Understanding the Evolution of Labor and Marriage Markets from 1968 to 2018

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Abstract

This paper examines how socioeconomic changes and divorce laws in the United States influenced labor and marriage market outcomes from 1968 to 2018. We develop a general equilibrium overlapping generations model that incorporates educational, marital, and female labor supply choices, to analyze the impacts of changing social attitudes towards marriage, rising college premiums, narrowing gender wage gaps, increasing wage volatility, and the shift from mutual consent to unilateral divorce regimes. We model both endogenous labor and marriage markets and allow for rich interactions between the two markets during the transition. To exploit both the rich empirical dynamics and the variation in state-level divorce law changes, we propose an innovative methodology and estimate the model by fitting connected equilibrium transitional paths to time-series data. This approach allows us to disentangle the effects of sequential exogenous driving forces. We find that rising college premiums drove increased educational attainment for both genders and were also important in explaining marriage delay among recent cohorts. Declining social attitudes toward marriage emerged as the primary driver of both marriage delay and increasing divorce risk, while divorce law reforms generated temporary spikes in divorce rates but had modest long-term effects. Our analysis reveals a fundamental shift from marriage market to labor market motivations in educational decisions among younger generations over time.

JEL classification: I21, J11, J12, J16, J31

Keywords: Marriage delay, Educational attainment, Divorce law reform, Wage structure, Transition dynamics

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1 Introduction

Understanding life-cycle decisions such as college attendance, labor market participation, and marital choices is fundamental to economic research. These intertwined choices not only shape individual long-term socioeconomic trajectories but also influence aggregate labor market dynamics, population evolution, and broader economic outcomes. As researchers, our goal is to comprehend how these decisions are made and how they evolve in response to exogenous driving forces. This understanding is crucial for conducting accurate policy evaluations and for predicting the far-reaching consequences of social and economic changes.

Over the past five decades, the United States has witnessed significant shifts in educational attainment, marital patterns, and labor force participation. One of the most notable trends has been the dramatic increase in college attendance for both men and women. Since the 1970s, there has been a steady rise in the proportion of high school graduates pursuing higher education. Interestingly, from the 1990s onward, women began to surpass men in terms of educational achievement. Associated with the increment in the highly educated labor supply of both genders, the wage structure in the labor market is reshaping over the past decades. The premium associated with college education has been on the rise since the 1960s, with a temporary decline occurring in the 1970s. Simultaneously, the gender wage gap has significantly decreased. After conditioning on crucial demographic characteristics including age, gender, and education, the dispersion of wages within each specific group has expanded, signifying an increase in the idiosyncratic wage volatility.

Concurrently, there has been a marked trend towards delayed marriage, with a growing number of individuals, regardless of gender or educational background, remaining unmarried even in their 30s[1]. Another aspect of the marriage market trends is the spiking divorce rate since the 1970s, although this trend has stabilized in recent years. Additionally, among those who still choose to settle down in marriages, there has been a substantial increase in labor force participation from the wives. These significant changes in both labor and marriage market outcomes intrigue economists and are important to understand in order to make reliable policy evaluations.

The evolution of labor and marriage markets stems from multiple exogenous changes that reshape individual decision-making motives. Among these, shifts in production-side demands emerge as a dominant factor. In recent decades, firms have increasingly valued high-skilled and female workers, leading to higher college attendance rates and increased female labor force participation through enhanced college premiums and a narrowing gender wage gap. Another

[1] We measure the population fractions of self-reported as "never married", for both genders at age 25 and 30, and find similar increasing trends.

significant exogenous factor is the shifting social attitudes towards marriage, which is prevailing not only in the United States but all around the world. Another important change in the marriage market is the reform of divorce laws. Traditionally, the U.S. operated under a mutual consent divorce regime, requiring both parties to agree to a divorce. However, this shifted to a unilateral divorce regime during the 1960s and 1970s, with most states implementing this change by 2000. Viewing marriage as a contract between spouses, this reform expanded the feasible choice set for married individuals contemplating divorce. The subsequent surge in divorce rates can be attributed to the dissolution of unhappy marriages where one spouse had previously been constrained[2]. Furthermore, the divorce law reform affected marriage incentives for singles by altering their perceived future value of entering a marriage without a lifelong commitment. This shift in legal framework has had lasting impacts on both marital stability and individuals' willingness to enter into marriage.

The dominant exogenous forces from the two markets—shifts in wage structure in the labor market, and changing attitudes toward marriage and divorce law reforms in the marriage market—simultaneously impact both labor and marriage market outcomes, creating a complex web of interactions that evolve dynamically over time. The effects of these exogenous changes unfold gradually across generations, making it challenging to isolate the specific impacts of each factor on the respective markets. For instance, the increased value of education in the labor market may lead to higher rates of college attendance, which not only affects income distribution but also influences mate selection criteria. Simultaneously, the ease of divorce might encourage individuals to invest more in acquiring a diploma as a form of insurance, further blurring the lines between cause and effect in these intertwined markets. These individual decisions, when aggregated, can lead to significant shifts in the composition and quality of the labor force, potentially altering the relative scarcity of different skill levels and, consequently, their respective wage rates. This intricate feedback loop between education, income, marriage, divorce, labor supply, and wage structures creates a dynamic system where changes in one area ripple through to others, often with indeterminate consequences. As such, policymakers and researchers face the complex task of disentangling these interconnected effects to understand fully how exogenous shocks propagate through both the labor and marriage markets over time.

To address the complex interplay between labor and marriage markets and capture the effects of exogenous changes, we have developed a general equilibrium overlapping generations model. In this framework, individuals make endogenous decisions regarding education, female labor supply, and marital status, taking exogenously given wage structures and meeting pair distributions in the marriage market. In equilibrium, both labor and marriage markets

[2] The overshooting response of divorce rate to the divorce law reform is well documented dating back to Wolfers 2006.

clear endogenously, with wage structures dependent on individual educational and female labor supply choices, and meeting pair distributions contingent on the distribution of singles remaining in the marriage market.

We solve for rational expectations equilibrium transitional dynamics, ensuring that individual optimal choices are consistent with the evolution of both markets over time. Exogenous driving factors being considered in this paper - shifts in wage structure determinants, changing attitudes towards marriage, and divorce law reforms - are treated as unexpected shocks to individuals in the economy.

The unexpected shifts in wage structures are modeled through adjustments in a set of parameters that govern wage income based on individual characteristics, including age, gender, educational background, and unobserved individual-specific productivity shocks. These parameters determine the wage structure by controlling three key factors: college premium, gender wage gap, and idiosyncratic volatility. The model parameters remain constant until an unexpected shock occurs, at which point agents adjust their behaviors in response to updated expectations of continuation values associated with their alternative choices for education, marriage, divorce, and female labor supply.

Similarly, the changing attitudes towards marriage are captured by the change in a model parameter which governs the average match quality when singles meet each other and try to form a family. The second unexpected exogenous shock in the marriage market, the transition from a mutual consent to a unilateral divorce regime, is incorporated into the feasible choice set of married couples. This change fundamentally alters the conditions under which a divorce can occur. In our model, married couples make joint divorce decisions by comparing the continuation values of maintaining or dissolving the marriage for both parties. The prevailing divorce regime is reflected in the number of inequalities that must be satisfied for a divorce to take place. Unlike the changing match quality and wage structure, which are assumed to occur uniformly across the nation, we model the divorce regime switches specifically for each state. The timing of divorce law reform in each state is observable, allowing us to precisely account for these legal changes in our analysis.

In our model, we adopt a dual approach to market structures. The labor market is modeled on a national scale, reflecting the interconnected nature of the U.S. economy. Wage rates for different types of workers are determined by clearing the nation-wide labor market, with labor supply quantities aggregated across all states. In contrast, marriage markets are modeled at the state level, with potential matches occurring only within state boundaries. This state-wise approach to marriage markets serves a crucial purpose in our analysis: it allows us to cleanly implement and study the effects of state-specific divorce law reforms. By constraining marital matches to within-state pairs, we ensure that individuals in each state face divorce regimes that accurately reflect the historical timing of legal changes in their jurisdiction. This modeling strategy provides a clear mechanism to examine how local legal environments influence marital decisions, while still capturing the national-level dynamics of the labor market.

This comprehensive modeling approach captures the dynamic interactions between labor and marriage markets, accounts for the gradual, generational nature of changes, and provides a framework for disentangling the effects of multiple sequential changes. Specifically, we model the socioeconomic shock (including wage structure and match quality shocks) and divorce reform shock as occurring sequentially, as indicated by historical data[3]. To analyze these dynamics, we solve for connected equilibrium transitional paths implied by an economy hit by two unexpected shocks at different points in time. This approach allows us to trace the evolving impacts of these shocks as they ripple through the economy over multiple generations.

In the existing literature, many researchers have explored similar family outcomes and driving forces. The prevailing methodology involves estimating structural models using data moments constructed from two distinct years. This approach assumes that the economy is in old and new steady states in the two chosen calendar years. In other words, if we were to adopt this two-steady-state comparison methodology, we would assume an old steady state with the initial socioeconomic parameters under the mutual consent regime, and a new steady state with the updated socioeconomic parameters under the unilateral divorce regime. While this estimation strategy is computationally convenient, its reliability is questionable when considering an overlapping generations model with more than 40 generations simultaneously present in the economy. In such a scenario, the economy would likely take over 40 years to converge to a new steady state after experiencing shocks. Moreover, this methodology is insensitive to the timing of shocks occurring between the two steady states, which is unrealistic.

A step towards improved estimation was made by Heathcote, Storesletten, and Violante (2010). They assumed that the economy is at the initial steady state in the first data period and then transitions towards a new steady state driven by a one-shot exogenous shock occurring in the first data period. However, the assumption that the shock happens in the initial data period is not testable, as these shocks are unobservable. Furthermore, this framework cannot accommodate multiple shocks occurring at different times.

This paper proposes to interpret the entire transition dynamics of the economy using connected equilibrium transition paths. We assume the economy is in an initial steady state until the socioeconomic shock occurs. This shock drives the economy onto a transition path towards a new steady state implied by the new wage structure and match quality, but still under the mutual consent regime. During this transition, divorce law reforms occur in different states, fur-

[3]The data indicates that the wage structure shifts have started as early as 1960s, while most of the U.S. states make the legal transformation to unilateral divorce regime after 1970s.

ther propelling the economy onto transition paths towards new steady states implied by both the new socioeconomic condition and the unilateral divorce regime. We use these connected transition paths to match the time series data and utilize the entire dynamics for model identification. After fitting the connected transitional paths, we use the estimated model to perform decomposition and counterfactual analyses to understand which factors are important for what family outcome transformations.

Related Literature

This paper contributes to the literature on wage structure and inequality. The canonical supply-demand framework of Katz and Murphy (1992) and the skill-biased technical change literature (Acemoglu 2002; Juhn, Murphy, and Pierce 1993) document rising skill premia and within-group inequality. Heathcote, Storesletten, and Violante (2010) analyze macroeconomic implications in general equilibrium, computing transition dynamics following wage structure shocks. We extend this approach by incorporating endogenous marriage market dynamics and allowing for multiple sequential shocks at historically observed timings.

A large literature studies female labor supply over the life cycle (Attanasio, Low, and S'anchez-Marcos 2008; Eckstein, Keane, and Lifshitz 2019; Blundell, Costa Dias, et al. 2016; Goldin 2006). Guvenen and Rendall (2015) explain the reversal of the college gender gap through an insurance motive against marital dissolution. Our contribution is to embed these decisions within a framework where both labor and marriage markets clear in general equilibrium during transitions.

The theoretical foundations for marriage market analysis derive from Choo and Siow (2006) and Galichon, Kominers, and Weber (2019). Several papers integrate labor and marriage considerations: Fern'andez and Rogerson (2001) and Pierre-André Chiappori, Dias, and Meghir (2018) study sorting and education, while Caucutt, Guner, and J. Knowles (2002) and Santos and Weiss (2016) analyze fertility and marriage timing. The Greenwood-Guner research program (Aiyagari, Greenwood, and Guner 2000; Greenwood, Guner, and J. A. Knowles 2003; Greenwood, Guner, Kocharkov, et al. 2016) develops unified models of marriage, divorce, and female employment. However, all these papers rely on steady-state comparisons. Our paper achieves general equilibrium in both markets while computing explicit transition dynamics.

Our modeling of household behavior builds on the collective framework (Pierre-Andr'e Chiappori 1988; Pierre-Andr'e Chiappori 1992; Pierre-Andr'e Chiappori and Mazzocco 2017) and related work on intra-household allocation (Blundell, Pierre-Andre Chiappori, et al. 2007; Lundberg and Pollak 1993; Lise and Seitz 2011; Mazzocco, Ruiz, and Yamaguchi 2013; Gayle and Shephard 2019). For divorce, we follow Voena (2015) and the literature on divorce regime welfare (Fern'andez and Wong 2017; Reynoso 2024). Wolfers (2006) shows that divorce rates spike then reverse following unilateral adoption; his dynamic treatment effects specification inspires our indirect inference approach.

A primary methodological contribution is connected equilibrium transition paths. The prevailing methodology uses steady-state comparisons (Greenwood, Guner, Kocharkov, et al. 2016; Reynoso 2024; Fern'andez and Wong 2017; Guvenen and Rendall 2015), which cannot capture shock timing. Single transition path approaches (Heathcote, Storesletten, and Violante 2010; Heckman, Lochner, and Taber 1998; Lee and Wolpin 2006; Huang, Imrohoroglu, and Sargent 1997; De Nardi, Imrohoroğlu, and Sargent 1999) improve on this but cannot accommodate sequential shocks occurring at different times. We develop a framework where the economy experiences multiple unexpected shocks at historically observed timings, with each transition beginning from positions implied by prior transitions. This enables identification from impulse responses and decomposition of distinct driving forces. To our knowledge, no prior paper employs connected equilibrium transition paths to analyze the joint evolution of labor and marriage markets.

The remainder of this paper is structured as follows: Section 2 presents the data sources and highlights the key stylized patterns that motivate our research. Section 3 details the model and formalizes the concept of connected equilibrium transition paths, which forms the basis of our empirical strategy. Section 4 elaborates on the estimation methodology. Section 5 evaluates the model's fit to the data and presents our counterfactual analyses. Finally, Section 6 concludes with a discussion of our findings and their implications.

2 Data

This section describes the data sources and the stylized patterns that demonstrate the empirical transitional dynamics to be explained by the structural model. We mainly rely on the Current Population Survey (CPS) March files (1968-2018) which provides informative time series in the past five decades on a set of family outcomes of interest. Our sample comprises both married and single households whose ages are between 20 and 49 years old.

Wage Structure

Figure 1 demonstrates the changes in the wage structure in the U.S. from 1968 to 2018. The top left panel shows how the college premium changes for different genders. The college premium is computed by the ratios of average annual wages of employed workers with some college or above, to the high school or below. The ratios was stagnant for the early 70s but started to

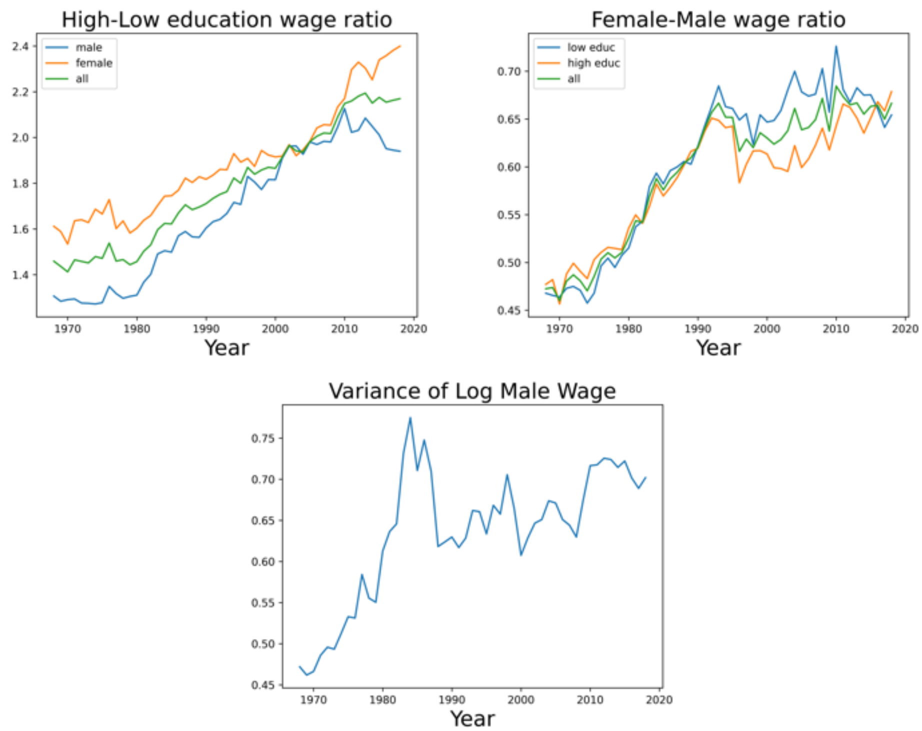

Figure 1: Wage structure: Cross-sectional wage structure time series. Source: CPS 1968-2018. Sample: Pooled single and married households. The high education is defined to be some college and above.

increase from 80s until now. During the same period, the gender wage gap has been shrinking, as shown in the top right panel. The gender wage gap is measured by the ratios of average annual wage of employed women to men. The declining trend applies to both groups with high and low education. The changes in the college premium and gender wage gap indicates changes from the demand side.

Another important aspect of the wage structure change is the increasing individual wage volatility. As the bottom panel of figure 1 shows, the variance of log male wage has been increasing and staying at a higher level since early 70s.

Education

The high education population fractions, as measured by the ratio of individuals of age between 25 and 29 with some college or above, have been increasing significantly during the past five decades for both men and women. This is partly resulted by the increase in the college premium, but it is also deeply related to how the young change their views regarding the value associated with their education ground in the marriage markets.

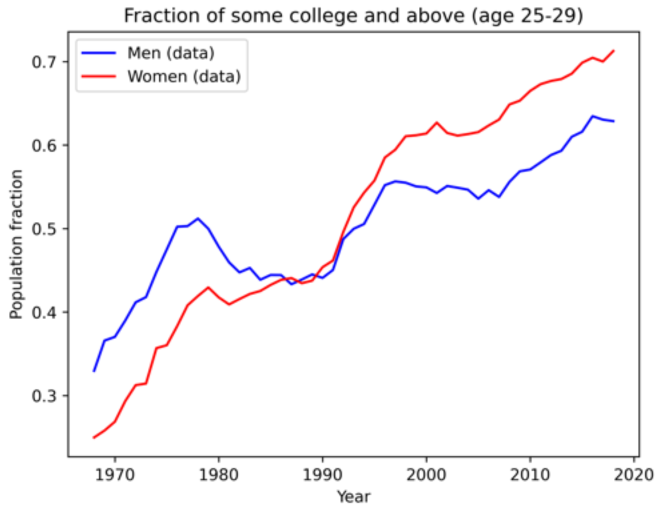

Figure 2: Education: Population fraction of high education over time. Source: CPS 1968-2018. Sample: Pooled single and married individuals with age between 25 and 29. The high education is defined to be some college and above.

Marriage

As well documented in many other family economics papers, the U.S. has been experiencing marriage delay as many other countries too. In this paper, we choose to focus on the measurement of marriage delay by computing the population fraction that self-report as "never married" in the CPS dataset[4]. We compute this ratio for both men and women, with either high or low education background, and in each calendar year. As figure 3 shows, the never married ratios have been increasing steadily for fifty years regardless of gender and education background.

The timing of marriage is a complicated life cycle choice which is not only related to the marriage market perspective at the time the singles live in, but also deeply related to the labor markets as the economic part of getting married will be dependent on the contemporary wage structure.

Female Labor Supply

Besides how singles change their marital decisions, married households have also significantly changed their decisions about whether the married women participate in the labor market. Figure 4 plots the trends of the employment ratio of wives over time, with the wife's educational background being either low or high. The ratios have been increasing from 1968 and achieved in a higher level in around 1990.

[4]In this paper, we make assumptions of within-cohort marriages. We look at men at age 30 and women at 28 to account for age gap which on average is two years.

