Gender Norms, Intrahousehold Bargaining, and the Dynamics of Female Labor Supply*

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Abstract

While labor force participation among married women has increased significantly over time, this trend has recently slowed, and gender gaps in market hours and wages persist. In this paper, we study the role of intrahousehold decision-making on aggregate female market work hours. We develop a neoclassical growth model with intrahousehold bargaining and a male breadwinning norm. Simulating our model, we find that rising female bargaining power and persistent gender norms have opposite effects on increasing the relative female wage. While a rise in relative female wage increases female market hours, both the increase in female bargaining power and the persistence of gender norms can help explain the subsequent stagnation in female market hours. Our findings reveal how intrahousehold bargaining and gender norms influence labor supply decisions, and these micro-level dynamics have significant implications for macro-level gender inequalities in wages and market hours.

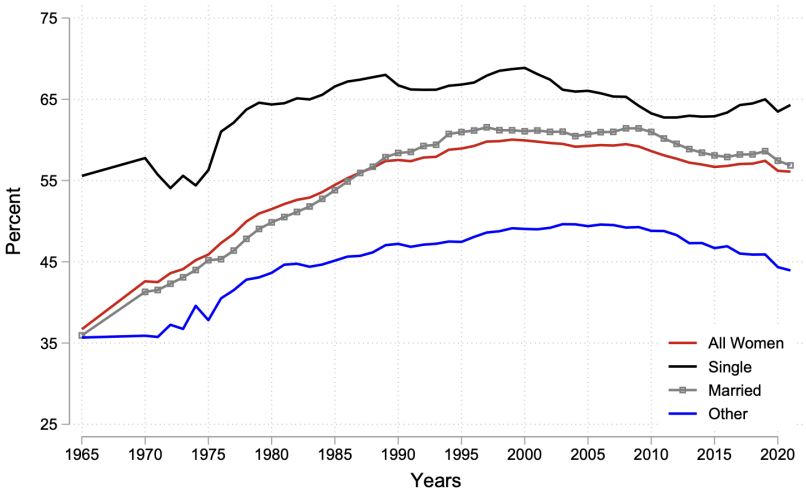
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1 Introduction

With large economic growth and increasing female educational attainment, the gender gap in the labor market has been decreasing over the past 50 years in terms of labor force participation rate, labor hours, wages, and occupational representation. However, the convergence has slowed in recent years, especially in the US, and the gap remains significant and constant. Understanding why gender disparities persist is important to achieve more inclusive economic growth and minimize any inefficient allocation of human capital (Hsieh et al., 2019).

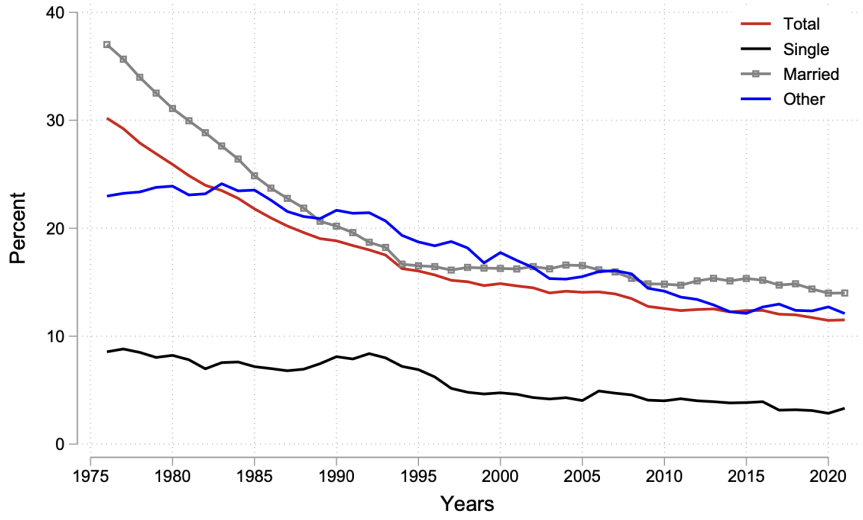
Our paper investigates the role of intrahousehold decision-making and gender norms (or gender role attitudes) in explaining the persistence of aggregate gender disparities. The motivation for focusing on intrahousehold decision-making stems from the divergence in labor force participation between single and married women. As shown in Figure 1, married women's labor force participation has increased significantly over time, while the labor force participation of single women has grown at a slower pace. As a result, the decrease in the married couple's gender gap in labor force participation has been the main driver of the aggregate gender gap decrease, as shown in Figure 2. However, the decreasing gender gap in the labor force participation rate of married couples and the aggregate has stagnated in recent years. This highlights the importance of analyzing intrahousehold time allocation in order to gain a clearer understanding of aggregate gender gaps in labor market participation and their persistence. In other words, as individuals make decisions within households, intrahousehold decision-making affects men's and women's consumption, labor supply, leisure, and home production choices, leading to the aggregate gender gap.

Figure 1: Labor force participation of women in the US, by marital status



Source: US Census Bureau (1965–1975), Bureau of Labor Statistics (BLS) (1975–)

Figure 2: Gender gap in labor force participation rate in the US, by marital status



Source: BLS (1975–)

To study the impact of intrahousehold decision-making on aggregate female market work hours, we combine a neoclassical growth model with a collective household model, while allowing for sectoral growth to affect gender-specific wages. This model also accounts for the influence of gender norms or attitudes toward prescribed gender roles on household decisions.

On the production side, there are two market sectors: goods and services. We allow for sectoral differences a lá Ngai and Petrongolo (2017) to capture how differential sectoral growth affects the gender gap in the labor market.

On the household side, the economy consists of single and married households. A representative married household includes a man and a woman. All individuals have utility functions that are additively separable in the consumption of market goods, market services, home-produced services, and leisure. We assume a collective model for married households, meaning they make Pareto-efficient decisions Chiappori (1988, 1992). In this framework, married households make time allocation and consumption decisions based on the preferences of both members and their respective Pareto weights, which represent their bargaining power. In contrast, single women and men determine their market hours, home production hours, and leisure hours solely based on their individual preferences. Therefore, even though representative single and married women share the same preference parameters, their time allocation across market work, home production, and leisure may differ.

Moreover, the utility of married households is affected by the male breadwinner norm, which prescribes men as the primary income earners. Married households incur a disutility if a woman's earnings relative to

a man's are above a threshold. This follows the definition of identity from Akerlof and Kranton (2000) and Breakwell (2015) in that the individuals dislike any threats to identity and prefer to behave as prescribed by the identity. In this case, the identity is gender, and it prescribes that men are the primary income earners and women are the caregivers. Following the roles prescribed by the identity, couples prefer it if men are breadwinners or earn more than a certain share of the total family income. The male breadwinner norm is a friction that may distort married households' time allocation decisions.

