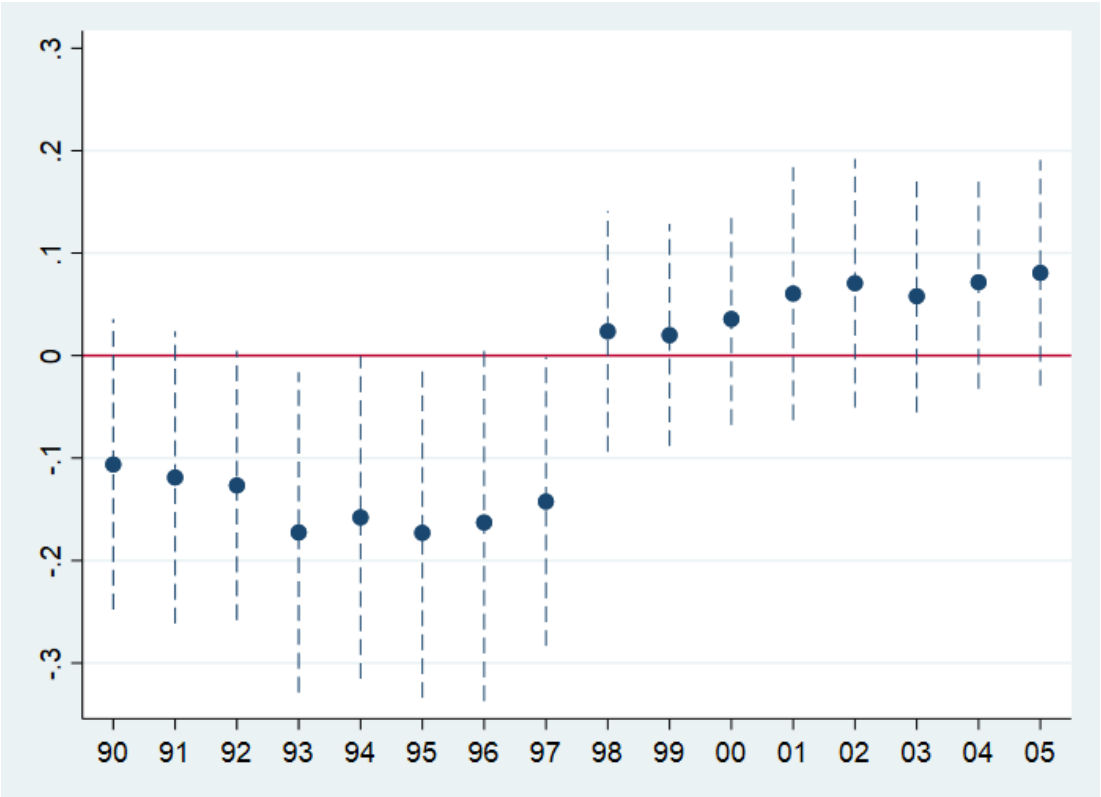
Which Industries Are Hit Harder during the Crisis?

$$\ln(\text{ROA}_{i,t}) = \sum_{t=1990}^{2005} \beta_t \cdot (\text{Debt Shock}_{d(i,t)} \cdot I_t) + I_t + \text{Age}_{i,t} + \epsilon_{i,t}, \tag{2}$$

- $\text{ROA}_{i,t}$ refers to the return on asset (as measured by profit divided by total assets) for a firm i in year t.
- I_t and $\text{Age}_{i,t}$ are year and firm-age fixed effects, and $\epsilon_{i,t}$ is the error term.
- The coefficient β_t captures the correlation between the debt shock and firms' ROA in each year after controlling for year and firm-age fixed effects.

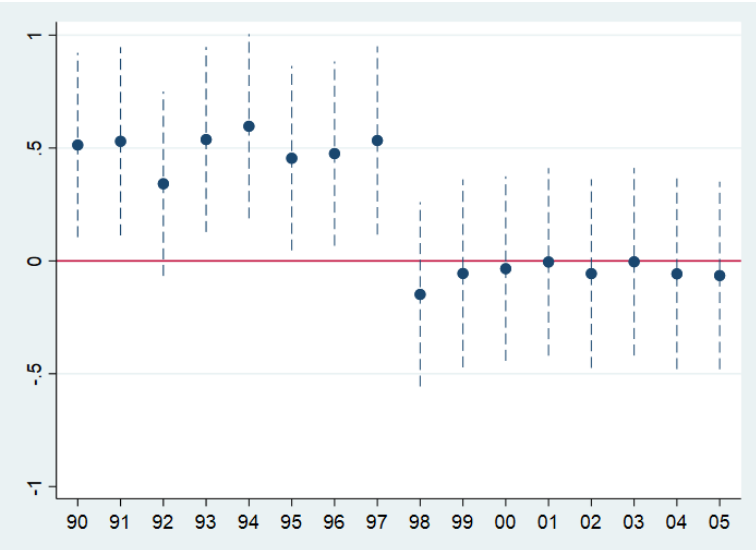
Which Industries Are Hit Harder during the Crisis?