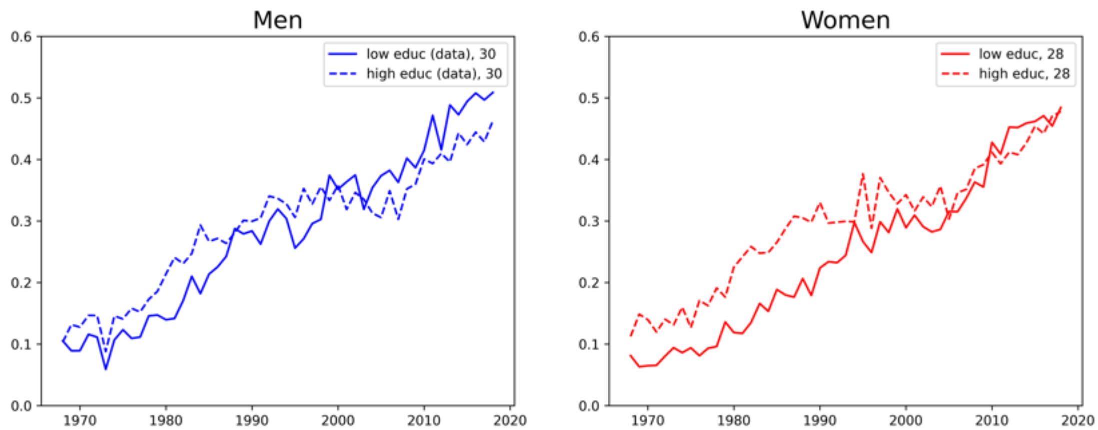

Figure 3: Never married ratio: Never married ratios over time. Source: CPS 1968-2018. Sample: Pooled single and married households. The high education is defined to be some college and above.

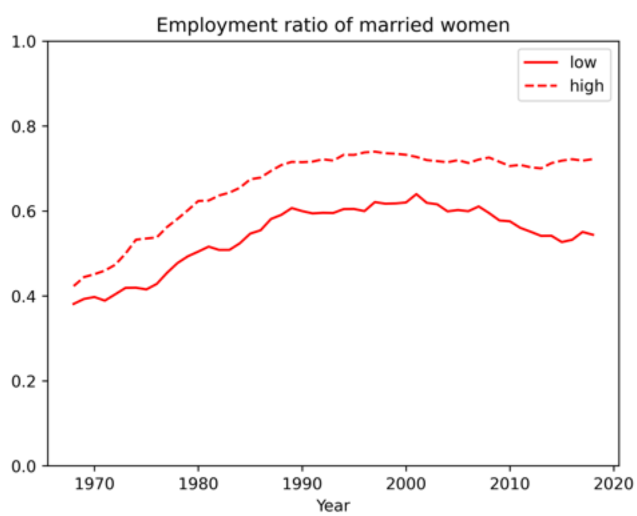

Figure 4: Married women employment: Employment ratio of married women over time. Source: CPS 1968-2018. Sample: married households. The high education is defined to be some college and above.

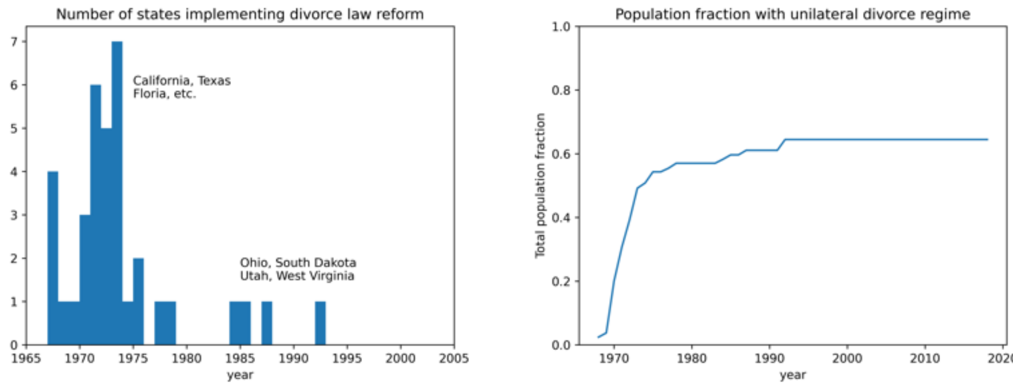

Figure 5: Timing of divorce regime change

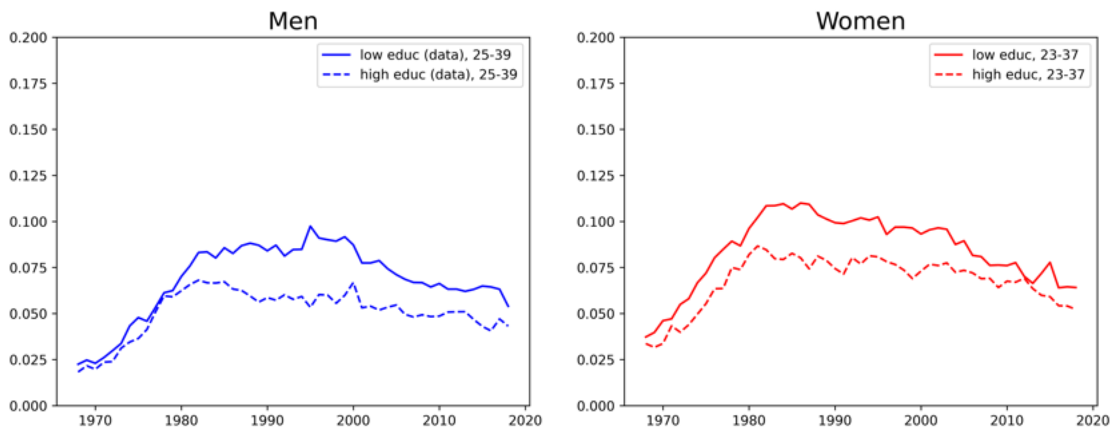

Figure 6: Divorced ratios over time. Source: CPS 1968-2018. Sample: Pooled single and married households. The high education is defined to be some college and above.

Divorce

The left panel of figure 5 is the histogram of the years when the divorce regime switched from mutual consent to unilateral divorce in each states. The switches have taken place in majority of the states by 1980. The right panel plots the overall national population fraction under unilateral divorce regime over time.

The population stock time series of self-reported divorcees in the CPS dataset over time is shown in figure 6. The divorced population fractions demonstrate a hump-shaped trend for both men and women. In the early 70s, the large magnitude of the increments in divorce indicates a release from "undesired" marriages that were locked before under the mutual consent regime. As the switch to unilateral divorce regime relaxes the constraints of divorcing, the spouse intending to leave is now able to escape. The downwards trending after 1980 is likely a indicator that the release effect is over, but the overall divorce rate stays higher than the 1968 level.

3 Model

We build a dynamic general equilibrium model that integrates labor and marriage markets to analyze how changes in wage structures and divorce laws impact various economic and social outcomes. The model considers an overlapping generations economy where individuals live for 30 periods (ages 20-50), with time progressing in discrete annual intervals. The economy is populated by men and women who make decisions about education, labor supply, marriage, divorce, consumption, and saving over their lifetimes. The model incorporates heterogeneity in age, gender, marital status, education level, and saving levels.

In this model, single individuals make decisions about education (one-shot decision at the beginning of life), consumption, savings, and whether to enter marriage. Married couples, on the other hand, make joint decisions about the wife's labor supply, consumption, savings, and whether to divorce. The model employs a collective household decision-making framework, allowing for potentially asymmetric bargaining powers between spouses. Both single and married households face uncertainty in wages, and married couples additionally contend with uncertainty in match quality, adding realistic dimensions of risk to their decision-making processes.

The labor market is modeled at the national level, with wages determined by education level, gender, age, and idiosyncratic wage shocks. The model incorporates skill-biased technological change and changes in gender-specific demand for labor, reflecting real-world trends in wage structures. In contrast, the marriage market is modeled at the state level with search frictions. Singles can meet potential partners with some probability, and marriages form when both parties agree. Divorce decisions have to be consistent the prevailing divorce laws (mutual consent versus unilateral), which change over time in different states, mirroring the historical shift in U.S. divorce legislation. This framework allows us to capture the complex interactions between labor market conditions, marriage market dynamics, and individual decision-making, enabling analysis of how exogenous changes in wage structures and divorce laws propagate through the economy over time.

3.1 Environment

Time is discrete and denoted by t, representing each calendar year. Denote j as individual's age, each agents live from $j = 1$ to J[5]. We do not model mortality risk, and each individual exits the economy at J with certainty. Gender is denoted as $g \in \{m, f\}$. Denote Ω_{gt} as the vector of

[5] We set $J = 30$. Therefore, j from 1 to 30 corresponds to ages 20 to 50. The post-retirement life will be accounted for by a terminal value function depending on the marital status and savings at age 50.

states for a single individual at time t,

$$\Omega_{gt} = \{j_g, e_g, n_{gt}, a_{gt}\},$$

where $e_g \in \{l, h\}$ indicates the education level[6], and a_{gt} is current saving[7]. Note that the education level e_g is time-invariant and a one-shot decision made by the individuals at the first period of life cycle. $n_{ft} \in \{0, 1\}$ indicates whether there is a child in the household[8].

For a married household, the state vector $\bar{\Omega}_t$ of the household is simply a combination of the states of the husband and the wife,

$$\bar{\Omega}_t = \{j_m, e_m, e_f, n_t, \theta_t, a_t\},$$

with pooled savings a_t and total number of children n_t. The additional state variable θ_t capturing the match quality for each couple at time t, and it evolves over time following a random walk process. We model within-cohort marriages such that the ages of the husband and the wife are equal in each married household.

3.2 Labor and Marriage Markets

The model incorporates distinct structures for the labor and marriage markets to capture both national economic trends and state-specific policy changes.

The labor market is modeled at the national level, reflecting the interconnected nature of the U.S. economy. All individuals across states face the same wage structure, which is determined by clearing the nation-wide labor market. The wage for an individual depends on their age, gender, education, and idiosyncratic transitory wage shocks[9]. The labor supply quantities are aggregated across all states to determine the national wage rates for different types of workers. This national labor market structure allows the model to capture broad economic trends such as changes in the college premium, narrowing of the gender wage gap, and increased wage volatility that affect all workers across the country.

In contrast to the national labor market, marriage markets are modeled at the state level. This approach serves a crucial purpose in the analysis: it allows for a clean implementation and study of the effects of state-specific divorce law reforms. By constraining marital matches to within-state pairs, the model ensures that individuals in each state face divorce regimes that

[6] We categorize high education group by people attended some college or with higher educational attainment.

[7] Let's set the timing such that a_{gt} is the saving level at the beginning of time period t.

[8] In this model, only married households will give birth. Single parent households are those who experienced divorce.

[9] See more details in section 3.4.

accurately reflect the historical timing of legal changes in their jurisdiction. This provides a clear mechanism to examine how local legal environments influence individual decisions, while still capturing the national-level dynamics of the labor market.

3.3 Preference

At any given time t, the flow utility of an individual comprises both economic and non-economic components. Utility from consumption c_t is captured using a CRRA function, where σ denotes the risk aversion parameter. Both male and female individuals face a fixed disutility from working, ψ_h. In households with children, an additional disutility ψ_n is incurred if neither parent is available to care for the children.

The utility for a single individual at time t, with state vector $\Omega_{g,t}$, is represented as:

$$u^S\left(c_t;\Omega_{gt}\right)=\frac{\left(E^s\left(n_{gt}\right)c_t\right)^{1-\sigma}}{1-\sigma}-\psi_h-\psi_n I\left(n_{gt}>0\right),$$

where $I\left(n_{gt}>0\right)$ is the indicator function that equals 1 if there are children in the household[10]. The consumption level is adjusted for household composition using an equivalence scale $E^s\left(n_{gt}\right)$.[11]

For married couples, the utility for each spouse $g\in\left\{m,f\right\}$ at time t, with state vector $\bar{\Omega}_t$, is defined as:

$$u^{M,m}\left(c_t,h_t;\bar{\Omega}_t\right)=\frac{\left(c_t\cdot E^m\left(n_t\right)\right)^{1-\sigma}}{1-\sigma}-\psi_h-I\left(n_t>0\right)\psi_n h_t,$$
$$u^{M,f}\left(c_t,h_t;\bar{\Omega}_t\right)=\frac{\left(c_t\cdot E^m\left(n_t\right)\right)^{1-\sigma}}{1-\sigma}-\left(\psi_h+I\left(n_t>0\right)\psi_n\right)h_t,$$

where $E^m\left(n_t\right)$ is the equivalence scale for married households. The disutility ψ_n enters both spouses' utility functions when there are children in the household and the mother goes to work[12]. The decision for the wife to work, $h_t=0$ or 1, is jointly made by the two spouses.

In addition to economic factors, four non-economic factors enter the flow utility of married couples additively: match quality θ_t, the taste for divorce $\boldsymbol{\varepsilon}_t^d$, the taste for the wife's working decision $\boldsymbol{\varepsilon}_t^h$, and the one-shot divorce penalty ζ. The initial match quality for a newly met pair is randomly drawn from the distribution $N\left(\mu_t^\theta,\lambda^\theta\right)$, and the match quality gets updated each period with probability ρ_θ following a random walk process,

$$\theta_{t+1}=\theta_t+\varepsilon_t^\theta,\qquad \varepsilon_t^\theta\sim N\left(0,\lambda^{\varepsilon,\theta}\right).$$

[10] In this paper, we assume singles always work.
[11] We use the OECD equivalence scale for adjusting consumption.
[12] We assume that fathers always go to work by default.

The average match quality μ_t^θ is evolving over time which reflects the changing social attitudes regarding marriages in the economy. It is considered as one important underlying driving force not only for marriage market evolutions, but also for labor market evolutions as the high education attainment will be evaluated differently by people when they have different plans for forming a family.

The taste shocks, $\boldsymbol{\varepsilon}_t^h = \left[\varepsilon_t^{h,0}, \varepsilon_t^{h,1}\right]' \sim N\left(0, \lambda^{\varepsilon,h}\right)$ and $\boldsymbol{\varepsilon}_t^d = \left[\varepsilon_t^{d,0}, \varepsilon_t^{d,1}\right]' \sim N\left(0, \lambda^{\varepsilon,d}\right)$, and are i.i.d. across couples and over time t.

The disutility $\zeta \cdot \left(1 + \zeta_e \mathbf{1}\left\{e_g = 1\right\}\right)$ enters the flow utility if the spouses jointly decides to divorce at the beginning of each time period t. We model divorce penalty dependent on education levels to reflect the distinction in the difficulties of divorce for people with different educational background[13].

3.4 Wage Process

The wage process is considered exogenous by the agents and plays a significant role in shaping individuals' decisions regarding education and marriage. The annual wage for an individual of age j, gender g, and education level e at time t is given as:

$$w_t^{g,e} = p_t^{g,e} \times \exp\left[L\left(j\right) + \varepsilon_t^{g,\omega}\right].$$

The annual wage $w_t^{g,e}$ is the product of two components. The first, $p_t^{g,e}$, represents the price per efficiency unit for a given labor type characterized by gender and education. The second term, $\exp\left[L\left(j\right) + \varepsilon_t^{g,\omega}\right]$, captures the individual-specific efficiency units of labor, which follow an exponential functional form. The term $L\left(j\right)$ is a deterministic function of age that reflects the wage profile over the life cycle, while $\varepsilon_t^{\omega,g}$ leverages the wage by the transitory idiosyncratic wage shocks at time t,

$$\varepsilon_t^{\omega,g} \sim N\left(0, \lambda_t^\omega\right)$$

The parameter λ_t^ω, one of the key wage structure parameters, captures individual wage volatility. The sequence of $\{\lambda_t^\omega\}_{t=t_0}^\infty$ describes how wage volatility evolves over time. As λ_t^ω increases, individuals face greater wage uncertainty.

The price $p_t^{g,e}$ equals the marginal productivity of efficiency unit for the labor type defined gender g and education background e. We model a representative firm in the economy that maximize profits according to the production function

$$Y_t = Z_t K_t^\alpha H_t^{1-\alpha},$$

[13] The difficulty of divorce can depend on how easy it is to divide property, and also how the parents are committed to investment in children's education, which will be different for high and low education spouses.

where K_t and H_t are the aggregate capital and labor inputs, respectively, and α is the capital share of output. Z_t is a time-varying scaling factor[14].

In line with Katz and Murphy (1992), Heckman, Lochner, and Taber (1998), and Heathcote, Storesletten, and Violante (2010), we model aggregate labor H_t as a constant elasticity of substitution aggregator of four types of labor input,

$$H_t = \Big[\lambda_t^E \left(\left(1-\lambda_t^E\right) H_t^{m,h} + \lambda_t^G H_t^{f,h}\right)^{\frac{\theta-1}{\theta}} + \left(1-\lambda_t^E\right)\left(\left(1-\lambda_t^G\right) H_t^{m,l} + \lambda_t^G H_t^{f,l}\right)^{\frac{\theta-1}{\theta}}\Big]^{\frac{\theta}{\theta-1}},$$

where $H_t^{g,e}$ represents the national aggregate labor supply of individuals of gender g and education e. The elasticity of substitution between different educational groups is given by θ, which remains constant over time. The two wage structure parameters λ_t^E and λ_t^G, interpreted as demand shifters, reflect the relative demand for highly educated and female workers, respectively.

3.5 Life Cycle

Given the preferences and the wage process, both single individuals and married households make optimal decisions about marriage, divorce, consumption, savings, and labor supply over their life cycle. For married households, all decisions are made jointly by the spouses. Newborns make optimal educational choice at the first period of their life cycles.

At the beginning of each time period t, a new generation of age $j = 1$ enters the economy. Newborns are equally distributed between males and females, and they all enter the economy as singles. Upon entering the economy, individuals randomly draw their initial savings $a_{gt} \sim \mu\left(\mu^{a,s}, \lambda^{a,s}\right)$.[15] Upon observing their draws a_{gt}, individuals decide whether to attend college, $e_g = 1$ or 0, by forming rational expectations about their lifetime values associated with high education versus not.

The life cycle for each individual spans from age 1 to age J, and within each period, individuals make a sequence of decisions. These decisions are made in two substages: 1. marital status update, 2. household decisions.

Individuals make marital decisions first. Single individuals search in the marriage market and may randomly meet potential partners. Upon each meeting, both parties observe the states of each other, Ω_{mt} and Ω_{ft}, and draw a random initial match quality θ_t. If both individuals are

[14]We will impose Z_t to be the residuals over time such that the real wage of low education male workers are constant over time.

[15]The distribution of initial savings are assumed to be state-specific, in order to capture the difference in wealth distributions among states.

better off with the match, they form a new household with mutual consent, and the marriage is formalized, $m_t(\bar{\Omega}_t, \theta_t) = 1$. Otherwise, they remain single and search again in the next period.[16]

For married couples, the decision to divorce is based on a comparison between the expected future value of staying married versus returning to single life, and also taking in account the realization of their tastes for divorce $\boldsymbol{\varepsilon}_t^d$ in t. This decision process depends on the current match quality θ_t, the composition of working efficiencies of the spouses, and, crucially, the prevailing divorce regime (mutual consent or unilateral). Denote the timing of legal transformation in state s as $t_{1,s}$. Under the mutual consent regime ($t < t_{1,s}$), a divorce only occurs if both spouses prefer to separate. In contrast, under the unilateral divorce regime ($t \geq t_{1,s}$), a divorce can be initiated by only one spouse if they find it optimal, regardless of the other's preference. If a couple chooses to divorce, each spouse incur a one-time divorce penalty $\zeta \cdot \left(1 + \zeta_e \mathbf{1}\left\{e_g = 1\right\}\right)$, and the household dissolves. After the divorce, both former spouses return to the pool of singles, where they can once again search for new partners in the marriage market.

After marital status is updated, individuals proceed to the second stage of decision-making. Single individuals supply one unit of labor inelastically and choose their optimal consumption c_{gt} and saving a_{gt+1} given their budget constraints. Married households, on the other hand, make more complex joint decisions. They will first draw random vectors of their tastes for wife's labor supply decision $\boldsymbol{\varepsilon}_t^h$ and wage shocks $\varepsilon_t^{\omega,m}, \varepsilon_t^{\omega,f}$, and choose optimal female labor supply decision h_t, consumption c_t, and saving a_{t+1} all jointly by maximizing the total household values which is weighted by the intra-household bargaining power ρ. The household total income will be dependent on the wife's labor supply decision.

Given the optimal decisions, individual states will be updated across periods such as the match quality θ_t as we described in the previous sections. Married women will give a new birth following an exogenous fertility process, $\Pr\left(n_t = 1 \mid n_t = 0, \bar{\Omega}_t\right)$, which is dependent on mother's age and the education composition of the family, and will be directly estimated from data.