The model predicts that three channels of intrahousehold decision-making may impact market work hours differently for married and single women. First, a relative increase in female wages raises market hours for married women but not for single women, as married households specialize based on comparative advantages. Similarly, a relative increase in the female share of inputs in home production reduces market hours for married women but not for single women. Second, married women's market hours depend on their bargaining power. As female bargaining power increases, married women's market hours decrease while their leisure hours increase. Lastly, a more conservative male breadwinner norm reduces married women's market hours. Taken together, these opposing forces of intrahousehold decision-making may explain the stylized fact shown in Figure 1, that aggregate female market hours has been increasing but the rate of growth has stagnated in recent years.

Our model simulations support these findings. In this version of the paper, we use simulations of the household model based on assumed parameters and gender-specific wage time series from the BLS. The results show that the model with benchmark parameterization can qualitatively account for the rise in female market hours since 1979. Additionally, we present three counterfactual scenarios where female market hours increase more slowly than predicted by the benchmark model. In particular, consistent relative female wage growth, combined with either an increasing female comparative advantage in home production, rising female bargaining power, or a binding male breadwinner norm, all generate trends in female market hours with a slower rate of increase compared to the benchmark model.

The main contribution of this paper is that it analyzes how intrahousehold decision-making and gender norms contribute to gender gaps in the aggregate labor market. While many papers have examined various other channels, from both labor demand and supply sides, through which the gender gap has narrowed and recently plateaued, few have focused on the role of intrahousehold bargaining and gender norms. For example, from the labor supply side, Blau and Kahn (2017) analyzes gender wage gap trends and finds although traditional human-capital factors like women's education and experience have played an important role in reducing the pay gap until 2010, they explain relatively little of the recent unexplained persistent pay

gap in the aggregate and newer explanations including gender division of labor and discrimination cannot be discounted. Cortés and Pan (2023) argues that various factors interact with parenthood and create gender differences in the labor market by imposing larger penalties for women's career paths. From the labor demand side, Ngai and Petrongolo (2017) investigates how the rise in services has narrowed gender gaps. Adding to the literature, we examine to what extent intrahousehold time allocation and gender norms explain the aggregate-level gender inequality in the labor market. As such, our paper introduces a novel framework demonstrating how micro-level intrahousehold decisions can drive significant macroeconomic impacts on aggregate labor supply and gender gaps, suggesting the importance of family-oriented policies in fostering gender-inclusive economic growth.

2 Related Literature

The main contribution of our paper is that we study the effect of intrahousehold decision-making and gender norms on the evolution of female labor force participation. While there has been an extensive literature on female labor market participation and why it has increased from the 1970s to 2000s, few has explored the role of intrahousehold decision-making in explaining this important phenomenon. Furthermore, the slowdown of the convergence has recently been an empirical phenomenon that not were not discussed in the previous literature.

From the labor demand side, Ngai and Petrongolo (2017) argues structural transformation and expansion of the service sector led to female labor market participation increase as women have a comparative advantage in the service sector. From the supply side, an increase in women's education and experience has increased women's competitiveness in the labor market (Goldin et al., 2006; Goldin, 2006; Blau and Kahn, 2017) which increased both single and married women's LFP. Focusing more on married women's market hours, Greenwood et al. (2005) argues that advances in home production technology freed up women's time to participate in market labor while Jones et al. (2015) finds that the gender wage gap decrease led married women to participate more in the labor market and accumulate experience as couples specialize less between market and non-market labor. Albanesi and Olivetti (2016) finds the improvement in maternal health has also contributed to the increase in married women's labor force participation.

Moreover, we hypothesize that intrahousehold decision-making not only explains the increase in female market hours from the 1970s to the 2000s but can also account for the recent slowdown in this trend. Building on studies that have explored various labor supply channels to explain this phenomenon, we contribute to

the literature by demonstrating that increasing female bargaining power and the influence of gender norms can account for the observed slowdown in the increase of female market hours. For instance, Blau and Kahn (2013) finds the slowdown in the increase of the female labor market participation is observed only in the U.S. as other OECD member countries introduced work-family policies to facilitate women's participation in the labor market, although such policies entail side effects of increasing part-time employment for women. Albanesi and Prados (2022) argues increasing income inequality and growth in top incomes of men generated negative income effects on the labor supply of their spouses, usually highly educated given assortative matching. Cortés and Pan (2023) documents a link between children and labor market outcomes where children impose larger penalties for women than men to explain the recent slowdown in women's market hours in the U.S. and one of the mechanisms is the existence of the gender norm among couples deterring women's labor supply. Using General Social Surveys data, Fortin (2015) finds progression in gender role attitudes stalled in the mid-2000s, and it explains a third to recent slowdown in women's market participation in the U.S. Focusing on the cultural changes, Fernandez et al. (2004) and Fernandez (2013) find intergenerational changes in both men's and women's attitude towards working women explain the s-shape or the rise and stagnation of female labor force participation in the U.S.

In addition, our paper contributes to the literature on intrahousehold time allocations by showing its importance in explaining the aggregate female market hours and the gender gap. We extend the collective household model with public consumption (Blundell et al., 2005; Mazzocco et al., 2014) to be combined with a two-sector production side. By linking micro-level household behaviors to macro-level aggregates, our paper examines both the labor supply and demand side's effects on the aggregate gender gap in market hours. Perhaps one of the closest papers to ours is (Knowles, 2013), where the paper claims that "the modeling of bargaining should not be a priority." However, we further investigate its claim by incorporating an additional intra-household factor, the gender norms, while expanding the model to be a two-sector general equilibrium model by adding the production side.

Lastly, our paper contributes to the literature on gender norms. Akerlof and Kranton (2000) defines identity as associated with different social categories and how people in these categories should behave. Gender role attitudes or gender norms stems from individuals choosing to behave in the prescribed way based on their identity, in this case, gender, and minimize any threat to identity (Breakwell, 2015). In our paper, we examine the male breadwinner norm, where individuals prefer to follow the traditional division of labor in the household where men act as the primary income earners and women act as the primary caregivers. The presence of the male breadwinner norms has been documented by Bertrand et al. (2015),

where the authors find that the distribution of U.S. households based on the female share of total earnings exhibits a sharp drop beyond 0.5 and attributes it to the influence of a gender identity norm.[1] In fact, previous findings that family-friendly policies affect married women disproportionately than men and that women are perceived as secondary earners allude to the existence of the gender norm or gender role bias based on which the married couples' decisions are made. Finally, we hope to highlight the importance of inclusive growth and address the lack of economic literature on this matter.

The order of the paper is as follows. We first introduce the model that incorporates the collective household model into the neoclassical growth model in section 3. Then, we analyze the model predictions of the intra-household bargaining power in explaining the female market hours plateau qualitatively and quantitatively in sections 4 and 5. Finally, section 6 concludes.

3 Model

Our quantitative model combines a static neoclassical growth model with a collective household model. The economy is populated by single and married representative households made up of women and men. Individuals have additively separable utility for consumption and leisure. While single and married individuals share the same gender-specific preference parameters, decisions in married households are influenced by each individual's bargaining power in addition to their preferences. married households benefit from economies of scale, as the consumption of market services and home production are regarded as household public goods.

