Speed of Gender Employment Convergence and Its Aggregate Impacts: Estimating Crowding Out Effects in Mexico *

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Abstract

This paper examines the impact of gender employment convergence by focusing on whether an increase in female employment crowds out male employment. A rapid rise in female employment could intensify labor market competition, leading to greater crowding out of male workers. The instrument variable estimation shows that increased female employment did not crowd out male employment, regardless of the growth rates of female employment in Mexico. The result is the same whether shocks are supply- or demand-driven for female employment. The empirical results suggest that increased female employment indirectly expands total labor demand. Furthermore, this paper estimates the crowding out effects at the industry level. A simple general equilibrium model explains that the degree of crowding out depends on industry-specific factor shares, output demand, and labor supply elasticities.

1 Introduction

Whether an increase in female labor force participation would threaten male employment has been a controversial topic for a long time. If female workers compete with male counterparts for jobs, male employment would shrink in response to a decline in male wages. In the early 20th century, it was a genuine concern for contemporary neoclassical economists. Their primary concern was whether equal pay for equal work would deteriorate male employment by promoting women to enter the labor market. Among them,

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Edgeworth (1922) speculated that the rapid inflow of unskilled women might take the place of male employment. Male workers would face stiffer competition due to increased female employment. Fawcett (1918), by contrast, argued that women would not displace men, despite women's large-scale entry into the labor market during World War I[1].

Even today, revisiting the debate remains crucial, given that female employment rates are considerably lower than male rates, especially in developing countries. While female employment grew in developing countries, the pace of catching up to male employment levels was slower than in developed countries. Slower gender employment convergence in developing countries raises a question: Does the speed of female convergence matter for the degree of crowding out? A rapid increase in female employment can lead to greater labor-market competition, resulting in greater crowding out of male employment than a slow-growth rate. As women enter the labor market more rapidly, it will cause severer social tensions between men and women because of a potential threat of female workers taking place of male jobs[2].

To address the question above, this paper analyzes the impact of gender employment convergence by estimating the crowding out effects in Mexico, where female employment followed a distinct pattern over the years. In Mexico, female employment growth followed a S-shaped pattern: sluggish growth from 1970 to 1990, a rapid rise in the 1990s, and a return to slow growth after 2000. Investigating the Mexican labor market enables analysis of the relationship between the degree of crowding out effects and the speed of female convergence. This paper empirically analyzes cross-state crowding out effects across periods with different speeds of female employment growth.

I estimate crowding out effects by regressing male employment rates on female employment rates. To address endogeneity, I construct two instrumental variables, each exploiting supply- or demand-driven shocks in female employment. The instrument built on the supply-driven shock is the cross-state variations in the timing of the legalization of no-fault divorce laws. On the other hand, I use the Job Opportunity Index (JOI) proposed by Nakamura et al. (1979) as an instrument with demand-driven shocks. The JOI instru-

[1]See Chassonnery-Zaïgouche and Cot (2021) for the historical background of the debate between classical and neoclassical economists in the late 19th to the early 20th century. Edgeworth viewed the market with a fixed labor demand in the face of a rise in female labor supply. From his perspective, an increase in female employment would not enlarge the market demand. On the other hand, Millicent Fawcett's perspective on the effects of increased female labor supply might be more flexible. Despite the spike in labor supply, she envisioned that labor demand could increase, as female labor productivity is high enough to boost aggregate productivity and thereby expand labor demand.

[2]A larger crowding out can be well understood in political or business settings. For instance, a significant rise of female politicians might cause spots for male candidates to decline. If the number of seats is fixed (or demand is unchanged) in a short period, a rapid increase in female workers can negatively affect male counterparts' probabilities of getting available seats.

ment captures differences in demand for female employment driven by changes in the occupational structure. The estimation results show that increased female employment did not crowd out male employment, regardless of the source of shocks to female employment. Rather, it increased male employment. Whatever causes female employment growth, an increase in female employment would not crowd out male employment.

Furthermore, even in the period of faster female employment growth, male employment increased by 0.44 % when using the JOI instrument. In both periods, male employment increases with rising female employment. Regardless of how fast female employment grows, it would not reduce male employment. In other words, regardless of the speed of gender employment convergence, increased female employment does not crowd out male workers.

If an increase in female employment did not crowd out male employment, it implies that total labor demand increases in response to increased female employment. As more women enter the labor market, household income will increase, expanding production and, in turn, the demand for total labor. The instrument estimation results ensure that the total employment over population rates increase by 0.72 % for the supply-side shocks and 0.56 % for the demand-side shocks. Therefore, increased female employment has an indirect effect on increasing male employment by expanding total labor demand.

However, the female employment effect on male employment also depends on its effect on male wages. To understand the equilibrium crowding out effect, I estimate the female employment elasticity of male wages using the supply-side instrument of the unilateral divorce law. The result indicates that increased female labor supply did not significantly reduce male wages, suggesting that an increase in female labor supply expands total labor demand. The effect of female employment on male wages is decomposed into a substitutability effect and a demand-enhancing effect. If men and women are substitutes, male wages can decrease in response to increased female employment, unless total labor demand rises significantly.

The extent to which male employment is crowded out by rising female employment should differ across industries depending on the elasticity of labor demand and supply. Moreover, the wage effect of female employment depends on the substitution pattern between male and female labor, which varies across industries based on industry-specific production technologies. To address this question, I estimate crowding out effects at the industry level. In most industries, rising female employment enhances male employment, suggesting the demand spillover effect dominates the substitutability effect, which negatively affects male employment across industries. In male-dominant industries, the effect on male employment in response to increased female employment is more pronounced

than in female-dominant industries. Industries that demand female labor more intensely can mitigate the effect on male employment by accommodating additional female workers.

Furthermore, this paper builds a simple general equilibrium model that accounts for differences in crowding out effects across industries in response to varying demand for male and female labor, and for output. The model indicates that more male workers will be crowded out by an increase in female employment in industries that make more intense use of female labor in a Cobb-Douglas production case. On the other hand, higher demand for output can lead to increased male employment. The model implications reveal the counteracting effects on male employment between the demand for female labor and the demand for output.

1.1 Related literature

There have been a few recent works on the macroeconomic impacts of gender employment convergence (Fukui et al., 2023; Albanesi, 2025; Olsson, 2025). The closest paper in the literature is Fukui et al. (2023). They find that the leading cause of slower employment recoveries is slower female convergence. They estimate the cross-sectional crowding out effect in the US and find it is close to zero. The estimation strategy for the crowding out effect in Section 3 is based on Fukui et al. (2023).

In addition, Olsson (2025) argues that the slowing of employment convergence among married women contributes more to the aggregate slow recovery than that of single women. However, none of the existing literature has focused on examining crowding out effects per se. Therefore, this paper takes a closer look at the various factors affecting male employment when more female workers enter the labor market[3].

This paper's contributions are threefold. First, it estimates the crowding out effect in Mexico, a developing country. None of the previous works have discussed the crowding out effect in developing countries, which is particularly important given that female employment rates were low, leaving room for potential increases. While previous studies have focused on the US labor market, examining crowding out effects could be of practical use to developing economies, where female employment has not yet converged with male employment.

In addition, the paper presents empirical evidence that the degree of crowding out is independent of the speed of gender convergence, contradicting the neoclassical view.

[3]Even though the scope of this paper targets the crowding out effect between men and women, it can be extended into two different demographic groups (e.g., immigrant and native workers). For instance, Galaasen et al. (2025) investigate the impacts of a surge in immigrant labor supply and immigrant consumption on native wage income.

