Female Entrepreneurship in the U.S. 1982 – 2012: Implications for Welfare and Aggregate Output†

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Abstract

The number of women-owned businesses in the U.S. has soared over the last several decades, even compared to the rise in female labor market participation. In 1982 less than 9 percent of working women owned businesses, compared to over 17 percent of men. By 2012 more than 18 percent of women owned businesses while the analogous rate for men only slightly increased to almost 20 percent. This and other evidence suggests that women have faced significant barriers to starting and running businesses and these barriers have been declining over time. I examine the impact of these trends on aggregate output and the welfare of women and men in the labor force. Interpreted through the lens of a model of entrepreneurship, observed trends imply substantial declines in several barriers facing female entrepreneurs. Together, these changes account for over 12 percent of observed growth in aggregate output and a 2 percent increase in workers' consumption-equivalent welfare since 1982. By 2012, lower barriers increased the welfare of female entrepreneurs by a dramatic 33 percent, while lowering the welfare of male entrepreneurs by 6 percent. These impacts are in addition to any gains to workers from declining labor-market barriers.

Keywords: women, entrepreneurship, business dynamism, misallocation, aggregate productivity, economic growth.
JEL codes: E02, E1, J7, O1, O4.

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1 Introduction

The number of women-owned businesses in the U.S. has soared over the last several decades, even compared to the rise in female labor market participation. In 1982 less than 9 percent of working women owned businesses, compared to over 17 percent of men. By 2012 more than 18 percent of women owned businesses while the analogous rate for men only slightly increased to almost 20 percent. Although growth in the female entrepreneurship rate varied across sectors, every sector saw a sharp increase – from a less than 2-fold increase in retail and services to a 6-fold increase in manufacturing. These numbers suggest, as does a large volume of anecdotal evidence, that women have faced significant barriers to starting and running businesses and these barriers have been declining over time. Standard theories of business dynamics suggest this decline in barriers to female entrepreneurship may have contributed to aggregate productivity growth, as well as to the welfare of women. Yet no formal study has been done to quantify this contribution.

This paper measures the contribution of the rise of women-owned businesses to aggregate productivity and welfare. I interpret the data through the lens of a model of entrepreneurship, extending Hopenhayn (1992). In the model both men and women are characterized by a distribution of entrepreneurial ability and can choose to start a firm. The goods produced by women-owned firms are imperfect substitutes for those produced by men, implying that the share of consumer expenditure on output from women-owned firms is higher the lower is the relative price of goods from women-owned firms. At the same time, firms face decreasing returns to scale in production. All new entrepreneurs must incur a cost to start a firm, and base their entry decision in part on their ability. I introduce four forces into the model that can act to distort outcomes for women relative to men, each affecting the cost or benefit of doing business. The first is a barrier to starting a firm, which raises the fixed (independent of size) cost of starting and running a business. This fixed cost can be interpreted as the cost of generating an idea for a new product or service, or the cost of acquiring permits or licenses for particular markets. For example the fraction of workers with occupational licenses has increased from 5 to

23 percent since the 1950s (Timmons, 2018). To the extent that this has impacted female more or less than male entrepreneurs, this trend would imply an increase or decrease in the relative cost of starting a woman-owned firm. If society tends to look down on female entrepreneurs, this could also act as a fixed cost of running a business. Any costs incurred to hide the sex of an owner from potential customers can similarly be interpreted as an additional cost of running a woman-owned business. Titlow (2017) and Weikle (2021) discuss recent anecdotal evidence of this phenomenon, quoting female entrepreneurs who hide their sex or hire male assistants to engage with potential customers.

The second force is a differential cost of using capital as an input into production for women and men, which could most-obviously be driven by a higher cost of obtaining credit and less available credit. For example, before the late 1980s women were required to have a male family member cosign on any business loan, regardless of the credit-worthiness of the loan applicant. Lillian Lincoln Lambert, the first African-American woman to graduate from Harvard Business School, needed the signature of her 17 year old dependent son to secure a loan (U.S. Congress, 1988). In testimony to Congress, another woman (an established and successful architect) recounted being patted on the head by a reputable banker while he explained the bank did not make loans to women. Anecdotal evidence from hearings related to the Women's Business Ownership Act of 1988 suggests that female entrepreneurs faced higher interest rates and substantially higher collateral requirements for business loans than comparable male applicants.[1] More recently, Coleman (2000) and Coleman and Robb (2009) document evidence that women-owned businesses continued to pay higher rates of interest than comparable men-owned businesses in the mid-2000s.

The third force I allow for in my analysis is a differential cost of employing workers. For example, a higher cost of financing working capital (as described above) can also raise the effective cost of

[1] In these hearings, several speakers addressed the question of whether the experiences of female entrepreneurs were common to all small businesses. They all stressed that while women testified to facing many of the same hurdles as male-owned small businesses, their experiences included an entirely different set of obstacles specific to women. Further, these same obstacles often had to be overcome by large and already-established women-owned businesses.

hiring and paying employees. To the extent that workers have preferences over the sex of their employer, female entrepreneurs might also need to provide more at-work amenities or other benefits to attract workers. Riffkin (2014) reports workers (men and women) have become increasingly indifferent about the sex of their employer, with more survey respondents over time preferring a female employer and fewer respondents preferring a male employer.

The fourth and final force I consider is consumer discrimination against female entrepreneurs, modeled as lower demand for output from women-owned businesses. Although some work has been done to consider consumer discrimination against black entrepreneurs (Becker, 1971; Borjas and Bronars, 1989), there is reason to believe female entrepreneurs may face similar barriers. That female entrepreneurs in fact sometimes hide their sex from customers, as discussed above, is consistent with this. And the U.S. Department of Transportation has in the past interpreted laws in such a way as to systematically preclude women-owned businesses from bidding for and winning procurement contracts (U.S. Congress, 1989). Beede and Rubinovitz (2015) document evidence that U.S. Federal Government procurement practices still evaluated bids from women-owned businesses differently than those from men-owned businesses (controlling for bid and business characteristics) as late as 2014. To the extent consumer preferences have changed over time, demand for output from women-owned businesses may have increased.

To infer how barriers have evolved over time, I use a model of entrepreneurship for men and women to interpret trends in entrepreneurship rates, average revenues per firm, average labor productivity per firm, and capital-labor ratios by sex. I then use the model to estimate several counterfactuals with respect to the evolution of aggregate output and the welfare of women and men. Interpreted through the model, observed trends suggest that each of the barriers described above have declined from 1982 to 2012. Women's startup costs have decreased by 12 percent, while the demand for output from women-owned firms has increased by 8 percent, both relative to male-owned firms. The effective tax on labor for women-owned firms has decreased from 24 percent down to almost zero, and the effective tax on using capital from 59 percent to 15 percent. Together, these changes increased the welfare (in consumption-equivalent terms) of workers by 2.3 percent, decreased the welfare of male entrepreneurs by 5.6 percent, increased the welfare of female entrepreneurs by 33 percent, and increased aggregate output per worker by 8.5 percent (more than 12 percent of the observed growth in GDP per worker).[2] Further, I find that aggregate output per worker in 2012 would be at least an additional 2 percent higher if remaining differential input costs for female entrepreneurs were removed, while the welfare of female entrepreneurs would be an additional 5 percent higher. This suggests the potential for additional gains if barriers continue to decline.

In mapping the model to the data I allow for changes in labor-market participation and labor-market discrimination over time. For these measures I borrow from Hsieh et al. (2019), an important related work. Hsieh et al. examine labor market data by gender over time, inferring changes in labor market discrimination (modeled as taxes on women's wages) and barriers to human capital investment, relative to men.[3] From them I take the effective tax on labor income faced by women, which I assume affects the opportunity cost of starting a firm.[4] By taking labor force participation and this effective tax as given in the model, I can therefore calculate the impact of barriers to female entrepreneurship *over and above* the impact of labor market barriers calculated by Hsieh et al. (2019).

A large and growing literature has studied the impact on aggregate output and productivity from policies and institutions that cause resources to be misallocated across firms (Restuccia and Rogerson, 2017). Although the mechanisms mapping barriers to aggregate output in this paper are often highlighted in the misallocation literature, I depart from much of the literature in focusing on barriers applied to a specific group of potential entrepreneurs. This has important implications for inferring the impact of misallocation from firm-level data. It is standard in the misallocation literature to take the observed distribution of producers as given, and infer

[2]The welfare loss for male entrepreneurs is calculated as the average welfare loss of males who would have been entrepreneurs if barriers had stayed constant at 1982 levels.

[3]Hsieh et al. (2019) also consider the evolution of barriers to black men and women.

[4]Hsieh et al. (2019) calculate effective wage taxes for white women, black women, and black men, each relative to white men. I use their results to obtain an effective tax for all women relative to all men by calculating an average tax by gender, weighted by incomes. This tax decreases from 48 percent in 1982 to 36 percent by 2012. I thank the authors for making their code and data available.

the distribution of firm-level distortions from firm-level observations. Doing this for the U.S. in 1982, one would mistakenly infer that only a small fraction of firms face high barriers. Further, such an analysis would take as given average productivity across producers, missing the fact that barriers to female entrepreneurship discourage relatively high-productivity women from starting firms while encouraging more low-productivity male entrepreneurs. An important conclusion from my model is that the decline in barriers to female entrepreneurship over time led to an increase in women-owned firms, and that these firms replaced less productive male entrepreneurs that would have entered had barriers remained at their 1982 levels. Relative to much of the misallocation literature, my measures of group-specific distortions are less open to common criticisms of the literature. Because sex is a relatively well-defined and exogenous characteristic of business owners, I can more confidently interpret measured distortions as a real feature of the business environment. For example to the extent that average revenue products of variable inputs differ systematically across female vs male entrepreneurs within an industry, controlling for firm and entrepreneur characteristics, I can confidently infer the existence of barriers to production for female entrepreneurs. This is in contrast to the broader misallocation literature, where observed differences in average revenue products across firms can be interpreted in many ways, some policy relevant (like taxes) and some as features of market structure (like markups dependent on firm size and age).

To date, the only research on this topic has been either descriptive, documenting the increase in the absolute number of women-owned businesses, for example Ventureneer (2019); or focused on identifying particular barriers to and determinants of female entrepreneurship, for example Ascher (2012), Bandiera et al. (2020), Beede and Rubinovitz (2015), Daymard (2015), and Georgellis and Wall (2005). This paper is the first (to my knowledge) to examine the quantitative impact of the observed trends in female entrepreneurship on aggregate output and the welfare of female and male participants in the labor market (however, see below). One contribution of this paper is to argue that to make inferences about the impact of trends in female entrepreneurship on aggregate output and welfare, one must be careful to measure the trends relative to labor force participation and relative to men. In particular, the most informative measures for my purposes are differential rates of entrepreneurship for working men and women, the average size of women- versus men-owned businesses, the average revenue product of labor of women- versus men-owned businesses, and differential capital-labor ratios. The method I use to infer barriers to entrepreneurship from the data produces four composite measures that are meant to capture the strength of all barriers facing women-owned businesses. This has the unfortunate implication that I can not speak to particular observed barriers, but the comprehensive measures I end up with allow me to estimate the impact of all barriers, including those that are unobserved or difficult to quantify. Two recent working papers follow a similar strategy to that in the present paper, modeling a set of potential barriers to interpret data on female entrepreneurship. Morazzoni and Sy (2021) explicitly model financial frictions and use their model to interpret recent data on debt and capital usage by women-owned startups in the U.S. They find similar results to what I find in the later years of my sample, and are able to identify collateral constraints and other distortions that disproportionately impact female entrepreneurs. The model I develop here is more agnostic about the source of capital barriers, but allows for a richer set of barriers affecting women-owned businesses. Chiplunkar and Goldberg (2021) employ a strategy similar to the one in this paper to interpret recent data on female entrepreneurship in India. Aside from the countries and time periods studied, the present paper departs from theirs in two ways. First, they incorporate features of informality that are important in the Indian context, while only accounting for a subset of the barriers I focus on here. Second, they account for the impact of barriers on female labor-market participation. I take labor-market-specific outcomes as given, in order to calculate the impact of barriers to entrepreneurship over and above those reported in Hsieh et al. (2019).

