Essays in Family Economics and Gender

A thesis presented for the degree of
Doctor of Philosophy by George Jacob

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George Jacob

Summary

This dissertation consists of three essays on family economics and gender. It delves into the problems families face with an emphasis on women. The first essay (Chapter 2) looks at how parents with different preferences take joint decisions on parenting. I show how parents who have the same preferences on consumption but have differences in altruism and how they discount the future of the child, take strategic parenting decisions. I extended the model of Doepke and Zilibotti, 2017 into a framework where two parents jointly decide on a parenting style by maximising a weighted utility function where each weight corresponds to the individual parent's bargaining power. These weights depend on the parenting decision itself (endogenous) and I use the Nash bargaining solution to characterise it. I show how the more altruistic parent strategically allows the parenting decision to be aligned with the preferences of the less altruistic parent to gain her say in other household decisions.

The second essay (Chapter 3) is focused on how family structures affect female labour force participation in the Indian context. I show that the death of a mother-in-law increases college-educated daughter-in-law's participation in salaried jobs. I argue that the mother-in-law is more a of custodian of restrictive gender norms rather than a provider of subsidised childcare. I also provide a plausible explanation of why female labour force participation and education are moving in different directions in India. By extending the model of Calvi, Beauchamp, and Fulford, 2021, I show that when educated women become more abundant, they choose marriages not aligned with their preferences and cohabit with her in-laws. This can reduce female labour force participation.

In the third essay (Chapter 4), I quantify how the risk of women experiencing intimate partner violence (IPV) for the first-time changes as they progress through different stages in life. I use individual-level data on woman's lifetime history of violence from the European Union Agency for Fundamental Rights (FRA), 2012. In Europe, women are at the highest risk to experience IPV for the first time when they are young and potentially dating (age 22). The risk remains high until they reach the age of first birth. I combine individual-level data with country-level historical data from the Global Database on Violence against Women, 2023 to evaluate how the existence of domestic violence laws and a national helpline for victims and survivors of IPV affect the risk of IPV at different stages in life. These resources are only effective for women in their thirties.

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Dedication

To My Family.

Contents

List of Figures

List of Tables

Chapter 1

General Introduction

This dissertation consists of three independent essays that center around the intricate challenges faced by families, with a particular emphasis on the experiences of women. It explores to unravel the complex web of decision-making, power dynamics, and societal norms that shape the economic well-being and roles within families.

Parenting plays a crucial role in a child's development and it along with family conditions shapes their future. In Chapter 2, I examine how even subtle differences between parents can affect their decisions on parenting. These disparities in preferences become particularly relevant in the developing world, and I provide a framework to study how parents navigate and negotiate these differences when faced with the task of making collective parenting decisions.

I extend the model of Doepke and Zilibotti, 2017 to develop a model of parenting that portrays it as a joint decision between two parents. In this model, parents have different preferences negotiate and the equilibrium decision is based on the Nash bargaining solution. I characterize a two-parent one child household, where parents exhibit varying degrees of altruism towards their child and approach the valuation of the child's future with differing discount rates. With this model, I focus on two important aspects of families. First, I examine how disagreements between spouses impact the household's response to the economic landscape when making optimal parenting decisions. Second, I examine how these parenting decisions can change the balance of power between the parents.

In my model parents collectively maximise a weighted sum, where each parent attaches a weight to their utility. I make it explicit that the weights assigned by parents, which determine

their bargaining power, are not fixed but are influenced by the parenting decision itself.

Evidence in the developing world suggest that mothers tend to exhibit higher levels of altruism compared to fathers, primarily due to differences in their preferences (Dizon-Ross and Jayachandran, 2022). I show that when parents take joint parenting decisions, the household is less likely to prioritize the preferences of the more altruistic parent, *the mother*. Consequently, the mother may be more willing to accommodate the preferences of the less altruistic parent, *the father*. I also demonstrate that at the optimum, the father stands to lose more if they decide not to cooperate and not take parenting decisions jointly. This implies that the mother's choice to consider the father's preferences could be seen as a strategic way to enhance her bargaining power, which she may use in other joint decisions within the household. In essence, this strategic behavior by the mother aligns with her aim to strengthen her position during decision-making in the household.

Chapter 3 revolves around the complexities of marriages, female education, and labor force participation within the context of India. While female graduate enrolment in the country witnessed a staggering 50% surge from 2010 to 2020, female labor force participation experienced a concerning decline of 27% (World Bank, 2023). What lies behind this divergence, and how does the structure of families contribute to this trend? Specifically, Chapter 3 focuses on cohabitation with the mother-in-law. Astonishingly, 35-39% of women in India find themselves living with their mothers-in-law (Khalil and Mookerjee, 2019). In a country where marriage is not solely an individual's decision but a family affair (Nanda, 1992), understanding why women choose marriages that entail cohabitation with their in-laws becomes a matter of utmost importance.

Using panel data from the Indian Human Development Survey (IHDS), I show that the exogenous variation caused by the death of a mother-in-law leads to an increase in labor force participation among graduate daughter-in-laws, specifically in salaried positions. The evidence suggests that mother-in-laws, act as guardians and enforcers of societal gender norms, impeding the professional aspirations of young, educated daughter-in-laws, while simultaneously supporting them in domestic activities within the vicinity of their homes.

Chapter 3 sheds light on a potential reason for the divergence observed in female labour force participation and college enrolment in India: the marriage market. I extend the model of Calvi, Beauchamp, and Fulford, 2021 by incorporating co-residency as a characteristic of the marriage within a static framework similar to Arcidiacono, Beauchamp, and McElroy, 2016. By introducing gender-specific preferences on co-residency, I demonstrate how women might choose marriages that do not align with their preferences to increase their chances of getting married. The model predicts that when the number of graduate women increases, marriages that are less preferred by women—e.g., where they must co-reside with their in-laws— become more common. This, in turn, could prevent married graduate women who live with their mothers-in-law from entering the labor market that matches their skills.

Chapter 4 focuses on intimate partner violence. Physical or sexual violence is a gruesome reality that affects one in every three women across the globe (Devries, Mak, Garcia-Moreno, Petzold, Child, Falder, Lim, Bacchus, Engell, Rosenfeld, et al., 2013). What is more disheartening is that this vulnerability persists even in developed regions of the world where divorce is more socially acceptable and legal frameworks against intimate partner violence exist. In Europe, 16-23% of women fall victim to physical or sexual violence perpetrated by their intimate partners (WHO, 2021). Chapter 4 seeks to deepen our understanding on the onset of IPV.

Chapter 4, co-authored with my supervisor, characterizes the risk of experiencing intimate partner violence (IPV) for the first time —*the hazard*— throughout women's lifetimes and examines how resources such as laws on domestic violence and national helplines could shift the onset of violence in Europe. I use data from the European Union Agency for Fundamental Rights (FRA), 2012 (special licence 181265) and Global Database on Violence against Women, 2023. In this chapter, I use survival analysis in the spirit of Currie and Neidell, 2005 and Corno, Hildebrandt, and Voena, 2020 by extending the data into a panel format to document three stylised facts.

Firstly, the risk of experiencing intimate partner violence (IPV) reaches its highest point at the age of 22 and remains elevated throughout the late twenties. This time frame aligns with

a stage in life when individuals are actively engaged in dating and romantic relationships. Secondly, I demonstrate that laws specifically created to combat IPV have a notable impact in reducing its risk among women of age 30-39, who are potentially married and starting families. However, the effectiveness of these legal measures is relatively limited for women who encounter violence during their teenage or early twenties, as well as those who encounter it later in life, in their forties or beyond. Lastly, a notable pattern emerges, highlighting the Nordic Region as having the highest hazard of IPV.

Chapter 2

Altruism, Parenting, and Bargaining: A Look into Strategic Parenting Decisions to Gain More Say in the Household

2.1 Introduction

Parenting decisions are critical for a child's overall development. Altruistic parents care about their children and even if spouses have the same ideas about what is best for their child, the slightest differences between spouses have prominent effects on parenting decisions. If parenting decisions are made by a single parent, it might be optimal for the spouse to make a different parenting decision if there is even the slightest difference between them. These decisions could be whether they should get their child the latest Lego instead of a football, how late the child can stay up watching TV, or telling the child which subjects to study contrary to the child's instincts. This idea is captured by Doepke and Zilibotti, 2017. But what happens if parenting decisions are joint household decisions? In a household, parents have a choice to jointly take parenting decisions. They negotiate and reach a middle ground or sway the decision towards one of their ideas. Balance of power between spouses becomes a major factor while making parenting decisions.

On top of wanting to do what is best for their child, parents also care about the child's experience, and it could be optimal for spouses to care about them differently. Parenting decisions affect the experience of a child. Because parents differ in how they care about child expe-

riences, spouses could value parenting decisions differently. Even if parents jointly decide to allow their child to attend football practice, the mother and the father could value this decision differently.

In this paper, I develop a model of parenting where parenting is a joint decision by two parents and is a result of Nash bargaining between them. Spouses have different levels of altruism towards their child and discount the child's future differently. The model serves as a laboratory to understand i) *how differences between spouses affect the household's response to the economic environment when they take parenting decisions in equilibrium*, and ii) *how the balance of power between spouses is affected by parenting decisions*. As such I extend the model of Doepke and Zilibotti, 2017.

In development psychology, Baumrind, 1967 categorized styles of parenting into three types: authoritarian, authoritative, and permissive. In an authoritarian household, parents restrict the choices available to the child (force the child to learn an instrument the child dislikes) whereas an authoritative household tries to influence the preferences of the child (buy the child a camera so that the child develops an interest in photography). A permissive household will allow the child to do what the child likes (sugary cereals). I will be using this classification.

Spouses in a household might differ on various accounts. Parents could have different preferences on the educational attainments of their children. Qian, 2008 show that an increase in male income decreases educational attainment for girls and has no effect on boys. Spouses could disagree on desired fertility. Doepke and Kindermann, 2019 shows that the distribution of the burden of childcare between spouses is a key determinant of fertility. Parents could also have different preferences on childcare (Alger and Cox, 2013) and altruism (Eswaran and Kotwal, 2004)[1].

I focus on two aspects of the spouses where they differ: *levels of paternalism/altruism towards the child* and how they *discount the child's future* (discount factors). [2] In my model parents

[1] Duflo, 2003 shows that these differences could also have an effect on the health outcomes of the child.

[2] While parenting decisions are important in determining outcomes of a child (Miller, Jenkins, and Keating, 2002; Dooley and Stewart, 2007; Ermisch, 2008; Dooley and Stewart, 2007; Ermisch, 2008) parents exerting the same level of care and attention may implement different parenting styles (decisions).

who have different levels of altruism and discount factors, bargain and jointly decide the parenting style (parenting decision) they want to adopt in the household. In Doepke and Zilibotti, 2017 parenting decisions were made by individual parents whereas in my model these decisions are jointly taken by both parents who have different parameters. Hence, I treat parenting decisions as household decisions rather than individual parent decisions. To better characterise the model, I use the Nash Bargaining Solution. As a result, the household decides on a parenting style by maximising a weighted sum, where each parent attaches a weight to their utility.

My contribution lies in showing that these weights are endogenous depending on the parenting style itself. The optimal household parenting decision which is the result of bargaining between spouses also affects the weight each parent attaches to their utility. These weights, solutions based on Nash Bargaining, are also determined by the parameters of the model, including levels of *altruism* and *discount factors*. [3]

Even when both parents have the same preferences on consumption, I show that the slightest difference among parents (exogenous differences in altruism and/or discount factors), changes the household's response (parenting decision) to the economic environment. When parents are altruistic but have different levels of altruism, it may be optimum for a household to adopt a certain parenting decision. This is because of the Nash Bargaining solution used to characterise each parent's weight attached to their utility.

I also show that it may be beneficial for a parent to deviate from the optimal parenting decision predicted by the original model of Doepke and Zilibotti, 2017 because by doing so, the parent will be increasing his/her bargaining power in the household. Again this is because of the Nash Bargaining solution used to characterise the weights each parent attaches to their utility. The parent who has more to lose ends up having less say in the household.

I show that when parents jointly make parenting decisions, they tend to prioritize the preferences of the less altruistic parent, often the father, rather than the more altruistic one, typically

[3]This is similar to Basu, 2006. The author shows that, in a collective model, the household's decisions depend on the power balance between the husband and the wife, but power balance can, in turn, depend on household decisions.

the mother. Additionally, I demonstrate that in the optimal scenario, the father has more to lose if they opt not to cooperate and make parenting decisions jointly. This suggests that the mother's choice to consider the father's preferences can be viewed as a strategic move to bolster her bargaining power, which she may leverage in other shared decisions within the household. In essence, this strategic behavior by the mother aligns with her goal of strengthening her position during household decision-making.

In the next section, I relate my contribution to the literature. Section 2.3 briefly explains the model of Doepke and Zilibotti, 2017. In section 2.4, I introduce my *model of parenting in households* followed by a general solution in section 2.5. Section 2.6 contains a discussion of the simulation and section 2.7 concludes. [4]

2.2 Related Literature

This paper adds to the limited literature on parenting in economics. To explain why parents with low income tend to depend more on practices like corporal punishment, Weinberg, 2001 modelled parent-child interaction as an agency problem with an altruistic principal where the parent uses financial incentives to control the behaviour of the child. Cobb-Clark, Salamanca, and Zhu, 2019 extended Weinberg, 2001 model of parenting to include non-cognitive effort (attention) as an additional input for parenting. In the model of Doepke and Zilibotti, 2017 the parent and child disagree (regarding patience or risky behaviour) and a parenting style is adopted to settle this dispute. In equilibrium, parenting decisions depend on socioeconomic factors (like social mobility and returns to education). Agostinelli, Doepke, Sorrenti, and Zilibotti, 2020 added another layer to Doepke and Zilibotti, 2017, where the interaction of parenting styles and peer effects is critical for the skill accumulation of the child. They modelled parenting decisions from a perspective of rational choice theory. Here the parent decides whether or not to prevent the child from befriending lower-skill peers. In this paper I treat parenting as household decisions jointly taken by two-parents with same preferences on consumption, but different parameters on altruism and discount factors. I closely follow the

[4]The appendix includes a sanity check of the model.

framework of Doepke and Zilibotti, 2017.

The literature treats parenting decisions in different ways. In the model of Lizzeri and Siniscalchi, 2008, the parent has to choose either to shelter the child from the child's actions or not to completely shelter the child so the child can learn from their own mistakes. Deviating from the sheltering approach, Lundberg, Romich, and Tsang, 2009 proposed a non-cooperative model of parental control over child behaviour and child resistance. In Lundberg, Romich, and Tsang, 2009, the key is to have a balance between parental authority and child independence, where controlling the child's behaviour is seen as an instrument to invest in the child's future. In this paper, parents care about the utility they get from the child's experience.

The model of Cosconati, 2013 defines parenting style in terms of strictness of the limit parents set for their children on their time allocation. Parents control the value of leisure time available to the child and the parent incurs a cost of monitoring in doing so. The focus is on the human capital of the child which depends on the effort put by the child. This paper (similar to Doepke and Zilibotti, 2017) defines parenting styles based on the Baumrind, 1967 classification in developmental psychology. The classification is based on how parent(s) addresses potential disputes with the child.

In the literature, parenting is almost always modelled in a one-parent one-child framework, where the parent and child have a dispute mostly on the valuation of the child's time (unitary approach). To my knowledge, this is the first paper that treats parenting as a household decision rather than an individual decision where parenting decisions are endogenous depending on socioeconomic factors.

2.3 A Brief Explanation of Doepke and Zilibotti, 2017

This is a one-parent one-child, two-period (*young* and *old*) model of parenting. Agents have period-specific preferences on consumption (c) denoted by $U^y(c)$ and $U^o(c)$. The young agent (child) has a preference vector (a) which could be influenced by the older agent (parent) through a child-rearing effort. The older agent also decides the feasible choice set (X) for

the younger agent. Decisions on the preference vector of the child and feasible choice set constitute parenting decisions. Parenting decisions (X, a) affect the child's experience and altruistic parents get utility $\omega(X, a)$ from it. Parents choose the parenting decision (X, a) that maximizes the function $\omega(X, a)$. [5]

The young agent has to spend some portion of the human capital stock as "an effort to develop human capital" (*educational effort*) during childhood which they can cash in adulthood as accumulated human capital. The young agent uses the remaining human capital in an occupation to finance their consumption as a child. The occupation the child chooses has two components: (1) depending on their talent and (2) a premium for working in the same profession as the parent. The authors explain this premium as an "incumbency effect" capturing acquisition skills within the family and avoiding entry barriers. The child has two choices in choosing the occupation. One option is to stay at home and follow the footsteps of the parent where there is an advantage of the incumbency, but this occupation might not be the best match for the child's talent. The other option is to leave home and search for a job that suits their talent, but the child would not have access to the premium.

For the parent, there are three strategies. The *first* strategy is to restrict the choice set available to the child so that the option of *leaving home* is not feasible for the child. In this strategy, the parent can monitor the effort of the child and will not influence the preference vector of the child. The *second* strategy is to let the child be independent by not restricting the choice set. The independent child leaves home and finds a job that suits them. In this strategy, the parent influences the preference vector of the child. The *third* strategy is to let the child be independent and not influence the preference vector of the child. The authors call the first strategy as *Authoritarian Parenting*, second strategy as *Authoritative Parenting* and third strategy as *Permissive Parenting*.

[5] The altruistic parent's optimisation problem includes own consumption, cost of parenting, and the experience of the child. They later assume no cost of parenting to solve the model.

2.4 A Model of Parenting in Households

I start with a general description of the model and a description of the general solution. Since there are no closed solutions, I move to special cases and solve them numerically.

I consider a two-period (***y****oung* and ***o****ld*) model of parenting. Parenting is a decision taken by two parents rather than by an individual. A household is formed by two parents (mother m and father f) and a child i. There are two older agents (m, f) and one younger agent (i). The agents' period-specific utility function depends on a consumption vector c and a preference vector a.

$x \epsilon X$ denotes the *economic decisions* of the child and X the feasible choice set available to the child. Three state vectors affect the child's choices: their preference (a), human capital (h) and stochastic ability shock (s). Parents decide the feasible choice set X and could influence the child's preference vector (a).

The constraints of the model depend on the investment in human capital. In period one, the younger agent invests in human capital through educational effort and consumes the rest in the same period. Educational effort leads to an accumulation of human capital. In period two, the agent becomes older and consumes the entire accumulated human capital.

Similar to Doepke and Zilibotti, 2017, I abstract from the cost of parenting and time constraints. Altruistic parents maximize the utility the household gets from the child's experience when the child is *y*oung (childhood) and *o*ld (adulthood). As a result, consumption decisions are only relevant for the child. Let c_i^y denote the consumption of child i when young, and c_i^o the consumption of same child when old.

A child's experience depends on consumption in both periods. The parent's decision on the choice set and preference vector of the child, (X, a'), has an effect on the child's consumption in both periods and thus parental decisions affects the child's experience. Since parents are altruistic, they get utility from the child's experience. Each parent $j \in \{m, f\}$ gets utility $\omega_{ji}(X, a')$ from child i's experience.

$$\omega_{ji}(X, a') = \left[(1-\lambda_j)U_i{}^y(c_i{}^y|a') + \lambda_j U_j{}^o(c_i{}^y|a') + \beta_j U_i{}^o(c_i{}^o|a')\right] \tag{2.1}$$

For parent $j \in \{m, f\}$, $(1-\lambda_j)$ is the parameter for altruism, λ_j for paternalism, and β_j the discount factor. Parent j attaches weight $(1-\lambda_j)$ to the child's valuation of present consumption $U_i{}^y(c_i{}^y|a')$, that is, *altruism*.[6] The second term of the RHS of equation 2.1, represents how parent j evaluates the utility of the child's present consumption through parent j's own utility function, $U_j{}^o(c_i{}^y|a')$, and attaches a weight λ_j to it. The weight λ_j is thus the parameter for *paternalism* of parent j. The last component of the RHS of equation 2.1, represents how parent j discounts the future consumption of the child $(\beta_j U_i{}^o(c_i{}^o|a'))$. Discount factor β can also be interpreted as how the child discount's her future consumption through a discount factor that is influenced by parent j. [7]

Parent $j \in \{m, f\}$, differ in paternalism (λ_j), altruism $(1-\lambda_j)$, and discount factor (β_j). I refer to this duple (λ_j, β_j) as Λ. Both parents f and m have the same preferences on consumption.[8] Later, I show that even under this very simplistic view, having two parents move the household away from the unitary model and bargaining power depends on the parenting style.

Parents jointly decide the preference parameter of the child $(a_i = a')$ and take actions either to restrict or expand the set of feasible choices X available to the child. The household (HH) maximizes a weighted sum where each parent $j \in \{m, f\}$ attaches a weight—corresponding to their bargaining power—to the utility they get from the child's experience (see equation 2.1).

[6] Eswaran and Kotwal, 2004 proposed a theory to explain gender differences in altruism. According to the authors, women have constrained fertility and men don't. This scarcity factor leads women to develop more altruistic feelings towards their children. Similarly Alger and Cox, 2013 developed a model to explain maternal-paternal differences in preferences on childcare. According to them the sex differences in gamete size and internal fertilization are related to male-female differences in altruism towards children and other preferences related to family behaviour.

[7] In the original model β was the discount factor of the child. But here (in a two-parent environment) the child will not have a discount factor, but will merely mirror the parent's discount factor. β_j is how parent $j \in \{m, f\}$ will make child i discount his/her future utility $U_i{}^y(c_i{}^o)$. I will show that when parenting is modelled as a household decision rather than a single parent decision, the child i 's discount factor will be a weighted sum of the parent's discount factors (β_m and β_f) where the weights are endogenous. In the following sections this aspect is explained in detail.

[8] Parents may also differ in their preferences over consumption, i.e. $U_f(.) \neq U_m(.)$. They could also want to influence the preference vector of the child (setting a' in different ways). But in this model we assume parents in a household **agree** on how to decide this preference vector a', because setting a' is based on the parenting style (explained later).

The problem of the household is:

$$v^o_{\mathbf{HH}}(a,h,s) = \max_{X,a'} E_{s'}\Bigg[\theta\Big[(1-\lambda_m)U^y(c^y|a') + \lambda_m U^o(c^y|a') + \beta_m U^o(c^o|a')\Big] \tag{2.2}$$

$$+(1-\theta)\Big[(1-\lambda_f)U^y(c^y|a') + \lambda_f U^o(c^y|a') + \beta_f U^o(c^o|a')\Big]\Bigg]$$

subject to

$$c^y = C^y(x,s')$$

$$h' = \eta(x,s';R)$$

$$c^o = C^o(h',s')$$

In equation 2.2, θ is the weight that the household gives to the $m$other's utility from the child's experience. $1-\theta$ is the weight that the household gives to the $f$ather's utility from the child's experience. [9]

The child's consumption when young, ${c_i}^y$, is a function $C^y(x,s')$ that depends on the child's choice x and the stochastic ability shock s'. The child's human capital, h', evolves following the function $\eta(x,s';R)$ where R is the returns to education. Child's consumption when old, ${c_i}^o$, is a function $C^o(h',s')$ that depends on her human capital and the stochastic ability shock s'.

The choice of the child x is an *investment in human capital*: x decreases the child's consumption when young, but is an investment for old age. Specifically, child's choice x is a duple $x = \{x^e, x^\mu\}$ where x^e is the effort the child puts into education and x^μ is the occupational choice of the child. The more the child's educational effort, the less they have to consume in period one. Thus, present consumption, $C^y(x,s')$, decreases with x^e. Accumulation of human capital $\eta(x,s';R)$ is an increasing function of x^e and returns to education, R. The larger the human capital the child accumulates, the higher the child's future consumption.

[9] Later I will sow how these weights in equation 2.2 depend on the parameters of paternalism/altruism, discount factors, and, the parenting decision (X,a') itself.

Let $y(x^{\mu}, s')$ be the stochastic occupation productivity for a given child. Productivity $y(x^{\mu}, s')$ affects child's consumption both when young and old. The child might have *low* productivity ($y = y_L$) or *high* ($y = y_H$) productivity, in occupation x^{μ}.

The constraints of the model are explicitly written as [10].

$$c^y = C^y(x, s') = (1 - x^e)y(x^{\mu}, s') \tag{2.3}$$

$$h' = \eta(x, s'; R) = (1 + Rx^e)y(x^{\mu}, s') \tag{2.4}$$

$$c^o = C^o(h', s') = h' \tag{2.5}$$

The child's consumption when old is the entire accumulated human capital (see in equation 2.5).

2.4.1 Decisions of the Child

The child makes two choices: educational effort (x^e) and occupational choice (x^{μ}). Regarding occupation, the child has two choices: $x^{\mu} \in \{x^{HOME}, x^{SEARCH}\}$. If the child stays at home ($x^{\mu} = x^{HOME}$) they do the same job as their parents and get a premium μ. Yet, this occupation might not be the best fit for the child given the stochastic ability component.

Parents have different occupations which lead to parent-specific premiums μ_f and μ_m. If the child chooses the occupation of parent $j \in \{m, f\}$, their expected productivity is $0.5(\mu_j y_H + \mu_j y_L)$. When the child stays at home, they choose the occupation for which they have the higher expected utility. The expected productivity of a child that stays at home is:

$$E_{s'}[y(x^{HOME}, s')] = \max\left[0.5(\mu_f y_H + \mu_f y_L), 0.5(\mu_m y_H + \mu_m y_L)\right]$$

$$= 0.5(y_H + y_L)\max\left[\mu_f, \mu_m\right]$$

$$= 0.5(y_H + y_L)\mu$$

[10] These functional forms are the same as Doepke and Zilibotti, 2017

where, $\mu = \max\left[\mu_f, \mu_m\right]$.

One can interpret μ as a premium that the child gets if she chooses the same occupation as one of the parents. Similar to Doepke and Zilibotti, 2017, I refer to this term as an *incumbency premium*. The incumbency premium captures skill acquisition within the family and entry barriers. μ can also be viewed as a proxy for social mobility, where a higher μ represents low social mobility.

The child could leave home and search for a job ($x^{\mu} = x^{SEARCH}$), which is a better fit. But in this case, the child does not get the advantage of the incumbency premium. The expected productivity now is no longer stochastic since the child finds a job which is a good fit.

$$E_{s'}[y(x^{SEARCH}, s')] = y_H$$

2.4.2 Decision of the Household (*Parenting*)

Households take decisions on whether or not to restrict the feasible choice set of the child (X) and whether or not to influence the preference vector of the child (a').

Parents jointly decide the *choice set* X available to the child. In particular, parents can either let X be free (X^{FREE}) and allow the child to venture out, or restrict it (X^{HOME}) and make it practically impossible for the child to venture out. If parents together set $X = X^{FREE}$, then the child is independent and such a child can choose x^{SEARCH} if they want to. In this case, the household cannot monitor the educational effort of the child (x^e).

$$(x^{\mu}, x^e) = \left\{ x^{\mu} \, \epsilon \, \{x^{HOME}, \, x^{SEARCH}\} \, , 0 \leq x^e \leq 1 \right\}$$

If the parents restrict the choice set available, $X = X^{HOME}$, the child stays at home and the educational effort can be monitored/verified. Hence the household makes sure the effort of

the child is optimal from the household's perspective, $x^e = \bar{x^e}$.

$$(x^\mu, x^e) = \left\{ x^\mu \;=\; x^{HOME} \;,\; x^e = \bar{x^e} \right\}$$

Parents together can also decide to influence the *preference* vector of the child. The child has an innate preference for instant gratification, $\bar{a} > 1$. If parents opt not to influence the preference vector of the child, then the child is allowed to express their innate preferences $a' = \bar{a}$, and if parents opt to influence, then $a' < \bar{a}$. Parents may like to set the preference vector to $a' < \bar{a}$ to curtail young-age consumption of the child.

2.4.3 Defining Parenting Styles

Similar to Doepke and Zilibotti, 2017, I adopt a definition of parenting style based on the Baumrind, 1967 classification in developmental psychology: *authoritarian*, *authoritative*, and, *permissive* style of parenting.

The household adopts an *authoritarian* parenting style if parents jointly decide to restrict the choice set available to the child ($X = X^{HOME}$) and not influence the preference vector of the child ($a = \bar{a}$).

The household adopts an *authoritative* parenting style if parents jointly decide not to restrict the choice set available to the child ($X = X^{FREE}$), but influence the preference vector of the child ($a \neq \bar{a}$).

The household adopts a *permissive* style of parenting if parents jointly decide not to restrict the choice set of the child ($X = X^{FREE}$) nor influence the preference vector of the child ($a = \bar{a}$).

2.4.4 Nash Bargaining Outcome

Assume a world where spouses use the Nash bargaining solution to determine a joint parenting decision, with single-parenting as a threat point. Let (X, a') denote the joint parenting decision and T^j the threat point of parent $j \in \{m, f\}$. Remember that, parenting decisions affect the experience of the child and parents care about this experience (see equation 2.1). The

general Nash bargaining problem is given by

$$\max \left[\left[w_m(X, a'|a) \right\} - T^m \right] * \left[\{ w_f(X, a'|a) \} - T^f \right] \right] \tag{2.6}$$

$w_j(X, a'|a) - T^j$ denotes the gains of household parenting as opposed to single parenting for parent $j \in \{m, f\}$. For parent j, the threat point is T^j and no parent will accept an agreement that is less desirable than their threat point. [11]

The Nash bargaining solution is a Pareto optimal. Hence there exist a value for θ (in equation 2.2), for which solving the maximising problem of the weighted sum in equation 2.2 is equivalent to solving the Nash bargaining problem in equation 2.6. The Nash bargaining solution can be written as [12]

$$\max \left[\theta(X, a', \Lambda) \left[w_m(X, a'|a) \right\} \right] + \left(1 - \theta(X, a', \Lambda) \right) \left[\{ w_f(X, a'|a) \} \right] \right]$$

where

$$\theta(X, a', \Lambda) = \frac{w_f(X, a'|a) - T^f}{w_m(X, a'|a) - T^m + w_f(X, a'|a) - T^f} \tag{2.7}$$

If both parents decide to cooperate (took parenting decisions as a household) then, θ, the pareto weight for parent m is directly proportional to the utility the other parent f gets from the child's experience. Under cooperation, the parent that gets more utility from the child's experience is the parent that also has more to lose if they decided not to cooperate. This gives more

[11] For parent $j \in \{m, f\}$, $T^j = v_j^{single} = \max_{X,a} \left[w_j^{single}(X_j, a_j) \right]$

[12] For parent $j \in \{m, f\}$

$$\omega_j(X, a') = E_{s'} \left[(1 - \lambda_j) U_i^y(c^y|a') + \lambda_j U_j^o(c^y|a') + \beta_j U_i^o(c_i^o|a') \right]$$

Pareto weight can be explicitly written as

$$\theta(X, a', \Lambda) = \frac{L_f(1 - x^e)^{1-\sigma} + \beta_f(1 + Rx^e)^{1-\sigma} - T^f}{(L_m + L_f)(1 - x^e)^{1-\sigma} + (\beta_m + \beta_f)(1 + Rx^e)^{1-\sigma} - T^m - T^f}$$

where $L_j = \lambda_j + (1 - \lambda_j)a'$. Notice that θ is affected by x^e and a'. This is going to be important while finding the value functions for each parenting style.

bargaining power to the other parent. Similarly, $1-\theta$, the pareto weight of parent f is directly proportional to the utility parent m gets from the child's experience (under cooperation).

