Women at Work: Fertility, Occupational Choice and Income*

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Abstract

We investigate how changes in barriers to female labor force participation and the child penalty impact occupational decisions, human capital, fertility, and income. To this end, we develop a general equilibrium model with men and women, endogenous fertility, human capital investment, and occupational choice. By calibrating the model to US data, we estimate that changes in both gender distortions account for 30% of the US growth observed between 1960 and 2020. While the decline in the child penalty increases fertility, the reallocation of female labor from high-fertility to low-fertility occupations explains approximately 28% of the decline in the fertility rate during this period. Furthermore, reducing existing gender barriers would increase output per capita by 9% in 2020, enhance gender diversity across occupations, increase fertility, and ultimately improve female welfare.

Keywords: Gender Barriers; Fertility; Occupational Choice; Growth

JEL codes: E25; J13; O10

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1 Introduction

Gender inequality has been declining in many different areas of life in most countries. Barriers to female labor force participation (LFP) in some jobs affect the occupational decisions of women and their accumulation of human capital.[1] Individuals in general and women in particular face conflicts between their work and home roles due to limited time and social norms. This is relevant for women with children or caregiving responsibilities who might face difficulties in finding a family-friendly arrangement in some occupations. Careers vary not only by wages, but also by their flexibility to accommodate family tasks. Consequently, occupations vary by a child penalty, which corresponds to the effects of children on women's careers and future wage.

We investigate how changes in barriers to female LFP and in the child penalty affect occupational decisions and fertility choices of women in the US.[2] To do this, we build a general equilibrium model of occupational choice with men and women, endogenous human capital investment and fertility, in which individuals choose occupations based on their comparative advantage and relative wages (Roy, 1951). Barriers to female LFP are occupation-specific, manifesting as a wedge between women's labor productivity and their wage in the chosen occupation. Women also face an occupation-specific child penalty. Some jobs with flexible working hours offer a comparative advantage to women to balance work's tasks and household chores (eg., Cubas et al., 2021; Goldin, 2014). Consequently, fertility, human capital investment, and occupation are mutually dependent decisions.

Consistent with our framework, United States (US) data show important heterogeneity in the proportion of women and in the fertility rate across occupations. The fertility rate barely changed in some occupations over more than four decades, while in other occupations fertility experienced a sharp decline. Moreover, there are more women working in previously male-dominated occupations and these occupations are associated with lower fertility levels.

We estimate the model parameters for the US using key macro and micro mo-

[1] Gender barriers manifest in several manners. They can reflect preference-based discrimination (e.g., Becker, 1957), unconscious bias that women are relatively better in some tasks than men, and culture at schools and in the workplace. These barriers can differ across industries.

[2] While we take these gender distortions as exogenous, Doepke and Tertilt (2009) study how women's economic and legal rights are endogenously extended over the economic development process.

ments of this economy, including statistics related to the labor share, gender gap and fertility across occupations. The model closely matches several moments, including the changes in the share of women and their fertility rates across all occupations from 1960 to 2020. We then implement counterfactual exercises to calculate the share of US growth accounted for by changes in the child penalty and in the barriers to female LFP by occupation from 1960 to 2020. Changes in these distortions had non-trivial effects in the US. Movements in both distortions account for approximately 30% of the observed US economic growth in per capita income between 1960 and 2020. Barriers to female LFP account for approximately 90% of the total effect. When home production is included, these two wedges account for approximately 21.57% of the US economic growth between 1960 and 2020, with the female LFP wedge contributing 88% of this overall effect.

We also calculate the welfare implications of changing gender distortions. Female workers in the US in 2020 would need to be compensated with a 21.96% increase in their consumption to experience the levels of occupational barriers and child penalties present in 1960. Changes in the child penalty are particularly significant for the welfare of female workers. The reduction in the child penalty between 1960 and 2020 increased the welfare of US female workers by approximately 16.61% in consumption equivalent to the 2020 baseline. The total welfare improvement is equivalent to a lump-sum transfer of approximately $9,223 per year for each woman in the US.

The model accounts for the entire change in the total fertility rate and the average fertility rate by occupation in the US from 1960 to 2020. Reductions in the child penalty increase the fertility rate by occupation, while decreases in female labor force barriers lead to the reallocation of women from high-fertility occupations to low-fertility occupations, thereby reducing the fertility rate. In the aggregate, the latter effect dominates the former, resulting in a decrease in fertility when both wedges are reduced.

We also use the model prospectively to examine the economic implications of eliminating existing gender wedges in the United States. Our counterfactual exercises show that income per capita would increase by 9% relative to the 2020 level, and female LFP would rise by 15 percentage points if gender barriers were eliminated. Furthermore, gender diversity across several occupations would improve substantially, and female welfare would increase by 43.45% in

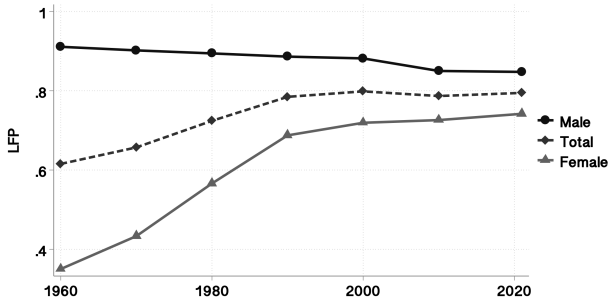
consumption equivalents relative to 2020, while male welfare would decline by 0.73% of their consumption. According to our model, this suggests a misalignment of preferences regarding whether governments should support policies to promote gender equality.

Related literature. Our framework provides a novel and complementary mechanism for fertility differentials within a society. Fertility is driven by the occupation decisions of women, which depend on gender barriers in the labor market and barriers to balance the work and household chores. In a recent survey, Doepke et al. (2023) highlight that new models aiming to understand the causes and consequences of fertility in high income countries should emphasize women's career and family goals as key drivers of fertility. This is the main mechanism in driving fertility differentials in our environment.

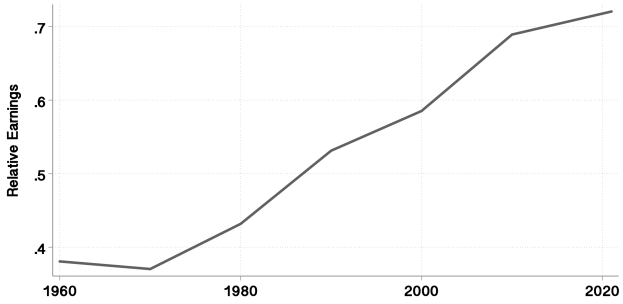
Our paper is related to different strands of the literature on fertility and development. Most papers in this literature focus on the joint evolution of economic and demographic processes represented by a negative relationship between fertility and income (Barro and Becker, 1989; de la Croix and Doepke, 2003; Doepke, 2015; Galor and Weil, 1996; Mookherjee et al., 2012). Most of these models abstract from occupational choices and explore the quantity-quality tradeoff, which depends on the income elasticity of the quantity and quality of children (Becker, 1960). Our main mechanism for fertility differentials works through the opportunity cost of child-rearing associated with each occupation.Adda et al. (2017) estimate a life cycle model of labor supply, fertility, and savings with occupational choices to quantify the life cycle career costs associated with children. Our focus is on how gender barriers affect the allocation of talent, fertility and economic growth. In this respect, our model is close to Hsieh et al. (2019). We extend their theory by introducing fertility decisions such that occupational choice, investment in human capital and fertility are jointly determined. Cavalcanti and Tavares (2016) also study the aggregate effects of barriers to female LFP in a model with endogenous fertility, but they abstract from occupational choices. Cuberes and Teignier (2016) and Chiplunkar and Goldberg (2024) investigate the aggregate effects of gender barriers in the labor market in a model of endogenous entrepreneurship but without fertility decisions. Therefore, our paper contributes to the literature by exploring fertility differentials driven by differences in the opportunity cost of child-rearing by occupation and by analyzing the aggregate effects of different gender barriers.

Figure 1: Labor force participation and gender wage gap

(a) Labor force participation



(b) Gender wage gap



Notes. Panels (a) displays the labor force participation rate for the US (1960-2021) for men and women aged between 25 and 54. Panels (b) displays the female to male average wage for the US (1960-2021).

2 Empirical Facts

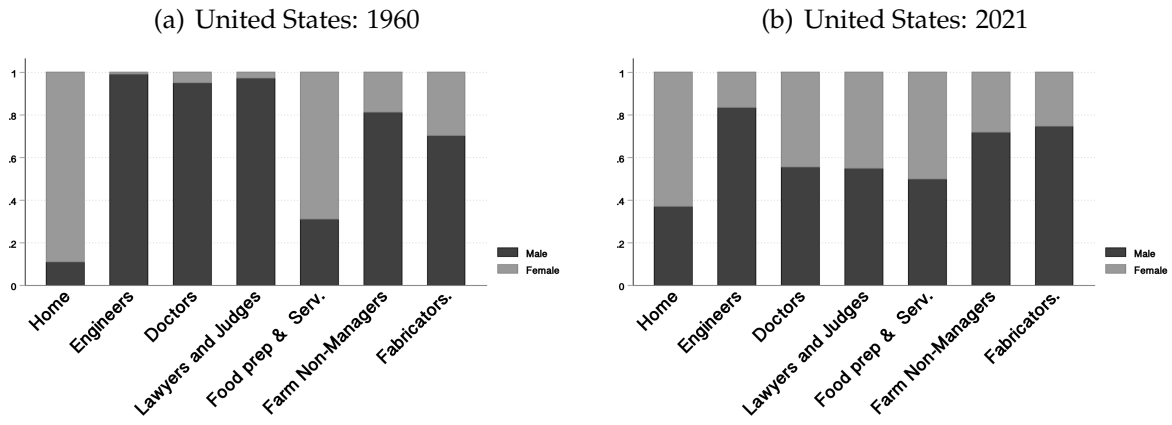
This section presents empirical facts that motivate our work and inspire our modeling strategy. We focus on individuals who have completed their education and are not yet retired, restricting our sample for men and women aged between 25 and 54.

Panel (a) of Figure 1 displays the labor force participation (LFP) rates for males and females in the United States from 1960 to 2021. The female LFP rate in the United States increased by 39 percentage points during this period, with most of the rise occurring between 1960 and 1990. Early gains in female LFP have slowed since the 1990s, with US labor participation rates falling behind peers (Blau, 2024). From 2010 to 2021 there is a relative small hike in female LFP. In contrast, the male LFP rate showed a slight decline from 1960 to 2021.

Panel (b) of Figure 1 illustrates the evolution of the female-to-male average wage ratio. The unconditional gender wage gap in the US has narrowed over time. In 1960, female workers in the US earned 38% of what male workers earned on average. By 2021, this ratio had increased to 72%, after a rise that started in the 1970s.

