Why don't married men take parental leave?

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October 2017†

Job Market Paper

Abstract

Despite its availability, only a few married men use parental leave in Canada while almost all eligible married women take parental leave. As possible explanations, I consider gender differences in rental rates of human capital, wage growth processes, wage penalties for time off from work, preferences for leisure, and productivity in home production. I first document empirically supporting evidence for the possible explanations. Next, to quantify the relative importance of these explanations, I develop a life-cycle model of family labour supply that features learning-by-doing human capital accumulation and time allocations across market work, leisure, and home production. The model is calibrated using Canadian data. The results imply that lower home productivity in the presence of an infant, higher rental rates of human capital, and higher wage penalties for not working for fathers are the main contributors to the low take-up of fathers. Among high-educated people, these three explanations account for 36%, 15%, and 13% of the gender gap in the take-up rates of parental leave, respectively, and for all the gender gap in the take-up rates in combination. I show that fathers' take-up rates are responsive to an increase in the income replacement rate combined with the introduction of paternity leave. Lastly, I find that for Canada a combination of introducing paternity leave and increasing replacement rates during maternity and paternity leaves relative to the current policy increases fathers' take-up rates for parental leave with only a small increase in aggregate spending on parental leave benefits.

*I am very grateful to Audra Bowlus and Betsy Caucutt for invaluable guidance and support. I also thank Jacob Short for helpful comments. Facilities provided at the Statistic Canada Research Data Centre at the University of Western Ontario and Computational resources from the Shared Hierarchical Academic Research Computing Network (SHARCNET) are also greatly appreciated. All errors are my own. E-mail: ychoi254@uwo.ca.

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1 Introduction

Paid parental leave, including maternity and paternity leave, is a family policy that helps working parents care for a newborn or newly adopted child by guaranteeing their return to the pre-birth job and providing financial support. In Canada, outside of Québec, paid parental leave is available to employed parents through the federal program Employment Insurance (EI). In addition to 17 weeks of maternity leave only for mothers who gave birth, 35 weeks of paid parental leave can be shared between a mother and a father as long as eligibility criteria are met. The intended purpose of shareable parental leave is to help working parents spend more time with their children for successful child development (Speech from the Throne, 1999; Cools, Fiva, and Kirkebøen, 2015) and to provide fathers the option to share more of the responsibilities of caring for babies (Human Resources and Skills Development Canada, 2005). Also, it may lead to more involvement of fathers in the future (Kotsadam and Finseraas, 2011).

The take-up of parental leave by fathers has two potential benefits. First, a father's take-up has positive effects on child development by allowing the child to spend extensive time with the father (Addati, Cassirer, and Gilchrist, 2014). The second benefit of a father taking up parental leave is to improve his wife's position in her career. While a father on leave looks after his child at home, his wife may return to work earlier and reduce the duration of her career interruption (Pylkkänen and Smith, 2003).[1]

Despite its positive effects on child development and career development of married women, many married couples choose to only have the wife take up the parental leave. In Canada excluding Québec, the take-up rate of eligible married fathers remains low at 13%, whereas that of eligible married mothers is 91% [Employment Insurance Coverage Survey (EICS), 2004-2011].[2] In Québec, which has provided five weeks of paternity leave to fathers since 2006, 84% of married fathers used paternity and/or parental leave in 2011 (Moss, 2015). In this paper, I examine why many fathers do not use paid parental leave in the rest of Canada.

Most research about parental leave focuses on leaves specific either to a mother or a father. One strand of research studies the effects of mothers' use of parental leave, including maternity leave, on child outcomes, mothers' labour market outcomes, and social welfare.[3] These studies abstract from fathers' use of parental leave. Recently, others have focused on the effects of the introduction of paternity leave (Dahl, Løken, and Mogstad, 2014; Ekberg, Eriksson, and Friebel, 2013; Rege and Solli, 2013; Patnaik, 2015). Ekerberg et al.(2013) and Patnaik (2015) investigate empirically the effects of the introduction of paternity leave on the intra-household division of labour in the short run in Sweden and Québec, respectively. I add to this literature by taking into account parental

[1] A mother and father cannot receive parental benefits under EI at the same time. However, it is possible that a mother is on maternity leave receiving EI maternity benefits and at the same time a father is on parental leave receiving EI parental benefits. In this case, when a mother uses up 17 weeks of maternity leave, a couple may choose for the husband to return to work, while the wife takes parental leave. Alternatively, a couple may choose for the wife to return to work while the husband continues on parental leave.

[2] For women, parental leave includes maternity leave.

[3] Ruhm (1998); Baker and Milligan (2008); Lalive and Zweimüller (2009); Schönberg and Ludsteck (2014); Erosa, Fuster, and Restuccia (2010); Lalive et al. (2014); Carneiro, Løken, and Salvanes (2015); Thomas (2015)

leave that is not specific to mothers nor fathers and studying how a husband and wife divide parental leave. My study helps to understand why shareable parental leave has not been effective in raising fathers' participation in parental leave.

Some studies suggest reasons for a gender difference in the take-up behaviour of parental leave. Using the General Social Survey in Canada, Beaupré and Cloutier (2007) document that financial reasons and working conditions are important factors affecting parents' take-up decisions. Using the Employment Insurance Coverage Survey in Canada, Marshall (2008) finds that fathers are more likely to use parental leave if their wives have the same or higher earnings and if their wives do not claim parental leave. Using data from Sweden, Albrecht, Edin, Sundstrom, and Vroman (1999) find that the negative effect of career interruptions due to parental leave on subsequent wages is four times greater for men than for women. To date, the literature has not yet quantified the role of multiple factors in married couples' take-up decisions within a unified life-cycle framework.

As possible explanations for the division of paid parental leave within married couples, I consider gender differences in wages upon entry into the labour market, wage growth processes, wage penalties for time off from work, preferences for leisure, and relative productivities in home production. The labour market and home productivities determine whether the husband or wife has a comparative advantage in either market or non-market activities as in a Beckerian model of the allocation of time (Becker, 1965, 1981). I provide empirical evidence for these possible reasons and disentangle the role of these factors in a life-cycle model of family labour supply.

My model has two key features. First, a husband and wife jointly allocate their time across labour supply, leisure, and home production. As in Knowles (2013), I consider joint labour supply with home production and exploit time allocations for the calibration. Whereas Knowles focuses on the importance of intra-household bargaining in marriage-divorce decisions, I let married couples have unitary utility and a life-long marriage. The second key feature is that human capital stochastically evolves via a learning-by-doing process. Hours of work in the market in a period determine current earnings and the evolution of human capital. As in Guner, Kaygusuz, and Ventura (2014), a husband and wife jointly decide their labour supply at the extensive and intensive margins, and the wife's labour market productivity endogenously evolves. My model is distinguished from Guner et al.(2014) in that a husband's labour productivity endogenously evolves as well.[4] When a child is born, a married couple makes decisions taking into account the gender differences I consider.

I calibrate the model with Canadian data by minimizing the distance between simulated and data moments. The baseline parental leave policy in the model mimics Canadian parental leave policy at the federal level under EI. Targeted moments include the moments associated with the take-up of parental leave, average hourly wage levels and growth, time allocations, and labour market transitions by gender and education. The model implies that compared to mothers, fathers have lower home productivity in the presence of an infant, higher rental rates of human capital,

[4]In their model, a couple accumulates financial assets instead of husband's human capital.

and higher wage penalties for not working.

I quantify the relative importance of the different factors for the low take-up rates of married fathers, using the calibrated model. I calculate the changes in take-up rates from the benchmark to the symmetry economy, where all gender differences are removed, and decompose the changes into the possible explanations. In particular, I let men and women have same parameter values for the explanation under consideration and leave the other parameters the same as in the benchmark. I then simulate the take-up behaviour of married couples and calculate the percentage of the changes that are narrowed for each explanation. I find that the gender differences in home productivity, rental rates of human capital, and wage penalties for not working are three major contributors to the low take-up of fathers. Among high-educated people, the three gender differences account for 36%, 15%, and 13% of the gender gap in the take-up rates of parental leave, respectively. Due to positive interactions among the three explanations, they explain all the gender difference in the take-up rates among high-educated parents.

Next, I examine the role of gender differences in paid parental leave policies and the role of cash benefits in married couples' decisions regarding parental leave. The baseline policy embodies a gender difference in maximum lengths of parental leave available to a mother and a father due to lack of paternity leave. I find that introducing paternity leave without an increase in cash benefits leads to only small changes in fathers' take-up of parental leave. I show that fathers' take-up rates are responsive to an increase in an income replacement rate combined with the introduction of paternity leave. In a set of policy experiments, I explore various parental leave policies that aim to increase high-educated fathers' take-up rates. I consider policies that keep the total number of weeks of leave available to a couple the same as the baseline policy. I find that, among these policies, a combination of introducing paternity leave and providing higher replacement rates during maternity and paternity leaves compared to the baseline policy increases fathers' take-up rates with a small increase in aggregate spending on parental leave benefits.

This paper is organized as follows. In Section 2, I briefly present empirical background about Canadian parental leave policy and supporting evidence for the possible explanations I consider for the low take-up rates of fathers. In Section 3 and 4, I present my framework for quantitative analyses and calibration results, respectively. Using the calibrated model, I carry out a decomposition analysis and policy experiments in Sections 5 and 6, respectively. In Section 7, I present conclusions including policy implications of the main findings.

2 Empirical Background

This study uses paid parental leave policy in Canada at the federal level under EI as a baseline policy. This section briefly documents the background information for the Canadian parental leave policy and patterns of married couples' take-up behaviour. The remaining part of this section provides empirical evidence for the possible explanations I consider for these patterns.

2.1 Canadian parental leave policy under Employment Insurance

Currently, parental leave benefits in most of Canada are paid under Employment Insurance (EI), a public insurance system at the federal level. The exception is Québec. In 2006, Québec developed its own public insurance system for parental leave, called Québec Parental Insurance Plan (QPIP). The rules under QPIP are different from the rest of Canada under EI.[5] This study focuses only on the federal parental leave policy under EI from 2001 until 2016.

In 1971, Canada's then policy allowed for fifteen weeks of maternity benefits. Maternity benefits could be used only by birth mothers under Unemployment Insurance, the public insurance system at the federal level preceding EI. In 1990, ten weeks of parental leave that could be shared by parents were added to fifteen-week-long maternity leave. A mother could use maternity and parental leave for at most six months including a two week waiting period.[6] A father could use at most ten weeks of parental leave at the expense of his wife's portion of parental leave. To help parents spend more time with their newborn children, in 2001, Canada extended statutory parental leave from 10 to 35 weeks. Overall, parents to a newborn child can spend up to a combined total of 52 weeks off work while receiving financial support. Since 2001, the maximum lengths of maternity and parental leave remained the same until just recently when the maximum time was extended to 18 months with a lower rate of income replacement.

In Canada, the maximum duration of job protection is the same as the maximum duration of parental benefit payments.[7] The federal Canadian Labour Code guarantees an employee the right to be reinstated in a position the same as or comparable to the pre-birth position when the employee returns to work after parental leave (section 209.1). The Canadian Labour Code provides employees 17 weeks of maternity leave and 35 weeks of parental leave.[8] EI pays at most 15 weeks of maternity benefits and 35 weeks of parental benefits after a two week waiting period.[9]

During parental leave, a worker who is eligible for parental benefits under EI receives cash benefits. Parental benefits under EI are funded by employer's and employee's EI premiums as with regular unemployment benefits. The average EI premium rate between 2001 and 2010 was 1.93% per $100 of earnings.[10] To be eligible for parental benefits under EI, a worker must have paid

[5] A key feature of QPIP is five weeks of paternity leave that is reserved for fathers. Compared to EI, QPIP has higher cash benefits with a higher replacement rate of 70% and a higher benefits cap. The maximum insurable income is $57,000 instead of $39,000.

[6] EI has a two week waiting period before a claimant can start receiving the benefits. This waiting period plays the role of an insurance deductible.

[7] Schönberg and Ludsteck (2014) study reforms in German parental leave policy that changed the duration of job protection and the duration of benefit payments. Their study highlights the relative importance of job protection and benefit payments in mothers' labour market outcomes.

[8] Most workers in Canada get job-protected unpaid leave under provincial and territorial Employment Standards. However, the provincial jurisdictions are fairly similar across jurisdictions because they followed the Canadian Labour Code (Pulkingham and Van der Gaag 2004). The 17 weeks of job-protection for birth mothers is called "pregnancy leave" in Ontario and "maternity leave" in other jurisdictions and at the federal level. In this paper, I use "maternity leave" to indicate the non-transferable leave for birth mothers following the federal EI.

[9] In the model, for simplicity, I ignore the waiting period and assume that the maximum duration of maternity benefits is 17 weeks.

[10] Employer's premiums are 1.4 times the amount of the employee's premiums. EI premium rates were 2.25% and 1.17% per $100 of earnings in 2001 and 2010, respectively.

employment insurance premiums and have accumulated at least 600 hours of insurable employment during the 52-week period immediately before the start date of parental leave. The basic income replacement is 55% of a recipient's average insurable weekly earnings, up to a maximum amount.[11] The maximum amount of benefits was at $413 Canadian dollars between 2001 and 2006. That is, the maximum insurable earnings amount was $39,000 a year. The maximum amount was adjusted up in 2010 to $43,200. In 2002 dollar, the average maximum amount of benefits between 2001 and 2010 was $391 per week. Before 2011, only paid employees were covered by EI.[12]

2.2 Take-up of parental leave in Canada

To document patterns of take-up behaviour among married parents, I use the Employment Insurance Coverage Survey (EICS). It is an annual cross-sectional survey that studies the coverage of the EI program in Canada. To examine the coverage of maternity and parental benefits, the survey includes a subsample of mothers of infants less than one year old as a part of its target population. These mothers are either working, unemployed, not in the labour force, or on leave. This survey collects information about whether the mothers received maternity and parental benefits and whether their spouses claimed or intended to claim parental benefits. I use the surveys collected between 2004 and 2011, because the number of weeks of parental benefits claimed by fathers started being collected in 2004.

I restrict the sample of interest to 23- to 42-year-old mothers who have an infant less than one year old and live with their spouse. I exclude mothers living in Québec between 2006 and 2011 because different rules applied to them under QPIP. I also exclude mothers who are students. I do not include male respondents who answer that they were receiving parental benefits under EI because of the small sample size. I apply the weights provided in the survey data. These sample restrictions result in 6,326 mothers. This sample is about 81% of the mother respondents living in Canada outside Quebec under EICS. Among the mothers in the sample, 67% were eligible for EI and 85% had a husband who was eligible for EI.[13][14]

Table 1 shows take-up rates and average durations by sex and educational attainment. It displays a stark difference in take-up rates between married fathers and mothers. Whereas 91% of the eligible mothers received maternity and/or parental benefits, only 13% of the eligible mothers

[11] For more details, see Service Canada: `http://www.esdc.gc.ca/en/reports/ei/maternity_parental.page`

[12] From 2011, self-employed people can access EI special benefits, which include maternity and parental benefits, by opting in the EI program and paying EI premium voluntarily.