The particular construction of θ in equation 2.7 leads to differences in single-parent decisions on parenting. The parent who has more to lose ends up having less say in the household. Assume that the father is more paternalistic than the mother, and such a household has to decide on how the child should spend time during weekends. Suppose the child would like to spend time playing video games, but if it was only up to the father, the child would be sent to additional math class, whereas, if the decision was only up to the mother she would have made the child join a club where they could do many activities. In this example sending the child to additional math class restricts the child's options and corresponds to authoritarian parenting. Making the child join a club could influence the preferences of the child, and corresponds to authoritative parenting. According to equation 2.7, the mother could get more say in household decisions if she agrees to send the child to additional math class (i.e., she agrees to do what her husband prefers). Since the mother (and father) knows that the father has more to lose if they disagree on math class, she has more bargaining power by implementing the parenting decision that she would not have adopted as a single parent. In a richer model with other household decisions, this could explain strategic behaviours where one parent agrees to do adopt a parenting style he/she would not have adopted as a single parent, to gain bargaining power and use this for other household decisions.

Notice that under this approach, in equilibrium, the Pareto weights of each parent in the overall household utility depends on the choice variables (X, a'), the parameters $\Lambda = (\lambda_m, \lambda_f, \beta_m, \beta_f)$ and the state variables (h', s). Essentially this particular form of endogenous weights is my contribution. *When parenting is a two-person decision, the parenting style adopted also affects the weight each parent gets in the overall household utility.*

Functional forms

Similar to Doepke and Zilibotti, 2017, I impose an isoelastic utility function. The child's and parent's utility function when *o*ld is,

$$U^o(c|a) = \frac{(c^o)^{1-\sigma}}{1-\sigma} \tag{2.8}$$

The child's utility function when *y*oung is

$$U^y(c|a) = a\frac{(c^y)^{1-\sigma}}{1-\sigma} \tag{2.9}$$

The parameter σ measures the risk aversion of the agent and we assume $0 < \sigma < 1$ so that utility is positive. The parameter $a \in (1, \bar{a})$ denotes the preference vector of the child. Without any influence $a = \bar{a}$, where $\bar{a} > 1$ is the child's innate preference for instant gratification. To instil patience, a parent could choose $a < \bar{a}$ which reduces the utility of the child when young.

2.5 General Solution

I first re-write the problem of the household with the functional forms followed by the value functions for authoritarian, authoritative, and permissive households. I then compare the value functions and find the parenting style chosen by the household in equilibrium. Since there are no closed-form solutions, I move to specific cases to find equilibrium parenting styles.

Replacing equations 2.1, 2.2, and 2.7 with the functional forms (see equations 2.8 and 2.9), we can write the problem of a household with different views on *paternalism/altruism* and *discount factors* as

$$v^o_{\mathbf{HH}}(a,h,s) = \max_{a',X} E_{s'}\left[\theta(\mathbf{X, a', \Lambda})\left[(1-\lambda_m)a'\frac{(c^y)^{1-\sigma}}{1-\sigma} + \lambda_m\frac{(c^y)^{1-\sigma}}{1-\sigma} + \beta_m\frac{(c^o)^{1-\sigma}}{1-\sigma}\right]\right.$$

$$+(1-\theta(\mathbf{X},\mathbf{a'},\Lambda))\left[(1-\lambda_f)a'\frac{(c^y)^{1-\sigma}}{1-\sigma}+\lambda_f\frac{(c^y)^{1-\sigma}}{1-\sigma}+\beta_f\frac{(c^o)^{1-\sigma}}{1-\sigma}\right]\Bigg]$$

subject to

$$c^y = (1-x^e)y(x^\mu, s')$$

$$c^o = h' = (1+Rx^e)y(x^\mu, s')$$

Here parent m has a pareto weight θ and parent f has a weight $1-\theta$. The household maximizes a weighted sum.

I solve the problem backwards. Since parenting style is a discrete choice, I find the effort the child puts into education (x^e) for each parenting style. The household finds the value function for each parenting style and adopts the parenting style that maximizes the joint utility of the household. If parents adopt an *authoritarian* parenting style, then $\bar{x}^e$ denotes the effort of the child which can be monitored and $v_{HH}^{\mathbf{A}}(a,h,s)$ represents the authoritarian household's value function. If the parents adopt an *authoritative* parenting style, then $x^e(a')$ denotes the effort of the child which depends on the preference vector of the child and $v_{HH}^{\mathbf{AT}}(a,h,s)$ represents the authoritative household's value function. For *permissive* parenting style, $x^e(\bar{a})$ denotes the effort of the child which cannot be monitored nor depends on the preference vector of the child. $v_{HH}^{\mathbf{P}}(a,h,s)$ represents the permissive household's value function. All of this is explained in the next section.

Authoritarian Parenting Style

We say that the household adopts an *authoritarian* parenting style if it decides to restrict the choice set available to the child ($X = X^{HOME}$) and does not influence the preference vector of the child ($a = \bar{a}$). When the child stays at home the expected productivity is [13]

$$E_{s'}[y(x^{HOME}, s')] = 0.5(\mu y_H + \mu y_L)$$

[13] When parents have different occupations, $\mu = \max\left[\mu_f, \mu_m\right]$

and the child's choice is

$$x^{\mu} = x^{HOME}, \; x^{e} = \bar{x^{e}}$$

Since the child stays at home, their educational effort x^e can be verified. The optimal effort of the child is

$$\bar{x}^e = arg\max_{x^e} E_{s'}\left[\theta(x^e,\bar{a},\Lambda)\left[\bar{L}_m\frac{\Big((1-x^e)y\Big)^{1-\sigma}}{1-\sigma}+\beta_m\frac{\Big((1+Rx^e)y\Big)^{1-\sigma}}{1-\sigma}\right]\right.$$

$$\left.+\Big(1-\theta(x^e,\bar{a},\Lambda)\Big)\left[\bar{L}_f\frac{\Big((1-x^e)y\Big)^{1-\sigma}}{1-\sigma}+\beta_f\frac{\Big((1+Rx^e)y\Big)^{1-\sigma}}{1-\sigma}\right]\right] \tag{2.10}$$

L_j is how parent $j \in \{m, f\}$ cares about the child's present consumption which is a combination of paternalism and altruism. In an authoritarian household since $a' = \bar{a}$, we have $L_j = \bar{L}_j$ where $\bar{L}_j = \lambda_j + (1-\lambda_j)\bar{a}$. There is no closed form solution for equation 2.10.

Substituting equation 2.10 and $a' = \bar{a}$ in equations 2.1 - 2.9 we find the value function of the authoritarian household, $v^{\mathbf{A}}_{HH}(\bar{a}, h', s')$.

$$v^{\mathbf{A}}_{HH}(\bar{a},h',s') = \left[\theta(\bar{x}^e,\bar{a},\Lambda)\left[\bar{L}_m\frac{\Big((1-\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}+\beta_m\frac{\Big((1+R\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}\right]\right.$$

$$\left.+\Big(1-\theta(\bar{x}^e,\bar{a},\Lambda)\Big)\left[\bar{L}_f\frac{\Big((1-\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}+\beta_f\frac{\Big((1+R\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}\right]\right] \tag{2.11}$$

where

$$\theta(\bar{x}^e,\bar{a},\Lambda) = \frac{\bar{L}_f(1-\bar{x}^e)^{1-\sigma}+\beta_f(1+R\bar{x}^e)^{1-\sigma}-T^f}{(\bar{L}_m+\bar{L}_f)(1-\bar{x}^e)^{1-\sigma}+(\beta_m+\beta_f)(1+R\bar{x}^e)^{1-\sigma}-T^m-T^f} \tag{2.12}$$

In an authoritarian household, the educational effort of the child is verified and set by the parents. This also has an effect on the pareto weight (see equation 2.12). Since educational effort can be verified, the authoritarian household refrains from influencing the preferences of

the child. Authoritarian parents affect the value function of the household directly by setting the educational effort of the child.

Non-Authoritarian Parenting Style

We say that the household adopts a non-authoritarian parenting style if it sets the feasible choice set to be $X = X^{FREE}$. In this scenario, the child is independent and chooses x^{SEARCH} if he/she wants to. The child's choice is

$$x^{\mu} \in \{x^{HOME}, x^{SEARCH}\}, 0 \leq x^{e}(a') \leq 1$$

As shown by Doepke and Zilibotti, 2017, when given the choice $X = X^{FREE}$, the child always leaves home [14] and chooses $x^{\mu} = x^{SEARCH}$. The expected productivity in this case is

$$E_{s'}[y(x^{SEARCH}, s')] = y_H$$

Here the educational effort of the child x^e cannot be verified by the household. The child in such a household maximizes the expected utility from current and discounted future consumption. Notably, the preference vector is decided by the parents. The child will discount the future consumption according to the discount rate set by the parents.

In a non-authoritarian household, the child decides the effort level $x^e(a')$

$$x^{e}(a') = arg\max_{x^e} E_{s'}\left[\theta(\mathbf{X},\Lambda)\left[a'\frac{(c^y)^{1-\sigma}}{1-\sigma} + \beta_m\frac{(c^o)^{1-\sigma}}{1-\sigma}\right]\right.$$
$$\left. + \quad (1-\theta(\mathbf{X},\Lambda))\left[a'\frac{(c^y)^{1-\sigma}}{1-\sigma} + \beta_f\frac{(c^o)^{1-\sigma}}{1-\sigma}\right]\right] \quad (2.13)$$

where

$$\theta(\mathbf{X},\Lambda) = \frac{L_f(1-x^e)^{1-\sigma} + \beta_f(1+Rx^e)^{1-\sigma} - T^f}{(L_m+L_f)(1-x^e)^{1-\sigma} + (\beta_m+\beta_f)(1+Rx^e)^{1-\sigma} - T^m - T^f} \quad (2.14)$$

[14] Doepke and Zilibotti, 2017 proves this in the original paper

There is no closed form solution for equation 2.13.

In a *non-authoritarian* household, the effort level of the child $x^e(a')$ depends on the preference vector of the child. A non-authoritarian household can be of two types Authoritative or Permissive.

Authoritative Parenting Style (Non-Authoritarian)

If a household jointly decides not to restrict the choice set available to the child ($X = X^{FREE}$), but influences the preference vector of the child ($a' \neq \bar{a}$), then this household adopts an *authoritative* parenting style.

The authoritative household will substitute equation 2.13 and $a' \neq \bar{a}$ in equations 2.1 to 2.9 to find the value function $v^{\mathbf{AT}}_{HH}(a', h', s')$.

$$v^{\mathbf{AT}}_{HH}(a', h', s') = \left[\theta(x^e, a', \Lambda)\left[L_m \frac{\Big((1-x^e)y\Big)^{1-\sigma}}{1-\sigma} + \beta_m \frac{\Big((1+Rx^e)y\Big)^{1-\sigma}}{1-\sigma}\right]\right.$$

$$\left. + \Big(1-\theta(x^e, a', \Lambda)\Big)\left[L_f \frac{\Big((1-x^e)y\Big)^{1-\sigma}}{1-\sigma} + \beta_f \frac{\Big((1+Rx^e)y\Big)^{1-\sigma}}{1-\sigma}\right]\right] \tag{2.15}$$

where $L_j = \lambda_j + (1-\lambda_j)a'$. See equation 2.14 for θ.

The value function of an authoritative household depends on the educational effort of the child, but this effort cannot be verified by the parents ($x^e \neq \bar{x}^e$). Since the educational effort cannot be verified, authoritative parents influence the preferences of the child ($a' \neq \bar{a}$) which in turn affects the education effort, $x^e(a')$ (see equation 2.13). This also affects the pareto weight (see equation 2.14 which depends on $L_j = \lambda_j + (1-\lambda_j)a'$). By influencing the preferences of the child, authoritative parents affect the value function of the household indirectly through the non-verifiable educational effort.

Permissive Parenting Style (Non-Authoritarian)

If a household jointly decides not to restrict the choice set of the child ($X = X^{FREE}$) nor to influence the preferences of the child ($a = \bar{a}$), then this household adopts a *permissive* style of parenting. The permissive household will substitute equation 2.13 and $a' = \bar{a}$ in equations 2.1 to 2.9 to find the value function $v^{\mathbf{P}}_{HH}(\bar{a}, h', s')$.

$$v^{\mathbf{P}}_{HH}(\bar{a}, h', s') = \left[\theta(x^e, \bar{a}, \Lambda)\left[\bar{L}_m \frac{\Big((1-x^e)y\Big)^{1-\sigma}}{1-\sigma} + \beta_m \frac{\Big((1+Rx^e)y\Big)^{1-\sigma}}{1-\sigma}\right]\right.$$

$$\left. + \Big(1-\theta(x^e, \bar{a}, \Lambda)\Big)\left[\bar{L}_f \frac{\Big((1-x^e)y\Big)^{1-\sigma}}{1-\sigma} + \beta_f \frac{\Big((1+Rx^e)y\Big)^{1-\sigma}}{1-\sigma}\right]\right] \tag{2.16}$$

where $\bar{L}_j = \lambda_j + (1-\lambda_j)\bar{a}$ (see equation 2.14 for θ)

In a permissive household, the value function depends on the educational effort of the child, which is not monitored by the parents. Also, permissive parents do not influence the preferences of the child. Thus, parents in a permissive household do not directly or indirectly affect the value function of the household.

2.6 Equilibrium Parenting Style

To find the choice between authoritarian and non-authoritarian (authoritative or permissive) parenting styles, we have to compare the value functions (see equations 2.11, 2.15, and 2.16). For a set of parameter values, the optimal parenting style choice of the household reduces to:

$$max\left\{v^{\mathbf{A}}_{HH}(a', h', s'), v^{\mathbf{AT}}_{HH}(a', h', s'), v^{\mathbf{P}}_{HH}(a', h', s')\right\}$$

There are no closed-form solutions for equations 2.10 and 2.13. To proceed I consider two special cases. First I consider a case where parents differ only in paternalism and second a case where parents differ only in discount factors. For both cases, I treat threat points as

endogenous and solve equations 2.10 and 2.13 numerically. Using simulations, I then check if predictions of these models (case 1 & 2) are different from the original model of Doepke and Zilibotti, 2017.

2.6.1 Case 1: Parents Only Differ in Paternalism

I begin by considering a household where parents differ only in how each parent values the child's experience through the parent perspective, i.e. paternalism. $\lambda_m \neq \lambda_f$ [15]. Parents have the same preferences on consumption and do not differ in any other way ($\beta_f = \beta_m = \beta$). First, I find the value functions for authoritarian, authoritative and permissive households and then, the equilibrium parenting style. Finally, using simulations I show how different are the predictions of this model compared to the original model by Doepke and Zilibotti, 2017.

[15] Because of the definition of paternalism, $1 - \lambda_m$ and $1 - \lambda_f$ can be viewed as the altruistic component of the male and female parent respectively. So this section can also be seen as, *Case 1: Parents Only Differ in Altruism*

When parents only differ on paternalism, the effort in education a child[16] in an authoritarian household is (see equation 2.10)

$$\bar{x}^e = arg\max_{x^e} E_{s'}\left[\theta(\bar{x}^e,\bar{a},\Lambda)\left[\bar{L}_m\frac{\Big((1-\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}+\beta\frac{\Big((1+R\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}\right]\right.$$

$$\left.+\Big(1-\theta(\bar{x}^e,\bar{a},\Lambda)\Big)\left[\bar{L}_f\frac{\Big((1-\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}+\beta\frac{\Big((1+R\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}\right]\right] \tag{2.17}$$

where $\bar{L}_j = \lambda_j + (1-\lambda_j)\bar{a}$. There is no closed form solution for equation 2.17.

The value function of the *authoritarian* household, $v^{\mathbf{A}}_{HH}(a',h',s')$ is thus:

$$v^A_{HH}(a,h,s) = E_{s'}\left[\theta(\bar{x}^e,\bar{a},\Lambda)\left[\Big[(1-\lambda_m)\bar{a}+\lambda_m\Big]\frac{\Big((1-\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}+\beta\frac{\Big((1+R\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}\right]\right.$$

$$\left.+\Big(1-\theta(\bar{x}^e,\bar{a},\Lambda)\Big)\left[\Big[(1-\lambda_f)\bar{a}+\lambda_f\Big]\frac{\Big((1-\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}+\beta\frac{\Big((1+R\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}\right]\right] \tag{2.18}$$

The function depends on the endogenous weight θ, which is a function of the choice variables x^e, $a' = \bar{a}$ and other parameters of the model.

The effort in education a child in a non-authoritarian household where parents only differ on paternalism is (see equation 2.13):

$$x^e(a') = arg\max_{x^e} E_{s'}\left[a'\frac{(c^y)^{1-\sigma}}{1-\sigma}+\beta\frac{(c^o)^{1-\sigma}}{1-\sigma}\right] \tag{2.19}$$

$$= arg\max_{x^e} E_{s'}\left[a'\frac{(1-x^e)^{1-\sigma}}{1-\sigma}+\beta\frac{(1+Rx^e)^{1-\sigma}}{1-\sigma}\right]$$

[16] from the household's perspective

$$x^e(a') = \frac{1 - \left(\frac{a'}{\beta R}\right)^{\frac{1}{\sigma}}}{1 + R\left(\frac{a'}{\beta R}\right)^{\frac{1}{\sigma}}} \tag{2.20}$$

Differences in paternalism/altruism of parents do not matter when the child decides on educational effort in a non-authoritarian household. Hence the closed-form solution for the educational effort of the child, in this case, do not depend on differences in paternalism/altruism [17]. A non-authoritarian household can be of two types Authoritative or Permissive type.

The value function of the authoritative household $[x^e = x^e(a'), a' < \bar{a}]$ where parents only differ on paternalism is:

$$v^{AT}_{HH}(a', h', s') = E_{s'}\Bigg[\theta(x^e(a'), \Lambda)\Bigg[\Big[(1-\lambda_m)a' + \lambda_m\Big]\frac{\Big((1-x^e(a'))y\Big)^{1-\sigma}}{1-\sigma} + \beta\frac{\Big((1+Rx^e(a'))y\Big)^{1-\sigma}}{1-\sigma}\Bigg]$$

$$+\Big(1-\theta(x^e(a'), \Lambda)\Big)\Bigg[\Big[(1-\lambda_f)a' + \lambda_f\Big]\frac{\Big((1-x^e(a'))y\Big)^{1-\sigma}}{1-\sigma} + \beta\frac{\Big((1+Rx^e(a'))y\Big)^{1-\sigma}}{1-\sigma}\Bigg]\Bigg] \tag{2.21}$$

The value function of the permissive household $[x^e = x^e(a'), a' = \bar{a}]$ where parents only differ on paternalism is:

$$v^{P}_{HH}(a, h, s) = E_{s'}\Bigg[\theta(x^e(\bar{a}), \Lambda)\Bigg[\Big[(1-\lambda_m)\bar{a} + \lambda_m\Big]\frac{\Big((1-x^e(\bar{a}))y\Big)^{1-\sigma}}{1-\sigma} + \beta\frac{\Big((1+Rx^e(\bar{a}))y\Big)^{1-\sigma}}{1-\sigma}\Bigg]$$

[17] This closed form solution is exactly same as the original model of Doepke and Zilibotti, 2017

$$+\Big(1-\theta(x^e(\bar{a}),\Lambda)\Big)\left[\Big[(1-\lambda_f)\bar{a}+\lambda_f\Big]\frac{\Big((1-x^e(\bar{a}))y\Big)^{1-\sigma}}{1-\sigma}+\beta\frac{\Big((1+Rx^e(\bar{a}))y\Big)^{1-\sigma}}{1-\sigma}\right] \tag{2.22}$$

The household compares equations 2.18, 2.21, and 2.22 and chooses the *optimal parenting style* (OPS).

$$OPS = \max\left\{v^{\mathbf{A}}_{HH}(a',h',s'), v^{\mathbf{AT}}_{HH}(a',h',s'), v^{\mathbf{P}}_{HH}(a',h',s')\right\}$$

The most important aspect in the model where parents differ only on paternalism (or altruism) is that the endogenous pareto-weight (θ) depends on the choice variables x^e and a' (see equation 2.7).

$$\theta(x^e,a',\Lambda) = \frac{L_f(1-x^e)^{1-\sigma}+\beta(1+Rx^e)^{1-\sigma}-T^f}{(L_m+L_f)(1-x^e)^{1-\sigma}+2\beta(1+Rx^e)^{1-\sigma}-T^m-T^f} \tag{2.23}$$

The household maximizes a weighted sum of the utilities, $\theta\omega_m + (1-\theta)\omega_f$. Each parent $j \in \{m,f\}$ attaches a weight—corresponding to their bargaining power—to the utility they get from the child's experience (see equation 2.1). Even when there is a small difference in paternalism (λ) among parents, the choice of the parenting style affects the balance of power between the parents $\theta(X,a',\Lambda)$. The endogenous $\theta(X,a',\Lambda)$ affects all the value functions and thus affects the optimal choice of parenting style itself. Joint parenting decisions in this context could affect each parent differently, thereby giving a parent more/less say in household decisions. This is how I expand the model of Doepke and Zilibotti, 2017 which treats parenting as a single parent decision (or a unitary household decision).

2.6.2 Numerical Solution and Simulations

I use the Nash bargaining solution to determine the joint parenting decision, with single-parenting as a threat point. The threat point (T^j) is given by the optimal parenting style each parent $j \in \{m,f\}$ would adopt as a single parent, when the returns to human capital and

incumbency premium are R and μ respectively.

There is no closed-form solution for this model. I solve the problem of the household in *case 1*—where parents differ only in paternalism/altruism— numerically.

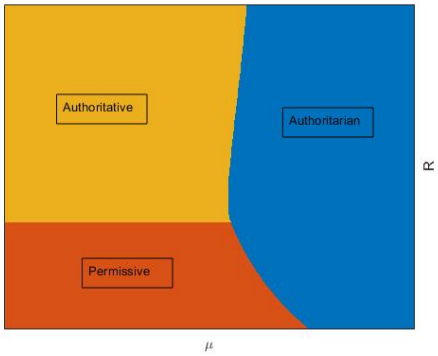
To preserve comparability, I use the same parameter values from Doepke and Zilibotti, 2017, $\sigma = 0.5$, $\beta = 0.8$, $\bar{a} = 1.5$, and $y_H/y_L = 1.5$. Similar to Doepke and Zilibotti, 2017, optimal parenting style is given as a function of returns to human capital R and the incumbency premium μ.

As a sanity check, I first show that my model collapses to the model of Doepke and Zilibotti, 2017, when both parents have the same level of paternalism/altruism (unitary model, $\lambda_m = 0.95$ and $\lambda_f = 0.95$).[18] I illustrate the results in a box (see figure 2.6.1), where the X axis represents the incumbency premium (μ) and the Y-axis represent returns to human capital (R). Within this box, the optimal parenting style is represented by a shaded region. A particular colour is assigned to each parenting style (blue for *authoritarian*, yellow for *authoritative*, and orange for *permissive* styles of parenting). When the incumbency premium μ is high, it is optimal for the household to adopt an *authoritarian* style of parenting for all levels of returns to human capital R. If the incumbency premium μ is not high enough, the optimal parenting style is *permissive* only if returns to human capital R is low. When returns to human capital R is high and the incumbency premium μ is low, then it is optimal for the unitary household to adopt an *authoritative* style of parenting. I will be using this simulation as a reference point.

Next, I conduct the analogous exercise for the model described in section 4 (case 1). We have two parents with different levels of paternalism (λ_m and λ_f). Household B is a non-unitary household—a special case of collective household—where we cannot represent paternalism at the household level as a simple average. This is because in the non-unitary (collective) approach we have a weighted average of paternalism where the weights are endogenous (i.e. Parenting Style (PS) depends on the weights and weights depend on PS). Household A is a

[18] The model of Doepke and Zilibotti, 2017 used $\lambda = 0.95$ as the parameter value for paternalism (for the single parent)

Figure 2.6.1: Sanity Check for Case 1.

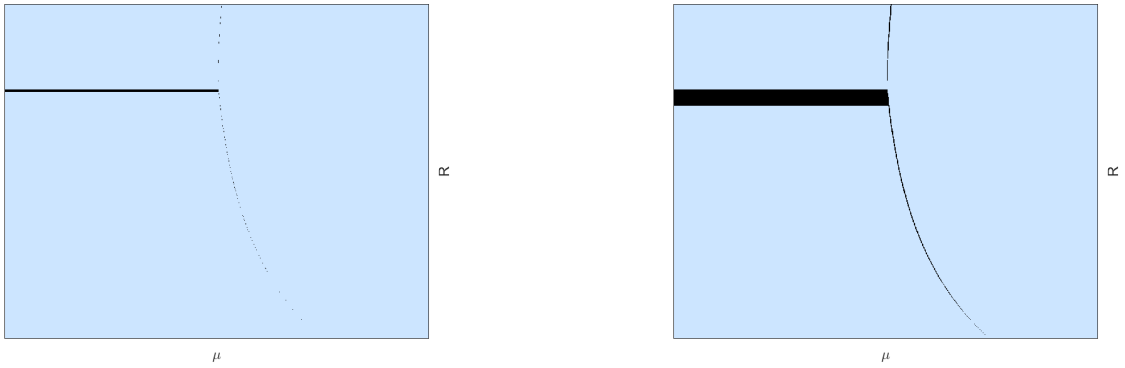


Model boils down to the original model if $\lambda_m = \lambda_f$.

unitary household where we can represent the level of paternalism at the household level (as a simple average of paternalism of both parents). The model of Doepke and Zilibotti, 2017 represents household A and the model presented in section 4 represents household B.

The optimal parenting style is given as a function of returns to human capital R and the incumbency premium μ. I illustrate the results of my numerical solution in a box (see figure 2.6.2), where the X axis represents the incumbency premium (μ) and the Y-axis represent returns to human capital (R). Within this box, the shaded darker portion represents regions of R and μ where households A and B have different optimal parenting styles. For higher premiums of incumbency, the optimal parenting style in households A and B are the same (*authoritarian parenting style*). We begin to observe differences in the optimal parenting style of household A and B, when incumbency premium is low and returns to human capital is high. For these combinations of R and μ, it would be optimal for household A (unitary) to adopt a *permissive* parenting style, whereas, the optimal parenting style of household B (collective) will be to be *authoritative*. The difference in the optimal parenting style originates from the pareto weights each parent attaches to the utility they derive from the child's experience. These weights can be seen as bargaining power of individual parents and is characterised by the Nash bargaining solution (see equation 2.23). Bargaining power of parent f (m) decreases with the the level of paternalism of the other parent λ_m (λ_f). Hence, the optimal parenting style in household B will not only be different from the unitary household, but will also be closer to

Figure 2.6.2: Comparing Household A & B (case 1).



(a) $\lambda_m = 0.88$, $\lambda_f = 0.94$ (b) $\lambda_m = 0.83$, $\lambda_f = 0.99$

Darker area shows the different optimal parenting style predicted by the collective model, compared to the unitary model of Doepke and Zilibotti, 2017

the likes of the more paternalistic parent (see below example). [19]

Even the slightest difference in paternalism make collective households to adopt a different optimal parenting style compared to the unitary households. In the left panel of figure 2.6.2, the difference in paternalism is around 7%. Larger differences in paternalism are coupled with larger differences in optimal parenting styles adopted by collective and unitary households. The right panel of figure 2.6.2 show households where the difference in paternalism is around 17 %. [20]

Case 1 Example

These differences can be interpreted with an example. Consider two parents who have different levels of altruism/paternalism and have to decide how their child spends time during weekends. Assume the mother is more altruistic than the father, $\lambda_{mother} < \lambda_{father}$, and consider an economy where the incumbency premium is low and returns to human capital is high. If the more altruistic mother makes the decision as a single parent, she would have sent the child

[19] The lighter blue area in figure 2.6.2 represents all the regions where the equilibrium PS is the same in households A and B. Average of λ_m&λ_f is 0.91 and $\lambda = 0.91$ in household A. For the same average $\lambda = 0.91$, the differences in PS (black area) increases when $\Delta\lambda$ increases.

[20] The differences in optimal PS is always seen at the boundary between different PS in the original model.

to basketball practice, which happens to be exactly what the child prefers. As a single parent the mother will be permissive (see Appendix B). Being more altruistic, the mother cares more about the child's present happiness. In contrast, if this decision was only up to the more paternalistic father, he would not want the child to play basketball during the weekends; he would want the child to join an after-school program covering a variety of extra-curricular subjects. This can be seen as an act to influence the preferences of the child, i.e., an authoritative parenting style (see Appendix B). Being more paternalistic (i.e., less altruistic) makes the father care less about the present happiness of the child, and care more about the future happiness of the child (or at least what he expects). If the decision was to be taken by both parents as a unitary household (household A), it would be optimal for the parents to sent their child to basketball practice (permissive PS) in line with the more altruistic mother. But if these parents formed a collective household described in section 4 (case 1), it would be optimal for them to sent their child to an after-school program (an authoritative PS) [21]. This is because the higher level of paternalism of father reduces the bargaining power of the mother (as described by equation 2.23).

Under cooperation the parent that gets more utility from the child's experience is the parent that also has more to lose if they decided not to cooperate. In a richer model this can also be seen as strategic behavior of the more altruistic mother. The mother cooperated and agreed to a parenting style, which she would not have adopted as a single parent, to gain more bargaining power that she can exert on other household decisions.

In this model, when the child becomes an adult he consumes the accumulated human capital. This accumulated human capital increases with the effort he puts into education. The change in parenting style in the collective household is associated with an increase in the child's human capital. This is mechanical and is driven by the definition of *authoritative* and *permissive* parenting styles. By construction, permissive parents allow the child to do whatever he wants. But authoritative parents will constrain the choice set available to the child, and this indirectly increases his educational effort. The increment in educational effort (in authoritative parenting

[21] The darker region in figure 2.6.2 captures the difference in the optimal parenting style by the unitary household and the collective household described in section 4.

relative to permissive parenting) is translated to the human capital of the child.

Other observations about the simulation are included in Appendix C.

Persistent Effect

If threat points of both parents are equal to *zero* ($T^m = T^f = 0$), then the pareto weight of parent m is

$$\theta(X, a', \Lambda) = \frac{L_f(1 - x^e)^{1-\sigma} + \beta(1 + Rx^e)^{1-\sigma}}{(L_m + L_f)(1 - x^e)^{1-\sigma} + 2\beta(1 + Rx^e)^{1-\sigma}}$$

When the discount factor goes to zero, $\beta \to 0$, pareto-weight θ will no longer depend on the choice variable x^e, but will still depend on the choice variable a' since both L_m and L_f depend on a'.

$$\theta(a', \Lambda) = \frac{L_f}{(L_m + L_f)}$$

where for $j \in \{m, f\}$, $L_j = (1 - \lambda_j)a' + \lambda_j$. [22]

The pareto weight θ remains endogenous through a' even in this extreme case when $\beta \to 0$. Because of this persistent effect, joint parenting decisions still affect each parent differently, thereby giving a parent more/less say in household decisions. This is how my extended model of Doepke and Zilibotti, 2017 captures joint parenting decisions.

2.6.3 Case 2: Parents Only Differ in Discount Factor

Now consider a household where parents differ only on how they discount the future consumption of their child (discount factor). $\beta_m \neq \beta_f$. Parents have the same preferences on consumption and do not differ in any other way ($\lambda_m = \lambda_f = \lambda$). Similar to the previous case,

[22] When $\beta \to 0$, the pareto weight of the other parent f is

$$(1 - \theta) = \frac{L_m}{(L_m + L_f)}$$

I first find the value functions for authoritarian, authoritative, and permissive households and then, the equilibrium parenting style. Using simulations I check how different are the predictions of this model compared to the original model of Doepke and Zilibotti, 2017.