The effects of increased female employment on male employment are expected to depend on the rate of growth of female employment. The faster the rate of gender employment convergence, the harsher the competition male workers will face, leading to a decrease in male employment. By empirically analyzing cross-state crowding out effects across periods with different convergence speeds, this paper shows the opposite result: no matter how rapidly female workers enter the market, it does not cause crowding out of male workers.

Lastly, this paper clarifies the mechanism by which a spike in female employment differentially expands labor demand across industries. This is the first paper to empirically estimate the crowding out effect at the industry level. Furthermore, this paper examines the role of industry-specific labor factor shares in explaining the extent of crowding out effects within a general equilibrium framework.

The rest of the paper is structured as follows: Section 2 illustrates the data and background of the Mexican labor market. Section 3 estimates the crowding out effects in Mexico using a shift-share instrument. Section 4 develops a general equilibrium model to highlight the key factors determining the degree of crowding out effects. Section 5 concludes.

2 Descriptive analyses

2.1 Data

I use harmonized microdata from IPUMS International (Ruggles et al. (2025)). The primary data source is the Encuesta Nacional de Ocupación y Empleo (ENOE) for the years 2005–2019, conducted by INEGI, the National Institute of Statistics, Geography, and Informatics. It is a national representative survey conducted quarterly in Mexico. It contains various characteristics of each worker, such as age, gender, place of residence, wage, sector, industry, and occupation. For long-run comparisons, I additionally use the Mexican population and housing censuses from 1990 to 2000. They cover individual-level variables, such as wages, occupation, sector, and place of residence, for every five years.

2.2 Female employment growth and institutional context in Mexico

Figure 1 shows the long-run growth in female employment to population rates (solid lines) and female labor force participation rates (dashed lines) in Mexico. Although the male employment-to-population ratio remained stable over time, female employment increased sharply during the 1990s. During the 20 years from 1970 to 1990, female labor

force participation rates grew slowly. The annual female employment growth rate during this period was 1.06% from 1970 to 1990. In the 1990s, the female employment growth rate was 4.7%, and the level of female employment rose from 20% to 40%[4]. After 2000, however, the pace of female convergence slowed down. The female employment rate remained lower than the male employment rate, approximately 48% in 2019 [5].

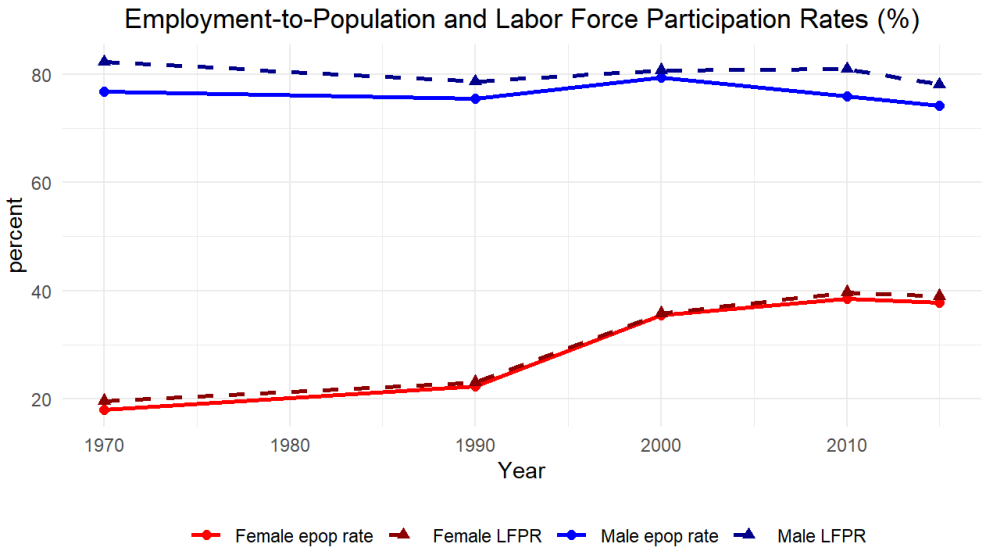


Figure 1: Employment-to-population and labor force participation rates in Mexico from 1970 to 2019

The Mexican labor market is gender-segregated across occupations. Women engaged in personal services and the education industries. In 1990, the female employment share in personal services amounted to 96%. It remained the same in 2000, but decreased to about 65% in 2005. The female employment share in the education industry remained around 60% during this period. Among male workers, officials and managers, industrial artisans, transport operators, protection workers, and agricultural workers are most common. The male employment share in most occupations decreased, but it increased for personal services.

Female workers in Mexico are more likely to be employed in the informal sector [6]. The

[4] Bhalotra and Fernández (2024) argue the drastic rise during the 1990s is explained mainly by the labor supply shift due to an improvement in female education

[5] The pattern of gender employment convergence both in Mexico and the US has been similar while the level of female employment rates has been lower in Mexico. Comparing the crowding out effects between both countries could highlight the factors which dampen the growth in female employment in the Mexican labor market.

[6] Bleynat et al. (2021) note that free mobility between the informal, formal, and self-employment sectors has been prevalent in Mexico. Faced with a high frequency of sectoral labor mobility, Mexico has experienced the historical wedge between the unskilled urban wage and GDP, which leads to prolonged inequality.

informal rates were roughly constant between 2005 and 2019 for both sexes. The informal employment rate is 38% for women and 30% for men in 2005, while 37% and 28% in 2019. Overall, informality is more common among women than among men.

Wages for both sexes rose at a stagnant rate. Figure 4 in Appendices shows wages drastically increased in 2015. This might reflect a continual increase in minimum wages since 2015. In addition, the Mexican labor market can be characterized by the downward wage rigidity due to strong union negotiation power.

2.3 Crowding out statistics

Crowding out is defined as the differential change in male employment relative to a female-biased shock scaled by the female employment shift[7]. L is the total employment rates while L_m and L_f are male and female employment rates. Assume the gender ratio of the working-age population is fixed over time, which is denoted by α[8]. The total employment rates are divided as follows:

$$L = \alpha L_f + (1-\alpha) L_m.$$

The object of interest is how a female-biased shock θ_f will change total employment rates. Taking the derivative of both sides of the above equation with respect to θ_f yields

$$\frac{dL}{d\theta_f} = \alpha \frac{dL_f}{d\theta_f} + (1-\alpha)\frac{dL_m}{d\theta_f}$$

$$\Rightarrow \frac{dL}{d\theta_f} \Big/ \frac{dL_f}{d\theta_f} = \alpha + (1-\alpha) \underbrace{\frac{dL_m}{d\theta_f} \Big/ \frac{dL_f}{d\theta_f}}_{\text{crowding out}}.$$

The second term on the right-hand side is crowding out effect. How total employment responds to a female-biased shock depends on the effect of that shock on male employment, scaled by the change in female employment. Here, θ_f can be any shocks on female employment (e.g., reduction in gender discrimination or an improvement in female labor productivity). In this regard, crowding out effect defined by $\frac{dL_m}{d\theta_f} / \frac{dL_f}{d\theta_f}$ is a broader concept than the cross-elasticity of male employment with respect to female wage. I will use this definition for the estimation of the crowding out effect in the next section.

[7] This statistics for crowding out is based on Fukui et al. (2023). While they assume the female working-age population ratio is 0.5, I parametrize it as α.

[8] The female to the total working-age population ratio has been slightly higher than 0.5 in Mexico. In contrast, the female working-age population ratio in the US has been on the decrease in the recent years.