The theoretical model I use to interpret the data is based on the canonical model of firm dynamics in Hopenhayn (1992), but extended to allow for important aspects of firm decisions in the context of female entrepreneurship and female-specific barriers to entrepreneurship. For example Hurst and Pugsley (2011) document that about 54 percent of all new entrepreneurs identify non-monetary reasons for becoming entrepreneurs, a neglected aspect of entrepreneurship in Hopenhayn (1992) and extensions thereof. I compliment their analysis by considering female and male entrepreneurs separately, finding that female entrepreneurs are 13 percent more likely to cite non-pecuniary considerations as their primary reason for starting a business. This evidence is consistent with reports from other less-representative surveys, for example DeMartino and Barbato (2003), that report women as more likely to cite flexibility of hours as a major reason for becoming entrepreneurs. This is therefore a potentially important aspect of female entrepreneurship when estimating the welfare impact of evolving barriers to women-owned firms, so I allow for non-monetary gains to entrepreneurship that differ by sex.

Several factors behind the increase in female labor market participation in recent decades are not explicitly addressed by the model I use to interpret female entrepreneurship data. For example, marriage rates, divorce rates (conditional on marriage), and the fraction of women who are single mothers have all declined during the period studied in this paper, as has the average number of children per family (Costa, 2000; Stevenson and Wolfers, 2007). Access to reproductive healthcare has increased over time (Zandberg, 2021). An important identifying assumption for the analysis in the present paper is that these factors may have affected women's labor market participation rates, but not their decision to become entrepreneurs conditional on choosing to engage in market work. To the extent this assumption is violated, these factors affect the model's inferred barrier to starting a woman-owned business. For example, if lower marriage rates raise the opportunity cost of entrepreneurship (say, because married women have access to a husband's income and are less averse to risk), then the decline in the entry cost for female entrepreneurship is in fact more pronounced than what is inferred by the model. In this case, the gain from lower barriers inferred by the model can be interpreted as a conservative estimate.

The paper proceeds as follows. In the next section, I describe the data and document trends in female entrepreneurship over time. In Section 3 I describe a model of entrepreneurship that can be used to interpret the data. In Section 4 I infer barriers to women-owned businesses and report how they change over time, and Section 5 uses the model to infer how the evolution of these barriers affected welfare and aggregate output per worker. Section 6 reports the robustness of my results to alternative assumptions, and Section 7 concludes.

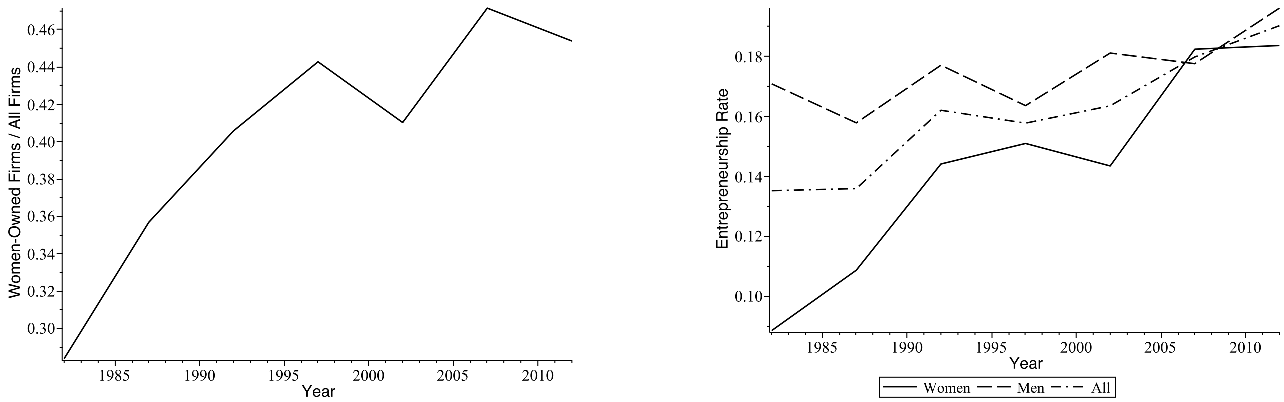
2 Women-Owned Businesses 1982 – 2012

I use firm data from women-owned businesses surveys, available for census years from 1982 to 2012.[5] Data is available for the number of firms and total revenue, by sex and industry, for several revenue-size bins. Employment data is from the Current Population Survey (CPS), by sex and industry, and measures the total employed civilian non-institutional population.

More recent data categorizes the sex of business owners into 'Female,' 'Male,' and 'Equally Male and Female', while older publications categorize both 'Female' and 'Equal' as women-owned businesses. For this paper, to keep measures comparable across years, I therefore use 'Female' to refer to businesses with at least 50 percent ownership by women. Public corporations are not classified according to sex, and so I remove them from all analysis, although most corporations are not public and are still accounted for in the data. The methodology used to identify the sex of business owners changed in 1997, so I make adjustments to earlier data as follows. As part of the 1997 publication, 1992 data is recalculated under the new methodology. For 1992 I therefore use the recalculated data. For earlier years I multiply the reported value of each variable by the adjustment factor reported for the same variable in 1992 (adjusted/reported).

Figure 1a illustrates how the fraction of firms belonging to women changed from 1982 to 2012 across the entire economy. This fraction increased from 28 percent in 1982 to 44 percent by 1997, then increased slightly to 45 percent by the end of the sample. These decades also saw an increase in the number of women in the labor force (from 43 to 47 percent of aggregate employment), which partially explains the surge in women-owned firms. Figure 1b controls for

[5] These data are published as 'Women-Owned Businesses' (1982-1997) and available online in digital form from 2002 onwards. Data are from U.S. Census Bureau's Survey of Women-Owned Businesses (1982-1992), Survey of Women-Owned Business Enterprises (1997), and Survey of Business Owners (2002-2012).



(a) Women-Owned Firms, Share of All Firms

(b) Entrepreneurship Rates

Figure 1: Women-Owned Firms and Entrepreneurship Rates Over Time

Notes: Entrepreneurship Rate calculated as number of firms relative to employed population (both by sex).

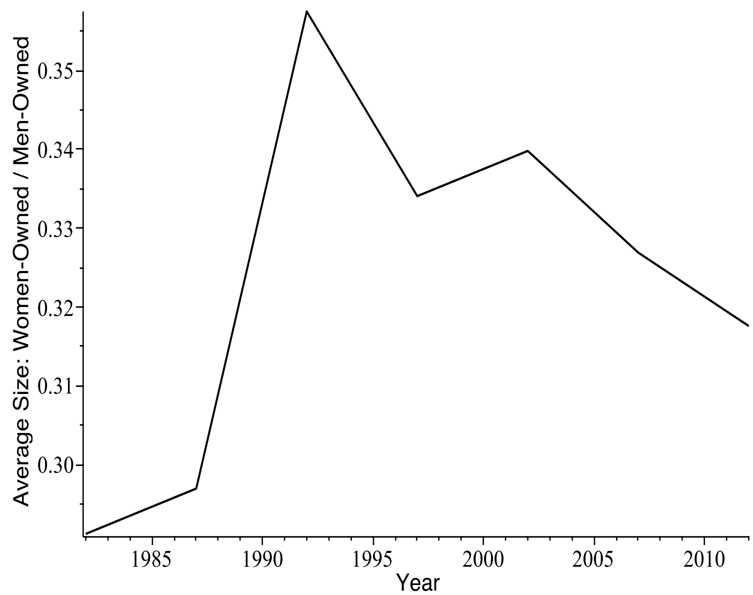
this, showing how the number of firms relative to the number of people employed (what I call the entrepreneurship rate) changed over time. These decades saw a dramatic rise in the number of firms per person (Bento and Restuccia, 2021), but Figure 1b shows that almost all of this rise was due to the more than doubling of the female entrepreneurship rate, from 8.9 percent in 1982 to 18.4 percent in 2012. The analogous rate for men increased only slightly from 17.1 to 19.6 percent.

The average revenue size of women-owned firms (relative to men) has also increased since 1982. But while the entrepreneurship rate for women essentially reached parity with men by 2012, average revenue for women-owned firms has only risen slightly from 29 to 32 percent of that for men, as illustrated in Figure 2.

The trends documented here are not merely the result of structural change in the U.S. economy. Figure 3 shows how the women-owned share of firms and the female entrepreneurship rate grew from 1982 to 2012, for nine sectors of the economy (those for which data is available by sector and comparable over time). Note the ninth sector 'other' aggregates all industries not included in the other eight sectors.[6] In every sector except 'other,' growth in the women-owned share of

[6]For sector-level data from 1982, I make the same adjustments to the data as for the aggregate data, described above. Note the sectoral measures of men-owned firms in 1982 include large public corporations that are excluded from the aggregate numbers. This should result in only a small discrepancy in the 1982 'share of all firms' numbers in Figure 3a, as the number of large public corporations is insignificant relative to the total number of firms.

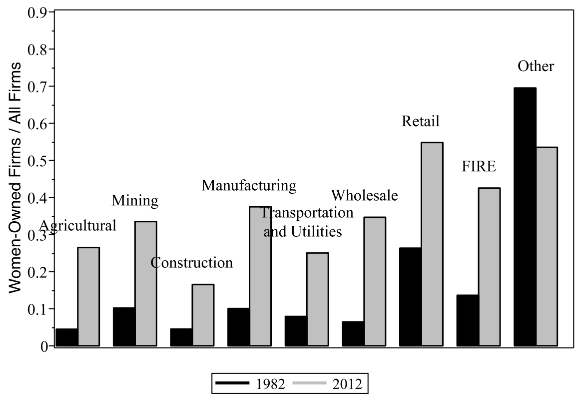
Figure 2: Average Revenue per Firm, Women Relative to Men



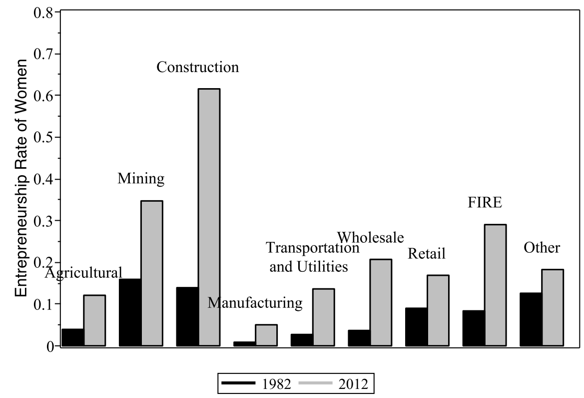
firms is substantial. And in every sector, female entrepreneurship rates increased significantly.[7]

In addition to differences in entrepreneurship rates and average revenue per firm, it would be of interest to know whether women-owned businesses grow at different rates after entry. Unfortunately data on the age of businesses is not available by sex until 2007. But I can at least consider whether women-owned businesses grew faster or slower than comparable men-owned businesses from 2007 to 2012. To do this I categorize businesses in both 2007 and 2012 by sex, date of birth, and industry. For this analysis I can identify firms born between 1980-1990, between 1990-2000, and between 2000-2007. Further, firms are categorized as belonging to one of twenty NAICS industries. Table 1 reports the results of regressions of (logged) average revenue per firm in 2012 on average revenue in 2007, with dummy variables included for industry and sex. For all three cohorts, the average growth rates of women- and men-owned firms are statistically indistinguishable from each other. Although evidence from earlier years would be ideal, these results suggest that any quantitatively important differences between women- and men-owned firms are determined at entry and are persistent over the life-cycles of these firms.