When parents only differ on discount factors, the effort in education a child[23] in an authoritarian household is (see equation 2.10):

$$\bar{x}^e = arg\max_{x^e} E_{s'}\Bigg[\theta(\bar{x}^e,\bar{a},\Lambda)\Bigg[\bar{L}\frac{\Big((1-\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}+\beta_m\frac{\Big((1+R\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}\Bigg]$$

$$+\Big(1-\theta(\bar{x}^e,\bar{a},\Lambda)\Big)\Bigg[\bar{L}\frac{\Big((1-\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}+\beta_f\frac{\Big((1+R\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}\Bigg]\Bigg] \tag{2.24}$$

where $\bar{L}=\lambda+(1-\lambda)\bar{a}$. There is no closed form solution for equation 2.24.

The value function of an *authoritarian* household, $v^A_{HH}(a,h,s)$ is thus:

$$v^A_{HH}(a,h,s) = E_{s'}\Bigg[\theta(\bar{x}^e,\bar{a},\Lambda)\Bigg[\Big[(1-\lambda)\bar{a}+\lambda\Big]\frac{\Big((1-\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}+\beta_m\frac{\Big((1+R\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}\Bigg]$$

$$+\Big(1-\theta(\bar{x}^e,\bar{a},\Lambda)\Big)\Bigg[\Big[(1-\lambda)\bar{a}+\lambda\Big]\frac{\Big((1-\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}+\beta_f\frac{\Big((1+R\bar{x}^e)y\Big)^{1-\sigma}}{1-\sigma}\Bigg]\Bigg] \tag{2.25}$$

The function depends on the endogenous weight θ, which is a function of the choice variables x^e, $a'=\bar{a}$ and other parameters of the model.

The effort in education a child in a non-authoritarian household where parents only how they discount the child's future is (see equation 2.13):

$$x^e(a') = arg\max_{x^e} E_{s'}\Bigg[\theta(x^e,a',\Lambda)\Bigg[a'\frac{(c^y)^{1-\sigma}}{1-\sigma}+\beta_m\frac{(c^o)^{1-\sigma}}{1-\sigma}\Bigg]$$

[23] from the household's perspective

$$+ \quad (1-\theta(x^e, a', \Lambda))\left[a'\frac{(c^y)^{1-\sigma}}{1-\sigma} + \beta_f \frac{(c^o)^{1-\sigma}}{1-\sigma}\right]\Bigg] \tag{2.26}$$

There is no-closed form solution for equation 2.26.

Differences in discount factors of the parent matters when the child decides on educational effort in a non-authoritarian household. Unlike case 1, we do not have a closed-form solution for the educational effort of the child in a non-authoritarian household. A non-authoritarian household can be of two types Authoritative or Permissive type.

The value function of the authoritative household $[x^e = x^e(a'), a' < \bar{a}]$ where parents only differ on how they discount the future of the child is:

$$v^{AT}_{HH}(a', h', s') = E_{s'}\Bigg[\theta(x^e(a'), \Lambda)\Bigg[\Big[(1-\lambda)a' + \lambda\Big]\frac{\Big((1-x^e(a'))y\Big)^{1-\sigma}}{1-\sigma} + \beta_m \frac{\Big((1+Rx^e(a'))y\Big)^{1-\sigma}}{1-\sigma}\Bigg]$$

$$+\Big(1-\theta(x^e(a'), \Lambda)\Big)\Bigg[\Big[(1-\lambda)a' + \lambda\Big]\frac{\Big((1-x^e(a'))y\Big)^{1-\sigma}}{1-\sigma} + \beta_f \frac{\Big((1+Rx^e(a'))y\Big)^{1-\sigma}}{1-\sigma}\Bigg]\Bigg] \tag{2.27}$$

The value function of the permissive household $[x^e = x^e(a'), a' = \bar{a}]$ where parents only differ on how they discount the future of the child is:

$$v^{P}_{HH}(a, h, s) = E_{s'}\Bigg[\theta(x^e(\bar{a}), \Lambda)\Bigg[\Big[(1-\lambda)\bar{a} + \lambda\Big]\frac{\Big((1-x^e(\bar{a}))y\Big)^{1-\sigma}}{1-\sigma} + \beta_m \frac{\Big((1+Rx^e(\bar{a}))y\Big)^{1-\sigma}}{1-\sigma}\Bigg]$$

$$+\Big(1-\theta(x^e(\bar{a}), \Lambda)\Big)\Bigg[\Big[(1-\lambda)\bar{a} + \lambda\Big]\frac{\Big((1-x^e(\bar{a}))y\Big)^{1-\sigma}}{1-\sigma} + \beta_f \frac{\Big((1+Rx^e(\bar{a}))y\Big)^{1-\sigma}}{1-\sigma}\Bigg]\Bigg] \tag{2.28}$$

The household compares equations 2.25, 2.27, and 2.28 and choose the *optimal parenting style* (OPS).

$$OPS = \max\left\{v^{\mathbf{A}}_{HH}(a', h', s'), v^{\mathbf{AT}}_{HH}(a', h', s'), v^{\mathbf{P}}_{HH}(a', h', s')\right\}$$

The most important aspect in the model where parents differ only on how they discount the child's future is that the endogenous pareto-weight (θ) depends on the choice variables x^e, a' (see equation 2.7).

$$\theta(x^e, a', \Lambda) = \frac{L(1 - x^e)^{1-\sigma} + \beta_f(1 + Rx^e)^{1-\sigma} - T^f}{2L(1 - x^e)^{1-\sigma} + (\beta_m + \beta_f)(1 + Rx^e)^{1-\sigma} - T^m - T^f}$$

The household maximizes a weighted sum of the utilities, $\theta\omega_m + (1 - \theta)\omega_f$. Each parent $j \in \{m, f\}$ attaches a weight—corresponding to their bargaining power—to the utility they get from the child's experience (see equation 2.1). Even when there is a small difference in discount factor (β) among parents, the choice of the parenting style affects the balance of power between the parents $\theta(X, a', \Lambda)$. The endogenous $\theta(X, a', \Lambda)$ affects all the value functions and thus affects the optimal choice of parenting style itself. Joint parenting decisions in this context could affect each parent differently, thereby giving a parent more/less say in household decisions.

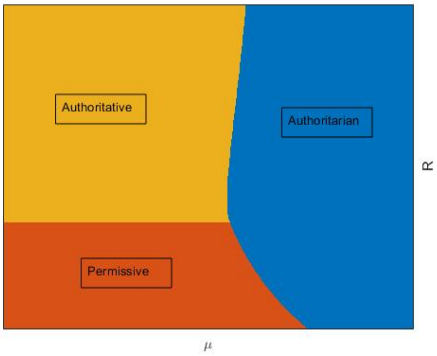
2.6.4 Numerical Solution and Simulations

Similar to the previous case, here I use the Nash bargaining solution to determine the joint parenting decision, with single-parenting as a threat point. The threat point (T^j) is given by the optimal parenting style each parent $j \in \{m, f\}$ would adopt as a single parent, when the returns to human capital and incumbency premium are R and μ respectively.

There is no closed-form solution for this model. I solve the problem of the household in *case 2*—where parents differ only in how they discount their child's future— numerically.

In order to preserve comparability, I use the same parameter values from Doepke and Zilibotti, 2017, $\sigma = 0.5$, $\lambda = 0.95$, $\bar{a} = 1.5$, and $y_H/y_L = 1.5$. Similar to Doepke and Zilibotti, 2017, optimal parenting style is given as a function of returns to human capital R and the incumbency

Figure 2.6.3: Sanity Check for Case 2.



Model boils down to the original model if $\beta_m = \beta_f$.

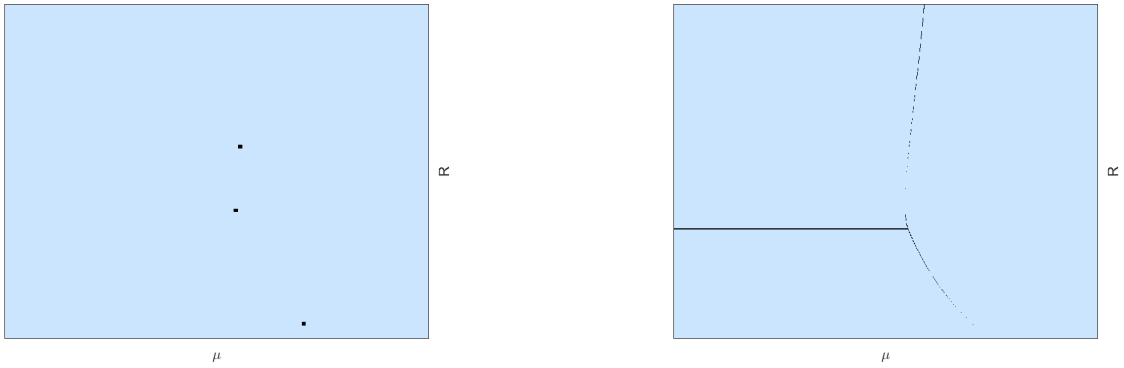
premium μ.

As a sanity check, I first show that my model collapses to the model of Doepke and Zilibotti, 2017, when both parents have the same discount factor (unitary model, $\beta_m = 0.80$ and $\beta_f = 0.80$).[24] I illustrate the results in a box (see figure 2.6.3), where the X axis represents the incumbency premium (μ) and the Y-axis represent returns to human capital (R). Within this box, the optimal parenting style is represented by a shaded region. A particular colour is assigned to each parenting style (blue for *authoritarian*, yellow for *authoritative*, and orange for *permissive* styles of parenting). When the incumbency premium μ is high, it is optimal for the household to adopt an *authoritarian* style of parenting for all levels of returns to human capital R. If the incumbency premium μ is not high enough, the optimal parenting style is *permissive* only if returns to human capital R is low. When returns to human capital R is high and the incumbency premium μ is low, then it is optimal for the unitary household to adopt an *authoritative* style of parenting. I will be using this simulation as a reference point.

Next, I conduct the analogous exercise for the model described in section 4 (case 2). We have two parents with different discount factors (β_m and β_f). Household B is a non-unitary household—a special case of collective household—where we cannot represent the discount factor at the household level as a simple average. This is because in the non-unitary (collec-

[24]The model of Doepke and Zilibotti, 2017 used $\beta = 0.80$ as the value for discount factor (for the single parent)

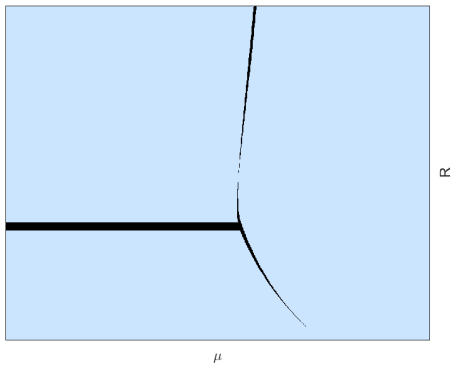
Figure 2.6.4: Comparing Household A & B (case 2).



$\beta_m = 0.83$, $\beta_f = 0.77$ $\beta_m = 0.87$, $\beta_f = 0.73$

tive) approach we have a weighted average of parent's discount factors where the weights are endogenous (i.e. Parenting Style (PS) depends on the weights and weights depend on PS). Household A is a unitary household where we can represent the discount factor at the household level (as a simple average of discount factors of both parents). The model of Doepke and Zilibotti, 2017 represents household A and the model presented in section 4 represents household B.

Figure 2.6.5: Comparing Household A & B (case 2).



$\beta_m = 0.98$, $\beta_f = 0.62$

Highlighted area shows the difference of optimal parenting style in household B.

The optimal parenting style is given as a function of returns to human capital R and the incumbency premium μ. I illustrate the results of my numerical solution in a box (see figure

2.6.4), where the X axis represents the incumbency premium (μ) and the Y-axis represent returns to human capital (R). Within this box, the shaded darker portion represents regions of R and μ where households A and B have different optimal parenting styles. As seen from figure 2.6.4, small differences in discount factors do lead to different optimal parenting styles in household A (collective) and household B (unitary). The left panel of figure 2.6.4 represents households where the difference in discount factors is around 7% and both households adopt the same optimal parenting styles (OPS). The right panel of figure 2.6.4 shows households where the difference in discount factors is around 18% and still there is not much of a difference in OPS. The results do not change much even when the difference is higher. In figure 2.6.5 the difference in discount factors is around 40% and we only identify a very small region where households A and B adopt different OPS.

Differences in discount factors do not have much of an effect in this framework. This not surprising because of the mechanism of the model. The discount factor only affects the parent's future valuation of the child's utility, where as the parameter of paternalism has impacts on the current utility of the child and his/her future utility. Also unlike the discount factor, the parameter of paternalism interacts with the child's evolving preference. On top of that, two out of the there parenting styles are involved with influencing the child's preferences (which interact with the parameter of paternalism and not discount factor).

2.7 Conclusion

This paper was motivated by the fact that parenting decisions are mostly decided by two parents who might have the same preferences on consumption but differ ever so slightly on parameters like altruism and/or discount factors. As with any other household decision, such parenting decisions will also be affected by the balance of power between spouses. Literature on household decisions, in general, has moved away from the unitary approach, while the literature on parenting decisions in the household mostly uses the unitary approach (Doepke and Zilibotti, 2017). This paper uses a non-conventional collective approach, where the balance of power between spouses depends on the parenting decision and this balance of power

also affects the parenting decision. This feedback effect is similar to Basu, 2006. To better characterize the solution, I used the Nash bargaining solution. Simulations of the model reveal that when parents have different levels of paternalism they can deviate from the optimal parenting style proposed by Doepke and Zilibotti, 2017. But, when parents only differ on how they discount the child's future, they do not deviate from the optimal parenting of Doepke and Zilibotti, 2017.

Appendices

Appendix A - Sanity Check

Theoretically if my model is correct then, an assumption of $\beta_m = \beta_f$ and $\lambda_m = \lambda_f$ along with $T^m = T^f = 0$ should result in the pareto weight θ that collapses the model to the unitary framework, i.e., Doepke and Zilibotti, 2017

Case 1

The optimizing problem of the **Authoritarian household** is

$$\max_X E_{s'} \Bigg[\theta(\mathbf{X},\Lambda) \Bigg[\Big[(1-\lambda_m)\bar{a} + \lambda_m \Big] \frac{(c^y)^{1-\sigma}}{1-\sigma} + \beta \frac{(c^o)^{1-\sigma}}{1-\sigma} \Bigg]$$

$$+(1-\theta(\mathbf{X},\Lambda)) \Bigg[\Big[(1-\lambda_f)\bar{a} + \lambda_f \Big] \frac{(c^y)^{1-\sigma}}{1-\sigma} + \beta \frac{(c^0)^{1-\sigma}}{1-\sigma} \Bigg] \Bigg]$$

The pareto weights are

$$\theta(\mathbf{X},\Lambda) = \frac{L_f(1-x^e)^{1-\sigma} + \beta(1+Rx^e)^{1-\sigma}}{(L_m+L_f)(1-x^e)^{1-\sigma} + 2\beta(1+Rx^e)^{1-\sigma}}$$

$$1-\theta(\mathbf{X},\Lambda) = \frac{L_m(1-x^e)^{1-\sigma} + \beta(1+Rx^e)^{1-\sigma}}{(L_m+L_f)(1-x^e)^{1-\sigma} + 2\beta(1+Rx^e)^{1-\sigma}}$$

If $\lambda_m = \lambda_f = \lambda$, then $L_m = L_f = L = (1-\lambda)a' + \lambda$

$$\theta(\mathbf{X},\Lambda) = \frac{L(1-x^e)^{1-\sigma} + \beta(1+Rx^e)^{1-\sigma}}{2L(1-x^e)^{1-\sigma} + 2\beta(1+Rx^e)^{1-\sigma}}$$

$$1-\theta(\mathbf{X},\Lambda)=\frac{L(1-x^e)^{1-\sigma}+\beta(1+Rx^e)^{1-\sigma}}{2L(1-x^e)^{1-\sigma}+2\beta(1+Rx^e)^{1-\sigma}}$$

$$\theta(\mathbf{X},\Lambda)=\frac{1}{2}$$

$$1-\theta(\mathbf{X},\Lambda)=\frac{1}{2}$$

Now the household's optimizing problem can be written as

$$\max_X E_{s'}\left[\frac{1}{2}\left[\left[(1-\lambda)\bar{a}+\lambda\right]\frac{(c^y)^{1-\sigma}}{1-\sigma}+\beta\frac{(c^o)^{1-\sigma}}{1-\sigma}\right]\right.$$

$$\left.+\frac{1}{2}\left[\left[(1-\lambda)\bar{a}+\lambda\right]\frac{(c^y)^{1-\sigma}}{1-\sigma}+\beta\frac{(c^0)^{1-\sigma}}{1-\sigma}\right]\right]$$

$$=\max_X E_{s'}\left[\left[(1-\lambda)\bar{a}+\lambda\right]\frac{(c^y)^{1-\sigma}}{1-\sigma}+\beta\frac{(c^o)^{1-\sigma}}{1-\sigma}\right]$$

This is exactly the optimization problem of the authoritarian household in the unitary model proposed by Doepke and Zilibotti, 2017. The optimization problem of the child in a **non-authoritarian household** in case 1 is already in the unitary framework (check equation 2.19)

Case 2

The optimizing problem of the **Authoritarian household** is

$$\max_X E_{s'}\left[\theta(\mathbf{X},\Lambda)\left[\left[(1-\lambda)\bar{a}+\lambda\right]\frac{(c^y)^{1-\sigma}}{1-\sigma}+\beta_m\frac{(c^o)^{1-\sigma}}{1-\sigma}\right]\right.$$

$$\left.+(1-\theta(\mathbf{X},\Lambda))\left[\left[(1-\lambda)\bar{a}+\lambda\right]\frac{(c^y)^{1-\sigma}}{1-\sigma}+\beta_f\frac{(c^o)^{1-\sigma}}{1-\sigma}\right]\right]$$

The pareto weights are

$$\theta(\mathbf{X},\Lambda) = \frac{L(1-x^e)^{1-\sigma} + \beta_f(1+Rx^e)^{1-\sigma}}{2L(1-x^e)^{1-\sigma} + (\beta_m+\beta_f)(1+Rx^e)^{1-\sigma}}$$

$$1-\theta(\mathbf{X},\Lambda) = \frac{L(1-x^e)^{1-\sigma} + \beta_m(1+Rx^e)^{1-\sigma}}{2L(1-x^e)^{1-\sigma} + (\beta_m+\beta_f)(1+Rx^e)^{1-\sigma}}$$

If $\beta_m = \beta_f = \beta$

$$\theta(\mathbf{X},\Lambda) = \frac{L(1-x^e)^{1-\sigma} + \beta(1+Rx^e)^{1-\sigma}}{2L(1-x^e)^{1-\sigma} + 2\beta(1+Rx^e)^{1-\sigma}}$$

$$1-\theta(\mathbf{X},\Lambda) = \frac{L(1-x^e)^{1-\sigma} + \beta(1+Rx^e)^{1-\sigma}}{2L(1-x^e)^{1-\sigma} + 2\beta(1+Rx^e)^{1-\sigma}}$$

$$\theta(\mathbf{X},\Lambda) = \frac{1}{2}$$

$$1-\theta(\mathbf{X},\Lambda) = \frac{1}{2}$$

Now the household's optimizing problem can be written as

$$\max_X E_{s'}\left[\frac{1}{2}\left[\left[(1-\lambda)\bar{a}+\lambda\right]\frac{(c^y)^{1-\sigma}}{1-\sigma} + \beta\frac{(c^o)^{1-\sigma}}{1-\sigma}\right]\right.$$

$$\left.+\frac{1}{2}\left[\left[(1-\lambda)\bar{a}+\lambda\right]\frac{(c^y)^{1-\sigma}}{1-\sigma} + \beta\frac{(c^o)^{1-\sigma}}{1-\sigma}\right]\right]$$

$$= \max_X E_{s'}\left[\left[(1-\lambda)\bar{a}+\lambda\right]\frac{(c^y)^{1-\sigma}}{1-\sigma} + \beta\frac{(c^o)^{1-\sigma}}{1-\sigma}\right]$$

This is exactly the optimization problem of the authoritarian household in the unitary model proposed by Doepke and Zilibotti, 2017.

According to equation 2.26, the child's optimization problem in a **non-authoritarian** household is

$$\max_{x^e} E_{s'}\left[\theta(\mathbf{X},\Lambda)\left[a'\frac{(c^y)^{1-\sigma}}{1-\sigma}+\beta_m\frac{(c^o)^{1-\sigma}}{1-\sigma}\right]+(1-\theta(\mathbf{X},\Lambda))\left[a'\frac{(c^y)^{1-\sigma}}{1-\sigma}+\beta_f\frac{(c^o)^{1-\sigma}}{1-\sigma}\right]\right]$$

$$=\max_{x^e} E_{s'}\left[\frac{1}{2}\left[a'\frac{(c^y)^{1-\sigma}}{1-\sigma}+\beta\frac{(c^o)^{1-\sigma}}{1-\sigma}\right]+(1-\frac{1}{2})\left[a'\frac{(c^y)^{1-\sigma}}{1-\sigma}+\beta\frac{(c^o)^{1-\sigma}}{1-\sigma}\right]\right]$$

$$=\max_{x^e} E_{s'}\left[a'\frac{(c^y)^{1-\sigma}}{1-\sigma}+\beta\frac{(c^o)^{1-\sigma}}{1-\sigma}\right]$$

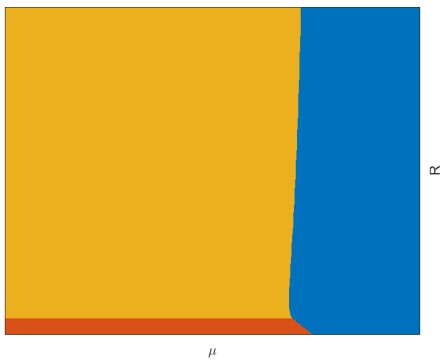
This is exactly the optimization problem of the authoritarian household in the unitary model proposed by Doepke and Zilibotti, 2017.

Appendix B - Comparing Households A & B

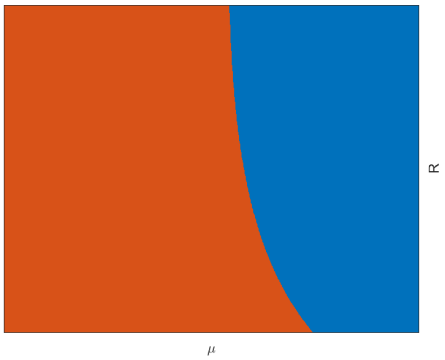
Left panel of figure 2.1 shows that, if parenting decisions are taken by a single parent who is more paternalistic/less altruistic (father), then it is more likely he would adopt an authoritative style of parenting (yellowish). This corresponds to sending the child to an after-school program in our example in section 4, case 1. Right panel of figure 2.1 shows that, if parenting decisions are taken by a single parent who is more altruistic/less paternalistic (mother), then it is more likely she would adopt a permissive style of parenting (orange). This corresponds to allowing the child attend basketball practice in our example in section 4, case 1.

Left panel of figure 2.2 shows equilibrium parenting decisions in a unitary household A and the right panel of figure 2.2 shows equilibrium parenting decisions in a collective household B. Looking carefully we can see that the probability of permissive parenting is more in the unitary household and probability of authoritative parenting is more in the collective household. These differences are seen in figure 2.6.2 in section 4, case 1.

Figure 2.1: Parenting Styles when decisions are taken by single parents.

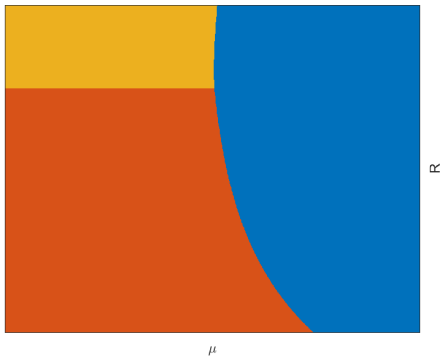


Single parent m, $\lambda_m = 0.99$

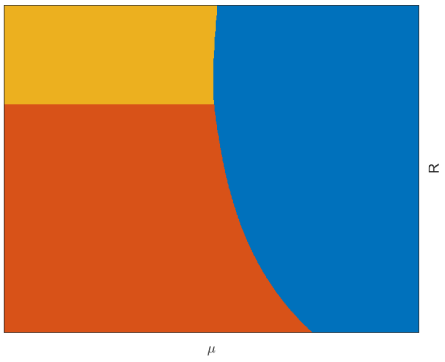


Single parent f, $\lambda_f = 0.83$

Figure 2.2: Parenting Styles when decisions are taken by both parents (household).



Household A (unitary)

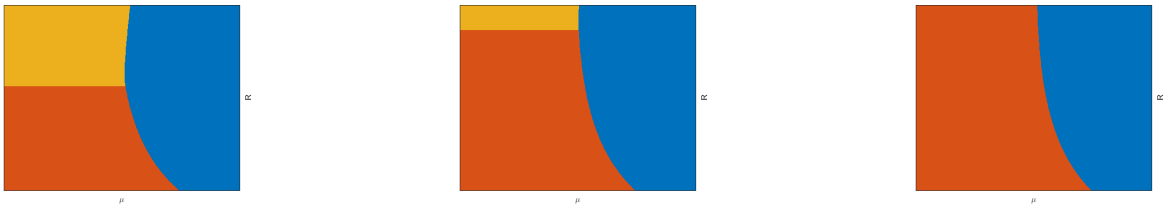


Household B (collective)

Appendix C- Other Observations

Here a lower λ represents higher altruism. I will also assume threat points to be zero. Figure 2.3 shows that when one parent becomes relatively more altruistic (compared to the other parent, $\lambda_m > \lambda_f$), then such a household will become more *permissive* and less *authoritative*. The original model cannot capture these differences in altruism, but predicts the same when the single parent who takes the parenting decision becomes more altruistic. So my model still captures the general predictions of Doepke and Zilibotti, 2017. Interestingly the role of social mobility remains unchanged.

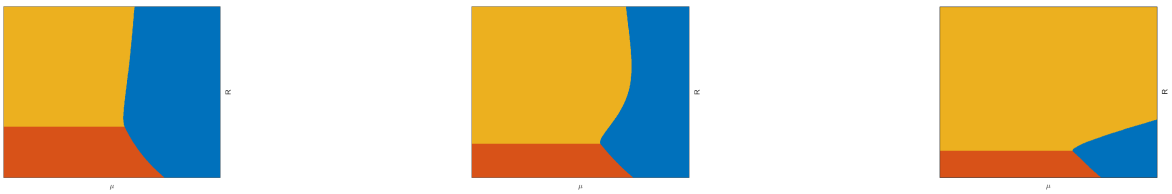
Figure 2.3: Parenting Styles when $\lambda_m > \lambda_f$ and $T^m = T^f = 0$ when $\Delta\lambda$ increases.



$\lambda_m = 0.95, \lambda_f = 0.90$ $\lambda_m = 0.95, \lambda_f = 0.85$ $\lambda_m = 0.95, \lambda_f = 0.80$

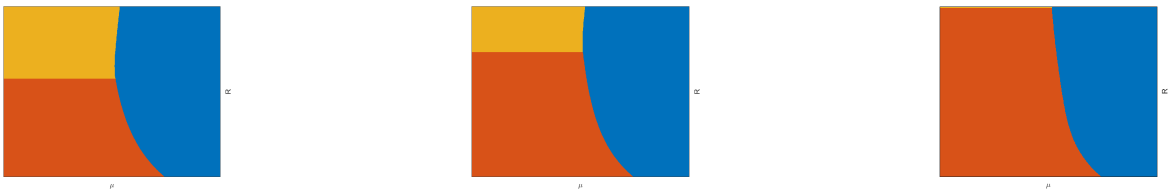
The more interesting case is when we include non-zero asymmetric threat points. I will introduce parents who are slightly different, $\lambda_m = 0.95$ and $\lambda_f = 0.93$. Figures 2.4 and 2.5 show that when we assume asymmetric non-zero threat points [25], even small differences in paternalism/altruism between parents have a notable effect on the optimal parenting style. The original model is not able to capture this.

Figure 2.4: Parenting Styles when $\lambda_m > \lambda_f$ and $T^m > T^f$ as ΔT increases.



$T^m = 2.22, T^f = 0$ $T^m = 3.11, T^f = 0$ $T^m = 3.50, T^f = 0$

Figure 2.5: Parenting Styles when $\lambda_m > \lambda_f$ and $T^f > T^m$ as ΔT increases.



$T^m = 0, T^f = 2.22$ $T^m = 0, T^f = 2.66$ $T^m = 0, T^f = 3$

The higher the threat point of the more altruistic parent (1) the higher the probability of *authoritative* parenting, (2) the lower the probability of *permissive* parenting, and (3) the lower

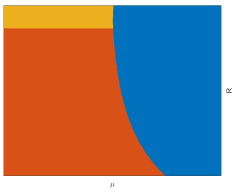
[25] Threat points in this case are exogenous. I made sure that the threat points are always lower than the value functions of the household and this is justified because the only utility parents derive in this model comes from the child's experience.

the probability of *authoritarian* parenting in the household. Interestingly these differences do not have much of an effect on societies with low social mobility (*high* μ). When the social mobility is high (*low* μ) a higher threat point the less altruistic parent pushes the household from *permissive* to *authoritative*. See figure 2.4

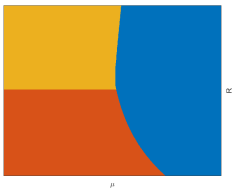
A higher threat point of the less altruistic parent (higher λ) lowers the probability of *authoritative* parenting and increases the probability of *permissive* parenting in the household. Again these differences in paternalism/altruism do not have an effect on societies with low social mobility (*high* μ). See figure 2.5.

When the differences in paternalism/altruism are larger ($\lambda_m = 0.95$ and $\lambda_f = 0.85$), the above-mentioned effects escalate even when the threat points are zero or low. This can be seen in figures 2.6 and 2.7.

Figure 2.6: Parenting Styles when $\lambda_m > \lambda_f$ (*larger* $\Delta\lambda$) and $T^m > T^f$ as ΔT increases.



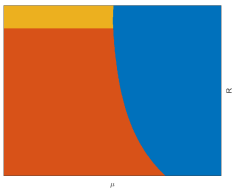
$T^m = 0$, $T^f = 0$



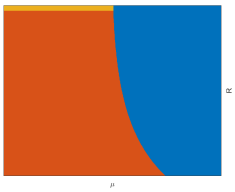
$T^m = 1.33$, $T^f = 0$

$T^m = 2.66$, $T^f = 0$

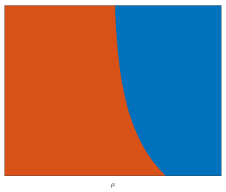
Figure 2.7: Parenting Styles when $\lambda_m > \lambda_f$ (*larger* $\Delta\lambda$) and $T^f > T^m$ as ΔT increases.



$T^m = 0$, $T^f = 0$



$T^m = 0$, $T^f = 0.44$



$T^m = 0$, $T^f = 0.88$

Chapter 3

The Reign of the Mother in-law over the College Graduate

3.1 Introduction

In the last 10 years in India, the ratio of female to male enrolment in colleges increased by 50%, and in 2020 women who attended college outnumbered men. Yet, female to male labour force participation ratio in India, is not only low but is alarmingly falling off from the mid-2000s to present (World Bank, 2023, see figure 3.1) [1]. Official data from the Ministry of statistics (Government of India), tells a similar story. When the share of young (aged 18-34) female graduates in India increased by 70% (from 2000 to 2012), the share of young female graduates working for a salary merely increased by less than 1% (from 17% to 18.5%) (NSSO Round 55, 68)[2].