3 Estimation of the crowding out effect

3.1 Estimating cross-state crowding out effect

A simple way to estimate the crowding out effect of male employment by female employment is to regress the male employment growth on female employment growth at the state-year level.

$$epop_{st}^{M} = \alpha + \beta_1 D + \beta_2 epop_{st}^{F} + \beta_3 epop_{st}^{F} \times D + X_{st}'\gamma + \phi_s + \epsilon_{st}, \tag{1}$$

where $epop_{st}^{M}(epop_{st}^{F})$ is the male (female) employment to population ratio in state s at year t. X_{st} is a vector of state-year control variables, consisting of the skill premium between university graduates and high school graduates, GDP at the state level, manufacturing employment share, agriculture employment share, service employment share, single population share, native population share at the state-year level. ϕ_s is a state fixed effect. Moreover, the growth rates of female employment varied over the years as shown in Figure 1. To account for the shift in gender convergence rates, I use a dummy variable for each period. D takes 1 if $t \in \{1990, 2000\}$ and 0 if $t \in \{2005, 2019\}$. β_2 is the estimate of crowding out effect for the period of slow female employment growth while $\beta_2 + \beta_3$ is the estimate of crowding out effect for the period of faster growth rate.

3.2 Instrument approach

Job Opportunity Index (JOI)

One issue with the estimation regression is that the OLS estimate of the crowding out effect is biased because both female and male employment rates can be affected by the same shocks (e.g., business-cycle or local-economy shocks). To address this endogeneity, we need a proxy for female-biased shocks that is orthogonal to gender-neutral shocks.

I use two instruments which exploit the demand-driven shocks or the supply-driven shocks on female employment, respectively. The first alternative proxy for female-biased shocks is the "Job Opportunity Index (JOI)", first proposed by Nakamura et al. (1979) and later developed by Fukui et al. (2023).

$$JOI_{st} = \sum_{\omega} \alpha_{-s,\tau_0}(\omega)\pi_{st}(\omega),$$

where α_{-s,τ_0} is the national prime-age female employment share in occupation ω in the initial period. $\pi_{s,t}(\omega)$ is the state-level employment share of occupation ω. This captures

state-year variations in female demand driven by changes in the occupational composition of employment. The identifying assumption is that the occupational structure ($\pi_{st}(\omega)$) is orthogonal to the male employment rates.

Unilateral divorce law (UDL)

An instrument arising from the variations in female labor supply is the no-fault unilateral divorce law. Mexican states have introduced unilateral no-fault divorce laws since 2008, in a staggered manner. The instrument UDL_{st} exploits cross-state variation in the timing of law adoption. A number of studies support that changes in marital status affect the female labor supply decision (Gray, 1998; Fernández and Wong, 2014; Kuhn et al., 2024). I use a dummy that takes 1 for the years after each state implemented the unilateral divorce law and 0 otherwise[9].

$$UDL_{s,t} = 1\{t \geq t_s^{adopt}\}$$

Since this law only affects married women, I use this instrument weighted by the state-year share of married women. Also, it only covers the period of slower female convergence since unilateral divorce laws began in 2008.

The results are shown in Table 1. An increase in female employment does not crowd out male workers regardless of the causes of female employment growth. The instrumental variable estimate of the crowding out effect using the unilateral divorce law as an instrument is 0.38. A 1 % increase in female employment increases male employment by 0.38 % from 2005 to 2019. Moreover, the estimate is 0.09, but insignificant with the JOI instrument for the period between 2005 and 2019. In a period between 1990 and 2000 with a faster female employment growth, a 1% increase in female employment leads to an increase in male employment by 0.44 %. Whether the increase in female employment is caused by a labor supply or a demand shock, increased female employment did not crowd out male employment.

The empirical outcomes imply that increased female employment has an indirect effect on total labor demand so that male workers will not be crowded out. Table 2 shows the effect of female employment growth on total employment-to-population rates. Either the supply-side instrument (UDL) or the demand-side instrument (JOI) leads to the increase in total employment in response to increased female employment. A 1 % increase in female employment over population rates increases the total employment over population rates

[9]The initial years of the unilateral divorce law's legalization are retrieved from Appendix B of Hoehn-Velasco and Penglase (2021). I refer to *de facto* years rather than *de jure* years.

	UDL		JOI	
	(1)	(2)	(3)	(4)
Dependent variable: Mepop				
Fepop	0.38	0.38	−0.11	0.09
	(0.02)	(0.04)	(0.11)	(0.14)
Fepop × D	—	—	0.34	0.35
			(0.11)	(0.11)
State FE	✓	✓	✓	✓
Controls	—	✓	—	✓
1st Stage F	102.00	232.40	633.10	214.00

Table 1: TSLS estimates of crowding out effects

Notes: Panel regression at the state-year level. Mepop denotes the ratio of male employment to the male working-age population. Fepop denotes the ratio of female employment to the female working-age population. Standard errors clustered at state level in parentheses.

by 0.72 % with the UDL instrument. Moreover, a 1 % increase in female labor demand leads to an increase in the total labor by 0.56 %. Given the female population ratio is around 51-52 % in Mexico, the total employment has increased slightly more than the increase in female employment, which can attribute to the increase in male employment seen in Figure 1. The result indicates that increased female employment has an indirect effect to additionally increase male employment by expanding total labor demand. In addition, faster female employment growth increases total employment by 0.15 % more than in a slow growth period.

The indirect effect (or "externality") on total demand for labor can be attributed to a new demand for male jobs complement with female labor. For instance, a rising demand for training and supporting women who enter the market without skills or experience can lead to the creation of new job titles such as assistant manager.

3.3 Wage effect

If total labor demand increases in response to increased female labor supply, male workers will not be crowded out. However, the female employment effect on male employment also relies on its effect on male wages. To ensure the indirect effect on total labor demand in response to increased female employment, I estimate the percentage change in male wages in response to increased female employment.

	UDL		JOI	
	(1)	(2)	(3)	(4)
Dependent variable: Total epop				
Fepop	0.70	0.72	0.51	0.56
	(0.01)	(0.02)	(0.02)	(0.03)
Fepop × D	—	—	0.11	0.15
			(0.02)	(0.03)
State FE	✓	✓	✓	✓
Controls	—	✓	—	✓
1st Stage F	102.00	232.40	633.10	214.00

Table 2: TSLS estimates of increased female employment on total employment

Notes: Panel regression at the state-year level. Total epop denotes the total employment-to-population rates. Fepop denotes the ratio of female employment to the female working-age population. Standard errors clustered at state level in parentheses.

$$\log wage_{st}^{m} = \alpha + \beta \log L_{st}^{f} + X_{st}'\gamma + \phi_s + \pi_t + \epsilon_{st}, \tag{2}$$

where $wage_{st}^{m}$ is the average male wages weighted by the population size at the state-year level. L_{st}^{f} is the total number of female employment at the state-year level. $X_s t$ is a vector of control variables. I use the same control variables as Equation 1 except the share of single population. ϕ_s denotes state fixed effect. π_t denotes year fixed effect. Table 3 shows the OLS and TSLS estimates of the female employment elasticity of male wages at the state-year level. For the variations in female employment, I use the supply-driven UDL instrument variable. Using state and year fixed effects and the instrument variable for female labor supply, I find that increase in female employment is not significantly associated with male wage decline. It implies that the demand expanding effect outweighs the substitutability effect which negatively affects male employment. Therefore, increased female employment expands total labor demand, thereby not crowding out male employment.