On the production side, there are three sectors: goods, services, and home production. Goods and services are market sectors, while home production is a non-market sector. All sectors require both female and male labor to produce output. Since the model is static, there are no capital accumulation dynamics.

3.1 Firms

There are two market sectors: goods (g) and services (s). Firms in each sector $j \in \{g, s\}$ produce output according to the following technology:

$$Y_j = A_j L_j \tag{1}$$

[1] Using employer-employee data from Finland, Zinovyeva and Tverdostup (2021) argues such phenomenon is due to earning equalization and women's earnings increase rather than women's earnings decrease from a gender norm.

where the total amount of labor L_j in sector j is an aggregate of female and male labor hours using constant elasticity of substitution production technology:

$$L_j = \left[\left(\xi_j\right)\left(L_j^f\right)^{\frac{\eta-1}{\eta}} + \left(1-\xi_j\right)\left(L_j^m\right)^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}} \tag{2}$$

A_j is defined as labor productivity, growing at a constant growth rate of $\gamma_j \equiv \frac{\dot{A_j}}{A_j}$. Following **?**, we impose $\eta_s > \eta_g$ to capture women's comparative advantage in producing services, and $\gamma_g > \gamma_s$ to represent faster productivity growth in the goods sector relative to the service sector.

3.2 Households

There exists two types of households: a single household and a married household. Single households only consist of a woman or a man, and married households consist of both women and men.

3.2.1 Utility for Single Women and Men

Each individual's utility depends on the consumption of market goods, market services, home services, and leisure. For single women and men, their time allocation problem is to divide their time (1 unit) into market work, home production, and leisure. Their resource allocation problem is to divide their total labor compensation into market goods, market services, and home production. Home services are produced using home production hours. For an individual $i \in \{f, m\}$, her preference is according to the following utility function:

$$\max \phi^i \log(c_g^i) + \lambda^i \log(c_s^i) + \tau^i \log(c_h^i) + (1-\phi^i-\lambda^i-\tau^i)\log(l_l^i)$$

such that the amount of total consumption is constrained by the individual's labor income:

$$c_g^i + p_s c_s^i \leq w^i l^i.$$

In the above utility function, c_j^i denotes the amount of consumption for $j \in \{g, s, h\}$, and l_l^i is the amount of time allocated to leisure by individual i. Home production consumption, c_h^i, is produced using a linear

production technology:

$$c_h^i \leq A_h l_h^i.$$

The feasibility constraint for the time allocation for individual i is $l^i + l_h^i + l_l^i = 1$, where l^i is the amount of time that individual i is dedicated to market labor.

3.2.2 Utility for Married Women and Men

The couple's utility is a weighted sum of women's and men's utility. Their time allocation problem is to divide each of their time (also 1 unit) into market work, home production, and leisure. Their resource allocation problem is to divide their labor compensation into market goods and market services. The joint preference for the married household is defined as

$$\begin{aligned}
&\max \mu^f \left[\phi^f \log(c_g^f) + \lambda^f \log(c_s) + \tau^f \log(c_h) + (1 - \phi^f - \lambda^f - \tau^f) \log(l_l^f)\right] \\
&+ \mu^m \left[\phi^m \log(c_g^m) + \lambda^m \log(c_s) + \tau^m \log(c_h) + (1 - \phi^m - \lambda^m - \tau^m) \log(l_l^m)\right] \\
&- \left(\frac{w^f l^f}{w^m l^m + w^f l^f} - \delta\right)^2 \mathbb{I}\left(\frac{w^f l^f}{w^m l^m + w^f l^f} > \delta\right)
\end{aligned}$$

subject to

$$c_g^m + c_g^f + p_s c_s \leq w^m l^m + w^f l^f.$$

The household determines each member's consumption and time allocated to leisure based on their individual preferences (ϕ^i, λ^i, and τ^i) and the Pareto weight μ^i. The Pareto weight μ^i reflects the extent to which the household values each individual's preferences and can be interpreted as their bargaining power. The sum of the Pareto weights is 1, in other words, $\mu^f + \mu^m = 1$.

Home production in a married household is defined as a CES function that aggregates time spent on home production by female and male in the household:

$$c_h \;=\; A_h \left[\xi_h \left(l_h^f\right)^{\frac{\eta-1}{\eta}} + (1 - \xi_h)\left(l_h^m\right)^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}} \tag{3}$$

where l_h^j is the amount of time spent by gender i on home production, and ξ_h is a weight between female's and male's hours on home production. A_h is an aggregate productivity parameter. η is the elasticity of

substitution between female and male hours in home production.

Married households differ from single households in three ways. First, married households benefit from the division of labor. Since both male and female members can participate in market work and home production, the household allocates their time based on comparative advantage. The individual with a comparative advantage in market labor should dedicate more time to market work, while the one with a comparative advantage in home production should focus more on home production. Second, household members engage in intrahousehold bargaining, represented by the Pareto weight parameter μ^i. A household member with greater bargaining power can influence allocations to better align with their own preferences. Lastly, the decision of a married household is affected by the male breadwinner norm. We model disutility from this gender norm bias à la Oh (2021). Under this specification, it is only when women's labor income share is above a certain threshold, $\delta \in [0, 1]$, that bias generates disutility. When it does, the magnitude of disutility is determined by the gap between female's labor income share and the threshold. When the gender norm bias does not bind, the utility function is not subject to the gender norms parameter δ, which is captured by the indicator function $\mathbb{I}\left(\frac{w^f l^f}{w^m l^m + w^f l^f} > \delta\right)$.

3.3 Competitive Equilibrium

A competitive equilibrium is defined by market wages (w^f, w^m), market prices (p_g, p_s), consumption $\{c_j^f, c_j^m\}_{j=g,s,h}$, and time allocation $\{l_j^f, l_j^m\}_{j=g,s,h,l}$ such that:

1. Representative firm maximizes profits, and the representative households (both single and married) maximize utilities.

2. Given the optimal choices of firms and households, market wages and prices clear the market in each sector, which satisfy the following market clearing conditions:

$$c_j = Y_j \qquad j = g, s \tag{4}$$

$$c_g^f + c_g^m = c_g \tag{5}$$

$$l_g^i + l_s^i = l^i - l_h^i - l_l^i \qquad i = f, m \tag{6}$$

$$\sum_{k \in \{single, married\}} l_j^{i,k} = l_j^i \qquad i = f, m \qquad j = g, s \tag{7}$$

The first market clearing condition states that each sector's output has to be consumed entirely. The second market clearing condition is that the total consumption of sector j's goods should be equal to the sum of

female and male consumption of that sector. The last two equations state that the labor markets need to clear: (i) the sum of labor demand for market goods and services should be equal to the market labor demand in that sector; and (ii) the total demand for each gender in each sector should be equal to the sum of the number of the singles and the married for that gender.

4 Model Predictions

In this section, we present model predictions on how intrahousehold decision-making influences female labor force participation. As outlined in Section 3, married households differ from single households in three key ways: comparative advantage, intrahousehold bargaining, and the male breadwinner norm. Below, we analytically examine how these three factors affect the time allocation of single and married households.