Unlike the rest of the world, the divergence between the growing number of female graduates and falling female labour force participation (F-LFP) in India is an inefficiency. Among a plethora of factors, gender norms can explain this inefficiency. In this paper, I investigate whether mothers-in-laws in India act as custodians of gender norms and restrict the labour force participation of their daughters-in-laws, thereby contributing to this inefficiency.

Using panel data from the Indian Human Development Survey (IHDS), I show that the exoge-

[1] In 2019, female labour force participation (F-LFP) in India was only 20 % (World Bank 2023). In 2018, the employment rate for women (aged between 20-64) in the European Union (EU) was 67%.

[2] In the same period (from 2000 to 2012), when the share of the share of young ?? *married* female graduates almost doubled (from 5.8% to 10%), the share of young ?? *married* female graduates working for a salary decreased from 17% to 16% (NSSO Round 55, 68)

nous variation caused by the death of a mother-in-law increases the graduate daughter-in-law's labour force participation in salaried jobs. This is not the case for non-graduate daughter in-laws. Removing inefficiencies like misallocated time and talent of women could lead to a gain in GDP for developing countries (Ostry, Alvarez, Espinoza, and Papageorgiou, 2018; Hsieh, Hurst, Jones, and Klenow, 2019).

Next, I provide a plausible explanation of why female labour force participation and education move in different directions. Features of the Indian marriage market could explain the divergence between the growing number of female graduates and the falling female labour force participation in India.

For women in the developing world, *conservative gender norms* could act as a major barrier to entering the labour market. Family members' discomfort with women interacting with men outside the family could be an obstacle for women to enter the labour force (Jayachandran, 2021; Dean and Jayachandran, 2019). The ethnographic literature suggests the association between extended family structures and the dis-empowerment of daughters-in-law in the South Asian context (Doss, Meinzen-Dick, A. Pereira, and Pradhan, 2022; Rajkarnikar, 2020; Allendorf, 2007; Rashid, 2013; Desai and Banerji, 2008).

In the developed world there is evidence to suggest that co-residing with in-laws increases female labour force participation (Sasaki, 2002; Posadas and Vidal-Fernandez, 2013; Bratti, Frattini, and Scervini, 2018). In the Indian context, there is evidence that reveals the misaligned preferences between the mother-in-law and the daughter-in-law (Weinberg, 2001).

In India, 54% of married women live with their in-laws (Khalil and Mookerjee, 2019). Married women co-residing with their husband's parents can be seen as the norm in India. Empirical evidence from the developing world shows corelation between the presence of a mother-in-law (MIL) and restrictions on mobility and autonomy of the married female in the household (daughter-in-law) (Cain, Khanam, and Nahar, 1979; Jejeebhoy, 1991a; Jejeebhoy, 1991b; Jejeebhoy and Sathar, 2001; Gram, Skordis-Worrall, Mannell, Manandhar, Saville, and Morrison, 2018). It is under this backdrop, I study the relationship between the co-residency with mother-in-law and female labour force participation in salaried jobs of young graduate women

in India.

I define co-residency as a living arrangement where married women live with their mothers-in-law (MIL). Ex-ante the MIL could provide subsidized childcare and increase the labour force participation of the daughter-in-law (DIL). On the other hand, the MIL being the custodian of gender norms could hinder women's (DIL's) participation in the labour market, especially in salaried jobs where she has to work outside (and away) from the household. Both these mechanisms could be present, but it is not clear which dominates the other.

Using panel data from the nationally representative India Human Development Survey (IHDS) and the death of the MIL as an exogenous variation affecting co-residency, I show that the death of a MIL increases the labour force participation in salaried jobs of young graduate DILs.[3] This effect amounts to an increase of 43.3 percent relative to graduate DILs in those households where the MIL is alive. Results also suggest that the death of MIL reduces women's participation in labour activities near home, such as farming and animal care (similar to Khanna and Pandey, 2021).

By extending the model of Calvi, Beauchamp, and Fulford, 2021, I provide a plausible explanation for why female labour force participation and education are moving in different directions in India. I extend the model of Calvi, Beauchamp, and Fulford, 2021 by including co-residency as a characteristic of the marriage in a static framework similar to Arcidiacono, Beauchamp, and McElroy, 2016. The model of Calvi, Beauchamp, and Fulford, 2021 is a dynamic, general equilibrium, two-sided matching model with non-transferable utility where women and men have different preferences over spousal characteristics (such as age and education) and features of their marriage. In this model, I introduce sex-specific preferences on co-residency to explain the possible deviation from one's ideal choice of marriage to increase their chances of getting married. I show that in equilibrium when graduate women become more abundant, women search more for marriages where she is willing to co-reside with her mother-in-law (against her ideal preference) to increase her chance of getting married. From a policy perspective, it is important to understand more about the marriage market in India. A policy that aims to

[3]Young women are those aged 18-34

improve the education of women without understanding the marriage market in the Indian context, could result in more graduate women co-residing with their mothers-in-law against they ideal preference.

The rest of the paper proceeds as follows. The next section discusses possible mechanisms through which a mother-in-law could affect female labour force participation and briefly discusses the current related literature. Section 3.3 describes the IHDS data. In section 3.4, I show an empirical fact relating co-residency and female labour force participation of daughter in-laws. Section 3.5 describes a directed search and matching model, where co-residency is a term of the marriage. Section 3.6 concludes.

3.2 Possible Mechanisms & Related Literature

The two potential mechanisms through which a co-residing mother in-law could affect daughter in-law's labour force participation are subsidizing childcare and custodian of conservative gender norms.

1. *Subsidized Childcare*: Mother in-law (MIL) provides subsidized childcare which allows daughter in-laws with children to enter the labour force. In this context, co-residence with mothers in-law has a positive effect on women's labour force participation (F-LFP). Evidence supporting this mechanism is mainly present in the developed world, where co-residence with MIL is not a norm (Sasaki, 2002; Posadas and Vidal-Fernandez, 2013; Bratti, Frattini, and Scervini, 2018).

A similar positive effect of the presence of MIL on F-LFP can be through an MIL who shares household burdens and frees-up time for the DIL, so that she can enter the labour force.

2. *Mother in-law* (MIL) *as the custodian/enforcer of conservative gender norms*: If the MIL acts as a custodian for restrictive gender norms, then she could effectively reduce the labour force participation of the daughter in-law (DIL). Co-residing with such a MIL will have a negative effect on the labour force participation of the DIL. Such an effect will be more prominent for employment outside the household, since notion of family honour in India is seen coupled

with married women's behaviour (Eswaran, Ramaswami, and Wadhwa, 2013) and there is widespread stigma attached to women working outside the home (Jayachandran, 2015; Bernhardt, Field, Pande, Rigol, Schaner, and Troyer-Moore, 2018; Eswaran, Ramaswami, and Wadhwa, 2013).

Both mechanisms could be present, but it is not clear which dominates the other.

In United States of America, Posadas and Vidal-Fernandez, 2013 shows that access to grand-parental childcare leads to an increase in mother's labour force participation. They used the National Longitudinal Survey of Youth 1979 (NLSY79) and used maternal grandmother's death as an instrument for the availability of grand-parental childcare. In Italy, Bratti, Frattini, and Scervini, 2018 shows that women with young children whose own mothers are eligible for retirement have a higher probability of labour force participation than those whose mothers are not yet eligible. They exploit the pension reform-induced changes in retirement eligibility. In Japan, Sasaki, 2002 shows that co-residence with one's own parents or in-laws has a positive effect on married women's labor force participation. Under he traditional Japanese norm, the eldest son along with his wife and children are responsible for family matters and co-reside with his parents. They use birth order of the married man as the exogenous variable deciding co-residency. They give evidence to suggest that co-residence allows married women to share the burden of household work with their parents or in-laws. In China, Maurer-Fazio, Connelly, Chen, and Tang, 2011 show that the presence of a parent, a parent in-law, or a person aged 75 or older increases woman's likelihood of participating in market work.

In contrast to the developed world, evidence from India suggests that co-residence with in-laws reduces daughter in law's labour force participation (LFP). Using the death of the father-in-law as an instrument for the dissolution of joint households, Debnath, 2015 show that residing in joint families reduces autonomy and LFP of the daughter in-law (DIL). Similarly Dhanaraj and Mahambare, 2019 show that co-residing with-laws in a joint family lowers married women's participation in non-farm work in rural India. Khanna and Pandey, 2021 finds that co-residing with mother in-law (MIL) increases female labour force participation, mainly through non-salaried near home activities including farm work and animal care. I have not identified any

paper that studied the effects co-residence of MIL on the labour force participation of highly educated DILs.

There is also literature in the Indian context suggesting that, co-residence with mother in-law (MIL) is negatively corelated with daughter in-law's autonomy, mobility, and social connections outside the household (Anukriti, Herrera-Almanza, Pathak, and Karra, 2020; Bernhardt, Field, Pande, Rigol, Schaner, and Troyer-Moore, 2018; Jejeebhoy and Sathar, 2001; Jejeebhoy, 1991a; Cain, Khanam, and Nahar, 1979). Here, autonomy is measured by whether or not the daughter in-law (DIL) is allowed to make decisions regarding her health and is allowed to visit healthcare facilities alone. Whereas, mobility is measured by whether or not the DIL is allowed to visit places outside the household alone (relatives/friends, market, grocery store, etc). Since mobility is relevant for participating in the labour market, one could expect that the obstructive effect of the mother in-law (MIL) on mobility of the DIL may lead to a negative effect on her participation in the labour market. There is also empirical evidence in the literature suggesting the misaligned preferences on fertility between MIL and DIL (Weinberg, 2001).

3.3 Data

I study the relationship between co-residency with mother in-law (MIL) and female labour force participation (F-LFP) of highly educated women in India.[4] I use the nationally representative India Human Development Survey (IHDS). It is a panel with two waves: one in 2004-2005 and another one in 2011-2012.

I identify 3,408 young married women co-residing with their MIL in wave-1.[5] Next, I use the death of a MIL between wave-1 and wave-2 as an exogenous variation that determines

[4]In the Indian context mother-in-laws play a major role compared to the father-in-laws while enforcing gender norms. This could be because of the traditional expectation for women to look after all matters of the household. Having said that, understanding the effect of father-in-laws (FIL) on the DIL's labour force participation is interesting. Identifying FIL is not straight forward in this dataset. This would be one potential area of research for the future.

[5]Young women are those aged 18-34.

co-residency in wave-2. By doing so, I compare married women who were living with their MIL in both waves, with those who were living with their MIL in wave-1 but not in wave-2. Among the 3,408 co-residing households in wave-1, the MIL died between the two waves in 330 households. I define highly educated as those who are graduated or above (4.54 % of young women). I focus on young women who are between 18-34 as fertile labour force.

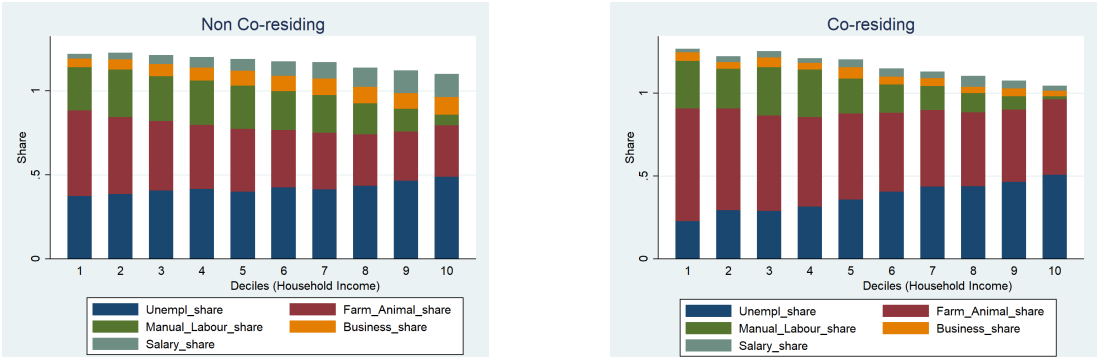
In India the total fertility rate is 2 children per woman. The median birth interval is 33 months since preceding birth and the median age at first birth is 20.2 years. The fertility rate is the highest in the age cohort 20-24 (165 births per 1000 women) and drops sharply after age 29 (National Family Health Survey-5 (2019-21)). In the rest of the paper, young women are those between age 18-34.

Table 3.3.1 describes the characteristics of married women between ages 18-34 living with (co-residing households) and without their mother in-law (non co-residing households). More share of women in non co-resident households work for a salary compared to co-resident households (also see figure 3.3.2.a). Whereas, more share of women in co-resident households are involved in unpaid jobs (farming in own land and looking after animals) compared to non co-resident households (also see figure 3.3.2.b). Co-resident households are more richer (in terms of household income and assets). Married women in co-resident households are younger and the share of graduates is higher in co-resident households. Even if we consider only highly educated women, share of women working for a salary is higher in non co-residing households.

Since co-resident households have more household income on average, I compare co-resident and non-coresident households who belong to the same household income decile. I show that the difference between co-resident and non co-resident households exists across income deciles. Each bar in figure 3.3.1 represents the decile of household income. I divided households in 10 equal groups. At every decile of household income, the share of women in salaried jobs is higher in non co-residing households, and the share of women in farming/animal care is higher in co-residing households (see figures 3.3.1 & 3.3.2).

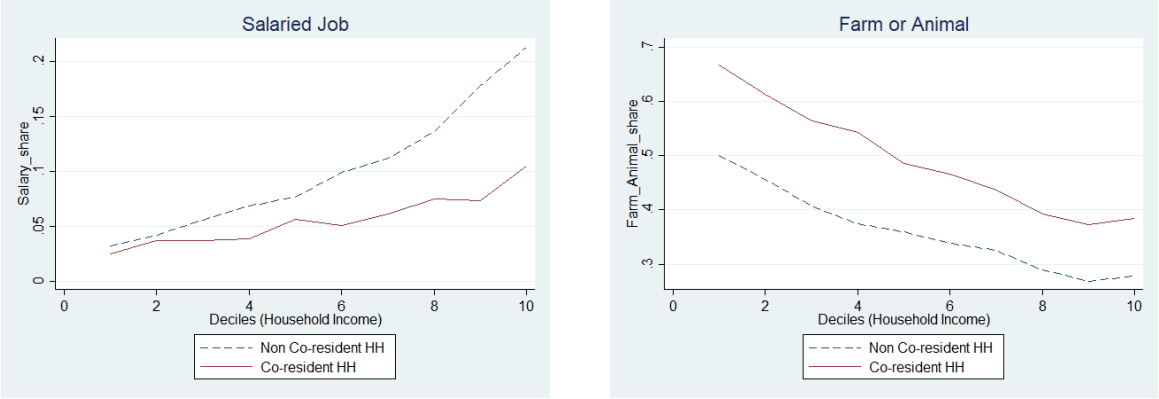
For both type of households, the share of activities related to farming and animal care is larger

Figure 3.3.1: Type of Female Labour Force Participation, Across Household Income Deciles: Non Co-resident Vs Co-resident Households



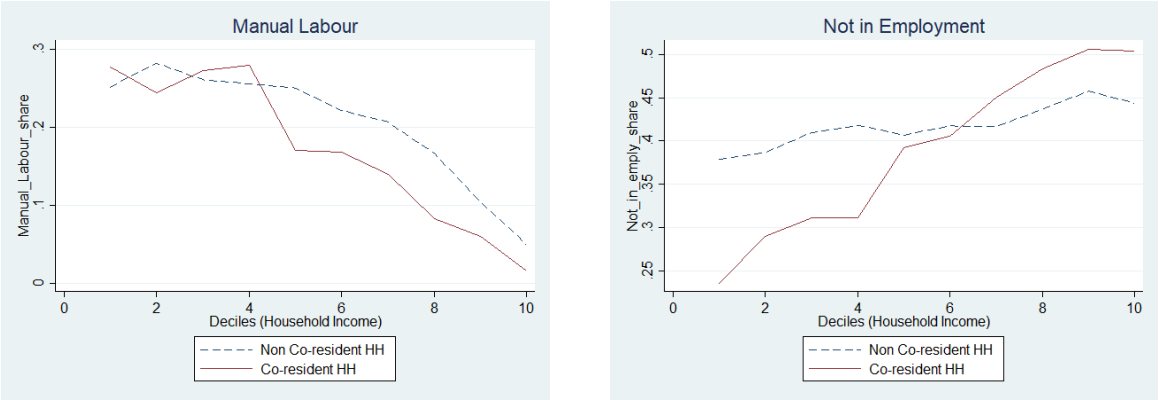
(a) No co-residence (b) Co-residence

Figure 3.3.2: Share of Women in Salaried Jobs and Farming/Animal Care, Across Household Income Deciles: Non Co-resident Vs Co-resident Households



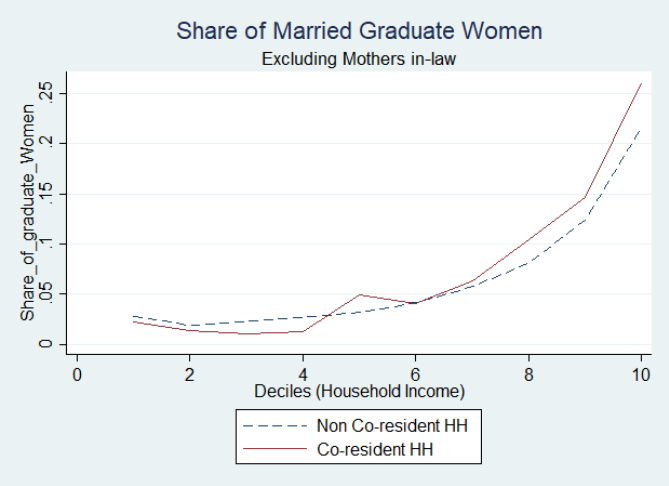
(a) Salaried Jobs (b) Farming/Animal Care

Figure 3.3.3: Share of Women in Manual Labour and Not in Employment, Across Household Income Deciles: Non Co-resident Vs Co-resident Households



(a) Manual Labour (b) Not in Employment

Figure 3.3.4: Share of Graduate Married Women (excluding mother in-laws), Across Household Income Deciles: Non Co-resident Vs Co-resident Households



at very low deciles (figure 3.3.2). This can be seen as unpaid labour and mostly near home. Also for both households, at lower deciles the share of manual labour (paid agricultural and non- agricultural jobs) is more (figure 3.3.3).

For married women not living with their mother in-laws, the share of labour near home (and manual labour) starts shrinking and share of salaried work starts to increase when we move from poor households to richer households (figure 3.3.2). This is a shift from *work near home* to *salaried work*, for married women not co-residing with their mother in-laws. Importantly, in non co-resident households this shift is not accompanied by a prominent increase in the share of married women not in employment (figure 3.3.3.b). So, moving from poor households to richer households, married women who are not co-residing with their mother in-laws do not seem to move out of the labour market.

For married women who co-reside with their mother in-laws, share of labour near home also start to shrink and share of salaried work starts increase (this increment is lower than non co-resident households) when we move from poor households to richer households. But this shift from *work near home* to *salaried work* goes along with women moving out of the labour market (an increasing share of women not in employment, see the red line in figure 3.3.3.b). When we move from poor to richer households, married women who co-reside with their mother

in-laws seem to move out of salaried jobs (unlike their counterparts who do not co-reside with their mother in-laws). These patterns are clear in figures 3.3.2, 3.3.3.

Even if non co-resident and co-resident households across income deciles are different on various regards, the share of married women who are graduates in both types of households are not that different. This can be seen in figure 3.3.4. This is of primary importance in this paper. Even if the share of female graduates in every income decile is similar in co-residing and non co-residing households, when we move from poor to rich households, daughters in-law who live with their mother in-law seem to move out of salaried jobs, unlike their counterparts who do live with their mother in-law. Is the mother in-law preventing the daughter in-law from working?

Now I focus on co-residing households and compare those women who's MIL died (treated) with those who are still living with their MIL (control) at baseline. Among the 3,408 co-residing households in wave-1, the MIL died between the two waves in 330 households. [6] Table 3.3.2 describes the characteristics of treated and control at baseline (wave-I). At baseline compared to control, households where the MIL died are poorer and women/DIL in these households are slightly older. Also, treated households are more rural and have a higher share of lower caste households (scheduled caste/tribe or other backward caste). Households are not equal at baseline even if the treatment is exogenous.

[6] Among the 3,408 co-residing households in wave-1, 301 households did not have a MIL in period 2 but I cannot confirm the death in these cases. Therefore these 301 households are excluded from control and treated households.

Table 3.3.1: Characteristics of Non Co-residing and Co-residing Households.

	(1)		(2)		T-test
	Non Co-residing		Co-residing		Difference
Variable	N	Mean/SE	N	Mean/SE	(1)-(2)
Working for salary	2992	0.028	3408	0.018	0.010***
		(0.003)		(0.002)	
Farming/Animal Care	2992	0.304	3408	0.311	-0.008
		(0.008)		(0.008)	
Household Income	2992	33363.604	3408	59075.702	-2.57e+04***
		(676.927)		(1034.929)	
Household Assets	2992	9.890	3408	12.838	-2.948**
		(0.098)		(0.101)	
URBAN	2992	0.307	3408	0.281	0.025**
		(0.008)		(0.008)	
SC/ST/OBC[a]	2956	0.771	3356	0.709	0.063***
		(0.008)		(0.008)	
Age	2992	24.083	3408	22.805	1.278**
		(0.064)		(0.057)	
Number of children (HH)	2992	1.902	3408	2.083	-0.181***
		(0.022)		(0.028)	
Graduates	2992	0.026	3408	0.058	-0.032***
		(0.003)		(0.004)	

Notes: Sample based on IHDS, 2004-2005 and consists of married women aged 18-34. The value displayed for t-tests are the differences in the means across the groups. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

[a]Scheduled Caste/Scheduled Tribe/Other Backward Caste.

Table 3.3.2: Baseline Characteristics of Restricted Sample.

	(1)		(2)		T-test
	Control[a]		Treated[b]		Difference
Variable	N	Mean/SE	N	Mean/SE	(1)-(2)
Working for a salary	2774	0.017	330	0.018	-0.002
		(0.002)		(0.007)	
Farming/Animal Care	2774	0.301	330	0.352	-0.051*
		(0.009)		(0.026)	
Household Income	2774	60613.499	330	51271.646	9341.853***
		(1161.157)		(3103.277)	
Household Assets	2774	13.075	330	11.639	1.436***
		(0.111)		(0.335)	
URBAN	2774	0.291	330	0.255	0.037
		(0.009)		(0.024)	
SC/ST/OBC[c]	2738	0.700	321	0.754	-0.054**
		(0.009)		(0.024)	
Age	2774	22.714	330	23.876	-1.162***
		(0.063)		(0.182)	
Number of children (HH)	2774	2.057	330	2.170	-0.113
		(0.031)		(0.095)	
Graduates	2774	0.061	330	0.033	0.027**
		(0.005)		(0.010)	

Notes: Sample based on IHDS, 2004-2005 and consists of married women aged 18-34. The value displayed for t-tests are the differences in the means across the groups. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

[a] Married women living with MIL in period 1 and 2.
[b] Married women living with MIL only in period 1, because MIL died in period 2.
[c] Scheduled Caste/Scheduled Tribe/Other Backward Caste.

3.4 Empirical Evidence

I analyse the *effect of co-residency with mother in-law on the labour force participation of young highly educated daughters in-law*. Similar to Khanna and Pandey, 2021, I exploit the exogenous variation in co-residency induced by the death of the mother in-law. Co-residency is defined as a living arrangement where a married woman co-resides with her husband's mother. The mother of the husband is the mother-in-law (MIL) of the household.

If a woman has a graduate degree or above, then we call them highly educated. Labour force participation is defined as working for a salary. In this context, working in a farm, animal husbandry (animal care) or other forms of manual labour is not a salaried job.

I use the death of the MIL as an exogenous variation defining co-residency. I estimate the effect of the death of a MIL on the labour force participation in salaried jobs for young highly educated women/DIL using the following specification

$$\begin{aligned} Y_{it} = \alpha_0 + \beta MIL_{died_i} + \alpha_1 College_i + \gamma MIL_{died_i} * College_i + \alpha_2 Y_{it-1} + \\ \phi_1 \mathbf{X}_{1it} + \phi_2 \mathbf{X}_{1it-1} + \phi_3 \mathbf{X}_{2i} + \epsilon_{it} \end{aligned} \tag{3.1}$$

Y_{it} is a dummy for the outcome of interest in period 1, and Y_{it-1} is a dummy for the outcome of interest in period 2. The outcomes of interest are having a salaried job, and working in farm and/or caring for animals. MIL_{died_i} is a dummy equal to 1 if the respondent's MIL was alive in period 1 and died between period 1 and 2. $College_i$ is an indicator equal to 1 if the respondent has a graduate degree or above. Time varying controls ($\mathbf{X}_{1it}, \mathbf{X}_{1it-1}$) include *household income, number of household assets, number of children in the household*, and other controls ($\mathbf{X}_{2it}$) include *age*, and *indicators for rural or urban household and scheduled caste/tribe*.The coefficients of interest are β and γ. β is the effect of the death of MIL on the outcome of interest for women who are not highly educated, and $\beta + \gamma$ is the effect of the death of MIL on the outcome of interest for

highly educated women.

In table 3.4.1, I present the results of estimating equation 3.1 with labour force participation in salaried jobs as the outcome variable. The point estimate for non-highly educated DILs is negative (-1.4 ppt) with a standard error of 0.10 and p-value 0.173. This confirms that when the MIL dies, highly educated DILs are 29.1 percentage points (ppt) more likely to enter the labour force as a salaried employee. When the MIL dies, young graduate women increase their participation in the labour market (salaried job) by 43.3%, compared to young graduate women who still co-reside with their MIL. The custodian of gender norms effect dominates the subsidized childcare effect for young educated women in co-resident households. It must be noted that only a small proportion of women are highly educated in India. This means that the results are driven by approximately 11 women who are graduates and whose MIL died in period 2. This is a limitation of the paper.

I also look at how the death of a MIL (effect of co-residency) have an effect on the labour activities such as farming and/or animal care ($Farm/Animal$)[7]. Unlike working in a salaried job where one has to go outside the home for employment, activities such as farming and/or animal care are mostly closer to households and/or are done with other members of the household/relatives. As mentioned before, in India there is widespread stigma attached to women working outside the home (Eswaran, Ramaswami, and Wadhwa, 2013).

In the second column of table 3.4.1, I look at the effect of MIL's death on young highly educated women/DIL's labour force participation in activities such as farming and/or animal care. Regardless of education, when the MIL dies, DILs reduce their participation in activities such as farming and/or animal care (similar to the results of Khanna and Pandey, 2021). The effects are not statistically significant. This along with previous results suggest that when MIL dies young highly educated women/DIL increase their participation in labour activities outside the home (salaried job) and reduce their participation in labour activities near home, such as farming and animal care.

[7] $Y_{it} = Farm/Animal_{it}$ is a dummy equal to 1 if the respondent is participating in activities such as farming and/or animal care in period 2. $Y_{it-1} = Farm/Animal_{it-1}$ is similar dummy for period 1 (baseline).

These results suggest that young highly educated married women who co-reside with their MIL are less likely to work for a salary. I controlled for household income and assets there by removing any income effects. This suggest that the *MIL as the custodian of gender norms* mechanism is more prominent than the subsidized childcare mechanism.

A possible alternate mechanism is that, daughter in-law (DIL) chooses to stay with the mother in-law (MIL) in period 1 because the MIL was chronically ill. When such a MIL passes away (between period 1 and 2), the DIL enters the labour force in period 2. If this were true, we would have seen an increment in labour force participation not only for the highly educated DILs but also for those who are also not-highly educated. But the point estimates suggests that, when the MIL dies, DILs who are not-highly educated reduce their participation in a salaried job. The estimates, even if not significant, suggests that the chronically ill MIL mechanism might not be the reason for the change in labour force participation when the MIL dies (see table 3.4.1).

After controlling for household and individual characteristics, I show that death of a mother-in-law increases the labour force participation in salaried jobs of highly educated co-residing daughters-in-law.

As a whole, the evidence provided suggests that educated married women who co-reside with their mothers-in-law are making sub-optimal decisions. When an educated young women agrees to live with her mother-in-law, it reduces her probability of working in jobs that match her skills.[8] Why do we see such a behaviour? Why do highly educated women end up in such relationships in India? One explanation is that, these co-residing women preferred to work in the first place, but the mother-in-law — being the custodian of gender norms— prevented them from entering the labour force. If that were true, why did these women decide to marry into a co-residing households in the first place?

[8]It is an inefficiency, if women deviate from their ideal preference on co-residency in order to get married.

3.4.1 Robustness Check

Since the results are driven by a very small sample of women (who are graduates and who's MIL died in period 2), I perform two robustness checks.

$$Y_{it} = \alpha_0 + \beta MIL_{died_i} + \alpha_1 Married_{18plus_i} + \gamma MIL_{died_i} * College_i + \alpha_2 Y_{it-1} + \phi_1 \mathbf{X}_{1it} + \phi_2 \mathbf{X}_{1it-1} + \phi_3 \mathbf{X}_{2i} + \epsilon_{it} \tag{3.2}$$

First I use *married after age 18* as a proxy for higher education. In my restricted sample I have 173 women who married after age 18 and who's MIL died in period two. In column 1 of table 3.4.2, I present the results of estimating equation 3.2 with labour force participation in salaried jobs as the outcome variable. The differential effect is negative and statistically significant. This confirms that when the MIL dies, DILs who married after age 18 are 0.12 percentage points (ppt) more likely to enter the labour force as a salaried employee. When the MIL dies, young women married after 18 increase their participation in the labour market (salaried job) by 23%, compared to young women married after 18 who still co-reside with their MIL. If married after age 18 is a good proxy for receiving higher education, this is in line with previous results.

$$Y_{it} = \alpha_0 + \beta MIL_{absent_i} + \alpha_1 College_i + \gamma MIL_{died_i} * College_i + \alpha_2 Y_{it-1} + \phi_1 \mathbf{X}_{1it} + \phi_2 \mathbf{X}_{1it-1} + \phi_3 \mathbf{X}_{2i} + \epsilon_{it} \tag{3.3}$$

I also study the effect of the absence of MIL. I compare women who co-resided with MIL in period 1 and did not in period 2. In my restricted sample I have 29 graduate women who did not co-reside with their MIL in period two. The reason for not co-residing with their MIL could be because of a range of reasons including the death of the MIL. It must be noted that, in this case co-residing with MIL can be endogenous. The results for this specification is in column 2 of table 3.4.2. The point estimates are in the expected direction, suggesting that

Table 3.4.1: Main Results

	(1) Salaried Job	(2) Farm/Animal
MIL_{died}	-0.014	-0.019
	(0.010)	(0.027)
$MIL_{died} * College$	0.305*	-0.141
	(0.153)	(0.138)
Control Group Mean	0.203	0.151
Total Observations	3082	3082

Sample consists of married women aged 18-34. The table presents the estimated effects of death of mother in-law on young highly educated daughter in-law's labour force participation. Estimates are based on the ANCOVA estimator. Column 1 studies the effect on salaried job and column 2 looks at other labour activities such as farming and animal care. An individual is defined as employed in an activity (salaried job, farming, animal care etc) if they worked for more than 240 hours in that activity annually (in the year preceding the interview). The estimate for MIL_{died} (β) is the treatment effect for young non-highly educated DILs and the estimate for $MIL_{died} * College$ (γ) is the differential effect of the treatment on young high educated DILs compared to the non-highly educated DILs. The sum gives us the treatment effect for young highly educated DILs. All specifications include *household income, household assets, number of children, age, scheduled caste/tribe, and indicators for urban households* as controls. In parenthesis, standard errors are clustered at the primary sampling unit (IDPSU)

absence of the mother-in-law increases female labor force participation, although the estimates are imprecisely estimated at conventional levels.