In summary, the US experienced a rise in female labor force participation (LFP) with most of the gains occurring from 1960 to 1990. There has also been a significant reduction in the gender wage gap, which has continued to decline in the last few decades, including the period from 2010 to 2021.

Figure 2: Gender composition for selected occupations



Notes. The figure shows the share of workers (panels (a)-(b)) by selected occupations for the United States (1960 and 2021).

Figure 2 illustrates the distribution of male and female workers across selected occupations in the United States in 1960 (panel a) and 2021 (panel b). Data for all occupations are provided in the appendix.

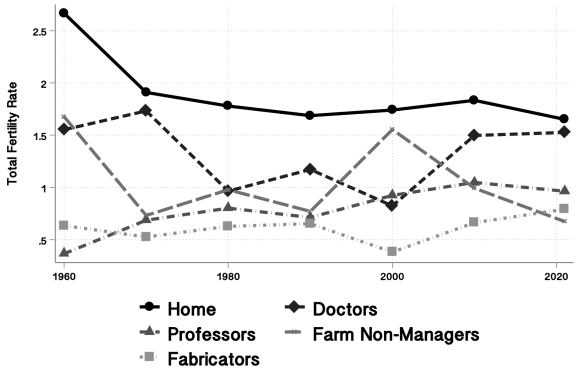
In 1960, 89% of individuals in the home sector were women. By 2021, however, men's participation in this sector had increased to 37%, representing a threefold rise in male representation in the home sector.

In contrast, nearly all individuals working as doctors and Lawyers and Judges in 1960 were men (95 and 97%, respectively). By 2021, this figure had declined to about 55%. Similarly, for engineers, the proportion of women in these occupations increased significantly, rising from 1% in 1960 to 16% in 2021.

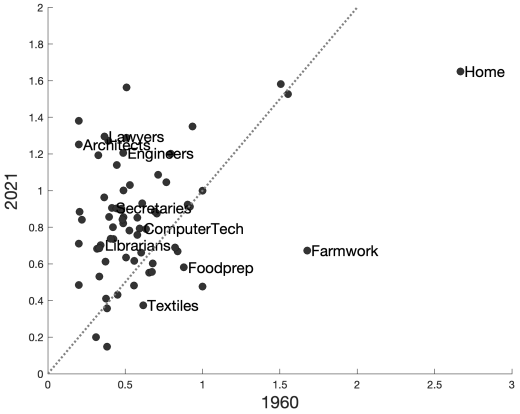
Panel (a) of Figure 3 illustrates the evolution of the total fertility rate across selected occupations in the United States from 1960 to 2021, highlighting significant differences in fertility rates over time and across occupations. In 1960, women in the home sector in the US had, on average, approximately 1.4 more children than women who were doctors or lawyers. By 2021, this fertility gap had narrowed to less than one child. Panel (b) of Figure 3 presents a scatter plot of the fertility rate across all occupations in 2021 (y-axis) compared to the fertility rate across all occupations in 1960 (x-axis). Two key features emerge from this graph. First, corroborating Panel (a) of the same figure, the fertility rate increased from 1960 to 2021 in many occupations that were male-dominated in 1960. In contrast, it declined significantly in the home sector and in other occupations, such as textiles, which were predominantly female-dominated in

Figure 3: Total Fertility Rate, 1960-2021

(a) United States, Selected Occupations



(b) United States, All Occupations



Notes. Panel (a) of this figure shows the total fertility rate for selected occupations and the home sector in the United States. Panel (b) presents the scatter plot of the total fertility rate in 1960 and in 2021 for all occupations in the United States

1960.[3] Another feature is the very high dispersion in fertility rates across all occupations, including in 2021. Hence, piecing together the findings from the last two paragraphs, 28.5% of the decline in total fertility rate from 1960 to 2021 in the United States can be explained by women moving to occupations associated with lower fertility.

The empirical facts presented in this section highlight key trends in female labor force participation, the gender wage gap, occupational distribution, and fertility in the United States from 1960 to 2021. Female labor force participation increased significantly, alongside a narrowing gender wage gap and greater representation of women in traditionally male-dominated occupations. Fertility differences across occupations also declined over time, reflecting shifts in

[3] A decomposition of the change in the average fertility from 1960 to 2021 implies that

$$(\bar{n}_{21} - \bar{n}_{60}) = \sum_i \left((Female\ Occu.\ Share)_{21,i} * n_{21,i} - (Female\ Occu.\ Share)_{60,i} * n_{60,i} \right).$$

Adding and subtracting $\sum_i (Female\ Occu.\ Share)_{60,i} * n_{21,i}$ to this equation leads to

$$(\bar{n}_{21} - \bar{n}_{60}) = \sum_i \left((Female\ Occu.\ Share)_{21,i} - (Female\ Occu.\ Share)_{60,i} \right) * n_{21,i} + ...$$

$$\sum_i (Female\ Occu.\ Share)_{60,i} * (n_{21,i} - n_{60,i}) = -0.2423 - 0.5978 = -0.8401.$$

The total fertility rate in the US decreased by 0.8401 from 1960 to 2021, and approximately 28.5% of this total change was driven by the movement of women from high-fertility occupations to low-fertility occupations.

societal roles. These findings provide the basis for the theoretical model presented below.

3 The Model

We build a model based on Hsieh et al. (2019) with men and women, endogenous fertility and occupational sorting. The economy consists of a continuum of measure one of individuals who are either male or female, $g \in \{m, f\}$. Men and women endogenously sort into $i \in \{1, 2, ..., I\}$ occupations, one of which is the home sector. Women choose how many children to have and bear the cost of raising them. Men do not make any fertility decision. Each person possesses an idiosyncratic ability for each occupation.

3.1 Individuals

Individuals live for two periods. In the first period, women and men draw an ability vector $\mathbf{z} = \{z_i\}_{i=1}^{I}$, which determines their productivity for working in each occupation. They make their occupational choice and investment in human capital. Women also choose how many children to have. In the second period, individuals work and consume.

Individuals derive utility from consumption C, leisure, $(1 - s)$, and fertility, n, according to the following utility function:

$$\log(U_g) = \beta \log C + \log(1 - s) + \theta_g \log(n) + \log(x_{ig}),\ g \in \{m, f\}, \tag{1}$$

where s denotes time spent on schooling. Parameters $\beta > 0$ and $\theta_g > 0$ control the relative weight of consumption and fertility in the individual's utility. We assume that $\theta_m = 0$, while $\theta_f > 0$. Moreover, x_{ig} is the common amenity of all members of gender g from working in occupation i.

After choosing occupation i, individuals invest in human capital, which depends on schooling time, s, and on education resources, e. The human capital formation function is given by

$$h_i = s^{\phi_i} e^{\eta}, \quad \phi_i, \eta \in (0, 1). \tag{2}$$

The elasticity of human capital with respect to schooling is occupation-specific, ϕ_i, such that each sector exhibits a different return to schooling.

Given the occupational choice, individuals' labor income depends on the product of the wage per efficiency unit in occupation i, w_i, their idiosyncratic ability in this occupation, z_i, and their acquired human capital for occupation i, h_i. Income is split into consumption, C, and expenditures on schooling resources, e. An individual's budget constraint can thus be written as:

$$C = (1 - \tau_{ig}^w) w_i z_i h_{ig} (1 - (1 + \tau_i^n) \chi_g n) - e. \tag{3}$$

Similarly to Hsieh et al. (2019), distortion τ_{if}^w represents barriers to female labor market participation. It corresponds to a wedge faced by women between their labor productivity and their wage in occupation i. We set $\tau_{im}^w = 0$ such that men do not face barriers in the labor market. Each child takes a fraction $\chi_f \in (0, 1)$ of their mother's time endowment. For men, we assume that $\chi_m = 0$. The wedge τ_i^n corresponds to an occupation-specific child penalty faced by women working in occupation i. They supply $(1 - \chi_f n_i)$ hours to the labor market, but they incur a cost $(1 - \tau_i^w) w_i h_{if} \tau_i^n \chi_f n_i$ for having n_i children. This barrier captures the occupation-specific heterogeneity in facilitating women to balance household chores and full-time work. Goldin and Katz (2016) and Goldin (2021) document that flexible jobs offer a comparative advantage to mothers, driving τ_n^i down. For instance, school teachers have summers off and, in general, have a similar schedule to their children. Copywriters or software engineers might have the freedom to manage their own schedule and adjust them to family activities. These jobs should have relatively low child penalty. However, managers and executives might be required to work long hours with direct contact with clients and therefore those occupations should have a higher τ_i^n. Maternity leave policies and provision of childcare can reduce this child penalty.

Given their occupational choice i, individuals choose $\{C, e, s, n\}$ to maximize (1) subject to (2) and (3). The solution of this problem is characterized by:

$$s_i^* = \frac{1}{1 + \frac{1-\eta}{\beta \phi_i}}, \tag{4}$$

$$n_{ig}^* = \frac{\theta_g (1 - \eta)}{\chi_g (1 + \tau_{ig}^n)[\theta_g (1 - \eta) + \beta]} \tag{5}$$

$$e_{ig}^* = \left(\eta (1 - \tau_{ig}^w) w_i z_i s_i^{\phi_i} (1 - (1 + \tau_{ig}^n) \chi_g n_{ig}^*) \right)^{\frac{1}{1-\eta}}. \tag{6}$$

Clearly, $n^*_{im} = 0$ since $\theta_m = 0$. Time spent accumulating human capital, s^*_i, is increasing in ϕ_i, the elasticity of human capital with respect to schooling. Individuals in high ϕ_i occupations acquire more schooling and have higher wages as compensation for time spent on schooling. s^*_{if} is not affected by female barriers. The number of children, n^*_{if}, is decreasing in the child-rearing parameter, χ_f, and in the child penalty, τ^n_i. Expenditure in human capital is distorted by the labor market barrier, τ^w_i, and the child penalty, τ^n_i.

Fertility can differ due to the child penalty, τ^n_i, in the occupation in which the woman chooses to work. Occupation and fertility are joint decisions. Therefore, our framework provides a novel and complementary mechanism for fertility differentials. Fertility is partly driven by the occupation decisions of women, which depend on gender barriers in the labor market and barriers to balance the work demands and household chores.

After substituting the optimal decisions of each individual into (3) and (1), an individual's indirect utility reads:

$$U^*_{ig} = (\bar{\eta}\tilde{w}_{ig}z_i)^{\frac{\beta}{1-\eta}}, \quad g \in \{m, f\}, \tag{7}$$

where $\bar{\eta} = \eta^\eta(1-\eta)^{1-\eta}$, and

$$\tilde{w}_{ig} = (1-\tau^w_{ig})w_i(s^*_i)^{\phi_i}(1-s^*_i)^{\frac{1-\eta}{\beta}}(1-(1+\tau^n_{ig})\chi_g n^*_{ig})(n^*_{ig})^{\frac{\theta_g(1-\eta)}{\beta}}x_{ig}^{\frac{1-\eta}{\beta}}.$$

Increases in τ^w represent higher barriers for female LFP, which lower women's indirect utility. Fertility n^*_{if} is decreasing with the child penalty τ^n_i and therefore the indirect utility is also decreasing in τ^n_i.