To formalize the decision making problems, we denote $V_{S,t}^m(\Omega_{gt})$, $V_{S,t}^f(\Omega_{gt})$, $V_{M,t}^m(\bar{\Omega}_t)$, $V_{M,t}^f(\bar{\Omega}_t)$ to be the *start-of-period* value functions, and $\tilde{V}_{S,t}^m(\Omega_{gt})$, $\tilde{V}_{S,t}^f(\Omega_{gt})$, $\tilde{V}_{M,t}^m(\bar{\Omega}_t)$, $\tilde{V}_{M,t}^f(\bar{\Omega}_t)$ to be the *end-of-period* value functions for each time period t. The Bellman equations that characterize the optimal decisions will be discussed in detail in sections 3.6 and 3.7.

Figure 7 illustrates the two substages of decision marking within each time period t.

Individuals age from $j = 1$ to J, at which point they retire and the marital status will no longer be updated. We denote $V_{S,t}^g(\Omega_{gt})$ and $V_{M,t}^g(\bar{\Omega}_t)$ to be the terminal value functions that capture the continuation values of living continuously given the marital status and the savings

[16] Note that we consider an endogenous frictional marriage market, such that both the probability of meeting someone at time t, $\delta(M_t)$, as well as the conditional probability of a particular meeting pair, $\gamma_t(\Omega_{mt}, \Omega_{ft})$, will be dependent on the current population distribution of available singles at time t. We will discuss the meeting technology in detail in section 3.10.

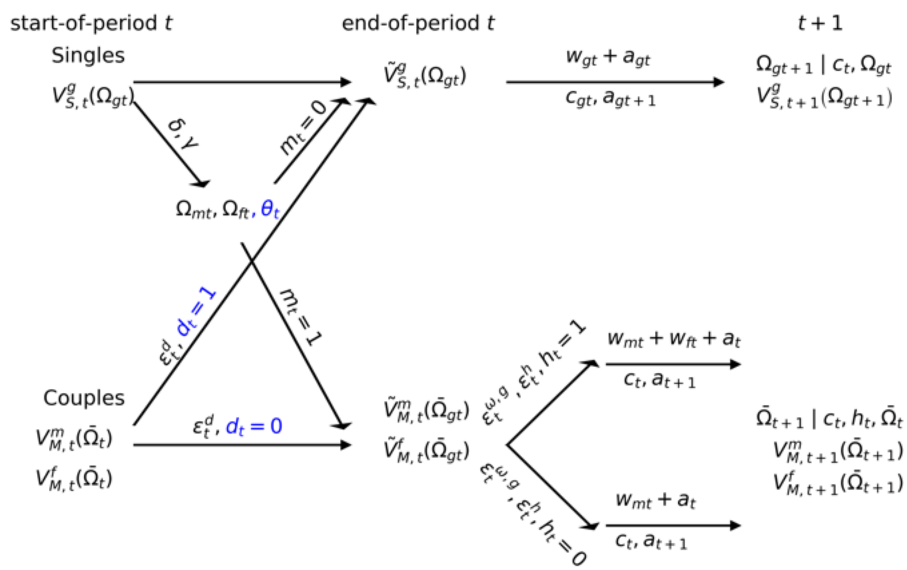

Figure 7: Decision substages within t

at age J.

$$V^g_{S,t}\left(\Omega_{gt}\right) = \frac{a_{g,t}^{\phi_{S,0}}}{\phi_{S,1}}$$

$$V^g_{M,t}\left(\bar{\Omega}_t\right) = \phi_2 + \frac{\left(a_t/2\right)^{\phi_{M,0}}}{\phi_{M,1}}$$

3.6 Problem of Singles

At each period t, the *start-of-period* value function $V^g_{S,t}\left(\Omega_{gt}\right)$ for a single agent of gender g and with state vector Ω_{gt} is characterized by

$$\begin{aligned} V^g_{S,t}\left(\Omega_{gt}\right) =& \delta\left(M_t\right) \times E_t\Big[m_t\left(\bar{\Omega}_t\right)\tilde{V}^g_{M,t}\left(\bar{\Omega}_t\right) + \left(1 - m_t\left(\bar{\Omega}_t\right)\right)\tilde{V}^g_{S,t}\left(\Omega_{gt}\right)\Big] \\ &+ \Big(1 - \delta\left(M_t\right)\Big)\tilde{V}^g_{S,t}\left(\Omega_{gt}\right) \end{aligned}$$

which takes into account the marriage market prospects. The marriage search is frictional, and $\delta\left(M_t\right)$ denotes the probability of meeting a potential partner of the opposite gender, where M_t is the population measure of the available singles at time t, and $\delta\left(M_t\right)$ is increasing return to scale.

Conditional on a successful meeting with probability $\delta\left(M_t\right)$, the meeting pair distribution is governed by $\gamma_t\left(\Omega_{mt}, \Omega_{ft}\right)$, which is dependent on the entire population distribution of singles, as we will discuss in more detail in section 3.10. The expected value of meeting a potential partner is given by

$$E_t\Big[m_t\left(\bar{\Omega}_t\right)\tilde{V}^g_{M,t}\left(\bar{\Omega}_t\right)+\left(1-m_t\left(\bar{\Omega}_t\right)\right)\tilde{V}^g_{S,t}\left(\Omega_{gt}\right)$$
$$=\int_{\Omega_{g't}}\int_{\theta_t}\Big[m_t\tilde{V}^g_{M,t}+\left(1-m_t\right)\tilde{V}^g_{S,t}\Big]f\left(\theta_t\right)\gamma_t\left(\Omega_{mt},\Omega_{ft}\right)d\theta_t d\Omega_{g't},$$

where $\tilde{V}^g_{M,t}$ and $\tilde{V}^g_{S,t}$ are the *end-of-period* value functions, and $m_t\left(\bar{\Omega}_t\right)$ is an indicator function representing whether the pair agrees to marry with combined states $\bar{\Omega}_t$. We always assume that marriage requires mutual consent, so that

$$m_t\left(\bar{\Omega}_t\right)=1 \text{ iff } \tilde{V}^g_{M,t}\left(\bar{\Omega}_t\right)>\tilde{V}^g_{S,t}\left(\Omega_{gt}\right) \text{ for } g=m,f.$$

Intuitively, two newly met individuals compare their *end-of-period* value functions for being married against staying single. They will form a marriage if and only if both parties benefit from the union. The *end-of-period* value function for married individuals $\tilde{V}^g_{M,t}\left(\bar{\Omega}_t\right)$ is discussed in section 3.7.

If a meeting does not result in marriage, both individuals will remain single, making optimal consumption and saving decisions in the subsequent stage of the period. For a single individual of gender g with states Ω_{gt}, the *end-of-period* value function $\tilde{V}^g_{S,t}\left(\Omega_{gt}\right)$ is given by

$$\tilde{V}^g_{S,t}\left(\Omega_{gt}\right)=\max_{c_t,a_{t+1}}u^{S,g}\left(c_t;\Omega_{gt}\right)+\beta E_t\left[V^g_{S,t+1}\left(\Omega_{gt+1}\right)\mid c_t,\Omega_{gt}\right], \tag{1}$$

subject to the budget constraint:

$$c_t+\frac{a_{t+1}}{1+r_{t+1}}=a_t+w^{g,e}_t.$$

$$a_{t+1}\geq \underline{a}, \quad c_t\geq \underline{c}$$

Here, c_t denotes consumption, a_{t+1} is the asset level carried into the next period, w^g_t is the wage of an individual of gender g, and $\underline{a}$ and $\underline{c}$ represent minimum asset and consumption levels, respectively.

3.7 Problem of Couples

At the beginning of each period t, married households decide whether to stay married or to divorce. This decision is driven by the spouses' updated match quality θ_t from the previous period. If they opt for divorce, both spouses incur a one-time penalty $\zeta\cdot\left(1+\zeta_e\mathbf{1}\left\{e_g=1\right\}\right)$.

The *start-of-period* value function $V^g_{M,t}\left(\bar{\Omega}_t\right)$ for each spouse g in the household characterized by $\bar{\Omega}_t$ is defined as follows:

$$V_{M,t}^{g}\left(\bar{\Omega}_t\right)=\begin{cases}\tilde{V}_{M,t}^{g}\left(\bar{\Omega}_t\right)+\varepsilon_t^{d,0} & \text{if } d_t\left(\bar{\Omega}_t\right)=0\\ \tilde{V}_{S,t}^{g}\left(\Omega_{gt}\right)-\zeta\cdot\left(1+\zeta_e\mathbf{1}\left\{e_g=1\right\}\right)+\varepsilon_t^{d,1} & \text{if } d_t\left(\bar{\Omega}_t\right)=1\end{cases}$$

where $d_t\left(\bar{\Omega}_t\right)$ is an indicator function denoting whether the couple divorces. The decision to stay married or divorce depends on a comparison between the value of remaining married, $\tilde{V}_{M,t}^{g}\left(\bar{\Omega}_t\right)$, and the value of becoming single, $\tilde{V}_{S,t}^{g}\left(\Omega_{gt}\right)$, minus the divorce penalty $\zeta\cdot\left(1+\zeta_e\mathbf{1}\left\{e_g=1\right\}\right)$. The comparison is subject to the temporary taste shocks for divorce $\boldsymbol{\varepsilon}_t^{d}$.

Unlike marriage decisions, which always require mutual consent, we model the transition from a mutual consent divorce regime to a unilateral divorce regime in the U.S. This transition occurs at state-specific times $t_{1,s}$. In the mutual consent regime (when $t<t_{1,s}$), divorce occurs only if both spouses prefer it:

$$d_t\left(\bar{\Omega}_t\right)=1 \text{ if } \tilde{V}_{M,t}^{g}\left(\bar{\Omega}_t\right)+\varepsilon_t^{d,0}<\tilde{V}_{S,t}^{g}\left(\Omega_{gt}\right)+\varepsilon_t^{d,1}-\zeta\cdot\left(1+\zeta_e\mathbf{1}\left\{e_g=1\right\}\right)\quad\forall g\in\{m,f\}.$$

However, once the unilateral divorce regime is in place (i.e., $t\geq t_{1,s}$), divorce can be initiated by just one spouse. In this case, divorce occurs if at least one spouse prefers to leave:

$$d_t\left(\bar{\Omega}_t\right)=1 \text{ if } \tilde{V}_{M,t}^{g}\left(\bar{\Omega}_t\right)+\varepsilon_t^{d,0}<\tilde{V}_{S,t}^{g}\left(\Omega_{gt}\right)+\varepsilon_t^{d,1}-\zeta\cdot\left(1+\zeta_e\mathbf{1}\left\{e_g=1\right\}\right)\quad\exists g\in\{m,f\}.$$

Upon divorce, children are randomly assigned to either the father or the mother[17].

As we discussed in section 3.6, the *end-of-period* value function of being single $\tilde{V}_{S,t}^{g}\left(\Omega_{gt}\right)$ is characterized by solving the optimal consumption and saving problem. Similarly, the *end-of-period* value function of staying married also maximizes over consumption, but the spouses are choosing one additional binary choice, which is whether the wife goes to work or not $h_t=0,1$.

To understand how the married couples choose the optimal c_t^{*} and h_t^{*}, we denote $\tilde{V}_{M,t}^{g}\left(c_t,h_t;\bar{\Omega}_t,\boldsymbol{\varepsilon}_t^{h},\boldsymbol{\varepsilon}_t^{\omega}\right)$ to be the *end-of-period choice-specific* value function for a spouse g, given the arbitrarily chosen c_t,h_t, conditional on the states $\bar{\Omega}_t$ and the realized taste shocks for female labor supply decision $\boldsymbol{\varepsilon}_t^{h}$ as well as the wage shock $\varepsilon_t^{\omega,m},\varepsilon_t^{\omega,f}$,

$$\begin{aligned}\tilde{V}_{M,t}^{g}\left(c_t,h_t;\bar{\Omega}_t,\boldsymbol{\varepsilon}_t^{h},\boldsymbol{\varepsilon}_t^{\omega}\right)=&\,u^{M,g}\left(c_t,h_t;\bar{\Omega}_t\right)+\theta_t\\&+\varepsilon_t^{0}\left(1-h_t\right)+\varepsilon_t^{1}h_t\\&+\beta E_t\left[V_{M,t}^{g}\left(\bar{\Omega}_{t+1}\right)\mid c_t,h_t,\bar{\Omega}_t\right].\end{aligned}$$

[17] When divorcees return to the marriage markets as singles, both of them will have state variable $n_{g,t}=1$ implying that whoever holds custody will receive support from the other, who will pay alimony and therefore the consumption levels of both parents should be affected.

We model the intra-household bargaining, and assume that the spouses jointly choose the optimal c_t^* and h_t^* to maximize the sum of household values $\tilde{V}_{M,t}\left(\bar{\Omega}_t, \boldsymbol{\varepsilon}_t^h, \boldsymbol{\varepsilon}_t^\omega\right)$ which is weighted by a constant bargaining power for the husband, ρ,

$$\tilde{V}_{M,t}\left(\bar{\Omega}_t, \boldsymbol{\varepsilon}_t^h, \boldsymbol{\varepsilon}_t^\omega\right) = \max_{c_t, a_{t+1}, h_t} \rho \tilde{V}_{M,t}^m\left(c_t, h_t; \bar{\Omega}_t, \boldsymbol{\varepsilon}_t^h, \boldsymbol{\varepsilon}_t^\omega\right) + (1-\rho)\, \tilde{V}_{M,t}^f\left(c_t, h_t; \bar{\Omega}_t, \boldsymbol{\varepsilon}_t^h, \boldsymbol{\varepsilon}_t^\omega\right), \tag{2}$$

subject to the household's budget constraint

$$c_t + \frac{a_{t+1}}{1+r_{t+1}} = a_t + w_t^{m,e} + w_t^{f,e} h_t,$$

$$a_{t+1} \geq \underline{a}, \quad c_t \geq \underline{c}.$$

The optimal consumption $c_t^*\left(\bar{\Omega}_t, \boldsymbol{\varepsilon}_t^h, \boldsymbol{\varepsilon}_t^\omega\right)$, saving $a_{t+1}^*\left(\bar{\Omega}_t, \boldsymbol{\varepsilon}_t^h, \boldsymbol{\varepsilon}_t^\omega\right)$, and wife's labor supply decisions $h_t^*\left(\bar{\Omega}_t, \boldsymbol{\varepsilon}_t^h, \boldsymbol{\varepsilon}_t^\omega\right)$ are functions of $\left(\bar{\Omega}_t, \boldsymbol{\varepsilon}_t^h, \boldsymbol{\varepsilon}_t^\omega\right)$ and are chosen to maximize $\tilde{V}_{M,t}\left(\bar{\Omega}_t, \boldsymbol{\varepsilon}_t^h, \boldsymbol{\varepsilon}_t^\omega\right)$. By substituting the optimal choices into the *end-of-period choice-specific* value functions, we obtain the $\left(\boldsymbol{\varepsilon}_t^h, \boldsymbol{\varepsilon}_t^\omega\right)$*-specific end-of-period* value function for each spouse g,

$$\tilde{V}_{M,t}^g\left(c_t^*\left(\bar{\Omega}_t, \boldsymbol{\varepsilon}_t^h, \boldsymbol{\varepsilon}_t^\omega\right), h_t^*\left(\bar{\Omega}_t, \boldsymbol{\varepsilon}_t^h, \boldsymbol{\varepsilon}_t^\omega\right); \bar{\Omega}_t, \boldsymbol{\varepsilon}_t^h, \boldsymbol{\varepsilon}_t^\omega\right),$$

and the *end-of-period* value function $\tilde{V^g}_{M,t}\left(\bar{\Omega}_t\right)$ is given by taking expectation over $\left(\boldsymbol{\varepsilon}_t^h, \boldsymbol{\varepsilon}_t^\omega\right)$,

$$\tilde{V}_{M,t}^g\left(\bar{\Omega}_t\right) = E_{\left(\boldsymbol{\varepsilon}_t^h, \boldsymbol{\varepsilon}_t^\omega\right)}\left[\tilde{V}_{M,t}^g\left(c_t^*\left(\bar{\Omega}_t, \varepsilon_t^h, \boldsymbol{\varepsilon}_t^\omega\right), h_t^*\left(\bar{\Omega}_t, \varepsilon_t, \boldsymbol{\varepsilon}_t^\omega\right); \bar{\Omega}_t, \varepsilon_t^h, \boldsymbol{\varepsilon}_t^\omega\right)\right].$$

3.8 Education

Individuals make educational decisions at the beginning of their life cycle, at age $j = 1$. Upon entering the economy, newborns observe their initial saving a_{gt}. They then form rational expectations regarding the lifetime benefits of pursuing higher education compared to not doing so. The lifetime values for an individual of gender g with state variables at time t for the two education choices are denoted by $V_{S,t}^g\left(j=1, e_g = h, n_{gt} = 0, a_{gt}\right)$ and $V_{S,t}^g\left(j=1, e_g = l, n_{gt} = 0, a_{gt}\right)$.

Educational decisions are also influenced by the individual's draw from a gender-specific distribution of utility cost of attending college, $\kappa^g \sim N\left(\mu^{\kappa,g}, \lambda^{\kappa,g}\right)$. The decision to attend college is based on whether the expected lifetime benefit of higher education outweighs the cost. Formally, an individual chooses to attend college if and only if:

$$V_{S,t}^g\left(j=1, e_g = h, a_{gt}, \eta_{gt}\right) - V_{S,t}^g\left(j=1, e_g = l, a_{gt}, \eta_{gt}\right) \geq \kappa^g. \tag{3}$$

3.9 Population Dynamics

The evolution of the single population, $ns_t^g(\Omega_{gt})$, is determined by the optimal educational and marital decisions made by each cohort at time t. The fraction of newborns who choose to pursue higher education at any time is given by Equation 3. Conditional on the individual's initial states a_{gt}, the population fraction of high-education newborns is:

$$\Phi\left(\frac{\kappa^g - \left(V_{S,t}^g(j=1, e_g=h, a_{gt}, \eta_{gt}) - V_{S,t}^g(j=1, e_g=l, a_{gt}, \eta_{gt})\right) - \mu^{\kappa,g}}{(\lambda^{\kappa,g})^{1/2}}\right),$$

where Φ is the cumulative distribution function of the standard normal distribution.

Each period there are outflows from the single population $ns_t^g(\Omega_{gt})$ due to successful marriages and the death of singles at age J. Inflows to single population consist of newborns and divorcees. Similarly, the evolution of the married population, $nm_t(\bar{\Omega}_t)$, is determined by inflows of newly married couples and outflows due to divorce or death.

The model does not consider either population growth or mortality risk. Hence, population sizes of each cohort remain constant over time and are normalized to 1 for simplicity.s

3.10 Marriage Market

The marriage market determines how singles meet and decide whether to form a household. We assume that the probability of meeting a potential partner at time t follows an increasing returns-to-scale (IRS) functional form:

$$\delta(M_t) = \frac{1}{1 + e^{-\alpha_0 + \alpha_1 M_t}}, \tag{4}$$

where $\delta(M_t)$ is the probability of a successful meeting, and M_t represents the size of the marriage market, defined as the population measure of available singles:

$$M_t = \frac{\sum_{g=m,f} \int_{\Omega_{gt}} ns_t(\Omega_{gt})\, d\Omega_{gt}}{2}.$$

Conditional on a successful meeting with probability $\delta(M_t)$, the probability for a meeting pair $(\Omega_{mt}, \Omega_{ft})$ is given by

$$\gamma_t(\Omega_{mt}, \Omega_{ft}) = \varphi^{ee'} \frac{ns_t(\Omega_{mt})}{\int_{\tilde{\Omega}_{ft}} ns_t(\tilde{\Omega}_{ft})\, d\tilde{\Omega}_{ft}}, \tag{5}$$

where $\varphi^{ee'}$ captures the level of homogamy in education.