The degree of crowding out effect is determined by both the elasticity of labor demand and supply. To understand the crowding out at the equilibrium, we need to look at female employment effect on male wages. The change in male wages in response to increased female labor supply depends on the interaction between the demand enhancing effect and the substitution effect. Suppose the male labor demand depends on male wage, female employment and total output such as

	OLS		TSLS	
	(1)	(2)	(3)	(4)
Dependent variable: log(Male wage)				
log(Female employment)	-0.27 (0.008)	-0.47 (0.08)	-1.04 (2.71)	-0.73 (2.07)
Observations	576	576	576	576
State Fixed Effects	—	✓	—	✓
Year Fixed Effects	—	✓	—	✓
Controls	—	✓	—	✓
1st stage F-stat	—	—	0.51	20.4

Table 3: Male wage effect of increased female labor supply

Notes: Standard errors clustered at the state level in parentheses.

$$L_m^D = L_m^D(w_m, L_f, Y(L_f)).$$

The object of interest is how male labor responds to increased female labor supply, that is denoted by

$$\eta = \frac{\partial L_m^D}{\partial L_f} \frac{L_f}{L_m^D}.$$

η is the female employment elasticity of male labor demand. By the chain rule, the derivative of male labor demand with respect to female employment is decomposed into two components:

$$\frac{\partial L_m^D}{\partial L_f} = \underbrace{\left.\frac{\partial L_m^D}{\partial L_f}\right|_Y}_{\text{substitutability}} + \underbrace{\frac{\partial L_m^D}{\partial Y}\frac{\partial Y}{\partial L_f}}_{\text{demand expansion}} \tag{3}$$

There are both a direct and an indirect effect on male labor demand. The first term denotes the direct effect on male labor demand. If women and men are substitutes, this term is negative. If they are compliments, the increase in female labor supply conditional on total output has a positive effect on male employment. The second term denotes the indirect spillover effect on total labor demand caused by increased female employment. If female labor supply increases, it will increase total labor demand by increasing households' consumption, expanding output and total labor demand.

From Equation 3, the elasticity of male labor demand with respect to female employment, η, is defined as

$$\eta = \eta_1 + \eta_2, \tag{4}$$

where

$$\eta_1 = \left.\frac{\partial L_m^D}{\partial L_f}\right|_Y \frac{L_f}{L_m^D}$$

and

$$\eta_2 = \frac{\partial L_m^D}{\partial Y}\frac{Y}{L_m^D} \cdot \frac{\partial Y}{\partial L_f}\frac{L_f}{Y}.$$

$\eta_1 < 0$ if men are substitutable with women. $\eta_1 \geq 0$ if they are complements. η_2 takes a positive value since η_2 captures the indirect effect on male labor demand induced by the expansion of total labor demand in response to increased female employment.

Subsequently, the female employment effect of male wages can be decomposed into η, the elasticity of labor supply, and the elasticity of labor demand.

$$d \log L_m^S = \epsilon^S d \log w_m + c^S, \tag{5}$$

where ϵ^S denotes the elasticity of male labor supply. c^S is a constant term.

$$d \log L_m^D = \epsilon^D d \log w_m + \eta \, d \log L_f + c^D, \tag{6}$$

where ϵ^D denotes the elasticity of male labor demand. η denotes the female employment elasticity of male labor demand, defined by Equation 4. Labor market clearing condition yields

$$d \log L_m^S = d \log L_m^D$$

Plugging Equation 5 and Equation 6 yields

$$\epsilon^S d \log w_m + c^S = \epsilon^D d \log w_m + \eta \, d \log L_f + c^D$$

$$\Rightarrow \; (\epsilon^S - \epsilon^D) \log w_m = \eta \log L_f + c^D - c^S$$

Let $c \equiv c^D - c^S$. Dividing both sides by $\epsilon^S - \epsilon^D$ gives

$$\log w_m = \frac{\eta}{\epsilon^S - \epsilon^D} \log L_f + \frac{c}{\epsilon^S - \epsilon^D}.$$

The coefficient β in Equation 2 corresponds to

$$\beta \simeq \frac{\eta}{\epsilon^S - \epsilon^D} = \frac{\eta_1 + \eta_2}{\epsilon^S - \epsilon^D}. \tag{7}$$

If $\epsilon^S - \epsilon^D > 0$, the sign of β, the female employment effect on male wages is determined by the sign of $\eta = \eta_1 + \eta_2$. If $|\eta_1| > \eta_2$, the substitutability effect dominates the demand

spillover effect, which renders β negative. If the substitutability effect is more pronounced than the demand spillover effect, male wages will decrease, leading to a decrease in male employment. Alternatively, the demand effect outweighs the substitutability effect, male wages will increase in response to increased female employment. As a result, male employment can increase in face of increased female labor supply. Therefore, the female employment effects on male wages informs which factor influences the degree of crowding out.

3.4 Crowding out effects at the industry-level

In this subsection, I estimate the crowding out effect by decomposing it by the industry level. The previous analysis finds that the degree of crowding out depends on both the elasticity of labor supply and labor demand. Moreover, as Equation 7 shows, the overall demand effect can interact with the substitution effect between men and women, determining the female employment effect on male wages. The degree of crowding out should depend on the production technology in relation to the substitutability between men and women, which differ across industries.

I adopt the same estimation strategy as in Equation 1 for the industry-level crowding out effects. I use the same instrument variables for both supply-side and demand-side. The cross-state variations in the timing of legalization of no-fault divorce laws are the shocks on female labor supply. For the demand-driven shocks, I use the Job Opportunity Index.

Table 4 shows the estimates of crowding out effects sorted by the ascending order of the female-to-male ratio of employment share in 2005. Regardless of the origin of shocks on female employment, the sign of crowding out estimates are positive in most industries, indicating male employment increases in response to increased female employment. Construction and services yield negative estimates, but they are not significant. Industries including agriculture, mining, manufacturing, hotels and restaurants yield significantly positive estimates, indicating male employment increased due to increased female employment. It implies that the growth in female employment can increase male employment across industries. The demand enhancing effects should be higher than the substitutability effect to increase male labor in response to increased female employment. Even though each industry adopts different production technologies which require the different mix of female labor and male labor. This ensures the strong evidence that increased female employment can significantly expand male labor demand across industries regardless of the degree of gender labor substitutability based on production technologies.

The effect on male employment is more pronounced in male-dominant occupations.

Industry	Supply-side IV	Demand-side IV	Female share (2005)
Construction	-214.3	-819.9	0.0348
	(2015.6)	(11794)	
Transportation, storage, and communications	2.893	20.44	0.108
	(3.840)	(26.20)	
Agriculture, fishing, and forestry	1.363	4.736***	0.134
	(0.891)	(0.795)	
Mining and extraction	6.153***	766.1	0.141
	(1.783)	(31554)	
Other services	3.137***	16.652	0.353
	(0.821)	(34.656)	
Financial services and insurance	1.679†	0.852*	0.367
	(0.948)	(0.402)	
Manufacturing	0.914	1.263***	0.383
	(3.479)	(0.128)	
Wholesale and retail trade	0.343	1.482*	0.503
	(0.234)	(0.658)	
Services, not specified	-0.256	-0.177	0.533
	(0.486)	(0.239)	
Hotels and restaurants	0.700**	1.469***	0.604
	(0.244)	(0.283)	
Health and social work	1.163*	5.131	0.635
	(0.572)	(15.835)	

Table 4: IV estimates of crowding out effects at the industry-level

Notes: Standard errors in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$, $^{\dagger}p < 0.1$.

In contrast, industries with a substantial share of female employment, such as wholesale and retail trade, services, hotel and restaurants, yield smaller absolute values of crowding out effects. If industries produce using female labor input more intensively, the degree of crowding out will be less significant due to high demand for female labor. These industries will benefit more from increased female employment than male-dominant occupations. To paint a consistent picture of the crowding out effects across industries, I develop a general equilibrium model in the next section.

4 General equilibrium model

4.1 Simple model

To illustrate industry-specific crowding out effects, I build a simple general model. I start with the analysis of the crowding out in a Cobb-Douglas production case, where two industries produce two goods with different factor shares of female and male labor. The object of interest is to analyze how male employment would respond to a growth in female employment across industries with varying intensities of demand for female labor, male labor and output demand.