Figure 8: Correlation between Debt Shock and ROA

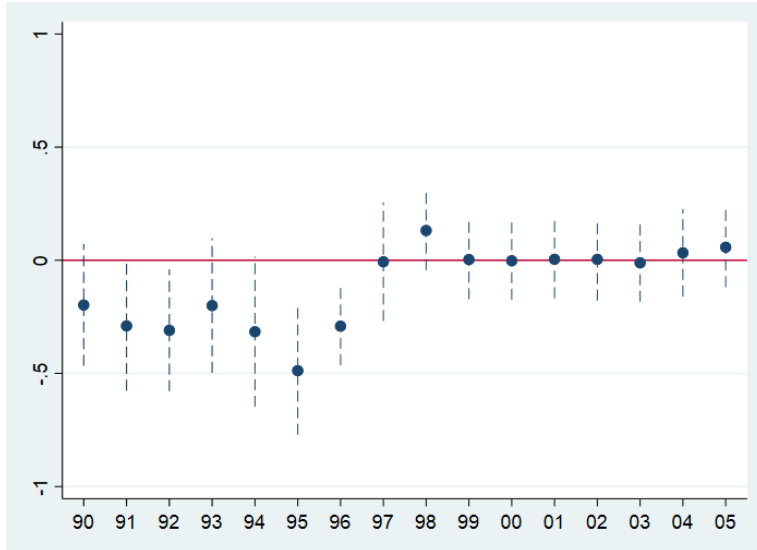


- Until 1997, a negative and significant relationship was observed between the debt shock and firms' ROA. However, after 1997, such negative association suddenly disappeared.
- The industries that exhibited a lower ROA before 1997 are more likely to be hit harder during the crisis.

Which Industries Are Hit Harder during the Crisis?



(a) Correlation between Debt Shock and non-female new entrepreneurs



(b) Correlation between Debt Shock and female share among new entrepreneurs

- Before 1997, a significantly large number of non-female firms started a business in an industry hit harder by the debt shock, but such tendency suddenly disappeared after 1997.

Role of Restructuring in Financial Market After the Crisis

- To sum, decreasing gender gap in the financial market seems to explain decreasing gender gap in entrepreneurship after the crisis.
- Evidence
  - gender gap in revenue per capital decreased after the crisis
  - industries hit harder by the crisis and experienced a larger debt reduction had lower ROA and more non-female new entrepreneurs before the crisis, and the tendency disappeared after the crisis.

Alternative Explanation: Labor Market (employer discrimination)

- Male workers' discrimination against female boss has been documented in other context (Chiplunkar and Goldberg [2021])
- Indeed, the share of male workers is lower for female firms than non-female firms.
  - For example, the male worker share is 46% in female firms, whereas it is 67% in non-female firms in our sample.
- We checked how the gender difference in the share of male workers changed over time.

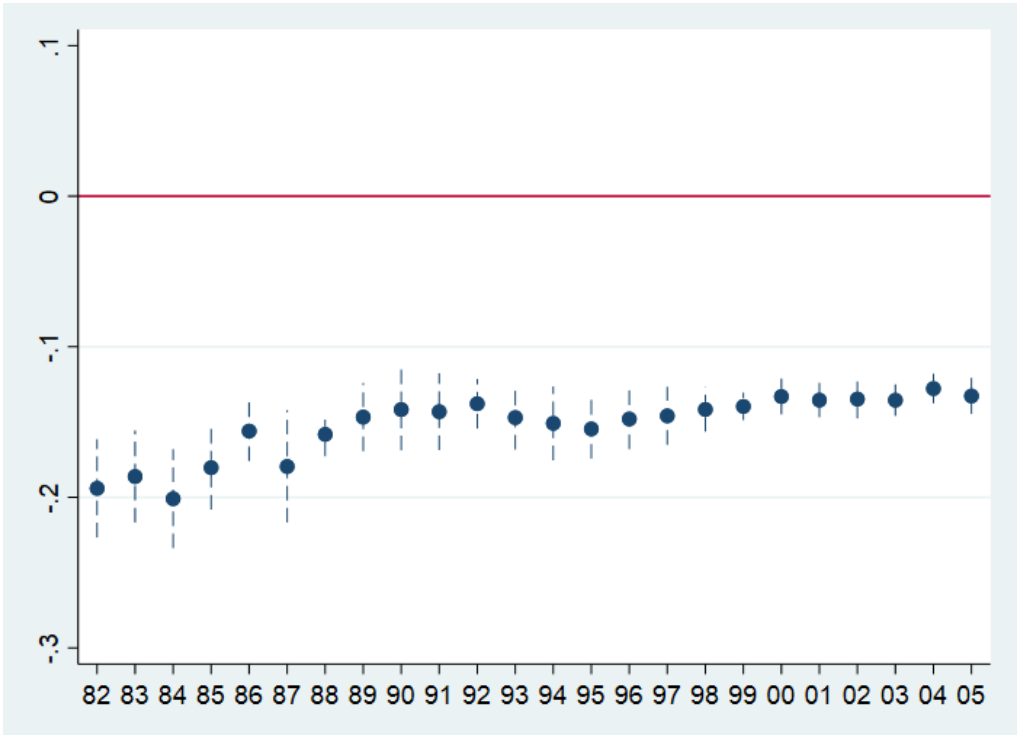
Alternative Explanation: Labor Market (employer discrimination)

$$\ln\left(\frac{\text{Male Workers}_{i,t}}{\text{All Workers}_{i,t}}\right) = \gamma_0 \cdot \text{Female}_i \cdot I_{t\leq 1996} + \gamma_1 \cdot \text{Female}_i \cdot I_{t\geq 1997} + I_t + \text{Age}_{i,t} + \tau_d + \epsilon_{i,t},$$