[13] EICS asks eligibility status to the mothers who are not working at the time of the survey. Because the eligibility status of working mothers is not collected, we cannot distinguish working mothers who did not use parental leave because of ineligibility from those who choose not to take up or who have returned from leave. I assume all these working mothers in the data were eligible. Therefore, the universe of "eligible" mothers includes all mothers, including all mothers currently working, except the non-working mothers who did not use parental leave because they were ineligible. Thus, the eligibility rate of mothers may be overstated, and mothers' take-up rates reported in this document may be understated.

[14] Because EICS does not directly ask mothers about their spouse's eligibility for EI, the universe of "eligible" fathers includes all fathers, including the fathers who used or planned to use parental leave, except the fathers whose wives answered that their husbands did not use parental leave because they were ineligible.

Table 1: Take-up Rates and Average Durations by Individual Educational Level

	Fathers			Mothers		
	All	Low	High	All	Low	High
Take-up rate (%)	13.1	11.8	13.6	90.8	90.6	90.6
Average duration (weeks)	14.1	14.9	13.9	46.3	46.6	46.2

Data source: Employment Insurance Coverage Survey (2004-2011). The sample of interest is restricted to 23- to 42-year-old mothers who have an infant less than one year old and live with their spouse. "High" denotes the high-educated who are college graduates. "Low" denotes a lower education level.

Table 2: Take-up Rates by Household Educational Type

	(Husband's education, Wife's education)			
	(Low , Low)	(Low , High)	(High, Low)	(High, High)
Fathers	11.2	12.3	10.2	14.2
Mothers	89.6	91.2	91.8	90.7

Source: Employment Insurance Coverage Survey, 2004-2011

answered that their husband had used or planned to use paid parental leave. A similar pattern emerges in durations of parental leave; the average duration of fathers' parental leave conditional on take-up is 14 weeks, whereas the average duration of mothers' parental leave including maternity leave is 46 weeks or 11 months.[15]

The statistics do not vary much by educational attainment. Throughout this paper, educational attainment is grouped into two levels. The low-educated, denoted by "Low" or "lo", are some college, high school graduates, and those who have less than twelve years of schooling. High-educated people, denoted by "High" or "hi", are college graduates. Among married mothers, there is almost no variation by education. Among married fathers, there is a small variation by educational attainment. The variation in married fathers' take-up rates by the wife's education is clearer when I condition on husbands' own education. In particular, among high-educated fathers, their take-up rate increase with their wife's education. Among high-educated fathers, their take-up rate is 10% for those with a low-educated wife and 14% for those with a high-educated wife.

These gender differences in the take-up behaviour among married couples are not unique to Canada. When a couple is offered a shareable parental leave, the take-up rate of fathers was low in Nordic countries and Germany as well (European Commission, 2005). Therefore, lessons to be learned from this study are not likely limited to Canada.

[15]EICS have two variables for the duration of leave. One variable is the duration of leave they have used as of the reference week (BENWEEK). The other variable is the length of all leave before they returned or expect to return (ALLEAVE). Because the first variable is right-censored, I use the second variable. An issue with the second variable is that this duration includes not only pregnancy and parental leave but also other types of leave such as sick leave. Thus, some recorded answers are longer than the maximum length of 52 weeks. Calculating average duration conditional on taking up parental leave, I replace the values greater than 12 months with 12 months. I also apply 12 months to those who answered that they do not plan to return.

2.3 Empirical evidence for explanatory factors

As possible explanations for the gender gap in take-up rates of parental leave, I consider gender differences in wages upon entry into the labour market, wage growth processes, wage penalties for time off from work, preferences for leisure, and relative productivities in home production. Before exploring the role of these explanations in a life-cycle framework, I provide empirical evidence for these explanations in Canada.

A. Time allocations between market and home work

The purpose of parental leave is to help parents take time off work and spend their time at home with their newborn child. I conjecture that the division of parental leave is closely related to the allocation of time within married households. Therefore, patterns of married people's time allocations are informative. I document patterns of married people's time allocations across market work, home work, and leisure in Canada, using two cycles of the General Social Survey (GSS) collected in 2005 and 2010 on the subject of time use.[16] Individuals record a retrospective 24-hour time diary during a day of the week. Recorded activities include detailed items related to paid work, unpaid work, recreation, personal care, and so on. Also, the survey collects respondents' demographic and household characteristics, such as age, marital status, the number of children, and the age of the youngest household member.

The sample of interest is restricted to married people aged between 25 and 64.[17] People who live in Québec and whose youngest child is born in 2006 or afterwards are excluded from the sample. The sample is grouped into three categories by the characteristics of their children: those without any children, those with an infant less than two years old, and those with only older children.[18]

I characterize three major uses of time: market work, home production, and leisure. My definition of market work is comparable to the category of core market work in Aguiar and Hurst (2007). This category includes all time spent working in the market sector on main jobs, second jobs, and overtime, but it excludes commuting time. Home production includes activities such as housework, maintenance, and childcare. Leisure is defined as time endowment remaining after subtracting the time spent on market and home production. The time endowment is discretionary time that excludes time dedicated to sleeping and other necessary personal care. I assume that a person spends 8 hours per day on necessary personal care and sleeping. Thus, the time endowment is equivalent to 16 hours per day, 112 hours per week, or 5,840 hours per year in calendar time.

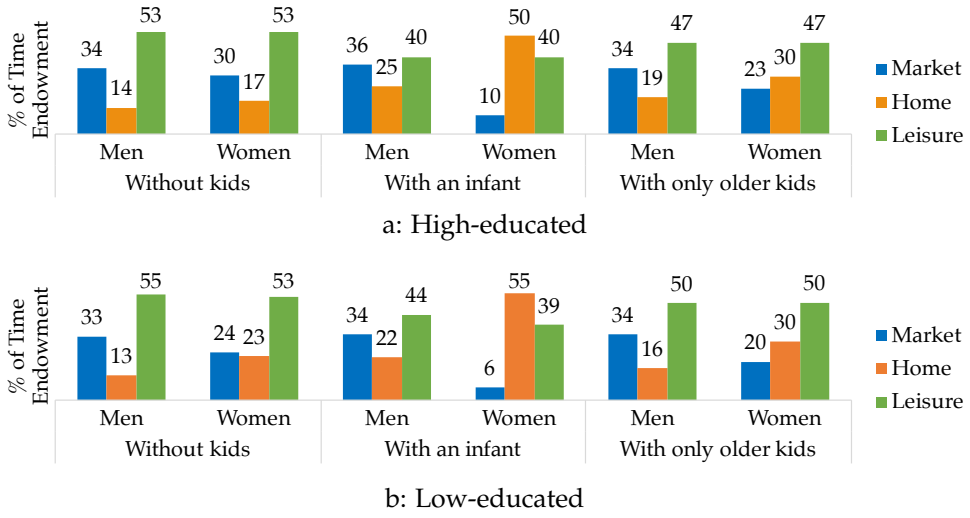
Figure 1 displays the average amount of time spent by married people on market work, home

[16] This survey collects cross-sectional data that measure individuals' time use in various activities every five to six years. The most recent GSS with a topic of time use was carried out from 2015-2016. Statistics Canada expects to release the data in Winter 2017.

[17] Public-use data provide age grouped in 5-year or 10-year bins.

[18] Since GSS collects the number of children living in a respondent's household, young married couples who have not yet have children cannot be distinguished from empty-nesters. Thus, I classify married people who are aged 45 or older and have no children at home as married people with older children.

Figure 1: Time Allocations of Married Individuals



a: High-educated

b: Low-educated

production, and leisure expressed as a percentage of the time endowment.[19] This figure shows that specialization between market and home production is much stronger among those with an infant than those without any children or with only older children. Before having children, compared to high-educated men, high-educated women spend less time on market work and more time on home production, while spending the same amount of time in leisure. When they have an infant at home, married women drastically reduce time spent on market work and increase time on home production. Although men also increase the amount of time they spend on home production, women spend twice as much time on home production as men do. When married people have only older children, the specialization declines as they reduce time spent in home production and married women return to market work. The same patterns are seen among the low-educated, although their specialization is stronger even before having children compared to the high-educated. Clearly, these patterns suggest that female comparative advantage in home production may be a contributing factor for the gender differences in parental leave take up rates. However, it is likely not the only factor. The next subsection examines evidence for differences in market work factors.

B. Wages upon entry into the labour market

The gender wage gap is closely related to specialization within a couple (Hersch and Stratton, 1994). I separate the gender wage gap in two parts: gender differences in rental rates of human capital conditional on educational attainment and gender differences in human capital gained from market experiences. The first part of the gender wage gap can impact specialization, and the second part can be influenced by specialization. As in Olivetti (2006), I label gender differences in the rental rates "pure" gender wage differences. I provide empirical evidence of the pure gender

[19] These statistics are not conditional on participation and include zeros in calculation.

Table 3: Descriptive Statistics of Hourly Wages at Age 23

	High-educated			Low-educated		
Statistics	Men (M)	Women (W)	Ratio (W/M)	Men (M)	Women (W)	Ratio (W/M)
Median	15.3	12.5	.817	13.0	9.2	.708
Mean	17.1	13.5	.789	13.5	10.6	.785

Cross-sectional data from Survey of Labour Income Dynamics (2001-2010) are used for the calculation. The sample is restricted to married people who were not a student and worked at least 300 hours for a year. Hourly wages are deflated to 2002 Canadian dollars.

wage gap using hourly wages upon entry into the labour market.

I use public-use cross-sectional data from Survey of Labour Income Dynamics (SLID) collected between 2001 and 2010. SLID is a Canadian household longitudinal survey that contains a broad range of information on the histories of labour market activities, educational attainment, and demographic characteristics of individuals and families. The annual cross-sections consist of two overlapping panels. Each panel is surveyed for six consecutive years. Every three years, a new panel is added. For a measure of wages, I use the hourly wage from the main job at which a respondent works for most hours during the reference year. Hourly wages are deflated to 2002 Canadian dollars using the federal Consumer Price Index. Throughout this paper, all monetary values are deflated to 2002 Canadian dollars unless mentioned otherwise.

Hourly wages of 23-year-old high-educated individuals are used as a proxy for rental rates of human capital. The assumptions behind this approach are that most high-educated people at age 23 are in their early careers and that both men and women have similar levels of human capital gained from market experiences upon entry into the labour market conditional on education. Among 23-year-old high-educated married people, 99% of men and 90% of women were employed for any positive number of hours during the reference year, whereas 91% of men and 78% of women were employed full-time at least for a week.

Table 3 reports the average and median hourly wages of married individuals at age 23. It shows considerable differentials between men and women. Among the high-educated, the median hourly wage of women is 82% of that of men, and the average hourly wage earned by women is 79% of that earned by men.[20] These gender differentials in the means and medians are consistent with the presence of pure gender wage differentials. Because this study abstracts from the choices of majors and occupations, I report the statistics that are not conditional on occupations and fields of study. Therefore, the statistics reflect different choices in college majors and occupations between men and women.[21]

[20] Table A2 in Appendix compares the statistics of the married sample to the same statistics for a sample of all individuals. When the sample is not restricted to married individuals, the gender gap in the median hourly wages of high-educated people is similar to that of the married sample and the gap in the average hourly wages is smaller. In contrast, among the low-educated, the gap in the median wages is smaller and the gap in the average wages is similar.

[21] The literature on gender wage gap and gender differences in college majors includes Altonji(1993), Brown and Corcoran (1997), Paglin and Rufolo(1990). Section 5 and section 7 in Altonji and Blank (1999) provide the summary of the literature.

C. Returns to experience and wage penalty for taking time out of work.

To demonstrate gender differences in returns to experience and wage penalties for taking time off work, I run Mincerian wage regressions using the SLID data. For this estimation, I combine cross-sectional data from SLID in 2001-2011. SLID contains self-reported retrospective information about educational attainment and market experience. Hourly wages from the main job during the reference year are used as a measure of wages. The real hourly wage rates expressed in natural logs are used as my dependent variable. Control variables include a quadratic in market experience, the accumulated amount of time off from work, educational attainment, the number of children, and an indicator variable for a private sector job.

SLID records a respondent's market experience accumulated since their first full-time job as the number of years as a full-year full-time equivalent.[22] This variable is denoted by *Experience*. This measure of experience excludes any part-time employment before the first full-time job. Those who have never had a full-time job have zero as its value. I measure foregone experience in two parts: potential foregone experience before the first full-time job, denoted by *TimeOut1*, and actual foregone experience after the first full-time job, denoted by *TimeOut2*. *TimeOut1* is defined as the age at which a person started to work full-time minus the number of years of schooling minus six.[23] *TimeOut2* is defined as the number of years since the first full-time job minus *Experience*. Because *TimeOut1* does not distinguish part-time employment from non-employment and thus overstates the amount of time off from work, the coefficient on *TimeOut2* is my preferred estimate of wage penalties for foregone experience.

The sample of interest is limited to married people aged between 25 and 49 with paid employment who are not students and do not have any disability in the reference year. Observations that have any missing information about education and experience are excluded from the sample. The final sample consists of 35,826 male observations and 36,692 female observations. Men had accumulated 3.37 more years of market experience compared to women, whereas women had taken 1.76 more years off of work since their first full-time job. These gender differences in market experience and foregone experience are related to the fact that in most case mothers take time off work due to childbirth and childcare and the fact that part-time employment is more common among women than among men. Other main characteristics of the sample are reported in Table A3 in the Appendix.

Table 4 presents the estimation results. The negative coefficients on variable *TimeOut2* show wage losses for an additional year of foregone experience after the first full-time job. Both men and women receive statistically significant penalties for taking time out. The absolute values of the coefficients for men are greater than those for women. That is, for the same amount of time off from work, married men face greater wage penalties than married women do. When log wage regressions are separately estimated by educational group, the results are similar. However, there

[22] In Canada, full-time work means at least 30 hours of work over a period of one week.

[23] I replace negative values of *TimeOut1* with zero under the assumption that these respondents started their first full-time job before receiving the highest level of degree or went back to school in the midst of their career.

Table 4: Log Wage Regressions

Dependent variable	All		Low-edu		High-edu	
: ln(Wage)	Men	Women	Men	Women	Men	Women
Experience	0.0270	0.0272	0.0178	0.0163	0.0281	0.0274
	(22.75)	(26.06)	(9.04)	(9.31)	(17.36)	(19.57)
Experience$^2/10^3$	-0.5178	-0.5273	-0.2841	-0.1818	-0.6984	-0.7229
	(-15.59)	(-15.73)	(-5.40)	(-3.40)	(-14.83)	(-15.72)
TimeOut1	-0.0102	-0.0065	-0.0103	-0.0081	-0.0120	-0.0129
	(-18.79)	(-15.22)	(-12.78)	(-12.90)	(-15.64)	(-21.22)
TimeOut2	-0.0204	-0.0156	-0.0219	-0.0155	-0.0244	-0.0217
	(-21.13)	(-28.83)	(-14.38)	(-18.17)	(-18.61)	(-29.65)
Constant	2.663	2.5012	2.8092	2.7027	3.076	3.0277
	(200.33)	(198.20)	(135.54)	(-29.05)	(224.93)	(289.34)
Adjusted R^2	0.2434	0.3575	0.1102	0.2056	0.1060	0.1964

t-statistics are in parentheses. Data is from Survey of Labour Income Dynamics, 2001-2010. The sample of interest is married people aged between 25 and 49 with paid employment who are not a student and do not have any disability in the reference year. Hourly wages are deflated to 2002 Canadian dollars. Education is controlled for the first two columns. The number of children and a private sector job indicator are controlled for all columns. A complete table is reported in Table A4 in the Appendix.

are some differences between the two education groups. In both education groups, men and women have similar returns to experience and receive statistically significant wage penalties for taking time out. Meanwhile, the adverse effect of time out of work on subsequent wages is larger among the high-educated, compared to the low-educated. For gender differences in the wage penalties, men have a larger wage penalty than women do for taking time off in both educational groups, whereas the gender difference is bigger among the low-educated. This is because high-educated women face a wage penalty that is as high as that for high-educated men.