[7]Unfortunately, much of the data used in this paper is not disaggregated by sector.



(a) Women-Owned Firms, Share of All Firms



(b) Female Entrepreneurship Rate

Figure 3: Women-Owned Firms and Female Entrepreneurship Rate by Sector

Notes: 'FIRE' refers to Finance, Insurance, and Real Estate.

Table 1: Firm Growth by Sex

dependent variable: logged average revenue per firm in 2012			
born:	1980-1990	1990-2000	2000-2007
Female	0.12	0.10	-0.09
	(0.12)	(0.29)	(0.09)
Ln(average revenue) in 2007	0.92	1.04	0.77
	(0.14)	(0.27)	(0.07)

Notes: All regressions control for industry. Robust standard errors in parentheses.

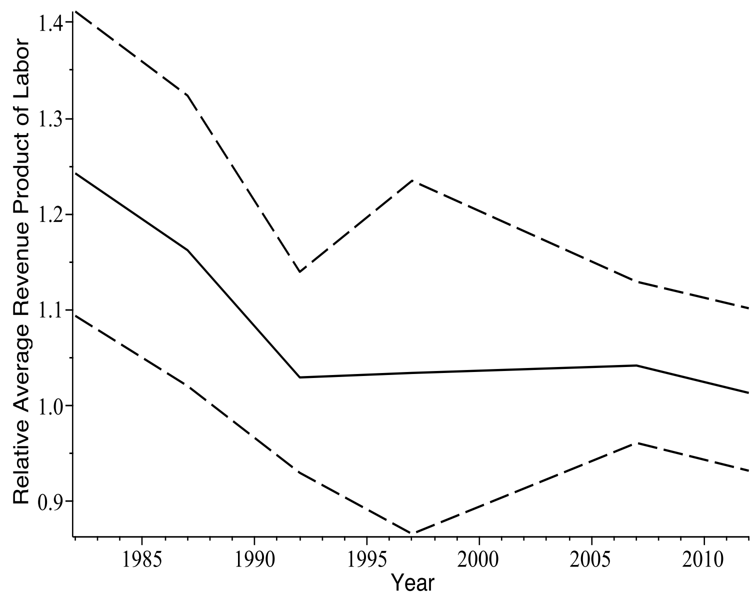
Hsieh and Klenow (2009) suggest differential production-based barriers on labor inputs can be inferred by comparing revenue products across firms. If firms competing within an industry face a common price for variable labor inputs, then profit maximization implies an equalized revenue product of labor across firms. To the extent average revenue products are higher for women-owned firms, we can (under some assumptions) infer that women face a higher effective 'tax' when hiring labor. One can think of this inferred tax as capturing a higher cost of acquiring short-term credit to finance labor costs due to credit-market discrimination, or the cost of compensating workers who dislike female owners with additional fringe benefits or at-work amenities. To investigate this possibility, I calculate the average revenue product of labor for women- and men-owned firms from 1982 to 2012. I then test whether average products differed by sex and observe whether this difference changed over time. To control for any differences in the composition of employees, I use the wage bill as a human-capital-weighted measure of employment (Hsieh and Klenow, 2009). The equation I estimate for each year is;

$$\ln(\text{average product})_{g,s,i} = \alpha + \beta_0 \cdot \text{sex} + \beta_1 \cdot \ln(\text{size})_{g,s,i} + \epsilon_{g,s,i},$$

where 'average product' is revenue over wage bill for firms with gender g in size bin s in industry i *relative to* total output over the wage bill for the same industry i, 'size' is average revenue per firm for the same observation relative to average revenue per firm for industry i, 'sex' is a dummy identifying women- and men-owned firms, and each observation is weighted by the number of firms represented. Data is reported by size bin, where size is defined as revenue per firm. There are up to 9 revenue ranges in the data, from "less than \$5,000" to "more than \$1 million." It is important to control for size, as data for intermediate inputs are not available and the share of intermediates in revenue is systematically related to firm size. As a result calculated average products are not very meaningful, but differences in average products across firms controlling for size can be used to infer relative production-based barriers. In the 1982-1997 industry-level data, public corporations are included in the 'all firms' counts by industry. I therefore exclude 'all firms' within the largest size bin (revenue over \$1 million) for these years.

Figure 4 reports estimates for the average product of labor for women-owned firms (β_0), relative to men, with dashed lines representing 95 percent confidence bounds. Data for 2002 by industry and revenue size is not available, so for that year Figure 4 reports the average of 1997 and 2007 estimates. The point estimates suggest women-owned firms faced high barriers to hiring labor in 1982 which dropped essentially to zero by 2012, with most of the drop complete by 1992. Following Hsieh and Klenow (2009), if these differences in average products are interpreted as reflecting differences in labor costs by sex, then women-owned firms effectively faced a 24 percent higher cost of labor than men in 1982. It is worth noting that if discrimination led female entrepreneurs to pay higher compensating wages to workers (rather than non-wage benefits), then the above estimates of labor distortions would be biased downward, as they do

Figure 4: Average Revenue Product of Labor (Women-Owned Firms / Men)



not account for higher wages per worker. As a result, using employment per firm rather than each firm's wage bill should result in larger differences in average products between female- and male-owned firms. In fact, employment-based measures are significantly lower in every year, suggesting this mechanism is much less important than differences in the human capital of employees at female- and male-owned firms.

To get an idea of how preferences for entrepreneurship differ between women and men, I look at data from the Panel Study of Entrepreneurial Dynamics II (PSED). The PSED data reflects a nationally representative cross-section of individuals who were surveyed in 2005 to identify those who were about to start new firms ('nascent entrepreneurs'). In 2006, those who had actually started firms and generated positive revenue were surveyed about their reasons for starting a firm. Using this data, Hurst and Pugsley (2011) report that of the 602 entrepreneurs surveyed, 53.9 percent cited non-pecuniary reasons for starting their firm.[8] Splitting these respondents by sex, I find that 57.9 percent of the 238 female entrepreneurs cited non-pecuniary reasons,

[8]This result is reported in their Table 9, with percentages weighted by sampling weights. Entrepreneurs were asked, "Why did you want to start this new business?" and were allowed up to two responses in their own words. I thank Erik Hurst and Benjamin Pugsley for making their code and data available.

compared to only 51.3 percent of the male entrepreneurs. This suggests that women give greater weight to factors like independence and flexibility of hours than men, consistent with other evidence such as DeMartino and Barbato (2003). As the PSED surveys are replicated over time, we will have a better idea of how these preferences might change and how they might depend on other factors.

3 A Model of Entrepreneurship

3.1 Environment

Here I describe the model I use to interpret the trends reported in Section 2 and infer how barriers to female entrepreneurship in the U.S. have changed over time. Consider a one-sector model economy consisting of L_f female and L_m male workers, with N_f and N_m of them working as entrepreneurs. Worker productivity is homogenous across the population, but I assume female workers are paid a fraction $1 - \tau_W$ of the male wage w. Following Hsieh et al. (2019), I assume τ_W exactly compensates business owners for hiring a woman, and so they perceive their marginal cost of female labor to be equal to w.[9] L_f and L_m are exogenous.

Although the model economy has only one sector, goods produced by women-owned firms are imperfect substitutes for those produced by men-owned firms. I assume a stylized representative final-good firm which produces a final consumption good (also the numéraire) using the output of women- and men-owned firms as intermediate inputs according to;

$$Y = \left[\phi Y_f^{\frac{\sigma-1}{\sigma}} + Y_m^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}, \tag{1}$$

where Y_f is total intermediates demanded from women-owned firms, Y_m is the same demanded from men-owned firms, and $\sigma > 1$ is the constant elasticity of substitution between the two types of goods. ϕ is meant to reflect a 'real' difference in demand for the output produced by

[9] For simplicity I assume all business owners dislike female employees equally.

women-owned firms, relative to men, due to a real difference in the types of goods produced by entrepreneurs of each sex and not due to any consumer discrimination. I distinguish aggregate output above from 'perceived' aggregate output $\hat{Y}$, which additionally takes into account any further impact on demand from consumer discrimination toward output from female-owned firms:

$$\hat{Y} = \left[(1-\tau_D)\phi \cdot Y_f^{\frac{\sigma-1}{\sigma}} + Y_m^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}. \tag{2}$$

τ_D represents consumer discrimination toward output from female-owned firms, effectively a tax on demand. The representative final-good firm takes all prices as given and chooses intermediates to maximize $\hat{Y}$.

Within each sex, firms produce a homogenous good using the following technology;

$$y = (Az)^{1-\gamma}\left(\ell^{1-\alpha}k^{\alpha}\right)^{\gamma}, \quad \gamma \in (0,1),\ \alpha \in (0,1),$$

where ℓ is labor, k is capital, A is an aggregate productivity term affecting all firms, and z is firm-level productivity which is heterogeneous across firms. Producers take output prices P_s and input prices w and r as given. Women-owned firms must pay a proportional tax τ_L on their wage bill. One can think of τ_L as a simple way of capturing a higher cost of acquiring short-term credit to finance labor costs due to credit-market discrimination, or the cost of compensating workers who dislike female owners with additional fringe benefits or at-work amenities. Similarly, women-owned firms must pay a proportional tax τ_K on the rental price of capital. I assume labor and capital markets are otherwise frictionless, and that all revenue from these 'taxes' are rebated lump-sum to consumers. Operating profit for an entrepreneur of sex s with productivity z is therefore;

$$\pi_s = P_s(Az)^{1-\gamma}\left(\ell^{1-\alpha}k^{\alpha}\right)^{\gamma} - w(1+\tau_L)\ell - r(1+\tau_K)r, \tag{3}$$

where $s \in \{f, m\}$ indexes sex, and τ_L and τ_K should be understood to apply only to women-owned firms.