- The estimated values of γ_0 and γ_1 are -0.15 and -0.13, respectively, indicating that female firms hire 15 percentage point smaller number of male workers before 1997 and 13 percentage point smaller number of male workers after 1997.

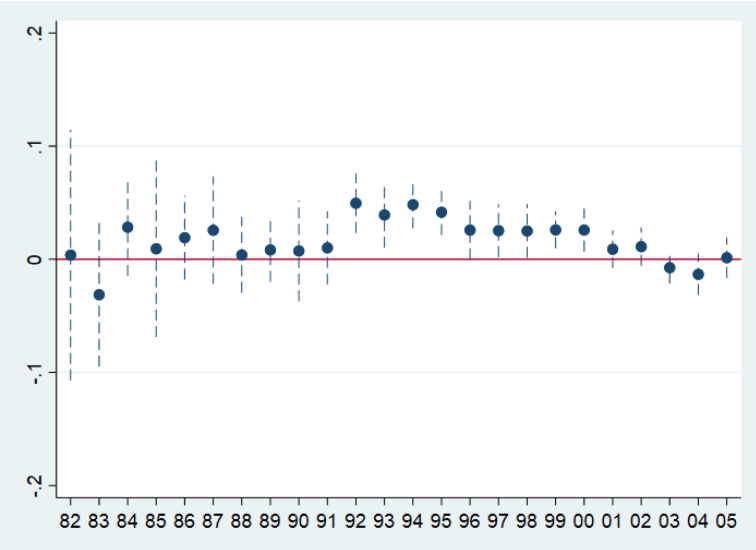
Alternative Explanation: Labor Market (employer discrimination)

Figure 9: Gender gap in the share of male workers over time

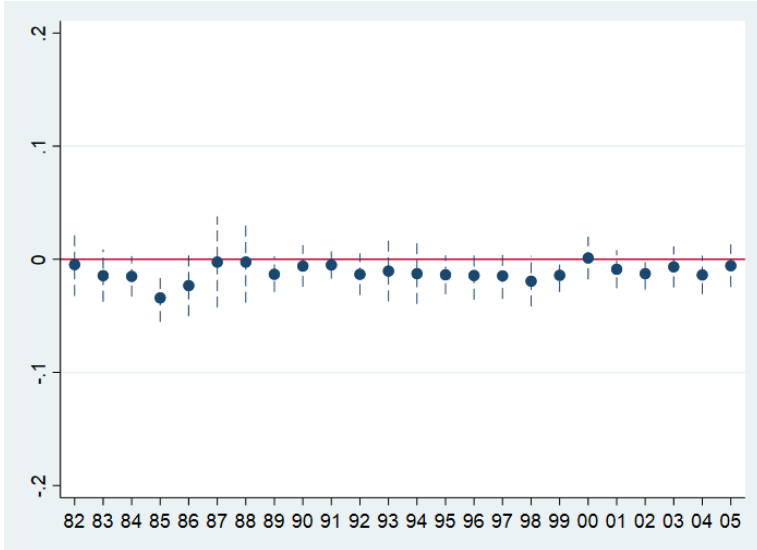


- The male-worker share in female firms has not dramatically increased since 1997.
- The sorting patterns regarding gender of workers may not be the main reason.

Alternative Explanation: Labor Market (labor cost: wage)