3.1.1 Occupational Skills

In the first period of life, each individual draws a vector of idiosyncratic abilities, $\mathbf{z} = \{z_i\}_{i=1}^I$, from a multivariate Fréchet distribution:

$$F(z_1, \ldots, z_I) = \exp\left[-\sum_{i=1}^{I} z_i^{-\lambda}\right], \ \lambda > 0.$$

The parameter λ governs the dispersion of individual productivity across occupations, with a higher λ implying smaller dispersion.

3.1.2 Occupational Choice

Individuals choose the occupation which maximizes their indirect utility and labor supply is determined by ability-driven self-selection. The following result can be derived:

Proposition 1 *Let p_{ig} denote the fraction of individuals in occupation i of each group $g \in \{m, f\}$. Aggregating across people, the solution to the individual's occupational choice problem leads to*

$$p_{ig} = \frac{\tilde{w}_{if}^{\lambda}}{\sum_{s=1}^{I} \tilde{w}_{sf}^{\lambda}}. \tag{8}$$

Proof. See Appendix B.1. ■

Given the properties of the Fréchet distribution and the endogenous occupational sorting, we can calculate the average quality of workers in an occupation for each group.

Proposition 2 *The average quality of workers in each occupation for each group $g \in \{m, f\}$ is*

$$\mathbb{E}[h_{ig} z_i] = (s_i^*)^{\frac{\phi_i}{1-\eta}} \left(\eta(1 - \tau_{ig}^w) w_i (1 - (1 + \tau_{ig}^n) \chi_g n_{ig}^*) \right)^{\frac{\eta}{1-\eta}} {p_{ig}}^{-\frac{1}{\lambda(1-\eta)}} \bar{\Gamma} \tag{9}$$

where $\bar{\Gamma} = \Gamma\left(1 - \frac{1}{\lambda}\frac{1}{1-\eta}\right)$ is the Gamma function evaluated at the constant $1 - \frac{1}{\lambda}\frac{1}{1-\eta}$.

Proof. See Appendix B.2. ■

3.1.3 Occupational Wages

The average wage for each group in a given occupation is the model counterpart to what we observe in the data and can be computed according to the following result:

Proposition 3 *Let $\overline{wage}_{ig}$ denote the average earnings in occupation i by group g. Its*

value satisfies

$$\overline{wage}_{ig} = \hat{\eta}\,\bar{\Gamma}\left[\sum_{k=1}^{J}\tilde{w}_{kg}^{\lambda}\right]^{\frac{1}{\lambda}\frac{1}{1-\eta}}\frac{x_{ig}^{-\frac{1}{\beta}}(1-s_i)^{-\frac{1}{\beta}}}{(1-(1+\tau_{ig}^{n})\chi_g n_{ig}^{*})(n_{ig}^{*})^{\frac{\theta_g}{\beta}}} \tag{10}$$

where $\hat{\eta} = \eta^{\frac{\eta}{1-\eta}}$ *and* $\bar{\Gamma} = \Gamma\left(1-\frac{1}{\lambda}\frac{1}{1-\eta}\right)$.

Proof. See Appendix B.3. ■

Average earnings for a given group differ across occupations because of differences in x_{ig}, s_i, n_{ig} and the occupation-specific child barrier τ_{ig}^{n}.

In human capital-intensive occupations—those in which schooling is more productive—average wages are higher. Sectors with high common disutility (low x) also have higher wages as compensation. Occupations with strong child barriers (high τ^{n}) feature relatively higher earnings for women through a similar compensation mechanism.

3.2 Firms

The production sector is summarized by a representative firm, which produces aggregate output Y from labor in each occupation:

$$Y = \left(\sum_{i=1}^{I}(A_i H_i)^{\rho}\right)^{\frac{1}{\rho}}, \tag{11}$$

where H_i denotes the total efficiency units of labor in occupation i. A_i is the exogenous productivity of occupation i.

The representative firm takes w_i as given and hires an amount H_i of efficiency units of labor in each occupation to maximize profits:

$$\max_{H_i}\ \left(\sum_{i=1}^{I}(A_i H_i)^{\rho}\right)^{\frac{1}{\rho}} - \sum_{i=1}^{I} w_i H_i. \tag{12}$$

The solution of this problem gives the labor demand for each occupation i.

In turn, H_i is defined in equilibrium as

$$H_i = \sum_{g \in \{m,f\}} q_g p_{ig} \mathbb{E}[h_{ig} z_i \mid \text{person chooses } i], \tag{13}$$

where q_g denotes the total measure of individuals of gender g, which is $1/2$ for males and females. H_i is the product of average human capital and the number of people in the occupation, summed across genders.

3.3 Equilibrium

A competitive equilibrium consists of individual choices $\{C, s, e, n\}$, occupational choices, total efficiency units of labor by group and occupation H_{ig}, final output Y and wages w_i such that:

- Individuals maximize their utility according to equations (4)-(6).
- Individuals choose the occupation that maximizes their indirect utility (7).
- The representative firm maximizes profits, according to (12).
- The occupational wage w_i clears the labor market for each occupation, according to (13).
- The final good market clears.

4 Fitting the Model to the Data

This section describes how we set and discipline the model parameters. We use micro-level Census data from the Integrated Public Use Micro-data Series (IPUMS) for the US economy. Appendix A contains the source and definition of the variables used, as well as the 67 sectors we analyze. While we can externally set some parameters, most of them are model-specific and we do not have much information about them, so they were internally estimated such that the model matches critical statistics related to occupations and fertility of the US economy.

External Calibration. For the time cost of raising a child, χ, Kleven et al. (2019) estimated the long-run female time cost of raising a child to be 0.097 in Den-

mark. We assume the same value for the US and set $\chi_f = 0.097$ based on their estimate.

To calibrate β, we assume that the pre-market period lasts 25 years so that $s_i = (\text{years of education})/25$. The average wage of group g in occupation i is proportional to $(1 - s_i)^{-1/\beta}$. We set $\beta = 0.693$ for the US to match the Mincerian return to schooling across occupations, which averages 12.7% across the six decades in the US. Parameter $\eta = 0.103$ denotes the elasticity of human capital and is calibrated balancing US spending on education as share of GDP and the labor share. Given η, the Fréchet parameter λ is set at 2, the same number used by Hsieh et al. (2019), which is a middle value to match the labor supply elasticity and the coefficient of variation of sectoral residual wages.

Parameter ρ governs the elasticity of substitution across occupations and is set to $2/3$, the value used by Hsieh et al. (2019). We also assume that the home occupational preference for all groups is equal to one, such that $x_{1g} = 1$. We provide sensitive analysis with respect to λ and ρ—See Tables D3 and D4 in Appendix D. Table 1 summarizes the value of the externally calibrated parameters and the key assumptions of the model.

Table 1: Baseline Parameters and Identifying Assumptions

Parameter	Definition	Determination	Value
λ	Fréchet shape	Wage dispersion, Frisch elasticity	2
η	Goods elasticity of human capital	Education Spending	0.103
β	Consumption weight in utility	Mincerian return to education	0.693
χ	Child-rearing penalty	Child penalty in terms of hours supplied	0.097
ρ	Elasticity of substitution across occupations	Hsieh et al. (2019)	2/3
τ^w_{im}	Labor market barriers (male)	Assumption	0
τ^h_{im}	Human capital barriers (male)	Assumption	0
τ^n_{im}	Child barriers (male)	Assumption	0
τ^n_{1f}	Home sector child barrier (female)	Assumption	0
x_{1g}	Home occupational preference (all groups)	Normalization	1

Internal Calibration. The remaining parameters are disciplined by solving the model and targeting certain data moments. In a general equilibrium setting a change in any parameter might affect all targets. However, some data moments are more sensitive to certain parameters. In particular, the female fertility weight in utility θ_f is set to match the fertility of women working in the home sector. The child barrier τ^n_i are calibrated to match the occupation-specific fertility rates. The male common amenity parameter, x_{im}, is set to match the average wage by occupation. We set the occupation-specific technology parameter A_i to fit male occupational shares exactly. The productivity of female workers in the

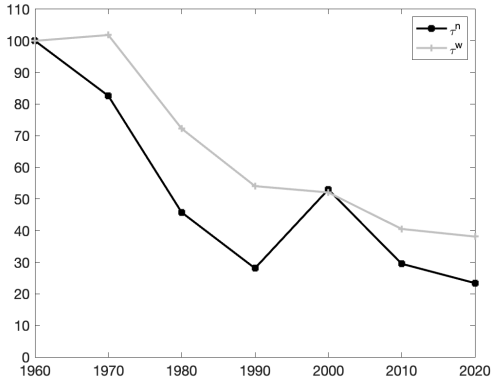
home sector and the proportion of women working in each occupation are used to discipline the amenity parameter x_{if}. The parameter for the time elasticity of human capital, ϕ_i, targets occupation-specific male education. The labor market distortion τ_i^w for each occupation is chosen to match the female wage gap by occupation.

Panel (a) of Figure 4 displays the evolution of aggregate barriers (mean value for τ_i^w and τ_i^n) from 1960 to 2010. Panel (b) of Figure 4 shows the labor market wedge for selected occupations. The labor market wedge declined in most occupations in the US, with the notable exception of the home sector.

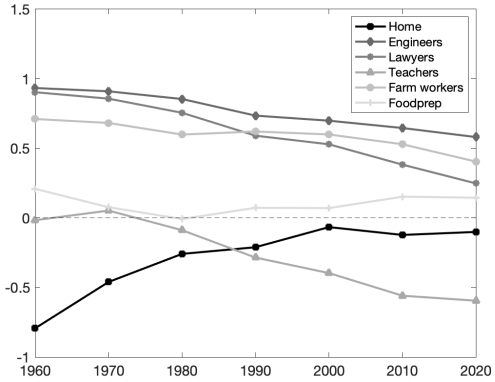
Panel (c) of Figure 4 displays the child barrier for selected occupations. While the general trend is downwards, some occupations have featured a larger decrease than others. The child barrier for engineers, for example, fell significantly – around 90% – while food-prep faced a smaller decline of 41% from 1960 to 2010. Most of the decline in this wedge occurred until the 1990s. The occupation-specific heterogeneity in the evolution of the child barrier can explain a significant share of the reallocation of women in and out of the labor force.