To sum up, 13% of eligible married fathers use parental leave whereas 91% of eligible married mothers use maternity and parental leave. Married men and women allocate their time differently when they have children, especially an infant. Men have higher average hourly wages upon entry into the labour market than women do. Finally, men receive higher wage penalties for taking time off work than women do.

In the remainder of the paper, all these possible explanations are incorporated into a unified life-cycle framework. In addition, I consider a gender difference in preferences for leisure as possible reasons. In the framework, parameters related to the possible explanations are allowed to differ by gender. By calibrating the model, I can quantitatively assess the role of each gender difference in married couples' decisions on how to divide parental leave between a husband and wife.

3 Model

This section describes a life-cycle model of married couples. For simplicity, the model abstracts from the formation and dissolution of marriage and educational and occupational choices.[24] This model is a partial equilibrium model. The period length is annual.

3.1 Economic Environment

Demographics. The model economy is populated by married households. Each married household consists of a husband and a wife. A marriage is lifelong, and a married couple has a working life of 40 years from age 23 to age 62. Each person is either high-educated, *hi*, or low-educated, *lo*. While preferences and home production technology are assumed to be the same across education types, human capital evolution processes and fertility shocks will depend on education types. A household's education type is a pair of husband's and wife's education types. In each period, a married couple jointly makes decisions.

Children do not make any decisions. However, the decisions of a married couple are influenced by the characteristics of their children, especially the number of children and the age of the youngest child. The age of the youngest child, a, is tracked until the age of two.[25] I define a child under two an "infant" and a child who is two years old or older an "older child." When a couple has an infant at home, $a = 1$. When a couple has only older children, $a = 2$. Children stay with their parents throughout their parents' whole life.

Fertility is exogenous and stochastic. Based on fertility, the life-cycle is split into three stages: the pre-fertile, fertile, and post-fertile stages. A married couple without any children begins in the "pre-fertile" stage. In this stage, the married couple does not face any birth shock. A married couple in the pre-fertile stage enters the fertile stage with probability π_f. The concept of fertility in this set-up does not relate to the biological ability to reproduce but rather to the state of considering having a child. The pre-fertile stage is needed in this model, where all couples begin married at age 23, to match the timing of having the first child in the data.

In the fertile stage, a couple faces a birth shock at the beginning of each period. The probability

[24] As the model abstracts from marriage and divorce decisions, it misses the effect of the fathers' take-up on marriage stability or family structure. Bernal and Fruttero (2008) use a general equilibrium model of marriage and divorce to assess the effects of maternity leave on intra-household decision making, family structure, and the distribution of income. My model also abstracts from educational and occupational choices. As the job protection provided by parental leave helps women retain their pre-birth employment after childbirth, parental leave encourages women to anticipate longer work lives. The expanded career horizon influences human capital investment and occupational choices (Goldin, 2006). Although their focus is on female's labour supply, Adda, Dustmann, and Stevens (2017) take career decisions into account quantifying the career costs associated with children using a dynamic life cycle model incorporating occupational choices with different human capital growth and atrophy paths. My model misses the effects of parental leave on educational and occupational choices especially in policy experiments. Instead, I take these choices as given in quantifying the contribution of various factors to the take-up of parental leave. I directly takes the distribution of couples across household educational types from the data. I implicitly assume that gender differences in occupations are reflected in gender differences in rental rate distributions and human capital evolution processes.

[25] I choose the age of two to keep the state space small. Due to this assumption, my model misses gradual changes in married women's behaviour until their children start school.

of a birth, $\pi_b(t, k, a, \epsilon_w)$, depends on the age of the couple, t, the number of children, k, the age of the youngest child, a, and the wife's education level, ϵ_w. A birth shock occurs every period until the couple enters the post-fertile stage in which a birth shock no longer occurs.

A couple enters the post-fertile stage in three ways. First, a couple enters when a couple becomes 43 years old. Thus, a couple can be in the fertile stage for at most 20 periods. Although the fertility rate of women aged 40 or higher is positive, the probability of a birth beyond age 43 is small. My estimation results show that the probability of having a newborn child at age 42 is less than two percent when a married couple has no child or one child. The probability is almost zero when a couple has two or more children (Table A7). Second, couples stop being able to have children once the number of children in a married household reaches three. Lastly, couples under the age of 43 with only older children enter the post-fertile stage with probability π_{post}. The transitional probabilities into the fertile stage π_f and into the post-fertile stage π_{post} depend on a wife's educational level.

Preferences. A married couple has unitary utility from consumption, c, husband's and wife's leisure, l_h and l_w, respectively, and output from home production, z. Per-period household utility, $u(c_t, l_{ht}, l_{wt}, z_t)$, is additively separable and concave. Consumption and output from home production are public goods within a household. Let the set of parameters γ_c, γ_h, γ_w and γ_z denote weights on consumption, husband's leisure, wife's leisure and output from home production. The functional form used in the quantitative analysis is:

$$u(c, l_h, l_w, z) = \gamma_c \frac{c^{\sigma_c}}{\sigma_c} + \gamma_h \frac{{l_h}^{\sigma_l}}{\sigma_l} + \gamma_w \frac{{l_w}^{\sigma_l}}{\sigma_l} + \gamma_z \frac{z^{\sigma_z}}{\sigma_z}.$$

The parameters σ_c, σ_l and σ_z denote elasticity parameters on consumption, leisure, and output from home production, respectively. Each period, an individual is endowed with discretionary time E and allocates it across three activities: paid work, n, home production, e, and leisure, l. Household incomes consist of labour earnings and parental leave benefits. Married couples live hand to mouth. They do not save nor borrow. Most people in their 20s and 30s have low net worth (Macdonald 2015). To focus on the role of husband's and wife's human capital accumulation in their decisions, I abstract from asset accumulation in the model.[26]

Couples with an infant at home must purchase childcare services for every hour that both parents are simultaneously working in the labour market. As in Domeij and Klein (2013), the amount of market childcare services to be purchased is determined as $\min\{n_h, n_w\}$ where n_h and n_w denote husband's and wife's hours of work, respectively. Let κ represent an hourly rate for market childcare services for an infant.[27] Although some parents have an option of unpaid childcare ser-

[26] Guner, Kaygusuz, and Ventura (2014) have a model where a couple accumulates financial assets instead of husband's human capital. Mazzocco, Ruiz, and Yamaguchi (2013) and Bayot and Voena (2015) have models that include wealth and husband's and wife's human capital accumulation. As Mazzocco, Ruiz, and Yamaguchi (2013)'s study emphasizes the wealth dynamics, they use two points for experience.

[27] This model tracks the age of the youngest child up to two and categorizes all older children into one group. Because I assume all children stay with their parents though their parents' whole life, I assume the childcare costs for the older children are relatively negligible. A weakness of the assumption is that the model understates the benefit of a parent

vices provided by grandparents or siblings, unpaid childcare services are beyond the scope of this paper.[28] In the cases in which either a husband or a wife does not work in the market, a couple does not purchase market childcare services but produces childcare services as a part of home production.

Home production technology. The output from home production includes not only general housework such as cleaning, maintenance, and cooking but also childcare. Home production requires inputs of market goods, g, and time from each spouse, e_h and e_w. The productivity of the husband's time in home production relative to the wife's time is denoted by $\eta(k,a)$. The wife's relative home productivity is denoted by $1-\eta(k,a)$. If the husband's time and the wife's time are equally productive, $\eta(k,a)=1/2$. If the wife's time produces more output than the same amount of her husband's time, $\eta(k,a)<1/2$. This relative productivity may vary upon the presence of an infant in a family. When a couple has an infant, $\eta(k,a)=\eta_1$; otherwise, $\eta(k,a)=\eta_0$.

For the quantitative analysis, I use a nested Cobb-Douglas function for the home production technology:

$$z=z(g,e_h,e_w,k,a)=(1+k\zeta(k,a))\,g^{1-\alpha}\left(e_h^{\eta(k,a)}e_w^{1-\eta(k,a)}\right)^{\alpha},$$

where k is the number of kids and a is the age of the youngest kid. The efficiency factor of home production, $(1+k\zeta(k,a))$, increases with the number of kids. Also, the efficiency factor is allowed to vary by the presence of an infant at home. If a couple has an infant $\zeta(k,a)=\zeta_1$ with $\zeta(k,a)=\zeta_0$ otherwise.

Rental rates of human capital. A worker earns an hourly wage which is defined as the product of a quantity of human capital and a rental rate per unit of human capital. Let p_i denote the rental rate of human capital for spouse i. A rental rate is randomly drawn from an exogenous gender-specific log-normal distribution. The means of husbands' rental rates, μ_h, and wives' rental rates, μ_w, are allowed to differ. I call this gender difference in the means of rental rates the "pure" gender wage gap. The argument about why the pure gender wage gap exists upon the entry into the labour market is beyond the scope of this paper, but one explanation is occupational gender segregation. Intended fertility and career interruptions influence women's occupational choices and lead to self-selection into more child-friendly occupations (Adda, Dustmann, and Stevens, 2017; Görlich and de Grip, 2009). Although occupational gender segregation has declined since 1970s, it still remains present in the labour market (Blau, Brummund, and Liu, 2013). For my quantitative analysis, the distribution of rental rates follows a log-normal distribution $G_i(p_i)\sim lnN(\mu_i,\sigma_i^2)$ for $i=h,w$.

A person draws a new rental rate from the same distribution G_i after a full year of non-employment or after a wage shock. A full year (period) of non-employment is either due to one's voluntary choice or due to a full-year non-employment shock at the end of the preceding period. A non-

staying at home to save childcare costs especially for older children.

[28] Bick (2016) builds a model in which a married couple chooses the type of childcare services to evaluate the effect of a childcare subsidy on parental labour supply, fertility, and social welfare.

employment shock occurs at the end of a period with probability ν_e to an employed person and with probability ν_n to a non-employed person. If this shock is realized, then the person is involuntarily non-employed for a full year in the following period. After the period, a worker draws a new rental rate. In addition, a wage shock may occur to an employed worker with probability λ at the end of a period. This shock is independent of the non-employment shock. If a wage shock is realized, a worker redraws a new rental rate at the beginning of the following period. This shock allows employed workers to change their rental rates without experiencing a full year of non-employment.

Evolution of human capital. Human capital, x, depends on formal education and market experience. An educational type, ϵ, remains fixed at either low-educated, lo, or high-educated, hi, over the life cycle. Human capital gained from market experience, x^{exp}, stochastically evolves via a learning-by-doing process.

The level of human capital from market experience takes a value on the finite set $\mathcal{X}^{exp}(\epsilon) = \{x_0^{exp}, x_1^{exp}, ..., x_{max}^{exp}(\epsilon)\}$. Each level is expressed not as the number of years but rather as the efficiency units of human capital gained from market experience. In the finite set, x_1^{exp} represents a baseline experience level which a worker at age 23 has upon entry into the labour market. Human capital may depreciate below the baseline level to the lowest level x_0^{exp}. The baseline level x_1^{exp} is normalized to one. There is a constant growth rate between the lowest level, x_0^{exp}, and the maximum level, x_{max}^{exp}. By allowing the maximum level, x_{max}^{exp}, to vary by education level, ϵ, the finite set $\mathcal{X}^{exp}$ differs between the two educational levels.

Transition probabilities of human capital depend on its level, x_j^{exp}, and time worked in the labour market, n, in a period. The human capital evolves by one grid point at a time. The following functional form is a variant of a stochastic process of labour productivity in Caucutt, Guner, and Knowles (2002): for $\epsilon \in \{lo, hi\}$ and $i \in \{h, w\}$,

$$\begin{aligned}
Pr(Up) \quad &= X_i^{\epsilon}(x_{j+1}^{exp} \mid x_j^{exp}, n_i) = \psi_i^{\epsilon}\tilde{n}_i/(x_j^{exp})^{\tau},\ j \in \{1, ..., N-1\}, \\
Pr(Down) \quad &= X_i^{\epsilon}(x_{j-1}^{exp} \mid x_j^{exp}, n_i) = (1-\tilde{n}_i)\,\delta_i^{\epsilon},\ j \in \{1, ..., N\}, \\
Pr(Same) \quad &= X_i^{\epsilon}(x_j^{exp} \mid x_j^{exp}, n_i) = 1 - Pr(up) - Pr(down),\ j \in \{1, ..., N-1\}, \\
Pr(Same) \quad &= X_i^{\epsilon}(x_0^{exp} \mid x_0^{exp}, n_i) = 1 - X_i^{\epsilon}(x_1^{exp} \mid x_0^{exp}, n_i), \\
Pr(Same) \quad &= X_i^{\epsilon}(x_N^{exp} \mid x_N^{exp}, n_i) = 1 - X_i^{\epsilon}(x_{N-1}^{exp} \mid x_N^{exp}, n_i),
\end{aligned} \tag{1}$$

where $\tilde{n}$ is hours of work expressed as a fraction of the maximum amount of time available for market work, $\bar{n}$, which is set to 40% of time endowment. That is, $\bar{n} = 0.4E$ and $\tilde{n}_i = n_i/\bar{n}$.

The transitional probabilities incorporate two key parameters. Let ψ_i^{ϵ} denote the maximum probability of human capital growth. It is the likelihood of human capital increasing when a person spends all available time for market work $\bar{n}$ in the labour market. Let δ_i^{ϵ} represent the maximum probability of human capital depreciation. It is the likelihood that human capital falls when a person is non-employed for a year. The parameter τ is related to the rate at which returns to experience diminish. As the possible explanations I consider for the gender gap in take-up

rates, ψ_i^ϵ and δ_i^ϵ are allowed to be gender-specific.

Parental leave policy (PL). Upon the birth of a child, an employed parent who meets the requirements for entitlement to EI is guaranteed paid parental leave. An eligible parent determines the number of weeks of paid parental leave to take. When a parent takes d weeks of parental leave, the parent is available for market work during at most $52-d$ weeks during the period. The maximum number of weeks available for market work restricts the total amount of time available for market work to $(\frac{52-d_i}{52})\bar{n}$.