(a) Gender gap in labor cost (wage) for white collar workers



(b) Gender gap in labor cost (wage) for blue collar workers

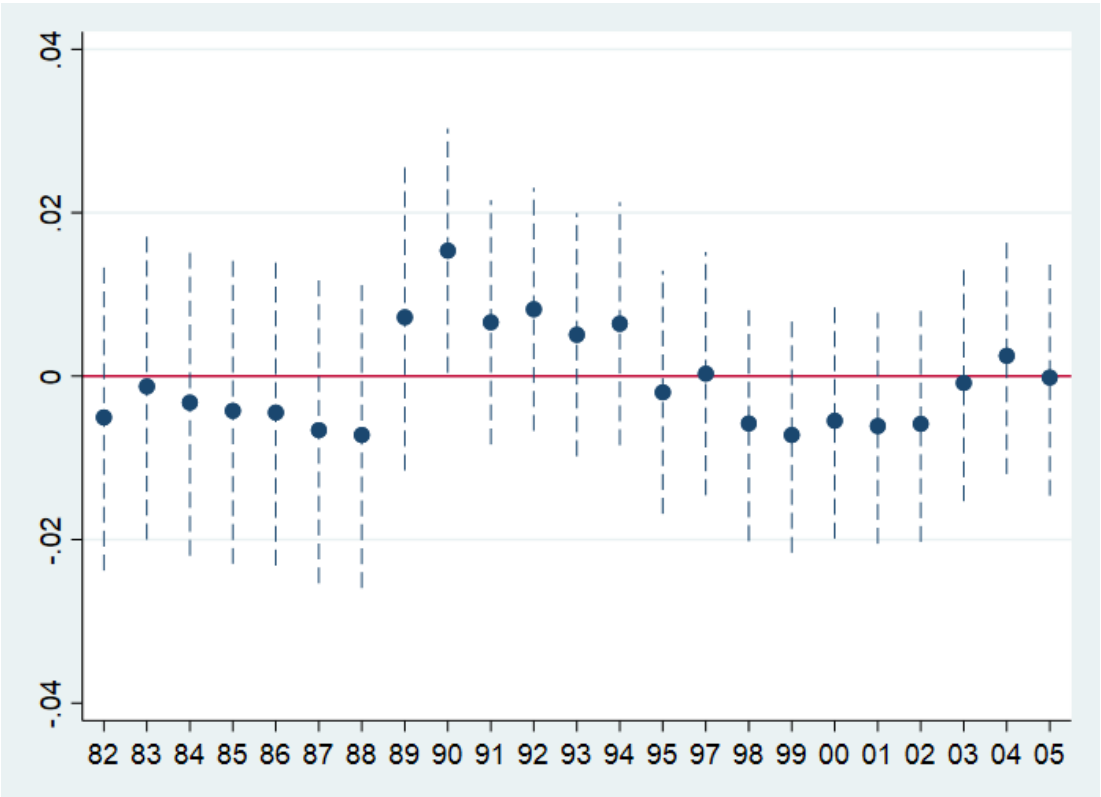
- Overall, we do not find a drastic change in wages before and after 1997.

Alternative Explanation: Product Market

- Decreasing the market concentration may have contributed to the increasing new female entrepreneurs.
- We investigate to what extent the concentration of product markets has changed after the IMF reform by using the Herfindahl-Hirschman Index (HHI).
- Figure 10 prsents the difference in HHI for each year relative to 1996 after controlling for the industry fixed effect.
- After 1997, HHI had decreased (meaning the level of market concentration had gone down), but it went back to the 1996 level in early 2000.

Alternative Explanation: Product Market

Figure 10: Changes in HHI index



- Overall, we do not observe a significant change in the market concentration for each industry before and after 1997.

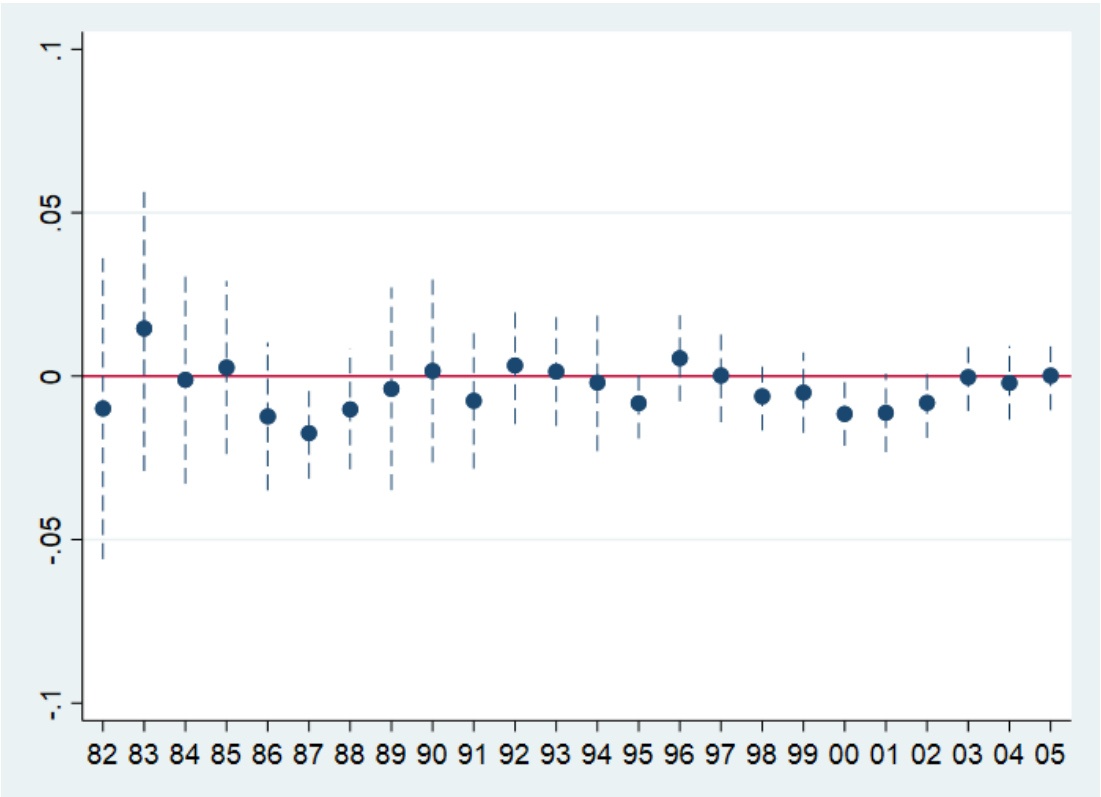
Alternative Explanation: Intermediary Goods Market