Firms' problem There are two sectors, indexed by $j \in \{1, 2\}$, populated by an infinite number of firms. Firms in each sector produce with a different mix of female and male labor demand by using a Cobb-Douglas technology.

$$y_j = A L_{mj}^{1-\beta_j} (\theta_f L_{fj})^{\beta_j}, \tag{8}$$

where y_j denotes output in sector j. L_{mj} denotes male labor. L_{fj} denotes female labor. $\beta_j \in (0, 1)$ denotes the industry-specific female labor factor share. A is a gender-neutral technology. θ_f is a female-specific productivity. An increase in female employment is assumed to be caused by an increase in θ_f. The occupational crowding out effect examines how the increase in total female employment causes differentiated effects on male employment across occupations.

Household problem A representative household consists of one man and one woman. The household joint utility depends on consumption for differentiated goods and the disutility of labor for men and women.

$$\max_{c_j, L_m, L_f} \alpha \log c_1 + (1-\alpha) \log c_2 - \sum_{i \in \{m,f\}} \frac{\kappa_i}{1+\phi_i} L_i^{1+\phi_i}, \tag{9}$$

where α is the expenditure share of consumption of good 1. c_1 is the consumption of good 1. c_2 is the consumption of good 2. $\frac{1}{\phi_i}$ denotes the Frisch elasticity of labor supply. κ_i measures the gender-specific degree of labor disutility. The budget constraint is

$$\sum_j p_j c_j = w_m L_m + w_f L_f. \tag{10}$$

Equilibrium A general equilibrium is characterized by $\{w_f, w_m, p_j, c_j, L_{fj}, L_{mj}\}$ such that

1. Each sector minimizes the cost subject to the production technology (8).
2. Given prices, $\{c_j, L_{fj}.L_{mj}\}$ solve the household maximization problem (9) subject to (10).
3. Market wages clear the labor market. Prices clear the goods market.

Crowding out Solving the model above yields the equilibrium employment for each sex as follows

$$L_f^* = \left(\frac{\alpha\beta_1 + (1-\alpha)\beta_2}{\kappa_f} \right)^{\frac{1}{\phi_f+1}}$$

$$L_m^* = \left(\frac{\alpha(1-\beta_1) + (1-\alpha)(1-\beta_2)}{\kappa_m} \right)^{\frac{1}{\phi_m+1}}.$$

The equilibrium employment does not depend on θ_f. In a Cobb-Douglas setting, no matter how much female employment increases, the gender ratio of employment is fixed. A productivity shock to female workers has a proportional effect on wages, unlike the linear production case. In a linear production technology where female and male labor are perfect substitutes, an increase in female employment crowds out male employment by the same amount. Therefore, the crowding out effect is -1. In contrast, male employment would respond to the changes in factor shares of labor and output by a fixed ratio in a Cobb-Douglas production case. The male-to-female employment ratio is fixed since the equilibrium employment is determined by constant shares of labor input.

To illustrate how changes in factor shares affect the equilibrium male employment, I simulate the equilibrium male employment in response to varying α, β_1, β_2. Figure 2

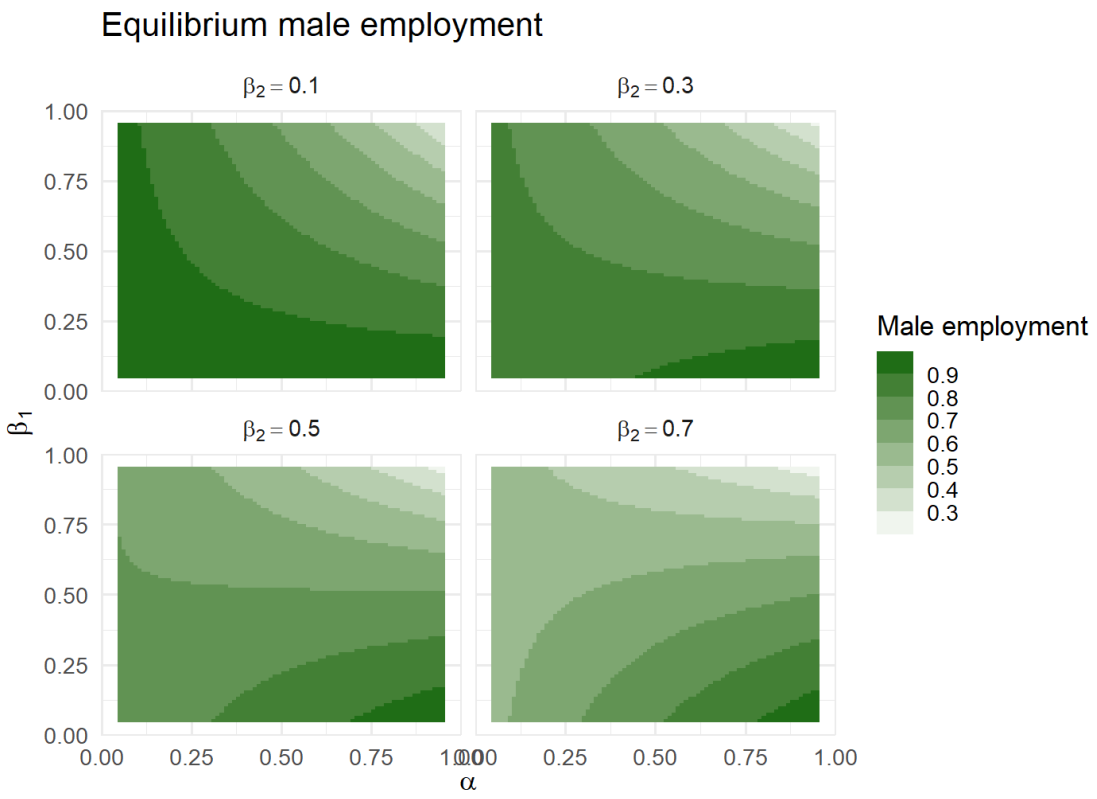


Figure 2: Male equilibrium employment shifts

plots the equilibrium male employment on the expenditure share of good 1 (α), the factor share of female labor in sector 1 (β_1) and sector 2 (β_2). Male employment is decreasing with both β_1 and β_2. Male employment will increase with α if $\beta_2 > \beta_1$ and decrease if $\beta_1 > \beta_2$. Higher output demand in a male-intensive sector will increase the equilibrium male employment. A higher factor share for female labor leads to lower male employment. This is more so if the output demand is higher in a female-labor-intensive sector.

In addition, Figure 3 shows the shifts in the ratio of male-to-female employment. The ratio decreases with both β_1 and β_2. An increase in the factor share of female labor in either sector will reduce the male-to-female ratio of equilibrium employment. The increase in α will increase the male to female ratio if $\beta_1 < \beta_2$. More male workers could be crowded out in a pale-colored area than in a thick-colored region. Male employment can shrink even with high output demand and high demand for male labor if the demand for female labor in the other sector increases.