3.5 The Model

In this section I present a model of marriage market in India which allows individuals to deviate from their ideal preferences over co-residency in order to increase their chances of getting married. This model is an extension to the static matching model of Arcidiacono, Beauchamp, and McElroy, 2016 and a simplified version of Calvi, Beauchamp, and Fulford, 2021. Arcidiacono, Beauchamp, and McElroy, 2016 proposed a model on how high school students form relationships based on ideal preferences. The model allows the trade-off between being in a relationship at all, and the inclusion of sex in a relationship. It is a two-sided static directed search model of relationship formation, and it disentangles male & female preferences over partner characteristics and over relationship terms. Calvi, Beauchamp, and Fulford, 2021 put forward a model of the Indian marriage market where women and men have specific preferences over spousal characteristics and features of their marriage. It is a dynamic, general equilibrium, two-sided matching model.

Table 3.4.2: Robustness Check

	(1) Salaried Job	(2) Salaried Job
MIL_{absent_i}	-0.027**	
	(0.011)	
$Married_{18plus_i}$	0.039*	
	(0.022)	
Control Group Mean	0.052	
Total Observations	3128	
MIL_{absent_i}		-0.008
		(0.008)
$MIL_{died} * College$		0.111
		(0.093)
Control Group Mean		0.203
Total Observations		3419

Sample consists of married women aged 18-34. The table presents the estimated effects of death of mother in-law on young highly educated daughter in-law's labour force participation. Estimates are based on the ANCOVA estimator. Column 1 studies the effect on salaried job and column 2 looks at other labour activities such as farming and animal care. An individual is defined as employed in an activity (salaried job, farming, animal care etc) if they worked for more than 240 hours in that activity annually (in the year preceding the interview). The estimate for MIL_{died} (or MIL_{absent_i}) is the treatment effect for young married before age 18 (or non-highly educated) DILs and the estimate for $Married_{18plus_i}$ (or $MIL_{died} * College$) is the differential effect of the treatment on young married after age 18 (or high educated) DILs compared to the non-highly educated DILs. The sum gives us the treatment effect for young married after age 18 (or highly educated) DILs. All specifications include *household income, household assets, number of children, age, scheduled caste/tribe, and indicators for urban households* as controls. In parenthesis, standard errors are clustered at the primary sampling unit (IDPSU)

I extend the model of Calvi, Beauchamp, and Fulford, 2021 by adding a relationship term: co-residency. Co-residency means *subsidized childcare by MIL and/or presence MIL as the custodian of Conservative Gender Norms (CGN)*. I do not separate the gender specific preferences on subsidized childcare provided by the MIL and preferences on living with the MIL who is a custodian of gender norms, instead I include the gender specific joint preference on co-residency. This is my contribution.

I model sex-specific preferences because if men and women have different preferences on co-residency, this would allow them to value subsidized childcare and MIL as the custodian of gender norms differently. As a result, men and women could deviate from their ideal preferences in order to get married (find a match).

Through this model, I am able to shed light on the trade-offs that an individual faces while searching for a spouse in the Indian marriage market. Consider an individual that derives utility from three sources: (1) the *type* of the spouse (age, education), (2) the *terms* of the marriage (co-residency), and (3) *probability* of getting married (matching). Individuals know in advance their payoffs from different spouse types and marriage terms (characteristics). The trade-off is between being married at all, and being in a less preferred marriage (based on preferences on the type of the spouse and characteristic of the marriage). The trade-off may increase the chances of getting married.

Each man can be of type m, where $m \in \{1, 2, ..M\}$. Similarly, each woman can be of type $w \in \{1, 2, ...W\}$. The type of the individual depends on age and education. For men, there are W types of potential mates. For woman, there are M types of potential mates. There are several individuals of a certain type, hence im (iw) is the i^{th} man (woman) of type m (w).

Term of marriage is the characteristic of the marriage and each marriage can be of term $r \in \{1, 2, \ldots, R\}$. Co-residency is a living arrangement where married women live with their mothers in-law. In this model co-residency is the only term (characteristic) of the marriage.

In this model, individuals search for a spouse of a certain type who would also agree with cer-

tain terms of the marriage (i.e., search is directed). The choice for a man (woman) can be seen as choosing a certain market, with women (men) of a certain *type* who is also ready to enter into a marriage with a certain *term*. Everyone searches in their own district of residence.

Within the district of residence, men search in one of the $W \times R$ markets to find a wife, and women search in one of the $M \times R$ markets to search for a husband. This will result in $M \times W \times R$ types of marriages (matches). Assume there are 2 types of women (W_1, W_2) and 3 possible terms of marriage (T_1, T_2, T_3). In this case every man has 6 options/markets to choose from i.e., $(W_1T_1,\ W_1T_2,\ W_1T_3,\ W_2T_1,\ W_2T_2,\ W_2T_3)$. The market W_2T_3 could have any number of women of type W_2 who are ready to marry with the term T_3. A man searching in this particular market is indifferent between all the women in this market. If you assume there are also 2 types of men (M_1, M_2), this results in 12 types of marriages (matches).[9] As the model is static, search is a one-shot game.

Without loss of generality, let us focus on a type-m man searching for a spouse of type-w who would agree to marriage term-r. This man essentially searches in the market wr. His expected utility depends on three factors: the probability of him marring a woman of type-w who agrees on marriage term r (P_m^{wr}), a deterministic portion of utility if he marries a woman of type-w with terms r (μ_m^{wr}), and his individual specific preference term (ϵ_{im}^{wr}). ϵ_{im}^{wr} is the specific m-type man's preference of marrying a woman of type-w with marriage term-r.

The expected utility for this man is:

$$E(U_{im}^{wr}) = P_m^{wr} \cdot \mu_m^{wr} + \epsilon_{im}^{wr}, \tag{3.4}$$

where the probability of matching depends only on the individual's and potential spouse's type along with the terms of the marriage (if they marry). [10] The utility of not matching is normalized to zero.

[9] $(M_1W_1T_1,\ M_1W_1T_2,\ M_1W_1T_3,\ M_1W_2T_1,\ M_1W_2T_2,\ M_1W_2T_3,\ M_2W_1T_1,\ M_2W_1T_2,\ M_2W_1T_3,\ M_2W_2T_1,\ M_2W_2T_2,\ M_2W_2T_3)$.

[10] The only individual specific part of the expected utility is ϵ_{im}^{wr} (ϵ_{iw}^{mr}) and is known to the individual before he(she) makes the decision.

Similarly, a type-w woman searching for a spouse of type-m who would agree to marriage term-r is essentially searching in the particular market mr and her expected utility is:

$$E(U_{iw}^{mr}) = P_{w}^{mr} \,.\, \mu_{w}^{mr} + \epsilon_{iw}^{mr} \,. \tag{3.5}$$

To maximise his (her) utility, the i^{th} man (woman) of type-m (type-w) chooses a market w, r (m, r) to search for a spouse, and it can be represented as $Market_{im} = w, r$ $(Market_{iw} = m, r)$.

$$Market_{im} = w, r = \underset{w', r'}{\operatorname{argmax}} \left(P_{m}^{w' r'} \,.\, \mu_{m}^{w' r'} + \epsilon_{im}^{w' r'} \right) \tag{3.6}$$

$$Market_{iw} = m, r = \underset{m', r'}{\operatorname{argmax}} \left(P_{w}^{m' r'} \,.\, \mu_{w}^{m' r'} + \epsilon_{iw}^{m' r'} \right)$$

I assume that the ϵ_{im}^{wr} and ϵ_{iw}^{mr} are independent, and identically distributed (i.i.d.) with type 1 extreme value errors. This assumption allows me to write the probability of an m-type man (w-type woman) searching for a w-type (m-type) spouse agreeing with marriage term-r, as a multinomial logit form ϕ_{m}^{wr} (ϕ_{w}^{mr}).

$$\phi_{m}^{wr} = \frac{e^{\mu_{m}^{wr} \,.\, P_{m}^{wr}}}{\sum_{w'} \sum_{r'} e^{\mu_{m}^{w' r'} \,.\, P_{m}^{w' r'}}} \tag{3.7}$$

$$\phi_{w}^{mr} = \frac{e^{\mu_{w}^{mr} \,.\, P_{w}^{mr}}}{\sum_{m'} \sum_{r'} e^{\mu_{w}^{m' r'} \,.\, P_{w}^{m' r'}}} \tag{3.8}$$

3.5.1 Matching

The matching process in this model is to get married. Matching is a function which takes the number of searching men and women in each market, and generates the number of marriages (matches) in that market as output. I parameterize the number of marriages (matches) in each market as X_{mwr}. N_m (N_w) is the number of unmarried men (women). The number of searching men (women) of a certain type is the product of two terms: the number of unmarried men

(women) of this type and probability that these men (women) searches in market wr (mr). Thus, $N_m\phi_m^{wr}$ is the number of m-type men searching for a w-type spouse who would agree on marriage term-r. Similarly, $N_w\phi_w^{mr}$ is the number of women of type-w searching for a spouse of type-m who would agree to marriage term-r. The number of marriages (matches) when a type-m man searches in the market wr, or when a type-w woman searches in the market mr is given by the following matching function (X_{mwr}): [11]

$$X_{mwr} = A * \left[\frac{(\phi_m^{wr} N_m)^\rho}{2} + \frac{(\phi_w^{mr} N_w)^\rho}{2} \right]^{\frac{1}{\rho}} \tag{3.9}$$

$$X_{mwr} = A * \left[(\phi_m^{wr} N_m)^\rho + (\phi_w^{mr} N_w)^\rho \right]^{\frac{1}{\rho}}$$

where the parameter ρ determines the elasticity of substitution (given by $1/1-\rho$), and A measures search frictions. When ρ approaches zero ($\rho \to 0$), the CES function becomes the Cobb-Douglas function where sex ratios (N_w/N_m) of unmarried individuals in a particular market will have no effect on the likelihood on observing a particular match.

All m-type men (w-type women) searching in the same market have the same probabilities of matching P_m^{wr} (P_w^{mr}). These probabilities are given by:

$$P_m^{wr} = \frac{X_{mwr}}{\phi_m^{wr} N_m} = \frac{A * \left[(\phi_m^{wr} N_m)^\rho + (\phi_w^{mr} N_w)^\rho \right]^{\frac{1}{\rho}}}{\phi_m^{wr} N_m}, \tag{3.10}$$

$$P_m^{wr} = P_m^{wr} \left(\phi_m^{wr}, \phi_w^{mr} \right).$$

$$P_w^{mr} = \frac{X_{mwr}}{\phi_w^{mr} N_w} = \frac{A * \left[(\phi_w^{mr} N_w)^\rho + (\phi_m^{wr} N_m)^\rho \right]^{\frac{1}{\rho}}}{\phi_w^{mr} N_w}, \tag{3.11}$$

$$P_w^{mr} = P_w^{mr} \left(\phi_w^{mr}, \phi_m^{wr} \right).$$

[11] Note that $X_{mwr} = X_{wmr}$ for all m, w, and r.

where equation 3.10 enters into the multinomial logit equation 3.7 as probabilities of m-type men marrying (matching) w-type women who would agree for a marriage with term r. Remember that equation 3.7 is the search probability, and searching in particular markets depends on probability of matching, which in turn depends on sex ratios. Similarly, equation 3.11 enters into the multinomial logit equation 3.8 as probabilities of w-type women marrying (matching) m-type men who would agree for a marriage with term r. This makes searching in particular markets (equation 3.7 & 3.8) to depend on the level of competition faced by grooms and brides who are looking for spouses with certain characteristics (types).

3.5.2 Equilibrium search probabilities.

Substituting the previous gender specific match probabilities (equations 3.10 & 3.11) into search probabilities (equations 3.7 & 3.8) gives the gender specific endogenous search probabilities in equilibrium. These equilibrium search probabilities can be written as:

$$\phi_m^{wr} = \frac{e^{\mu_m^{wr}} \cdot P_m^{wr}}{\sum_{w'} \sum_{r'} e^{\mu_m^{w'r'}} \cdot P_m^{w'r'}} = \frac{e^{\mu_m^{wr}} \cdot P_m^{wr}(\phi_w^{mr}, \phi_m^{wr})}{\sum_{w'} \sum_{r'} e^{\mu_m^{w'r'}} \cdot P_m^{w'r'}(\phi_{w'}^{mr'}, \phi_m^{w'r'})}, \tag{3.12}$$

$$\phi_w^{mr} = \frac{e^{\mu_w^{mr}} \cdot P_w^{mr}}{\sum_{m'} \sum_{r'} e^{\mu_w^{m'r'}} \cdot P_w^{m'r'}} = \frac{e^{\mu_w^{mr}} \cdot P_w^{mr}(\phi_w^{mr}, \phi_m^{wr})}{\sum_{m'} \sum_{r'} e^{\mu_w^{m'r'}} \cdot P_w^{m'r'}(\phi_w^{m'r'}, \phi_{m'}^{wr'})} \tag{3.13}$$

The search probability ϕ_m^{wr} gives the share of type-m men who searches in the market wr, and ϕ_w^{mr} gives the share of type-w women who searches in the market mr. Assume there are 2 types of men (M_1, M_2), 2 types of women (W_1, W_2) and 3 possible terms of marriage (T_1, T_2, T_3). In equilibrium, the probability that M_1-type men searches for W_2-type women with marriage term-T_3 depends on the equilibrium share of W_2-type women searching in the same market (i.e, for M_1-type men with marriage term-T_3). These interdependent equilibrium search probabilities make sex-ratios relevant in the model.

3.5.3 What happens when sex ratios change?

As in Arcidiacono, Beauchamp, and McElroy, 2016, when sex ratio moves such that, women become more abundant, then both men and women increase their relative search probabilities in the market where men have a relative preference. In this model, if men prefer a term of marriage, *for example, if men strongly prefer to co-residence with his parents (relative to women)*, then a change in sex-ratio where women become more abundant will make everyone search more in the market with co-residence as a term of the marriage. This will make women who weakly prefer to co-reside with their in-laws to deviate from their relative preference in equilibrium.

To understand how a change in sex-ratios affect marriages in equilibrium, consider two marriage markets that include m-type men and w-type women. The marriage terms in the two markets are r and $r^{'}$. Fix the search probabilities (ϕ) and increase the number of unmarried w-type women, N_w. We can see which of the two marriage terms (r or $r^{'}$) become relatively more attractive for men and women. Here $r^{'}$ is defined as the marriage term that gives relatively more utility to the man compared to the woman, hence we say *m-type men have a stronger preference for $r^{'}$ over r than their w-type potential spouses*.

If m-type men have a stronger preference for $r^{'}$ over r than their w-type potential spouses, then this must reflect in the deterministic portion of the utility. I call this as *condition-I*.

$$\mu_m^{wr^{'}} - \mu_m^{wr} > \mu_w^{mr^{'}} - \mu_w^{mr}$$

Sex ratios will only be relevant if there is no substitutability between men and women. I assume that the parameter ρ, that decides the elasticity of substitution in the matching function (equation 3.9) is less than 1. This makes sure that the matching function is not Cobb-Douglas (hence no substitutability between men and women). I call this as *condition-II*.

$$\rho < 0$$

Under conditions I and II, **b31** show that the following relationships hold.

1. $$\frac{\phi_m^{wr}}{\phi_w^{mr}} < \frac{\phi_m^{wr'}}{\phi_w^{mr'}}$$

2. $$P_m^{wr} > P_m^{wr'} \quad and \quad P_w^{mr} < P_w^{mr'}$$

3. $$\frac{\partial \frac{\phi_m^{wr'}}{\phi_m^{wr}}}{\partial G_m^w} > 0 \quad and \quad \frac{\partial \frac{\phi_w^{mr'}}{\phi_w^{mr}}}{\partial G_m^w} > 0$$

where G_m^w (= N_w/N_m) is the sex ratio defined by the number of type-w single women (N_w) divided by number of type-m single men (N_m).

In relationship 1, the ratio of search probabilities will make m-type men to search relatively more in the market with marriage term-r'. This is because m-type men have a strong preference for marriage term r' over term-r.

Relationship 2 translates relationship 1 into matching probabilities. Since m-type men are more likely to search for w-type women who would agree to marriage term-r', the probability of matching for these m-type men will be lower in r' than r. This is simply because there is more competition among the m-type men to get married to w-type women who would agree to marriage term-r', compared to w-type women who would agree to marriage term-r. The reverse is true for women.

Relationship 3 deals with sex ratios. If the sex ratio changes such that there is an abundance of type-w women, then both men and women increase their search probabilities in the market where men have a relative preference, that is in the market with marriage term-r'.

Relevance of sex ratios in this model

In this model, *women* with certain characteristics (w-type) search for men with certain characteristics (m-type). Assume there are 2 types of men (M_1, M_2) and 2 types of women (W_1, W_2).

Lets focus on the market M_1W_2 [12]. If type-W_2 become more abundant, then for both men and women in the market M_1W_2, a marriage with a term which is weakly preferred by the type-W_2 women becomes relatively more attractive to all individuals (relationship 3). This is an inefficiency in the sense that, if the sex-ratio changes such that certain type of women become abundant, then these women choose to search for a marriage with a term of marriage that she dislikes. She does this in order to increase her chances of being married.

A change in sex-ratios in the Indian marriage market can lead to unintended consequences. Data suggests that, highly educated women are much more likely to marry highly educated men (see section on the distribution of matches in the Appendix). Hence, the market that we focus contains women of type-$w_{graduate}$ and men of type-$m_{graduate}$. We will have two different markets based on the term of the marriage; r=without co-residence (no-cores) and $r^{'}$= with co-residence (cores).

Assume men have a stronger preference for a marriage with co-residence[13]. There could be sex-specific preferences (μ_m^{wr}, μ_w^{mr}) for a marriage term-r like *co-residence*.

$$\mu_m^{wCores} = \alpha_{1m} * SubsidizedChildcare$$

$$\mu_w^{mCores} = \alpha_{1w} * SubsidizedChildcare + \alpha_{2w} * CustodianOfGenderNorms$$

For women, *co-residing with MIL* creates a positive utility ($\alpha_{1w} > 0$) because of subsidized childcare and a negative utility ($\alpha_{2w} < 0$) because the MIL is the custodian of gender norms (for example, such an MIL could prevent the daughter in-law from entering the labour force). On the other hand, for men *co-residing* will only create positive utility ($\alpha_{1m} > 0$) from subsidized childcare. Empirical evidence suggest that, MIL prevents educated women from entering the labour force in salaried jobs. This could make educated women to weakly prefer co-residency

[12] A market where type-M_1 men marry type-W_2 women with a certain term of marriage.

[13] Co-residence is defined as married women moving into her husband's household with his parents. So the assumption is that men prefer to co-reside with his parents compared to women co-residing with her in-laws. There are cultural reasons in the Indian context that explain why men prefer to stay with thier parents after marriage. Depending on the region elder/youngest son is expected to live with his parents and is required to do so to inherit the family home (J. C. Caldwell, Reddy, and P. Caldwell, 1984).

compared to men, $\alpha_{1w} + \alpha_{2w} < \alpha_{1m}$.

Under this assumption, I can re-write condition-I as:

$$\mu^{w_{graduate}Cores}_{m_{graduate}} - \mu^{w_{graduate}NoCores}_{m_{graduate}} > \mu^{m_{graduate}Cores}_{w_{graduate}} - \mu^{m_{graduate}NoCores}_{w_{graduate}}$$

Now, we can re-write relationship 3 for highly educated women who are searching for highly educated men as:

$$\frac{\partial \frac{\phi^{m_{graduate}Cores}_{w_{graduate}}}{\phi^{m_{graduate}NoCores}_{w_{graduate}}}}{\partial G^{w_{graduate}}_{m_{graduate}}} > 0$$

When graduate women become more abundant, they will deviate from their ideal preference and search for a marriage where she has to co-reside with her MIL (since men in that market had a stronger preference for co-residence).

The empirical evidence (in section 4) suggests that, young highly educated (graduate or above) women who co-reside with their mothers-in-law (MILs) are less likely to enter the labour force (salaried job). So an increase in highly educated women will make an educated woman search for a marriage where she has to co-reside with her mother-in-law, and thus reduce her chances in entering a job that matches her skills.

3.6 Conclusion

In this paper, I study how gender norms could also explain the falling female labour force participation in India despite the growing number of female graduates. To study this, I focus on households where married females live with their mothers-in-law. I show that when the mother-in-law, who is the custodian of restrictive gender norms dies, then young highly educated daughter-in-laws increase labour force participation in salaried jobs and reduce participation in activities near home such as farming and/or animal care.

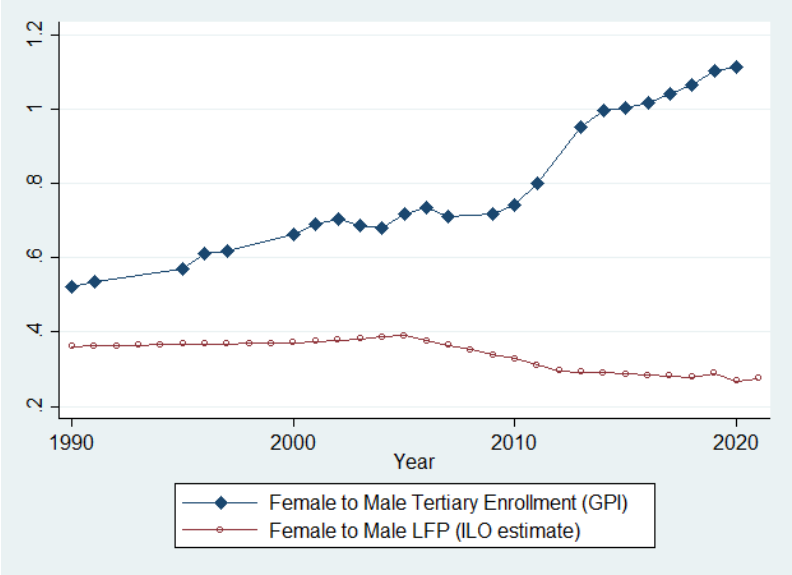
This paper reveals the particular behaviour of the mother-in-law as the custodian of gender norms. This behaviour of the mother-in-law is in sync with the literature on family honour in India. Family honour in India is intertwined with the behaviour of married women (Eswaran, Ramaswami, and Wadhwa, 2013) and there is widespread stigma attached to women working outside (Jayachandran, 2015; Bernhardt, Field, Pande, Rigol, Schaner, and Troyer-Moore, 2018) especially when women interacting with men outside the family (Jayachandran, 2021; Dean and Jayachandran, 2019). I show that the mothers-in-law act as custodians/enforcers of gender norms by hindering young graduate daughters-in-law from participating in salaried jobs, and on the other hand, supporting the daughters-in-law in near-home activities (farming/animal care).

Why do women (especially graduate women) choose to marry into co-residing households, even if the mother-in-law as custodian of gender norms, prevents them from working? To answer this, I extend the model of Calvi, Beauchamp, and Fulford, 2021. By adopting the results from Arcidiacono, Beauchamp, and McElroy, 2016 I show that to increase the chances of getting married, individuals might deviate away from their ideal preferences. When graduate women become more abundant, they will deviate from their ideal preference and search for a marriage where she has to co-reside with her mother-in-law. This could explain at least partly, the inefficient labour force participation of graduate women in India (i.e., the divergence between the growing number of female graduates and falling female labour force participation).

From a policy perspective, it is important to document the effects of the mother-in-law on the daughter-in-law's labour force participation. Policies that aim at improving the education of women without acknowledging the underlying social norms and how they manifest in society, might not reap the intended results. In the Indian context, where the stigma of being unmarried is not so small, policymakers need to understand the nature of the marriage market. As shown in the paper, an increase in graduate women (relative to graduate men) could lead to more graduate women searching for marriages where she is ready to co-reside with a mother-in-law (against her ideal preference), and as a result not enter the labour market that matches her skills.

Appendix

Figure 3.1: Tertiary Enrollment and Female Labour Force Participation



Source: World Bank

Distribution of Matches

In table 5 we show the share of marriages by couple's education. Most common marriages (50.8%) are between individuals with same level of education. 39.2% marriages are between man with a level of education higher than the woman. Only 10% marriages are between woman with a level of education higher than the man. [14]

We mainly focus on the matches of graduated women. Only 5% of the matches include a graduate woman. Among the marriages of graduate women, 67% were with a graduate man. Table 6 gives the share of marriages by age, and the majority of marriages (52%) were between young women (14-19) and young men (20-24).

[14] We see that most matches (18.5%) are between men and women who have no formal education.

We now inspect share of marriages by education and age of marriage. Graduate women did not marry when they were young (15-19) (Field and Ambrus, 2008 shows that delaying marriage will lead to improved education outcomes girls). According to table 7, 3 out every 4 graduate women (75%), only got married when they were old (20-24). Most marriages for female graduates were with old male graduates, and this amounts to 40% of marriages involving graduate women.

Women co-resided with the mother in-law in more than a quarter (26%) of marriages. [15]

Table 5

Distribution of Matches (by Education)

			Wife's Education		
Husband's Education	None	Primary/High School	Secondary/Higher Secondary School	Graduate or above	*Total*
None	3,220	562	145	0	3,927
	(18.55)	(3.24)	(0.84)	(0)	(22.62)
Primary/High School	2,141	1,781	744	8	4,674
	(12.33)	(10.26)	(4.29)	(0.05)	(26.93)
Secondary/Higher Secondary School	1,521	2,023	3,230	283	7,057
	(8.76)	(11.65)	(18.61)	(1.63)	(40.65)
Graduate or above	84	145	883	589	1,701
	(0.48)	(0.84)	(5.09)	(3.39)	(9.80)
Total	6,966	4,511	5,002	880	
	(40.12)	(25.98)	(28.83)	(5.07)	

[15] 4,641 married women co-resided with their mother in-law, and 12,718 married women did not co-reside with their mother in-law

Table 6

Distribution of Matches (by Age)

	Wife's Age at marriage		
	(14-19 yrs)	(20-24 yrs)	
Husband's Age at marriage	Young	Old	*Total*
(19-24 yrs)			
Young	5,857	1,116	6973
	(52.61)	(10.02)	(62.63)
(25-29 yrs)			
Old	2,189	1,971	4160
	(19.66)	(17.70)	(37.37)
Total	8046	3087	
	(72.27)	(27.82)	

Table 7

Distribution of Matches (by Education and Age)

		Wife's Education		
Husband's Education	None	Primary/High School	Secondary/Higher Secondary School	Graduate or above
Young Husband + Young Wife				
None	1,189	206	48	0
Primary/High School	784	723	239	0
Sec/Hi Sec School	534	773	976	21
Graduate or above	31	61	220	52
Old Husband + Young Wife				
None	331	83	32	0
Primary/High School	235	256	117	2
Sec/Hi Sec School	127	308	477	25
Graduate or above	5	15	146	30
Young Husband + Old Wife				
None	135	25	8	0
Primary/High School	93	114	72	3
Sec/Hi Sec School	70	127	299	39
Graduate or above	4	5	64	58
Old Husband + Old Wife				
None	177	46	17	0
Primary/High School	116	163	107	3
Sec/Hi Sec School	79	167	591	74
Graduate or above	5	21	193	212
Total	3,915	3,093	3,606	519

Table 6

Distribution of Matches (by Co-residency)

	Wife's Age at marriage		
	(14-19 yrs)	(20-24 yrs)	
Husband's Age at marriage	Young	Old	*Total*
(19-24 yrs)			
Young	5,857	1,116	6973
	(52.61)	(10.02)	(62.63)
(25-29 yrs)			
Old	2,189	1,971	4160
	(19.66)	(17.70)	(37.37)
Total	8046	3087	
	(72.27)	(27.82)	

More Data: 2001 Census of India

In the 2001 Census of India we can see a variance in gender ratios of single individuals in different marriage markets. We need to find gender ratios in each market in a district. The census gives us population counts in each district by age and marital status. Population count of by education is not available. To overcome this limitation, we use the second wave of IHDS survey to calculate the probability of achieving a certain level of education conditional on their marital status, age, and district of residence. Calvi, Beauchamp, and Fulford, 2021 used the same strategy, but used a ordered logit regression to find these probabilities.

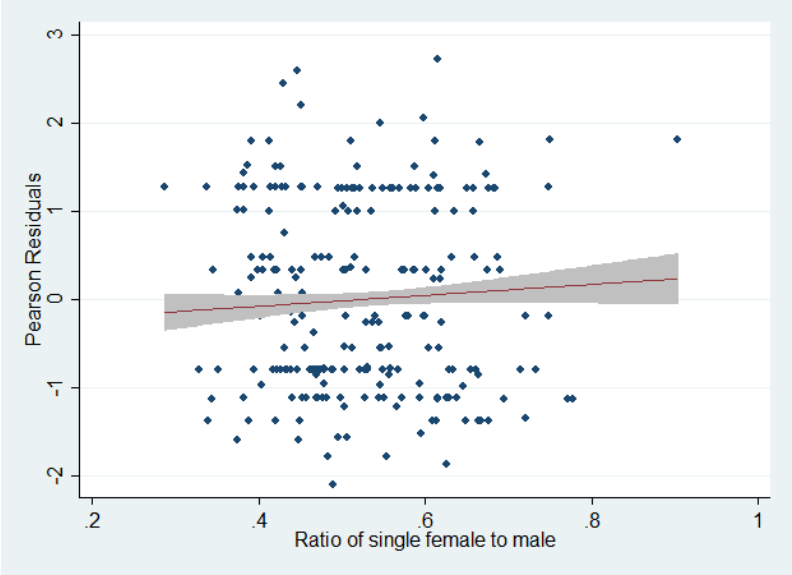
Some evidence to suggest women deviate from their ideal preference on *co-residence*

Similar to Calvi, Beauchamp, and Fulford, 2021 we estimate a logistic regression for the binary marriage term on *co-residence* against district level gender-ratios among unmarried individuals aged 15-29. We only consider highly educated women.

Here we see that when sex ratios are low, that is when graduate women become more scarce (hence face low competition), there is a low likelihood for graduate women to choose a marriage with *co-residence*. When graduate women face less competition (high sex ratios) we could expect them to choose their preferred term. It seems that graduate women like marriages where she doesn't have to live with the MIL. This could be seen as evidence supporting the substitution effects in equilibrium (seen in relationship 3).

However such evidence could be misleading because the logistic regression doesn't account any equilibrium effects, especially substitution between partner types (based on age and education) and terms of the marriage. We need to estimate the model to make more strong arguments.