- If firms selling the raw material goods have a discrimination against female owners or a search friction for female firms is particularly high due to a lack of networks among female owners, the costs for raw material will be higher for female firms than male firms.
- We investigate the gender difference in raw material cost per revenue between female and male firms within an industry overtime:

$$\ln\left(\frac{\text{Material Cost}_{i,t}}{\text{Revenue}_{i,t}}\right) = \gamma_0 \cdot \text{Female}_i \cdot I_{t\leq 1996} + \gamma_1 \cdot \text{Female}_i \cdot I_{t\geq 1997} + I_t + \text{Age}_{i,t} + \tau_d + \epsilon_{i,t},$$

Alternative Explanation: Intermediary Goods Market

Figure 11: Gender gap in the material costs



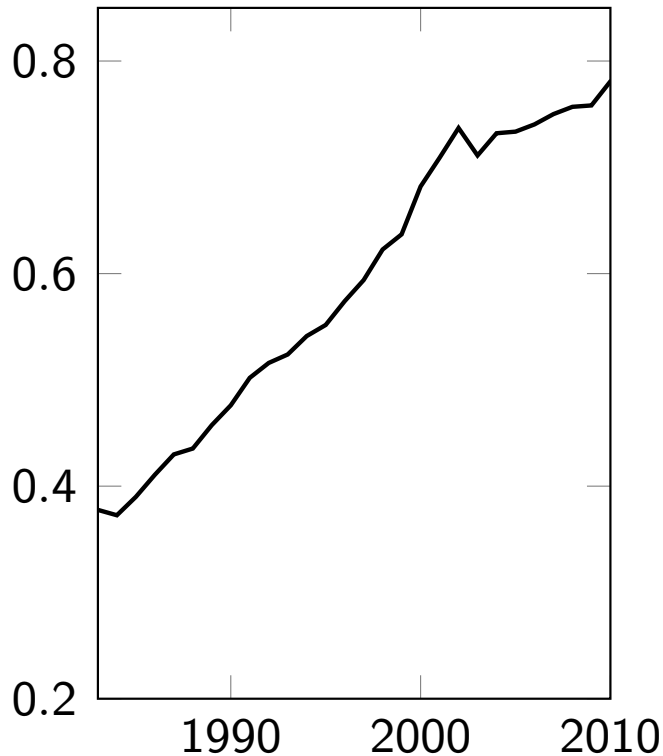
- Overall, we do not observe a significant change in the gender gap in material costs for each industry before and after 1997.

Alternative Explanation: Changes in the Outside Option

- The unemployment (UE) rate in South Korea was 2.4 percentage points on average between 1990 and 1996.
- UE rate peaked at 8.2 percentage points in July 1997, decreased gradually over time since mid 1998, and then recovered its pre-crisis level of 3.1 percentage points in mid 2002.
- A sudden increase in the unemployment rate could have lowered the value being a worker, which could have increased the relative value of being an entrepreneur.
- There are two possible channels:
  - Individual labor supply: if the labor market opportunity worsened more for women than for men, the value of being an entrepreneur increased relatively more for women, which could increase female share among new entrepreneurs.
  - Joint labor supply: negative income shock can increase women's labor force participation, and some of those marginal wives may choose to be an entrepreneur.

Alternative Explanation: Changes in the Outside Option

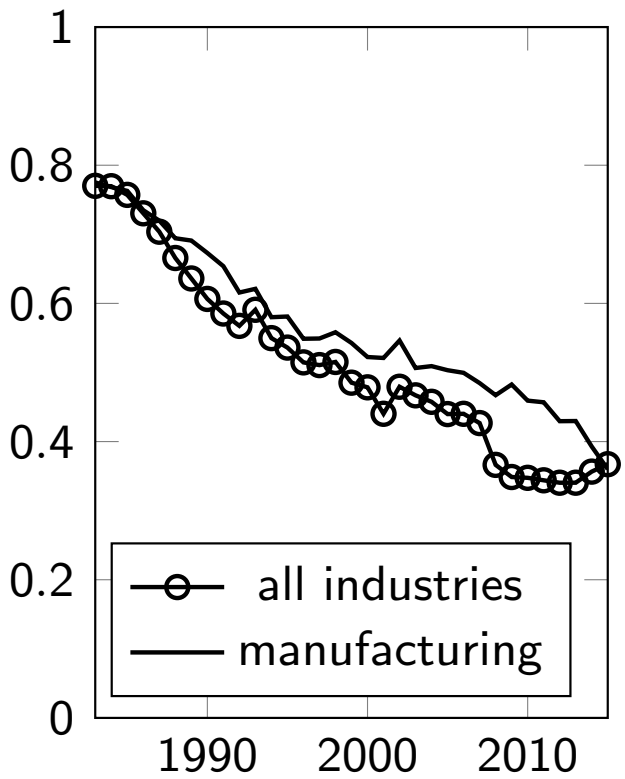
Figure 12: Gender difference in the employment rate