4.1 Relative Female Wages

First, we investigate the role of relative female wages on labor supply for market labor and home production.

Investigating the single female and male households, changes in relative wages do not affect labor supply in our model. From the first-order conditions of the singles' problem, we find that:

$$\begin{aligned} l^{market,i} &= \phi^i + \lambda^i \\ l_h^i &= \tau^i \\ l_l^i &= 1 - \phi^i - \lambda^i - \tau^i, \end{aligned}$$

where we find that the time allocations are only affected by singles' consumption weight preferences in their utility function. Therefore, wages are not factored into their decisions.

For married households, the results are more complicated. We need to consider two cases. First, when the gender norms parameter does not bind, from the first-order conditions of the model, we find that

$$\frac{l_l^f}{l_l^m} = \left(\frac{B}{C}\right)\left(\frac{w^f}{w^m}\right)^{-1} \tag{8}$$

where $B = \mu^f(1-\phi^f-\lambda^f-\tau^f)$ and $C = \mu^m(1-\phi^m-\lambda^m-\tau^m)$. From this equation, we find that as relative female wages increase, relative female leisure time decreases as leisure becomes more expensive compared to non-leisure time, such as time spent in home production or market labor.

Furthermore, from the first-order conditions of the household problem, we find that

$$\frac{l_h^f}{l_h^m} = \left(\frac{B}{C}\right)^{-\eta} \left(\frac{1-\xi_h}{\xi_h}\right)^{-\eta} \left(\frac{l_l^m}{l_l^f}\right)^{-\eta}. \tag{9}$$

From (9), when relative female leisure hours decrease, relative home production hours for women increase, but the magnitude is less than the decrease in the leisure hours due to the elasticity of substitution η, where the decrease in leisure hours translates into market hours instead of home production hours; this tells us that the increase in relative female wages leads to an increase in women's market hours.

Second, we consider the case in which the gender norms parameter does bind. Then, from the first-order conditions of the model, we find that

$$\frac{l_l^f}{l_l^m} = \frac{B}{C}\left(\frac{w^f}{w^m}\right)^{-1} \left(1 + \frac{2\delta y w^m l^m}{y\left[F w^m l^m + (F-\delta)\, w^f l^f\right] + 2(w^f)^2 (l^f)^2}\right)^{-1}, \tag{10}$$

where $y = w^f l^f + w^m l^m$, $B = \mu^f(1-\phi^f-\lambda^f-\tau^f)$, $C = \mu^m(1-\phi^m-\lambda^m-\tau^m)$, and $F = \mu^f(\phi^f + \lambda^f) + \mu^m(\phi^m+\lambda^m)$.[2] Similar to the non-binding case, we find that wages and leisure hours have an inverse relationship. Extending the previous analysis, along with (9), we also conclude that the increase in relative female wages leads to an increase in women's market hours. This leads to our first proposition.

Proposition 1. *Relative female wages are positively associated with the relative market hours for women.*

4.2 Relative Female Productivity Advantage in Home Production

Next, we study how the productivity of home production affects labor supply. From (9), we find that relative home production hours of married women is increasing in ξ_h, the female input share in the home production function. From (8) and (10), we find that relative leisure hours is independent of ξ_h. Therefore, relative market hours is decreasing in ξ_h.

Proposition 2. *Relative female home production hours is increasing in the female share in home production, and relative female market hours is decreasing in the female share in home production.*

[2] Proof of this is in the Appendix.

4.3 Female Bargaining Power

We now discuss how female bargaining power is associated with changes in market hours. Like the previous section, we consider two cases: (i) a non-binding case and (ii) a gender norm-binding case.

Consider the case in which the gender norm does not bind. Then, from equation (8), we can interpret the fraction $\frac{B}{C}$ as relative bargaining power for women in the household. Equation (8) states that the relative Pareto weight for women within the married household is positively associated with the relative female leisure time. Along with equation (9), both home production and market hours decrease when female bargaining power increase.

When we consider the gender norm-binding case, we analyze equation (10) and (9), where we can conclude the similar result as the non-binding case. This leads to our next proposition in this paper.

Proposition 3. *When the bargaining power increases for women within a household, relative female leisure increase, and home production and market hours for women decrease.*

4.4 Male Breadwinner Norm

Lastly, we study the role of the male breadwinner norm. We come back to equation (10) where we consider cases of the gender norm (male breadwinner norm) changes. When the male breadwinner norm declines (increase in δ), we observe from equation (10) that the relative female leisure hours decrease. Furthermore, along with equation (9), we find that the relative female leisure hours decrease, the relative home production hours increase but not as much as the amount of decrease in the leisure hours. This tells us that the rest of the time allocation goes to increase the relative market hours for women. This mechanism in our model leads to our next result.

Proposition 4. *When gender norm bias decreases for women in married households, relative market hours for women increase, leading to marketization.*

4.5 Summary of the Model Mechanisms

Our model predicts the following interesting results, summarized in Table 1. Relative female market hours increase in relative female wages, decrease in female share in home production, decrease in female bargaining power, and decrease in the strength of male breadwinner norm. Relative female home production hours decrease in relative female wages, increase in female share in home production, decrease in female bargaining power, and decrease in the strength of male breadwinner norm. Finally, relative female leisure hours decrease in relative female wages, increase in female bargaining power, and increase in the strength of male breadwinner norm. In the next section, we qualitatively demonstrate the importance of intrahousehold decision-making parameters in explaining time allocation patterns through model simulations.

Table 1: Model Predictions

Relative Female Hours	Market	Home Production	Leisure
Increasing relative female wages	↑	↓	↓
Increasing female share in home production	↓	↑	–
Increasing female bargaining power	↓	↓	↑
Decreasing male breadwinner norm	↑	↑	↓

5 Model Simulations and Counterfactuals

In this section, we study the role of intrahousehold decision-making in explaining changes in time allocation of married households.

In this version of the paper, we use simulations of the household model based on assumed parameters. We demonstrate that the model with benchmark parameterization can qualitatively account for the rise in female market hours since 1979. Additionally, we show that specific features of the model, including female comparative advantage in home production, increasing female bargaining power, and the male breadwinner norm, can generate a trajectory where female market hours rise more slowly than expected from the benchmark model.

These findings suggest that our model has the potential to explain two key patterns: the long-term increase in female market hours and the significant slowdown in this increase since 2000. In future iterations, we plan to estimate full model parameters using data targets and quantitatively evaluate the impact of intrahousehold decision-making parameters on the observed time allocation of married households.