3.11 Equilibrium

Given sequences $\mu_t^\theta, \lambda_t^E, \lambda_t^G, \lambda_t^\omega$ that govern the average match quality, wage structure, and the divorce regime, a *competitive equilibrium* is characterized by sequences of value functions $V_{S,t}^m$, $V_{S,t}^f$, $V_{M,t}^m$, $V_{M,t}^f$, $\tilde{V}_{S,t}^m$, $\tilde{V}_{S,t}^f$, $\tilde{V}_{M,t}^m$, $\tilde{V}_{M,t}^f$, $\tilde{V}_{M,t}$; sequences of marital, female labor supply, consumption, educational choices m_t, d_t, h_t, $c_{m,t}^S$, $c_{f,t}^S$, c_t^M, $e_{m,t}$, $e_{f,t}$; prices $p_t^{g,e}$; population dynamics ns_t^m, ns_t^f, nm_t; marriage market meeting probabilities δ_t, γ_t, such that for all t, the following conditions hold:

1. The educational choices $e_{g,t}$ solves the individual problem (3).

2. The optimal marital decisions m_t, d_t and the *start-of-period* value functions $V_{S,t}^g$, $V_{M,t}^g$ are consistent. In particular, the divorce decision d_t is consistent with the divorce regime in each state at time t.

3. The optimal consumption decisions $c_{g,t}^S$ solve the individual optimization problem for singles (1). The optimal consumption and female labor supply decisions c_t^M and h_t maximizes the weighted sum of household values (2).

4. Capital and labor inputs are chosen optimally,

$$r = \alpha Z_t \left(\frac{H_t}{K_t}\right)^{1-\alpha}$$

$$p_t^{m,l} = \chi_t^l \left(1-\lambda_t^G\right)\left(1-\lambda_t^E\right), \quad p_t^{m,h} = \chi_t^h \left(1-\lambda_t^G\right)\lambda_t^E$$
$$p_t^{f,h} = \chi_t^h \lambda_t^G \lambda_t^E, \quad p_t^{f,l} = \chi_t^l \lambda_t^G \left(1-\lambda_t^E\right)$$

   where

$$\chi_t^h \equiv (1-\alpha)\, Z_t K_t^\alpha H_t^{(1/\theta)-\alpha} \left[\lambda_t^G H_t^{f,e} + \left(1-\lambda_t^G\right) H_t^{m,e}\right]^{-1/\theta}.$$

5. The domestic labor market clears so that for each (g, e),

$$H_t^{g,e} = \int_{\Omega_t^g} I\left(e_g = e\right) ns_t^g\left(\Omega_t^g\right) d\Omega_t^g.$$

6. The domestic good market clears,

$$C_t + K_{t+1} = Z_t K_t^\alpha H_t^{1-\alpha},$$

   where C_t is the aggregate consumption.

7. The world asset market clears, such that

$$(A_{t+1} - K_{t+1}) - (A_t - K_t) = NX_t + r(A_t - K_t),$$

   where A_t is the aggregate domestic wealth.

8. The population dynamics ns_t^m, ns_t^f, nm_t are consistent with the optimal marital and educational choices $m_t, d_t, e_{m,t}, e_{f,t}$.

9. The marriage market meeting probabilities δ_t, γ_t are consistent with population distributions of singles ns_t^m, ns_t^f at each time t.

3.12 Transition

We assume that the economy is initially in an old steady state before the first data period. This initial steady state is characterized by a set of parameters $\mu_{old}^{\theta}, \lambda_{old}^{E}, \lambda_{old}^{G}, \lambda_{old}^{\omega}$, along with a mutual consent divorce regime.

The first shock, an unexpected change in the social attitude towards marriage and wage structure, occurs at an unknown time t_0, and is depicted by a sequence $\{\mu_t^{\theta}, \lambda_t^E, \lambda_t^G, \lambda_t^{\omega}\}_{t=t_0}^{\infty}$. This change is an unexpected shock to the agents at t_0, but the agents have correct belief about $\mu_t^{\theta}, \lambda_t^E, \lambda_t^G, \lambda_t^{\omega}$ after t_0. The economy is on the equilibrium transitional path from the old steady state towards a new steady state indexed by $\mu_{\infty}^{\theta}, \lambda_{\infty}^{E}, \lambda_{\infty}^{G}, \lambda_{\infty}^{\omega}$, under the unchanged mutual consent divorce regime.

A second shock occurs at time $t_{1,s}$, specific to state s, representing a switch from the mutual consent to the unilateral divorce regime. The economy's transition to the new steady state after this shock starts from the position given by the first transition path. This second shock, which is also unexpected, causes the economy to transition to a new steady state under the same parameters $\mu_{\infty}^{\theta}, \lambda_{\infty}^{E}, \lambda_{\infty}^{G}, \lambda_{\infty}^{\omega}$, but now under the unilateral divorce regime.

Figure 8 demonstrates an abstract illustration of the connected equilibrium transitional paths driven by the sequential unexpected shocks as described above. The blue dot represents the initial steady state, characterized by the old socioeconomic parameters and the mutual consent divorce regime. At time t_0, an unexpected shock pushes the economy onto the blue transitional path, which converges to the new steady state (represented by the blue star) under the mutual divorce regime. At time $t_{1,s}$, the economy diverges from the blue path onto the red transitional path due to the divorce regime reform, eventually converging to the red star representing the new steady state under the unilateral divorce regime.

We will estimate the model by fitting the connected equilibrium transitional path to the observed data, using the portion of the equilibrium path that corresponds to actual historical

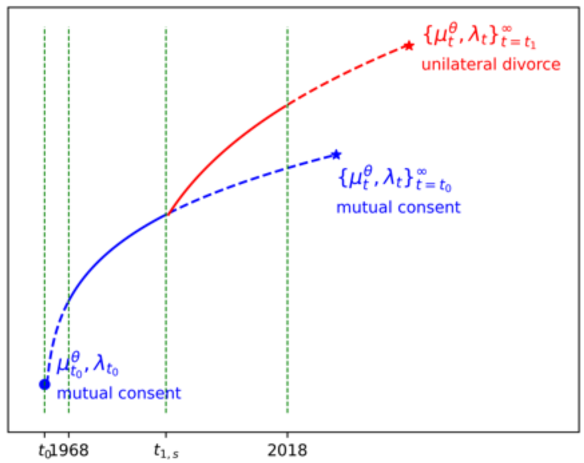

Figure 8: An abstract illustration of the connected equilibrium transitional path

transitions. Specifically, the solid segments of the connected equilibrium paths represent observable moments in the data, allowing us to directly align the model's predicted outcomes with real-world transitions during the period under study.

4 Estimation

To identify the primary factors driving labor and marriage market outcomes, we align our model's time series with connected equilibrium transition paths. Our estimation strategy combines calibration, simulated method of moments (SMM), and indirect inference.

We calibrate some parameters based on external sources and estimate others using SMM, targeting key moments. To enhance identification, we employ indirect inference by estimating dynamic response functions of outcomes (e.g., educational choice and marital choices) to state-specific divorce law reform timings. These empirical impulse responses serve as additional moments for our model to match, capturing short-term adjustments of the economy.

To generate model moments, we compute separate equilibrium transition paths for each state, accounting for differences in reform timing and initial savings distributions of newborns. This approach captures the heterogeneity in policy implementation and economic conditions across states. We then aggregate state-level outcomes, weighted by population size, to match national data moments. We also use the model generated simulation data to compute counterparts of the auxiliary regression results.

Parameter		Value
γ	Relative risk aversion	1.50
α	Capital share of output	.33
θ	Elasticity of substitution for workers given education	1.43
ρ	Intra-household bargaining power of husband	0.70
r	Risk-free interest rate	.05
$L(j)$	Wage life cycle profile	see Figure 26
$\Pr(n=1)$	Fertility process	see Figure 27
$\mu(\mu^{a,s}, \lambda^{a,s})$	Initial distribution of savings	see Figure 28
t_0	Timing of the socioeconomic shock	1963

Table 1: Externally calibrated model parameters

4.1 Calibration

We calibrate several parameters based on external sources and widely accepted values in the literature. Table 1 summarizes these externally calibrated parameters.

The relative risk aversion parameter γ is set to 1.5, following Heathcote, Storesletten, and Violante (2010). This value is within the range commonly used in macroeconomic models and captures households' risk preferences. The capital share of output α is set to 0.33, a standard value in the macroeconomic literature that reflects the historical average of capital's share in national income (Gollin (2002)). The elasticity of substitution between workers with different education levels, ϑ, is set to 1.43. This value is taken from Heathcote, Storesletten, and Violante (2010) and is consistent with estimates from Katz and Murphy (1992). We set the intra-household bargaining power for the husband to be 0.7, in line with Voena (2015). The annual risk-free interest rate r is set to 0.05, which is a commonly used value in the literature and consistent with the average real return on government bonds over the long term (Mehra and Prescott (1985)).

The wage life cycle profile $L(j)$ is calibrated using data from the Current Population Survey (CPS)[18]. This profile captures the typical evolution of wages over an individual's working life. We also exogenously estimate and impose fertility process and initial saving distribution as model inputs.

We calibrate the timing of socioeconomic shock to be in year 1963[19].

[18] We use the low education male worker as the reference group to compute $L(j)$.

[19] In our model, the underlying socioeconomic shock is not fixed at the first data period (1968). Instead, we can actually estimate it, while it is computationally expensive. Currently, we calibrate it to be the earliest year in order to make the model able to explain the high education fraction observed in 1968. In the data, we compute the high education fraction between age 25 and 29 in year 1968, which we assume to be decisions made 5 years ago (i.e. 1963) which aligns with our model setting.

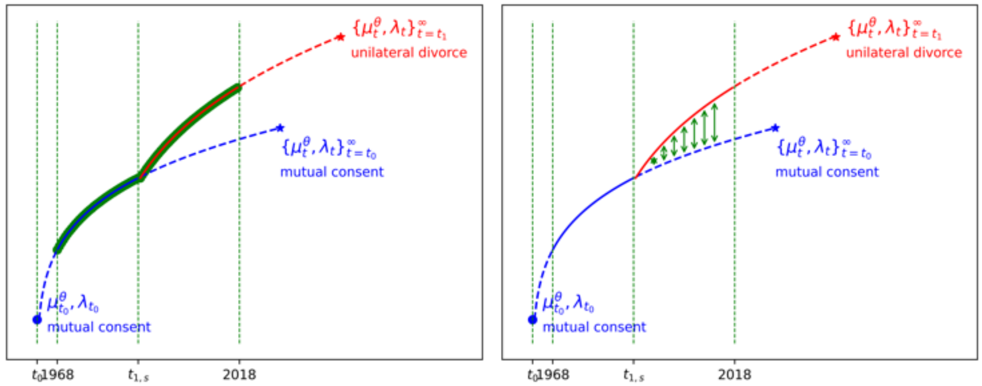

Figure 9: Estimation strategy: national moments and dynamic response function

4.2 Estimation Strategy

We will estimate the remaining parameters by fitting the connected equilibrium transition path to the data, as illustrated in Figure 9. Most straightforwardly, we will match the observable part of the connected equilibrium transition path to the corresponding data moments. This corresponds to the green highlighted bold line in the left panel. Note that such connected equilibrium transition paths will be state-specific. We will compute transition dynamics for each state and then calculate the average weighted by the population size of each state[20].

Recognizing that the second half of the first transition path is not observable, there could be multiple sets of parameters that generate the same first half of the red line. To aid in identifying the model, we will attempt to add the difference between the blue and red transition paths, as shown in the right panel. In other words, we will utilize the short-term dynamic response function to the policy shock to address the observational equivalence issue. Because the second half of the blue transition path is not observable, we will utilize the variation in the timing of divorce law reforms among states and estimate a dynamic response function using an auxiliary model to provide additional support for identification.

We will estimate the model parameters by minimizing the data and model moments

$$\min_{\theta \in \Theta} \left[m(\theta) - m^{data} \right] W \left[m(\theta) - m^{data} \right]'$$

where $m(\theta) = [m_1(\theta), m_2(\theta)]$, where $m_1(\theta)$ is the vector of national moments and $m_2(\theta)$ consists of auxiliary model parameters.

[20]Ideally, we would like to match the empirical transitional dynamics for each state, but it is difficult due to the data limitation. The CPS data does not provide large enough sample for computing moments by states accurately.

4.3 National Moments

We include a comprehensive set of data moments in $m_1(\theta)$ that capture key trends in labor and marriage markets from 1968 to 2018. These moments, derived from the Current Population Survey (CPS), reflect the significant shifts in educational attainment, wage structures, marital patterns, and labor force participation observed over the past five decades. Specifically, we target five categories of moments: (1) fractions of individuals with some college education or above for ages 25-29, by gender and year; (2) high-to-low education wage ratios, by gender and year; (3) female-to-male wage ratios, by education level and year; (4) male worker wage volatility over year; (5) employment rates of married women aged 25-50, by education and year; (6) never-married population fractions at age 30, by gender, education, and year; (7) fractions of divorcees among the population aged 25-39, by education and year; (8) average savings, by single and married household type and year; (9) average savings, by single and married household type and year.

These targeted moments are carefully chosen to capture the interplay between labor market dynamics and marriage market outcomes, which is central to our model. The education, wage structure aspects, and employment rate moments (categories 1-5) allow us to track the evolution of the labor market, including the college premium, the narrowing gender wage gap, increasing wage volatility, and increased female labor force participation. The marriage market moments (categories 6-7) reflect the trends towards delayed marriage and changing marital stability, which our model aims to explain through the lens of evolving economic incentives and legal transformations. We also want our model to replicate the saving behaviors observed in the data (categories 8-9).

4.4 Indirect Inference

To enhance our model's identification and capture the dynamic effects of divorce law reforms, we employ an indirect inference approach, estimate a dynamic response function similarly as in Voena (2015) and Wolfers (2006) and use it as the auxiliary model. This approach allows us to exploit the variation in the timing of divorce law reforms across states, recovering the dynamics of the economy in response to the policy shock, providing a powerful tool for identifying the model's parameters and validating its predictions.

$$\text{Outcome}_{s,t} = \sum_{k\geq 1} \beta_k \text{Unilateral divorce has been in effect for k periods}_{s,t} + \sum_s \text{State fixed effects}_s + \sum_t \text{Time fixed effects}_t \quad (6)$$

In equation 6, $\text{Outcome}_{s,t}$ represents various labor and marriage market outcomes (e.g., high educated worker fractions, female labor participation rates, never married population fractions, divorced population fractions) in state s and year t. β_k captures the effect of unilateral divorce laws k years after implementation. We control for state fixed effects and time fixed effects.

This specification is inspired by Wolfers (2006), who used a similar approach to study the dynamic effects of unilateral divorce laws on divorce rates. We extend this methodology to examine a broader range of outcomes including population fractions of never married and divorcees, as well as educational choices by both men and women[21].

The key independent variables are a series of dummy variables indicating how long unilateral divorce has been in effect in a given state. This allows us to capture both immediate and long-term effects of the policy change, addressing potential anticipation effects and gradual adjustments in behavior.

We estimate this auxiliary model using both actual data and model-simulated data. The estimated coefficients β_k from the actual data become additional moments $m_2(\theta)$ to match in our SMM estimation. By matching these dynamic response coefficients, we ensure that our structural model can replicate not just the overall trends in the data, but also the specific timing and magnitude of responses to divorce law changes.

5 Results

This section presents our main empirical findings and their implications for understanding the transformation of US families over the past five decades. We begin by demonstrating the model's ability to match key trends in both labor and marriage markets (Section 5.1), validating our methodological approach of using connected equilibrium transition paths. We then decompose the relative contributions of different factors—wage structure changes, shifting at-

[21] In this paper, we do not attempt to match the response of married female labor supply decision when there is divorce regime switch shock. Intuitively, married female labor supply may be boosted by the increasing divorce risk, mostly in fear of depreciation of human capital. However, our model is already complicated enough that we cannot incorporate another intensive dimension of working experience.

Parameter		Value
ψ_h, ψ_n	Disutility from work	0.5744,0.2395
$\phi_{S,0}, \phi_{S,1}, \phi_{M,0}, \phi_{M,1}, \phi_2$	Terminal value parameters	0.7916, 0.1437, 0.0038, 1.1548, 0.0160
ζ, ζ_e	Utility penalty on divorce	7.7750, 0.4999
ρ_θ	Match quality shock probability	0.2945
$\lambda^\theta, \lambda^h, \lambda^d$	Variance of preference shocks	6.9896, 19.9564, 0.3661
$\mu^{\kappa,m}, \lambda^{\kappa,m}, \mu^{\kappa,f}, \lambda^{\kappa,f}$	Mean and variance of utility cost for college attendance	7.4430, 1.8577, 14.5052, 2.8034
$\phi_{ee}, \alpha_0, \alpha_1$	Meeting probability parameters	0.4136, 0.3068, 0.0445
$\mu_t^\theta, \lambda_t^E, \lambda_t^G, \lambda_t^\omega$	Wage structure parameters	See Figure 10

Table 2: Estimates

titudes toward marriage, and divorce law reforms—in driving observed outcomes (Section 5.2). Finally, we explore the evolving interplay between labor and marriage market incentives for educational attainment, revealing a fundamental shift in the nature of human capital investment (Section 5.3).

Estimated model parameters are presented in detail in table 2.

5.1 Model Fit

Our structural model captures the complex transformation of the US family outcomes across multiple dimensions. Rather than simply matching moments, the model reproduces intricate patterns of change that emerged from the interplay between labor markets, marriage markets, and policy reforms. This section examines how well our estimated model tracks the data across key outcomes.

Figures 11 reveals one of the most striking social transformations of the late 20th century: the reversal of the gender education gap. From 1968 to 1980, both men and women increased college attendance at similar rates, rising from about 35% to 45%. The 1980s marked a critical divergence point where women's college attendance accelerated while men's stagnated. By 2018, the gap had completely reversed, with women's college attendance rate reaching 70% compared to men's 63%. The model is able to capture this reversal through endogenously changing economic incentives rather than imposing it mechanically.

Other aspects of labor market evolution are also captured by the model. Figure 12 demon-

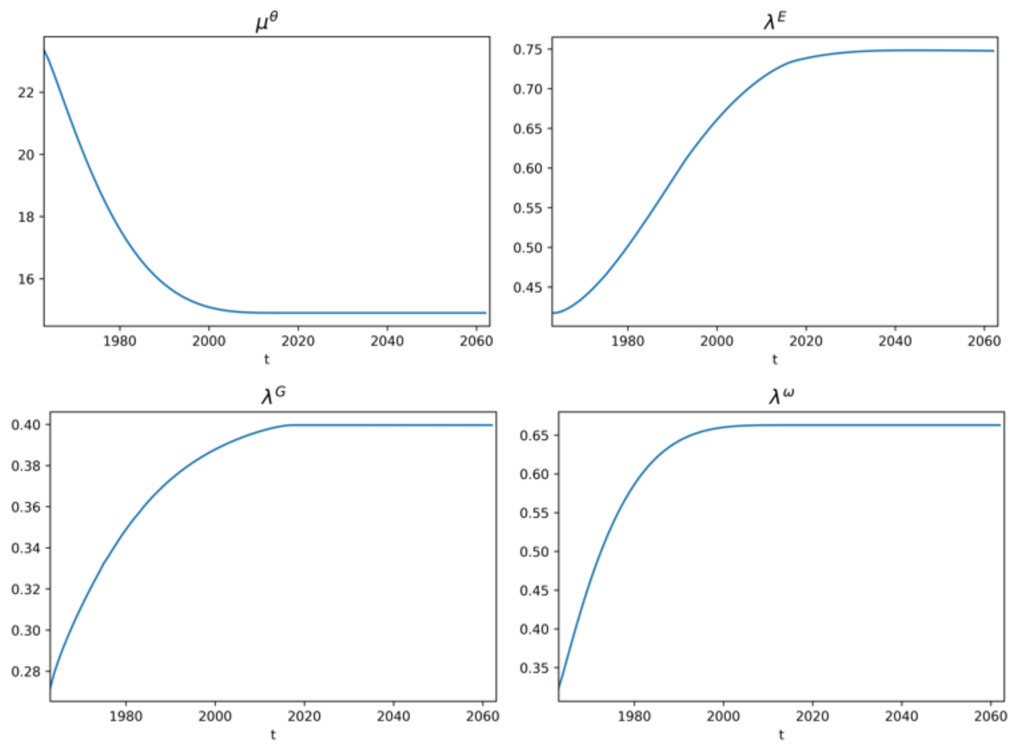

Figure 10: Underlying driving forces

strates that our empirical model generates wage structure evolutions as we observe in data. These model outcomes are driven by the underlying technology shifts from the production side, and are consistent with individual optimal labor supply and educational choices.