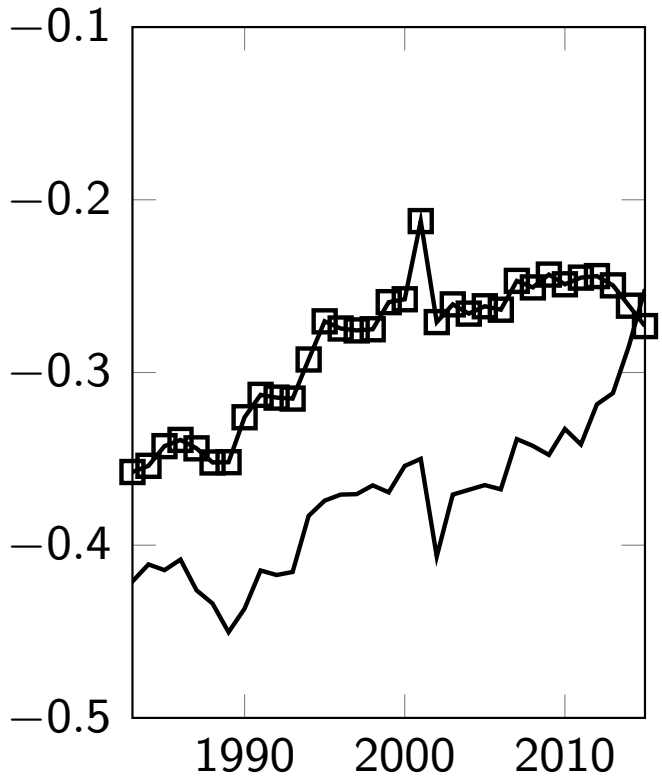
(a) $P_m(worker)/P_f(worker)$

- The gender gap in employment rate decreased over time and there is no sudden increase in the gender gap in employment rate during the crisis.