Table 2: Benchmark parameter values

Description	Symbol	Benchmark value
Preferences		
Weight on market goods consumption (male)	ϕ^m	0.35
Weight on market goods consumption (female)	ϕ^f	0.3
Weight on market services consumption (male)	λ^m	0.15
Weight on market services consumption (female)	λ^f	0.15
Weight on home services consumption (male)	τ^m	0.1
Weight on home services consumption (female)	τ^f	0.15
Home production		
Home productivity	A_h	1
Share of female inputs in home production	ξ_h	0.5
Substitution of male and female inputs in home production	η_h	2.27
Bargaining power		
Female Pareto weight	μ_f	0.5
Gender norms		
Minimum female income share at which utility penalty from male breadwinner norm binds	δ	1

5.1 Benchmark Parameterization

Benchmark parameterization are shown in Table 2. In future iterations of the paper, we plan to calibrate the preference parameters to match data targets. The home production parameters ξ_h and η are chosen to match parameter values in Ngai and Petrongolo (2017). In the benchmark parameterization, we do not consider the impact of gender norms. This parameter, δ, is chosen as 1, so that utility penalty from male breadwinner norm will never be incurred by households.

5.2 How Time Allocation Respond to Relative Female Wages

Using benchmark parameters, we simulate the household model to generate time series of market hours, home production hours, and leisure hours for single women, married women, single men, and married men over the period 1979 to 2023. In this version of the paper, we simulate the household model rather than the full model with both household and production sides. Therefore, we input male and female wages as additional exogenous parameters.

We sourced the wage series for male and female workers from the Bureau of Labor Statistics (BLS), using median usual weekly earnings for full-time, wage, and salary workers across all industries and occupations, aged 16 and over, adjusted to constant (1982–84) dollars. Figure 3 illustrates the time series of wages for

men and women. Over this period, male wages have remained higher than female wages. However, female wages have increased at a faster rate, leading to a rise in relative female wages over time.

Figure 3: Median Usual Weekly Earnings, 1979-2023

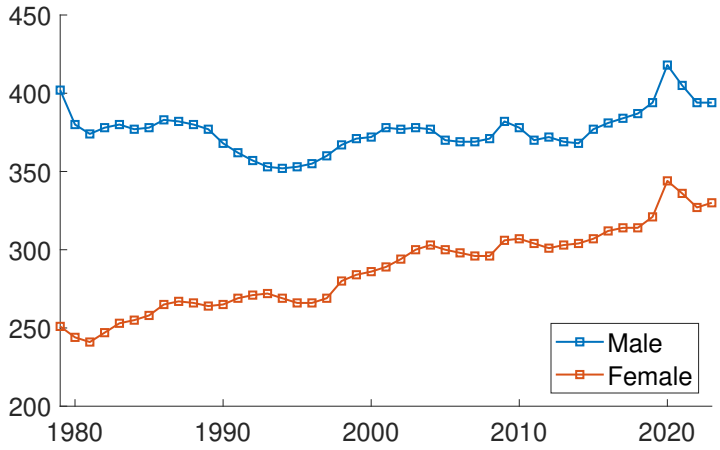
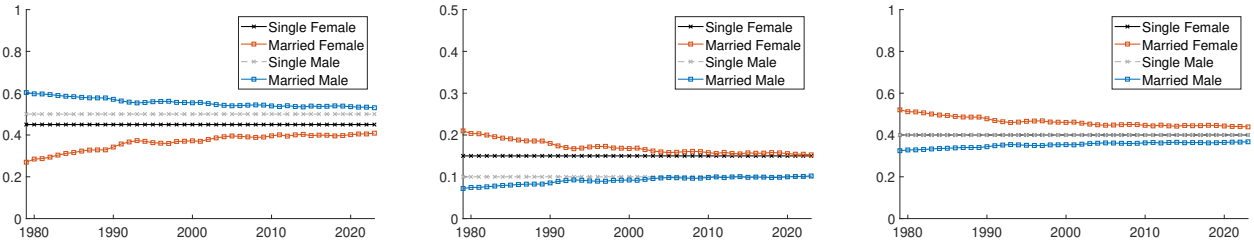


Figure 4 illustrate the simulation results of the benchmark model. We observe two patterns in the simulation results that align with the model mechanisms due to division of labor in married households. As women have comparative advantage in home production and men have comparative advantage in market work, married women allocate fewer hours to market work and more to home production compared to single women. Similarly, married men have higher market hours and fewer home production hours than single men. Moreover, female wages rise over time, which decreases women's comparative advantage in home production. Therefore, over time, married women increase their market hours and reduce their home production hours, while married men decrease their market hours and increase their home production hours. Additionally, married women experience a decline in leisure hours over time, whereas married men enjoy an increase in leisure hours.

Figure 4: Benchmark Model Simulation

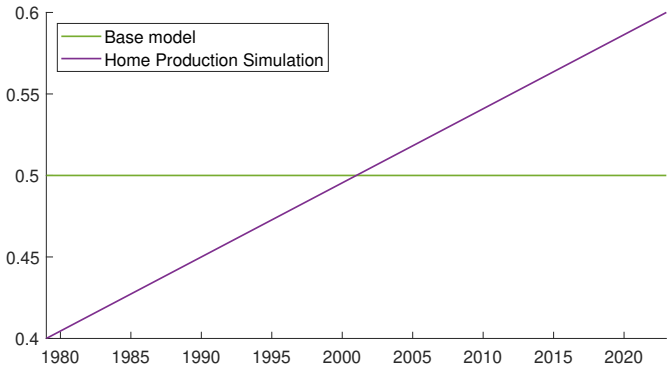


(a) Market Hours (b) Home Production Hours (c) Leisure Hours

5.3 Counterfactual: Increasing Female Share in Home Production

In this counterfactual exercise, we study the impact of the female share in home production on time allocation. In the base model, the share of female inputs in home production is set at 0.5, meaning that female and male home production hours are equally productive. For this simulation, we assume the female share in home production increases linearly from 0.4 to 0.6.

Figure 5: Increasing Female Share in Home Production Over Time

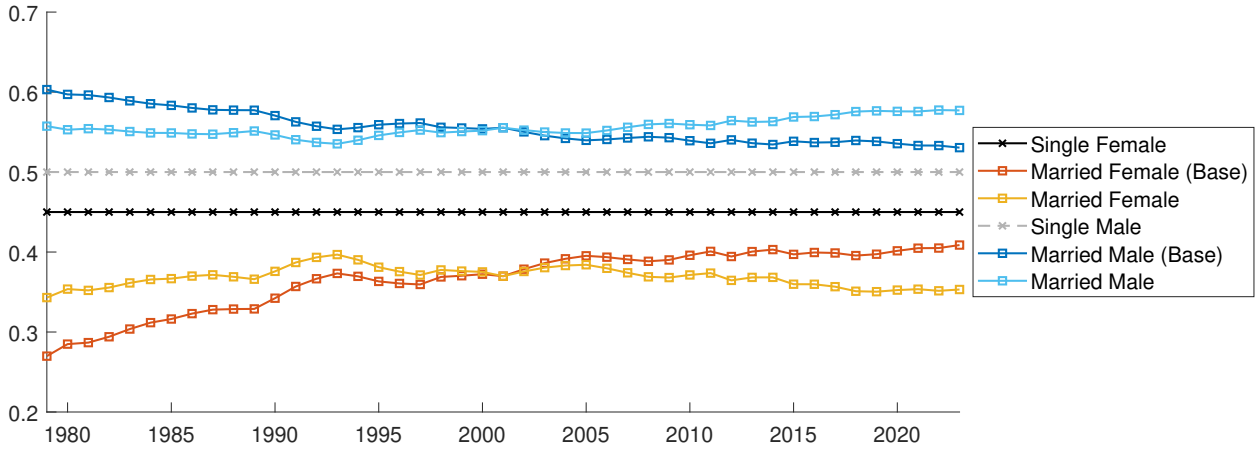


The simulation results are shown in Figure 6. Compared to the base model, a lower female share in home production leads to higher market hours and lower home production hours for married women. Conversely, a higher female share in home production means that married women spend fewer hours doing market work and more hours in home production. The female share in home production has no impact on the leisure hours of either married women or men.