Turning to marriage markets, Figure 13 presents a tale of two dramatic changes in family formation: the delay of marriage and the rise and fall of divorce. Never-married rates at age 30 rose from under 10% to over 30% for both genders, representing an extraordinary shift in life-cycle timing. The model not only matches the overall magnitude but also captures important nuances among different educational groups.

The evolution of divorce presents one of the most complex patterns in family demography. Divorce rates tripled from 1968 to 1980, then gradually declined, creating a distinctive hump shape. Our model successfully reproduces this pattern through three mechanisms: the immediate release of "trapped" marriages when unilateral divorce became available, selection effects as the composition of married couples changed, and behavioral adaptation as new generations internalized the reality of marital instability.

Figure 14 provides the stringent test of our model by examining dynamic responses to divorce law reforms. Unlike the gradual evolution of most outcomes, divorce reforms created sharp policy experiments that allow us to test whether our model captures behavioral responses correctly. The model matches the empirical finding that divorce reform had different effects on

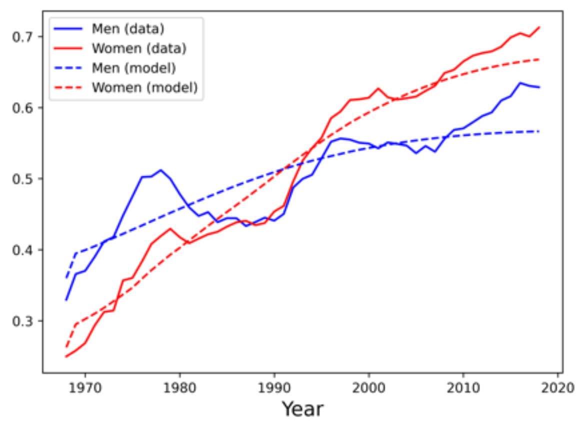

Figure 11: Model fit: college attendance

Figure 12: Model fit: wage structure

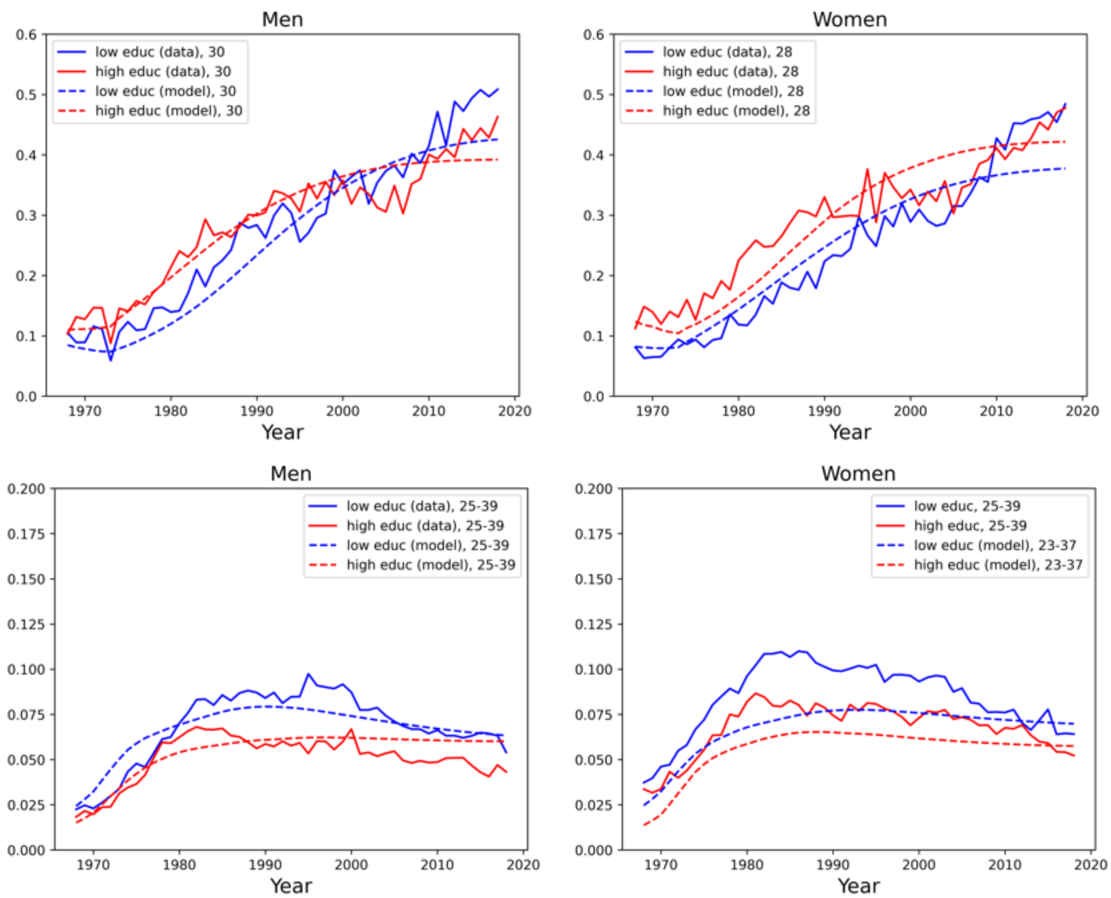

Figure 13: Model fit: marriage markets evolution

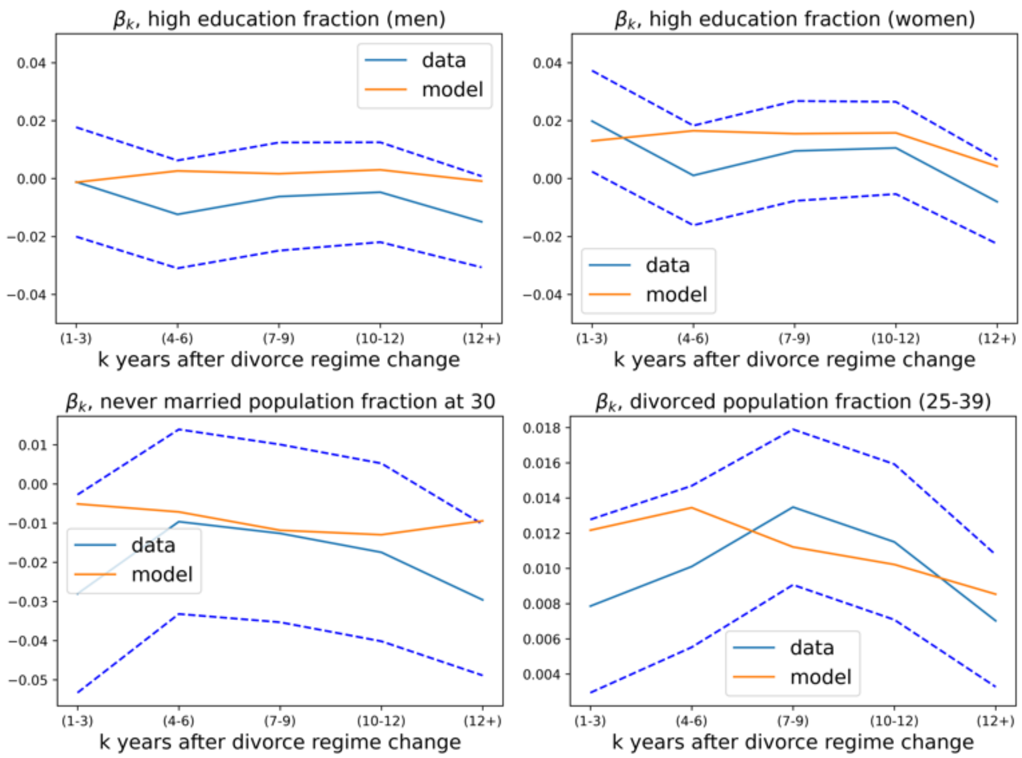

Figure 14: Model fit: dynamic response functions

education by gender. The population fraction of never married will decline after the divorce regime switch, and the model matches both the signs and the levels.

The divorced population response shows a sharp initial increase in both the data and the model, followed by a gradual decline, correctly capturing the overshooting effect of divorce liberalization documented in the literature. The close alignment between the empirical and simulated responses in terms of sign, direction, and timing across these various outcomes provides strong validation of the model's ability to capture not just long-term trends, but also the complex short-term dynamics following policy changes.

Figure 15 shows the model fitting of married female labor supply. Overall, we match the patterns showing that married female labor supply increases over time, with the high-education group having higher participation rates.

The current model does not generate a more significant increase in female labor supply over time, mainly due to the absence of one model feature: working experience. Married female labor supply decisions would respond more positively to divorce law reform and increasing divorce risk if there were deterioration of human capital when not working. However, modeling this feature requires additional individual state dimensions and is not feasible under current computational resource constraints. Nevertheless, the current model successfully matches overall married female labor supply levels.

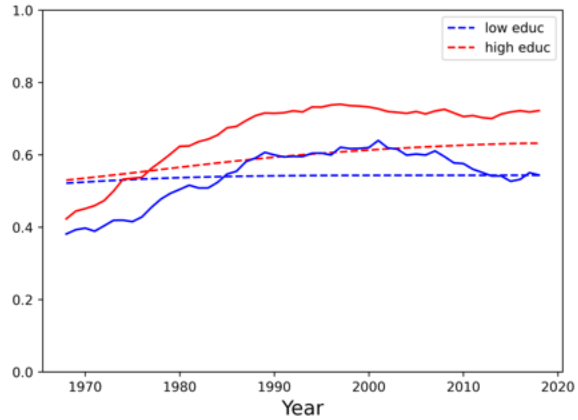

Figure 15: Model fit: married female labor supply

Taken together, our model demonstrates remarkable success in capturing 50 years of family change across multiple dimensions simultaneously. All outcomes emerge from a single set of parameters and mechanisms—we do not separately calibrate different parts of the model to match different outcomes. The model matches not just long-run trends but also transition dynamics, including non-monotonic patterns. Most importantly, aggregate patterns emerge from individual optimization, ensuring that our results reflect actual behavioral responses rather than mechanical relationships. The strong fit across labor markets, marriage markets, and household behavior validates our approach of modeling these with a unified framework. The next sections explore what this unified model reveals about the driving forces behind family change.

5.2 Decomposition Analysis

To understand which forces drove the dramatic changes in family outcomes, we decompose the total effect into contributions from individual factors. This analysis reveals interactions and offsetting effects that would be missed by examining each factor in isolation.

We construct six counterfactual economies to isolate individual effects:

1. Baseline: This is our fitted model that incorporates all changes in socioeconomic changing parameters (μ_t^θ, λ_t^E, λ_t^G, λ_t^ω) and the divorce law reforms.

2. Case 1: In this scenario, only the average match quality (μ_t^θ) changes over time, while all wage structure parameters remain constant and no divorce law reform occurs.

3. Case 2: In this scenario, only the college premium (λ_t^E) changes over time, while other socioeconomic parameters remain constant and no divorce law reform occurs.

4. Case 3: Here, only the gender wage gap (λ_t^G) narrows over time, with other factors held constant and no divorce law reform.

5. Case 4: This case isolates the effect of increasing wage volatility (λ_t^ω), keeping other factors constant and without divorce law reform.

6. Case 5: In this scenario, all socioeconomic parameters (μ_t^θ, λ_t^E, λ_t^G, λ_t^ω) stay at their initial (t_0) levels, but the divorce law reform is implemented as in reality.

For each counterfactual, we simulate the full transition path from 1968 to 2018, allowing for general equilibrium effects and dynamic adjustments. This approach reveals both direct effects and indirect channels operating through equilibrium prices and marriage market composition.

The following figures demonstrate the evolutions of key family outcomes in each hypothetical economy.

Figures 16-18 show the decomposition of educational attainment. While the overall increase in college attendance is substantial, our analysis uncovers important opposing forces that partially offset each other.

For men, the rising college premium (Case 2) would have generated even higher educational attainment if operating in isolation—the green line in Figure 16 rises well above the baseline. However, this effect is partially offset by changing marriage patterns. The decline in match quality and increasing marital instability actually discourage male educational investment. In a world where marriages are less common and less stable, education loses value as a signal in the marriage market. The net increase in male college attendance thus occurred despite, not because of, changes in family formation patterns.

For women, the story differs dramatically. All factors reinforce each other: rising college premiums provide direct economic returns, improving relative wages increase the opportunity cost of staying home, and marital instability creates insurance motives for human capital investment. This alignment of incentives helps explain why women's educational gains outpaced men's during this period, eventually reversing the historical gender gap in college attendance.

It is no surprise that the increase in λ^E is the dominating factor for explaining the increase in high education workers. However, it is also meaningful to assess the magnitudes of other factors. As such, we conduct additional experiments where λ^E increased only 5%, 10%, or 20% percent. Figure 17 shows that the magnitude of other factors roughly corresponds to the increase in λ^E with 5%, and in the opposite directions.

For women, the decrease in match quality μ_θ and unilateral divorce law are equivalent to a 20% increase in λ^E, and the shrinking gender wage gap λ^G incentivized even more college attendance. The factor of increasing idiosyncratic wage volatility is equal to a 10% increase in λ^E.

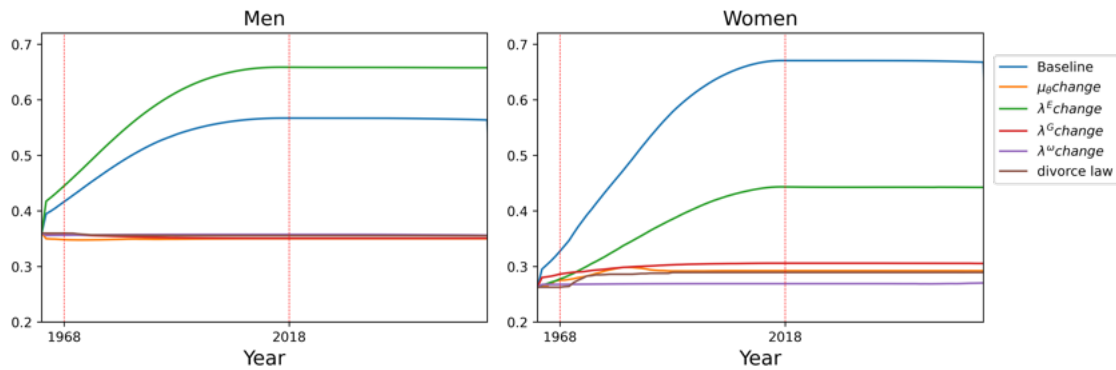

Figure 16: Decomposition analysis: education

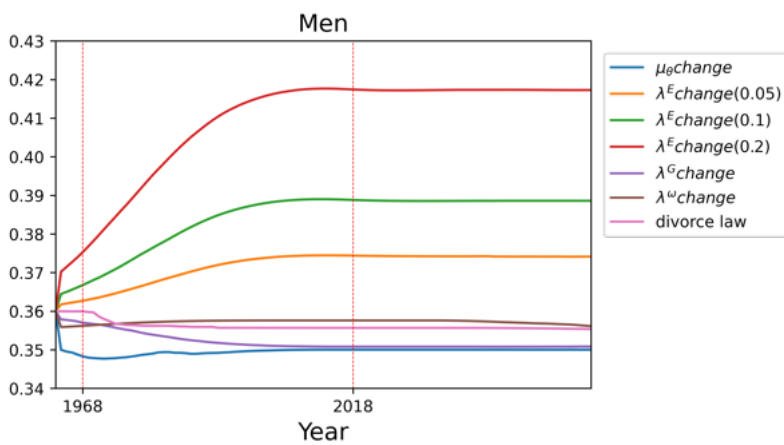

Figure 17: Decomposition analysis: education (small λ^E change, men)

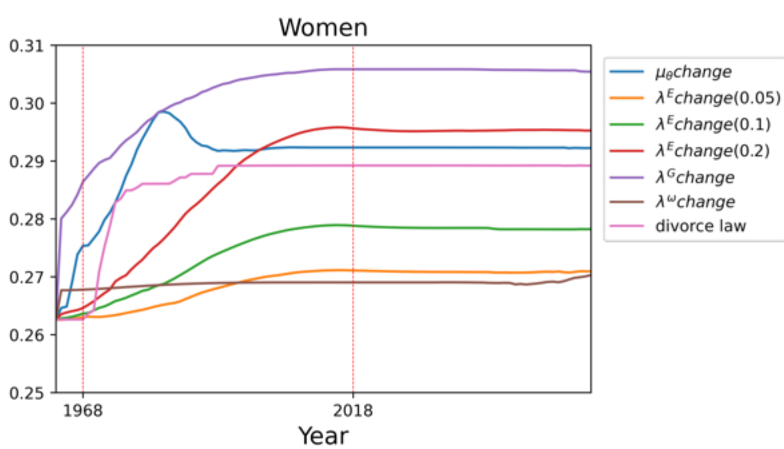

Figure 18: Decomposition analysis: education (small λ^E change, women)

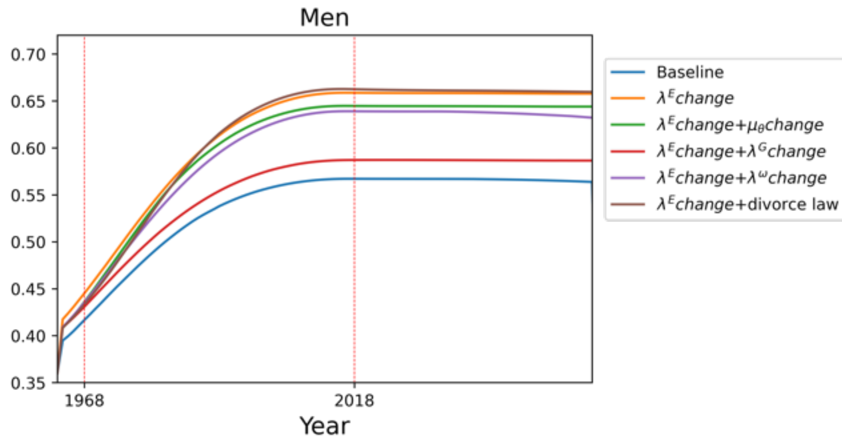

Figure 19: Decomposition analysis: education, men (interaction with other factors)

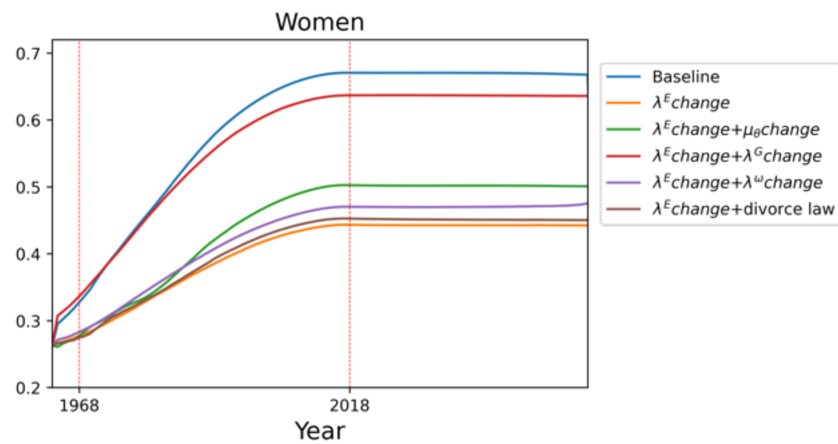

Figure 20: Decomposition analysis: education, women (interaction with other factors)

To better understand which factor interacts with the technological shift in λ_t^E and pulls back higher education attainment for men and boosts for women, we compute counterfactual transitions for combinations of underlying factor changes, as figures 19 and 20 show. The red lines are closest to the blue lines which are the baseline cases, and are futherest away from the orange lines which are the cases where only λ_t^E changes. The red lines are the cases where both λ_t^E and λ_t^G change, indicating that the historical comovement of shrinking gender wage gap significantly modifies how the incentives for higher education change for men and women, through the endogenous price determination and labor market competition between genders.

Figure 21 demonstrates that declining match quality—our proxy for changing social attitudes toward marriage—dominates other factors in explaining delayed marriage. This finding has important implications for policy: economic interventions aimed at promoting marriage may have limited effects if cultural factors are the primary driver.