Alternative Explanation: Changes in the Outside Option



(b) $ln(wage_m) - ln(wage_f)$

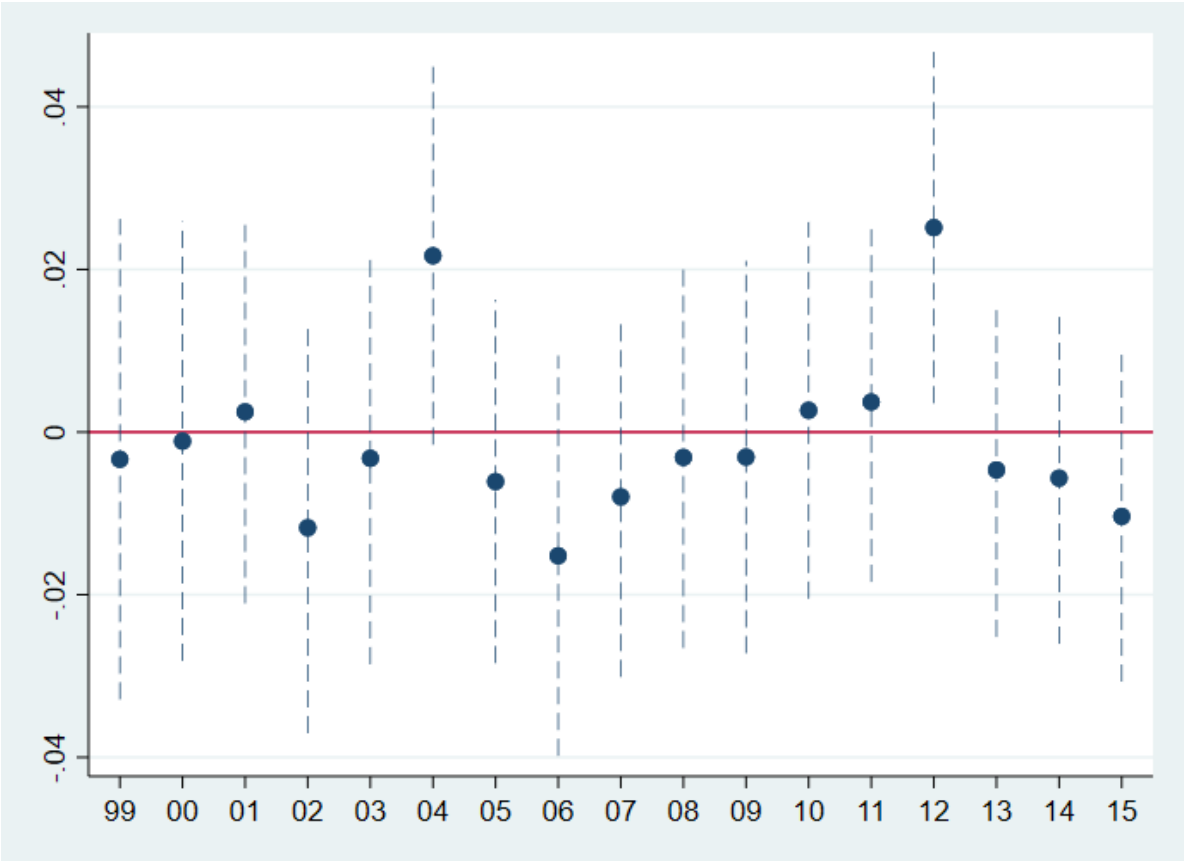


(c) Gender wage gap in Mincer regression

- The gender wage gap decreased over time and there is no sudden increase in the gender gap in labor market opportunity during the crisis.

Alternative Explanation: Women's Outside Option

Figure 13: Correlation between husband's unemployment and wife's entrepreneurship (Data: KLIPS)



- Focusing on manufacturing industries, we find that the association between husband's UE status and wife's entrepreneurship does not change drastically during the crisis.

Alternative Explanation: Government Policy

- The Act on Support for Female-Owned Businesses was enacted in June 1999. The act supports the activities of female firms by providing several female-firm-friendly policies.
- Although the act may have boosted female entrepreneurship after 2000, we argue that the act is not the main driving force behind the surge of female entrepreneurship we document in this paper.
  - First, while the sudden increase in the female new firm share started in 1997, the act was enacted in the second half of 1999.
  - Second, the act recommends several preferential treatment toward female firms, often times, such policies were not enforced.
    * For example, the act recommended government agencies provide a preferential treatment to female firms when they purchases needed materials, it had not enforced before 2014. As a result, the share of government purchased goods by female firms were less than 5% until 2014.

Discussion

- Before the crisis, industries with "excess debt" tend to have more male entrepreneurs. Such industries also have lower ROAs than other industries. The correlation between ROAs and "excess debt" disappears after the crisis.
- Overall, these data patterns suggest that the IMF-driven financial shock "cleansed out" non-performing firms and made less-performing male firms hard to enter.
- To provide a theoretical framework to discuss the gender gap in financial market, we consider two possible mechanisms through which the credit availability is different for men and women.
  - statistical discrimination
  - taste-based discrimination

Discussion

- Before the crisis, industries with "excess debt" tend to have more male entrepreneurs. Such industries also have lower ROAs than other industries. The correlation between ROAs and "excess debt" disappears after the crisis.
- Overall, these data patterns suggest that the IMF-driven financial shock "cleansed out" non-performing firms and made less-performing male firms hard to enter.
- We provide a model to describe how the change in the gender gap in financial market affects the evolution of gender specific entrepreneurship over time
  - statistical discrimination
  - taste-based discrimination

Model

Model: two possible mechanisms for the gender gap in borrowing

- There is a fixed borrowing limit $k \leq \lambda_{j,t} z$, where k is capital, z is asset, and $\lambda_{j,t}$ is gender specific borrowing limit that changes over time.
- The following two mechanisms affects bank's choice for $\lambda_{j,t}$:
  1. Statistical discrimination
     - Due to the historically strong gender social norm, the entrepreneurial ability might have been overstated for men and understated for women compared to the true ability
  2. Taste-based discrimination
     - Banks have prejudice against female entrepreneurs before the crisis, but the increased competitiveness in the financial market crowded out prejudiced banks

Model: Bayesian Learning and Statistical Discrimination

- Let θ_m and θ_f be the entrepreneurial ability for male and female, where the true distribution is $ln\theta_j \sim N(\hat{\mu}_j, \hat{\sigma}_j^2)$.
- Both individuals or the bank do not know the true $\hat{\mu}_j$, but have common priors for $\hat{\mu}_j \sim N(\mu_{j0}, \sigma_{j0}^2)$.
- The belief on $\hat{\mu}_j \sim N(\mu_{jt}, \sigma_{jt}^2)$ is updated over time following an Bayesian update:

$$\mu_{j,t+1} = \frac{\mu_{j,t}\sigma_\epsilon^2 + N_{j,t}\overline{x}_{j,t}\sigma_{j,t}^2}{\sigma_\epsilon^2 + N_{j,t}\sigma_{j,t}^2} \tag{3}$$

$$= \frac{1}{1 + N_{j,t}\left(\frac{\sigma_{j,t}}{\sigma_\epsilon}\right)^2}\mu_{j,t} + \frac{N_{j,t}\left(\frac{\sigma_{j,t}}{\sigma_\epsilon}\right)^2}{1 + N_{j,t}\left(\frac{\sigma_{j,t}}{\sigma_\epsilon}\right)^2}\overline{x}_{j,t} \tag{4}$$

where $\overline{x}_{j,t} = \frac{1}{N_{j,t}}\sum_{i=1}^{N_{j,t}} lny_{jt}$ is the mean outcome of entrepreneurs of gender j in period t.