Therefore, the demand for female labor and for output exert opposing effects on male employment. An increase in output demand can increase male employment. However, this will be offset by increased demand for female labor. The model with a Cobb-Douglas

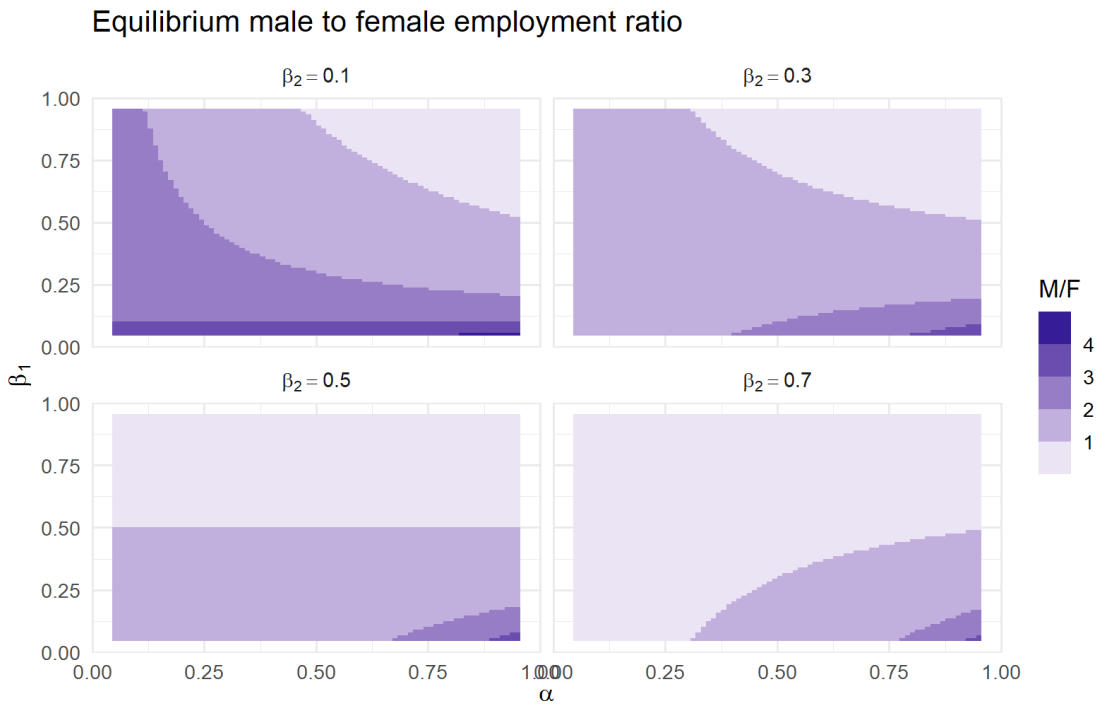


Figure 3: Male to female employment ratio shifts

function implies that crowding out is more pronounced when the adverse effect driven by the demand for female labor exceeds the positive impact of the demand for output on male employment. The interaction among β_1, β_2 and α can capture the effects of substitutability and demand, both of which determine the degree of crowding out as counteracting forces.

To fully incorporate substitutability into the model, I will enrich it with a CES production function. In a CES production technology, male and female labor are assumed to be imperfect substitutes with a constant elasticity of substitution, which captures the change in male employment in response to an increase in female employment (e.g., improvement in female relative productivity).

4.2 Extension of the model

The model in the previous section does not consider key determinants of the degree of crowding out effect. In a Cobb-Douglas function, male employment would not respond to a female-biased shock since the markets for men and women are independent due to fixed factor labor shares. Therefore, we need to incorporate substitution patterns between male and female labor across sectors to explain crowding out at the industry level.

Two counteracting forces determine the degree of crowding out effect. First, if male and female workers are highly substitutes for each other, more male employees would be

crowded out by female workers. The second force, on the other hand, could positively affect male employment even as female employment increases. As more women enter the market, higher household incomes will increase demand for male labor, depending on the consumption share across goods.

The second force, the income elasticity of output, is related to home production. If goods produced in a sector are more substitutable with home-produced goods, the increase in output in that sector will be higher in response to increased female employment than in the other sectors.

As a result, if the demand effect outweighs the substitutability effect, male employment will increase even as female employment rises. Therefore, the extended model below will incorporate the constant elasticity of substitution between female and male labor and varying degrees of elasticity of substitution with home-produced goods across sectors, to capture more precisely the crowding out effects at the industry level.

Firms' problem[10] To simplify, firms produce two market goods $j \in \{g, s\}$. Firms use male and female labor as inputs with a constant elasticity of substitution.

$$Y_j = A_j L_j = A_j \left[\beta_j (\theta_f L_{fj})^{\frac{\rho-1}{\rho}} + (1-\beta_j) L_{mj}^{\frac{\rho-1}{\rho}} \right]^{\frac{\rho}{\rho-1}},$$

where $\frac{1}{1-\rho}$ denotes the elasticity of substitution between female and male labor. A_j denotes a sectoral labor productivity. θ_f denotes a female-specific productivity. β_j denotes in which sector women have a comparative advantage.

Household's problem A representative household consists of a continuum of men and women. The household's maximization problem is:

$$\max_{C, L_m, L_f} \log C - \nu(L_m, L_f), \tag{11}$$

where

$$\nu(L_m, L_f) = \sum_{i \in \{m,f\}} \frac{\kappa_i}{1+\phi_i} L_i^{1+\phi_i}$$

$$C = \left[(c_s + c_h)^{\frac{\eta-1}{\eta}} + c_g^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}.$$

c_s denotes the consumption of goods in sector s. c_g denotes the consumption of goods

[10] The model closely follows Ngai and Petrongolo (2017)

in sector g. c_h denotes the consumption of home-produced goods. Each sector differs in terms of the elasticity of substitution with home production. Goods in sector s are assumed to be perfect substitute with home-produced goods. $\eta > 1$ denotes the constant elasticity of substitution between goods in sector g and home production. Higher elasticity of substitution with home production will yield higher income elasticity of output in response to an increase in female employment.

Home production Assume only women engage in home production. Women differ in their home production productivity. The home production function is

$$y_h = A_h \int_h \omega L_f^h(\omega) dG(\omega),$$

where A_h is an aggregate home productivity. ω is female home productivity. $\omega \sim G(\omega)$ in a support of $(\underline{\omega}, \bar{\omega})$[11]. The budget constraint for households is

$$\sum_{j \in \{g,s\}} p_s c_s = w_m L_m + w_f \int_{\underline{\omega}}^{\theta_f} L_f(\omega) dG(\omega)$$

The expected result is that the degree of crowding out effect could depend on two factors. If men and women are more substitutable in the sector that is affected by an increase in female employment, men are more likely to be crowded out. On the other hand, an increase in female employment will increase the aggregate output and increase demand for male labor in other sectors. If the positive effect of increased female employment on labor demand outweighs the substitution effect, male employment could also increase. As a result, the industry composition of men and women would change.

5 Conclusion

This paper examines the causal effects of an increase in female employment on male employment. The empirical findings suggest that the increased female employment did not crowd out male employment in Mexico from 1990 to 2019. Moreover, a sharp increase in female employment did not lead to a larger crowding out effect on male employment than the slower growth. Regardless of the growth rate of female employment, increased female employment led to higher male employment rates. In other words, women would not threaten male employment even if they entered the labor market rapidly. To clarify the

[11]The setup for home production follows the model of Fukui et al. (2023).

effect of increased female employment on labor demand, this paper analyzes how male employment responds to higher female employment by estimating crowding-out effects at the industry-level. The empirical results suggest that the effect of increased female employment on expanding labor demand varies with the factor shares of female labor across industries The theoretical evidence indicates that higher industry-level female labor demand yields a smaller effect on increasing male employment.

In future work, I will develop the model for an open economy, accounting for state-level economic disparities. In addition, considering that women are more likely to engage in informal jobs would be an interesting margin, especially given the frequent transition between the formal and informal sectors in Mexico. Even though this paper shows that increased female employment stimulates aggregate labor demand, the factors that enhance this channel remain unclear. For instance, an increase in male employment accompanied by a rise in female employment might indicate that gender employment convergence encourages job creation, leading to job reallocation among men and women. Although the total number of jobs increases, the output productivity of new jobs where women are employed might be relatively low. As a result, newly created jobs account for only a small portion of the economy. Thus, the welfare effect of increased female employment is ambiguous. Lastly, the current model abstracts from the capital input. However, the degree of crowding out effect should depend on the capital accumulation costs associated with the different technologies men and women use. Therefore, I will consider the substitutability among female labor, male labor, and capital.