Figure 4: Baseline US economy: labor market friction and child penalty by occupations; Fertility rate by occupation

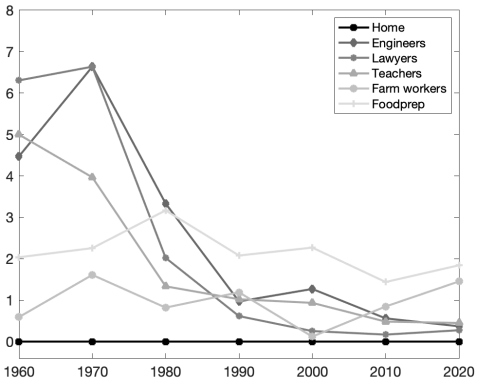
(a) Mean Frictions



(b) Labor market barrier (τ^w)



(c) Child barrier (τ^n)



Notes. Panel (a) displays the average labor market friction τ_i^w and the average child barrier τ_i^n for the calibrated United States economy from 1960 to 2010. Panel (b) displays the labor market friction τ_i^w for selected occupations from 1960 to 2010. Panel (c) displays the child penalty τ_i^n for selected occupations from 1960 to 2010.

Model Fit. The accuracy of the baseline model for selected statistics is reported in Table 2. Additional graphs detailing the model fit for occupational shares and fertility can be found in Figure C1 of Appendix C. The overall fit of the model is very good as some statistics are matched perfectly, including occupational shares for males and females, and fertility rates across occupations, as reported in Figure C1.

Table 2: Model Fit for Selected Statistics

	Earnings		GDP per person		LFP	
	Data	Model	Data	Model	Data	Model
1960	21737	21743	22303	22256	0.609	0.609
1970	29359	29338	30536	30411	0.649	0.649
1980	32374	32349	33757	33604	0.717	0.717
1990	40092	40071	41684	41504	0.779	0.779
2000	47602	47554	49194	48848	0.793	0.793
2010	47602	47531	47310	46964	0.780	0.780
2020	56214	56184	55954	55686	0.789	0.789

5 Quantitative Analysis

5.1 Output and Welfare Gains of Changing Gender Barriers from 1960 to 2020

With our parameters set, we now perform counterfactual analysis to understand the role of wedges on growth and allocation in the US. We first calculate the share of growth accounted for by changes in the child penalty and in the barriers to female LFP. To do this, we keep distortions τ_i^w and τ_i^n at their initial calibrated values in 1960 and calculate the counterfactual output in the final year of the sample with all the other parameters fixed at the baseline. We also run counterfactual exercises in which we keep just one of the wedges at their initial value.

Table 3: Output Implications of Changing Frictions, 1960-2020

	Share of growth accounted for by		
	τ^w and τ^n	τ^n only	τ^w only
Market GDP per person	29.93%	2.13%	26.98%
Market Earnings per person	30.31%	1.60%	29.15%
Home + market GDP per person	21.57%	1.35%	18.98%
Labor Force Participation	129.96%	16.27%	111.44%
Market GDP per worker	-9.48%	-3.45%	-6.29%
Home+market GDP per worker	-31.94%	-6.02%	-26.67%
Market GDP per hours worked	30.40%	4.21%	26.78%
Home+market GDP per hours worked	21.56%	3.75%	18.19%

Table 3 displays the results for aggregate statistics. We calculate the impact of the wedges on GDP per person, per worker, per hours worked and labor force participation. The combined movements in both wedges accounted for approximately 30% of the growth in market GDP per person in the period, with labor market frictions alone contributing to approximately 90% of the overall effect. When we consider only the role of the child penalty in the change in GDP per hour worked, the growth contribution of this wedge is larger relative to its effect on GDP per person. It accounts for about 4.21% of the growth in GDP per hour worked from 1960 to 2020 in the US, or 3.75% when home production is included—approximately 14% and 17% of the overall impact of both frictions on the growth of market and total (home + market) output per hour worked, respectively. A reduction in the wedges would decrease growth in GDP per worker since the marginal worker leaving the home sector is less productive and falling the child penalty increases fertility.

The reduction in both wedges accounts for the bulk of the rise in female labor force participation from 1960 to 2020 in the US, with the reduction in market frictions contributing the largest fraction of this rise. The movement of both wedges account for most of the fall in the average total fertility rate in the period. See the analysis of fertility below.

In Appendix E we consider a simplified version of our model by setting fertility to zero for all occupations. The model becomes very similar to the framework presented by Hsieh et al. (2019). The aggregate effects, reported in Table E5 in Appendix E, on GDP per person in this version of the model are similar to those reported in the last column of Table 3. This suggests that, quantitatively, the model by Hsieh et al. (2019) neither overestimates nor underestimates the overall effects of changes in wedges on US aggregate output per person. Rather, it abstracts from an additional mechanism which, if included, would increase the role of gender wedges in explaining US growth by approximately 3%. But the implications of the child penalty for female welfare and gender diversity for some occupations are nontrivial, as we discuss below.

Table 4 displays a welfare analysis for changes in barriers to female LFP and in the child penalty. Changing wedges increase the average welfare for all women in the US by 21.96% in consumption equivalent terms. That is, female workers in 2020 in the US would, on average, need to be compensated by an increase in 21.96% of their consumption to live in an economy with the 1960 levels of fe-

Table 4: Welfare Impact of Frictions

	Compensating Variation		
	τ^w and τ^n	τ^n only	τ^w only
Men, all workers	0.300%	0.224%	0.238%
Men, stayers	-3.35%	-0.44%	-3.03%
Men, switchers	97.54%	102.17%	97.75%
Women, all workers	21.96%	16.61%	14.88%
Women, stayers	-13.93%	9.84%	-15.60%
Women, switchers	94.54%	123.63%	86.88%

male barriers and child penalty, instead of those observed in 2020. Changes in the child penalty only, τ^n, lead to an increase in welfare of 16.61% in consumption equivalent to the baseline. This effect is approximately 11% greater than the welfare impact of changes in the labor market barrier, τ^w. For women who would have liked to switch jobs with lower barriers, the welfare gains are even greater: 94.54% of consumption equivalent to the baseline. Lower child penalty increased welfare of female workers who would have switched jobs by 123% of consumption equivalent to the baseline. In 2020, the earnings of the average female worker in the US were approximately $42,000. Therefore, such aggregate welfare effects on women translate into a lump-sum transfer of approximately $9,223 per year for each woman.

We also calculate the impact on the welfare of men from changing female wedges. Changes in female wedges affect the welfare of male workers in two different channels: one possible negative channel comes from more competition in some occupations; and another positive channel from improving aggregate efficiency and wages. For the US the overall welfare effect of changing the female child penalty wedges and the female labor force wedges is small but positive for all men, since there is an average welfare gain of about 0.3% in consumption equivalent terms. The competition channel is more relevant for those male workers who remain in their original sector facing more competition from female workers. For stayer male workers, there is an average welfare loss of about -3.35%.

5.2 Sectoral Effects of Changing Gender Barriers from 1960 to 2020

To understand the underlying mechanisms behind the aggregate output and welfare results, we now investigate the sectoral effects, focusing on how changes in gender barriers affected the share of female workers by occupations and their fertility rate.

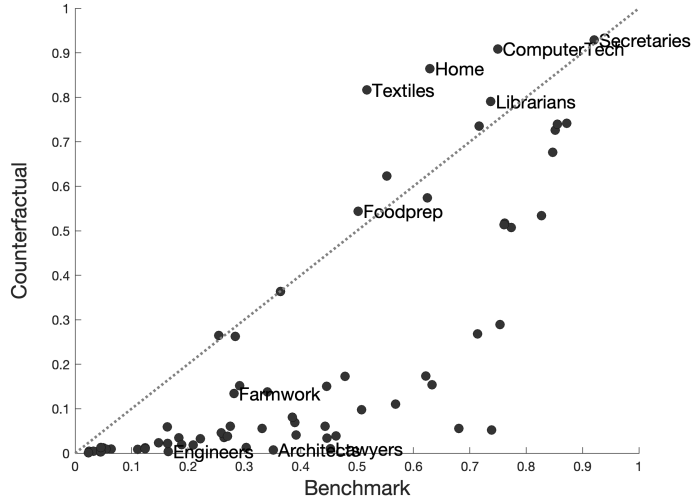
Panel (a) of Figure 5 presents a scatter plot with the share of female workers by occupations in the US in the counterfactual with wedges observed in 1960 (y-axis) and in the 2020 (x-axis) baseline economy. If distortions did not affect female occupational choices, the resulting simulations would lie along the 45 degree line. This is not what we observe. The share of female labor in the home sector and textile industry are two of few occupations in which the points lie above the 45-degree line. The proportion of women in the home (textile) sector would be approximately 25 (30) percentage points higher in the counterfactual with wedges at the 1960's level than what is observed in the 2020 baseline. The majority of other points are below the 45 degree line, implying that the share of female labor in most other occupations would be lower in the counterfactual with higher barriers than in 2020. For some occupations, such as architects, engineers and lawyers, the share of female labor would be almost null in an economy in 2020 with the 1960 distortions.

Panels (b) and (c) of Figure 5 display similar results, but with only one of the wedges held at its initial value, $\tau_n^{i,1960}$ and $\tau_w^{i,1960}$, respectively. Most of the reallocation of female labor in the US from 1960 to 2020 was driven by the labor market wedge. However, for certain occupations, the child wedge had a significant impact. For example, the share of women among architects would be approximately 15 percentage points lower if child-related barriers were similar to those in 1960, compared to the 2020 baseline.

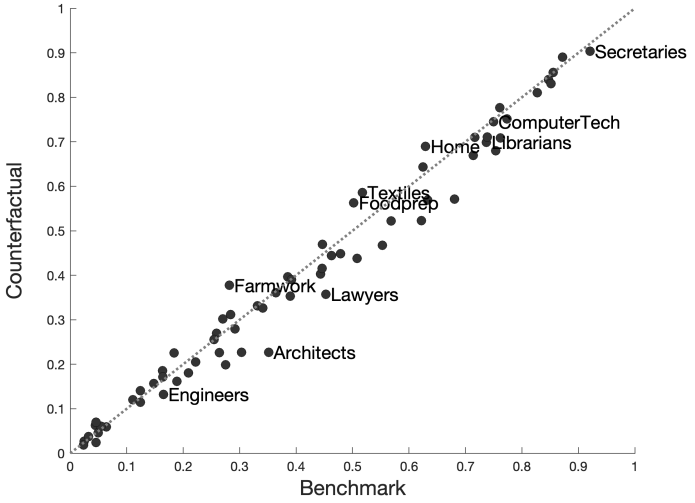
Figure 6 shows the fertility rate by occupation in the counterfactual scenario where all barriers are set at the 1960 level, compared to the fertility rate in the 2020 benchmark. As observed, most points lie below the 45-degree line, indicating that the fertility rate by occupation would be lower in the counterfactual scenario compared to the 2020 baseline. This is because, in most occupations, the child penalty decreased between 1960 and 2020. If child penalties in 2020 were as high as they were in 1960, they would have suppressed fertility rates.