Model: Taste-Based Discrimination

- Let R be the interest rate imposed on the borrower and let D be the interest rate that should be paid to the depositor.
- The bank has a prejudice $c > 0$ against female entrepreneurs, which increases the cost of lending.
- The cost of lending k for the bank is $D(1 + c)k$.

Model: Bank's Choice for the Borrowing Limit

- If τ is large enough, bank's profit increases by z. A free entry condition implies a zero profit for the marginal entrepreneur.
- For a given $D, R, c, \overline{k}, w_{jt}, F(\xi), \mu_{jt}, \sigma_{jt}$, there is a unique solution for λ that satisfies the following condition:

$$P_s(\theta_{j,t}, \hat{z})R(\overline{k} - \hat{z}) + (1 - P_s(\theta_{j,t}, \hat{z}))\tau\hat{z} = D(1 + c)$$

  - λ decreases as c increases: taste-based discrimination decreases borrowing limit for female.
  - λ increases as $\mu_{j,t}$ increases: statistical discrimination can explain a lower borrowing limit for female if θ is understated for female and is overstated for male.

Model: Individual's Problem

- Bank's choice for λ_{jt} affects selection into entrepreneurship.
- Output of an entrepreneur is $y = \theta_j \epsilon$, where $ln\epsilon \sim N(0, \sigma_\epsilon)$ is a i.i.d. random productivity shock.
- An individual with $\lambda_{j,t} z > \overline{k}$ chooses to be an entrepreneur iff

$$\mu_{jt} \geq w + \xi + \left[P_s R(\overline{k} - z) + (1 - P_s)\tau z \right] I(\overline{k} > z) + D\overline{k} \cdot I(\overline{k} \leq z)$$

  - $\overline{k}$: a fixed amount of capital used in production.
  - w_j $(j \in \{f, m\})$: wage as a worker.
  - ξ: heterogeneity in the value of being a worker.

Model: Statistical Discrimination and the Evolution of Gender Gaps

- How does the statistical discrimination affect changes in the gender gap for borrowings and entrepreneurship?
  - Suppose that $\mu_{f,t} < \hat{\mu}_f$, that is, the ability for female is understated.
  - The average signal $\overline{x}_{f,t}$ would be greater than the predicted prior, which increases $\mu_{f,t}$ over time.
  - Accordingly, $\lambda_{f,t}$ increases over time because the default rate decreases.

Can Statistical Discrimination Alone Explain the Sudden Increase in Female Entrepreneurship?

- Under what condition can the statistical discrimination explain a sudden increase in female entrepreneurs after the crisis?
  - $\overline{x}_{f,t}$ should increase (a testable implication)
  - conditional on $\overline{x}_{f,t}$, the extent of update is greater when the weight on the signal is higher.
    * the weight on signals increases by $N_{j,t}$ and $\sigma_{j,t}$ and decreases by $\sigma_{\epsilon,t}$.
- We found that the average revenue among female ($\overline{x}_{f,t}$) did not increase significantly during the crisis.
- Thus, statistical discrimination alone may not be able to explain the sudden increase in female entrepreneurship.

Can Taste-Based Discrimination Explain the Sudden Increase in Female Entrepreneurship?

- Yes, if c decreases suddenly, $\lambda_{f,t}$ can increase after the crisis.
  - A sudden increase in D would have decreased $\lambda_{f,t}$. To have a positive demand, the bank may need to drop c.
  - Increased competition in the financial market would crowd out prejudiced banks (Becker [2010]; Weber and Zulehner [2014]; Hirata and Soares [2020]; Ashenfelter and Hannan [1986])
- Any evidence from our data?
  - Looking at geographic variations, more banks defaulted after the crisis if there were more male entrepreneurs (less female entrepreneurs) before the crisis.

Conclusion

- We document a sudden increase in female entrepreneurship after the 1997 financial crisis in South Korea.
- We argue that decreasing gender gap in financial market was the main driver.
- We further discuss the role of discrimination in the financial market. We claim that without taste-based discrimination, statistical discrimination alone cannot explain the sudden episodic change.

References

Orley Ashenfelter and Timothy Hannan. Sex discrimination and product market competition: The case of the banking industry. *The Quarterly Journal of Economics*, 101(1):149–173, 1986.

Gary S Becker. *The economics of discrimination*. University of Chicago press, 2010.

Gaurav Chiplunkar and Pinelopi K Goldberg. Aggregate implications of barriers to female entrepreneurship. Technical report, National Bureau of Economic Research, 2021.

Guilherme Hirata and Rodrigo R Soares. Competition and the racial wage gap: Evidence from brazil. *Journal of Development Economics*, 146:102519, 2020.

Chang-Tai Hsieh and Peter J Klenow. Misallocation and manufacturing tfp in china and india. *The Quarterly journal of economics*, 124(4):1403–1448, 2009.

Marta Morazzoni and Andrea Sy. Female entrepreneurship, financial frictions and capital misallocation in the us. *Journal of Monetary Economics*, 2022.

Antoinette Schoar. The divide between subsistence and