Given the job protection provided by parental leave, a mother who uses a full year of parental leave retains her pre-birth rental rate. I assume that a mother on a full year of parental leave does not search for a new job, her probability of drawing a new rental rate is zero, and a full-year non-employment shock occurs with probability ν_e. If a parent uses less than a full year of parental leave and does not return to work during the period, I view this as voluntary non-employment and let the parent draw a new rental rate with probability one at the beginning of the following period. If a parent does not use parental leave or if a parent uses less than a full year of parental leave and returns to work during the period, I let the parent draw a new rental rate with probability λ and a full-year non-employment shock occur with probability ν_e. The function of job protection is summarized by the probability of drawing a new rental rate, denoted by $\tilde{\lambda}_i$, as follows:

$$\tilde{\lambda}_i = \begin{cases} 0 & \text{if } n_i = 0 \text{ and } d_i = 52 \text{ (Job protection after a full year of PL)}, \\ 1 & \text{if } n_i = 0 \text{ and } d_i < 52 \text{ (Voluntary non-employment after a part year of PL)}, \\ \lambda & \text{if } n_i > 0 \text{ and } 0 \leq d_i < 52 \text{ (Return to work after a part year of PL or not using PL)}. \end{cases} \tag{2}$$

The second function of parental leave is financial support through cash benefits. The amount of weekly benefits, B, is determined based on hours worked and earnings in the previous period. Specifically it is given by the following updating rule:

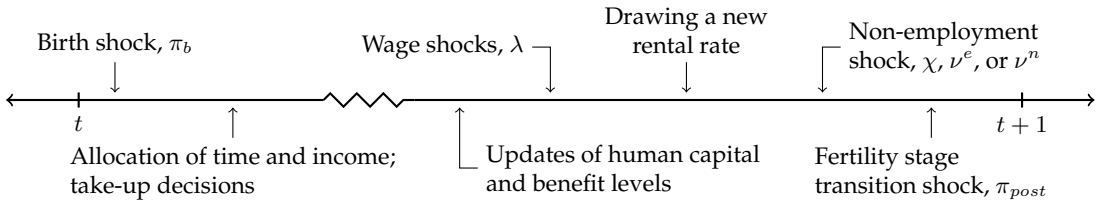
$$B' = \mathbb{1}\{n_{it} \geq 600\} \min\left\{\rho \frac{p_{it} x_{it} n_{it}}{52}, \bar{B}\right\}, \tag{3}$$

for $i \in \{h, w\}$. To be eligible for paid parental leave under EI, a parent must meet the minimum requirement of 600 hours of work within the last 52 weeks. The indicator variable $\mathbb{1}\{n_{it} \geq 600\}$ is equal to one if person i meets the requirement and zero otherwise. Conditional on being eligible, the parental benefits replace the pre-birth earnings, $p_{it} x_{it} n_{it}$, at a rate of ρ with a maximum amount $\bar{B}$. As a state variable, $B_i = 0$ if person i is not eligible for EI. A positive value of B_i represents the weekly benefit amount that person i can receive.

3.2 Household Problem

I present in detail the household problem in a fertile period in which a married couple faces a birth shock. Because household problems in pre-fertile and post-fertile periods are similarly defined except for the continuation values, only continuation values are presented in these cases.

Figure 2: Timeline of events in a fertile period



A couple starts a fertile period with a given set of state variables $\mathcal{S} = (\mathbf{p}, \mathbf{x}, \epsilon, \mathbf{B}, k, a_k, \Upsilon, t)$ indicating the rental rates of human capital, $\mathbf{p} = (p_h, p_w)$; levels of human capital from market experience, $\mathbf{x} = (x_h^{exp}, x_w^{exp})$; education types, $\epsilon = (\epsilon_h, \epsilon_w)$; the weekly amounts of parental benefits, $\mathbf{B} = (B_h, B_w)$; the number of children at home, k; the age of the youngest child, a; non-employment risks, Υ; and the age of the couple, t.

Non-employment risks are exogenous and stochastic. A spouse experiences a part-year non-employment shock with probability χ at the end of a period. In this case, a person can work up to $\frac{1}{2}\bar{n}$ during half of the following period. This state is denoted by P. If a spouse experiences a full-year non-employment shock, the person cannot participate in the labour market in the following period. This state is denoted by F. The probability of a full-year non-employment shock depends on an individual's current employment status. The shock for an employed person is realized with probability ν^e and for a non-employed person is with probability ν^n. If neither non-employment shock is realized, denoted by N, a person can work in the labour market up to $\bar{n}$ hours of work.

The non-employment risks at the household level, denoted by Υ, are a pair of husband's and wife's non-employment risks. For example, $\Upsilon = PN$ represents a state where the husband experiences a part-year non-employment shock and the wife experiences neither non-employment shock. Assuming that the husband's and wife's non-employment risks are dependent, I allow Υ to take one of the five states: $\{NP, NF, PN, FN, NN\}$, where for each state the first and the second letters stand for the husband's and wife's non-employment risks, respectively.

$$\Upsilon = \begin{cases} NP & \text{with probability } \chi_w \text{ (part-year non-employment shock to the wife)} \\ NF & \text{with probability } \nu_w \text{ (full-year non-employment shock to the wife)} \\ PN & \text{with probability } \chi_h \text{ (part-year non-employment shock to the husband)} \\ FN & \text{with probability } \nu_h \text{ (full-year non-employment shock to the husband)} \\ NN & \text{with probability } 1 - \chi_w - \nu_w - \chi_h - \nu_h, \end{cases}$$

where $\chi_i = \chi$ and ν_i is either ν^e or ν^n for $i = h, w$.

Figure 2 displays the timeline of decisions and stochastic events during a fertile period. A birth shock is realized at the beginning of a fertile period. If a birth does not occur, $b = 0$, a couple jointly allocates their time and income. If a birth occurs, $b = 1$, and parents are eligible for parental leave, they also make decisions on how to use their parental leave. After a couple makes decisions, levels of human capital are updated, and a new rental rate is drawn if applicable. Next, non-

employment shocks are realized. Lastly, if a couple has only older children, a transition shock into the post-fertile stage is realized with probability π_{post}.

Given a set of state variables, $\mathcal{S}$, the value to a couple in which both a husband and wife experience neither non-employment shock, denoted by $\Upsilon = NN$, before the realization of a birth shock is

$$W^f_{NN}(\mathcal{S}) = \pi_b(t,k,a,\epsilon_w)V^{b=1}_{NN}(\mathcal{S}) + (1-\pi_b(t,k,a,\epsilon_w))V^{b=0}_{NN}(\mathcal{S}),$$

where $V^{b=1}_{NN}$ is the value to a couple when a birth occurs, and $V^{b=0}_{NN}$ is the value to a couple when a birth does not occur. The value to a couple when a birth occurs, $V^{b=1}_{NN}$, is given by

$$\begin{aligned}
&V^{b=1}_{NN}(p_h,p_w,\mathbf{x},\epsilon,\mathbf{B},k,a_k,t) \qquad (4)\\
&= \max_{\substack{d_h,d_w,n_h,n_w,\\ c,g,e_h,e_w,l_h,l_w\geq 0}} \quad u(c,l_h,l_w,z(g,e_h,e_w);\ k+1,1)\\
&\qquad + \beta\Big\{\tilde{\lambda}_h\tilde{\lambda}_w\mathbb{E}_{p'_h,p'_w}\left[\mathbb{W}^f(p'_h,p'_w)\right] + \tilde{\lambda}_h(1-\tilde{\lambda}_w)\mathbb{E}_{p'_h}\left[\mathbb{W}^f(p'_h,p_w)\right]\\
&\qquad\quad + (1-\tilde{\lambda}_h)\tilde{\lambda}_w\mathbb{E}_{p'_w}\left[\mathbb{W}^f(p_h,p'_w)\right] + (1-\tilde{\lambda}_h)(1-\tilde{\lambda}_w)\mathbb{W}^f(p_h,p_w)\Big\}\\
&\quad \text{subject to} \quad c+g+\left(\tfrac{52-d_h-d_w}{52}\right)\kappa\min\{n_h,n_w\} = p_h x_h n_h + p_w x_w n_w + B_w d_w + B_h d_h,\\
&\qquad d_h \leq 35, \quad d_w \leq 52, \quad d_h+d_w \leq 52,\\
&\qquad n_i \leq (\tfrac{52-d_i}{52})\bar{n}, \quad n_i+e_i+l_i = E,
\end{aligned}$$

where $\mathbb{W}^f(p_h,p_w) = \mathbb{E}_{\Upsilon',x',B'}\left[W^f_{\Upsilon'}(p_h,p_w,\mathbf{x}',\epsilon,\mathbf{B}',k+1,1,t+1)\right]$ and the probability of drawing a new rental rate, $\tilde{\lambda}_i$, is determined by equation (2).

Parents with $B_i > 0$ determine the length of their parental leave, d_h and d_w, from a menu of 0, 6.5, 17, 26, and 35 weeks for a father and a menu of 0, 6.5, 17, 26, 35, 45.5, and 52 weeks for a mother. A parent who chooses to use parental leave allocates time taken away from market work between home production and leisure. As a result, a couple gains increased output from home production and increased leisure time. Additionally, while a spouse is on leave, a couple does not pay childcare costs. When a couple does not use all 52 weeks, the couple must purchase market childcare services for every hour that both parents work in the market at an hourly rate κ. In this case, the childcare services cost $\left(\frac{52-d_h-d_w}{52}\right)\kappa\min\{n_h,n_w\}$.

When a parent uses parental leave to care for children, the parent gives up work experience. The couple incurs costs from this reduction in hours of work. First, as the reduction in hours of work raises the likelihood of human capital depreciation according to a learning-by-doing process, a parent on leave is more likely to experience a wage penalty. All other things being equal, a couple would choose to have the spouse with the lower wage penalty take time off through parnetal leave. Also, as the reduction in hours worked lowers the probability of human capital accumulation, the couple anticipates wage losses in the future due to the foregone experience. All other things being equal, a couple would choose to have the spouse with the lower return to experience use parental leave. The other cost is an income loss in the current period. Because cash benefits replace 55% of the pre-birth earnings with a cap, to minimize household income losses, a

couple is likely to let the spouse with with lower wage rate use parental leave.

The value to a couple in a fertile period without the realization of a birth shock, $V_t^{b=0}$, is similarly defined. For a couple with only older children, a stochastic transition into the post-fertile stage is realized with probability π_{post}. Their continuation value is $\pi_{post}\mathbb{E}\left[W^{post}(\mathcal{S}_{t+1})\right] + (1 - \pi_{post})\mathbb{E}\left[W^{f}(\mathcal{S}_{t+1})\right]$, where W^{post} is the value to a couple in a post-fertile period. The value, W^{post}, is similarly defined as $V_t^{b=0}$. In a pre-fertile period, a couple makes a transition into the fertile stage with probability π_f, and their continuation value is $\pi_f\mathbb{E}\left[W^{f}(\mathcal{S}_{t+1})\right] + (1-\pi_f)\mathbb{E}\left[W^{pre}(\mathcal{S}_{t+1})\right]$, where W^{pre} is the value to a couple in a pre-fertile period.

4 Calibration

The goal of the calibration is to provide a unified framework to quantify the relative importance of the various factors I consider for the low take-up rates of fathers and to carry out policy experiments. The model is calibrated to match Canadian data. Given a set of the parameters determined outside the model, the remaining parameters are jointly determined within the model by minimizing the sum of squared errors between simulated and data moments. The calibrated economy is set as the benchmark economy.

4.1 Externally determined parameters

Table 5 displays the parameters determined outside the model. Parameters related to the parental leave policy are set to mimic Canadian parental leave policy under EI. The maximum duration is 52 weeks for a mother and 35 weeks for a father.[29] The income replacement rate ρ is 0.55, and the weekly benefit maximum $\bar{B}$ is $\$413$ as it was between 2001 and 2006. I let the weekly benefit amount B_i take a value on the finite set $\mathcal{B} = \left\{0, \frac{1}{3}\bar{B}, \frac{2}{3}\bar{B}, \bar{B}\right\}$.[30]

The discount factor is set to 0.96. I set the utility curvature parameters σ_c and σ_l to -1. There is little guidance in the literature on the value of the curvature parameter for home output σ_z. I set the curvature parameter for home output σ_z to the utility curvature parameter for human capital investment on children as in Caucutt, Guner, and Knowles (2002). Although their environment is not the same as here, using their parameter value is not unreasonable in the sense that home production in my model includes childcare activities and requires goods and time inputs as with their children human capital production.

The share of goods input to time input is set to 0.67. There is little guidance in the literature on this parameter value. I assume that this share is the same as the labour income share that is commonly used for the aggregate production technology in the macroeconomics literature. The

[29] A mother and a father cannot take leave simultaneously, so the maximum duration of leave per couple is 52 weeks.

[30] As I use a discrete menu for parental leave choices, I choose to let the state variable of weekly benefits be discrete as well. In quantitative analysis, I let the weekly benefit amount B_i take a value on the finite set $\mathcal{B} = \left\{B_1, B_2, B_3, \bar{B}\right\}$ and be stochastically updated on the finite set. Transitional probabilities of the weekly benefits amount depend on the updating rule in equation (3). If $B' = \bar{B}$, $B_{i,t+1} = \bar{B}$ with probability 1. If $B' \in [B_j, B_{j+1}]$ for $j = 1, 2, 3$, $B_{i,t+1} = B_j$ with probability $\frac{B_{j+1}-B'}{B_{j+1}-B_j}$ and $B_{i,t+1} = B_{j+1}$ with probability $\frac{B'-B_j}{B_{j+1}-B_j}$.

Table 5: Externally Determined Parameters

Parameters	Description	Sources
$\bar{d}_{PL} = 35$	Maximum length of parental leave (weeks)	Employment Insurance
$\rho = 0.55$	Income replacement rate	Employment Insurance
$\bar{B} = 413$	Maximum weekly benefits ($)	Employment Insurance
$\beta = 0.96$	Discount rate	-
$\sigma_c = -1.0$	Elasticity of consumption	-
$\sigma_l = -1.0$	Elasticity of labour supply	-
$\sigma_z = 0.3$	Elasticity of output from home production	Caucutt et al. (2002)
$\gamma_c = 1.0$	Weight on consumption	Normalization
$\alpha = 0.67$	Elasticity of substitution between goods and time	-
$\kappa = 6.69$	Hourly cost of childcare services ($)	-
$\pi_b(t, k, a, x_w^{edu})$	Stochastic fertility process	Estimates from SLID
$\pi_f = 0.417$	Prob. a transition to the fertile stage (low)	Estimates from SLID
$\pi_f = 0.277$	Prob. a transition to the fertile stage (high)	Estimates from SLID
$\pi_{post} = 0.029$	Prob. a transition to the post-fertile stage (low)	Estimates from SLID
$\pi_{post} = 0.069$	Prob. a transition to the post-fertile stage (high)	Estimates from SLID
$lnN(\mu_h, \sigma^2)$	Dist. log rental rates at age 23	MLE from SLID
$p_h \sim lnN(2.69, 0.39^2)$	(men) $p_h \in \{9.39, 12.97, 16.63, 23.00\}$	
$p_w \sim lnN(2.52, 0.37^2)$	(women) $p_w \in \{8.10, 11.06, 14.05, 19.19\}$	
$\omega^{edu} = 0.850$	Relative efficiency of the low-educated (men)	MLE from SLID
$\omega^{edu} = 0.814$	Relative efficiency of the low-educated (women)	MLE from SLID
x^{ϵ}_{max}	Maximum experience level	Wage regressions
$= 2.276$	(low) $x_i^{exp} \in \mathcal{X}^{exp} = \{0.81, 1.00, 1.23, 1.51, 1.85, 2.28\}$	for males in Table 4
$= 2.296$	(high) $x_i^{exp} \in \mathcal{X}^{exp} = \{0.81, 1.00, 1.23, 1.52, 1.87, 2.30\}$	
$\pi_x = 1.00$	Fraction of men beginning with x_2	SLID
$\Gamma(\epsilon_h, \epsilon_w)$	Distribution of household education levels	SLID
$= \{21.0, 20.6, 15.5, 42.9\}$	$\{(lo, lo), (lo, hi), (hi, lo), (hi, hi)\}$	

hourly rate for childcare services is set to $6.69 dollars. Macdonald and Friendly (2016) reported the median monthly fees for full-time childcare in big cities in Canada in 2016. The average of the reported median fees for an infant, excluding cities in Quebec where low-cost subsidized day care has been available since 1997, is $843 in 2002 dollars. By assuming the full-time care corresponds to 126 hours per month (30 hours per week), I get the hourly rate of $6.69.