All workers are potential entrepreneurs, and know their ability $z_0^{1-\gamma}$ (which I assume is their initial productivity at entry) before deciding whether to start a business. I assume the distribution of $z_0 \in (1, \infty)$ across women is identical to that across men, described by a Pareto distribution with shape parameter $\xi > 1$. Starting a firm requires an entrepreneur to incur a sex-specific entry cost. I specify this cost in terms of the numèraire, but I assume it scales up with the wage.[10] Male entrants must incur a cost equal to $w \cdot c_{E,m}$, while female entrants must incur a cost equal to $w_f \cdot \cdot c_{E,f}$, $c_{E,f} \equiv \hat{c}_{E,f} \cdot (1 + \tau_E)$. τ_E is effectively a 'tax' faced by female entrants, representing any barriers or social norms impacting the perceived cost of starting and running a woman-owned firm that are fixed in nature. I allow for 'real' differences in entry costs ($\hat{c}_{E,f}$ vs $c_{E,m}$) due to differences in the types of firms across groups. This last complements my assumptions that women- and men-owned firms are imperfect substitutes for each other, and that the difference in demand for output from women-owned firms relative to other firms is in part due to a difference in the type of businesses they run (represented by ϕ). Assuming the opportunity cost of entry for women is reduced by τ_W captures a lower opportunity cost of entry if women earn lower wages.

Entrants start production immediately, and all producers face an exogenous probability of exit each period after production equal to λ. The productivity of every producer grows deterministically by a factor $(1 + g)^{1-\gamma}$, conditional on survival. If a firm exits, its entrepreneur is free to start a new firm and again incur an entry cost. I assume entrepreneurs do not use up their labor when running a firm, and so they continue to earn the market wage.[11] To capture the possibility that people have non-pecuniary reasons for becoming entrepreneurs, I assume the preferences of every person of sex s attaches a weight $X_s \in (0, 1)$ to net income from entrepreneurship (including returns to capital purchased with that income), and $1 - X_s$ to other income.

[10] Having the entry cost scale up with the wage is consistent with Bollard et al. (2016). If the entry cost were a fixed goods cost, then a growing economy would reduce the entry cost relative to firm profits. With exponential economic growth and free entry, the number of firms would explode. Specifying the entry cost in terms of the final good (rather than in terms of labor) simplifies the exposition.

[11] One can think of owners of larger firms paying themselves a wage, and owners of very small (low-productivity) firms working part-time for other firms. U.S. data suggests most entrepreneurs (especially those without employees) continue to work for other firms while running their own business. For example in 2017 only about one third of all entrepreneurs identified self-employment as their main occupation according to Current Population Survey data.

Every person in the economy has linear preferences for consumption (subject to preferences for the source of income and source of consumption), supplies one unit of labor inelastically, and discounts the future using an exogenous interest rate of R. I assume a representative competitive financial intermediation firm borrows capital from the rest of the world, paying a rental rate r, and rents out this capital to entrepreneurs in each period. This intermediary charges $r(1+\tau_K)$ to women-owned firms and r to other firms, but perceives the rate it receives to be equal to r in all cases. Assuming capital depreciates at rate $\delta \in (0,1)$, and given the exogenous interest rate, the rental rate on capital r must be such that the perceived real return on capital investment is equal to the interest rate, $r - \delta = R$. Note that under these assumptions, perceived profits for the financial intermediary are zero. I focus on the steady-state equilibrium of the economy, in which aggregate variables, prices, the number of women- and men-owned firms, the number of female and male entrants, and the cross-sectional distributions of productivity across s-firms are all invariant over time. When I use the model to interpret the data I assume the economy is in a new steady state in each observed period, and so I implicitly assume here that all decision makers always believe they exist in an unchanging economy.[12]

3.2 Production

A producer of sex s and productivity z chooses labor to maximize operating profit (3), taking all prices as given. This leads to the following optimal demand for labor, demand for capital, output, and operating profit, all as functions of z;

$$\ell_s(z) = Az\left[\frac{\gamma P_s}{(1+\tau_K)^{\alpha\gamma}(1+\tau_L)^{1-\alpha\gamma}}\left(\frac{1-\alpha}{w}\right)^{1-\alpha\gamma}\left(\frac{\alpha}{r}\right)^{\alpha\gamma}\right]^{\frac{1}{1-\gamma}}, \tag{4}$$

$$k_s(z) = \ell_s(z)\frac{1+\tau_L}{1+\tau_K}\left(\frac{w}{1-\alpha}\right)\left(\frac{\alpha}{r}\right), \tag{5}$$

$$y_s(z) = Az\left[\frac{\gamma P_s}{(1+\tau_K)^{\alpha}(1+\tau_L)^{1-\alpha}}\left(\frac{1-\alpha}{w}\right)^{1-\alpha}\left(\frac{\alpha}{r}\right)^{\alpha}\right]^{\frac{\gamma}{1-\gamma}}, \tag{6}$$

[12] This last assumption follows Hsieh et al. (2019) and simplifies the analysis.

$$\pi_s(z) = (1-\gamma)P_s y_s(z), \tag{7}$$

where r is the rental rate for capital, and τ_L and τ_K are again understood to apply only to women-owned firms.

Average Revenue Product of Labor It is immediately clear from (4) and (6) that the average revenue product of labor for a woman-owned firm relative to a man-owned firm is;

$$\frac{P_f y_f/\ell_f}{P_m y_m/\ell_m} = 1 + \tau_L. \tag{8}$$

Note that average revenue products are independent of productivity z, prices P_s, and the capital 'tax' τ_K . Interpreting the observed average revenue product ratios over time in Figure 4 using the above expression, I infer that τ_L dropped from 24 percent in 1982 to just 1 percent in 2012.

Capital-Labor Ratio It is similarly clear from (4) and (5) that the capital-labor ratio for a woman-owned firm relative to a male-owned firm is;

$$\frac{k_f/\ell_f}{k_m/\ell_m} = \frac{1+\tau_L}{1+\tau_K}. \tag{9}$$

Note that capital labor ratios are also independent of productivity z and output prices P_i. Fairlie et al. (2016) estimate this ratio, controlling for industry as well as owner and firm characteristics, and report that female-owned startups in 2004 use 14% less capital on average than comparable male-owned startups with the same level of employment. Given a calculated value for τ_L of 3.8% in 2002, I infer $\tau_K = 20.4\%$ in 2002.[13]

[13] I do not have analogous measures of capital-labor ratios in other years. I discuss below how I infer τ_K in years other than 2002.

3.3 Entrants

The value of starting a firm for a potential entrepreneur of sex s with ability z_0 is;[14]

$$V_s(z_0) = \pi_s(z_0) \cdot \left(\frac{1+R}{1+R-(1-\lambda)(1+g)} \right) - w \cdot (1-\tau_W) c_{E,s}, \tag{10}$$

where τ_W should again be understood to apply only to female entrepreneurs. Free entry then implies a threshold $z^*_{0,s}$ such that potential entrepreneurs of sex s start firms if and only if $z_0 \geq z^*_{0,s}$. This threshold for each sex is characterized by the following expression;

$$w \cdot (1-\tau_W) c_{E,s} = \pi_s(z^*_{0,s}) \cdot \left(\frac{1+R}{1+R-(1-\lambda)(1+g)} \right). \tag{11}$$

Note that since men- and women-owned businesses exit and grow at the same rates, average productivity across all s-firms as a function of average productivity across s-entrants is;[15]

$$\mathbb{E}^{all}_s(z) = \mathbb{E}^{ent}_s(z_0) \cdot \left(\frac{\lambda}{1-(1-\lambda)(1+g)} \right),$$

where the expectations operator here is used to signify an average. This in turn implies that the average productivity of female entrants relative to male entrants is equal to the average productivity of all female producers, relative to males;

$$\frac{\mathbb{E}^{all}_f(z)}{\mathbb{E}^{all}_m(z)} = \frac{\mathbb{E}(z_0 \mid z_0 > z^*_{0,f})}{\mathbb{E}(z_0 \mid z_0 > z^*_{0,m})} = \frac{z^*_{0,f}}{z^*_{0,m}}, \tag{12}$$

where the Pareto distribution of ability implies $\mathbb{E}(z_0 \mid z_0 > z^*_{0,s}) = z^*_{0,s} \cdot \xi \cdot (\xi - 1)^{-1}$.

[14] Since X_f applies to entrepreneurial income net of costs and entrepreneurs continue to earn a wage, X_f does not affect decisions. I therefore ignore it here.

[15] WIth a constant number of s-firms in steady state, the fraction of firms that are entrants must be equal to the fraction that exit, λ. With each firm's z growing at rate g, z across firms is therefore equal to average z_0 multiplied by $\lambda \left[1 + (1-\lambda)(1+g) + (1-\lambda)^2(1+g)^2 + ...\right]$.

Entry Costs Combining equations (6), (7), (11), and (12), the following relationship between the cost of entry for female and male entrepreneurs must hold;

$$\frac{c_{E,f}(1-\tau_W)}{c_{E,m}} = \left(\frac{P_f}{P_m}\right)^{\frac{1}{1-\gamma}} \left(\frac{z^*_{0,f}}{z^*_{0,m}}\right) \left[(1+\tau_K)^{\alpha}(1+\tau_L)^{1-\alpha}\right]^{\frac{-\gamma}{1-\gamma}} = \frac{\mathbb{E}(P_f y_f)}{\mathbb{E}(P_m y_m)}. \tag{13}$$

This expression tells us that relative entry costs (adjusted for τ_W) are equal to average revenue per women-owned firm relative to the same for men-owned firms. Equivalently, (adjusted) relative entry costs must be equal to the present value of expected life-time profits for the marginal female entrant ($z_0 = z^*_{0,f}$), relative to the marginal male entrant. To see the intuition here, imagine something happens to make women-owned firms more profitable for any given z_0, relative to men. If entry costs remain unchanged, this reduces the threshold $z^*_{0,f}$ required to justify entry, encouraging more (less productive) women to enter and reducing relative average revenue until equation (13) holds once again. An increase in relative profits in equilibrium therefore implies that the relative opportunity cost of entering for women must have increased. Since revenue per firm increased from 1982 to 2012 for women-owned firms relative to men-owned firms, the opportunity cost of becoming an entrepreneur must have risen for women relative to men. Data from Hsieh et al. (2019) imply a drop in τ_W over this period from 48 to 36 percent. Assuming $\hat{c}_{E,f}/c_{E,m}$ has remained constant over time, I therefore infer that the entry cost 'tax' for female entrepreneurs $1+\tau_E$ decreased by 12 percent from 1982 to 2012. Combined, these two trends suggest the relative opportunity cost of entering increased over the same period by 9 percent.