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References

Acemoglu, Daron, and Pascual Restrepo. 2018. The Race between Man and Machine: Implications of Technology for Growth, Factor Shares, and Employment. *American Economic Review*, 108(6): 1488–1542.

Albanesi, Stefania. 2025. Changing Business Cycles: The Role of Women's Employment. *American Economic Journal: Macroeconomics*, 17(4): 345–390.

Autor, David H., Frank Levy, and Richard J. Murnane. 2003. The Skill Content of Recent Technological Change: An Empirical Exploration. *Quarterly Journal of Economics*, 118(4): 1279–1333.

Bhalotra, Sonia, and Manuel Fernández. 2024. The Rise in Women's Labor-Force Participation in Mexico—Supply vs. Demand Factors. *World Bank Economic Review*, 38(2): 319–350.

Bleynat, Ingrid, Amílcar E. Challu, and Paul Segal. 2021. Inequality, Living Standards, and Growth: Two Centuries of Economic Development in Mexico. *Economic History Review*, 74(3): 584–610.

Chassonnery-Zaïgouche, Cléo, and Annie L. Cot. 2021. Sentiment and Prejudice: Francis Ysidro Edgeworth on Women's Wages. *History of Political Economy*, 53(5): 799–832.

Edgeworth, Francis Y. 1922. Equal Pay to Men and Women for Equal Work. *Economic Journal*, 32(128): 431–457.

Edgeworth, Francis Y. 1923. Women's Wages in Relation to Economic Welfare. *Economic Journal*, 33(132): 487–495.

Fawcett, Millicent Garrett. 1892. Mr. Sidney Webb's Article on Women's Wages. *Economic Journal*, 2(5): 173–176.

Fawcett, Millicent Garrett. 1918. Equal Pay for Equal Work. *Economic Journal*, 28(109): 1–6.

Fernández, Raquel, and Joyce C. Wong. 2014. Unilateral Divorce, the Decreasing Gender Gap, and Married Women's Labor Force Participation. *American Economic Review*, 104(5): 342–347.

Fukui, Masao, Emi Nakamura, and Jón Steinsson. 2023. Women, Wealth Effects, and Slow Recoveries. *American Economic Journal: Macroeconomics*, 15(1): 269–313.

Galaasen, Sigurd, Andreas Kostøl, Joan Monras, and Jonathan Vogel. 2025. The Labor Supply Curve Is Upward Sloping: The Effects of Immigrant-Induced Demand Shocks. Working Paper (NBER No. 33930).

Gray, Jeffrey S. 1998. Divorce-Law Changes, Household Bargaining, and Married Women's Labor Supply. *American Economic Review*, 88(3): 628–642.

Hoehn-Velasco, Lauren, and Jacob Penglase. 2021. Does Unilateral Divorce Impact Women's Labor Supply? Evidence from Mexico. *Journal of Economic Behavior & Organization*, 187: 315–347.

Instituto Nacional de Estadística y Geografía (INEGI). 2005–2019. Encuesta Nacional de Ocupación y Empleo (ENOE). Microdata. Mexico City.

Kuhn, Moritz, Iourii Manovskii, and Xincheng Qiu. 2024. Female Employment and Structural Transformation. Working paper (IZA Discussion Paper No. 17118).

Nakamura, Masao, Alice Nakamura, and Dallas Cullen. 1979. Job Opportunities, the Offered Wage, and the Labor Supply of Married Women. *American Economic Review*, 69(5): 787–805.

Ngai, L. Rachel, and Barbara Petrongolo. 2017. Gender Gaps and the Rise of the Service Economy. *American Economic Journal: Macroeconomics*, 9(4): 1–44.

Olsson, Jonna. 2025. Singles, Couples, and Their Labor Supply: Long-Run Trends and Short-Run Fluctuations. *American Economic Journal: Macroeconomics*, 17(1): 1–34.

Ruggles, Steven, Lara Cleveland, Rodrigo Lovaton, Sula Sarkar, Matthew Sobek, Derek Burk, Dan Ehrlich, Quinn Heimann, Jane Lee, and Nate Merrill. 2025. Integrated Public Use Microdata Series, International: Version 7.6. Dataset. Minneapolis, MN: IPUMS. https://doi.org/10.18128/D020.V7.6

Appendices

A. Summary statistics

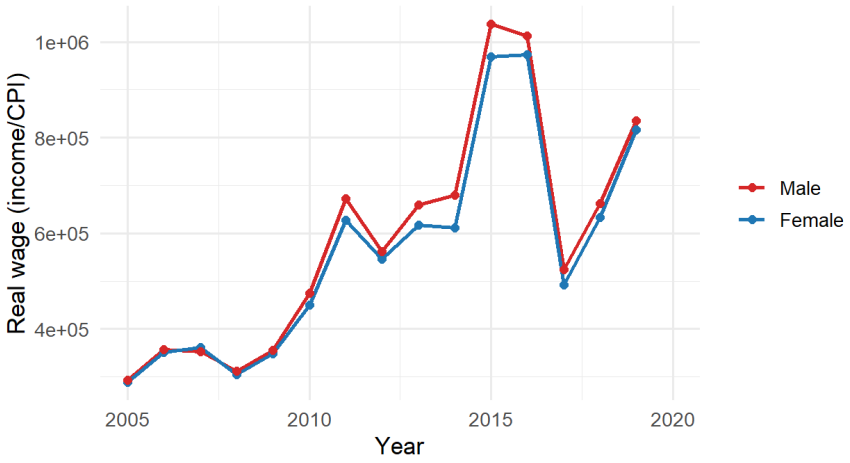


Figure 4: Real wage growth between 2005 and 2019

Variable	Mean	Std. Dev.	Min	Max
Mepop	0.889	0.050	0.691	0.961
Fepop	0.491	0.103	0.127	0.676
Dummy	0.167	0.373	0.000	1.000
Single share	0.290	0.056	0.204	0.453
Native share	0.004	0.005	0.000	0.026
Agriculture share	0.136	0.094	0.002	0.568
Manufacturing share	0.159	0.068	0.047	0.338
Service share	0.252	0.037	0.131	0.345
GDP	2049.317	5790.014	54.297	39737.095
Skill premium	-0.011	0.312	-0.555	1.848
Male wage	4498668.711	978113.196	1424959.612	7269739.843
Female wage	6107325.525	2169769.586	566766.495	8336756.553

Table 5: Summary statistics of variables used in the estimation

Notes: State-year panel. All variables are at the state level. Mepop (Fepop) denotes the male (female) employment over population rates.

B. Deriving the crowding out at the general equilibrium

The firms' cost minimization problem

$$\min_{L_{mj}, L_{fj}} w_m L_{mj} + w_f L_{fj}$$

subject to

$$y_j \leq A L_{mj}^{1-\beta_j} (\theta_f L_{fj})^{\beta_j}$$

Deriving the FOCs with regard to L_{mj} and L_{fj},

$$w_f = A\beta_j \theta_f^{\beta_j} L_{fj}^{\beta_j - 1} L_{mj}^{1-\beta_j}$$

$$w_m = A(1-\beta_j) \theta_f^{\beta_j} L_{fj}^{\beta_j} L_{mj}^{-\beta_j}$$

$$\frac{w_m}{w_f} = \frac{1-\beta_j}{\beta_j} \frac{L_{fj}}{L_{mj}}$$

$$\Rightarrow L_{mj} = \frac{1-\beta_j}{\beta_j} \frac{w_f}{w_m} L_{fj}$$

Taking the derivative of both sides with respect to θ_f gives

$$\frac{\partial L_{mj}}{\partial \theta_f} = \frac{1-\beta_j}{\beta_j} \Big(\frac{w_f}{w_m} \frac{\partial L_{fj}}{\partial \theta_f} + \frac{\partial \frac{w_f}{w_m}}{\partial \theta_f} L_{fj} \Big)$$