The rising college premium contributes secondarily to marriage delay. When more individ-

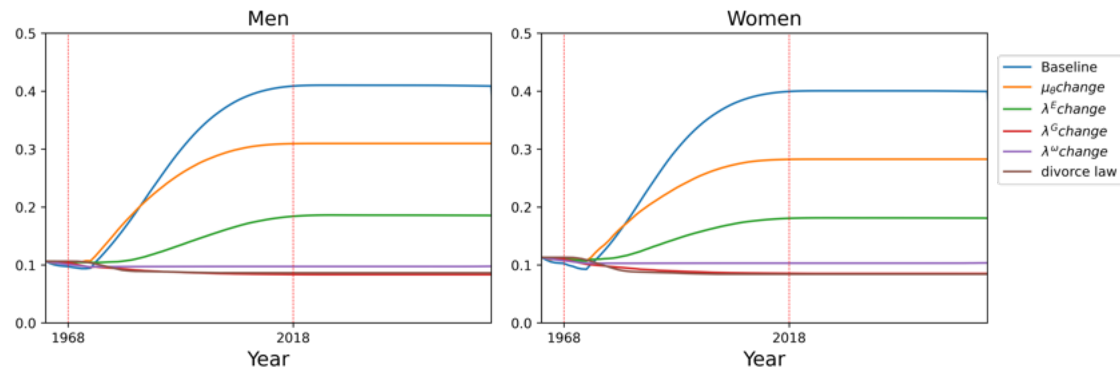

Figure 21: Decomposition analysis: never married

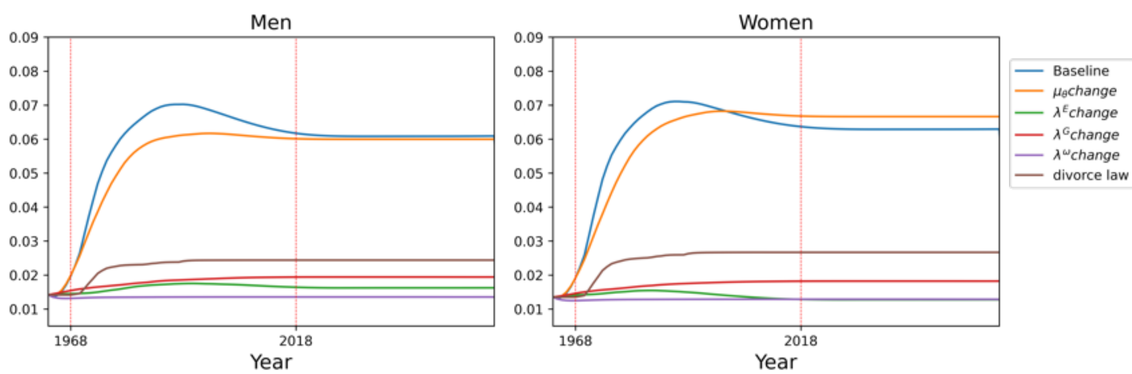

Figure 22: Decomposition analysis: divorce

uals attend college and have higher labor income to support their single lives, they can afford longer period of marriage search and will be more selective to enter first marriage.

The decomposition of divorce trends (Figure 22) clearly identifies declining match quality as the fundamental driver, accounting for almost all the long-run increase in divorce rates. Divorce law reform, while generating dramatic short-run dynamics, has modest long-run effects—the stock of marriages adjusts to reflect easier exit options, but the flow of new divorces eventually returns near baseline levels.

Figure 23 reveals that improving relative wages explain the vast majority of increased married women's labor force participation. This dominance of wage effects over other factors suggests that women's entry into the labor force was primarily an economic phenomenon.

Figure 24 provides detailed insights into how divorce law reform affected different outcomes. The reform generated opposing effects on male and female education: women increased educational investment for insurance purposes, while men reduced it as marriage became a less reliable institution. Divorce law regime change also decreases the proportion of never married population. Note that the fractions of "never married" and "single" can be distinct: even though unilateral divorce regime may cause more population to stay single, the frac-

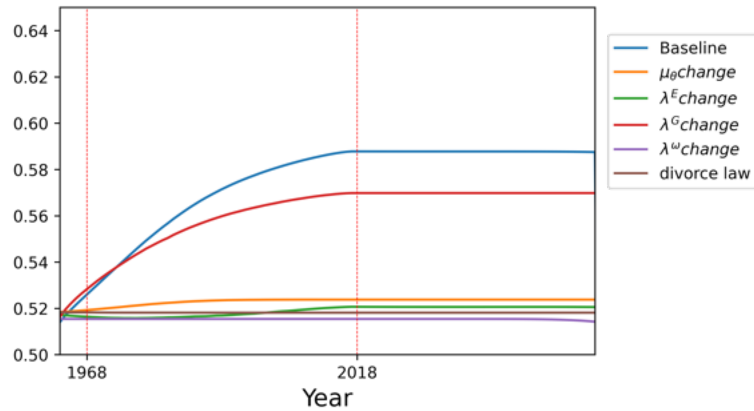

Figure 23: Decomposition analysis: married female labor supply

tion of "never married" will decrease since individuals are less hesitant to enter marriages when it is easy to exit bad marriages later.

5.3 Decomposing Motives for High Education

Using our estimated model, we further analyze the interactions between labor and marriage markets to understand the drivers behind increasing educational attainment. As revealed in the decomposition analysis in Section 5.2, the primary driver behind this trend is the growing college premium. This premium impacts both labor and marriage markets by making higher education more appealing.

From a labor market perspective, individuals with higher education tend to earn significantly higher wages, leading to increased consumption and a better standard of living. This economic incentive encourages more individuals to pursue higher education. Simultaneously, the marriage market rewards higher education by offering better prospects for marriage, as higher-educated individuals are considered more desirable partners.

In this section, we seek to decompose the relative contributions of labor market and marriage market effects in driving the increase in the population with high educational attainment. Specifically, we focus on quantifying the added value of higher education at each point in time by comparing the lifetime benefits of being highly educated versus having lower educational attainment:

$$V^g_{S,t}\left(j=1, e_g=h, n_{gt}, a_{gt}\right) - V^g_{S,t}\left(j=1, e_g=l, n_{gt}, a_{gt}\right), \quad g \in \{m, f\} \tag{7}$$

To estimate the contribution from the labor market, we simulate life cycles where individuals are forced to remain single. This allows us to isolate the "labor market effect," represented by the lifetime wage benefits associated with higher education. The residual difference, after ac-

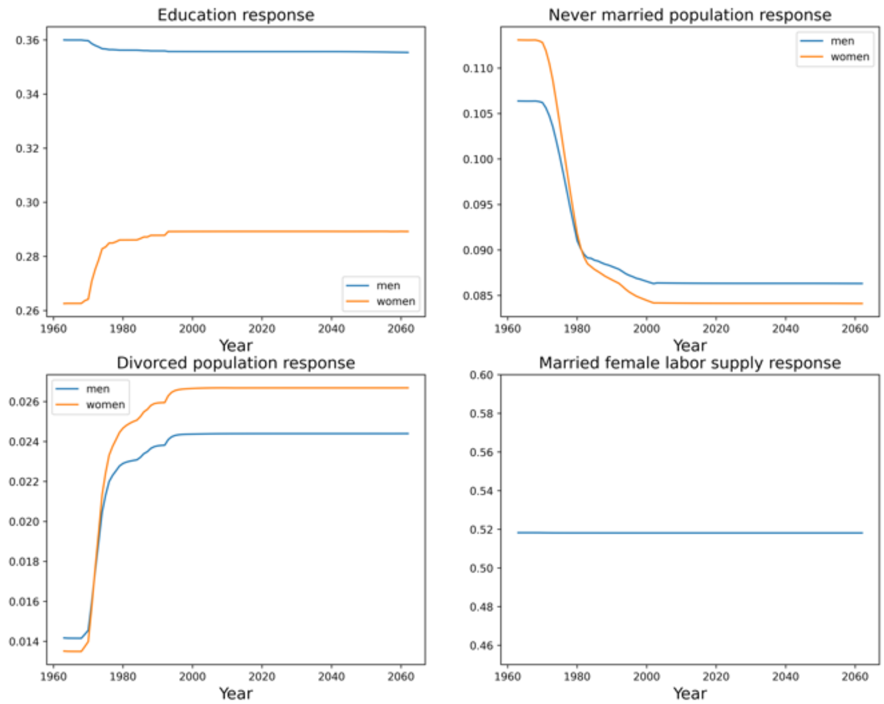

Figure 24: Divorce law reform responses

counting for the labor market effect, can then be attributed to the "marriage market effect," which reflects the enhanced marriage prospects associated with higher education.

Figure 25 illustrates how these two effects have evolved over time. The top left panel shows the actual evolution of the difference in lifetime values with or without education conditional on gender, and the right panel shows the normalized difference by dividing the standard deviation of utility cost to attend college, $(\lambda^{\kappa,g})^{1/2}$. The bottom two panels show the "labor market" and "marriage market" contributions.

The "labor market" values are the lifetime differences in utilities due to different levels of consumptions driven by labor income differentials. The "marriage market" values are negative, indicating that having access to marriage actually ameliorate the lifetime value differences, since both low and high education individuals can better smooth consumption by pooling wage income after getting married.

The relative order of "marriage market" contributions indicate how important the consideration of marriage market prospects associated with high education is. This "marriage" residual is higher for men than women, meaning that men are more driven by the marriage market prospects to obtain a college diploma. The marriage market residuals are decreasing over time, meaning that for both men and women, the marriage market prospects associated with higher education are becoming less important when they make decisions of college attendance at age 20. This is consistent with the actual marriage delay over time.

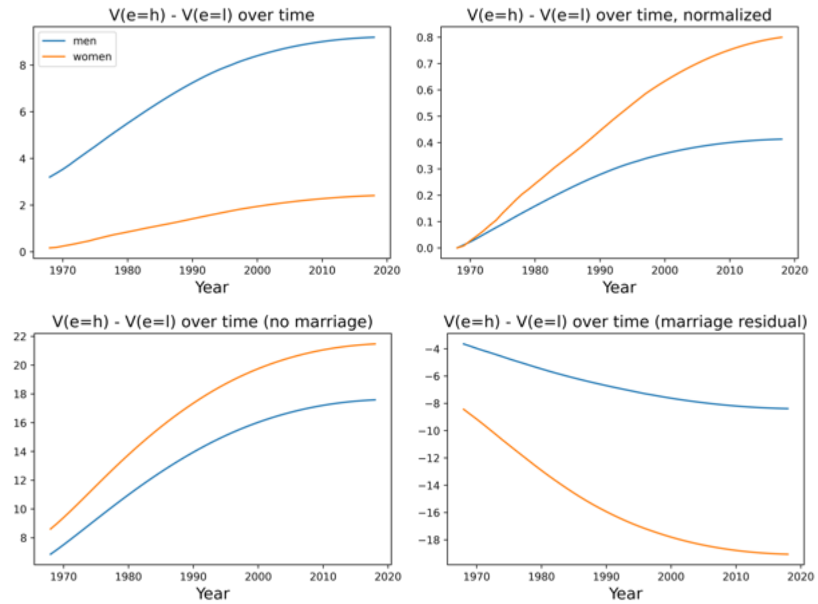

Figure 25: Decomposing motives for high education

6 Conclusion

This paper provides a comprehensive analysis of the dramatic transformation of the US family life over the past five decades through the lens of interconnected labor and marriage markets. Our findings reveal a complex web of interactions where technological change, evolving social norms, and legal reforms combined to reshape individual life-cycle decisions in ways that fundamentally altered the structure of the US families.

The empirical analysis demonstrates that the increasing college premium served as the primary engine driving educational expansion, but its effects operated through distinctly different channels for men and women. Women experienced a remarkable alignment of incentives where rising educational returns, improving relative wages, and increasing marital instability all pointed toward greater human capital investment. This convergence of forces explains not only the dramatic increase in female educational attainment but also the historic reversal of the gender education gap that occurred during our sample period. For men, the economic benefits of education were partially offset by declining marriage market returns as the institution of marriage itself became less central to life planning.

Our examination of marriage and divorce patterns reveals the powerful influence of changing social attitudes, which dominated economic factors in explaining delayed marriage. The decline in what we term "match quality" captures a broader cultural shift in how people value marriage as an institution. Simultaneously, divorce law reforms created strong short-term dynamics while having more modest long-term effects. The reforms succeeded in releasing couples trapped in unhappy marriages but also reduced barriers to marriage formation by making exit easier, in which way it decreased the population fraction of “never married” individuals in recent years.

Methodologically, our approach of using connected equilibrium transition paths combined with indirect inference provides a template for analyzing complex, multi-market transitions in other contexts. By moving beyond traditional two-steady-state comparisons, we demonstrate how researchers can capture the rich dynamics that characterize real-world policy and social changes.

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Online Appendix

A. Data Description

This paper uses data from the Current Population Survey (CPS) March Annual Social and Economic Supplement (ASEC) for the years 1968-2018. We use both cross-sectional and longitudinal subsets to compute data moments.

The analysis sample consists of both married and single households with individuals aged 20-49. To ensure data quality and consistency, the sample excludes observations with missing values for key variables including gender, age, educational attainment, marital status, labor force participation, and earnings (if employed).

Education is coded as a binary variable distinguishing between high education (some college or above) and low education (high school degree or below). Educational attainment is measured for individuals aged 25-29 to capture completed education levels while avoiding selection issues from delayed completion. For wage calculations, annual earnings are converted to 1968 US dollars using the Consumer Price Index (CPI). We focus on the reported annual wage.

Marital status is categorized as never married, currently married, divorced, widowed, or separated.

State of residence information is crucial for the analysis as it allows matching individuals to state-specific divorce laws, accounting for variation in implementation of unilateral divorce, and computing state-specific moments. This geographic detail enables the paper to exploit state-level policy variation in the empirical analysis.

We compute saving data by dividing the variable “INCINT” (reported annual income from interest payment) by the actual interest rate in that year, adjust for inflation, and measure them in 1968 US dollars.

The paper constructs several key variables for analysis. The college premium is calculated as the ratio of average wages between high and low education workers, computed separately by gender for full-time workers aged 25-49. The gender wage gap is computed as the ratio of female to male average wages, calculated separately by education level. Marriage market statistics include never married ratios (fraction reporting "never married", age 30 for men and age 28 for women), divorce ratios (fraction reporting "divorced", men aged 25-39 and women aged 23-37). Female labor supply is measured through employment rates for married women aged 25-49, calculated separately by education level.

B. Divorce Law Reform

Prior to the 1960s, divorce in the United States operated under a fault-based, mutual consent system that required both proof of marital misconduct (such as adultery, abandonment, or physical abuse) and agreement from both spouses to terminate the marriage. This system was widely criticized for creating substantial financial and emotional transaction costs in the divorce process.

Starting in the late 1960s, states began implementing two major reforms to divorce laws. The first was the introduction of no-fault divorce, which eliminated the requirement to prove marital misconduct and allowed divorce on grounds of "irreconcilable differences" or similar no-fault bases. While some states had adopted no-fault divorce as early as the 1930s, it became widespread in the 1970s (Gruber 2004). The second and more consequential reform was the shift to unilateral divorce, which removed the requirement for mutual consent and allowed either spouse to initiate and obtain divorce without the other's agreement (Voena 2015).

C. Externally calibrated parameters

We estimated the deterministic wage profile over age, $L(j)$, directly from CPS data and use this as an external input in model computation. We use employed male workers with low education as the reference group and compute average annual wages conditional on ages from 20 to 49. The blue solid line represents the data, and the orange line shows the smoothed profile using a second-degree polynomial function, which is used as the model input. Note that we measure wage in 1968 US dollars.

State	Year	State	Year
Alabama	1971	Montana	1973
Alaska	pre-1967	Nebraska	1972
Arizona	1973	Nevada	1967
Arkansas	no	New Hampshire	1971
California	1970	New Jersey	no
Colorado	1972	New Mexico	pre-1967
Connecticut	1973	New York	no
Delaware	1968	North Carolina	no
District of Columbia	no	North Dakota	1971
Florida	1971	Ohio	1992
Georgia	1973	Oklahoma	pre-1967
Hawaii	1972	Oregon	1971
Idaho	1971	Pennsylvania	no
Illinois	no	Rhode Island	1975
Indiana	1973	South Carolina	no
Iowa	1970	South Dakota	1985
Kansas	1969	Tennessee	no
Kentucky	1972	Texas	1970
Louisiana	no	Utah	1987
Maine	1973	Vermont	no
Maryland	no	Virginia	no
Massachusetts	1975	Washington	1973
Michigan	1972	West Virginia	1984
Minnesota	1974	Wisconsin	1978
Mississippi	no	Wyoming	1977
Missouri	no		

Table 3: State-level divorce law reform timings before 2005. Source: Voena (2015), Rasul (2003), Gruber (2004), Golden (1983).

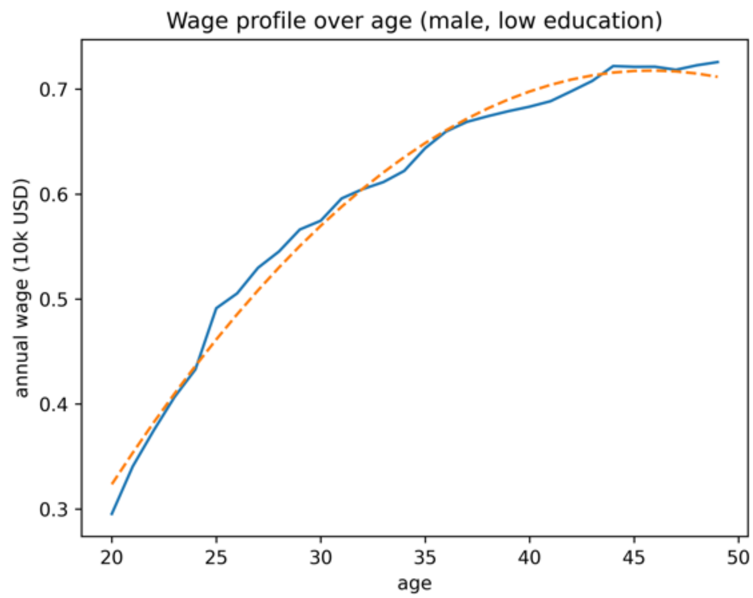

Figure 26: Wage profile over age, low education male workers

Fertility is also treated as an exogenous input in this paper. We use CPS longitudinal data, focusing on married households. We compute the probability of transitioning from having no children in the household to having at least one child across two years, conditional on mother's age and parents' education composition. Since we assume the fertility process is stationary across years, we pool all available years of the CPS data.

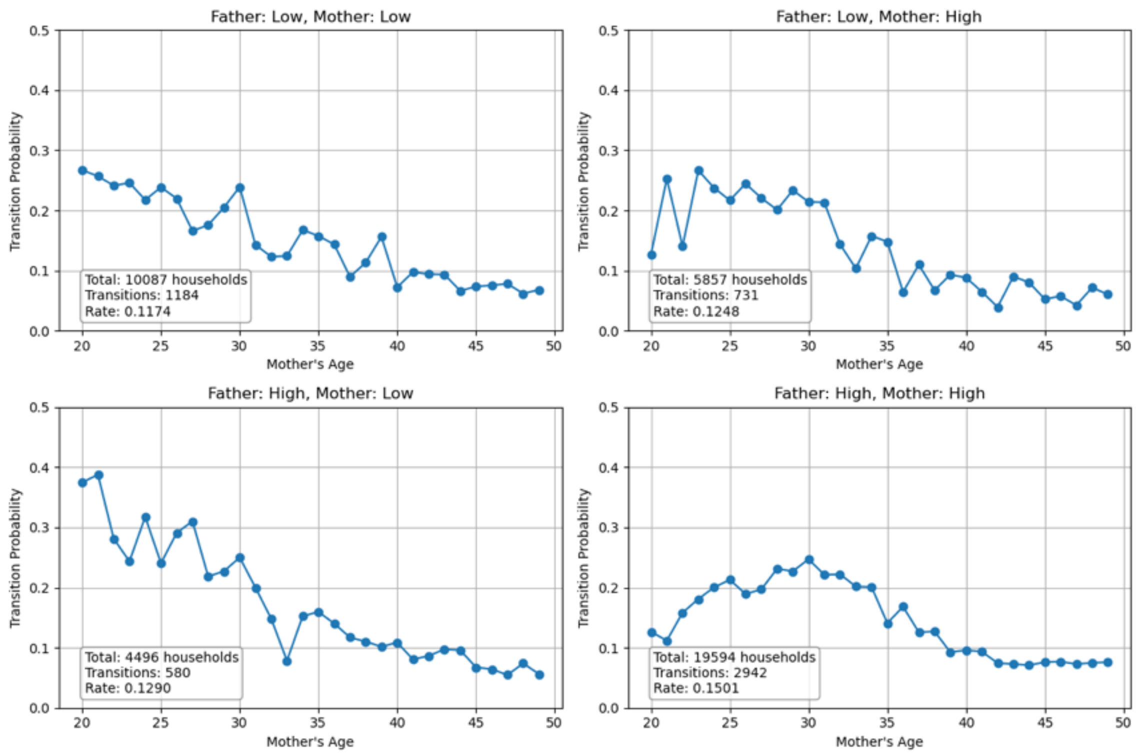

Figure 27: Fertility over mother's age, by parent education composition

The distribution of initial savings of newborns (at age 20) is also an exogenous input to the model. We use the CPS dataset to compute savings using the INCINT variable and compute the distributions at age 20, pooling across years.