The probability of a birth and the transitional probabilities between fertility stages are estimated using SLID outside the model. Details are presented in Section A.2 in Appendix.

Lastly, parameters related to hourly wage levels are determined outside the model using SLID. Assuming that rental rates of human capital follow a log-normal distribution, I estimate the means and variances with wage data of 23-year-old married individuals (Table A9 in Appendix). For quantitative analysis, the 12.5, 37.5, 62.5, and 87.5 percentiles of the estimated distribution for the high-educated are used as four possible rental rates $\{p_1, p_2, p_3, p_4\}$ with equal probability $1/4$, for each gender. The estimation results show that the average hourly wages of the low-educated are 85% and 81% of that of the high-educated for men and women, respectively.

The upper bound of human capital gained from market experience, x_{max}^{exp}, is set to replicate the maximum experience premium of married men in the data for each educational group. I calculate the maximum experience premium using the wage regression estimates reported in Table 4. The

maximum experience premium is 130% for the high-educated and 128% for the low-educated, respectively.[31] For each education group, the finite set $\mathcal{X}^{exp} = \{x_0^{exp}, x_1^{exp}, ..., x_{max}^{exp}\}$ is set such that with the normalization of x_1^{exp} to one, the elements have a constant growth rate between x_0 and the maximum x_{max}^{exp}.

In my sample of married couples between 23 and 62 in SLID, the median age difference between husband and wife is two years. I use the wife's age as the age of the couple in quantitative analyses. I let the wife's experience level be x_1 and the husband's experience level be x_2 to reflect a possible difference in experience level due to an age difference between husband and wife.[32] For the distribution of household educational types, $\Gamma(\epsilon_h, \epsilon_w)$, I use the empirical distribution of married couples by educational types in the cross-sectional sample of SLID.

4.2 Internally calibrated parameters

Given the set of externally determined parameters, the remaining 20 parameters are jointly determined within the model. These include preference parameters (γ_h, γ_w, γ_z), home production technology parameters (ζ_1, ζ_0, η_1, η_0), parameters governing the transitional probabilities of human capital gained from market experiences (τ, ψ_h^ϵ, ψ_w^ϵ, δ_h^ϵ, δ_w^ϵ for $\epsilon \in \{hi, lo\}$), and wage and non-employment shocks (λ, χ, ν_e, ν_n).

These parameters are jointly determined to minimize the distance between the simulated and data moments. The measure of distance I use is the sum of squared percentage deviations of the simulated moments from the data moments: $\sum_j \left(\frac{d_j - m_j}{d_j}\right)^2$ where d_j is the j^{th} data moment and m_j is a corresponding simulated moment. I use the number of targeted moments that is larger than the number of parameters to be calibrated. The targeted moments include take-up rates, average hourly wages and employment rates by age group, wage growth rates conditional on continuous employment and conditional on foregone experience, time allocations by children characteristics, and labour market transitions. All of the moments are calculated separately by sex and educational attainment.

Because there is not an one-to-one mapping from a parameter to a data moment, I provide a brief argument about how each parameter to be calibrated is affected by subsets of the targeted moments. Parameters in preferences (γ_h, γ_w, γ_z) are related primarily to married individuals' time allocations across market work, leisure, and home production by sex, especially those without any children (Table A10).

Parameters in home production technology, ζ_1, ζ_0, η_1, η_0, are pinned down primarily by matching average amounts of time spent on home production. The efficiency parameters of home production technology as a function of the number of children, ζ_1 and ζ_0, guide the model to match the average amounts of time spent on home production by the number of children and the pres-

[31] According to the wage regression in Table 4, the experience premium is peaked at 19 years of market experiences for the high-educate, while it continues growing for the low-educated. I assumed that experience premium is peaked at 19 years of market experience for both education groups.

[32] In the data the ratio of the average hourly wage of 25-year-old men to that of 23-year-old men is 1.24, which is greater than the parameterized value of x_2 in the model. $\bar{w}_{wife23}/\bar{w}_{own23} = 1.244$

ence of an infant at home (Figure 3). Husbands' relative home productivities, η_1 and η_0, help the model match gender ratios of the amount of time spent on home production. For example, the relative home productivity in the presence of an infant, η_1, guides the gender ratio in the presence of an infant.

Parameters in human capital accumulation technology, τ, ψ_h^ϵ, ψ_w^ϵ, δ_h^ϵ, δ_w^ϵ for $\epsilon \in \{hi, lo\}$, jointly govern the dynamic decisions on household labour supply. The parameter governing the probability of an increase in human capital, ψ_i^ϵ, is pinned down by matching the five-year wage growth rate conditional on working full-year full-time for five consecutive years (Table A11). The parameter governing the probability of a decline in human capital, δ_i^ϵ, is determined by the five-year wage growth rate of those who have experienced at least one year of full-year-full-time equivalent non-employment within five years.

In addition, together with the parameters in the transition probabilities of human capital, part-year and full-year non-employment shocks, χ, ν_e, ν_n, help the model match the labour market transition rates across non-employment, part-year employment, and full-year employment (Table A12). The probability of a wage shock, λ, is pinned down by the fraction of people who experience negative wage growth after full-year full-time employment (Table A13). Given the externally determined distributions of rental rates and the finite set of human capital levels, $\mathcal{X}^{exp}$, all of these parameters together shape the average hourly wages and employment rates by age group.

4.3 Calibration Results

Table 6 displays the calibrated parameter values. Table 7 and Figures 3 and 4 show selected sets of simulated moments and their empirical counterparts. Other moments are in the Appendix (Section A.4).

Combined with time allocations of married people in Table A10, Table 7 and Figure 3 show that the model replicates decisions regarding take-up of leave and time allocations. Although the calibrated model slightly overpredicts mothers' take-up rates and underpredicts take-up rates of fathers with a high-educated wife, the model can clearly capture large differences in take-up of leave between mothers and fathers. Also, the model is able to match the pattern that fathers spend much less time on home production with an infant at home, compared to mothers. The model does less well at matching the average durations of leave conditional on take-up. The model predicts that fathers use longer leave and mothers use shorter leave compared to the data. For example, the model predicts the average duration of 25 weeks for high-educated fathers and 41 weeks for high-educated mothers, whereas the empirical counterparts are 14 and 46 weeks, respectively. Figure 4 indicates that the model is able to replicate the age profiles of average hourly wages and employment rates, except those for low-educated women. For this subgroup, the model predicts a slight flattening of average wages and a continuous decline in employment relative to the data.

Next, let us look at the calibrated values of the parameters of interest. I find the calibrated weights on a husband's leisure and a wife's leisure show a small difference. A couple puts 20% more weight on the husband's leisure time than on the wife's leisure time; $\gamma_h/\gamma_w = 1.24$. This

Table 6: Calibrated Parameters

Parameters	Description	Values
γ_h	Weight on a husband's leisure	0.777
γ_w	Weight on a wife's leisure	0.629
γ_z	Weight on output from home production	1.718
ζ_1	Home productivity per children with an infant	61.846
ζ_0	Home productivity per children without an infant	3.196
η_1	Relative home productivity of husband's time with an infant	0.262
η_0	Relative home productivity of husband's time without an infant	0.491
τ	Curvature of HC growth probability	4.883
ψ_{lo}	Probability of HC growth (low, husbands)	0.350
ψ_{lo}	Probability of HC growth (low, wives)	0.150
ψ_{hi}	Probability of HC growth (high, husbands)	0.706
ψ_{hi}	Probability of HC growth (high, wives)	0.717
δ_{lo}	Probability of HC depreciation (low, husbands)	0.840
δ_{lo}	Probability of HC depreciation (low, wives)	0.421
δ_{hi}	Probability of HC depreciation (high, husbands)	0.429
δ_{hi}	Probability of HC depreciation (high, wives)	0.156
χ	Probability of a part-year unemployment shock	0.040
ν_e	Conditional prob. of a FY nonemployment shock (employed)	0.017
ν_n	Conditional Prob. of a FY nonemployment shock (non-employed)	0.735
λ	Probability of a wage shock	0.223

Table 7: Take-up Rates by Education Level

	Individual				Household (Husband's, Wife's)							
	Fathers		Mothers		(lo, lo)		(lo, hi)		(hi, lo)		(hi, hi)	
	Low	High	Low	High	Husb	Wife	Husb	Wife	Husb	Wife	Husb	Wife
Data	11.8	13.6	90.6	90.8	11.2	89.6	12.3	91.2	10.2	91.8	14.2	90.7
Model	11.4	10.2	93.4	93.4	6.8	93.5	14.1	89.9	6.4	93.2	11.0	95.3

"High" and hi denote the high-educated who are college graduates. "Low" and lo denote a lower education level.

explains why husbands enjoy roughly the same leisure as their wives although they on average have a higher wage than their wives, especially among couples having no infant at home. Second, the calibrated relative home productivity of a husband's time without an infant at home, η_0, is close to 0.5, which means that the husband's time and the wife's time are almost equally productive in home production when they do not have an infant at home. The ratio of the husband's home productivity to the wife's is $\eta_0/(1-\eta_0) = 0.96$. The calibrated value is similar to the value in Knowles (2013).

In contrast, the calibrated relative home productivity with an infant at home shows a stark gender difference. The ratio of husband-to-wife's home productivity $\eta_1/(1-\eta_1) = 0.36$. That is, when a newborn child is born, the husband's time is much less productive in home production than the wife's time. In addition to the parameters in transition probabilities of human capital, this parameter influences the accumulation of human capital for mothers through career interruptions due to motherhood.

Figure 3: Average Time Allocation on Home Production by Number of Children

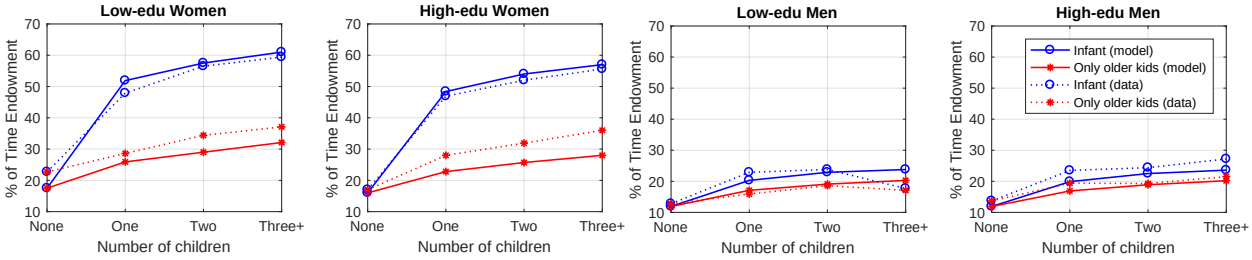
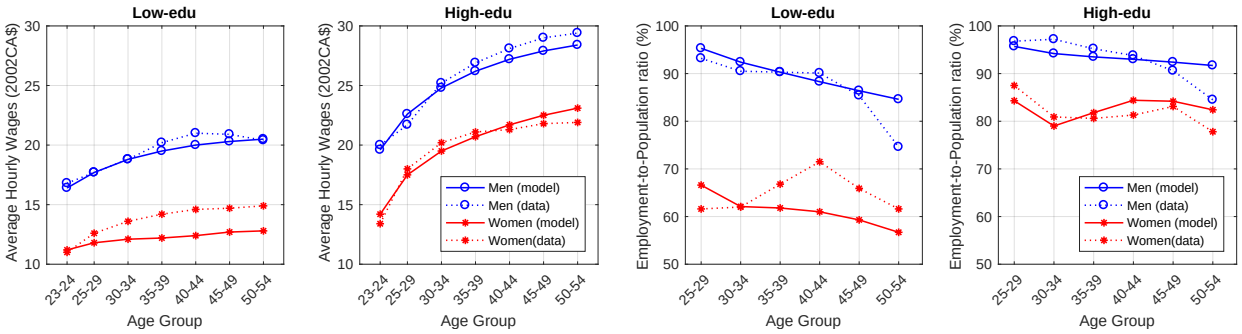


Figure 4: Age Profiles of Hourly Wages and Employment Rates



(a) Hourly Wages (b) Employment Rates

While gender differentials in rental rates are externally determined, the remaining gender differences in the calibrated transitional probabilities of human capital determine gender differences in the evolution of human capital. Among the high-educated, the calibrated values of the probability of human capital accumulation show almost no difference. Husbands' expected return from full-year full-time employment are almost the same as wives' return: $\psi_h^{hi}/\psi_w^{hi} = 0.98$. In contrast, the calibrated values for the probability of human capital depreciation show a large difference. In particular, the parameters imply that husbands face higher wage penalties than wives do for taking time off. For the high-educated, husbands have a wage penalty 175% higher than wives do: $\delta_h^{hi}/\delta_w^{hi} = 2.75$. This result is qualitatively consistent with the empirical evidence demonstrated in Section 2 and the findings in Albrecht et al. (1999). Although my model abstracts from career choices, I can relate this gender difference to the gender difference in career choices. The calibrated parameter values are consistent with the findings that because of potential time off for children, women choose occupations with low skill depreciation (Polachek, 1981; Adda, Dustmann, and Stevens, 2017).

5 Explaining the Gender Gap in the Use of Parental Leave

In this section, I conduct counterfactual exercises to decompose the division of paid parental leave into the different explanations. Among the various gender differences featured in the calibrated model, I focus on those in 1) preferences for leisure, 2) relative home productivity with an infant, 3) rental rates of human capital, 4) probabilities of an increase in human capital, and 5) probabilities of a decrease in human capital. First, I describe the take-up behaviour of married couples when men and women are symmetric. Second, I quantify the contributions of the above gender differences to the gender gap in the take-up rates. Third, I examine the interactions among these explanations.