3.4 Final-Good Firm

The final-good firm demands Y_f and Y_m to maximize profit each period, given prices P_f and P_m. This implies the following relationships between the price, total perceived output, and total revenue of women-owned firms relative to those of men-owned firms;

$$P_f = \left(\frac{Y_f}{\hat{Y}}\right)^{-\frac{1}{\sigma}} (1-\tau_D)\phi, \quad P_m = \left(\frac{Y_m}{\hat{Y}}\right)^{-\frac{1}{\sigma}}$$

$$\left(\frac{P_f}{P_m}\right)^{\sigma-1} = \frac{P_m Y_m}{P_f Y_f}(1-\tau_D)^{\sigma}\phi^{\sigma} = \frac{N_m}{N_f}\cdot\frac{\mathbb{E}(P_m y_m)}{\mathbb{E}(P_f y_f)}(1-\tau_D)^{\sigma}\phi^{\sigma}, \tag{14}$$

where the number of s-firms N_s is equal to the number of people of sex s with ability above $z^*_{0,s}$. With a Pareto distribution of ability, this is equal to;

$$N_s = L_s \cdot \left[1 - F(z^*_{0,s})\right] = L_s \cdot (z^*_{0,s})^{-\xi}. \tag{15}$$

Productivity, τ_K, and τ_D Given average revenue per woman-owned firm relative to men, the numbers of women- and men-owned firms, and the numbers of female and male labor market participants, (6) and (14) can be used to back out the relative average firm-level productivity of women-owned firms as a function of τ_L, τ_K, and τ_D;[16]

$$\frac{z^*_{0,f}}{z^*_{0,m}} = \frac{\mathbb{E}(P_f y_f)}{\mathbb{E}(P_m y_m)}\cdot\left(\frac{P_m}{P_f}\right)^{\frac{1}{1-\gamma}}\left[(1+\tau_K)^{\alpha}(1+\tau_L)^{1-\alpha}\right]^{\frac{\gamma}{1-\gamma}}$$

$$= \left(\frac{\mathbb{E}(P_f y_f)}{\mathbb{E}(P_m y_m)}\right)^{1+\frac{1}{(\sigma-1)(1-\gamma)}}\left(\frac{N_f}{N_m}\right)^{\frac{1}{(\sigma-1)(1-\gamma)}}\left[\mathcal{T}_{KD}(1+\tau_L)^{\gamma(1-\alpha)}\phi^{\frac{\sigma}{1-\sigma}}\right]^{\frac{1}{1-\gamma}}, \tag{16}$$

$$\mathcal{T}_{KD} \equiv \frac{(1+\tau_K)^{\alpha\gamma}}{(1-\tau_D)^{\frac{\sigma}{\sigma-1}}}. \tag{17}$$

Higher revenue per woman- relative to man-owned firm can be due to higher relative productivity, higher prices, lower τ_K, and lower τ_L. $\mathcal{T}_{KD}$ is a composite barrier combining τ_K and τ_D. Given relative average revenue, ability, number of firms, τ_L, and τ_K, the above expression can be used to infer τ_D in 2002. The evolution of $\mathcal{T}_{KD}$ relative to its 2002 value can be inferred in a similar way.

[16]Note that firm-level productivity is specified as $z^{1-\gamma}$. I ignore the exponent here for ease of exposition.

3.5 Equilibrium

I now solve for the steady-state equilibrium of the model, allowing me to evaluate the impact of changing barriers on aggregate output and the welfare of women and men. I start by imposing labor market clearing, denoting aggregate employment by $L = L_f + L_m$. Using (4) and (13), labor market clearing implies;

$$L = A \left[\gamma P_f \left(\frac{1-\alpha}{w(1+\tau_L)} \right)^{1-\alpha\gamma} \left(\frac{\alpha}{r(1+\tau_K)} \right)^{\alpha\gamma} \right]^{\frac{1}{1-\gamma}} \mathbb{E}_f^{all}(z) \left[N_f + N_m \frac{c_{E,m}(1+\tau_L)}{c_{E,f}(1-\tau_W)} \right], \tag{18}$$

where average z across all women-owned firms is equal to;

$$\mathbb{E}_f^{all}(z) = z_{0,f}^* \left(\frac{\xi}{\xi - 1} \right) \left(\frac{\lambda}{1-(1-\lambda)(1+g)} \right).$$

Equation (18) can be solved for the male wage w. Plugging this w into (11) results in the following relationship between N_f and N_m;

$$N_f c_{E,f} \left(\frac{1-\tau_W}{1+\tau_L} \right) + N_m c_{E,m} = \Psi L, \tag{19}$$

$$\Psi \equiv \gamma^{-1} \left(\frac{\xi-1}{\xi} \right) \left(\frac{1-\gamma}{1-\alpha} \right) \left(\frac{1+R}{1+R-(1-\lambda)(1+g)} \right) \left(\frac{1-(1-\lambda)(1+g)}{\lambda} \right).$$

Note that the above equation can also be used to infer the value of $c_{E,m}$, given N_f, N_m, (13), and values for exogenous parameters. I make use of this in Section 5. Combining (13), (14), and (15) results in a second expression relating N_f and N_m;

$$\frac{N_f}{N_m} = \left(\frac{z_{0,f}^*}{z_{0,m}^*} \right)^{(\sigma-1)(1-\gamma)} \left(\frac{c_{E,m}}{c_{E,f}(1-\tau_W)} \right)^{\gamma+\sigma(1-\gamma)} \left[\mathcal{T}_{KD}(1+\tau_L)^{\gamma(1-\alpha)} \phi^{\frac{\sigma}{1-\sigma}} \right]^{1-\sigma}, \tag{20}$$

or

$$\left(\frac{N_f}{N_m} \right)^{1+\frac{(\sigma-1)(1-\gamma)}{\xi}} = \left(\frac{L_f}{L_m} \right)^{\frac{(\sigma-1)(1-\gamma)}{\xi}} \left(\frac{c_{E,m}}{c_{E,f}(1-\tau_W)} \right)^{\gamma+\sigma(1-\gamma)} \left[\mathcal{T}_{KD}(1+\tau_L)^{\gamma(1-\alpha)} \phi^{\frac{\sigma}{1-\sigma}} \right]^{1-\sigma}.$$

Together, (19) and (20) characterize N_f and N_m (or $z^*_{0,f}$ and $z^*_{0,m}$) as functions of exogenous variables.

The following characterization of aggregate output per worker can be derived using (1), (6), (13), (14), and (18);

$$\frac{Y}{L} = \left[\frac{(1-\tau_D)^{\frac{\sigma}{\sigma-1}}}{1+\tau_K}\right]^{\frac{\alpha\gamma}{1-\alpha\gamma}} \left[\left(\frac{N_f}{L}\right) A z^*_{0,f} \Psi'\right]^{\frac{1-\gamma}{1-\alpha\gamma}}$$

$$\cdot \frac{\left(1+\frac{N_m c_{E,m}}{N_f c_{E,f}(1-\tau_W)}\right)^{\frac{\alpha\gamma}{(\sigma-1)(1-\alpha\gamma)}}}{\left(1+\frac{N_m c_{E,m}(1+\tau_L)}{N_f c_{E,f}(1-\tau_W)}\right)^{\frac{\gamma(1-\alpha)}{1-\alpha\gamma}}} \cdot \left(1+\frac{N_m c_{E,m}(1-\tau_D)}{N_f c_{E,f}(1-\tau_W)}\right)^{\frac{\sigma}{\sigma-1}}, \tag{21}$$

$$\Psi' \equiv \left(\frac{\alpha\gamma}{r}\right)^{\frac{\alpha\gamma}{1-\gamma}} \left(\frac{\xi}{\xi-1}\right) \left(\frac{\lambda}{1-(1-\lambda)(1+g)}\right) \phi^{\frac{\sigma}{(\sigma-1)(1-\gamma)}}.$$

Perceived output per worker can be derived in a similar fashion;

$$\frac{\hat{Y}}{L} = \frac{Y}{L}\left[(1-\tau_D)\frac{\left(1+\frac{N_m c_{E,m}}{N_f c_{E,f}(1-\tau_W)}\right)}{\left(1+\frac{N_m c_{E,m}(1-\tau_D)}{N_f c_{E,f}(1-\tau_W)}\right)}\right]^{\frac{\sigma}{\sigma-1}}. \tag{22}$$

Combining (14) and (18) results in an expression for w relative to output per worker;

$$w = \frac{Y}{L}\gamma(1-\alpha) \cdot \frac{(1-\tau_D)^{\frac{\sigma}{\sigma-1}}}{1+\tau_L}\left(1+\frac{N_m c_{E,m}(1+\tau_L)}{N_f c_{E,f}(1-\tau_W)}\right)\frac{\left(1+\frac{N_m c_{E,m}}{N_f c_{E,f}(1-\tau_W)}\right)^{\frac{1}{\sigma-1}}}{\left(1+\frac{N_m c_{E,m}(1-\tau_D)}{N_f c_{E,f}(1-\tau_W)}\right)^{\frac{\sigma}{\sigma-1}}}. \tag{23}$$

The aggregate capital-labor ratio can be characterized using (5), (14), (18), and capital market clearing;

$$\frac{K}{L} = \left(\frac{w}{1-\alpha}\right)\left(\frac{\alpha}{r}\right)\left(\frac{1+\tau_L}{1+\tau_K}\right)\left(\frac{N_f c_{E,f}(1-\tau_W)+N_m c_{E,m}(1+\tau_K)}{N_f c_{E,f}(1-\tau_W)+N_m c_{E,m}(1+\tau_L)}\right). \tag{24}$$

My measure of welfare is equivalent to average income by sex from work and entrepreneurship, adjusted for differences in preferences for entrepreneurship, preferences for the source of consumption, entrepreneurs' preferences for the sex of employees, and the preferences of factor suppliers with respect to entrepreneurs. In particular, I take into account that workers in group s perceive their wage per effective unit of labor to be equal to w (for men) or w (for women), financial intermediaries perceive the rental rate they receive for loaned-out capital to be equal to r, and entrepreneurs perceive their cost per unit of (composite) labor to be equal to $(1+\tau_L)w$, again with τ_L applying only to black entrepreneurs. In the cross-section, everyone expects to earn a wage forever, and those choosing to be entrepreneurs expect to start a new firm immediately in the event of exiting in the future. I calculate average welfare (and the change in welfare over time) separately for workers and entrepreneurs. For female and male workers, average welfare is equal to;

$$U_{f,w} = \frac{\hat{Y}}{Y}(1-X_f)w(1-\tau_W)\left(\frac{1+R}{R}\right), \tag{25}$$

$$U_{m,w} = \frac{\hat{Y}}{Y}(1-X_m)w\left(\frac{1+R}{R}\right), \tag{26}$$

For female entrepreneurs, average welfare is equal to;

$$\begin{aligned} U_{f,e} = \frac{\hat{Y}}{Y}\Bigg[&(1-X_f)w(1-\tau_W)\left(\frac{1+R}{R}\right) \\ &+X_f\mathbb{E}_f^{all}[\pi_f(z)]\left(\frac{1+R}{1+R-(1-\lambda)(1+g)}\right) \\ &+X_f\mathbb{E}_f^{all}[\pi_f(z_0)]\left(\frac{1+R}{1+R-(1-\lambda)(1+g)}\right)\left(\frac{\lambda}{R}\right) \\ &- X_f(1-\tau_W)w(1-\tau_W)c_{E,f}\lambda\left(\frac{1+R}{R}\right)\Bigg], \end{aligned}$$

where the first line represents labor earnings, the second expected discounted profits from current producers (per entrepreneur), the third expected discounted profits from future firms, and the last represents current and discounted future expenditure on entry costs. Given the relationships between $\mathbb{E}_f^{all}[z]$, $\mathbb{E}_f^{all}[z_0]$, and $c_{e,f}$, the above collapses to the following simple expression;

$$U_{f,e} = \frac{\hat{Y}}{Y}(1-\tau_W)w\left[(1-X_f)\left(\frac{1+R}{R}\right) + X_f\frac{\lambda c_{e,f}}{R(\xi-1)}\right]. \tag{27}$$

Average welfare for male entrepreneurs can be derived in an analogous way to obtain the following expression;

$$U_{m,e} = \frac{\hat{Y}}{Y}w\left[(1-X_m)\left(\frac{1+R}{R}\right) + X_m\frac{\lambda c_{e,m}}{R(\xi-1)}\right]. \tag{28}$$

Given our assumption of linearity in utility (with respect to perceived consumption), a given percentage increase in utility can be straightforwardly interpreted as equivalent to the utility gain from the same permanent percentage increase in actual consumption (keeping constant the fraction of income from each source, the fraction of consumption from each source, etc...).