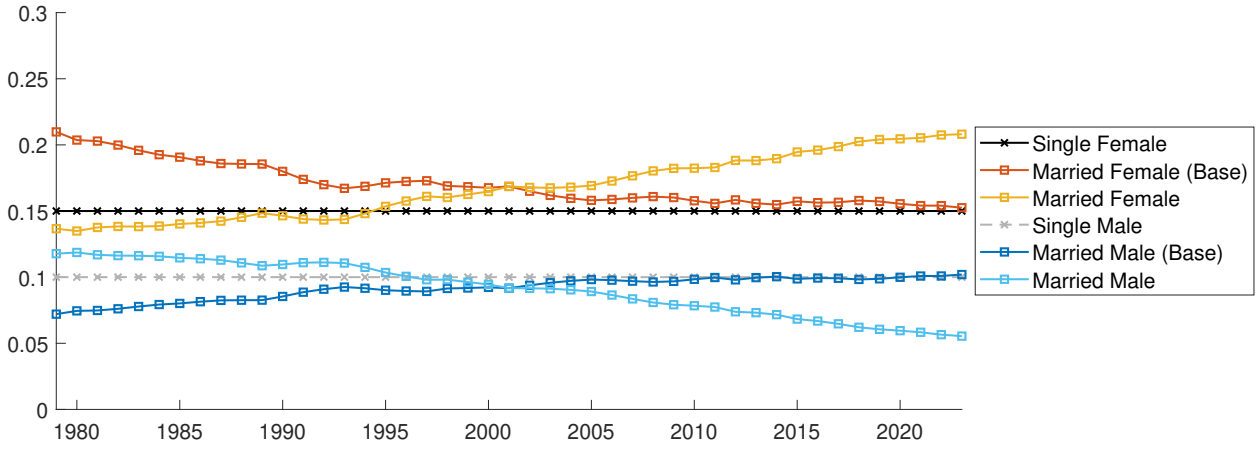
5.4 Counterfactual: Increase Female Bargaining Power

In this next counterfactual exercise, we explore how increasing female bargaining power affects time allocation. In the base model, the Pareto weight is set at 0.5, indicating that the household values female and male preferences equally. For this simulation, we assume that the Pareto weights for married women increase linearly over time, from 0.47 to 0.53, as depicted in Figure 7.

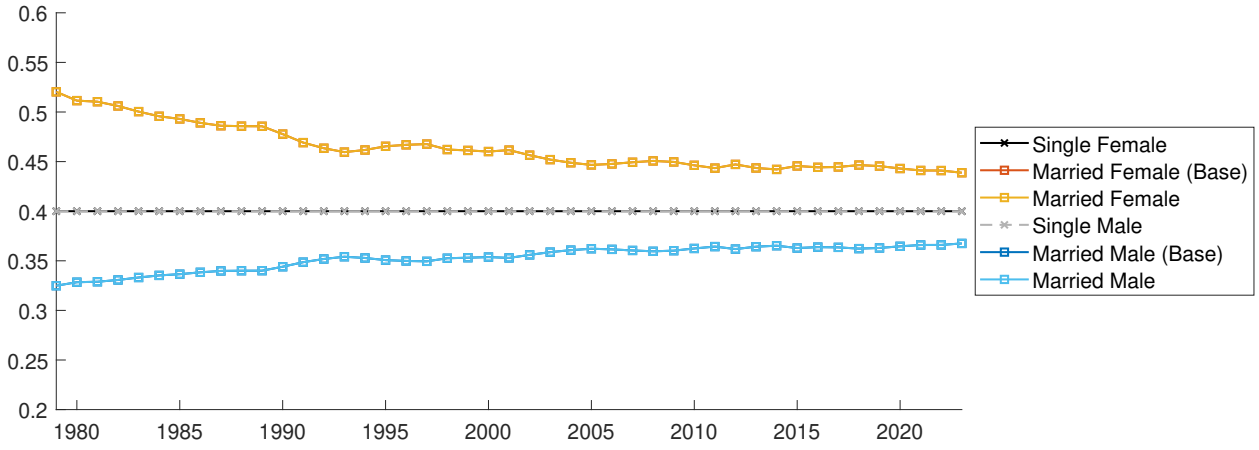
Figure 6: Model Simulation: Increasing Female Share in Home Production