5.1 Take-up behaviour when all gender differences are removed

In this symmetry scenario, all the gender differences in the model are removed.[33] I present two scenarios of eliminating gender differences: 1) when everyone has men's parameter values and 2) when everyone has women's parameter values.[34] Compared to the second scenario, in the first scenario married couples have higher household incomes and put more emphasis on leisure. Also, both husbands and wives have a higher probability of a decline in human capital when taking time off work.

Table 8 shows that, for both scenarios, the gender gap in take-up rates is almost closed. However, the two scenarios show different patterns. First, take-up rates of fathers and mothers converge to different values. Both fathers' and mothers' take-up rates are higher in the second scenario. Among the high-educated, the take-up rates of fathers and mothers converge to around 50% when women have men's values, while they converge to around 62% when men have women's values. Second, the two scenarios show differences in the sum of husbands' and wives' take-up rates. When everyone has men's values, the sum is less than or just above 100%, whereas in the other scenario the sum exceeds 100%. This pattern implies that in the first scenario many couples choose to have only one spouse use parental leave or to leave parental leave on the table, compared to the second scenario.

The divergence between the two scenarios is mainly due to differences in probabilities of human capital depreciation. When everyone has the men's values for the probabilities of human capital depreciation, wage penalties for taking time off work are high for both fathers and mothers. The high dynamic costs of taking time off work lead to fewer parents taking parental leave to avoid a fall in human capital. In a scenario where everyone has equal home productivity, women's values for the probabilities of human capital depreciation, and men's values for the remaining parameters, take-up rates converge to values that are higher than when everyone has men's values

[33] In addition to the five listed before, these also include relative home productivity with no infant at home, education premium, educational composition, and initial human capital gained from market experience due to the average age gap within a couple.

[34] I have the baseline policy of maternity and parental leave unchanged for these counterfactuals.

Table 8: Take-up Rates When All Gender Differences Are Removed

	Benchmark		1) Women's values		2) Men's values	
Educational type	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers
Individual type						
Low	11.4	93.4	60.3	57.1	69.5	65.4
High	10.2	93.4	50.8	49.8	60.2	64.6
Household type						
(lo, lo)	6.8	93.5	46.2	46.0	51.7	51.3
(lo, hi)	14.1	89.9	72.3	28.2	83.8	36.7
(hi, lo)	6.4	93.2	27.2	73.2	27.4	85.6
(hi, hi)	11.0	95.3	56.8	59.4	68.2	76.9

for all parameters.[35]

One thing to note is that even when a husband and wife have the same educational attainment, especially when both spouses are high-educated, the wives' take-up rate is still higher than the husbands' take-up rate. The remaining gap in the take-up rates is explained by a gender difference embodied in the baseline parental leave policy. The maximum durations of parental leave available to a father and a mother are different due to maternity leave. I explore alternative gender-neutral parental leave policies in Section 6.

5.2 Decomposition

To quantify the roles of the possible explanations I consider, I examine each explanation separately. Table 9 shows results from the decomposition analysis. The first two columns report the take-up rates in the benchmark economy and in the symmetric economy where everyone has men's values from Section 5.1. Column (3) displays the changes in take-up rates from the benchmark to the symmetric economy. The changes are decomposed into five possible factors. In particular, I let women have men's parameter values for the explanation under consideration and leave the other parameters the same as in the benchmark. An exception is relative home productivity. Due to the specification of the home production technology, relative home productivity is set to $1/2$ when both men and women are equally productive. Given a change in a parameter specification, I then simulate the take-up behaviour of married couples and calculate the percentage of the change that is narrowed for each explanation. Each cell in columns (4) to (8) presents a simulated take-up rate and in parentheses a percentage of the change in column (3) that is accounted for by each possible explanation for education groups. The last two rows report gender differences in the take-up rates for each education group. Panels (a) and (b) show the results by individual educational type and by household educational type, respectively.

First, I examine the role of relative home productivity in the presence of an infant at home. The calibrated value of η_1 implies the ratio of husbands' to wives' productivities, $\eta_1/(1-\eta_1)$, equals 0.35. I eliminate the gender difference in relative home productivities by setting $\eta_1 = 0.5$ so that

[35] See Table A15 in the Appendix.

Table 9: Decomposition of the Gender Gap in Take-up Rates

(a) Take-up Rates by Individual Educational Type (%)

	Benchmark	All Removed*	Change (2)-(1)	Home Productivity (Infant), η_1	Rental Rates of Human Capital, μ	Prob. a Fall in Human Capital, δ^ϵ	Prob. a Rise in Human Capital, ψ^ϵ	Weight on Leisure, γ
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fathers' take-up rates (%)								
Low-edu (a)	11.4	60.3	48.9	28.8(35.7%)	19.6(16.8%)	15.6(8.7%)	12.0(1.3%)	10.1(-2.6%)
High-edu (b)	10.2	50.8	40.6	28.8(45.9%)	17.7(18.4%)	13.5(8.0%)	10.3(0.1%)	8.5(-4.1%)
Mothers' take-up rates (%)								
Low-edu (c)	93.4	57.1	-36.3	89.0(12.0%)	92.4(2.7%)	89.9(9.5%)	92.3(3.1%)	93.3(0.2%)
High-edu (d)	93.4	49.8	-43.6	81.7(26.9%)	87.8(12.9%)	85.5(18.2%)	93.3(0.4%)	95.3(-4.2%)
Gender differences (%p)								
Low-edu (c)-(a)	82.0	-3.2	-85.2	60.2(25.6%)	72.8(10.8%)	74.3(9.1%)	80.3(2.1%)	83.2(-1.4%)
High-edu (d)-(b)	83.2	-0.9	-84.2	52.9(36.0%)	70.2(15.5%)	72.1(13.3%)	83.0(0.2%)	86.8(-4.2%)

(b) Take-up Rates by Household Educational Type (%)

	Benchmark	All Removed*	Change (2)-(1)	Home Productivity (Infant), η_1	Rental Rates of Human Capital, μ	Prob. a Fall in Human Capital, δ^ϵ	Prob. a Rise in Human Capital, ψ^ϵ	Weight on Leisure, γ
(ϵ_h, ϵ_w)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(lo, lo)								
Husband (a)	6.8	46.2	39.5	11.2(11.1%)	8.8(5.1%)	7.8(2.5%)	7.8(2.7%)	6.9(0.4%)
Wife (b)	93.5	46.0	-47.5	88.4(10.8%)	91.7(3.7%)	88.8(9.9%)	92.0(3.1%)	93.5(-0.1%)
(lo, hi)								
Husband	14.1	72.3	58.2	40.0(44.4%)	26.9(21.9%)	20.5(10.9%)	14.5(0.7%)	12.0(-3.6%)
Wife	89.9	28.2	-61.7	70.7(31.1%)	77.8(19.7%)	78.7(18.1%)	90.1(-0.3%)	93.4(-5.7%)
(hi, lo)								
Husband	6.4	27.2	20.8	9.5(15.1%)	7.5(5.2%)	6.2(-0.9%)	7.1(3.4%)	6.0(-1.8%)
Wife	93.2	73.2	-20.0	90.2(14.9%)	93.6(-2.1%)	92.2(4.9%)	92.7(2.4%)	92.9(1.5%)
(hi, hi)								
Husband (c)	11.0	56.8	45.7	32.8(47.6%)	19.8(19.2%)	14.9(8.5%)	10.9(-0.3%)	9.1(-4.3%)
Wife (d)	95.3	59.4	-35.9	87.4(22.0%)	92.9(6.9%)	89.2(17.1%)	95.0(1.0%)	96.3(-2.8%)
Gender differences (%p)								
(lo, lo) [(b)-(a)]	86.7	-0.3	-87.0	77.2(11.0%)	82.9(4.4%)	81.0(6.5%)	84.2(2.9%)	86.6(0.1%)
(hi, hi) [(d)-(c)]	84.3	2.7	-81.6	54.6(36.3%)	73.1(13.8%)	74.2(12.3%)	84.1(0.3%)	87.3(-3.6%)

Values in parentheses present percentages of the change in column (3) that is explained by each gender difference in columns (4) to (8).
* In column (2) everyone has men's parameter values, except the maximum durations of leave available to mothers and fathers due to maternity leave.

$\eta_1/(1-\eta_1) = 1$. Among the five factors considered, this factor results in the largest changes in both fathers' and mothers' take-up rates. Fathers' take-up rate increases from the benchmark from 10% to 29% for the low-educated and from 11% to 29% for the high-educated. At the same time, mothers' take-up rate decreases from 93% to 82% for the high-educated. The largest proportion of the change in take-up rates is explained by this factor. In particular, among the high-educated, this factor accounts for 46% of the change for fathers and 27% of the change for mothers. Also, this factor makes up about 36% of the overall gender gap among the high-educated (column (4), row (6)).

Couples with a high-educated wife contribute greatly to the significant changes in the take-up behaviour (Panel (b)). When husbands and wives become equally productive in the presence of an infant, the take-up rate of husbands with a high-educated wife increases from 14% to 40% for the low-educated and from 11% to 33% for the high-educated. These changes make up about half of the change in column (3) for these husbands. For high-educated wives, a resulting decrease in their take-up rate explains a third and a fifth of the change for those with a low-educated husband and with a high-educated husband, respectively. Among these couples, removing the gender difference in η_1 accounts for 36% of the overall gender gap in take-up rates.

It is noteworthy that when I condition on the wife's educational attainment, the husbands' take-up rate does not show significant variation given their own educational attainment. In other words, in terms of husbands' take-up rate, their wives' educational attainment is the first-order determinant, and their own educational attainment is the second-order determinant. This result remains the same in other columns as well.

Gender differentials in rental rates explain the second largest proportion of the change in the take-up rates for fathers (column (5)). When these differentials are removed, high-educated mothers draw a rental rate from a distribution with a higher mean than that in the benchmark. It implies that now mothers have a higher opportunity cost of taking time off work. As a result, slightly fewer high-educated mothers take parental leave. The reason why the change in their take-up rate is small is that their husbands, who are mostly high-educated, are still more likely to have higher hourly wages because of age differences between a husband and wife. In contrast, husbands' take-up rates considerably increase in reaction to the change. In particular, the interaction within married couples is strong among couples with a high-educated wife and husband. While wives' take-up rate barely decreases, an increase of their high-educated husbands' take-up rate makes up one fifth of the change for the husbands.

The third most significant contributor is gender differences in the probability of human capital depreciation. Column (6) reports how take-up behaviour reacts to making mothers face as a high probability of losing human capital as fathers do. In this scenario, mothers face a probability more than twice as high as in the benchmark. This change causes significant reactions of fathers' take-up behaviour to the change. Because of higher wage penalties for taking time off, the mothers's take-up rate falls to 90% for the low-educated and 86% for the high-educated. In reaction to the changes in wives' take-up behaviour, the husbands' take-up rate slightly increases. As in columns (4) and

(5), couples with a high-educated wife contribute greatly to the significant changes in husbands' take-up rates. The husbands' take-up rate increases from 14% to 20% for the low-educated and from 11% to 15% for the high-educated.

One thing to note is that in terms of absolute values the decrease in high-educated wives' take-up rate is greater than the increase in their husbands' take-up rate. This pattern implies that some couples substitute a mother with a father or even give up using paid parental leave because increasing the dynamic cost of mothers taking time off work makes taking parental leave too costly for these couples. If instead, fathers have low probabilities of losing human capital similar to mothers, mothers' take-up behaviour barely changes while fathers' take-up rates almost double. In this case, this explanation accounts for the second largest proportion of the gender gap in the take-up rates.

Lastly, eliminating the gender differences in probabilities of human capital growth and in preferences for leisure has very small impacts on take-up rates. However, it is noteworthy that when the weight on a wife's leisure is raised to the level of the weight on a husband's leisure, the gender gap in the take-up rates widens. Because a couple gains more utility from a wife's leisure time compared to the benchmark, more couples choose to have a wife use parental leave. Among high-educated couples, while the wives' take-up rate goes up, their high-educated husbands' take-up rate goes down. That is, some of these couples switch the parent in charge of caring for their baby from husband to wife.

5.3 Interactions among explanations

The above results indicate that gender differences in relative home productivity, rental rates of human capital, and the probability of a decline in human capital are the more influential determinants of the gender gap in the take-up rates of parental leave among the explanations I consider. Clearly none of the explanations can fully explain the gender gap in parental leave take-up. In the following exercises, I examine interactions among these three explanations by removing two or more differences simultaneously. I show three combinations of the three explanations in Table 10.

First, gender differences in relative home productivity and the means of rental rates are simultaneously removed (column (4)). The percentage of the change explained by combining these two factors is greater than the sum of the percentages explained by each factor. This implies a large positive interaction between the two factors. Because a husband and wife become equally good at home production in the presence of an infant and their wages become similar, comparative advantage and specialization between a husband and wife become substantially weaker than in the benchmark. Due to weak specialization, a higher fraction of married couples choose to have a husband at home with a newborn child. Among the four household educational types, the positive interaction is larger among couples with a high-educated wife.

Next, I remove the gender difference in the probability of human capital depreciation, which is related to the dynamic costs of taking parental leave (column (6)). Combining the probability of human capital depreciation and the two other explanations exhibits a large positive interaction.

For high-educated people, combining these three explanations accounts for more than 100% of the gender gap in take-up rates. That is, high-educated fathers' take-up rate exceeds high-educated mothers' take-up rate. The reason for this pattern is that, given the gender parity in the three major factors, the remaining gender differences make parental leave more favorable to a father in some couples.

Table 10: Interactions among Explanations

(a) Take-up Rates by Individual Educational Type (%)

	Benchmark	All Removed	Change (2)-(1)	$\eta_1 + \mu$	$\eta_1 + \delta$	$\eta_1 + \mu + \delta$
	(1)	(2)	(3)	(4)	(5)	(6)
Fathers' take-up rates (%)						
Low-edu (a)	11.4	60.3	48.9	43.3(65.4%)	37.4(53.2%)	51.1(81.3%)
High-edu (b)	10.2	50.8	40.6	46.0(88.3%)	37.2(66.4%)	54.9(110.2%)
Mothers' take-up rates (%)						
Low-edu (c)	93.4	57.1	-36.3	83.1(28.4%)	82.0(31.3%)	70.5(62.9%)
High-edu (d)	93.4	49.8	-43.6	65.8(63.3%)	62.0(72.1%)	43.0(115.7%)
Gender differences (%p)						
Low-edu (c)-(a)	82.0	-3.2	-85.2	39.7(49.6%)	44.7(43.8%)	19.4(73.4%)
High-edu (d)-(b)	83.2	-0.9	-84.2	19.8(75.4%)	24.9(69.3%)	-11.9(113.0%)

(b) Take-up Rates by Household Educational Type (%)

	Benchmark	All Removed	Change (2)-(1)	$\eta_1 + \mu$	$\eta_1 + \delta$	$\eta_1 + \mu + \delta$
(ϵ_h, ϵ_w)	(1)	(2)	(3)	(4)	(5)	(6)
(lo, lo)						
Husband (a)	6.8	46.2	39.5	19.1(31.2%)	14.4(19.2%)	24.8(45.6%)
Wife (b)	93.5	46.0	-47.5	80.1(28.3%)	78.9(30.7%)	65.3(59.3%)
(lo, hi)						
Husband	14.1	72.3	58.2	61.5(81.4%)	52.0(65.1%)	71.1(97.9%)
Wife	89.9	28.2	-61.7	47.8(68.2%)	48.4(67.2%)	27.6(100.9%)
(hi, lo)						
Husband	6.4	27.2	20.8	14.9(41.1%)	10.3(18.8%)	18.2(56.8%)
Wife	93.2	73.2	-20.0	88.4(24.0%)	88.0(25.7%)	80.4(64.0%)
(hi, hi)						
Husband (c)	11.0	56.8	45.7	52.7(91.2%)	42.9(69.6%)	62.7(113.0%)
Wife (d)	95.3	59.4	-35.9	74.7(57.4%)	69.2(72.8%)	50.6(124.5%)
Gender differences (%p)						
(lo, lo) [(b)-(a)]	86.7	-0.3	-87.0	61.0(29.6%)	64.5(25.5%)	40.5(53.1%)
(hi, hi) [(d)-(c)]	84.3	2.7	-81.6	22.0(76.3%)	26.3(71.1%)	-12.1(118.1%)

Values in parentheses present percentages of the change in column (3) that is explained by each column. Parameter η_1, μ, and δ_i denote relative home productivity in the presence of an infant, means of rental rates, and probabilities of a fall in human capital, respectively.