Figure 3.2: Co-residence with mother in-law



ANCOVA estimator

$$Sal_2 = \beta_0 + \beta_1 * Treated + \beta_2 * Hi\_Edu + \beta_3 * Treated * Hi\_Edu + \beta_4 * Sal_1$$

Low Educated

$$E[Sal_2|T = 1, Hi\_Edu = 0] - E[Sal_2|T = 0, Hi\_Edu = 0] = \beta_1$$

High Educated

$$E[Sal_2|T = 1, Hi\_Edu = 1] - E[Sal_2|T = 0, Hi\_Edu = 1] = \beta_1 + \beta_3$$

Salaried Job

	(1) Ancova	(2) Ancova	(3) DD	(4) DD	(5) DD	(6) DD
Trt (β)	-0.014	-0.014	-0.013	-0.014	-0.009	-0.009
	(0.010)	(0.010)	(0.011)	(0.011)	(0.012)	(0.012)
Difference (γ)	0.300**	0.299*	0.323**	0.324**	0.247	0.247
	(0.153)	(0.155)	(0.156)	(0.156)	(0.156)	(0.157)
Trt_Hi_Edu ($\beta + \gamma$)	0.286*	0.285*	0.310**	0.311**	0.238	0.238
	(0.153)	(0.155)	(0.155)	(0.156)	(0.156)	(0.157)
Dist (FE)	n	y	n	y	n	y
Indi (FE)	n	n	n	n	y	y
Controls						
Income	y	y	y	y	y	y
n_children	y	y	y	y	y	y
Age	y	y	y	y	y	y
Urban/Rural	y	y	y	y	y	y

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

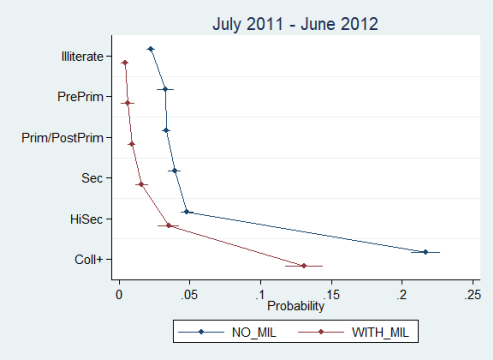
Farm Work or Animal Care

	(1) Ancova	(2) Ancova	(3) DD	(4) DD	(5) DD	(6) DD
Trt (β)	-0.022	-0.027	-0.020	-0.024	-0.007	-0.007
	(0.027)	(0.027)	(0.031)	(0.031)	(0.035)	(0.035)
Difference (γ)	-0.141	-0.194**	-0.133	-0.136	-0.283**	-0.283**
	(0.097)	(0.094)	(0.106)	(0.110)	(0.121)	(0.121)
Trt_Hi_Edu ($\beta + \gamma$)	-0.163*	-0.221**	-0.153	-0.160	-0.290**	-0.290**
	(0.095)	(0.092)	(0.104)	(0.108)	(0.118)	(0.119)
Dist (FE)	n	y	n	y	n	y
Indi (FE)	n	n	n	n	y	y
Controls						
Income	y	y	y	y	y	y
n_children	y	y	y	y	y	y
Age	y	y	y	y	y	y
Urban/Rural	y	y	y	y	y	y

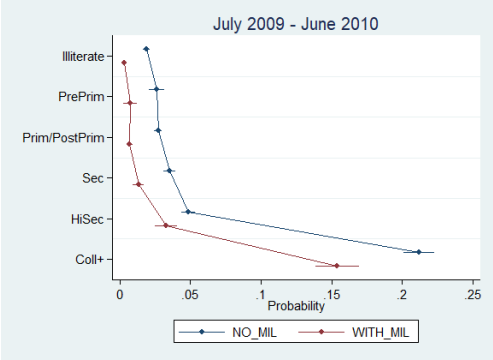
t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

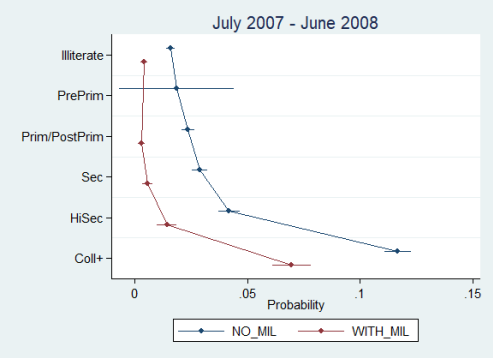
Figure 3.3: Probability of working for a Salary in Co-resident and Non Co-resident Households (predicted probabilities from logit regressions without controls)



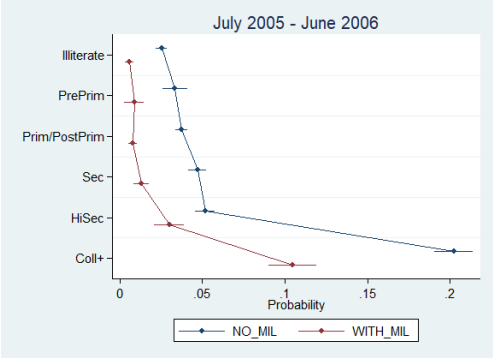
(a) NSS Round 68



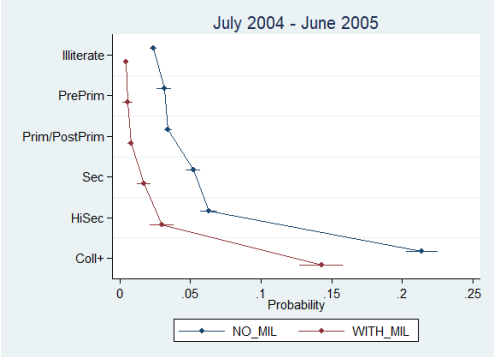
(b) NSS Round 66



(c) NSS Round 64



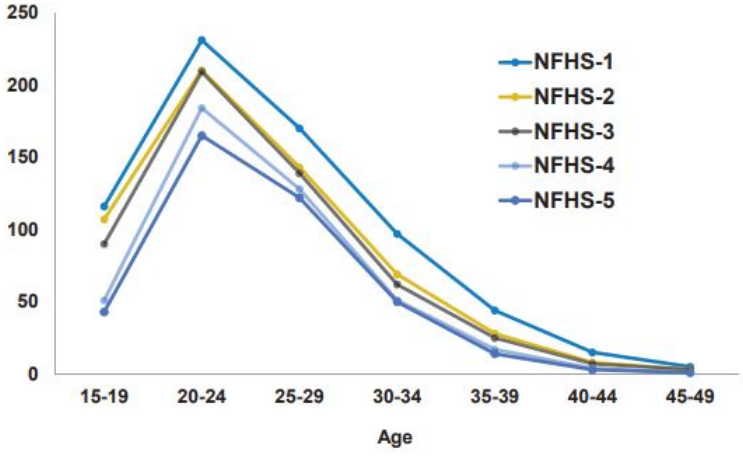
(d) NSS Round 62



(e) NSS Round 61

***Figure 4.3* Trends in Age-specific Fertility Rates**

Births per 1,000 women



Chapter 4

Understanding the Onset of Intimate Partner Violence

4.1 Introduction

One-third of women worldwide report being physically or sexually abused by an intimate partner at some point in their life (Devries, Mak, Garcia-Moreno, Petzold, Child, Falder, Lim, Bacchus, Engell, Rosenfeld, et al., 2013). This figure is not restricted to the developing world, families in poverty situations or women with low education levels. Although in Sub-Saharan Africa and South Asia, the prevalence of physical or sexual violence by an intimate partner stands at 33-35%; in Europe, 16 to 23% of women have experienced such violence (WHO, 2021). These figures underscore the significance of the issue, indicating that, even in the developed world, intimate partner violence is rampant.

Given the scope of the problem and its negative consequences (Peterson, Kearns, McIntosh, Estefan, Nicolaidis, McCollister, Gordon, and Florence, 2018; Ellsberg, Jansen, Heise, C. H. Watts, Garcia-Moreno, et al., 2008; Bonomi, R. S. Thompson, Anderson, Reid, Carrell, Dimer, and Rivara, 2006), governments and organizations around the world devote resources to curtail violence, ensuring the victim's well-being, health, and safety.[1] National helplines, shelters,

[1]It has been well documented that physical abuse is a major cause of injury in women (Parish, Wang, Laumann, Pan, and Luo, 2004; M. P. Thompson, Saltzman, and Johnson, 2003; Kyriacou, Anglin, Taliaferro, Stone, Tubb, Linden, Muelleman, Barton, and Kraus, 1999; Fanslow, Norton, and Spinola, 1998). There is evidence suggesting that physical and sexual intimate partner violence (IPV) is associated with negative health outcomes including gynecological disorders, adverse pregnancy outcomes, irritable bowel syndrome, gastrointestinal disorders, and various chronic pain syndromes (Vos, Astbury, Piers, Magnus, Heenan, Stanley, Walker, and Webster, 2006; Campbell, 2002; Heise, Ellsberg, and Gottemoeller, 1999). IPV is also co-related with many psychiatric problems such as; depression, anxiety, phobias, post traumatic stress disorder, suicidality, and alcohol & drug abuse (Patel, Kirkwood,

crisis counseling services, referral services, long-term housing support, and guidance on legal and rights-related matters are some of the resources available for victims and survivors. [2] Yet, these resources are ultimately forms of "curative" or "palliative" care that activates after the onset of violence. But, what about preventing violence itself? [3]

In this paper, we delve into the onset of intimate partner violence in the developed world. In particular, we aim to characterize the incidence of intimate partner violence (IPV) throughout women's lifetimes and document how resources such as laws on domestic violence and national helplines could shift the onset of violence in Europe. To do so, we use individual-level data on the woman's lifetime history of violence from the European Union Agency for Fundamental Rights (FRA), 2012. [4] We combine this data with a survival analysis framework to characterize how the probability of becoming a victim or survivor of violence for the very first time - the *hazard*- changes from the beginning of women's dating life during adolescence until they reach their fifties. We combine this information with country-level historical data on the existence of domestic violence laws and a national helpline for victims and survivors of IPV (Global Database on Violence against Women, 2023), to evaluate how these resources curb the incidence of violence at different stages in life.

With this strategy, we document three crucial facts. First, the probability of experiencing intimate partner violence (IPV) for the very first time is the highest in the pre-marriage years. The highest hazard of IPV is observed at age 22 and remains high until the late twenties — the *dating* period. The probability of the onset of violence declines during women's thirties and early forties — the time of *fertility*. These findings suggest that in Europe, the risk of the onset of IPV is concentrated in the younger years (twenties). Second, although laws against IPV curtail the incidence of violence for women in their thirties and potentially married, they have

Pednekar, B. Pereira, Barros, Fernandes, Datta, Pai, Weiss, and Mabey, 2006; Loxton, Schofield, and Hussain, 2006; Bonomi, R. S. Thompson, Anderson, Reid, Carrell, Dimer, and Rivara, 2006; Romito, Turan, and De Marchi, 2005; Plichta and Falik, 2001; Fischbach and Herbert, 1997).

[2]There is some evidence to suggest that these resources are effective for reducing Intimate Partner Violence (Sullivan, 2012; Olson, Garcia-Moreno, and Colombini, 2020)

[3]Interventions focused on the prevention of IPV rather than services for survivors are more prevalent in low-income and middle-income countries. These interventions are mostly linked to HIV prevention programs (Ellsberg, Arango, Morton, Gennari, Kiplesund, Contreras, and C. Watts, 2015).

[4]Special Licence - Project 181265

a limited impact on women who experience violence for the first time at the beginning of their romantic lives. We show that laws against domestic violence reduce the likelihood of the onset of IPV by 24%, and bring down the hazard of experiencing IPV only for women aged 30-40 (potential period of *fertility*). Such laws are unable to curtail the onset of violence for women who are below 30 or above 40. The empirical evidence suggests that national helplines do not affect the onset of violence. [5] Finally, we show that the Nordic region exhibits the highest levels of hazards of IPV, emphasizing the immediate necessity for focused interventions and preventive strategies within their borders. [6]

Effective interventions against the incidence of IPV include women-centered interventions for survivors of violence, interventions for perpetrators, school-based interventions, and high-level policy commitments and legislative reforms (Ellsberg, Arango, Morton, Gennari, Kiplesund, Contreras, and C. Watts, 2015). IPV can also be reduced through psycho-social interventions (Kiely, El-Mohandes, El-Khorazaty, and Gantz, 2010; Tiwari, W. C. Leung, T. Leung, Humphreys, Parker, and Ho, 2005) and interventions involving advocacy and home visitations (Bell and Goodman, 2001; Taft, Small, Hegarty, Watson, Gold, and Lumley, 2011). In the last decade, numerous countries have made laws to make IPV illegal. However, the degree of enforcement and compliance with these laws varies across countries (Kolev, Nowacka, and Ferrant, 2014). We examine whether the implementation of laws against IPV and the presence of support services like national helplines are successful in lowering the risk of IPV.

Numerous cross-country studies have explored the extent of IPV across different countries, providing insights into its prevalence (García-Moreno, Jansen, Ellsberg, Heise, C. Watts, et al., 2005; Johnson, Ollus, and Nevala, 2007). However, none of them focus on the onset of IPV, highlighting a gap in our understanding of how and when such violence begins in relationships. Using data from 211 women of Japanese descent in Los Angeles, Yoshihama and Gillespie, 2002 found that the risk of intimate partner violence (IPV) is highest between the

[5] It must be noted that these helplines provide immediate assistance to victims of domestic violence. We have no evidence to contradict this.

[6] Similar results on the prevalence of IPV was shown by Martín-Fernández, Gracia, and Lila, 2020. There is also existing evidence that suggests Nordic countries excel in gender equality and struggles with disproportionately high rates of IPV — *Nordic Paradox* (Gracia and Merlo, 2016).

ages of 18 and 22. Similarly, using a sample of 87 women of Filipino descent from the San Francisco Bay Area, Yoshihama and Bybee, 2011 suggest that physical IPV tends to increase during the early stages of life and then gradually decline. To the best of our knowledge, ours is the first cross-country study that investigates the onset of IPV.

According to Article 1 of the United Nation's Declaration on the Elimination of Violence against Women, "*Violence against women is any act of gender-based violence that results in, or is likely to result in, physical, sexual, or mental harm or suffering to women, including threats of such acts, coercion or arbitrary deprivation of liberty, whether occurring in public or in private life*". We focus on sexual or physical Intimate Partner Violence (IPV) in Europe. Although the figures on the prevalence of IPV are appalling, it doesn't reveal the whole story. Many studies have tried to pin down the causes and effects of IPV, but studies investigating the age at which IPV begins (age at first incidence) are rather sparse.

There is preliminary evidence to suggest that the first incidence of physical/sexual IPV happens in adolescence, indicating Teen Dating Violence (TDV) (Tomaszewska and Schuster, 2021). We use duration analysis to investigate more about the age of the first incidence of IPV. First, I estimate a simple discrete approximation of a duration model, adapted from Currie and Neidell, 2005 following Corno, Hildebrandt, and Voena, 2020 follow. Then I treat duration as a continuous variable and estimate a conditional Cox proportional hazards model following Zeng, Mao, and Lin, 2016.

4.2 Data

4.2.1 Individual level data on Intimate Partner Violence

We use data from the European Union Agency for Fundamental Rights (FRA), 2012 survey on violence against women. The survey gathers data on the experiences of violence of 42000 women across 28 EU Member States. [7] Within each country, the sample is representative of all

[7] Accessed: October 09, 2019

women aged 18 years or older.[8] This includes women who are single, married, and unmarried at the time.

One of the main advantages of the FRA survey is that it collects data on violence against women using a common survey instrument and sampling design across several countries. [9] The survey instrument resembles the WHO Multi-country Study on Women's Health and Violence against Women (García-Moreno, Jansen, Ellsberg, Heise, C. Watts, et al., 2005) and is in alignment with the principles set forth by the Istanbul Convention, which was specifically designed to capture instances of violence perpetrated by current or former partners (FRA, 2015). [10] We focus on physical and sexual intimate partner violence (IPV). A woman is said to have experienced physical violence if she was ever pushed/shoved, slapped, thrown at by a hard object, grabbed (or pulled by her hair), beaten with a fist or a hard object, or kicked, burned, suffocated/strangled (tried to), cut/stabbed/shot, or beaten her head against something by an intimate partner since age 15. A woman is said to have experienced sexual violence if she was ever forced into sexual intercourse by holding her down or hurting her in some way, attempted to be forced into sexual intercourse by holding her down or hurting her in some way, made to take part in any form of sexual activity when she did not want to or were unable to refuse, or made to consent to a sexual activity out of fear by an intimate partner since age 15.

FRA's survey instrument focuses on women's experience of intimate partner violence by the hands of the current or previous partner. The survey also recovers information on the timing of the first incidence of IPV by this partner. We refer to this episode as the onset of violence. The

[8]The European Union Agency for Fundamental Rights (FRA), 2012 survey uses a multistage random sampling method. This method ensures that each woman older than 18 years in each EU Member State had the same (or similar) chance to be part of the survey. The sample is also stratified by geographical region and urban/rural level.

[9]Existing national surveys on violence against women in the EU are not fully comparable. These surveys focus on different groups; use different sample sizes and sampling approaches; use different survey modes; and, most importantly, ask different interview questions covering different subjects. There are few standardised international surveys on violence against women which solve the problem of non-comparability: the WHO Multi-country Study on Women's Health and Violence against Women (covered 10 non-EU Member States) (García-Moreno, Jansen, Ellsberg, Heise, C. Watts, et al., 2005), and the International Violence Against Women Survey (covered 11 countries around the world, including three EU Member States) (Johnson, Ollus, and Nevala, 2007). International surveys such as demographic and health surveys (DHSs) and multi-indicator cluster surveys (MICSs) have also included questions on violence, among other topics, but do not cover most EU Member States.

[10]The Istanbul Convention (by the Council of Europe) defines 'violence against women' (in Article 3) as '*a violation of human rights and a form of discrimination against women and shall mean all acts of gender-based violence that result in, or are likely to result in, physical, sexual, psychological or economic harm or suffering to women, including threats of such acts, coercion or arbitrary deprivation of liberty, whether occurring in public or in private life.*

structure of the data allows us to identify whether violence started *1 year* before the interview, *2 years*, *3 years*, *4 years*, *5 years*, *before 6 to 10 years*, or *more than 10 years ago*.

The survey also gathers on the respondent's relationship status at the time of the interview. With this information, we can distinguish whether the respondent is married, dating & co-habiting, dating & not cohabiting, or single. Unfortunately, the survey does not collect data on the age at the time of marriage, the duration of marriage (if any) or prior marriage/dating history.

The sample consists of 41,895. [11] The share of women belonging to age category 18-24, 25-29, 30-34, and 35-39 are similar and range from 7% to 9%. Around 20 % of the women belong to each of the age categories 40-49 and 50-59. Almost one-fourth of the interviewed women are older than 60 (see table 4.1). On average women in the sample had 12 years of education (see figure 4.1).

One in five women interviewed reported to have experienced physical and/or sexual violence (IPV) by their current and/or previous partner. 15% of young women aged 18-24 have experienced IPV, whereas 19% of the older women who age more than 60 years old have experienced IPV. The share of women who have experienced IPV and belonging to other age categories are similar ranging from 21% to 25 % (see table 4.2.1).

Figure 4.2.1 shows the distribution of women by their relationship status and age. Type of relationship status is represented by coloured boxes — green (married), blue (living together, but not married), yellow (dating, but not living together), and grey (single). We also used different shades of each colour to represent the age category. Lighter shades represent young women and darker shades represent older women. [12] Each sub-figure in figure 4.2.1 consists of 100 boxes and each box corresponds to 1%. For example, figure 4.2.1a includes the entire sample and there is only one green box with the lightest shade. This represents 1% of the entire sample and they are *married* & *between age 18-24*.

[11] Out of the 42,000 women only 41,895 answered questions related to intimate partner violence.

[12] Every colour has 5 different shades/intensities. For simplicity, we re-categorised ages to 18-24, 25-29, 30-39, 40-49, and 50+.

Figure 4.2.1: Distribution of women by relationship status and age Status

(a) Full Sample.

(b) Women who have ever experienced IPV.

Relationship status is represented by different colours; Green—*married*; Blue—*living together, but not married*; Yellow—*dating, but not living together*; and Grey—*single*. Light shades represent young women and darker shades represent older women. Each coloured box represents 1% of the sample.

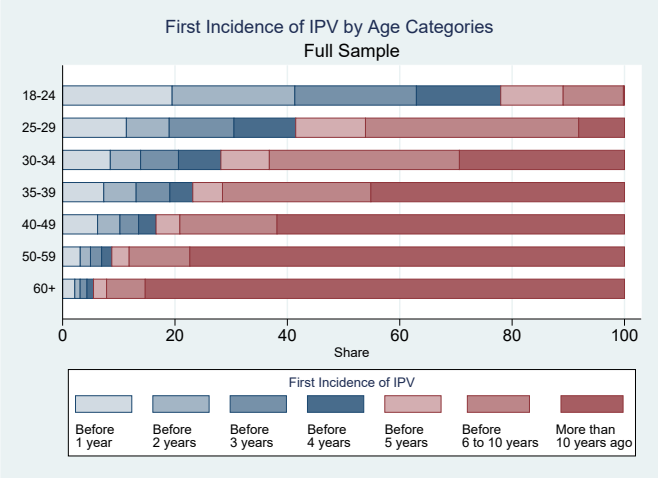
Most women interviewed were married (green) at the time of the interview and these married women are not young. The share of single women (grey) stands second, followed by those who are dating (blue) and then living together (yellow) (see figure 4.2.1a).

Figure 4.2.1b represents the subset of the sample who has ever experienced physical and/or sexual violence (IPV) by their current or previous partner. We compare figure 4.2.1a & 4.2.1b, and make two suggestions. (1) Unmarried women are over represented in the sample of victims of IPV. The share of currently unmarried women who have ever experienced IPV (non-green boxes, in figure 4.2.1b) is larger, compared to their corresponding share in the full sample (non-green boxes, in figure 4.2.1a). (2) Younger women are over represented in the sample of victims of IPV. Share of younger women who have experienced IPV is larger compared to their share in the full sample. There are more lighter shade boxes in figure 4.2.1b compared to figure 4.2.1a. This might indicate that the first incidence of IPV occur at a younger age when women at not married. [13]

The objective of this paper is to deepen the understanding on the *age of first incidence (onset) of IPV*. Among those women aged 18-24 who have experienced IPV, more than half of them

[13]These patterns have nothing to do with the sampling design. Remember that, respondents were selected to take part in this survey using multistage random (probability) sampling. This means that a series of sampling steps was used to try to ensure that each interviewee had a chance of being selected for interview among the general population of women in each EU Member State.

Figure 4.2.2: First Incidence of IPV (Full Sample).



Full Sample

Distribution of the time of first incidence of IPV of women belonging to different age categories.

experienced IPV for the first time within the last three years. Whereas, among those women aged 25-29 who have experienced IPV, 58% of them experienced IPV for the first time before 5 years or earlier. Only a small fraction of women older than 50 experienced IPV for the first time when they were older (see table 4.2.1 and figure 4.2.2). Almost all older women experience IPV for the first time before 10 years ago (see table 4.2.1 and figure 4.2.2). This suggests that the first incidence of IPV mostly occurs at a younger age.

We dropped all individuals who are age 50 or older, since most women who had experienced IPV encountered it for the first time before age 50. We also drop those women who older than 30 and experienced IPV for the first time more than 10 years ago. We perform the analysis on this restricted dataset which includes women aged 18 to 49 (see table 4.2.2 and figure 4.2.3).

4.2.2 Country-level Historical Data

We collected country-level historical data on the existence of domestic violence laws and a national women's helplines for victims and survivors of intimate partner violence (IPV) from the Global Database on Violence against Women, 2023 which is updated by UN Women (see

Table 4.2.1: Full Sample

Age	Prevalence of IPV	Share of those who first experienced IPV						
		Before 1 year	Before 2 years	Before 3 years	Before 4 years	Before 5 years	Before 6 to 10 years	More than 10 years ago
18-24	15%	19%	22%	22%	15%	11%	11%	0%
25-29	21%	11%	8%	12%	11%	12%	38%	8%
30-34	23%	8%	5%	7%	8%	9%	34%	29%
35-39	23%	7%	6%	6%	4%	5%	27%	45%
40-49	25%	6%	4%	4%	3%	4%	17%	62%
50-59	24%	3%	2%	2%	2%	3%	11%	77%
60+	19%	2%	1%	1%	1%	2%	7%	85%
All	22%	6%	4%	5%	4%	5%	17%	59%

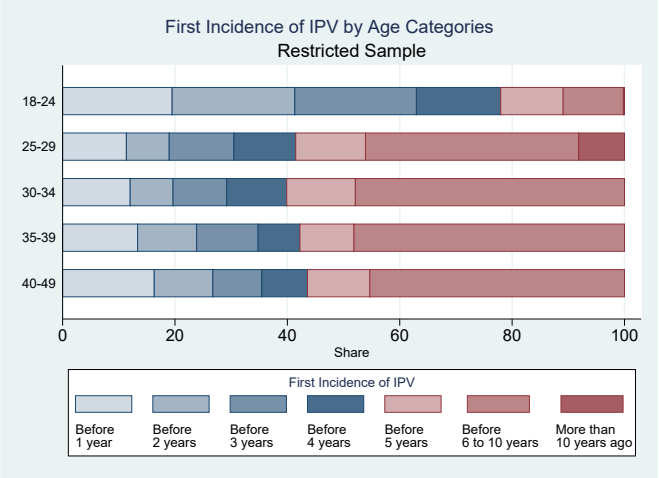
Table 4.2.2: Restricted Sample

Age	Prevalence of IPV	Share of those who first experienced IPV						
		Before 1 year	Before 2 years	Before 3 years	Before 4 years	Before 5 years	Before 6 to 10 years	More than 10 years ago
18-24	15%	19%	22%	22%	15%	11%	11%	0%
25-29	21%	11%	8%	12%	11%	12%	38%	8%
30-34	18%	12%	8%	9%	11%	12%	48%	0%
35-39	15%	13%	11%	11%	7%	10%	48%	0%
40-49	13%	16%	10%	9%	8%	11%	45%	0%

table 4.8). [14]

[14] Accessed: May 25, 2023

Figure 4.2.3: First Incidence of IPV (Restricted Sample).



Restricted Sample

Distribution of the time of first incidence of IPV of women belonging to different age categories.

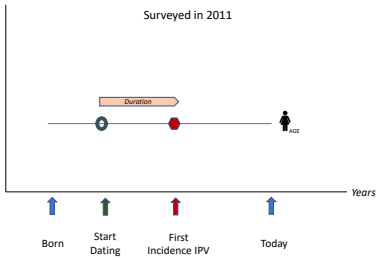
4.3 Ideal Data

Since the object of interest is time of first incidence (onset) of IPV, the ideal data for individual i is *time/duration individual i survived without ever experiencing IPV in her life, since the age of dating*. To find this, we need information on the age of dating for the first time and age when experiencing IPV for the first time. Assume that a 38 year old woman interviewed in 2011 reported that she experienced IPV for the first before 8 years (in 2003). If we know that she first started dating in 1988, then she survived 15 years without experiencing IPV since she first started dating anyone (see figure 4.3.1).

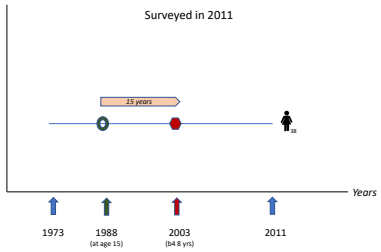
But the data we have from European Union Agency for Fundamental Rights (FRA), 2012 is not ideal. In the following we explain three problems of the data and propose possible solutions where needed.

The first problem is that we do not have information on when an individual starts dating for the first time. Assume that a 38 year old woman interviewed in 2011 reported that she experienced IPV for the first time before 8 years (in 2003). If we do not know when she started dating, then we cannot find the duration/years she survived without experiencing IPV since

Figure 4.3.1: Ideal Data



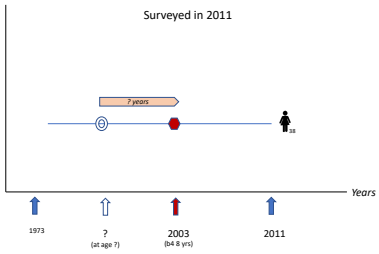
Ideal Data on Duration



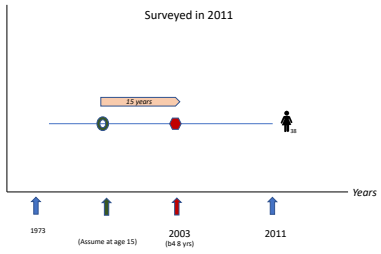
Ideal Data on Duration *an example*

she first started dating. To overcome this limitation of the data, we assume 15 as the age of dating for the first time (figure 4.3.2).

Figure 4.3.2: Problem 1



No data on age of dating for the first time.

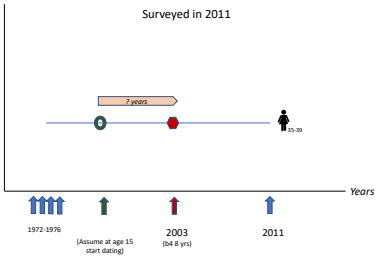


Assume women start dating at age 15.

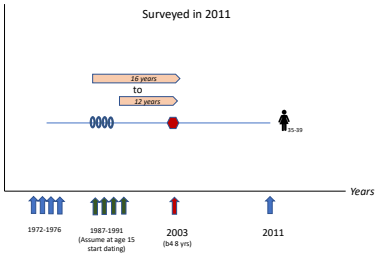
The second problem is that we do not have information on the exact age of the individuals. Instead, we have information on their age categories. Assume that woman *i* belonging to the age category 35-39 interviewed in 2011 reported that she experienced IPV for the first before 8 years (in 2003). As mentioned before, we assume she first started dating at age 15. If this individual is 35 years old (in 2011), then she was 27 when she experienced IPV for the first time, and she survived from age 15 to age 27 without experiencing IPV (duration = 12 years). On the other hand, if this individual is 39 years old (in 2011), then she was 31 when she experienced IPV for the first time, and she survived from age 15 to age 31 without experiencing IPV (duration = 16 years). Woman *i* aged 35-39 in 2011 who experienced IPV

for the first time before 8 years survived somewhere between 12 to 16 years without ever experiencing IPV (figure 4.3.3). The age of first incidence of IPV is between age 27 to age 31 for this individual.

Figure 4.3.3: Problem 2



We only have information on age categories.



We observe duration intervals .

The third problem is that many women, especially older women report that they experienced IPV for the first time more than 10 year ago. Assume that woman i belonging to the age category 24-29 interviewed in 2011 reported that she experienced IPV for the first time more than 10 years ago (before 2001). We assume that woman start dating at age 15. If this individual is 25 years old (in 2011), then she was 15 when she experienced IPV for the first time, and she survived zero years without experiencing IPV (duration = 0 years). On the other hand, if this individual is 29 years old (in 2011), then she was younger than 19 when she experienced IPV for the first time, and she survived for a maximum of 4 years since age 15 without experiencing IPV (duration = maximum of 4 years). Woman i aged 25-29 in 2011 who experienced IPV for the first time more than 10 years ago survived somewhere between 0 to 4 years without ever experiencing IPV. The age of first incidence of IPV is between age 15 and age 19 for this woman.

4.4 Time as a Discrete Variable

4.4.1 Empirical Strategy

We examine the hazard of intimate partner violence women face at every age since age 15. As a first step, we estimate a simple discrete approximation of a duration model (using simple OLS), adapted from Currie and Neidell, 2005 and following Corno, Hildebrandt, and Voena, 2020. The baseline specification is discussed below.

For this analysis, we make five assumptions on woman's age and reported time of first incidence of IPV. We can only identify age categories in the original data set. The age of woman i belongs to the interval (t_l, t_u), where t_l is the lower limit and t_u is the upper limit. [15] (1) We assume that the age of woman i is a random draw from a uniform distribution with t_l and t_u, as lower and upper limits respectively i.e., $Age_i \sim U(t_l, t_u)$. (2) If woman i experienced IPV for the first time before 6 to 10 years, we assume it to be a random draw from a uniform distribution with 6 and 10, as lower and upper limits respectively i.e., first incidence of IPV for woman $i \sim U(6, 10)$. [16] (3) We drop those who are older than 29 years and said they experienced IPV for the first time more than 10 years ago. (4) We assumed that first incidence of IPV occurred before 11 years for woman i, if she is younger than 30 and experienced IPV for the first time more 10 years ago. Note that no one aged 18-24 in the restricted dataset reported to have experienced IPV for the first time more 10 years ago. [17] Finally, (5) we assume woman start dating age 15. [18]

The duration of interest is the time between t_0, the age when a woman starts dating (when she is first at risk of experiencing intimate partner violence), and t_m, the age when she experiences intimate partner violence for the first time. In our analysis, t_0 is assumed to be age 15.