Figure 5: Sectoral analysis: Share of women in each occupation in the 2020 benchmark (x-axis) and in model counterfactual (y-axis)

(a) All barriers fixed at 1960's level



(b) Child barriers fixed at 1960's level



(c) Market barriers fixed at 1960's level

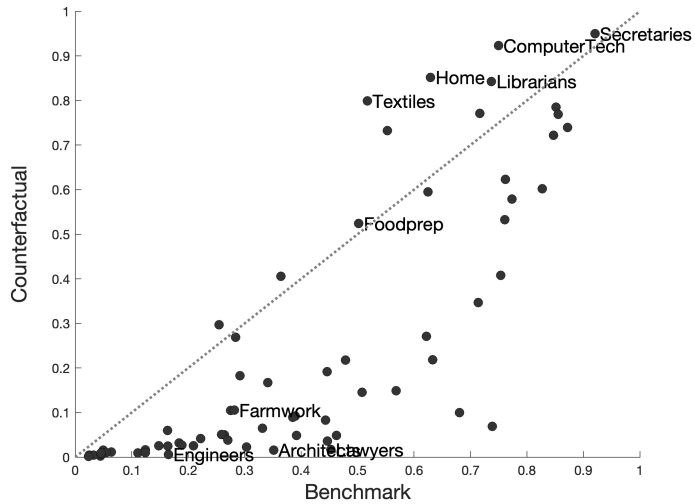
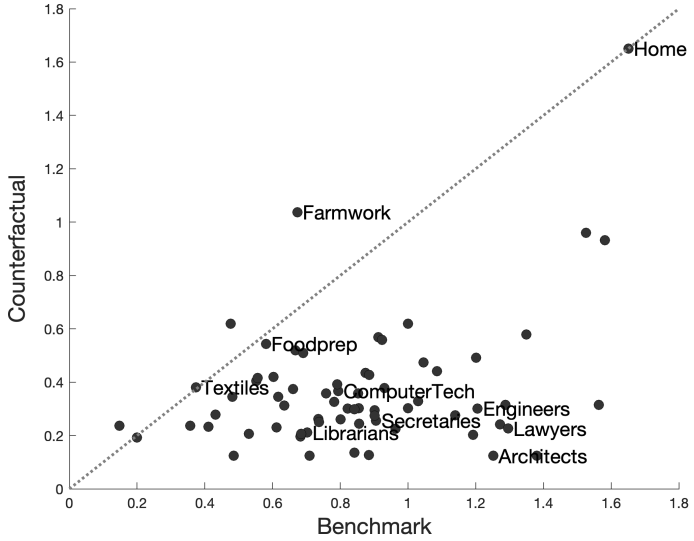


Figure 6: Sectoral analysis: Fertility in each occupation in the 2020 benchmark (x-axis) and in model counterfactual (y-axis). All barriers fixed at 1960's level



Since fertility is a key component of welfare, this explains the significant impact of changes in the child penalty on welfare. However, when both wedges are kept at their 1960 levels, then the average fertility rate is 19% than the 2020 benchmark average. This is because the high female labor force participation wedges of 1960 keep women in high-fertility occupations. Table 5 presents the average fertility rate in the benchmark scenario and in counterfactual scenarios where wedges are held constant at their 1960s values.

Table 5: Fertility Implications of Changing Frictions, 1960-2020

	Benchmark	τ^w and τ^n	τ^n only	τ^w only
Average fertility rate	1.1395	1.3516	0.8024	1.4372

We do not report the graph where only the child penalty by occupation is kept at the 1960 level because it is identical to the one shown in Figure 6. The average fertility rate by occupation is influenced only by the child penalty and not by the female LFP wedge—See Equation (5). However, the total fertility rate differs because the child penalty affects the distribution of women across occupations. When all child penalty wedges are held at the 1960 level, the average fertility rate is approximately 30% lower than at the benchmark (0.8024 instead of 1.1395). Analogously, when only the female LFP wedges are kept at the 1960 level, the fertility rates by occupation are identical to the 2020 benchmark. But

given the high share of women in high-fertility occupations when τ_i^ws are held at the 1960 level, then the average fertility in this counterfactual is approximately 26% higher than in the 2020 benchmark (1.4372 instead of 1.1395).

5.3 Potential Output and Welfare Gains of Eliminating Gender Barriers

The counterfactual exercises conducted so far have examined how changes in gender barriers in the US from 1960 to 2020 influenced economic growth, welfare, and the reallocation of labor across occupations. However, we can also use the model to analyze the potential effects of improving current gender barriers on the US economy.

Table 6: Model predictions for eliminating US gender barriers

		Counterfactual		
	Zero all τ's	Actual	Zero τ^n	Zero τ^w
Market GDP per person*	1.00	0.91	0.92	1.00
Home + market GDP per person*	1.00	0.97	0.96	1.02
Labor force participation, %	0.869	0.714	0.759	0.836
Average fertility rate	1.6507	1.1395	1.6750	0.9842
Consumption equivalent (CE)				
CE, all	-	21.15%	14.81%	6.86%
CE, male	-	-0.73%	-0.63%	-0.09%
CE, female	-	43.45%	30.56%	13.95%

* means relative to counterfactual in which all barriers are zero.

Table 6 presents the model-predicted output per capita in the US under the assumption of eliminating all gender barriers, i.e., τ_i^w and τ_i^n equal to zero for all occupations. The output results are relative to the zero-barrier counterfactual, which is why the output is normalized to 1 in this case. In this counterfactual scenario, market GDP per person in the US would increase by 9% compared to the current output per person (Column Actual). When home production is included, the aggregate output would increase by 3% under the assumption of no gender barriers. Furthermore, female participation in the labor force and the total fertility rate would increase significantly, by approximately 22 and 44 percent, respectively. Therefore, the lack of support for women to have children remains an important factor that negatively affects the fertility rate. Women's

actual welfare is also substantially lower compared to the zero-gender-barrier scenario. In the baseline case, women would need to increase their consumption by 43.45% to achieve the same utility as in the zero-barriers scenario..

Once again, most of the aggregate output impact arises from the female labor market barrier—Column zero τ^w—rather than the child penalty wedge—Column zero τ^n. However, the child penalty remains significantly important for female LFP, fertility and female welfare. Moreover, the men in the model have a vested interest in maintaining female barriers at their current levels (particularly in preserving the child penalty wedges), as their welfare would decrease if gender barriers were eliminated.

5.4 Sectoral Effects of Eliminating Gender Barriers

Panel (a) of Figure E2 shows the share of female workers by occupation in the US under the scenario of zero gender barriers (y-axis) compared to the 2020 benchmark economy (x-axis). Observe that the female share in the zero-barrier scenario can differ from 0.5 due to gender differences in preferences for certain occupations—See Equation (1).

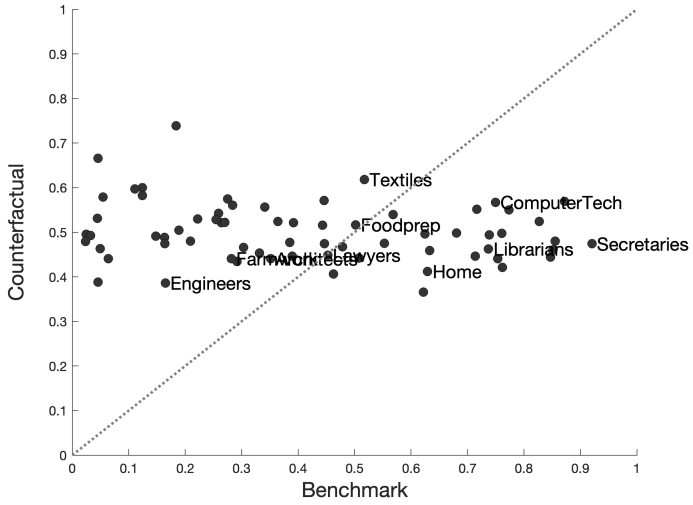
The results are highly heterogeneous, with the share of women in some occupations increasing and in others decreasing in this counterfactual scenario relative to the baseline. For example, although the share of female engineers in the US has grown significantly from 1960 to 2020, female wedges still act as barriers, preventing more women from becoming engineers. In the zero-wedges counterfactual, the share of women in this occupation would be twice as large as the observed value. In contrast, the female share for secretaries would be half of the actual value.

Another key takeaway from this figure is that gender diversity in certain occupations differs significantly from the zero-barrier counterfactual. In the zero-barrier scenario, the share of female workers in most occupations falls between 0.4 and 0.6. However, in the 2020 benchmark, many occupations are male-dominated or female-dominated, indicating a stark deviation from the more balanced distribution predicted in the absence of gender barriers.

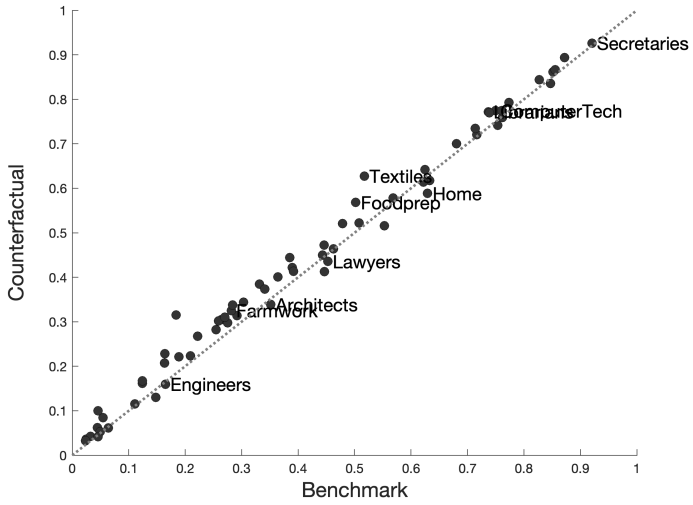
Panels (b) and (c) of Figure E2 demonstrate that female labor barriers are the primary factor explaining the current lack of gender diversity in certain occupations. Eliminating child penalty wedges would lead to small deviations in

Figure 7: Sectoral analysis: Share of women in each occupation in the benchmark (x-axis) and in model counterfactual (y-axis)