6 Policy Experiments

In this section, I explore the role of paid parental leave policies in the division of parental leave within married households. Specifically, I study the role of gender differences in paid parental leave policy and the role of cash benefits, especially income replacement rates. Then, based on the lessons from this analysis, I explore various paid parental leave policies to increase fathers' participation in parental leave.

6.1 Role of Gender Difference in Parental Leave Policy

The baseline policy in the benchmark economy embodies a gender difference in maximum lengths of parental leave available to a mother and a father. While a mother can use at most 52 weeks of parental leave including maternity leave, a father can use at most 35 weeks of parental leave. To explore the role of gender differences in parental leave policy, I consider three alternative parental leave policies. They feature a smaller or no gender difference in maximum lengths of parental leave while keeping the total number of weeks of leave available to a couple the same as the baseline policy.

First, I consider a policy featuring a short paternity leave of 6.5 weeks with 17 weeks of maternity leave and a total of 52 weeks of leave available to a couple. Although this policy still has a gender difference in the maximum durations, it provides non-transferable leave to fathers as well.[36] The other two alternative policies feature an equal number of weeks available to a mother and father. In that sense, these two policies are gender neutral. One policy includes an equal length of maternity and paternity leave. I let both the mother and the father have 17 weeks of non-transferable leave. The maximum durations of leave available to a mother and a father are the same at 35 weeks.[37] The other policy allows a couple to share all 52 weeks at their discretion.[38] Under this policy, their maximum durations are the same at 52 weeks.

Table 11 demonstrates two sets of simulated take-up rates. In these simulations, the income replacement rate and the maximum insured earnings remain the same as the baseline policy. The first set of take-up rates are from the policy experiments with the calibrated parameter values, and the other set of take-up rates are from the policy experiments with all gender differences removed. Statistics in the first row with the baseline policy are the same as those in columns (1) and (2) of Table 9, and the remaining rows report the statistics from policy experiments.

The results with the calibrated parameter values show only small changes in take-up rates in response to changes in parental leave policies. The main reason for this result is that the intro-

[36] In the simulations, fathers choose a duration of parental leave from the menu of 0, 6.5, 17, 26, and 35 weeks, and mothers choose it from the menu of 0, 6.5, 17, 26, 35, and 45.5 weeks. The sum of the mother's and father's durations cannot be more than 52 weeks. As in the benchmark economy, assuming that a mother and father use parental leave sequentially, I let the reduction in market childcare costs be proportional to the sum of the mother's and father's durations.

[37] In the simulations, both the husband and wife choose a duration of parental leave from the menu of 0, 6.5, 17, 26, and 35 weeks.

[38] In the simulations, both a husband and wife choose a duration of parental leave from the menu of 0, 6.5, 17, 26, 35, 45.5, and 52 weeks, keeping the sum of their durations less than or equal to 52 weeks.

Table 11: Take-up Rates under Alternative Policies (%)

(a) With the Calibrated Parameter Values

	Fathers		Mothers	
	Low	High	Low	High
(1) Baseline Policy	11.4	10.2	93.4	93.4
(2) Short Paternity Leave	12.1	11.8	93.1	93.2
(3) Equal Mat./Pat. Leave	12.5	12.6	93.3	93.4
(4) All Shareable Par. leave	11.7	10.3	93.4	92.8

(b) With All Gender Differences Removed

	Individual				Household (Husband's, Wife's)							
	Fathers		Mothers		(lo, lo)		(lo, hi)		(hi, lo)		(hi, hi)	
	Low	High	Low	High	Husb.	Wife	Husb.	Wife	Husb.	Wife	Husb.	Wife
(1) Baseline Policy	60.3	50.8	57.1	49.8	46.2	46.0	72.3	28.2	27.2	73.2	56.8	59.4
(2) Short Paternity Leave	60.6	52.4	56.2	49.7	47.2	46.0	72.2	28.4	29.5	71.3	58.2	59.2
(3) Equal Mat./Pat. Leave	60.5	52.9	57.2	49.8	47.0	46.4	72.0	28.4	29.0	73.1	59.0	59.3
(4) All Shareable Par. leave	59.9	50.3	56.8	47.4	46.1	46.5	71.9	26.6	26.9	72.1	56.3	56.6

duction of paternity leave does not provide most couples with enough incentive to change in the environment where specialization within married couples with an infant is strong.

When all 52 weeks are shareable and all gender differences are removed, the high-educated mothers' take-up rate is lower than in the case with the baseline policy. Specifically, among high-educated couples, wives' take-up rate decreases while husbands' take-up rate remains unchanged. This means that in some couples a high-educated wife uses maternity leave because the time is not transferable to her husband under the baseline policy. When all leave is shareable, those couples choose to have a wife stay at work and her for husband take longer parental leave.

To sum up, some couples' choices are constrained by the baseline parental leave policy. The introduction of a gender-neutral policy leads to small increases in fathers' take-up of parental leave. However, the small changes are in contrast to evidence from the countries and states which have introduced paid paternity leave, as they show much higher take-up rates of fathers. For example, after Québec introduced paid paternity leave in 2006, fathers' take-up rate increased from 28% in 2005 under EI to 56% in 2006 and 78% in 2014 (Leave Network 2010, 2016).[39] A key feature of paid parental leave policies in these places is higher cash benefits, especially higher income replacement rates. For example, during parental leave parents in Québec and Sweden are paid 70-75% and 80% of their pre-birth income, respectively. I examine the role of cash benefits in the following section.

[39]These statistics from Leave Network are unconditional on eligibility (Leave Network 2010, 2016).

Table 12: Take-up Rates by Income Replacement Rate

	(a) Baseline Policy						(b) Short Paternity Leave					
	Fathers (F)		Mothers (M)		Gap (M-F)		Fathers (F)		Mothers (M)		Gap (M-F)	
Replacement rate ρ	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Baseline rate=0.55	11.4	10.2	93.4	93.4	82.0	83.2	11.4	10.2	93.4	93.4	82.0	83.2
0.01	10.9	8.7	89.0	85.5	78.2	76.9	11.1	8.5	89.0	85.6	77.9	77.1
0.33	10.7	9.4	91.9	90.3	81.1	80.9	11.0	9.5	91.8	90.2	80.8	80.7
0.70	11.2	11.2	94.6	96.5	83.3	85.3	13.6	15.9	95.1	96.4	81.5	80.5
0.85	12.5	13.8	96.1	97.7	83.6	83.9	16.1	21.9	96.3	97.8	80.2	75.9
1.00	13.9	17.0	97.0	98.9	83.1	81.9	19.9	29.3	96.8	98.8	77.0	69.5

"High" denotes the high-educated who are college graduates. "Low" denotes a lower education level.

6.2 Cash Benefits

In this subsection, I explore the role of cash benefits in the division of parental leave within married households. Under the baseline policy, parental benefits replace the pre-birth earnings at the baseline rate of 55% with a weekly cap. Those who earn more than $39,000 a year receive the capped amount of weekly benefits. Thus, a worker who uses parental leave loses at least 45% of earnings every week on leave. Such income losses could be critical to their decisions regarding parental leave. Because in many couples a husband usually outearns his wife, the amounts of parental benefits may be too low for a couple to have a husband take parental leave. Taking the maximum insurable earnings of $39,000 a year as given, I explore five different levels of income replacement rates, denoted by ρ.[40]

Table 12 displays take-up rates from simulations with income replacement rates of 1%, 33%, 55%, 70%, 85%, and 100%. Panel (a) reports the statistics from simulations with the durations of maternity and parental leave the same as the baseline policy. Panel (b) reports the same statistics from simulations under an alternative parental leave policy with short paid paternity leave as in the preceding subsection.

The case of $\rho = 0.01$ is close to unpaid parental leave. When a worker is barely paid during parental leave, slightly fewer parents take parental leave for all subgroups while the overall division of parental leave remains more or less the same as in the benchmark. Although parental leave is almost unpaid, many mothers still use it, but for a shorter period. Under the baseline policy, 92% of mothers use parental leave for more than 40 weeks. Under unpaid parental leave, 89% of low-educated mothers use parental leave, on average, for 33 weeks, and 85% of high-educated mothers do so, on average, for 29 weeks. Given the gender differences in the benchmark economy, once a couple has a newborn child, a mother is much more likely to be the parent who specializes in home production.

In contrast, when parents receive 100% of their pre-birth earnings, take-up rates go up for all subgroups. Mothers' take-up rates become close to 100%, and fathers' take-up rates increase by

[40] Because the maximum insurable earnings are fixed at $39,000, as the income replacement rate increases, the maximum weekly benefit amount increases proportionally.

22% to 14% for the low-educated and by 62% to 17% for the high-educated. Because increasing a replacement rate does not change the comparative advantages between a husband and wife, mothers are still much more likely to take parental leave than fathers.

In terms of percentage changes in take-up rates, the change is greatest among high-educated fathers. Even though they are more likely to earn more than the threshold amount, among all subgroups, they gain the most benefits from a fully paid parental leave policy because their earnings are the highest. Also, compared to low-educated fathers, they are more likely to have a high-educated wife. Fathers with a high-educated wife are more responsive to changes in income replacement rates.[41] As more fathers use parental leave even for a short period, the average duration of fathers' use becomes shorter than in the benchmark.

In the simulations for panel (b), an eligible father has an option of taking 6.5 weeks off or leaving it on the table, reducing the maximum duration of shareable parental leave by 6.5 weeks. In this case, fathers' take-up behaviour becomes more responsive to changes in income replacement rates than under the baseline policy. Under a parental leave policy with short paternity leave, an increase of the income replacement rate from the baseline rate to 100% results in a 75% increase to 20% for the low-educated and a 187% increase to 29% for the high-educated. Meanwhile, mothers' take-up rates remain the same as with Table 12.

To sum up, providing greater financial incentives through an increase in the income replacement increased both mothers' and fathers' take-up rates. In addition, the results showed that when increasing the income replacement rate is combined with introducing short paternity leave, an increase in fathers' take-up rates becomes more responsive to an increase in the income replacement rate. In particular, high-educated fathers are more responsive to these changes than others.

6.3 Parental Leave Policies to Increase Fathers' Take-up of Leave

An aim of sharable parental leave is to provide fathers the option to be more involved in caring for new babies. However, the take-up rate of fathers remains low even after parental leave was extended. Putting the findings in the two preceding subsections together, I conduct policy experiments to increase fathers' take-up of parental leave. I set a target for fathers' take-up rates and explore various combinations of durations and replacement rates that can achieve the target. Because high-educated fathers are more responsive to policy changes, I set the target of high-educated fathers' take-up rate to be 20%. This target is almost twice the rate in the benchmark economy. In the experiments, I also consider policies that provide different replacement rates among maternity, paternity, and shareable parental leaves and between fathers and mothers. As before, the maximum insured earnings remains the same as in the benchmark policy. I compare the policies that meet the target in terms of their monetary costs by looking at percentage changes in aggregate parental benefit expenses from the benchmark economy. Also, I look at changes in the amount of time newborn children spend with their parents during the first year of their life.

[41] See Table A18b.

Table 13: Policy Experiments

Duration type &	Take-up rates				% changes in aggregate			Changes in full-time care		
	Fathers		Mothers		parental benefit expenses†			for a baby (weeks)‡		
$(\rho_h^{pat}, \rho_w^{mat}, \rho_h^{par}, \rho_w^{par})$	Low	High	Low	High	Fathers	Mothers	Total	Fathers	Mothers	Total
Baseline durations										
$(-, 0.55, 0.90, 0.55)$	17	20	93	94	160.7	-1.7	12.2	1.5	-0.5	1.1
All Shareable Par. Leave										
$(-, -, 0.90, 0.55)$	17	20	93	93	188.9	-3.7	12.9	1.6	-0.5	1.1
Short Paternity Leave										
$(0.80, 0.80, 0.80, 0.80)$	15	20	96	97	83.4	45.4	48.6	0.7	-0.5	0.2
$(0.80, 0.80, 0.55, 0.55)$	16	20	95	97	35.6	11.4	13.5	0.5	-2.4	-2.0
$(0.80, 0.55, 0.55, 0.55)$	16	20	93	94	37.7	-11.0	-6.8	0.5	-3.1	-2.6
Equal Mat./Pat. Leave										
$(0.76, 0.76, 0.76, 0.76)$	16	20	95	97	76.0	12.5	18.0	0.8	-4.7	-4.0
$(0.76, 0.76, 0.55, 0.55)$	16	20	95	97	57.5	-4.6	0.8	0.7	-5.5	-4.8

$(\rho_h^{pat}, \rho_w^{mat}, \rho_h^{par}, \rho_w^{par})$ denotes replacement rates for paternity, maternity, and father's and mother's parental leaves, respectively. † compared to the aggregate budget in the benchmark economy. ‡ When a mother or father does not work during the period, their duration is counted as 52 weeks regardless of eligibility and take-up of leave. Otherwise, the choices of leave are used in the calculation.

In this set of simulations I take all the gender differences, including the three major contributors, in the benchmark economy as given. Table 13 summarizes the results.

I find that under a policy with baseline maximum durations, a parental leave policy to achieve the target needs to provide a higher replacement rate for fathers than for mothers. Without paternity leave, even applying a 100% replacement for all does not meet the target (Table 12). When the replacement rate for mothers remains at the baseline rate of 55%, the replacement rate for fathers must be at least 90%. The higher replacement rate for fathers is necessary to increase the husband's marginal benefit of taking leave relative to the wife's marginal benefit. Compared to the benchmark, this policy increases aggregate EI spending by 12%.[42] Children spend more time with their fathers. On average, children receive 1.5 more weeks of full-time care from their father. Although they spend less time with their mother, overall, they receive 1.1 more weeks of full-time care from parents. A drawback of this policy is that it may not be politically viable.[43]

As mentioned above, a combination of introducing paternity leave and raising replacement rates for all can increase fathers' take-up rates. However, this policy is costly. The replacement rate of 80% increases high-educated fathers' take-up rates to 20%. The policy costs about 1.5 times the benchmark aggregate spending. This policy might be unaffordable without a large increase in the EI premium.[44]

[42] In these policy experiments, neither general equilibrium effects nor effects on education, occupation, marriage, and fertility choices are taken into consideration.