Comparative Statics Above I have focused my discussion on how various barriers to female entrepreneurship can be inferred from the data. I conclude my description of the model by summarizing how these barriers (along with the quantity of labor) affect steady-state outcomes. Equation 19 shows that a proportional decrease in all entry costs, $c_{E,f}$ and $c_{E,m}$, results in a proportional increase in women- and men-owned firms. Mechanically, this leads to lower average ability across all entrepreneurs. But from (15) and (21), the product of $z^*_{0,s}$ and N_s and therefore aggregate output increase. Relative average productivity and relative average revenue both remain unaffected.

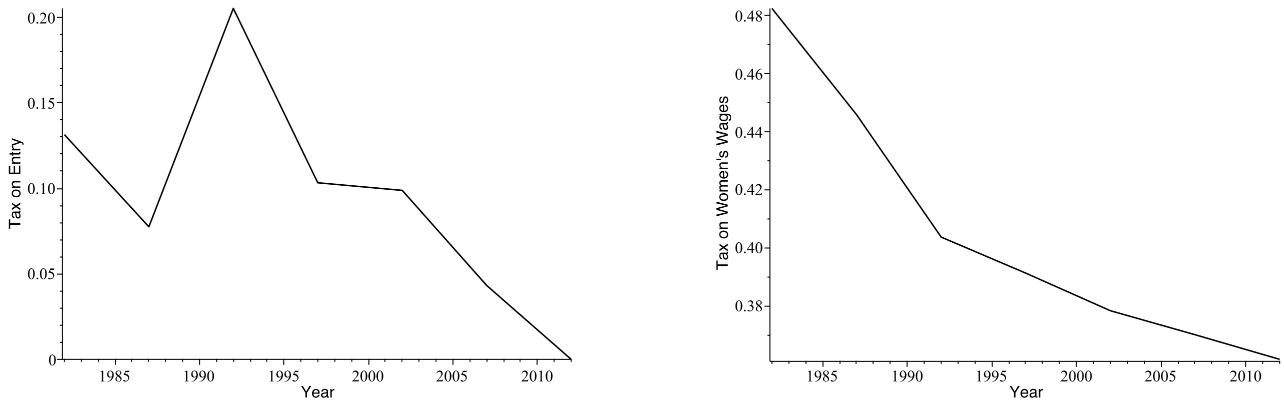
If female entry costs alone decrease, then (19) and (20) show that entry by women-owned firms will increase, while the number of men-owned firms will contract in response to higher wages and lower profits. Now the lower average ability of female entrepreneurs results in lower average revenue for women- relative to men-owned firms. Aggregate output increases along with the product of $z^*_{0,s}$ and N_s, but this effect is partially offset by the fall in male entrepreneurship. Any decrease in τ_W increases the opportunity cost of starting a firm for women, and is therefore analogous to an increase in $c_{E,f}$ (except for its effect on welfare).

All else equal, a decrease in τ_L, the effective tax rate on payments to labor in women-owned firms, increases labor demanded, revenue, and profits for a woman-owned firm with a given level of productivity. But this encourages entry by female entrepreneurs and discourages entry by male entrepreneurs such that relative average revenue remains unchanged (equations 19 and 20). For a given distribution of firms, a lower τ_L reduces the misallocation of labor, encouraging labor to flow from men- to women-owned firms. Aggregate output increases due to both the increase in the number of women-owned firms and the lower level of misallocated labor. A decrease in τ_K propagates similarly through the economy, but with the further effect of encouraging a higher stock of capital and further increasing aggregate output. Lower consumer discrimination, represented by a lower τ_D, directly affects relative prices by increasing the demand for output from women-owned firms. The end result is similar to that from a lower τ_L – a higher female entrepreneurship rate, lower male entrepreneurship, and higher aggregate output.

From 1982 to 2012 the number of working women increased much faster over time than the number of working men, by 56 compared to 34 percent. In this model, a proportional increase in the quantity of female and male labor increases N_f and N_m in equal proportions (equations 19 and 20). If L_f increases faster than L_m, then the entrepreneurship rate for women grows less than that for men. This implies an increase in the relative average ability of female entrepreneurs. Relative average revenue stays constant, however, as the change in relative abilities is exactly offset by a change in relative prices (equations 13 and 14). And since the number of women-owned firms still grows faster than men-owned firms, a greater share of aggregate revenue is generated by women-owned firms. Regardless of whether L_f or L_m grows faster, output per worker remains unchanged.

4 Barriers Faced by Women-Owned Businesses

Before documenting the barriers faced by women-owned businesses I need values for four parameters, γ, α, σ, and ξ. The product $\alpha \cdot \gamma$ represents the elasticity of output with respect to



(a) Startup Tax τ_E

(b) Wage Tax τ_W

Figure 5: Startup Costs and Wage Tax

Notes: Relative startup costs calculated using (13). τ_W calculated using data from Hsieh et al. (2019).

capital, while $(1-\alpha)\cdot\gamma$ represents the same with respect to labor. For these two parameters I use values commonly used in the literature, $\gamma = 0.8$ and $\alpha = 1/3$. σ represents the elasticity of substitution between the output of women- and men-owned firms. Estimated elasticities between products vary widely across sectors (Broda and Weinstein, 2006), but Imbs and Méjean (2015) suggest a value of 6.5 for one-sector models. I use their value ($\sigma = 6.5$), but acknowledge that this choice is somewhat arbitrary given the lack of any estimates of elasticities based on sex. In Section 6 I discuss the robustness of my findings to different values for σ and other parameters. ξ determines the shape of the firm size distribution within each sex. I choose ξ by targeting the revenue-size distribution across male-owned manufacturing firms in 2007.[17] Revenue per firm at the 52nd percentile of this distribution is 3.6 percent of the average. Given the direct mapping from relative productivity to relative revenue in (6), this ratio (rev_{52}/rev_{ave}) is equal to $(\xi-1)\xi^{-1}(1-0.52)^{-1/\xi}$ in a Pareto distribution. This implies $\xi = 1.02$.

I now infer how differences in the labor-input tax, startup costs, ability, consumer discrimination, and the capital-input tax changed between 1982–2012 using equations (8), (9), (13), (15), (16), and (17). These are illustrated in Figures 5 through 6, along with τ_W, the measure of labor market discrimination from Hsieh et al. (2019).

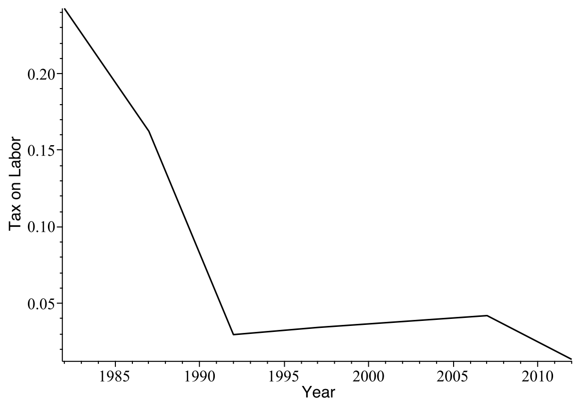
[17]The revenue-size distribution of male-owned firms is more broadly spread over reported size bins, relative to other sectors and relative to women-owned firms, allowing for a better estimate of ξ. I use the reported moment closest to the median.

Two features of Figure 5a are immediately apparent. First, inferred startup costs for female entrants generally declined over time, relative to those for male entrants, although the data suggest a spike from 1987 to 1992. Over the whole time period, female startup costs dropped 12 percent relative to male startup costs. Second, startup costs for female entrants were lower than those for men in all years. Broadly, there are two ways to interpret lower startup costs for women. Either male entrants truly incur higher costs than women to start the same type of business, or female entrepreneurs choose to start businesses that differ systematically from those started by men. That male entrants face higher costs to start the same business seems implausible given the high effective taxes women have apparently faced with respect to their labor income (as workers) and their cost of hiring inputs (as entrepreneurs). In the counterfactual exercises I perform in the next section, I therefore assume that differences in inferred startup costs in 2012 only reflect differences in the nature of the businesses chosen by women and men. I emphasize that regardless of how differences in startup costs are interpreted in a given year, the data suggests women have seen declining barriers to starting a business over time.

The decline in τ_W shown in Figure 5b reflects the fact that wage gaps between women and men, controlling for human capital and occupational choice, have gradually narrowed.[18] When combined with the trend in relative startup costs from Figure 5a, this suggests the total opportunity cost of starting a woman-owned firm has actually increased over time, relative to that for men.

Figure 6a shows a clear decrease in τ_L over time, down from 24 percent in 1982 to 3 percent in 1992, and finally down to about 1 percent by 2012. This suggests that women-owned businesses paid much higher costs for labor than men-owned businesses in 1982. Again, this could have been due to a higher cost of obtaining short-term credit to pay wages, a need to offer higher non-pecuniary benefits or work-place amenities to attract workers, or some combination of these and other related reasons. By 2012, differences in labor costs between women- and men-owned

[18] See Hsieh et al. (2019) for details about how τ_W is inferred from the data.

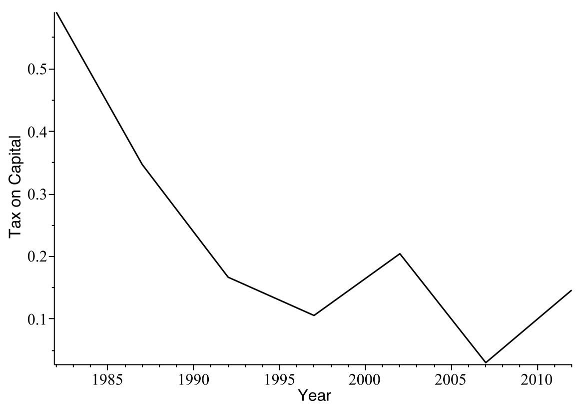


(a) Tax on Labor Input τ_L

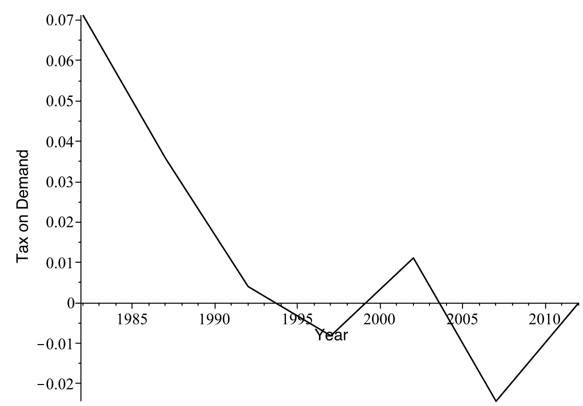
(b) Relative Ability

Figure 6: Labor Input Tax and Relative Entrepreneurial Ability

Notes: τ_L calculated using (8). Relative ability $z^*_{0,f}/z^*_{0,m}$ calculated using (15).



(a) Tax on Capital Input τ_K



(b) Consumer Discrimination τ_D

Figure 7: Capital Input Tax and Consumer Discrimination

Notes: τ_K and τ_D calculated using (9), (16), and (17).

businesses essentially disappeared.