[15] The age categories in the restricted data set are 18-24, 25-29, 30-34, 35-39, and 40-49.

[16] In the original data set, timing of the first incidence of IPV is recorded as before 1 year, or 2 years, or 3 years, or 4 years, or 5 years, or 6 to 10 years, or more than 10 years ago.

[17] There was one individual between 18-24 who experienced IPV for the first time more than 10 years ago. We dropped this observation since it is an outlier.

[18] In the restricted dataset, there is no one who is older than 30 and who experienced IPV for the first time more than 10 years ago.

Similar to Corno, Hildebrandt, and Voena, 2020, we converted (expanded) the data from European Union Agency for Fundamental Rights (FRA), 2012 into person-year panel format. A woman who experiences IPV for the first time at age t_m contributes $(t_m - t_0 + 1)$ observations to the sample: one observation for each at-risk year until she experiences IPV for the first time, after which she exits the data. Assume that a woman is 23 years old and during the interview she reports that she experienced IPV for the first time before 3 years. She experienced IPV for the first time at age 20. This woman will be in the expanded dataset from age 15 until age 20.

The expanded data includes years of education of every individual i and every year y. Education of an individual is allowed to vary over years. [19] Using this sample, we estimate the probability of IPV for a woman i living in location g in year y and experiencing IPV for the first time at age t as follows:

$$IPV_{i,g,k,t} = X_{i,g,y,t}\beta + \alpha_t + \omega_g + \gamma_y + \epsilon_{i,g,k,t}. \tag{4.1}$$

The dependent variable, $IPV_{i,g,y,t}$, is a binary variable coded as 1 in the year the woman experiences IPV, and zero otherwise. We examine data on women until age 49. Thus, women experiencing IPV for the first time after age 49 (or those who never experienced IPV by their current/previous partners) are right-censored. The main effect of interest is α_t, a vector of age fixed effects. It captures the different probabilities of experiencing the IPV for the first time at different ages. The variable $X_{i,g,y,t}$ is a individual level time-varying measure of education (years of education) during the year y when she is age t. The coefficient β measures the effect of years of education on the probability of experiencing IPV for the first time. Including years of education will help us to controlling for the effect of education on the hazard of experiencing IPV. Higher levels of education could increase an individual's awareness of one's rights and could empower them to report instances of violence and/or seek help. This can

[19] We use Eurydice to find the number of years of education corresponding to each educational category and age at the start of education in each EU country (Eurydice is a network and information service established by the European Commission and the Member States of the European Union). In the expanded dataset education of an individual is allowed to vary with time.

lead to more reports of violent incidents. At the same time, more education can improve their economic independence which can in turn reduce the hazard of experiencing violence. We also include country-specific fixed effects, ω_g, to control for time-invariant local unobservable characteristics, such as geographic, economic, and cultural factors, and year fixed effects γ_y. We estimate regressions with standard errors clustered at the country level. These effects are only descriptive and not causal in nature.

4.4.2 Hazard and cumulative hazard ratios

We construct *hazard* and *cumulative hazard ratios* when time is treated as a discrete variable. The random variable for time, t has a discrete support 15, 16, 17...,49 with probability mass function $p(\tau) = Pr(t = \tau)$ and cdf F(t)=p(15) + p(16) + ... + $p(t)$ for t = 15,16,17...,49. Using the OLS estimates, the expected probability of experiencing IPV for the first time can be calculated at every age ($p(t)$). [20]

The hazard of experiencing IPV at age τ is defined as the probability (density) of experiencing IPV at age τ conditional on never being experienced IPV before (probability of experiencing IPV for the first time at age τ). The *hazard function* is: [21]

$$h(\tau) = Pr(t = \tau | t \geq \tau) = \frac{Pr(t = \tau)}{Pr(t \geq \tau)} = \frac{p(\tau)}{1 - F(\tau - 1)} \tag{4.2}$$

The integrated or cumulative hazard is: [22]

$$H(\tau) = \sum_{t=15}^{\tau} h(t) \tag{4.3}$$

[20] Using $p(t)$, we calculate the cdf for t = 15,16,17...,49.

[21] In practice we find a conditional hazard function described as

$$h(\tau|X) = \frac{Pr(t = \tau)|X}{Pr(t \geq \tau|X)} = \frac{p(\tau|X)}{1 - F(\tau|X)}$$

[22] Conditional cumulative hazard function described as

$$H(\tau|X) = \sum_{t=15}^{\tau} h(t|X)$$

4.4.3 Results.

Estimates of the simple discrete approximation of a duration model (equation 4.1) are reported in table 4.3 and 4.4. Column 1 estimates a model only with age and country fixed effects. The coefficients are significant and probability of experiencing IPV for the first time increases with age. [23]. Column 3 shows results when I add country fixed effects, year fixed effects, and years of education. Estimates reveal an intriguing pattern in the likelihood of experiencing intimate partner violence (IPV) among women. The probability of experiencing IPV for the first time is particularly high among younger women, reaching its peak at the age of 22. However, as women progress into their mid-30s, this probability takes a gradual decline. A subtle rise in the likelihood of experiencing IPV emerges as women grow older. These findings shed light on the dynamics of IPV across different age groups, emphasizing the need for targeted interventions and support systems to address the distinctive challenges faced by women at various stages of their lives. We also estimate the odds ratios which indicate similar results (see table 4.5 and 4.6).

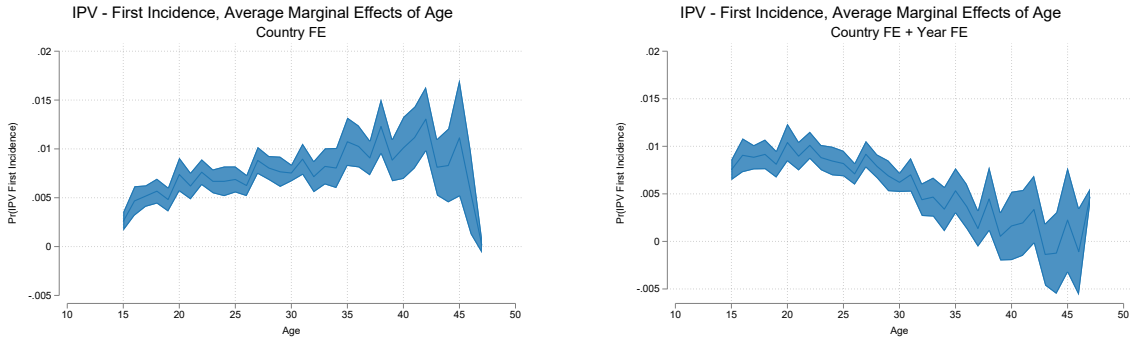
The estimated conditional probability of experiencing IPV for the first time at every age for a model only with country fixed effects is shown in figure 4.4.1a and it increases with age. In the model with country fixed effects, year fixed effects, and years of education, the estimated conditional probability of experiencing IPV for the first time increases at a younger age and peaks at the early 20s, before falling down until late 30s (see figure 4.4.2). [24]

The hazard of experiencing IPV for the first time and cumulative hazard of experiencing IPV is calculated using estimates from table 4.3 and 4.4. When we only include country fixed effects, the hazard of experiencing IPV for the first time increases with age and peaks during the mid 40s (see figure 4.4.3a). Figure 4.4.4 shows the hazard of experiencing IPV for the first time when country fixed effects, year fixed effects and years of education are included in the regression (column 3 of table 4.3 and 4.4). It unfolds a pattern, with the hazard soaring to its pinnacle during the early-20s, signifying a critical period of vulnerability. Interestingly,

[23] In column 2, I show the results when year fixed effect is also included.

[24] Estimates from logistic regressions also indicate similar results (see figure 4.4 and 4.5)

Figure 4.4.1: Expected Probability of Experiencing IPV for the first time.



(a) Country FE

(b) Country FE, and year FE

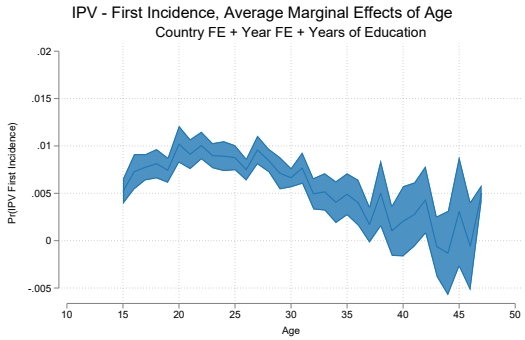
Based on OLS estimates.

this elevated hazard persists through the late-20s, suggesting an ongoing risk. However, as individuals move into their 30s, the hazard begins to drop, gradually diminishing and reaching its minimum during the early-40s. These findings show the dynamic trajectory of IPV hazards across different age groups, highlighting the importance of tailored interventions to protect individuals during their formative years and beyond. [25]

As expected the cumulative hazard of experiencing IPV for the first time increases with age. In the model with only country fixed effects the slope of the cumulative hazard of experiencing IPV is concave and increasing (see figure 4.4.3a). In the model where country fixed effects, year fixed effects and years of education are included, we can see that the slope of the cumulative hazard of experiencing IPV decreases after age 30. This is mechanical because of the falling hazard after this age (see figure 4.4.4).

[25] Estimates from logistic regressions also indicate similar results (see figure 4.6 and 4.7)

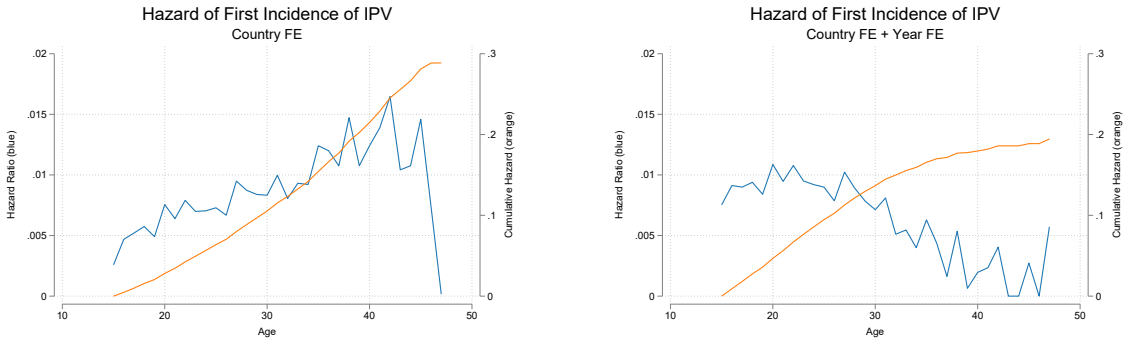
Figure 4.4.2: Expected Probability of experiencing IPV for the first time.



Country & year FE, and education

Based on OLS estimates.

Figure 4.4.3: Hazard of experiencing IPV for the first time at every age.



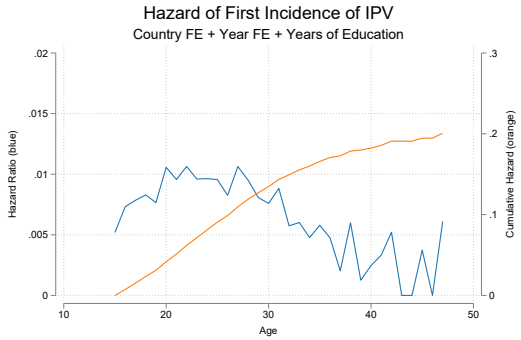
(a) Years of Education

(b) Years of Education and Year FE

Based on OLS estimates.

Using the estimates from column 3 of table 4.3 and 4.4, we calculated the hazard of intimate partner violence (IPV) for every age within individual countries (see table 4.7). Astonishingly, the hazard consistently reaches its peak at the age of 21 across most countries, with a notable exception in Denmark where it peaks at age 47. Figure 4.4.5 depicts the highest hazard of IPV in each country in Europe. Denmark, Latvia, Finland, Sweden, and Hungary stand out with the most elevated hazards, underscoring the urgent need for targeted interventions and preventive measures within these nations. Conversely, Cyprus has the lowest hazard, closely followed by Slovenia, Spain, Poland, and Croatia. In Denmark, the peak hazard of IPV is

Figure 4.4.4: Hazard of experiencing IPV for the first time at every age.



Years of Education, Year FE, and Country FE

Based on OLS estimates.

approximately three times that of Cyprus, painting a vivid picture of the disparities in IPV risks faced by individuals within different national contexts. [26]

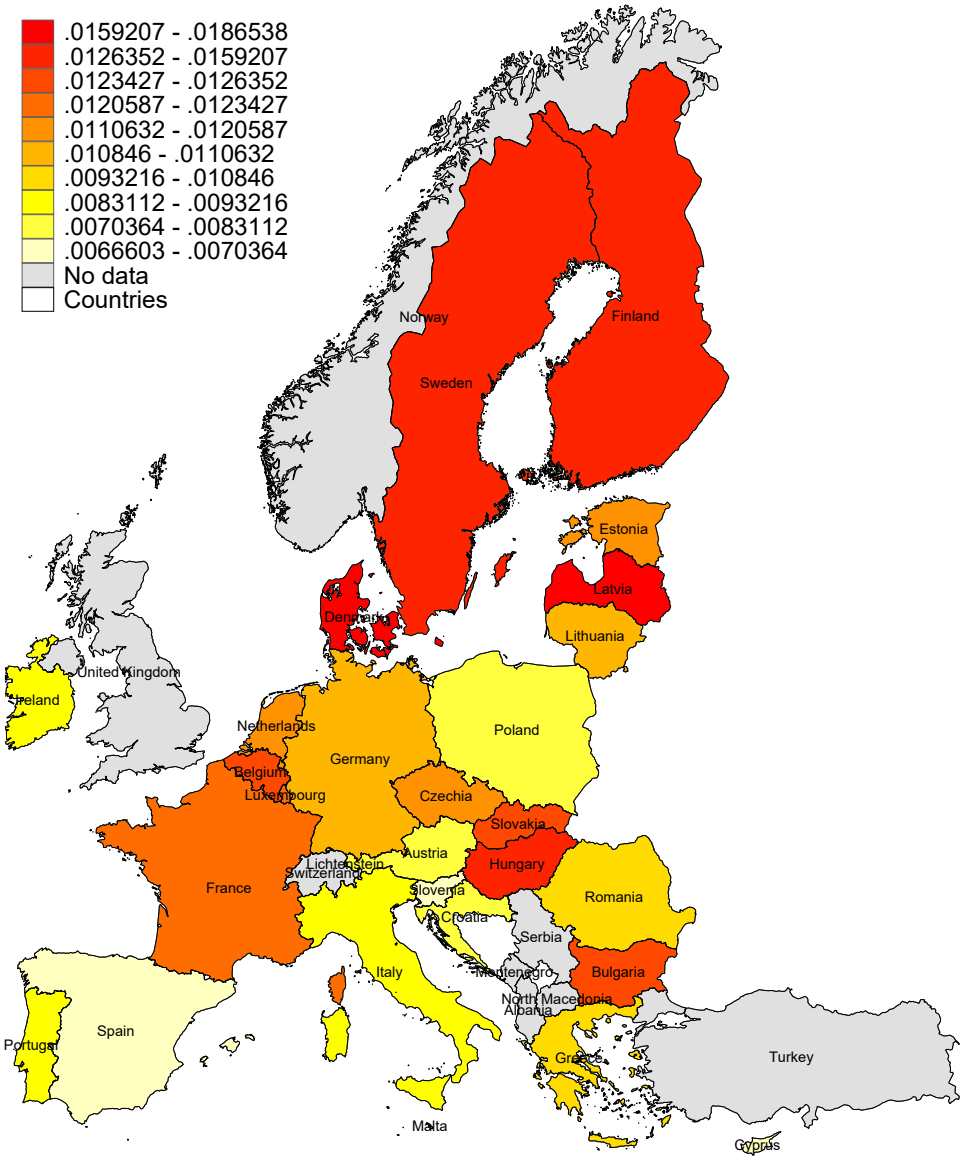
Early relationships where there is less commitment could be one of the reasons why IPV peaks at a younger age. There is already evidence that violence is prevalent in relationships between younger pupils, for example *Teen Dating Violence* (Tomaszewska and Schuster, 2021). When individuals become older they are more economically independent, access/find more stronger support networks, and be more aware of their rights and resources available for them. All of these will equip women to leave violent relationships. Early 20s can also be the age where women find stable relationships. Unlike the data from European Union Agency for Fundamental Rights (FRA), 2012, access to a dataset on the characteristics of the relationships of women aged 20-30 would give more insights as to why IPV peaks at a younger age.

4.4.4 Effect of Policies

In this section we investigate whether the implementation of laws against intimate partner violence (IPV) and introduction of national women's helplines, had an effect on the onset and

[26]Similar results on the prevalence of IPV was shown by Martín-Fernández, Gracia, and Lila, 2020. They show that Denmark, Finland, Sweden, and the UK stood out as the front runners in terms of average levels of physical and sexual IPV within the European Union. It must also be noted that the Nordic countries which excel in gender equality struggles with disproportionately high rates of intimate partner violence against women. Gracia and Merlo, 2016 calls this as the *Nordic Paradox*.

Figure 4.4.5: Country Level, Hazard of IPV



hazard of IPV.

$$\begin{aligned} IPV_{i,g,y,t} = \beta_0 + Age_{30to40}\ \beta_1 + Age_{40plus}\ \beta_2 + Law_{g,y}\ \eta_0 + Hotline_{g,y}\ \zeta_0 \\ Age_{30-40} * Law_{g,y}\ \eta_1 + Age_{40+} * Law_{g,y}\ \eta_2 + Age_{30-40} * Hotline_{g,y}\ \zeta_1 \\ + Age_{40+} * Hotline_{g,y}\ \zeta_2 + X_{i,g,y,t}\ \beta + \alpha_t + \omega_g + \gamma_y + \epsilon_{i,g,y,t}. \end{aligned} \tag{4.4}$$

$Law_{g,y}$ is a binary variable coded 1, if there exists atleast one law against IPV in location g in year y. Similarly $Hotline_{g,y}$ is a binary variable coded 1, if a national women's helpline is introduced in location g in/before year y. To understand the effect of policies on various age groups, we categorized women into three groups: (1) women who are younger than 30 - *dating period*, (2) women who are between age 30 and 40 -*fertility period*, and (3) women who are older than 40 - *post fertility period*. Age_{30to40} and Age_{40plus} are dummies coded 1, if the age of the individual is between age 30-40, and above age 40 respectively. [27] The coefficient η_0 measures effect of laws against IPV on the probability of experiencing IPV for the first time for young women below 30 (*dating period*). $\eta_0 + \eta_1$ and $\eta_0 + \eta_2$ measures effect of the law on IPV for women belonging to age category 30-40 (*post fertility period*) and above 40 (*post fertility period*) respectively. The coefficient ζ_0 measures effect of national women's helplines (hotlines) on the probability of experiencing IPV for the first time for young women (below 30). $\zeta_0 + \zeta_1$ and $\zeta_0 + \zeta_2$ measures effect of hotlines on IPV for women belonging to 30-40 and above 40 respectively.

The findings showcased in table 4.4.1 unveil an insight into the impact of laws against intimate partner violence (IPV) on its onset, particularly among women aged 30 to 40, which arguably coincides with their *fertility period*. For this specific age category, the likelihood of experiencing IPV drops by a notable 24% due to the presence of such laws (see table 4.9). However, the effect of these laws disappears for women younger than 30 (*dating period*) or older than 40 (*post fertility period*), suggesting potential gaps in their protective effects across different age groups.

[27] The age category *below 30* is omitted in equation 4.4.

Table 4.4.1: Effect of Policies on Onset of IPV..

	(1) IPV	(2) IPV	(3) IPV	(4) IPV	(5) IPV
Law (overall)	-0.00130				
	(0.00103)				
Law on $Age_{Below30}$ (η_0)		-0.00011			0.00000
		(0.00118)			(0.00117)
Law on Age_{30to40} ($\eta_0 + \eta_1$)		-0.00294**			-0.00284*
		(0.00142)			(0.00148)
Law on $Age_{Above40}$ ($\eta_0 + \eta_2$)		-0.00390			-0.00395
		(0.00269)			(0.00246)
Hotline (overall)			-0.00126		
			(0.00150)		
Hotline on $Age_{Below30}$ (ζ_0)				-0.00093	-0.00092
				(0.00210)	(0.00219)
Hotline on Age_{30to40} ($\zeta_0 + \zeta_1$)				-0.00119	-0.00080
				(0.00129)	(0.00123)
Hotline on $Age_{Above40}$ ($\zeta_0 + \zeta_2$)				-0.00319	-0.00324
				(0.00222)	(0.00209)
N	345,756	345,756	345,756	345,756	345,756
Education	y	y	y	y	y
Country FE	y	y	y	y	y
Year FE	y	y	y	y	y
Cohort FE	y	y	y	y	y

Standard errors in parentheses

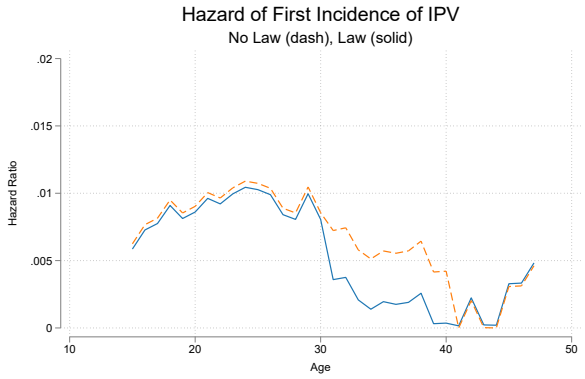
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Data on the existence of *Hotlines* is not available for Czech Republic, Ireland and Malta. Observations from these countries are dropped when *Hotline* is included in the regression.

The impact of laws against intimate partner violence (IPV) extends beyond just the onset and directly influences the hazard of IPV. Figure 4.4.6 illustrates that the effects of these laws are predominantly observed among women aged 30 to 40. The implementation of such laws resulted in a reduction in the hazard of IPV for these women, providing a vital layer of protection. This compelling evidence underscores the effectiveness of legal interventions in curbing the ongoing risk and ensuring a safer environment for women during their reproductive years. [28]

Contrary to the influence of laws, the results paint a different picture for the existence of national women's helplines. Surprisingly, these helplines do not appear to have an impact on the onset of IPV for women in any age category (columns 5-10, table 4.4.1). This finding highlights the need for a comprehensive examination of the effectiveness of helpline services in reducing the onset of IPV.

Figure 4.4.6: Effect of Law on Hazard of Experiencing IPV



Years of Education, Year FE, Country FE, and Law

[28] To find the effect of law on the hazard of IPV, we estimate the following:

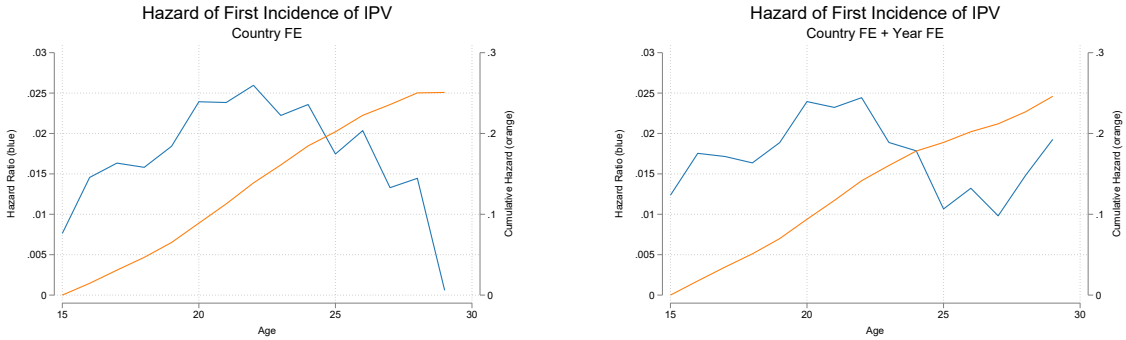
$$IPV_{i,g,y,t} = X_{i,g,y,t}\beta + \alpha_t + \omega_g + \gamma_y + \sum_{c=1}^{3} AgeCat_c * Law_{g,y}\eta_c + \epsilon_{i,g,y,t}.$$

Unlike equation 4.4, here we include binary variables coded 1 if an individual belongs to each age category and is exposed to the law. Using the estimated coefficients, I separately find the hazard for each category and join the hazard curves.

4.4.5 Robustness

As a robustness check, the analysis was done on the restricted sample for those aged below 29. Similar to the previous results, I show that the hazard of experiencing IPV is the highest around age 22 when country fixed effects, years fixed effects, and years of education is added in the model (see figures 4.4.7 and 4.4.8). The hazard declines when women get older. It again reiterates the need for targeted interventions to prevent IPV especially focusing younger women.

Figure 4.4.7: Hazard of experiencing IPV for the first time at every age.

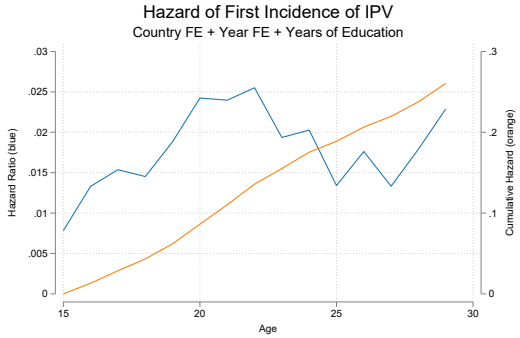


(a) Years of Education

(b) Years of Education and Year FE

Based on OLS estimates (excluding all individuals above age 29).

Figure 4.4.8: Hazard of experiencing IPV for the first time at every age.



Years of Education, Year FE, and Country FE

Based on OLS estimates (excluding all individuals above age 29).

4.5 Time as a Continuous Variable

4.5.1 Empirical Strategy

We examine the hazard of intimate partner violence women face at every age since age 15. In this section, we treat time as a continuous variable and estimate a conditional Cox proportional hazards model following Zeng, Mao, and Lin, 2016.

Data in the original data set is *interval censored*, hence we can only identify age categories. The age of woman i belongs to the interval (t_l, t_u), where t_l is the lower limit and t_u is the upper limit. [29]

The duration of interest is the time between t_0, the age when a woman starts dating (when she is first at risk of experiencing intimate partner violence), and t_m, the age when she experiences intimate partner violence for the first time. We cannot observe t_m, but is given as an interval (i.e., we observe $\bar{t}_m < t_m < \underline{t}_m$ instead of t_m).

Similar to Corno, Hildebrandt, and Voena, 2020, we converted (expanded) the data from European Union Agency for Fundamental Rights (FRA), 2012 into person-year panel format. We only expand the dataset if women who experienced IPV for the first time before 10 years or less. A woman who experiences IPV for the first time during the age interval $(\underline{t}_m, \bar{t}_m)$ contributes $(\underline{t}_m - t_0 + 1)$ observations to the sample: one observation for each at-risk year until she experiences IPV for the first time, after which she exits the data. The lower and upper limits of age category at every year is coded as t_l and t_u respectively. For example assume that a woman is 25-29 years old during the interview and she reports that she experienced IPV for the first time before 3 years. She experienced IPV for the first time when she was 22-26 ($\underline{t}_m$ = 22). This woman will be in the expanded dataset from age category 15-21 until 22-26 (observed 8 times).

If a woman experiences IPV for the first time more than 10 years ago, she is only observed once. Assume that woman j belongs to the age category 35-39 at the time of the interview,

[29] The age categories in the restricted data set are 18-24, 25-29, 30-34, 35-39, and 40-49.

and she reported to have experienced IPV for the first time more than 10 years ago. Since we assume that the age of dating cannot be lower than 15, woman j could have experienced IPV for the first time before 11 years ($age_j \in [24, 28]$) or up to before 20 years ($age_j \in [15, 19]$). Hence, woman j appears in the dataset only once and we treat woman j to have experienced IPV for the first time between age 15 (t_l) and age 28 (t_u).

Our data is left censored if we have individuals where $\underline{t_l}$ is not observed. The assumption on t_0 removes any left censoring in the data.

If woman i has never experienced violence, then she is observed multiple times, and her last observation in the expanded dataset is *right censored*. For example, assume that a woman is 25-29 years old during the interview and she reports that she never experienced IPV. She will be observed 10 times from when she is 15-19 (in year 2001) to 25-29 (in year 2011). She has definitely not experienced IPV until year 2010 (so interval censored until year 2010). She could have theoretically experienced IPV after 2011, hence the observation in year 2011 is *right censored*. The duration for woman i in year 2011 is $t_l < t_m$.

The expanded data includes years of education at the individual-year level. [30]

Let t denote the event time, and let $X(t)$ denote a $1 \times$ p vector of covariates that can potentially depend on time (e.g. years of education). Let the probability density function be $f(\tau) = Pr(t = \tau)$ and cdf $F(\tau) = \int_{15}^{\tau} f(t)\,dt$, for $t =\in (15, 49)$. Similar to equation 4.2, the conditional hazard function when time is treated as a continuous variable is

$$h(\tau|X) = \frac{Pr(t = \tau|X)}{Pr(t \geq \tau|X)} = \frac{f(\tau|X)}{1 - F(\tau|X)} \tag{4.5}$$

[30] In the survey, We can only identify the highest level of education of each individual (figure 4.3 in appendix). We use Eurydice to find the number of years of education corresponding to each educational category and the age at the start of education in each country. Eurydice is a network and information service established by the European Commission and the Member States of the European Union.

4.5.2 Hazard and cumulative hazard ratios

The integrated or cumulative hazard in this case is written as:

$$H(t) = \int_{-\infty}^{t} h(s)\, ds \tag{4.6}$$

The integrated hazard function can also be written as a function of $f(t)$ and $F(t)$:

$$H(t) = \int_{-\infty}^{t} \frac{f(s)}{1 - F(s)}\, ds = \Big[- ln\Big(1 - F(s)\Big)\Big]_{-\infty}^{t} = -ln\Big[1 - F(t)\Big] \tag{4.7}$$

Therefore we can write the pdf and cdf as:

$$F(t) = 1 - exp\Big(- H(t)\Big)$$

$$f(t) = \frac{\partial F(t)}{\partial t} = h(t) exp\Big(- H(t)\Big) \tag{4.8}$$

Under the conditional Cox proportional hazards model, the hazard function can be written as:

$$h(t, X) = h_0(t)\, exp(X'\beta) \tag{4.9}$$

The function $h_0(t)$ is called the baseline function. $h_0(t)$ decides the shape of the conditional hazard function and is scaled differently for every women. $exp(X'\beta)$ is called the systematic part of the hazard. β is a $p \times 1$ vector of unknown regression parameters.

Under the conditional Cox proportional hazard model, the pdf can be written as (substitute equation 4.9 in equation 4.8):

$$f(t|X) = h(t, X) exp\Big(- H(t, X)\Big)$$

The log likelihood sample of this function is:

$$\mathcal{L}_{\mathcal{N}} = \sum_{i=1}^{N} f(t|X) = \sum_{i=1}^{N} h(t,X)\ exp\Big(- H(t,X)\Big)$$

We have interval censored and right censored data. If woman i who belongs to age category (t_l, t_u) experienced IPV for the first time in a given year, then she contributes to the *log-likelihood function* for duration between t_l and t_u. If woman j who belongs to age category (t_l, t_u) never experienced IPV in her life time (*right censored)*, then she is only observed in one period and contributes to the *log-likelihood function* for duration between 15 and t_u. The log-likelihood can be written as:

$$\mathcal{L}_{\mathcal{N}} = \sum_{i=1}^{N} \Big(w_i\ ln\Big(F(t_{ui}|X) - F(t_{li}|X)\Big) + (1 - w_i)\ ln\Big(1 - F(t_{li}|X)\Big)\Big) \tag{4.10}$$

where w_i is an indicator for interval censored data.