(a) Market Hours

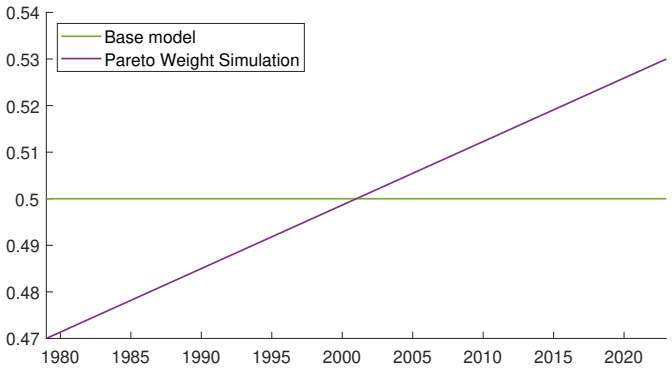


(b) Home Production Hours



(c) Leisure Hours

Figure 7: Increasing Female Bargaining Power Over Time



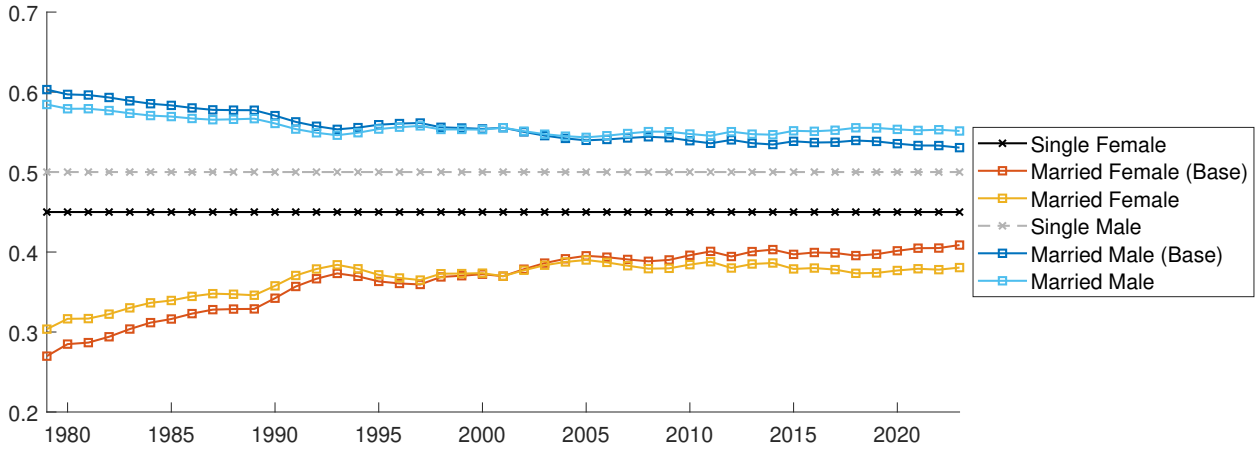
The simulation results are presented in Figure 8. Compared to the base model, lower female bargaining power leads to higher market hours and lower leisure hours for married women. In contrast, higher female bargaining power results in lower market hours and higher leisure hours for married women. Thus, an increase in female bargaining power alongside rising relative female wages results in a more gradual increase in market hours and a smaller decrease in leisure hours for married women.

5.5 Counterfactual: Male Breadwinner Norm

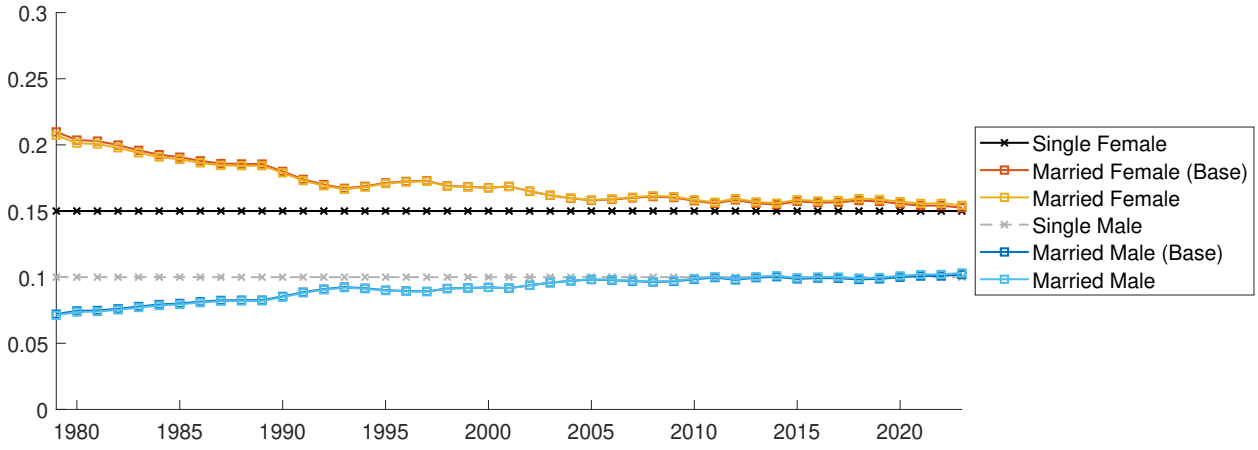
In the last counterfactual exercise, we examine the impact of the male breadwinner norm on time allocation. In the base model, the utility penalty associated with the male breadwinner norm is not considered ($\delta = 1$). For this simulation, we set $\delta = 0.35$, indicating that the household incurs a utility penalty if the female income share exceeds 35%, and the magnitude of the penalty increases with female income share.

The simulation results are shown in Figure 10. Compared to the base model, the time allocation of married couples ceases to respond to further increases in relative female wages after 2002. Beyond this point, the market hours, home production hours, and leisure hours of both married women and men remain constant despite continued relative female wage growth. This occurs because, by 2002, the female income share reaches 35%. Any further increase in market hours by married women would cause the female income share to rise more rapidly, which married households are unwilling to accept due to the additional gender norms penalty. Therefore, the gender norms friction stalls the increase in married women's market hours once the female income share reaches a certain threshold.

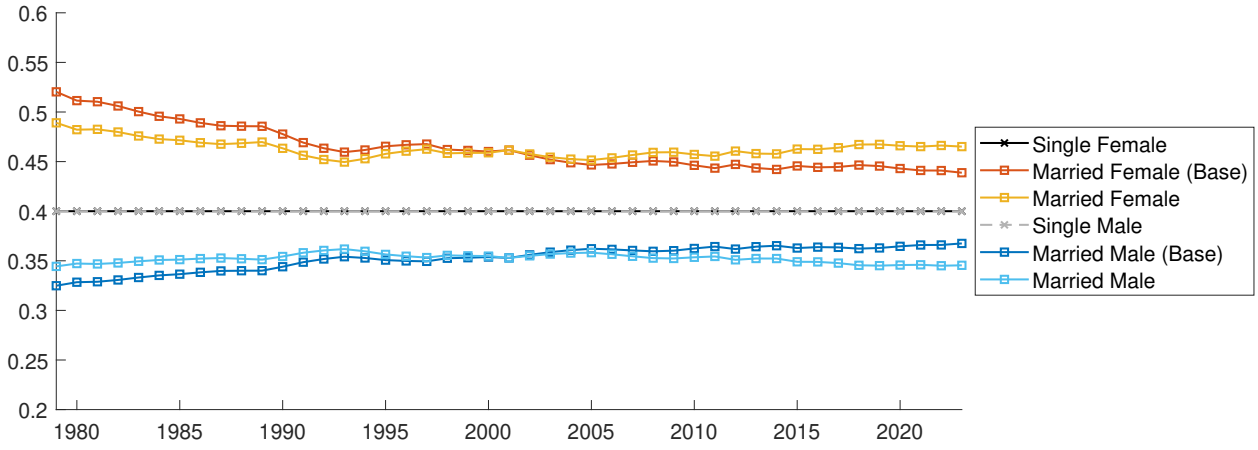
Figure 8: Model Simulation: Increasing Female Bargaining Power