(a) Zero wedges versus benchmark



(b) Zero child barrier versus benchmark



(c) Zero labor market barrier versus benchmark

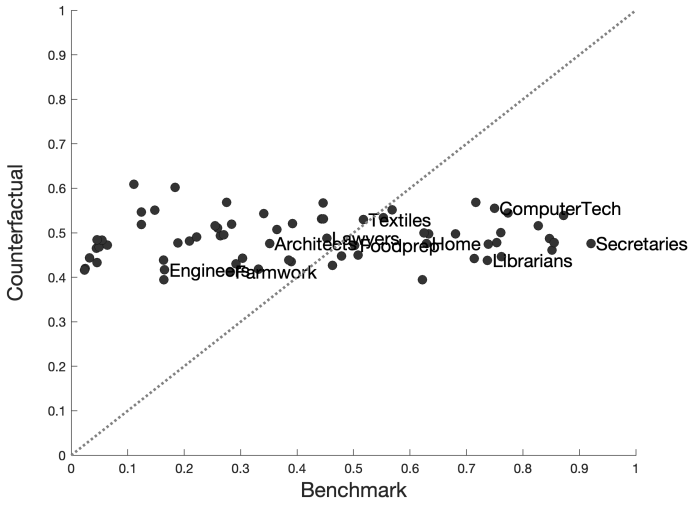
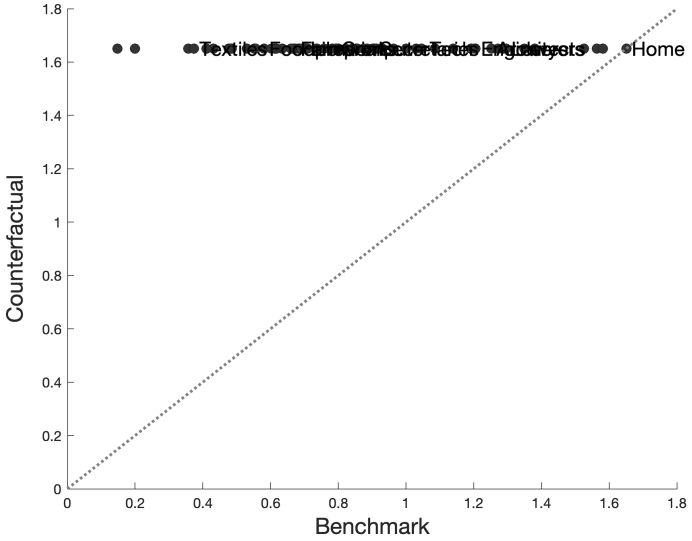


Figure 8: Sectoral analysis: Fertility in each occupation in the 2020 benchmark (x-axis) and in model counterfactual (y-axis) with all wedges set at zero



occupation share relatively to the 2020 benchmark.

Figure 8 shows that when all gender barriers (particularly the child penalty) are eliminated, fertility rates in all occupations are equalized and similar to that in the home sector. When both wedges are zero, the average fertility rate would be approximately 45% higher than in the 2020 benchmark—See Table 6. When the female LFP wedges are eliminated, fertility by occupation decreases slightly relative to the 2020 benchmark. The shift of women from high-fertility to low-fertility occupations reduces the total fertility rate by approximately 14%.

6 Concluding Remarks

Our work contributes to a growing literature documenting the macroeconomic effects of gender barriers. By incorporating fertility choices, labor market distortions and child penalties in the occupational choice model of Hsieh et al. (2019), we show how the joint decline in barriers to female labor market participation and child penalties changed fertility, occupational choices and aggregate efficiency. We fit the model to the US data and quantify gender distortions' aggregate income and welfare effects. The model matches almost perfectly the changes in occupation share by men and women and in the fertility rate by oc-

cupation. Movements in barriers to female labor force participation and in the child penalty accounted for approximately 30% of the growth in US GDP per person from 1960 to 2020. The decline in labor market frictions contributed approximately 88-90% of this 30% overall effect, with the remainder attributed to the reduction in the child penalty wedge.

The reduction in female wedges played a significant role in improving gender diversity in the US from 1960 to 2020. The fraction of female workers in certain occupations (e.g., engineers and lawyers) was almost negligible in 1960 but increased substantially by 2020. Meanwhile, men increased their participation in other roles, such as in the home sector. While the reduction in the child penalty contributed to improving gender diversity in some occupations, the overall large impact was, once again, primarily driven by changes in gender barriers to female LFP.

The effects of changing wedges on female welfare were also significant. Female workers in the US in 2020 would need to be compensated with a 21.96% increase in their consumption to experience the levels of occupational barriers and child penalties present in 1960. The reduction in the child penalty alone between 1960 and 2020 increased the welfare of US female workers by approximately 16.61% in consumption equivalent to the 2020 level.

We also use the model to investigate the impact on the US economy if gender barriers were eliminated. Our findings suggest that income per capita would increase by 9% relative to the 2020 level, and female LFP would rise by 15 percentage points.The average fertility rate would grow significantly by 44%. Additionally, gender diversity in occupations would improve substantially. Some occupations still remain male-dominated (e.g., more than 80% of engineers in the US are men) or female-dominated (e.g., more than 90% of secretaries are women) and the elimination of gender barriers would change this significantly. Furthermore, female welfare would increase by 21.15% in consumption equivalent to 2020, while male welfare would decline by 0.73% of their 2020 consumption. This implies that men may have a vested interest in maintaining the child penalty and female LFP barriers at their current levels.

In conclusion, our results indicate that flexibility in working-time arrangements, support for families with young children and policies to address gender bias in occupations can effectively reduce gender distortions, improve gender diversity, leading to significant gains in macroeconomic efficiency and welfare.

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Appendix

A Data Appendix

We use data from the 1960-1990 decennial Censuses and the 2000, 2010 and 2021 American Community Surveys (ACS) for the United States.

In order to focus on individuals who have completed their education and before their retirement, we restricted our sample for men and women aged between 25 and 54 (inclusive). We excluded those individuals who reported being unemployed (not working but searching for work), on active military duty, and in undefined occupations.

We restrict the sample to two groups: men and women. We classify a person as being in the home sector if they are not currently employed or work less than ten hours per week. Those individuals who are employed but usually work between ten and thirty hours per week are classified as part-time workers. We split the sampling weight of part-time workers equally between the home sector and the occupation in which they are working. Individuals working more than thirty hours per week are considered to be full-time workers in a market occupation. We consider 66 market occupations, including the home sector. The occupations are listed in Table A1. To solve the model, we assume a fertility rate of 0.2 for cells where this variable is not observed in the data.

Table A1: List of Occupations

Home	Sales, all
Executives, Administrative and Managerial	Secretaries
Management Related	Info. Clerks
Architects	Records Processing, Non-Financial
Engineers	Financial Records Processing
Math and Computer Science	Office Machine Operator
Natural Science	Computer/Communications Operator
Doctors	Mail Distribution
Health Assessment	Scheduling and Distributing Clerks
Therapists	Adjusters and Investigators
Professors	Misc. Admin Support
Teachers, Non-Postsecondary	Private Household Occupations
Librarians and Curators	Firefighting
Social Scientists and Urban Planners	Police
Social Work	Guards
Lawyers and Judges	Food Prep and Service
Arts and Athletes	Health Service
Health Technicians	Cleaning and Building Service
Engineering Technicians	Personal Service
Science Technicians	Farm Managers
Technicians, Other	Farm Work
Forest, Logging, Fishers and Hunter	Mechanics
Elec. Repairer	Misc. Repairer
Construction Trade	Extractive
Supervisor(P)	Precision Metal
Precision Wood	Precision, Textile
Precision, Other	Precision, Food
Plant Operator	Metal and Plastic Machine Operator
Metal and Plastic Processing Operator	Woodworking Machine Operator
Textile Machine Operator	Print Machine Operator
Machine Operator, Other	Fabricators
Production Inspectors	Motor Vehicle Operator
Non Motor Vehicle Operator	Freight, Stock, Material Handler

All variables are defined separately for each occupation-group-year. For ease of exposition, we will refer to the occupation-group-year as a "cell". The variables are the following:

Women: women of any age or marital status.

Income: We measure earnings as the sum of labor, business, and farm income in the previous year for the United States. We compute the average annual earnings for each full time working individual in that cell (we follow Hsieh et al. (2019) and compute earning only for those who are currently working, who worked 48 weeks during the prior year, and had at least $1000 of income (in 2010 dollars)).

Education: The average years of schooling for all individuals in that cell.

Fertility: Average number of children living in the household for women between 35-45 years old.

In Table A2 we present the share of individuals across all occupations for 1960 and 2021:

Table A2: Gender composition by occupation, 1960 and 2021

Occupation	**1960**		**2021**	
	Men	**Women**	**Men**	**Women**
Home	0.11	0.89	0.37	0.63
Executives, Administrative, and Managerial	0.87	0.13	0.56	0.44
Management Related	0.84	0.16	0.43	0.57
Architects	0.98	0.02	0.65	0.35
Engineers	0.99	0.01	0.84	0.16
Math and Computer Science	0.75	0.25	0.71	0.29
Natural Science	0.94	0.06	0.54	0.46
Doctors	0.95	0.05	0.55	0.45
Health Assessment	0.15	0.85	0.15	0.85
Therapists	0.53	0.47	0.25	0.75
Professors	0.82	0.18	0.49	0.51
Teachers, Non-Postsecondary	0.34	0.66	0.24	0.76
Librarians and Curators	0.15	0.85	0.26	0.74

Continued on next page...

Occupation	1960		2021	
	Men	Women	Men	Women
Social Scientists and Urban Planners	0.77	0.23	0.37	0.63
Social Workers	0.76	0.24	0.38	0.62
Lawyers and Judges	0.97	0.03	0.55	0.45
Arts and Athletes	0.73	0.27	0.52	0.48
Health Technicians	0.21	0.79	0.28	0.72
Engineering Technicians	0.95	0.05	0.74	0.26
Science Technicians	0.88	0.12	0.61	0.39
Technicians, Other	0.87	0.13	0.73	0.27
Sales, all	0.66	0.34	0.55	0.45
Secretaries	0.04	0.96	0.08	0.92
Information Clerks	0.33	0.67	0.17	0.83
Records Processing, Non-Financial	0.45	0.55	0.29	0.71
Records Processing, Financial	0.19	0.81	0.15	0.85
Office Machine Operator	0.28	0.72	0.45	0.55
Computer and Communications Equipment Operator	0.08	0.92	0.25	0.75
Mail Distribution	0.93	0.07	0.67	0.33
Scheduling and Distributing Clerks	0.88	0.12	0.61	0.39
Adjusters and Investigators	0.88	0.12	0.32	0.68
Misc. Admin Support	0.42	0.58	0.23	0.77
Private Household Occupations	0.15	0.85	0.13	0.87
Firefighting	1.00	0.00	0.96	0.04
Police	0.98	0.02	0.79	0.21
Guards	0.97	0.03	0.70	0.30
Food Prep and Service	0.31	0.69	0.50	0.50
Health Service	0.23	0.77	0.14	0.86
Cleaning and Building Service	0.85	0.15	0.66	0.34
Personal Service	0.28	0.72	0.24	0.76
Farm Managers	0.97	0.03	0.85	0.15
Farm Non-Managers	0.81	0.19	0.72	0.28
Related Agriculture	0.89	0.11	0.84	0.16
Forest, Logging, Fishers and Hunter	0.99	0.01	0.88	0.12
Mechanic	1.00	0.00	0.98	0.02

Continued on next page...