Figure 6b shows how the inferred average ability of female relative to male entrepreneurs has changed over time. Given the low female entrepreneurship rate in 1982, relative to men, the model infers that only the highest-ability women became entrepreneurs while male-owned firms included many low-ability entrepreneurs. Given the observed distribution of firm size, this suggests the average ability of female entrepreneurs was 90 percent higher than that of male entrepreneurs in 1982. As the female entrepreneurship rate converged to the male rate over time, I infer that relative average abilities also converged.

Given (9), the relative capital-labor ratio for female entrepreneurs reported by Fairlie et al. (2016) suggests $\tau_K = 0.204$ in 2002. Using (16) and (17), I infer $(1 - \tau_D) \cdot \phi = 0.68$ in 2002. For all other years, measures of relative average revenue, $z^*_{0,f}/z^*_{0,m}$, and τ_L can be used with (16) to infer how $\mathcal{T}_{KD}$ – a combination of τ_K and τ_D – evolves over time relative to 2002. The available data does not allow me to separately identify τ_K and τ_D in other years, so I assume each of these barriers contributes proportionately to changes in $\mathcal{T}_{KD}$:

$$\left(\frac{1+\tau_{K,t}}{1+\tau_{K,2002}}\right)^{\alpha\gamma} = \left(\frac{1-\tau_{D,t}}{1-\tau_{D,2002}}\right)^{\frac{\sigma}{1-\sigma}} = \left(\frac{\mathcal{T}_{KD,t}}{\mathcal{T}_{KD,2002}}\right)^{1/2}.$$

Given that τ_D and ϕ also can not be separately identified, I assume $\tau_D = 0$ in 2012. This implies that any differences in demand in 2012 are due to real differences in the nature of firms started by female and male entrepreneurs (ϕ), similar to my assumption about 'real' entry costs above. This implies $\phi = 0.69$. Again, I emphasize that the value chosen for ϕ does not affect the implied impact of changing τ_D over time. With these assumptions in hand, Figure 7 shows how τ_K and τ_D evolve over time. Figure 7a shows women-owned firms faced a cost of using capital much higher than that of male-owned firms in 1982, and that this difference decreased substantially by 2012, from 59 to 15 percent. The significant difference still persisting in 2012 suggests that female entrepreneurs still face barriers to financing capital expenditures relative to males. This is consistent with the evidence documented in Coleman and Robb (2009). I infer τ_D drops from 7.1 percent in 1982 to 0 by 2012.

5 Impact Over Time

In this section I use the model from Section 3 to calculate the impact of the barriers from Section 4 on aggregate output per worker and the welfare of female and male labor market participants. For this I need values for five more parameters: the real interest rate R, the probability of firm exit from the market λ, the growth rate of productivity over a firm's life (a function of g), and preference parameters for entrepreneurship X_f and X_m.[19] For the first two, I use standard values from the literature, $R = 0.05$ and $\lambda = 0.1$. g is the growth rate of firm-level employment over the life of a firm, conditional on survival. I use $g = 0.05$ from Hsieh and Klenow (2014), also standard. For X_s I assign values equal to the fraction of entrepreneurs by sex from the PSED survey who cited non-pecuniary reasons for starting a firm. As reported in Section 2, I use $X_f = 0.58$ and $X_m = 0.51$.

For my benchmark economy, given the barriers derived in Section 4, I assume the entry cost for male entrants $c_{E,m}$ in each reported year is equal to the value required to match the number of women- and men-owned firms in that year (equation 19). This implies a male entry cost that decreased by 19 percent from 1982 to 2012. Note that after accounting for all implied changes to entrepreneurship due to barriers to female (relative to male) entrepreneurship, the model attributes any residual changes in observed entrepreneurship rates to proportional changes in both entry costs. The implied drop in the male entry cost should therefore be interpreted as a catch-all for any trends in the economy that led to higher entrepreneurship across the board but not to differential changes in female and male entrepreneurship. Similarly, any change over time in U.S. aggregate output per worker not otherwise generated by the model can be attributed to exogenous changes in A.

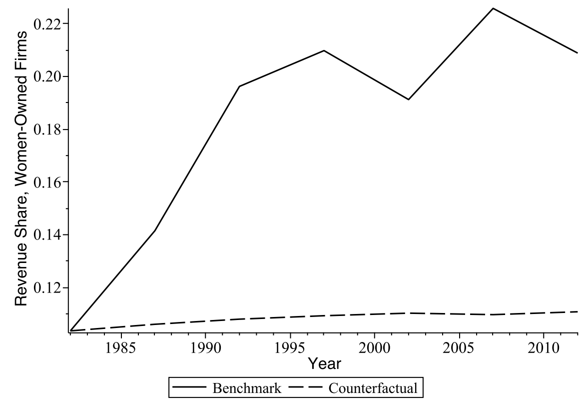
Total Net Impact I start by answering the following question: How would outcomes have differed over time if barriers facing female entrepreneurs had remained at their 1982 levels? To answer this I calculate outcomes in each year under the assumption that τ_E, τ_L, τ_K, and τ_D remain constant at 1982 levels while $\hat{c}_{E,f}$, $c_{E,m}$, τ_W, L_f, L_m, and A change as in the benchmark. Figures 8 through 10 illustrate how the women-owned share of firms and revenue, entrepreneurship rates, aggregate output per worker, and the welfare of women and men would have behaved under this counterfactual, compared to benchmark outcomes.[20]

If barriers facing female entrepreneurs had stayed at their 1982 levels, Figure 8a shows the share

[19]These parameter values are all necessary to calculate welfare.

[20]These outcomes are calculated using (13), (15), (19) through (23), and (25) through (28).

(a) Women-Owned Firms, Share of All Firms



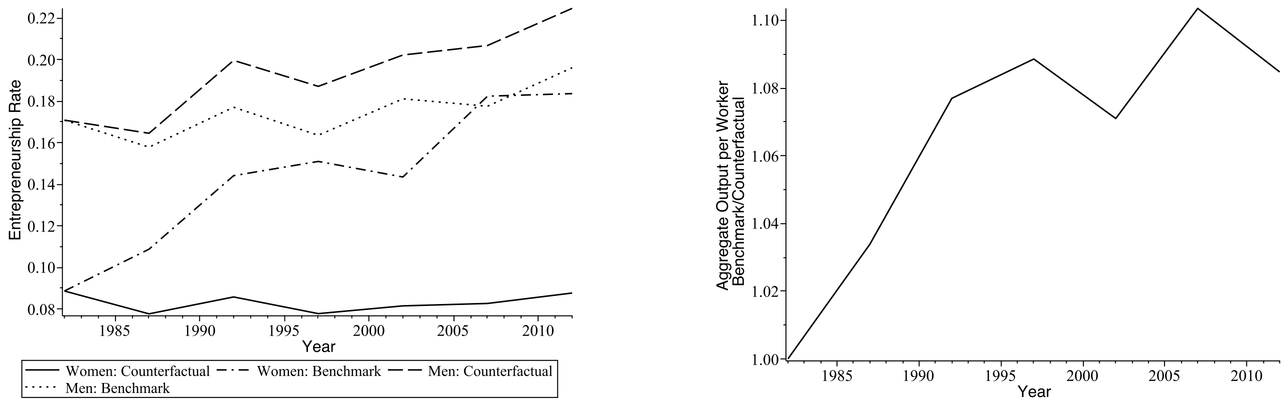
(b) Women-Owned Firms, Share of Revenue

Figure 8: Counterfactual: Women-Owned Share of Firms and Revenue

Notes: Panel (a) calculated using (19) and (20). Panel (b) calculated using (13), (19), and (20).

of firms owned by women would have decreased slightly over time, as the counterfactual increase in male entrepreneurship would have more than offset the increase in female labor market participants (20). The entry tax τ_E would have remained constant (by construction), but the opportunity cost of female entrepreneurship would have increased slightly due to higher relative wages. As a result, relative average revenue per firm would have increased proportionately. The combination of these factors leads the counterfactual share of aggregate revenue generated by women-owned firms (Figure 8b) to increase slightly from 10 to 11 percent, much lower than the observed 21 percent share in 2012. The counterfactual entrepreneurship rate for women would have remained essentially constant, rather than increasing to 18.4 percent (Figure 9a). Without a large increase in female entrepreneurship, the male entrepreneurship rate would have increased much more, to 22.5 rather than 19.6 percent, as male entrepreneurs would expect to face less competition from women-owned firms. In total, the number of firms would have been 16 percent lower than the observed number in 2012. Relative to the benchmark, Figure 9b shows aggregate output per worker would have been 7.8 percent lower by 2012, suggesting that the decline in barriers has contributed to an 8.5 percent increase in output per worker by 2012, relative to 1982.

How do the above findings compare to aggregate output growth in the data? From 1982 to



(a) Entrepreneurship Rates

(b) Aggregate Output per Worker

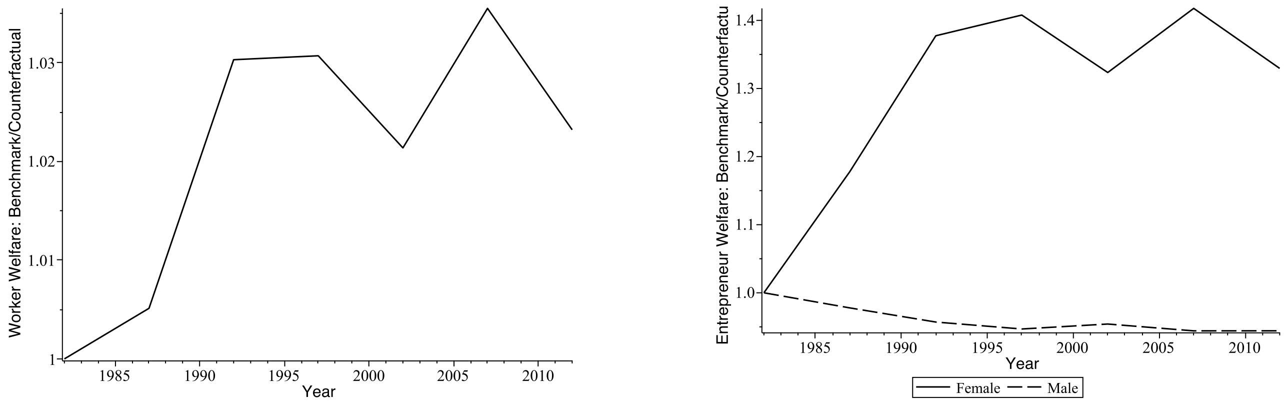
Figure 9: Counterfactual: Entrepreneurship Rates and Aggregate Output per Worker

Notes: Panel (a) calculated using (15). Panel (b) calculated using (21).

2012, gross domestic product (GDP) per worker in the U.S. grew by 68.7 percent.[21] Lower barriers to female entrepreneurship can therefore account for 12.3 percent of observed growth. Again, this is in addition to the increase in GDP per worker coming from lower labor-market barriers reported by Hsieh et al. (2019). Using labor market data to infer barriers facing white women, black women, and black men, all relative to white men, they report a reduction in labor-market barriers from 1960 to 2010 which resulted in higher labor-force participation and human capital accumulation, as well as more efficient occupation decisions. They find these lower barriers can account for 24 percent of the observed increase in GDP per worker from 1960 to 2010, with much of the contribution appearing early in their sample. These results suggest that the entrepreneurship channel highlighted in the present paper is quantitatively as important as the labor market in accounting for U.S. growth over the last several decades.