(a) Market Hours

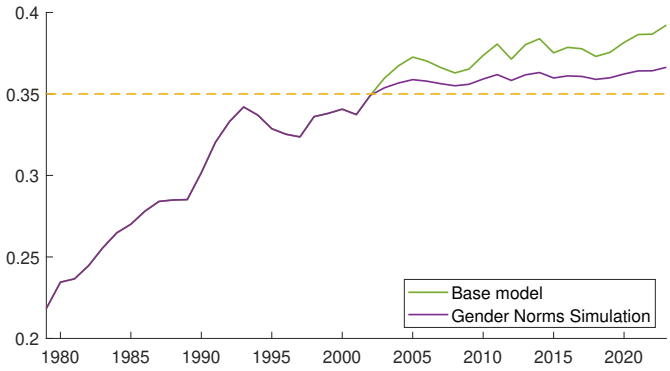


(b) Home Production Hours



(c) Leisure Hours

Figure 9: Time Series of Female Income Share

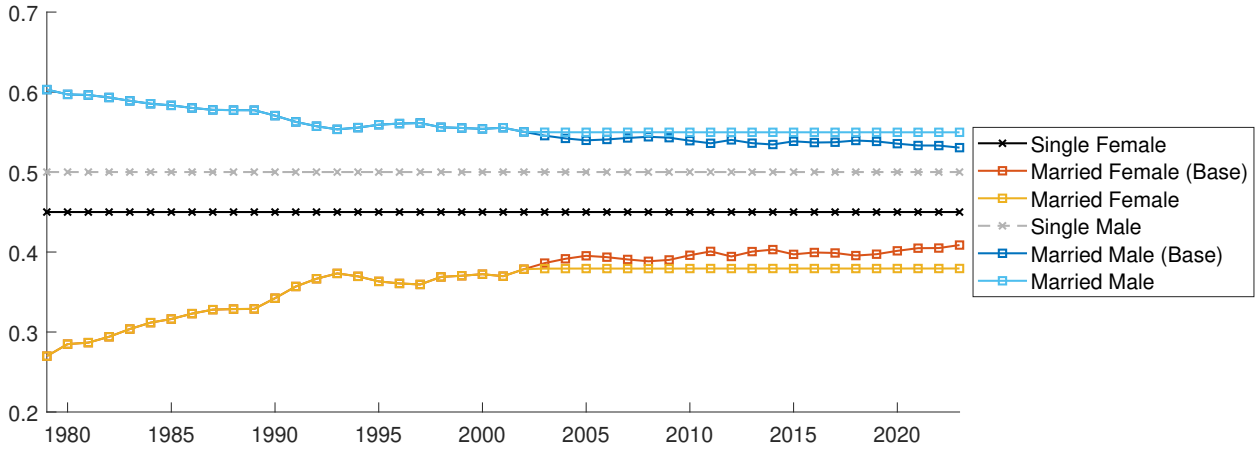


6 Conclusion

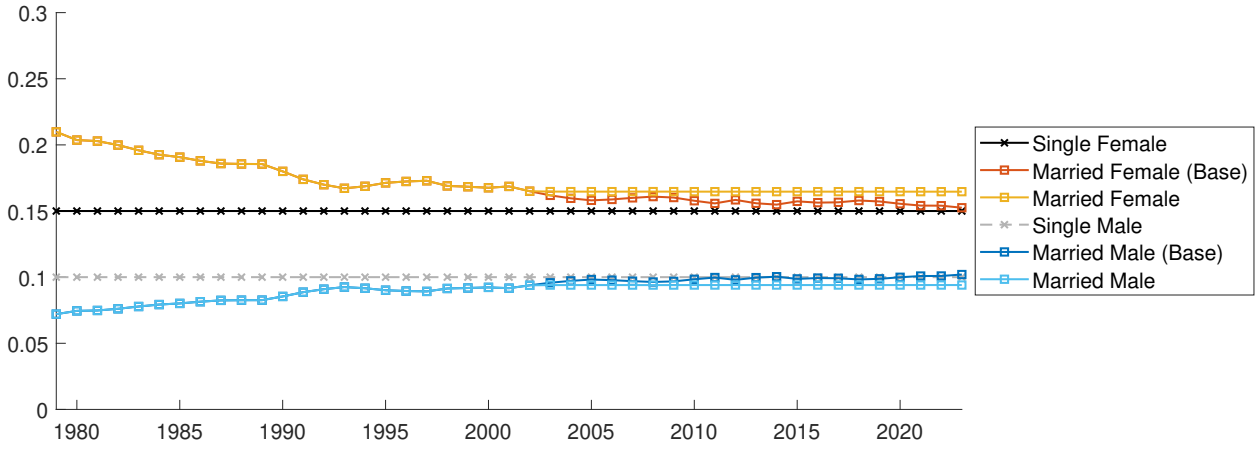
The rise and subsequent plateau of female labor force participation in the United States over the past several decades has been one of the important empirical labor market phenomena. Existing literature has highlighted the roles of anti-discrimination measures in the workplace, the expansion of the service sector, medical advancements, and improvements in home technology in explaining this trend. This paper contributes to the literature by explicitly examining how changes in female bargaining power and the male breadwinner norm influence labor supply, thereby offering insights into the observed empirical trend.

To do so, we embed a collective household model into a standard neoclassical two-sector framework. Our model indicates that an increase in relative female wages leads to an increase in relative market hours for women. However, increasing female bargaining power and binding male breadwinner norm have opposite effects: greater female bargaining power is negatively associated with relative female market hours, while a binding male breadwinner norm leads to stagnating female market hours despite continued growth in relative female wages. These results suggest that increasing relative female wages may account for the rise in female labor force participation since the 1970s, whereas the growth in female bargaining power or the persistence of the male breadwinner norm could explain the subsequent plateau. In sum, this paper provides an interesting framework to illustrate how micro-level household decisions can potentially generate significant macroeconomic effects on labor supply dynamics.

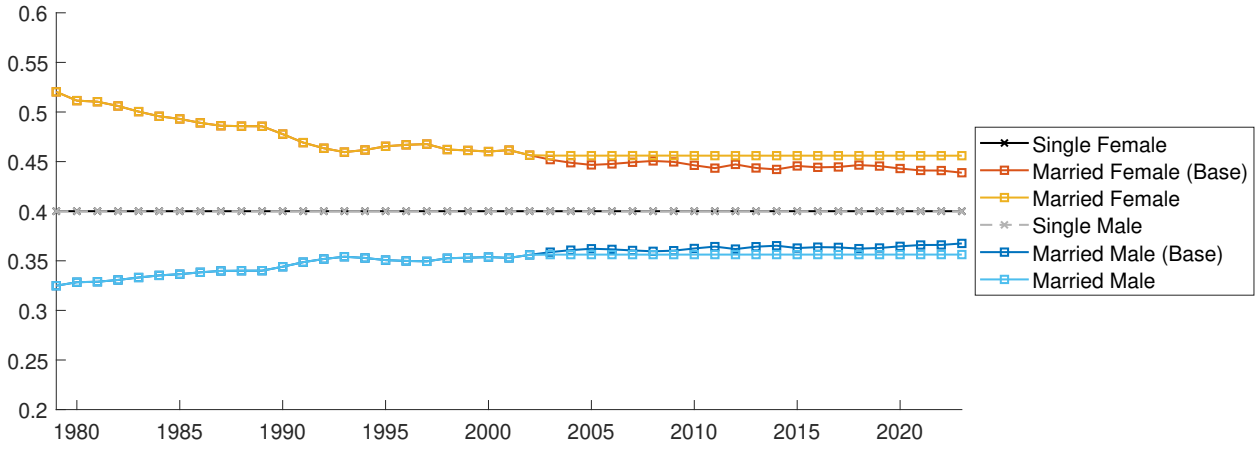
Figure 10: Model Simulation: Male Breadwinner Norm



(a) Market Hours



(b) Home Production Hours



(c) Leisure Hours

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