Occupation	1960		2021	
	Men	Women	Men	Women
Electronic Repairer	0.98	0.02	0.95	0.05
Misc. Repairer	0.99	0.01	0.94	0.06
Construction Trade	0.99	0.01	0.97	0.03
Extractive	1.00	0.00	0.98	0.02
Supervisor (P)	0.93	0.07	0.78	0.22
Precision Metal	0.99	0.01	0.95	0.05
Precision Wood	0.99	0.01	0.89	0.11
Precision, Textile	0.15	0.85	0.48	0.52
Precision, Other	0.88	0.12	0.26	0.74
Precision, Food	0.93	0.07	0.61	0.39
Plant and System Operator	0.99	0.01	0.95	0.05
Metal and Plastic Machine Operator	0.96	0.04	0.84	0.16
Metal and Plastic Processing Operator	0.98	0.02	0.82	0.18
Woodworking Machine Operator	0.97	0.03	0.81	0.19
Textile Machine Operator	0.93	0.07	0.74	0.26
Printing Machine Operator	0.33	0.67	0.38	0.62
Machine Operator, Other	0.70	0.30	0.72	0.28
Fabricators	0.70	0.30	0.75	0.25
Production Inspectors	0.54	0.46	0.64	0.36
Motor Vehicle Operator	0.99	0.01	0.88	0.12
Non Motor Vehicle Operator	0.99	0.01	0.95	0.05
Freight, Stock, Material Handler	0.96	0.04	0.73	0.27

B Derivations and Proofs

B.1 Proof of Proposition 1 – Occupational Shares

The individual's utility from choosing a particular occupation, $U(\tau_{ig}, w_i, z_i)$, is proportional to $(\tilde{w}_{ig} z_i)^{\frac{\beta}{1-\eta}}$, where $\tilde{w}_{ig} = (1 - \tau_i^w) w_i (s_i^*)^{\phi_i} (1 - s_i^*)^{\frac{1-\eta}{\beta}} (1 - (1 + \tau_{ig}^n) \chi_g n_{ig}^*)^{\alpha} (n_{ig}^*)^{\frac{\theta_g (1-\eta)}{\beta}}$.

Without loss of generality, consider the probability that the individual of gender g chooses occupation 1 and denote this by p_{1g}. Then

$$\begin{aligned} p_{1g} &= \Pr[\tilde{w}_{1g} z_1 > \tilde{w}_{sg} z_s], \ \ \forall s \neq 1 \\ &= \Pr[\tfrac{\tilde{w}_{1g} z_1}{\tilde{w}_{sg}} > z_s], \ \ \forall s \neq 1 \\ &= \int F_1(z, \upsilon_2 z, \ldots, \upsilon_J z).dz \end{aligned}$$

where $F_1(\cdot)$ is the derivative of the cumulative distribution function with respect to its first argument and $\upsilon_i \equiv \tilde{w}_{1g}/\tilde{w}_{ig}$.

Recall that

$$F(z_1, \ldots, z_J) = \exp\left[\sum_{j=1}^{J} z_j^{-\lambda}\right]$$

Taking the derivative with respect to z_1 and evaluating at the appropriate arguments gives

$$\begin{aligned} F_1(z, \upsilon_2 z, \ldots, \upsilon_J z) = & \quad \lambda z^{-\lambda-1} \exp[-\textstyle\sum_{s=1}^{J} \upsilon_s^{-\lambda} z^{-\lambda}] \\ = & \ \ \lambda z^{-\lambda-1} \exp[-\bar{\upsilon} z^{-\lambda}], \ \ \text{where } \bar{\upsilon} \equiv \textstyle\sum_{j=1}^{J} \upsilon_j^{-\lambda} \end{aligned}$$

p_{1g} is now:

$$\begin{aligned} p_{1g} &= \int_0^{\infty} \lambda z^{-\lambda-1} \exp[-\bar{\upsilon} z^{-\lambda}] dz \\ &= \int_0^{\infty} \lambda z^{-\lambda-1} \exp[-(\bar{\upsilon}^{\frac{-1}{\lambda}} z)^{-\lambda}] dz \end{aligned}$$

We proceed with integration by change of variables $z' = \bar{v}^{\frac{-1}{\lambda}} z$ e $dz' = \bar{v}^{\frac{-1}{\lambda}} dz$:

$$\begin{aligned}
p_{1g} &= \int_0^\infty \lambda(\bar{v}^{\frac{1}{\lambda}} z')^{-\lambda-1} \exp[-(z')^{-\lambda}] \bar{v}^{\frac{1}{\lambda}} dz' \\
&= \bar{v}^{-1} \int_0^\infty \lambda(z')^{-\lambda-1} \exp[-(z')^{-\lambda}] dz' \\
&= \bar{v}^{-1} \int_0^\infty dF(z') \\
&= \bar{v}^{-1} \\
&= \frac{1}{\sum_{s=1}^J v_s^{-\lambda}} \\
&= \frac{\tilde{w}_{1g}^\lambda}{\sum_{j=1}^J \tilde{w}_{jg}^\lambda}
\end{aligned}$$

More generally,

$$p_{ig} = \frac{\tilde{w}_{ig}^\lambda}{\sum_{s=1}^J \tilde{w}_{sg}^\lambda}, \quad \forall i \in \{1, \ldots, I\}$$

B.2 Proof of Proposition 2 – Average Quality of Workers

Efficiency units of labor of an individual in occupation i is given by $h_{ig} = s^{\phi_i} e^\eta$. Using the results from the individual's optimization problem, we have that:

$$\begin{aligned}
h_{ig} z_i &= (s_i^*)^{\phi_i} \left(\eta(1 - \tau_{ig}^w) z_i w_i (1 - (1 + \tau_{ig}^n) \chi_g n_{ig}^*)(s_i^*)^{\phi_i} \right)^{\frac{\eta}{1-\eta}} z_i \\
h_{ig} z_i &= (s_i^*)^{\phi_i} \left(\eta(1 - \tau_{ig}^w) w_i (1 - (1 + \tau_{ig}^n) \chi_g n_{ig}^*)(s_i^*)^{\phi_i} \right)^{\frac{\eta}{1-\eta}} z_i^{\frac{1}{1-\eta}}
\end{aligned}$$

The average of efficiency units of labor in an occupation is given by:

$$\mathbf{E}[h_{ig} z_i \mid \text{choose occ } i] = (s_i^*)^{\phi_i} \left(\eta(1 - \tau_{ig}^w) w_i (1 - (1 + \tau_{ig}^n) \chi_g n_{ig}^*)(s_i^*)^{\phi_i} \right)^{\frac{\eta}{1-\eta}} \mathbf{E}[z_i^{\frac{1}{1-\eta}} \mid \text{choose occ } i]$$

The next step is to calculate $\mathbf{E}[z_i^{\frac{1}{1-\eta}} \mid \text{choose occ } i]$. Let's calculate $\mathbf{E}[z^x \mid \text{choose occ } i]$. As shown during the derivations of occupational share, the new conditional distribution of z_i given that workers sorts into occupation i is given by $G(z) = F(v_1 z, v_2 z, \ldots, v_J z) = \exp(-\sum_{j=1}^J v_j^{-\lambda} z^{-\lambda}) = \exp(-\frac{1}{p_j} z^{-\lambda})$. So we

now have the following:

$$\begin{aligned}\mathbf{E}[z_i^x] &= \int_0^\infty z^x dG(z) \\ &= \int_0^\infty \lambda \frac{1}{p_j} z^{-\lambda-1+x} \exp(-\frac{1}{p_j} z^{-\lambda}) dz\end{aligned}$$

Let $y = \frac{1}{p_j} z^{-\lambda}$, so that $\mathbf{E}[z_i^x]$ simplifies to:

$$\begin{aligned}\mathbf{E}[z_i^x] &= \frac{1}{p_j}^{\frac{x}{\lambda}} \int_0^\infty y^{-\frac{x}{\lambda}} e^{-y} dy \\ &= {p_j}^{-\frac{x}{\lambda}} \, \Gamma\left(1 - \frac{x}{\lambda}\right)\end{aligned}$$

So for $x = \frac{1}{1-\eta}$, we have:

$$\mathbf{E}[z_i^{\frac{1}{1-\eta}}] = {p_j}^{-\frac{1}{\lambda(1-\eta)}} \, \Gamma\left(1 - \frac{1}{\lambda}\frac{1}{1-\eta}\right)$$

So average productivity is given by:

$$\text{avg quality}_{ig} = (s_i^*)^{\phi_i} \left(\eta(1-\tau_{ig}^w) w_i (1-(1+\tau_{ig}^n)\chi_g n_{ig}^*)(s_i^*)^{\phi_i}\right)^{\frac{\eta}{1-\eta}} {p_{ig}}^{-\frac{1}{\lambda(1-\eta)}} \, \Gamma\left(1-\frac{1}{\lambda}\frac{1}{1-\eta}\right)$$

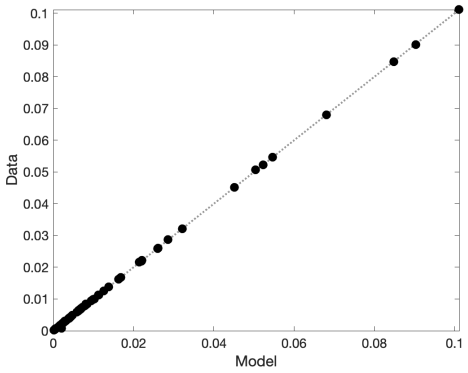
B.3 Proof of Proposition 3 – Average Earnings

Let $\overline{wage}_{ig}$ denote the average earnings in occupation i by group g. Its value satisfies