To compare welfare in the benchmark to the that in the counterfactual, I distinguish between 'always' workers and 'would-be' entrepreneurs. In each year, 'always' workers are women and men who remain workers in both the benchmark (where barriers are declining) and the counterfactual (where barriers are constant). Equations (25) and (26) show that welfare gains for workers are the same for women and men, and Figure 10a shows a 2.3 percent increase in welfare from 1982 to 2012, as declining barriers led to more firms, higher demand for labor, and

[21]GDP per worker over time is from the Penn World Table v9.0.



(a) Worker Welfare

(b) Entrepreneur Welfare

Figure 10: Counterfactual: Welfare of Workers and Entrepreneurs

Notes: Panels calculated using (23), (27), and (28).

therefore higher wages. In each year, 'would-be' entrepreneurs are people who choose to be entrepreneurs in either the benchmark or the counterfactual. For women this means entrepreneurs in the benchmark, some of whom would be workers if barriers had not declined. For men this means entrepreneurs in the counterfactual, some of whom are workers in the benchmark. Figure 10b shows that female would-be entrepreneurs saw striking welfare gains of 33 percent from 1982 to 2012, due to two factors. First, wages increased, increasing labor-market earnings. Second, many women who would have been workers if barriers had remained constant in fact earned entrepreneurial profits. Male would-be entrepreneurs, on the other hand, experienced lower welfare than they would have if barriers had remained constant. Although wages increased, some men who would have been entrepreneurs instead remained workers. The resulting loss in entrepreneurial profits more than offset wage gains, enough that declining barriers led to a 5.6 percent decline in welfare.

Impact by Barrier How much did the drop in each barrier contribute to the increase in output per worker and welfare? I answer this question by calculating counterfactual outcomes when all but one of the barriers change over time as in Section 4. Columns 2-5 in Table 2 report counterfactual outcomes in 2012 when one barrier is kept fixed at its 1982 level, relative to the benchmark. The last column reports outcomes in 2012 when all barriers remain fixed at 1982 levels, corresponding to Figures 9b and 10.

Table 2: Contribution of Each Barrier

	fixed barrier				benchmark
	τ_E	τ_L	τ_K	τ_D	
output per worker	1.000	0.973	0.960	0.981	1.085
female entrepreneur welfare	0.999	0.895	0.910	0.891	1.329
male entrepreneur welfare	1.000	1.036	1.021	1.000	0.944

Notes: Each column (except the last) reports outcomes in 2012, relative to the benchmark, when one barrier is fixed at its 1982 level while all others change. The last column reports 2012 outcomes in the benchmark (where all barriers change over time).

Table 2 shows that changes in the startup tax τ_E barely contributed to net outcomes.[22] This is the case for three reasons. First, changes in startup costs were relatively modest. Second, changes in the number of women-owned firms are somewhat offset by opposite changes in men-owned firms. Third, and most important, the observed dispersion in firm size within sectors in the data implies that when the number of firms changes, the drop in average ability largely offsets the impact on aggregate output.

Most of the changes over time in output and welfare implied by the model are due to the large drops in production-based barriers, τ_L and τ_K, as well as the lower effective tax on demand τ_D due to lower consumer discrimination. The model suggests that as these three barriers were reduced over time, women-owned firms were able to operate at much closer to their efficient size, reducing the level of misallocation in the economy. At the same time, the higher profits from this more efficient production led to more entry by female entrepreneurs.

Scope for Future Gains Section 4 suggests further scope for improvement in the economic environment facing female entrepreneurs. As of 2012, women-owned firms still face a much higher cost of using capital in production, along with a slightly higher cost of labor. Of what magnitude are the changes in outcomes we could expect if female entrepreneurs were treated

[22]Note that output is slightly lower and female welfare is slightly higher than 1 in column 2. Similarly, male welfare is slightly higher than 1 in column 5.

identically to male entrepreneurs? To answer this question, I recalculate outcomes for 2012 under the assumption $\tau_L = \tau_K = 0$. Under this counterfactual, I find that aggregate output per worker would be an additional 2.1 percent higher in 2012, while the welfare of workers would be 0.4 percent higher. The welfare of male entrepreneurs would be an additional 1 percent lower, while female entrepreneurs would see an additional increase in welfare of 5 percent. These results suggest additional gains are still possible in the future for the U.S. economy. And to the extent that consumer discrimination and barriers to entry may still exist towards women-owned firms in 2012 (in contrast to my assumptions), these results may understate the scope for further gains.

6 Robustness to Alternative Assumptions

Here I explore the robustness of my results to alternative assumptions. In particular, I consider alternative values for the elasticity of substitution between output from women- and men-owned firms σ, the parameter governing decreasing returns to scale in production γ, and parameters governing preferences for entrepreneurship by sex X_s, as well as different rates of change for τ_K and τ_D. For σ and γ, I recalibrate the model to obtain alternative inferred 'taxes' τ_K and τ_D over time and then recalculate counterfactual outcomes in 2012 when all barriers are held constant at 1982 levels.[23] Recalculated outcomes are reported in Table 3, expressed as factor changes from 1982 to 2012.

The high value for σ used in the second column corresponds to the elasticity of substitution used by Atkeson and Burstein (2010) for firms competing in the same narrowly-defined product market (for example, competing Italian restaurants). A very high value for σ reflects an assumption that the products and services produced by women-owned firms are very similar to those produced by men-owned firms. As a consequence, the model assigns a low value to consumers from having access to a greater variety of goods from women-owned firms. Nev-

[23]Inferred values for τ_L and τ_E over time are independent of the parameter values used.

Table 3: Counterfactual Outcomes
Under Alternative Parameter Assumptions

outcomes	benchmark	alternative assumption			
		$\sigma = 10$	$\sigma = 3$	$\gamma = 2/3$	$X_f = X_m = 0.5$
output per worker	1.085	1.064	1.183	1.174	1.085
female entrepreneur welfare	1.329	1.318	1.362	1.705	1.270
male entrepreneur welfare	0.944	0.942	0.955	0.918	0.946

Notes: Each column reports factor increases from 1982–2012 when all barriers change. The first column reflects the benchmark results illustrated by Figures 9b and 10. Other columns reflect recalculated results under an alternative assumption with respect to parameter values.

ertheless, the gains from less misallocation over time still increase output per worker by 6.4 percent (compared to 8.5 in the benchmark) and the welfare of female entrepreneurs increases by only slightly less than in the benchmark.

Using a very low value for σ as in the third column of Table 3 greatly increases the inferred benefit to consumers from more varieties of goods and services from women-owned firms. As a result, the implied increase in output per worker due to declining barriers is much higher. Welfare for all entrepreneurs is somewhat higher than in the benchmark case, due to higher wages generated by the more productive economy.

In the second-to-last column I assume a lower value for γ, corresponding to Hsieh and Klenow (2009). This lower value reduces the implied impact on output per worker coming from misallocation, as noted by Hsieh and Klenow (2009). At the same time, however, it increases the impact on output per worker from changes in the total number of firms, which I take from the data.[24] This last effect dominates, leading to a much larger implied impact from lower barriers on output per worker. A lower γ also implies higher profit margins for entrepreneurs. As a result, the impact of declining barriers on the welfare of all entrepreneurs is magnified relative to the benchmark case.

The last column of Table 3 recalculates changes in welfare when women and men are assumed to

[24] With decreasing returns to scale in production, more firms per worker implies all firms operate at a more efficient scale of production.

have identical preferences for entrepreneurship. These results are very similar to the benchmark, as differences in preferences implied by the PSED data targeted in the benchmark calibration are not significant enough to generate large differences in implied welfare outcomes.

Taken together, the numbers reported in Table 3 suggest the benchmark results reported in Section 5 are robust to reasonable changes in the parameter values used.

In Section 4 I note that the data does not allow me to separately identify how τ_K and τ_D change over time. In the benchmark analysis I therefore assume each contributes proportionately to changes in $\mathcal{T}_{KD}$. I now consider two extreme alternative possibilities, where each barrier is assumed to be responsible for all changes in $\mathcal{T}_{KD}$ while the other barrier remains constant at its 2002 level.

$$\text{Case 1:} \quad \left(\frac{1+\tau_{K,t}}{1+\tau_{K,2002}}\right)^{\alpha\gamma} = \left(\frac{\mathcal{T}_{KD,t}}{\mathcal{T}_{KD,2002}}\right) \qquad \text{Case 2:} \quad \left(\frac{1-\tau_{D,t}}{1-\tau_{D,2002}}\right)^{\frac{\sigma}{1-\sigma}} = \left(\frac{\mathcal{T}_{KD,t}}{\mathcal{T}_{KD,2002}}\right).$$

In both cases I assume $\tau_D = 0$ in 2012, and choose a value for real demand ϕ to satisfy (16). In Case 1, I infer τ_K drops from 110 to 9 percent from 1982 to 2012. In Case 2, τ_D drops from 13.7 percent to zero.

Table 4: Counterfactual Outcomes
Under Alternative Rates of Change

	benchmark	Case 1	Case 2
output per worker	1.085	1.102	1.067
female entrepreneur welfare	1.329	1.311	1.349
male entrepreneur welfare	0.944	0.931	0.958

Notes: Each column reports factor increases from 1982–2012 when all barriers change. The first column reflects the benchmark results illustrated by Figures 9b and 10. Other columns reflect recalculated results under an alternative assumptions with respect to how τ_K and τ_D change over time.

Table 4 shows how counterfactual outcomes differ relative to the benchmark in each case. When τ_D is assumed constant (Case 1), the impact of declining barriers on output per worker is slightly higher while welfare outcomes are slightly lower. The opposite holds for Case 2. Clearly, the benchmark results are robust to different assumptions about how τ_K and τ_D contribute to changes in $\mathcal{T}_{KD}$ over time.

In summary, reasonable variations in the assumptions used in Sections 4 and 5 only marginally affect the implications of the benchmark analysis. Barriers to female entrepreneurship have been large, and have been significantly reduced over time. While this convergence has led to significant increases in output per worker and welfare, there is still scope for further gains in the future.

7 Conclusion

Several measures related to women-owned firms suggest a dramatic increase in the contribution of female entrepreneurship to economic activity in the U.S. over time, both relative to males and relative to the rise in female labor market participation. In this paper I develop a framework to interpret these trends over time. I build on the Hopenhayn (1992) model of firm dynamics by introducing four distortions faced by female entrepreneurs, relative to males – differential costs of employing labor and capital in production, a differential cost to start a business, and consumer discrimination – as well as preferences for entrepreneurship that differ by sex. I infer how each of these distortions evolved from 1982 to 2012, showing that in each case conditions facing female entrepreneurs improved over time. The model suggests these changes are responsible for over 12 percent of the observed growth in GDP per worker from 1982 to 2012, as well as a permanent 2 percent increase in the welfare of workers, 33 percent increase in the welfare of female entrepreneurs, and a 6 percent decrease in the welfare of male entrepreneurs. Further, the data suggest opportunities for further gains. If barriers to female entrepreneurship are eliminated entirely, output per capita could increase by at least an additional 2 percent and the welfare of female entrepreneurs could increase by an additional 5 percent. All of these gains are *in addition to* any gains to output per worker and welfare coming directly from a reduction in labor-market barriers to female workers.

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