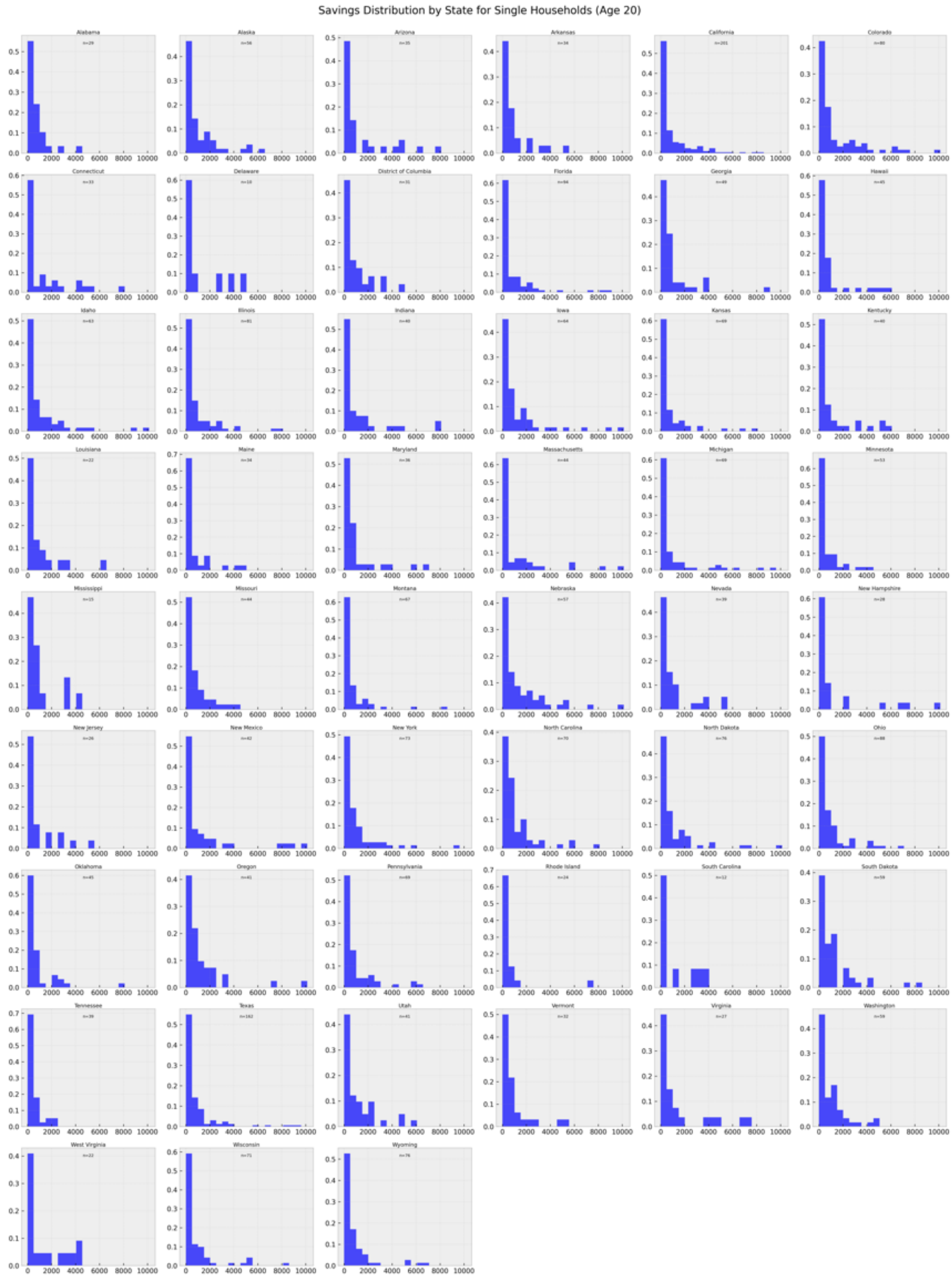

Figure 28: Distribution of initial savings at age 20, by US states

D. Computational details

This section provides detailed information about the computation in the paper. We describe the main computational algorithm for solving the model and the numerical methods employed.

D.1 Discretization

For the discretization, assets a are discretized into 20 equally spaced points, match quality θ uses a 5-point grid, and shocks ε^h, ε^d and ε^ω are integrated out using simulation methods (sample size = 300).

D.2 Model Solution Algorithm

Given any model parameters, the state-wise transitional paths are solved in the following 4 steps:

1. Take guesses on the economy conditions over time, including the prices of efficiency units and population distribution (which will determine the meeting distributions in the marriage market).
2. Solve for individual optimal policy backwards in each US state.
3. Simulate population dynamics forwards for each US state.
4. Update the guesses, and go back to 1 if no convergence.

In this model, endogenous prices per efficiency unit of labor (conditional on gender and education) are determined in equilibrium by the endogenous labor supply of each type and the underlying technology shifters. We call this the "outer loop" of iteration (in contrast, the "inner loop" finds the equilibrium marriage market dynamics where individual marital choices are consistent with population evolution).

In practice, we use the following iteration method to ensure stable and speedy convergence for the outer loop:

1. Take a guess of prices
2. Solve for equilibrium transition paths, importantly, the endogenous labor supply
3. Using the production function, find the implied λs that are consistent with the endogenous labor supply and prices
4. Using the implied λs to update prices

5. Iterate steps 1-4 until finding a fixed point
6. Match the prices with data moments, and update guesses of prices and other model parameters

We approximate the price sequences using the regularized incomplete beta function, which fits our needs well (starting from one steady state and converging to another).

D.3 Computational Acceleration

The model is implemented using Python package called JAX, a high-performance numerical computing library that combines automatic differentiation, just-in-time (JIT) compilation, and GPU acceleration capabilities. The implementation focuses on computational efficiency while handling the high dimensionality of the state space and the parallelization in the dimension of the US states.

D.4 Age-dependent asset grid

In our computation, we use discretized asset grids and adopt grid search to find optimal savings for the next period. When the asset grid is relatively sparse, approximation errors can occur, especially for young households with low labor income, where the increment between two asset grid points might be relatively too large.

While we are constrained by the number of asset grid points due to GPU memory limitations, we can alleviate approximation errors by implementing age-dependent asset grids. We use the CPS longitudinal dataset and compute savings by dividing "income from interest payment" (variable INCINT) by the interest rate in that year, adjusting for inflation. We compute changes in savings for the same household across two years and investigate the distributions of these changes by age and household type, as shown in Figure 29.

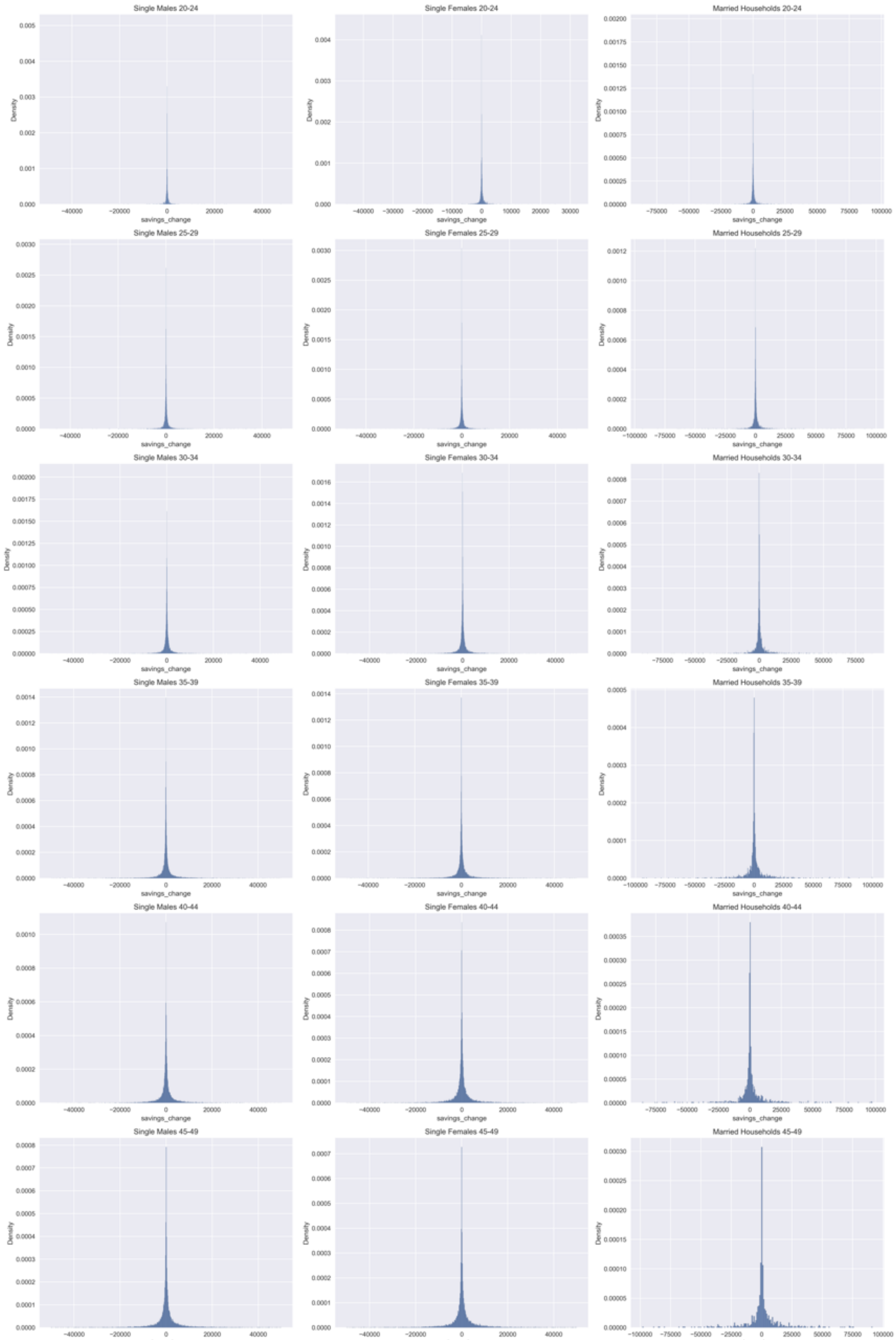

Figure 29: Distributions of asset changes by age

For each age, we find a range k, such that at least $x\%$ ($x = 80, 85, 90$) of single households save or dissave within the range $(-k, k)$, and $x\%$ of the married households save or dissave within the range $(-2k, 2k)$. The top left panel of figure 30 shows the sequences of k values across ages for each lower bound of coverage rates $x = 80, 85, 90$. The other three panels show the actual coverage of households given each k sequence.

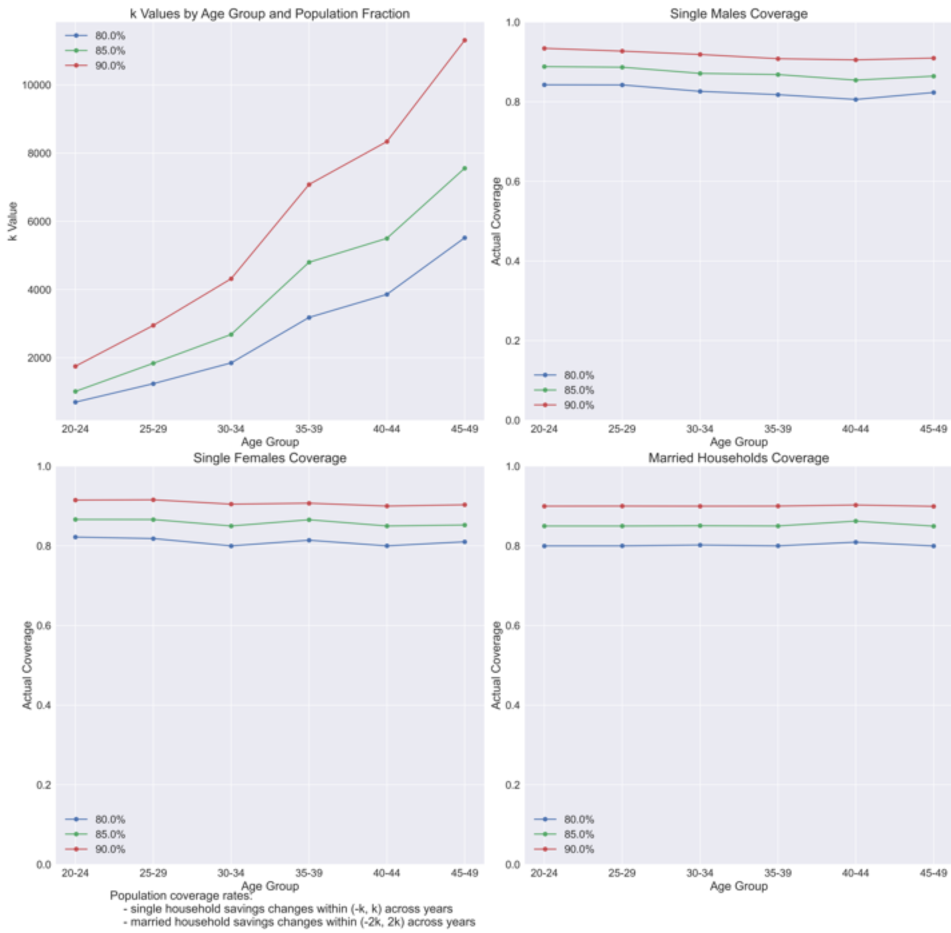

Figure 30: k values and coverages by age and household types

Balancing coverage rates and sparsity of the asset grid, we use the green line to determine the asset grid ranges for our model computation. Figure 31 shows the actual range of asset grid points used in computation.

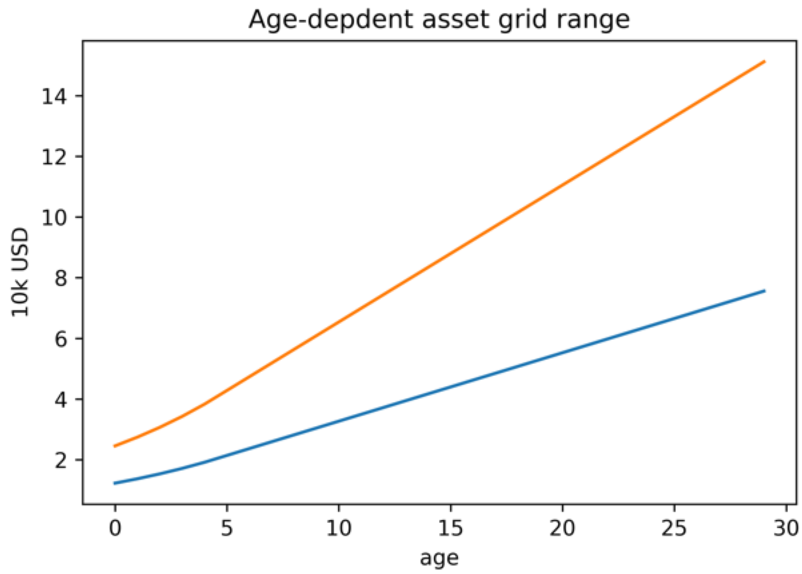

Figure 31: Age-depedent asset grid range

E. Other targeted moments

In the estimation, we also match saving moments—both time trends and age profiles by household types. we assign lower weights on saving moments for two reasons. First, saving data obtained from CPS using "income from interest payment" does not fully represent total assets owned by households. Second, this paper externally calibrates the risk-aversion parameter, and the only flexible model parameters governing saving behaviors are the terminal value function coefficients, which have limited effects on saving decisions throughout the life cycle, especially in early stages.

Figure 32 shows the model fitting of savings trends and age profiles. While not perfectly fitted, overall levels are matched, ensuring that saving behaviors of agents in the model are reasonable.

F. Identification and Robustness

Theoretical identification argument is typically difficult for dynamic structural models with high dimensional states and rich interactions of endogenous decisions under multiple layers of equilibrium conditions. Nevertheless, we can assess local identification around our estimated parameters and understand which parameter combinations are most reliably pinned down by our moment conditions.

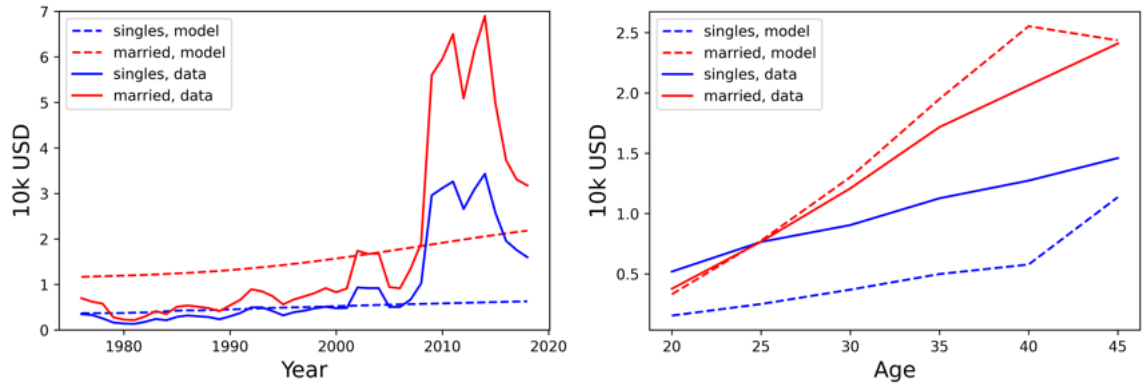

Figure 32: Model fit: savings

Our identification strategy employs two complementary approaches that together provide a comprehensive view of parameter identification:

1. Univariate function profiling: Tests identification of individual parameters by examining how the SMM objective function responds to single-parameter variations

2. Hessian eigenvalue decomposition analysis: Identifies problematic parameter combinations through the curvature structure of the objective function

We further compute robust counterfactual results by perturbing parameters along the weakly identified directions implied by Hessian eigenvalue decomposition results.