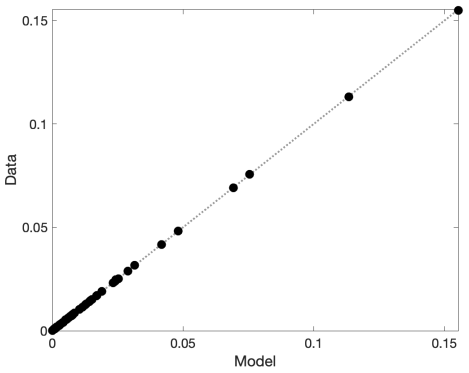
$$\begin{aligned}\overline{wage}_{ig} &= (1-\tau_{ig}^w) w_i \cdot \text{avg productivity}_{ig} \\ &= (1-\tau_{ig}^w) w_i (s_i^*)^{\phi_i} \left(\eta(1-\tau_{ig}^w) w_i (1-(1+\tau_{ig}^n)\chi_g n_{ig}^*)(s_i^*)^{\phi_i}\right)^{\frac{\eta}{1-\eta}} {p_{ig}}^{-\frac{1}{\lambda(1-\eta)}} \, \Gamma\left(1-\frac{1}{\lambda}\frac{1}{1-\eta}\right) \\ &= \hat{\eta} \, \bar{\Gamma} \, x_{ig}^{-\frac{1}{\beta}} (1-s_i)^{-\frac{1}{\beta}} \left[\sum_{k=1}^J \tilde{w}_{kg}^\lambda\right]^{\frac{1}{\lambda}\frac{1}{1-\eta}} \frac{1}{(1-(1+\tau_{ig}^n)\chi_g n_{ig}^*)(n_{ig}^*)^{\frac{\theta_g}{\beta}}}\end{aligned}$$

Figure C1: Model fit for the United States economy: Share of workers and fertility rate by occupation in the model (x-axis) and in the data (y-axis), 1960 and 2020

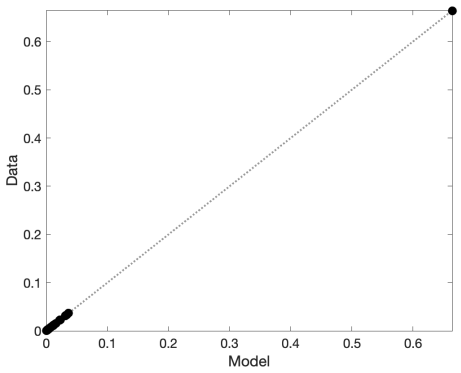
(a) Male workers (%) by occupation, 1960



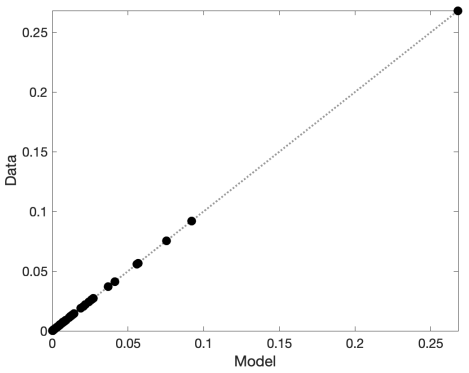
(b) Male workers (%) by occupation, 2020



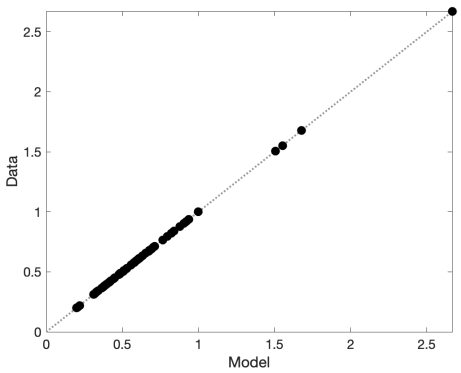
(c) Female workers (%) by occupation, 1960



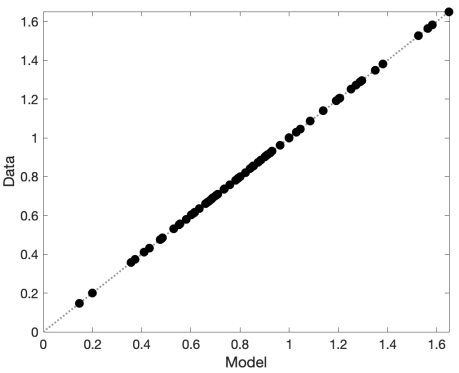
(d) Female workers (%) by occupation, 2020



(e) Fertility rate by occupation, 1960



(f) Fertility rate by occupation, 2020



C Model Fit

This appendix presents Figure C1, which reports the fraction of male and female workers by occupation in the data and the model for 1960—Panels (a) and (c)—and for 2020—Panels (b) and (d). It also displays the fertility rate in the model and the data for 1960 and 2020—Panels (e) and (f). As we can see, the model fit is excellent, matching very well such moments.

D Sensitivity Analysis

This appendix presents a sensitivity analysis of two key parameters (λ and ρ), which were externally set following the values specified by Hsieh et al. (2019).

Table D3 shows the share of US growth attributable to changes in the child penalty and barriers to female LFP when the Fréchet shape parameter is decreased (Part I: $\lambda = 1.8$) or increased (Part II: $\lambda = 2.2$) by 10% relative to the baseline ($\lambda = 2$). The share of GDP per capita growth explained by these wedges varies by less than 5% compared to the values reported in Table 3.

Table D3: Sensitivity Analysis to Variations in the Fréchet Parameter (λ)

Part I: $\lambda = 1.8$			
	τ^w and τ^n	τ^n only	τ^w only
Market GDP per person	31.20	3.47	27.93
Market Earnings per person	29.94	2.14	28.57
Labor Force Participation	127.52	17.57	107.73
Market GDP per worker	-5.62	-1.92	-2.58
Home + Market GDP per person	19.96	0.23	17.05
Part II: $\lambda = 2.2$			
	τ^w and τ^n	τ^n only	τ^w only
Market GDP per person	28.55	1.80	25.84
Market Earnings per person	30.73	1.31	29.73
Labor Force Participation	132.81	15.24	115.67
Market GDP per worker	-13.98	-3.69	-10.80
Home + Market GDP per person	22.30	0.97	20.13

Table D4 presents a sensitivity analysis of model outputs to variations in the elasticity of substitution, ρ—We vary this parameter by 10% relative to its base-

line value of $\rho = 2/3$. Once more, the share of GDP per capita growth attributed to both wedges varies by less than 5% compared to the values reported in Table 3. Other statistics vary also by similar magnitude.

Table D4: Model Robustness on Elasticity of Substitution (ρ)

$\rho = 0.6$			
	τ^w and τ^n	τ^n only	τ^w only
Market GDP per person	30.57	2.34	27.30
Market Earnings per person	31.25	1.77	29.92
Labor Force Participation	134.62	16.90	115.67
Market GDP per worker	-11.20	-3.51	-8.17
Home + Market GDP per person	22.66	1.21	20.33
$\rho = 0.73$			
	τ^w and τ^n	τ^n only	τ^w only
Market GDP per person	28.45	2.15	25.32
Market Earnings per person	29.30	1.48	28.20
Labor Force Participation	125.23	15.76	107.01
Market GDP per worker	-8.86	-3.09	-6.17
Home + Market GDP per person	21.79	1.10	19.55

E Model without Fertility

In this appendix, we consider a simplified version of our model by setting fertility to zero across all occupations.

This framework reduces to a simplified version of the model presented by Hsieh et al. (2019), which is calibrated to match similar moments of the US economy used in the full model. For obvious reason, fertility moments are excluded from consideration in the calibration of this model.

Table E5 reports the share of growth accounted for by changes in barriers to female LFP when the fertility rate is set to zero across all occupations. In this exercise, we hold the distortions τ_i^w at their initial calibrated values from 1960 and compute the counterfactual output for 2020, keeping all other parameters fixed at their baseline values.

Interestingly, the decline in τ_i^w accounted for 27.11% of US growth in market GDP per person and 19.61% of US growth in combined home and market GDP

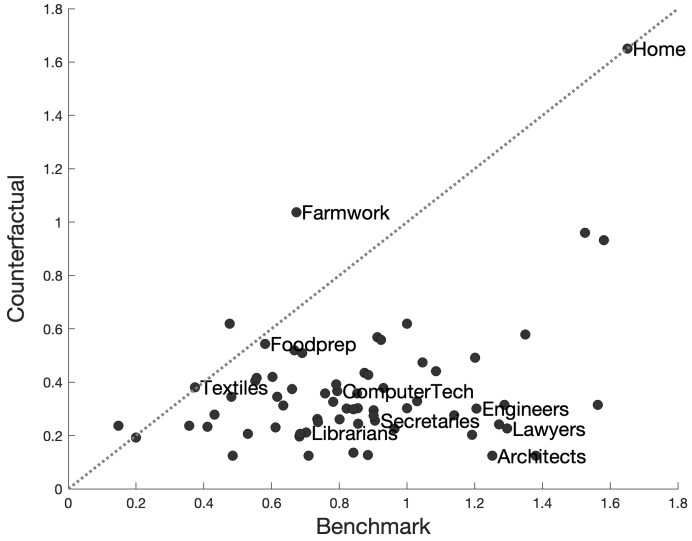
Table E5: Output Implications of Changing Frictions, 1960-2020. Model without Fertility

	Share of growth accounted for by		
	τ^w and τ^n	τ^n only	τ^w only
Market GDP per person	27.11%	0.00%	27.11%
Market Earnings per person	29.17%	0.00%	29.17%
Home + market GDP per person	19.61%	0.00%	19.61%
Labor Force Participation	111.19%	0.00%	111.19%
Market GDP per worker	-5.99%	0.00%	-5.99%

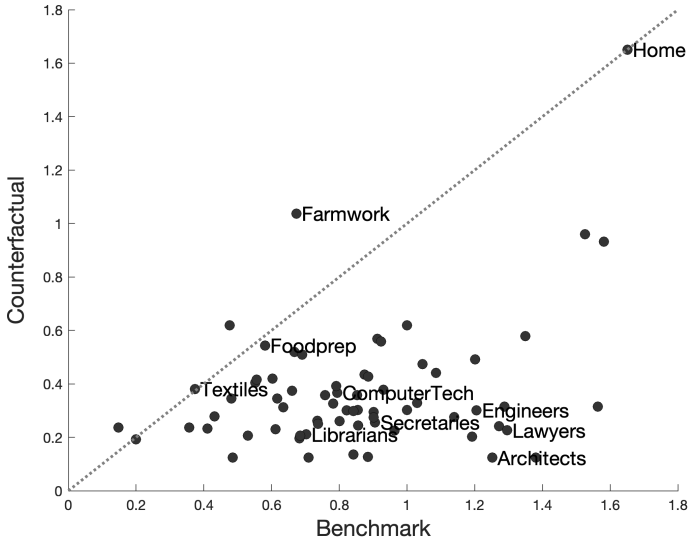
per person during the period from 1960 to 2020. These measures are very close to those reported in the last column of Table 3, in which the wedges of the female LFP are altered.

Figure E2: Fertility analysis: Average fertility in each occupation in the benchmark (x-axis) and in model counterfactual (y-axis)

(a) All barriers fixed at 1960's level



(b) Child barriers fixed at 1960's level



(c) Market barriers fixed at 1960's level