$$\frac{\frac{\partial L_{mj}}{\partial \theta_f}}{\frac{\partial L_{fj}}{\partial \theta_f}} = \frac{1-\beta_j}{\beta_j} \frac{w_f}{w_m} \Big(1 + \frac{\partial \frac{w_f}{w_m}}{\partial \theta_f} \frac{\theta_f}{\frac{w_f}{w_m}} \cdot \frac{\partial \theta_f}{\partial L_{fj}} \frac{L_{fj}}{\theta_f} \Big),$$

where $\frac{\partial w_f / w_m}{\partial \theta_f} \frac{\theta_f}{w_f / w_m}$ is the elasticity of the relative wage with respect to θ_f and $\frac{\partial \theta_f}{\partial L_{fj}} \frac{L_{fj}}{\theta_f}$ is the inverse of the elasticity of female employment with respect to θ_f. When $\frac{\partial \frac{w_f}{w_m}}{\partial \theta_f} = 0$, the crowding out effect is $\frac{1-\beta_j}{\beta_j} \frac{w_f}{w_m}$. This is the same as (**??**).

The goods market clearing condition yields

$$c_j = y_j$$

$$= A L_{mj}^{1-\beta_j} (\theta_f L_{fj})^{\beta_j}$$

$$= A(\frac{1-\beta_j}{\beta_j}\frac{w_f}{w_m}L_{fj})^{1-\beta_j}(\theta_f L_{fj})^{\beta_j}$$

$$= A(\frac{1-\beta_j}{\beta_j}\frac{w_f}{w_m})^{1-\beta_j}\theta_f^{\beta_j}L_{fj} \tag{12}$$

Zero profit condition yields

$$p_j y_j = w_m L_{mj} + w_f L_{fj}$$

$$\Rightarrow p_j A L_{mj}^{1-\beta_j}(\theta_f L_{fj})^{\beta_j} = w_m L_{mj} + w_f L_{fj}$$

$$\Rightarrow p_j = \frac{\frac{1-\beta_j}{\beta_j}w_f L_{fj} + w_m\frac{1-\beta_j}{\beta_j}\frac{w_f}{w_m}L_{fj}}{A(\frac{1-\beta_j}{\beta_j}\frac{w_f}{w_m})^{1-\beta_j}\theta_f^{\beta_j}L_{fj}}$$

$$\Rightarrow p_j = \frac{w_m^{1-\beta_j}w_f^{\beta_j}}{A\beta_j^{\beta_j}(1-\beta_j)^{1-\beta_j}\theta_f^{\beta_j}} \tag{13}$$

Household's utility maximization problem

$$\max \alpha \log c_1 + (1-\alpha)\log c_2 - \sum_{i\in\{m,f\}}\frac{\kappa_i}{1+\phi_i}L_i^{1+\phi_i} \tag{14}$$

Taking the FOCs of (14) with respect to L_i for $i \in \{m, f\}$ yields

$$\kappa_i L_i^{\phi_i} - \lambda w_i = 0$$

$$L_i = \left(\frac{\lambda w_i}{\kappa_i}\right)^{\frac{1}{\phi_i}}, \tag{15}$$

where λ is a Lagrange multiplier for the household budget constraint.
Solving the FOC with respect to c_j fro $j \in \{1, 2\}$ gives

$$\frac{\partial U}{\partial c_1} = 0 \Rightarrow \frac{\alpha}{c_1} = \lambda p_1$$

$$\frac{\partial U}{\partial c_2} = 0 \Rightarrow \frac{1-\alpha}{c_2} = \lambda p_2$$

Plugging (12) and (13) into the above yields

$$L_{f1} = \frac{\alpha\beta_1}{\lambda w_f}$$

$$L_{f2} = \frac{(1-\alpha)\beta_2}{\lambda w_f}$$

$$\frac{L_{f1}}{L_{f2}} = \frac{\alpha}{1-\alpha}\frac{\beta_1}{\beta_2} \tag{16}$$

The labor market clearing condition $L_f^S = L_{f1} + L_{f2}$ derives

$$\left(\frac{\lambda w_f}{\kappa_f}\right)^{\frac{1}{\phi_f}} = \frac{\alpha\beta_1}{\lambda w_f} + \frac{(1-\alpha)\beta_2}{\lambda w_f} \tag{17}$$

The equilibrium wage w_f^* satisfies (17). Solving (17) for λ yields

$$\lambda = \frac{[\alpha\beta_1 + (1-\alpha)\beta_2]^{\frac{\phi_f}{\phi_f+1}} \kappa_f^{\frac{1}{\phi_f+1}}}{w_f}$$

Plugging this into (15) yields the equilibrium female employment:

$$L_f^* = \left(\frac{\alpha\beta_1 + (1-\alpha)\beta_2}{\kappa_f}\right)^{\frac{1}{\phi_f+1}}$$

Likewise, the equilibrium male employment is

$$L_m^* = \left(\frac{\alpha(1-\beta_1) + (1-\alpha)(1-\beta_2)}{\kappa_m}\right)^{\frac{1}{\phi_m+1}}$$

From (16), the equilibrium employment in each sector is

$$L_{f1} + \frac{1-\alpha}{\alpha}\frac{\beta_2}{\beta_1}L_{f1} = L_f$$

$$L_{f1}^* = \frac{\alpha\beta_1}{\alpha\beta_1 + (1-\alpha)\beta_2}L_f^*,\ L_{f2}^* = \frac{(1-\alpha)\beta_2}{\alpha\beta_1 + (1-\alpha)\beta_2}L_f^*$$

Similarly,

$$L_{m1}^* = \frac{\alpha(1-\beta_1)}{\alpha(1-\beta_1) + (1-\alpha)(1-\beta_2)}L_m^*,\ L_{m2}^* = \frac{(1-\alpha)(1-\beta_2)}{\alpha(1-\beta_1) + (1-\alpha)(1-\beta_2)}L_m^*$$

The relative equilibrium wage is

$$\frac{w_f^*}{w_m^*} = \frac{\left[\alpha\beta_1 + (1-\alpha)\beta_2\right]^{\frac{\phi_f}{\phi_f+1}} \kappa_f^{\frac{1}{\phi_f+1}}}{\left[\alpha(1-\beta_1) + (1-\alpha)(1-\beta_2)\right]^{\frac{\phi_m}{\phi_m+1}} \kappa_m^{\frac{1}{\phi_m+1}}} \tag{18}$$

Set $p_1 = 1$ in (13)

$$p_1 = \frac{w_m^{1-\beta_1} w_f^{\beta_1}}{A\beta_1^{\beta_1}(1-\beta_1)^{1-\beta_1}\theta_f^{\beta_1}} = 1 \tag{19}$$

Combining (18) and (19) yields the equilibrium wage for both sexes:

$$w_f = \frac{A\beta_1^{\beta_1}(1-\beta_1)^{1-\beta_1}\theta_f^{\beta_1}}{S^{1-\beta_1}}$$

$$w_m = \frac{A\beta_1^{\beta_1}(1-\beta_1)^{1-\beta_1}\theta_f^{\beta_1}}{S^{-\beta_1}}$$

where

$$S = \frac{\left[\alpha(1-\beta_1) + (1-\alpha)(1-\beta_2)\right]^{\frac{\phi_m}{\phi_m+1}} \kappa_m^{\frac{1}{\phi_m+1}}}{\left[\alpha\beta_1 + (1-\alpha)\beta_2\right]^{\frac{\phi_f}{\phi_f+1}} \kappa_f^{\frac{1}{\phi_f+1}}}$$