F.1 Univariate function profiling

Univariate profiling provides an intuitive first assessment of identification by examining the objective function's sensitivity to each parameter individually. We implement the following procedure:

1. True parameter generation: Treat our point estimates $\hat{\theta}$ as "true" parameters and generate corresponding "true" moments $m(\hat{\theta})$

2. Parameter variation: For each parameter θ_i, create a grid of values around the estimated value: $\theta_i^{(k)} = \hat{\theta}_i(1+\delta_k), k = 1,2,\ldots K$. where δ_k represents percentage deviations

3. Objective evaluation: Compute the SMM objective function

$$Q\left(\theta_i^{(k)}\right) = \left[m\left(\theta_i^{(k)}, \hat{\theta}_{-i}\right) - m\left(\hat{\theta}\right)\right]' W \left[m\left(\theta_i^{(k)}, \hat{\theta}_{-i}\right) - m\left(\hat{\theta}\right)\right]$$

   where W is the weighting matrix and $\hat{\theta}_{-i}$ represents all parameters except θ_i held at their estimated values

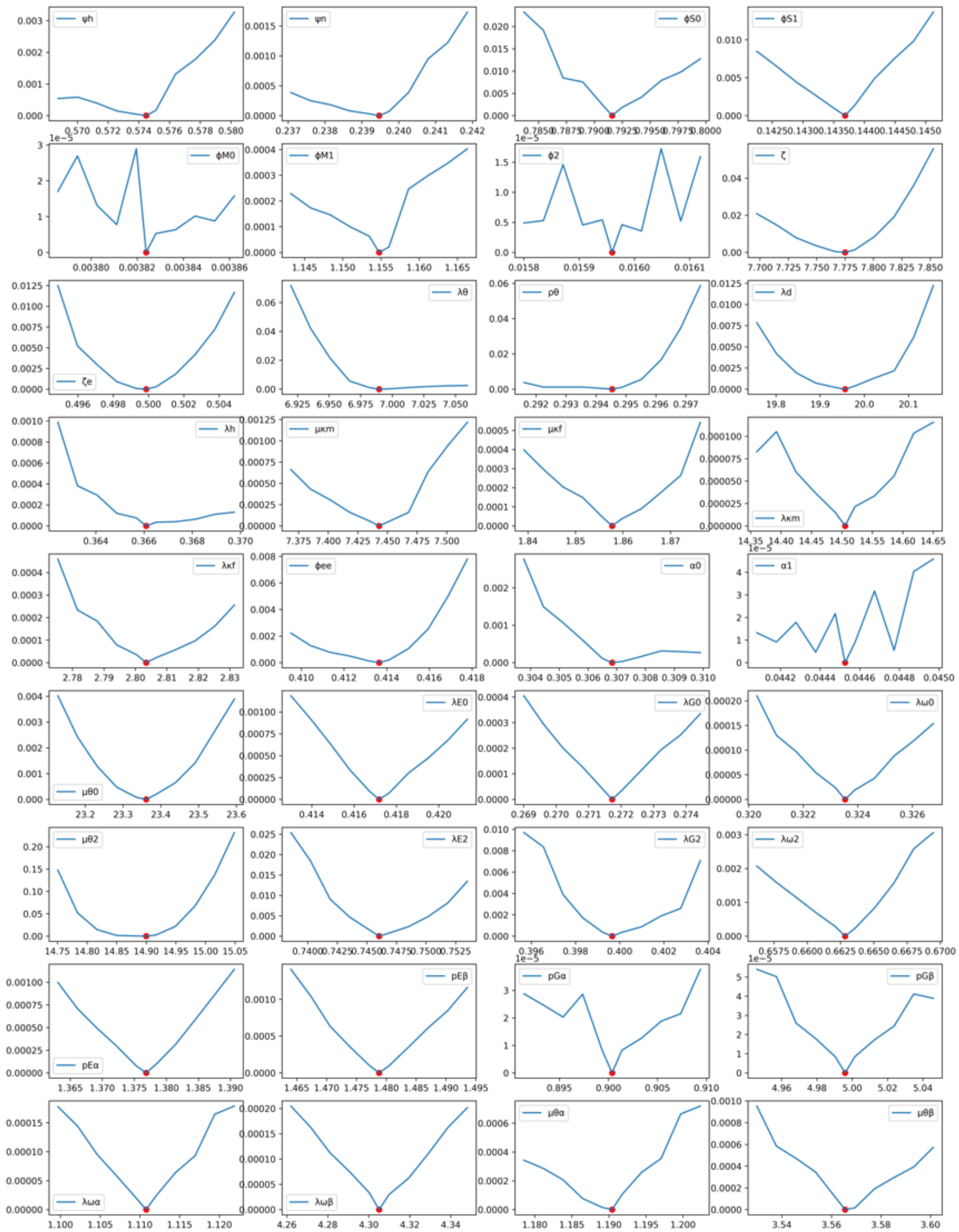

Figure 33: Univariate profiling of objective function

Figure 33 demonstrates that most model parameters exhibit strong identification characteristics:

1. Smooth convexity: The objective function displays well-behaved quadratic shapes around the optimum
2. Steep curvature: Small parameter deviations lead to substantial increases in the objective function
3. Unique minima: Clear single optima at the estimated parameter values

However, a small subset of parameters (notably ϕ_0^M, ϕ_2, and α_1) show flat objective surfaces, indicating potential identification concerns. We will address these concerns in the robustness check.

F.2 Hessian matrix and eigenvalue decomposition

Although univariate function profiling demonstrates intuitive relationship between the objective function and each model parameter, it does not shed light on the relationship with combination of parameters. To address the limitations of univariate analysis, we conduct a comprehensive multivariate identification analysis using the Hessian matrix of the SMM objective function. This approach captures the full identification structure, including parameter interactions and substitution patterns.

We evaluate the Hessian matrix around the point estimate as

$$H_{ij} = \frac{\partial^2 M(\theta)}{\partial \theta_i \partial \theta_j}$$

where $M(\theta)$ is the weighted quadratic SMM objective function[22]. After deriving H, we first verify that it is positive definite (all eigenvalues are positive), demonstrating that our point estimate is the local minimum and there is no identification issue.

We conduct eigenvalue decomposition of the Hessian matrix and further investigate weak identification issues of parameters. We decompose the Hessian matrix H to be

$$H = Q\Lambda Q^T$$

where

[22] Due to the dominating numerical errors in the auxiliary regression moments given that the step size of Hessian matrix computation is tiny, we use the CET moments to evaluate Hessian matrix. Because the CET moments are perfectly nested in the CET-II moments, the CET Hessian provides more conservative evaluations for both identification assessment and robust counterfactual computations.

- $\Lambda = diag(\lambda_1, \lambda_2, \ldots, \lambda_k)$ contains eigenvalues
- $Q = [q_1, q_2, \ldots, q_k]$ contains corresponding eigenvectors

Small eigenvalues $\lambda_i \approx 0$ indicate directions where the objective function is nearly flat. If λ_i is small, then for the corresponding eigenvector q_i

$$q_i^T H q_i = \lambda_i \approx 0$$

This means moving in direction q_i barely changes your objective function, indicating weak identification along that parameter combination.

We classify eigenvalues as "small" using the criterion: $\lambda_i < \epsilon \cdot \max_j |\lambda_j|$ where $\epsilon = 10^{-3}$ provides a conservative threshold. This identifies the parameter combinations that are least reliably estimated. Each eigenvector q_i corresponding to a small eigenvalue represents a specific linear combination of structural parameters: Weakly identified combination is given $\sum_{j=1}^{p} q_{ij}\theta_j$.

To investigate how counterfactual results are affected by weak identification, we implement a targeted sampling strategy that focuses on the most problematic identification directions:

$$\tilde{\theta}^{(j)} = \theta_{true} + \sum_{i \in weak} \alpha_i^{(j)} \cdot \frac{1}{\sqrt{|\lambda_i|}} \cdot \gamma \cdot q_i$$

- $\alpha_i^{(j)} \sim N(0,1)$ are independent standard normal random variables
- the sum is over weak eigenvalues only
- $\gamma = 0.1$ is an additional damping factor to avoid extreme perturbations

We sample 100 $\tilde{\theta}^{(j)}$s and below we plot the marginal distribution of each θ_i in figure 34. Note that the three model parameters $\phi_0^M, \phi_2, \alpha_1$ are sampled with large variance, which are coherent with our findings in the univariate function profiling.

We compute counterfactual transitions as in the decomposition analysis, and plot the 95% confidence intervals. All the decomposition analysis demonstrates strong stability, which means that although a very small subset of model parameters are weakly identified, the counterfactual results are still reliable.

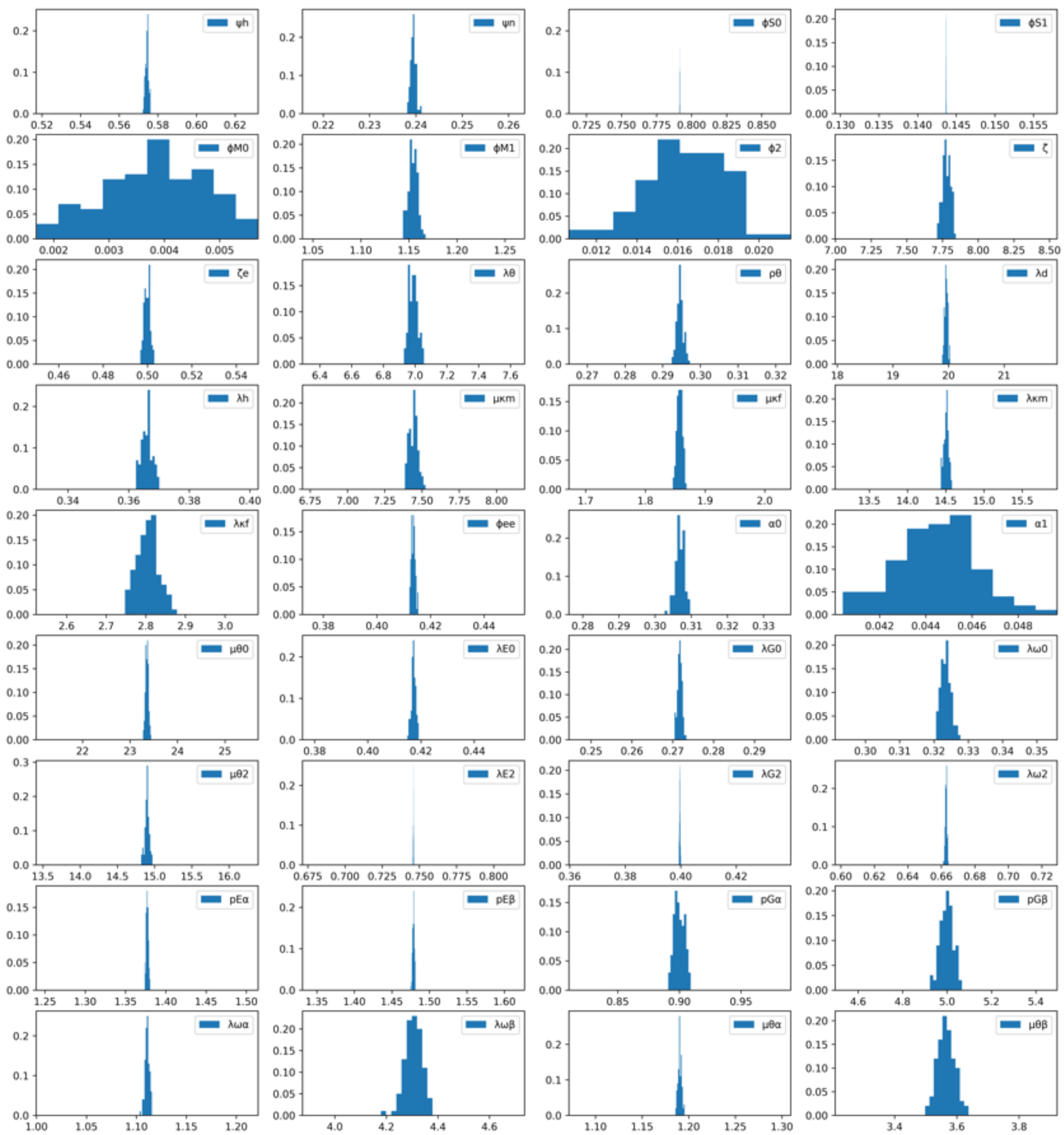

Figure 34: Parameter sampling along weak identification directions

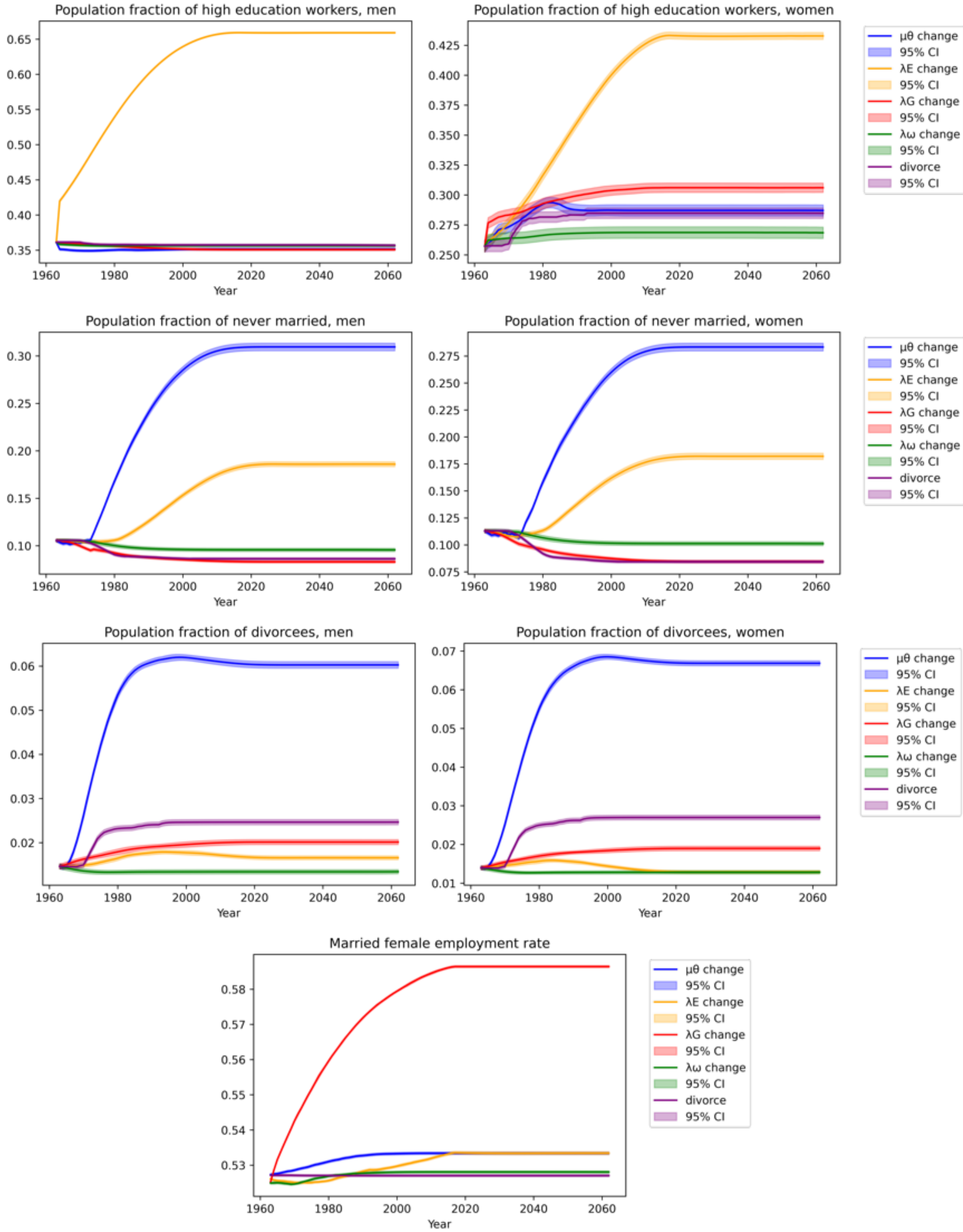

Figure 35: Robustness check of counterfactuals

F.3 Sensitivity analysis: CET-II versus CET

Below we compare the fitting of auxiliary regression coefficients when targeting them explicitly (CET+II, stands for "connected equilibrium transition plus indirect inference") versus not (CET). The responses to divorce law reforms are not naturally fit when the overall national aggregate moments are fit, and therefore the estimates will be biased. In the counterfactual analysis, the responses to divorce law reforms will also be distinct in levels.

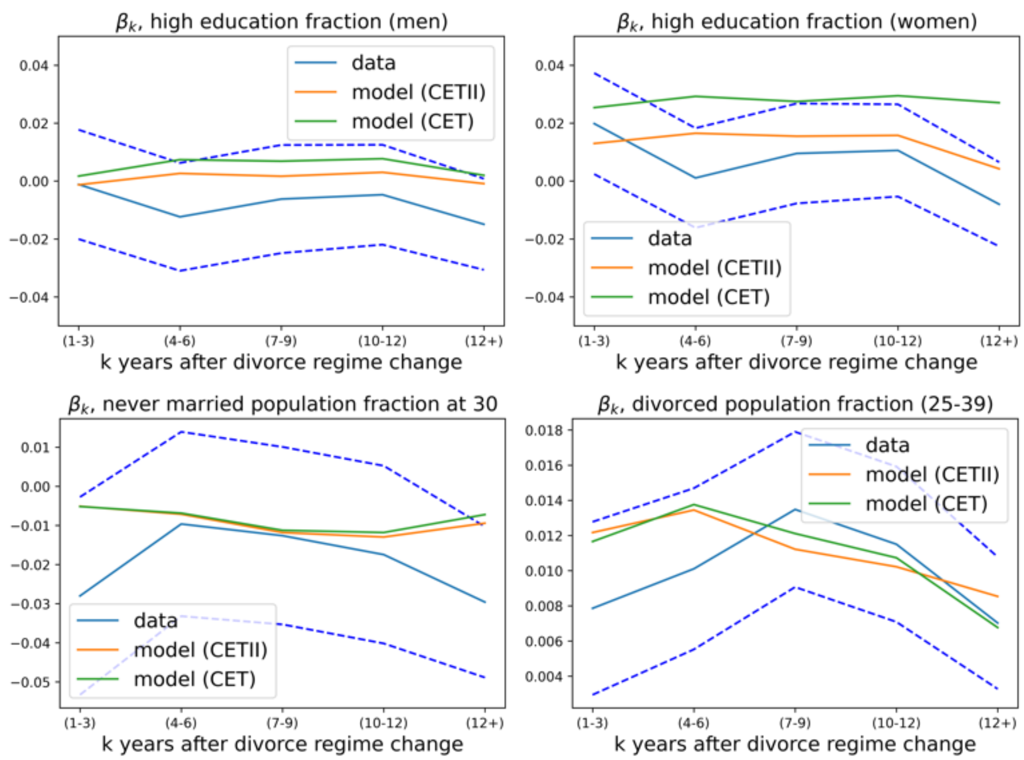

Figure 36: Fitting comparison between CET-II and CET

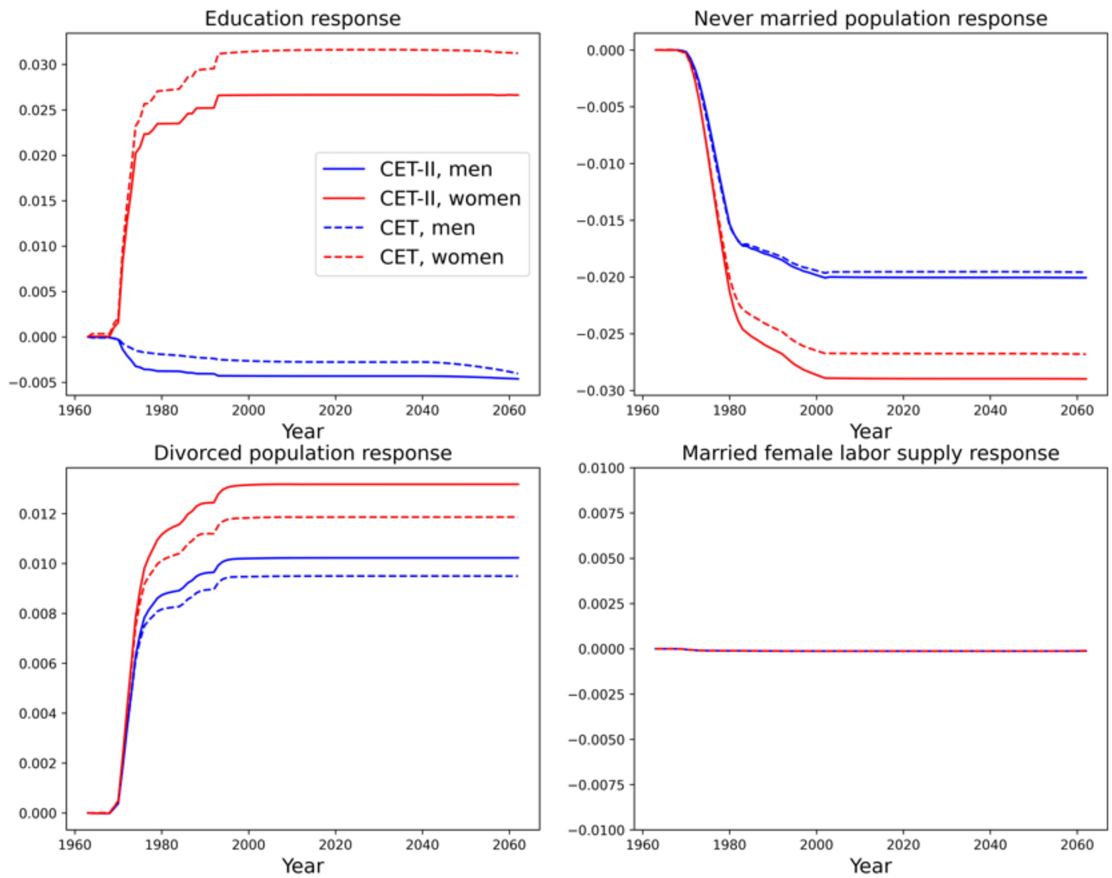

Figure 37: Counterfactual transitions with divorce law reform, comparison between CET-II and CET