The log-likelihood function is therefore:

$$\mathcal{L}_{\mathcal{N}} = \sum_{i=1}^{N} \Bigg\{ w_i\ ln\Bigg(exp\Big(- \int_{15}^{t_l} \Big(h_0(t)\, exp(X'\beta)\Big)\, dt\Big) - exp\Big(- \int_{15}^{t_u} \Big(h_0(t)\, exp(X'\beta)\Big)\, dt\Big)\Bigg)$$

$$+(1 - w_i)\Big(- \int_{15}^{t_l} \Big(h_0(t)\, exp(X'\beta)\Big)\, dt\Big)\Bigg\} \tag{4.11}$$

We maximize equation 4.11 by the method proposed by Chiappori, 1997. The authors use the Expectation–Maximization (EM) algorithm to find (local) maximum likelihood.

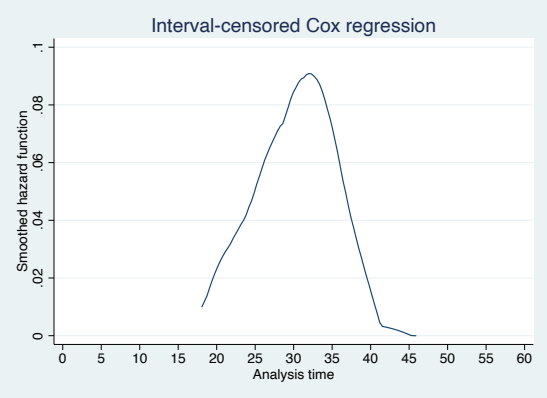
4.5.3 Results

We estimate the model with (1) only years of education, and (2) years of education & year fixed effects.

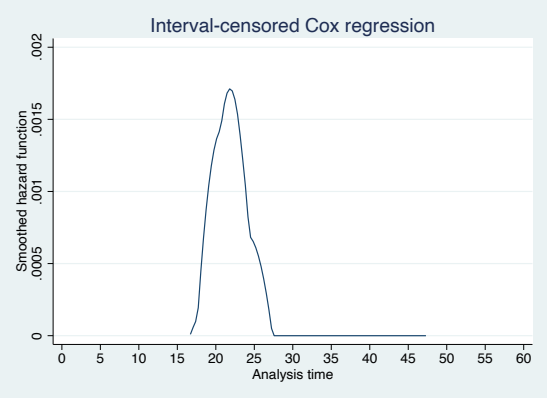
In the model only with years of education, the hazard of IPV peaks around mid-30s (figure 4.5.1a). When we also include year fixed effects, the results coincide with the OLS results pre-

sented in the previous section. In figure 4.5.1b we show that hazard of IPV goes up even at a younger age and peaks during the early 20s. This can be see as the time of dating.

Figure 4.5.1: Hazard of experiencing IPV for the first time at every age (from conditional Cox proportional hazards model)



(a) No year fixed effect.



(b) Year fixed effect included.

4.6 Conclusion

In this paper, we specifically examine the onset of Intimate Partner Violence (IPV) in Europe, where a notable proportion of women, ranging from 16-23%, have experienced IPV at some point in their lives (Devries, Mak, Garcia-Moreno, Petzold, Child, Falder, Lim, Bacchus, Engell, Rosenfeld, et al., 2013). We use survey data from European Union Agency for Fundamental Rights (FRA), 2012 on violence against women and combine this with country-level data on historical laws against IPV and the presence of national helplines (Global Database on Violence against Women, 2023), to assess their impact on the hazard of violence at various life stages. We show that the hazard of IPV peaks at the early stages of life and laws against IPV are only effective at later stages.

We estimate a simple discrete approximation of a duration model adapted from Currie and Neidell, 2005 and Corno, Hildebrandt, and Voena, 2020. Following the approach of Corno, Hildebrandt, and Voena, 2020, we expand the data into a person-year panel format. Essentially, for each woman, we create an observation for every year she is at risk of experiencing

IPV until she encounters it for the first time. This allows us to capture the dynamic nature of the onset of IPV and find the hazard of IPV at every age from 18 onwards. Our findings reveal that the risk of experiencing IPV reaches its highest level at the age of 22 and continues to remain elevated until the late twenties, which coincides with the period when individuals are actively engaged in dating. We also show that laws against IPV effectively reduce the occurrence of IPV for the first time among women in their thirties — those who are potentially married and having children. However, the impact of the law is relatively limited for women who experience violence for the first time during the early stages of their romantic lives (teenage/early twenties) or at a later stage, when they are in their forties or beyond. Additionally, we show that the hazard of violence is highest in the Nordic Region.

These findings illuminate the nuanced relationship between legal interventions, helpline services, and the onset of IPV among women. It underscores the importance of age-specific approaches to tackle IPV effectively, considering the distinct vulnerabilities and needs of women within different stages of their lives. Future research and policy efforts should focus on refining and tailoring interventions to offer targeted support to women across various age brackets.

Appendix

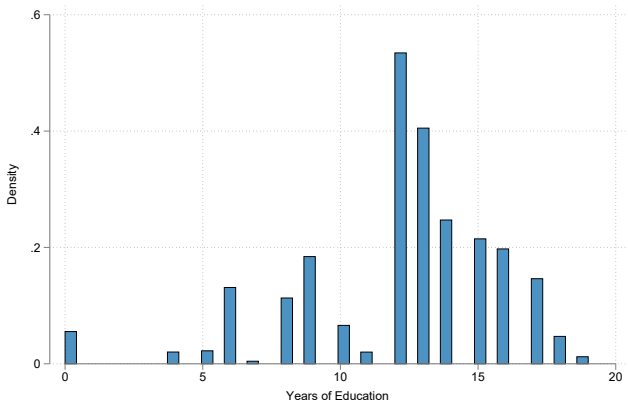
Table 4.1: Age Distribution

Age	Number of women	Percentage of women
18-24	3,775	9.01
25-29	3,052	7.28
30-34	3,532	8.43
35-39	3,951	9.43
40-49	8,269	19.74
50-59	8,299	19.81
60+	11,017	26.3
Total	41,895	100

Table 4.2: Age Distribution (Restricted Sample)

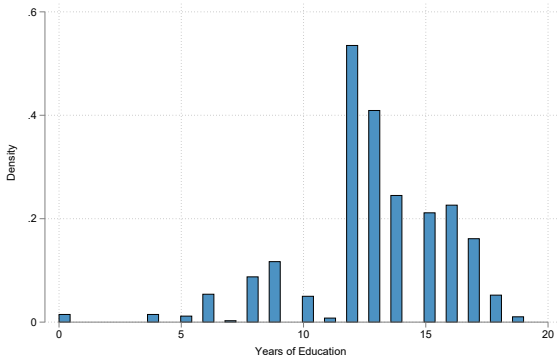
Age	Number of women	Percentage of women
18-24	3,775	18.17
25-29	3,052	14.69
30-34	3,314	15.95
35-39	3,575	17.21
40-49	7,057	33.97
Total	20,773	100

Figure 4.1: Distribution of Years of Education (Full Sample).



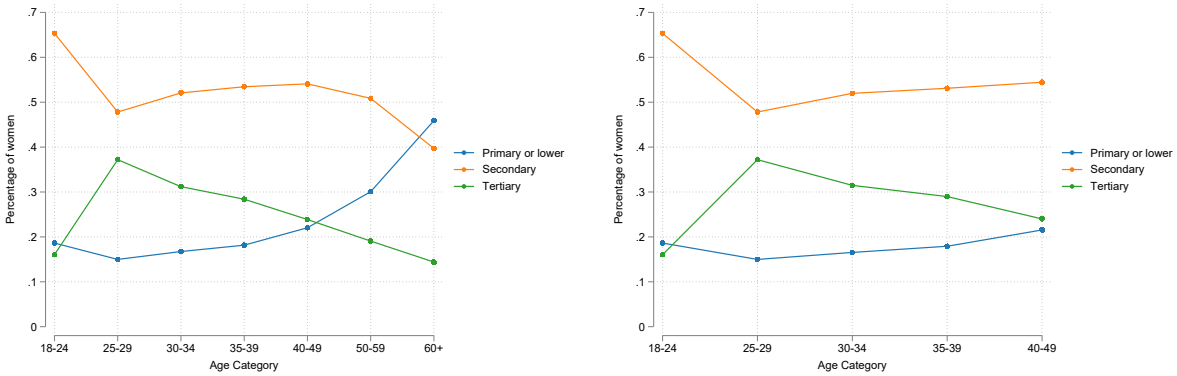
Full Sample

Figure 4.2: Distribution of Years of Education (Restricted Sample).



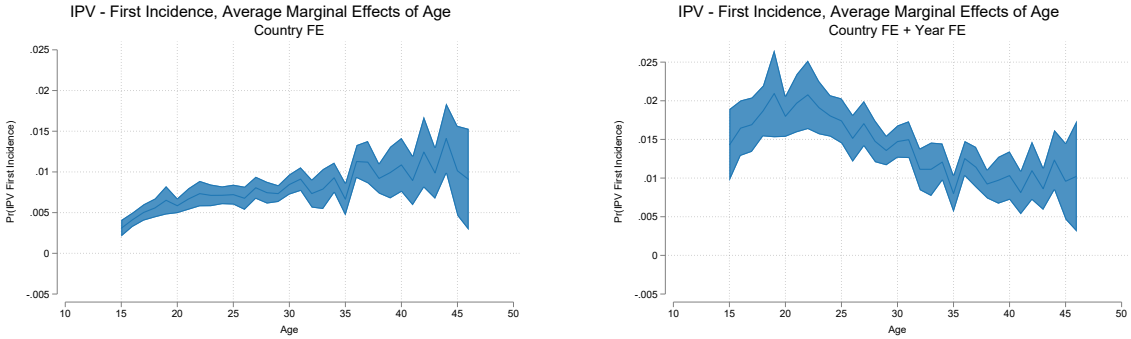
Restricted Sample

Figure 4.3: Share of women with different levels of education in each age category.



Full Sample Restricted Sample

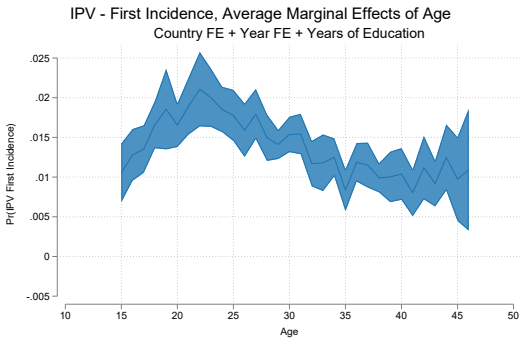
Figure 4.4: Expected Probability of experiencing IPV for the first time at every age.



Country FE Country FE, and year FE

Based on estimates of logistic regressions

Figure 4.5: Expected Probability of experiencing IPV for the first time at every age.



Country & year FE, and education

Based on estimates of logistic regressions.

Table 4.3: OLS Results (Age of First Incidence of IPV and Years of Education)

	(1) IPV	(2) IPV	(3) IPV
Age 15	0.00310***	0.00819***	0.01339***
	(0.00054)	(0.00074)	(0.00117)
Age 16	0.00473***	0.00923***	0.01477***
	(0.00058)	(0.00079)	(0.00117)
Age 17	0.00533***	0.00912***	0.01519***
	(0.00044)	(0.00056)	(0.00115)
Age 18	0.00636***	0.00998***	0.01644***
	(0.00074)	(0.00094)	(0.00140)
Age 19	0.00528***	0.00870***	0.01542***
	(0.00083)	(0.00096)	(0.00146)
Age 20	0.00579***	0.00896***	0.01581***
	(0.00042)	(0.00056)	(0.00129)
Age 21	0.00663***	0.00950***	0.01671***
	(0.00046)	(0.00059)	(0.00125)
Age 22	0.00620***	0.00872***	0.01623***
	(0.00051)	(0.00059)	(0.00133)
Age 23	0.00722***	0.00940***	0.01685***
	(0.00074)	(0.00077)	(0.00143)
Age 24	0.00776***	0.00955***	0.01720***
	(0.00082)	(0.00085)	(0.00182)
Age 25	0.00768***	0.00907***	0.01695***
	(0.00062)	(0.00060)	(0.00125)
Age 26	0.00794***	0.00886***	0.01651***
	(0.00061)	(0.00061)	(0.00136)
Age 27	0.00678***	0.00721***	0.01509***
	(0.00066)	(0.00062)	(0.00146)
Age 28	0.00707***	0.00691***	0.01471***
	(0.00079)	(0.00082)	(0.00153)
Age 29	0.00916***	0.00839***	0.01634***
	(0.00081)	(0.00086)	(0.00166)
Age 30	0.00821***	0.00679***	0.01459***
	(0.00073)	(0.00073)	(0.00139)
Age 31	0.00735***	0.00527***	0.01301***
	(0.00077)	(0.00080)	(0.00171)
Country FE	Yes	Yes	Yes
Year FE	No	Yes	Yes
Years of Education	No	No	Yes
N	361,589	361,589	345,378

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.4: OLS Results (Age of First Incidence of IPV and Years of Education)

	(1) IPV	(2) IPV	(3) IPV
Age 32	0.00816***	0.00531***	0.01307***
	(0.00091)	(0.00104)	(0.00180)
Age 33	0.00730***	0.00366***	0.01132***
	(0.00081)	(0.00085)	(0.00127)
Age 34	0.00748***	0.00283***	0.01057***
	(0.00065)	(0.00089)	(0.00146)
Age 35	0.00903***	0.00341***	0.01105***
	(0.00097)	(0.00117)	(0.00138)
Age 36	0.00969***	0.00292*	0.01080***
	(0.00124)	(0.00146)	(0.00184)
Age 37	0.01087***	0.00299*	0.01089***
	(0.00136)	(0.00158)	(0.00233)
Age 38	0.01187***	0.00361**	0.01150***
	(0.00106)	(0.00131)	(0.00148)
Age 39	0.00960***	0.00109	0.00918***
	(0.00134)	(0.00139)	(0.00193)
Age 40	0.01083***	0.00205	0.01013***
	(0.00165)	(0.00186)	(0.00214)
Age 41	0.00984***	0.00043	0.00777***
	(0.00156)	(0.00193)	(0.00206)
Age 42	0.01150***	0.00164	0.00989***
	(0.00164)	(0.00186)	(0.00231)
Age 43	0.00966***	-0.00028	0.00790***
	(0.00170)	(0.00201)	(0.00249)
Age 44	0.01010***	0.00017	0.00790**
	(0.00263)	(0.00274)	(0.00309)
Age 45	0.01251***	0.00387	0.01100***
	(0.00255)	(0.00286)	(0.00313)
Age 46	0.00958***	0.00302	0.01105***
	(0.00282)	(0.00268)	(0.00306)
Age 47	0.00008	0.00477***	0.01255***
	(0.00043)	(0.00056)	(0.00143)
Country FE	Yes	Yes	Yes
Year FE	No	Yes	Yes
Years of Education	No	No	Yes
N	361,589	361,589	345,378

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.5: Odds Ratio (Age of First Incidence of IPV and Years of Education)

	(1) IPV	(2) IPV	(3) IPV
Age 15	1	1	1
	(.)	(.)	(.)
Age 16	1.226	1.059	1.107
	(0.208)	(0.181)	(0.196)
Age 17	1.840***	1.352	1.582**
	(0.288)	(0.214)	(0.258)
Age 18	1.756***	1.264	1.502*
	(0.278)	(0.202)	(0.249)
Age 19	1.645**	1.133	1.295
	(0.265)	(0.184)	(0.223)
Age 20	1.870***	1.229	1.524*
	(0.296)	(0.196)	(0.256)
Age 21	2.201***	1.384*	1.863***
	(0.340)	(0.216)	(0.304)
Age 22	1.819***	1.086	1.443*
	(0.293)	(0.176)	(0.247)
Age 23	2.536***	1.453*	1.961***
	(0.388)	(0.224)	(0.320)
Age 24	2.265***	1.229	1.698**
	(0.355)	(0.195)	(0.284)
Age 25	2.069***	1.056	1.470*
	(0.333)	(0.171)	(0.251)
Age 26	2.222***	1.061	1.460*
	(0.355)	(0.171)	(0.248)
Age 27	2.202***	0.980	1.356
	(0.355)	(0.160)	(0.232)
Age 28	2.278***	0.952	1.351
	(0.368)	(0.155)	(0.231)
Age 29	2.516***	0.991	1.422*
	(0.403)	(0.160)	(0.241)
Age 30	2.498***	0.927	1.280
	(0.405)	(0.152)	(0.220)
Age 31	2.455***	0.844	1.183
	(0.404)	(0.140)	(0.206)
Country FE	Yes	Yes	Yes
Year FE	No	Yes	Yes
Years of Education	No	No	Yes
N	358,945	358,945	342,860

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.6: Odds Ratio (Age of First Incidence of IPV and Years of Education)

	(1) IPV	(2) IPV	(3) IPV
Age 32	2.980***	0.950	1.338
	(0.477)	(0.154)	(0.227)
Age 33	2.428***	0.722	0.975
	(0.411)	(0.123)	(0.175)
Age 34	2.839***	0.770	1.054
	(0.472)	(0.129)	(0.185)
Age 35	3.009***	0.772	1.031
	(0.501)	(0.130)	(0.183)
Age 36	3.059***	0.710*	0.978
	(0.518)	(0.121)	(0.175)
Age 37	2.270***	0.495***	0.664*
	(0.423)	(0.0928)	(0.131)
Age 38	3.182***	0.679*	0.950
	(0.558)	(0.120)	(0.175)
Age 39	4.005***	0.831	1.142
	(0.685)	(0.144)	(0.206)
Age 40	3.023***	0.607**	0.868
	(0.572)	(0.116)	(0.171)
Age 41	3.124***	0.624*	0.853
	(0.609)	(0.123)	(0.175)
Age 42	3.714***	0.697	0.983
	(0.725)	(0.138)	(0.201)
Age 43	3.388***	0.656	0.924
	(0.720)	(0.142)	(0.205)
Age 44	4.343***	0.840	1.182
	(0.924)	(0.182)	(0.265)
Age 45	3.661***	0.755	1.032
	(0.919)	(0.194)	(0.273)
Age 46	3.717***	0.962	1.298
	(1.088)	(0.289)	(0.406)
Country FE	Yes	Yes	Yes
Year FE	No	Yes	Yes
Years of Education	No	No	Yes
N	358,945	358,945	342,860

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.7: Country Level Highest Hazard of IPV.

Country	Age	Highest Hazard
Cyprus	21	0.0066603
Slovenia	21	0.0069186
Spain	21	0.0070364
Poland	21	0.0072107
Croatia	21	0.0082248
Austria	21	0.0083112
Portugal	21	0.0089278
Italy	21	0.0091183
Ireland	21	0.0093216
Romania	21	0.0106465
Greece	21	0.010846
Germany	21	0.0108814
Lithuania	21	0.0109254
Malta	21	0.0110632
Estonia	21	0.0115012
Czech Republic	21	0.0118475
Netherlands	21	0.0120587
France	21	0.0120839
Luxembourg	21	0.0123427
Slovakia	21	0.012415
Belgium	21	0.0124541
Bulgaria	21	0.0126352
Hungary	21	0.0136472
Sweden	21	0.0138321
Finland	21	0.0159207
Latvia	21	0.0168694
Denmark	47	0.0186538

OLS estimates of equation 4.1 from table 4.3 & 4.4 are used in calculating hazard ratios at different ages for each country.

Table 4.8: Policy Implementation.

Country	Year (Law)	Year (Hotline)
Austria	1997	1998
Belgium	1999	2012
Bulgaria	2005	2017
Croatia	2008	Not Introduced
Cyprus	1994	2002
Czech Republic	2004	*na*
Denmark	2004	2002
Estonia	2006	2008
Finland	2005	2016
France	2004	2011
Germany	2009	2009
Greece	2006	Not Introduced
Hungary	Not Introduced	2018
Ireland	1996	*na*
Italy	2001	2006
Latvia	Not Introduced	2005
Lithuania	Not Introduced	2004
Luxembourg	2003	1992
Malta	Not Introduced	*na*
Netherlands	1991	2014
Poland	2005	2005
Portugal	1999	Not Introduced
Romania	2000	Not Introduced
Sweden	Not Introduced	2007
Slovenia	1999	2011
Slovakia	Not Introduced	2015
Spain	2003	2000
UK	1999	2010

Laws against IPV and introduction of hotline for victims/survivors of IPV until year 2011.

Table 4.9: OLS estimates.

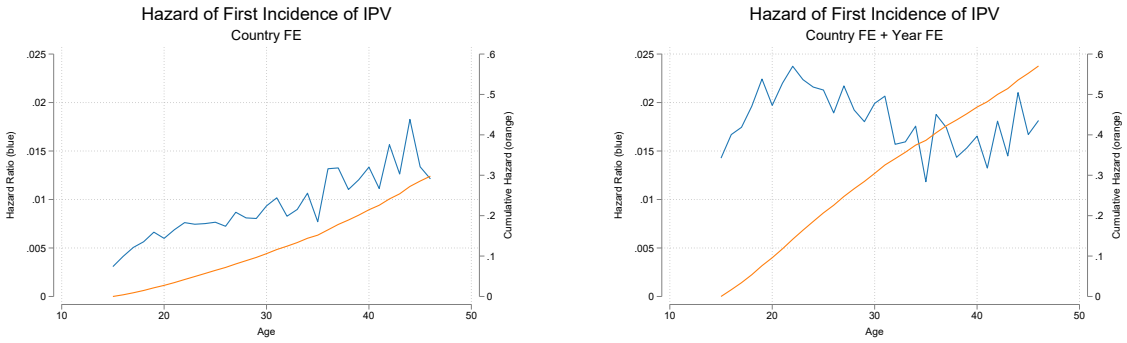
	(1) IPV	(2) IPV	(3) IPV	(4) IPV	(5) IPV
Law (η_0)	-0.00130	-0.000114			0.00000156
	(0.00103)	(0.00118)			(0.00117)
Age_{30to40} (β_1)		-0.00243**		-0.00367***	-0.00246**
		(0.000758)		(0.000711)	(0.000693)
$Age_{Above40}$ (β_2)		-0.00428		-0.00564*	-0.00306
		(0.00259)		(0.00206)	(0.00279)
Law*Age_{30to40} (η_1)		-0.00282			-0.00285
		(0.00152)			(0.00161)
Law*$Age_{Above40}$ (η_2)		-0.00378			-0.00395
		(0.00287)			(0.00279)
Hotline (ζ_0)			-0.00126	-0.000932	-0.000920
			(0.00150)	(0.00210)	(0.00219)
Hotline*Age_{30to40} (ζ_1)				-0.000262	0.000121
				(0.00184)	(0.00205)
Hotline*$Age_{Above40}$ (ζ_2)				-0.00226	-0.00232
				(0.00285)	(0.00290)
Constant (β_0)	0.0127***	0.0147***	0.0125***	0.0146***	0.0148***
	(0.00115)	(0.00128)	(0.000967)	(0.00110)	(0.00127)
N	345756	345756	345756	345756	345756

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

OLS estimates of equation 28.
Data on the existence of *Hotlines* are not available for Czech Republic, Ireland and Malta. Observations from these countries are dropped when *Hotline* is included in the regression.

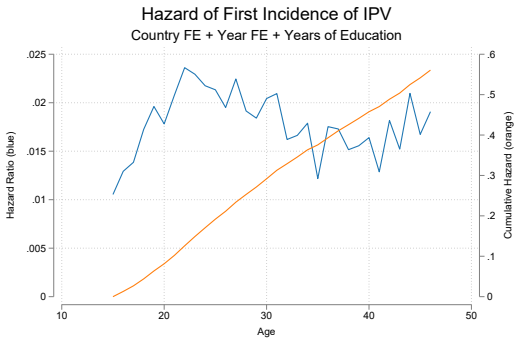
Figure 4.6: Hazard of experiencing IPV for the first time at every age



Years of Education | Years of Education and Year FE

Based on estimates of logistic regressions.

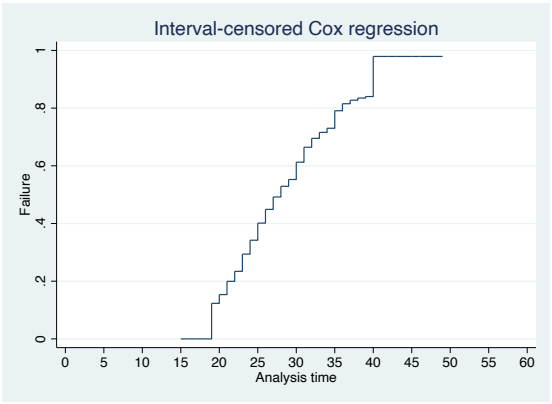
Figure 4.7: Hazard of experiencing IPV for the first time at every age.



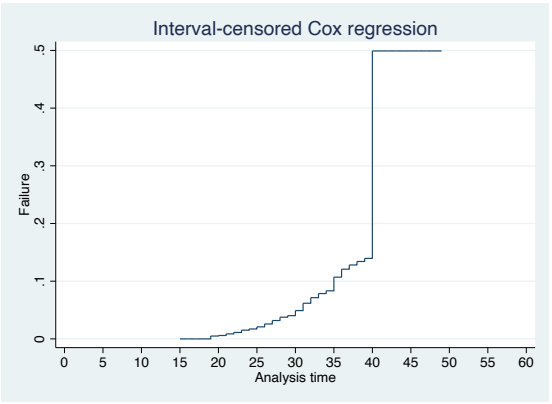
Years of Education, Year FE, and Country FE

Based on estimates of logistic regressions.

Figure 4.8: Probability of experiencing IPV for the first time at every age (from conditional Cox proportional hazards model)

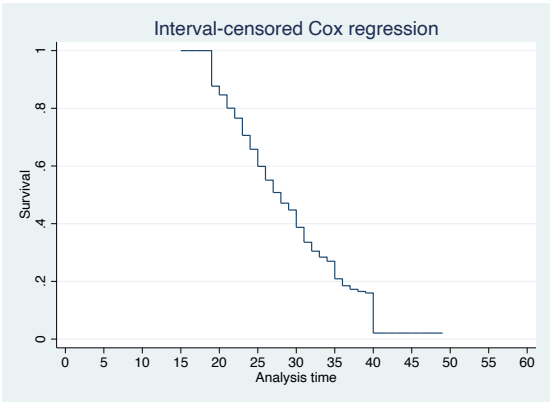


No year fixed effect.

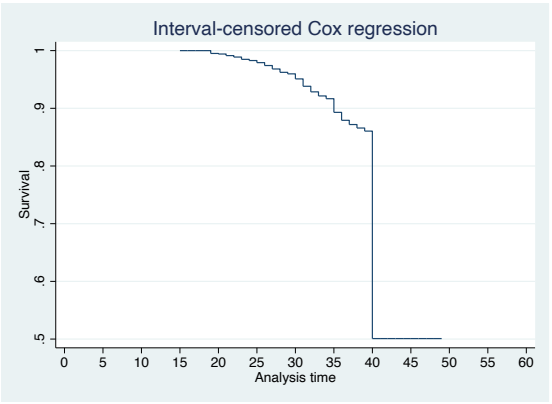


Year fixed effect included.

Figure 4.9: Probability of not experiencing IPV for the first time at every age (from conditional Cox proportional hazards model)

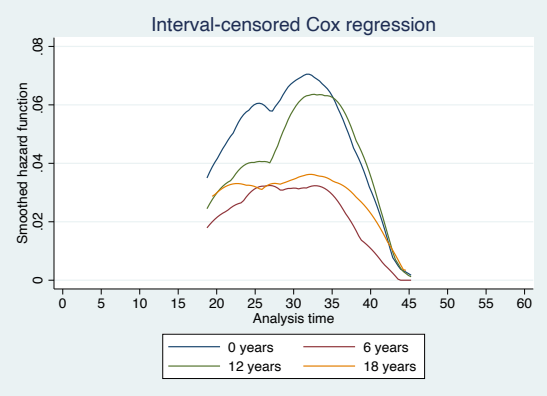


No year fixed effect.

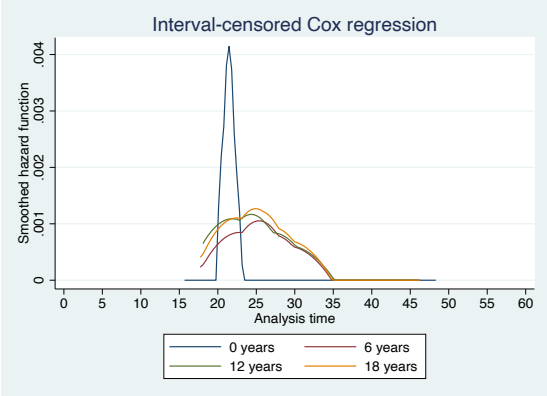


Year fixed effect included.

Figure 4.10: Hazard of experiencing IPV for the first time at every age for different years of education (from conditional Cox proportional hazards model)

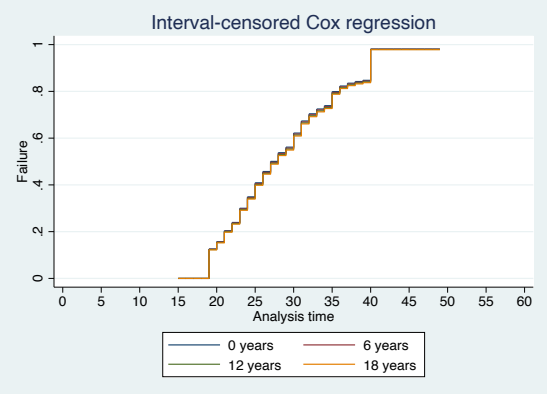


No year fixed effect.

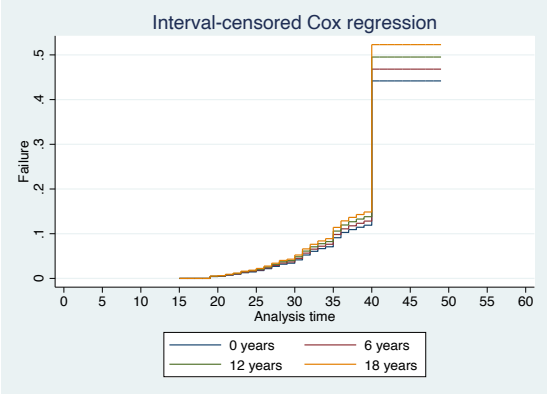


Year fixed effect included.

Figure 4.11: Probability of experiencing IPV for the first time at every age for different years of education (from conditional Cox proportional hazards model)



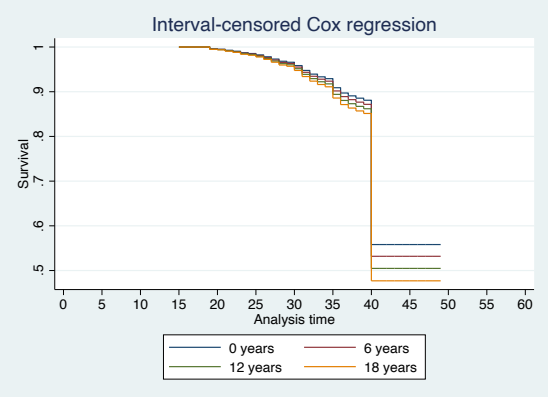
No year fixed effect.



Year fixed effect included.

Figure 4.12: Probability of not experiencing IPV for the first time at every age for different years of education (from conditional Cox proportional hazards model)

No year fixed effect.



Year fixed effect included.

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