[43] However, considering a gender-based public policy is not unusual in economics. Gender-based taxation has been studied in the optimal taxation literature. Alesina, Ichino, and Karabarbounis (2011) argue that because women's labour supply is more elastic due to higher male wages and higher female home productivity, imposing higher marginal tax rates on men is optimal.

[44] Because the experiments here do not mandate balanced EI budget, the indirect effect of increasing replacement rates on labour supply decisions through an increase in the EI premium is not included in this analysis.

A more affordable option is to increase replacement rates only during non-transferable leaves. For example, increasing the replacement rate to 80% only during paternity leave doubles high-educated fathers' take-up rate, while it requires less aggregate spending than the benchmark level. Increasing a replacement rate during paternity leave even to 100% costs less by 3% than the benchmark policy, while high-educated fathers' take-up rate is tripled to 30%. The reason for the reduction in aggregate EI spending is that almost all mothers receive parental benefits for shorter periods while a fraction of fathers receive parental benefits.

Finally, a policy that offers higher replacement rates during maternity and paternity leaves may be politically viable and an affordable option to increase fathers' take-up of leave. Combined with a short paternity leave, providing 80% of income replacement during maternity and paternity leaves increases high-educated fathers' take-up rates to 20%. Implementing this policy implies a 13.5% increase in aggregate spending on parental benefits. Under a policy with an equal length of maternity and paternity leaves, a replacement rate of 76% achieves the target. This policy only increases aggregate spending by 1%. A caveat of these policies is that the average amount of time parents spend with their newborn child slightly declines. The policies with short paternity leave and with longer paternity leave reduce the number of weeks parents provide full-time care during the first year of their child's life by 2 and 5 weeks, respectively. This is because many fathers do not use the non-transferable paternity leave, while many mothers who used to take a full year of leave now take shorter leaves.

Haas and Rostgaard (2011) compared parental leave policies and take-up from five Nordic countries. They suggest that introducing paternity leave is more important than generous compensation during paternity leave in promoting fathers' take-up of parental leave.[45] All five countries have income replacement rates that are higher than the Canadian benchmark policy. Based on my results from the policy experiments, I argue that fathers' take-up rates in the Nordic countries might not be as high as in the data if paternity leave is not accompanied with generous income replacement rates.

7 Conclusions

In this paper, I examine quantitatively the contribution of several possible explanations for the division of paid parental leave within married households in a life-cycle model of family labour supply. I document that despite its availability only a small fraction of married men use parental leave and demonstrate empirical evidence for explanatory factors to understand the low take-up rates of married men. Then, I calibrate a life-cycle model of family labour supply that features labour/leisure/home production choices and learning-by-doing human capital accumulation. In the quantitative analyses, I find that lower home productivity in the presence of an infant, higher rental rates of human capital, and higher wage penalties for not working for fathers than for moth-

[45] The five countries are Denmark, Finland, Iceland, Norway, and Sweden. Policies and fathers' take-up in 1998, 2007, and 2010 are compared.

ers are major contributors to the low take-up rates of fathers. Among high-educated people, the three gender differences account for about 36%, 15%, and 13%, respectively. Eliminating gender differences in the three factors results in fathers' take-up rate exceeding mothers' take-up rates among the high-educated. Also, I find that when increasing the income replacement rate is combined with introducing short paternity leave, an increase in fathers' take-up rates becomes more responsive to an increase in the income replacement rate.

This study is motivated by the low take-up rate of fathers even after parental leave was extended. The aims of the extension were to help working parents spend more time with their children for successful child development and to provide fathers the option to share more of the responsibilities of caring for babies. My findings suggest policies to achieve these goals. First, the policy experiments show that a combination of introducing paternity leave and offering higher replacement rates during maternity and paternity leaves is an effective way of promoting fathers' participation in parental leave. Despite a slight decrease in the total amount of time newborn children spend with their parents, this policy could increase fathers' take-up with a small increase in aggregate spending.

Further, the findings on the three major factors determining the low take-up rates of fathers have policy implications for fulfilling the goal of encouraging fathers to take parental leave. First, initiatives to reduce gender differences in the rental rates of human capital would increase fathers' take-up rates. In many countries, employment and pay discrimination by gender has been prohibited by law such as the Canadian Human Rights Act in Canada and the Equal Pay Act in the U.S. Although there has been a large increase in women's labour force participation and a decline in gender wage gaps over the past several decades, gender wage gaps still remain (Goldin, 2014).

Another key finding is that a large gender difference in home productivity with an infant is the most significant contributor to the division of parental leave. Eliminating the difference leads to a substantial increase in fathers' take-up rates. This finding implies that an initiative to improve men's skill in caring for a newborn child before their child is born can increase fathers' take-up rates. For example, parenting education for fathers may improve their parenting skill (Doherty, Erickson, and LaRossa, 2006). Early parenting education programs for new parents have a significant positive effect on parenting and child development (Pinquart and Teubert, 2010). Nonetheless, nearly all education programs about parenting primarily target mothers, and very few parent education programs are father-oriented (Matusicky and Russell, 2009; Gilmer et al., 2016).

Lastly, I find that men have a higher probability of human capital depreciation and that this probability matters for married couples' take-up decisions. The wage penalty for taking time off work may be partly because taking leave is perceived as signaling weak commitment to work (Wayne and Cordeiro, 2003). As statutory maternity leave reduced the motherhood penalty (Correll, 2013), providing statutory paternity leave may lessen the stigma effect of taking leave for fathers. We can anticipate a gradual increase in fathers' take-up rates in the long run due to the peer effects in taking paternity leave (Dahl, Løken, and Mogstad, 2014).

While this study demonstrates that the gender difference in wage penalties for not working is a

significant contributor to the low take-up of fathers, it still leaves some important areas for future research. In calibration, the probability of human capital depreciation is determined by the wage growth rates for those who have not worked for at least one year (full-year full-time equivalent) within five years. Only a few married men in my sample from SLID had such experience of non-employment. Therefore, the relative importance of the explanation may be due to selection based on unobserved heterogeneity, which is not considered in this paper. Although Albrecht et al. (1999) find that the negative effect of men's career interruptions is greater for parental leave than for unemployment using a rich data set from Sweden, this has not been studied in the Canadian context due to lack of data. It would be useful to examine gender differences in wage penalties for career interruptions using new administrative data in Canada.

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A Appendix

A.1 Empirical evidence

Table A1: Employment-to-population ratios (%) at age 23

	High-educated		Low-educated	
Employment	Men (M)	Women (W)	Men (M)	Women (W)
$\mathbb{1}\{n_i \geq 300\}$	98.3	83.5	95.8	54.3
$\mathbb{1}\{n_i \geq 1,560\}$	81.6	55.5	83.4	27.4
All year	71.8	61.9	71.5	33.2
Part-year or more	93.6	79.7	92.1	53.1
Ever in the year	98.8	90.1	97.2	58.3
Full-year full-time	63.3	47.8	67.0	24.7
Part- or full-year full-time	90.6	78.4	94.4	44.1

Annual hours worked is denoted by n_i. The first group is based on variable "alhrp28" for total hours paid all jobs during the reference year. The second group is based on variable "alfst28" for annual labour force status. The third group is based on variable "scsum28" for yearly summary of schedules of jobs during the reference year. Cross-sectional data from Survey of Labour Income Dynamics (2001-2010) are used for the calculation.

Table A2: Descriptive statistics of high-educated people's hourly wages at age 23

	Married			Any marital status		
	Men (M)	Women (W)	Ratio (W/M)	Men (M)	Women (W)	Ratio (W/M)
High-edu						
Median	15.3	12.5	.817	14.9	12.1	.812
Mean	17.1	13.5	.789	16.1	13.6	.845
S.D	8.9	5.1		7.5	6.3	
Low-edu						
Median	13.0	9.2	.708	12.3	9.6	.780
Mean	13.5	10.6	.785	13.4	10.8	.806
S.D	4.4	4.2		5.8	4.1	

Table A3: Descriptive Statistics

	All				Low-educated				High-educated			
	Male		Female		Male		Female		Male		Female	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
ln(Wage)	3.07	0.44	2.83	0.47	2.90	0.40	2.58	0.41	3.16	0.42	2.93	0.45
Age	38.9	6.57	38.3	6.75	39.1	6.80	39.5	6.67	38.5	6.44	37.8	6.72
Years of schooling	14.2	3.20	14.4	2.89	11.5	2.06	11.8	2.05	15.5	2.62	15.4	2.51
Education - 2	0.23	0.42	0.23	0.42								
Education - 3	0.41	0.49	0.42	0.49								
Education - 4	0.25	0.44	0.29	0.45								
Experience (years)	16.5	7.93	13.1	7.69	18.5	8.07	14.0	8.39	15.5	7.66	12.7	7.35
TimeOut1 (years)	2.49	4.49	3.51	5.93	2.99	4.91	5.53	7.56	2.23	4.24	2.68	4.88
TimeOut2 (years)	0.87	2.11	2.63	4.01	0.83	2.22	2.97	4.60	0.89	2.06	2.48	3.73
Number of children	1.51	1.10	1.48	1.07	1.55	1.13	1.52	1.07	1.49	1.09	1.46	1.07
Private sector	0.80	0.40	0.69	0.46	0.88	0.32	0.84	0.36	0.76	0.43	0.63	0.48
Number of obs.	35,826		36,692									

Source: Survey of Labour Income Dynamics, 2001-2011 (Restricted Data).
Education is grouped into four categories: those who did not graduate high school (baseline group), high school graduates and college dropouts (Education-2), people with post-secondary certificates and university degrees below a bachelor's degree (Education-3), and those with a bachelor's degree or higher (Education-4). "High-educated" includes Education-3 and -4. "Low-educated" is its complement.

Table A4: Log wage regressions

Dependent variable	All		Low-edu		High-edu	
: ln(Wage)	Male	Female	Male	Female	Male	Female
Experience	0.0270	0.0272	0.0178	0.0163	0.0281	0.0274
	(22.75)	(26.06)	(9.04)	(9.31)	(17.36)	(19.57)
Experience$^2/10^3$	-0.5178	-0.5273	-0.2841	-0.1818	-0.6984	-0.7229
	(-15.59)	(-15.73)	(-5.40)	(-3.40)	(-14.83)	(-15.72)
TimeOut1	-0.0102	-0.0065	-0.0103	-0.0081	-0.0120	-0.0129
	(-18.79)	(-15.22)	(-12.78)	(-12.90)	(-15.64)	(-21.22)
TimeOut2	-0.0204	-0.0156	-0.0219	-0.0155	-0.0244	-0.0217
	(-21.13)	(-28.83)	(-14.38)	(-18.17)	(-18.61)	(-29.65)
Education - 2	0.0965	0.1606				
	(12.76)	(18.07)				
Education - 3	0.2299	0.2894				
	(12.76)	(33.51)				
Education - 4	0.5078	0.5862				
	(64.97)	(63.23)				
Number of children	0.0245	0.0064	0.0273	0.0143	0.0239	0.0006
	(12.90)	(3.34)	(9.15)	(4.26)	(9.16)	(0.22)
Private sector	-0.1249	-0.2599	-0.1384	-0.2816	-0.1670	-0.3172
	(-24.35)	(-58.19)	(-13.34)	(-29.05)	(-26.70)	(-60.04)
Constant	2.663	2.5012	2.8092	2.7027	3.076	3.0277
	(200.33)	(198.20)	(135.54)	(-29.05)	(224.93)	(289.34)
Adjusted R^2	0.2434	0.3575	0.1102	0.2056	0.1060	0.1964

t-statistics are in parentheses. Data is from Survey of Labour Income Dynamics, 2001-2010. The sample of interest is married people aged between 25 and 49 with paid employment who are not a student and do not have any disability in the reference year. Hourly wages are deflated to 2002 Canadian dollars.

A.2 Estimation of a fertility process

The probability of a birth shock, $\pi_b(t, k, a, x_w^{edu})$, is estimated using a logit model. The dependent variable is an indicator variable that is equal to one if a person has a newborn baby in the survey year. I estimate a logit regression of a birth as a function of a quadratic in a married woman's age, t, the number of children, k, and the age of youngest child, a, separately for each educational group. Married women between 23 and 42 years old in SLID between 2001 and 2010 are used as the sample of interest.

The estimates and the predicted probability of a birth shock by age of a mother, number of children, and age of the youngest child are displayed in Tables A6 and A7 in Appendix.

Table A5: Distribution of mothers by the number of children (%)

		At age 30		At age 35		At age 40	
	N. of kids	data	model	data	model	data	model
Low-educated	None	22.9	23.1	12.3	13.1	11.4	9.2
	One	23.9	19.0	17.5	20.7	19.4	22.4
	Two	34.5	35.5	43.2	39.0	42.5	40.3
	Three +	18.8	22.5	27.0	27.3	26.6	28.0
High-educated	None	40.1	36.7	17.5	17.8	14.6	12.0
	One	26.6	22.8	19.9	20.4	18.6	19.0
	Two	25.9	25.9	44.7	37.3	45.1	41.7
	Three +	7.4	14.6	17.8	24.4	21.7	27.3

Given the estimated processes of a birth shock, the transitional probabilities between fertility stages, π_f and π_{post}, are determined by minimizing the sum of squared errors between the simulated and empirical distributions of mothers by their age and the number of children in Table A5. The simulated distribution is generated by simulating birth histories of married women using the estimated birth shock process and the empirical distribution of married women at age 23 by children characteristics (Table A8 in Appendix). In the simulation, whereas 23-year-old women with children start in the fertile stage, childless women begin in the pre-fertile stage. The transitional probabilities are also estimated separately for each educational group. The estimated probability π_f implies that high-educated women who were childless at age 23 do not consider having a child on average until 3.6 years later, and low-educated women wait on average for 2.4 years. In Canada, the average age of first-time mothers between 2001 and 2011 is 28 years old[46]. The estimated probability π_{post} implies that, on average, high-educated women choose to have no more child at an earlier age than low-educated women do.

The specification of the logit model for the probability of the birth shock:

$$\begin{aligned} Pr(birth = 1) = \Lambda\Big(&\beta_0 + \beta_1 age + \beta_2 age^2 \\ &+ \beta_3 \mathbb{1}\{k = 1, a = 1\} + \beta_4 \mathbb{1}\{k = 1, a = 2\} + \beta_5 age \times \mathbb{1}\{k = 1, a = 2\} \\ &+ \beta_6 \mathbb{1}\{k = 2, a = 1\} + \beta_7 \mathbb{1}\{k = 2, a = 2\} + \beta_8 age \times \mathbb{1}\{k = 2, a = 2\}\Big), \end{aligned}$$

where $\Lambda(\cdot)$ denotes the logistic function.

[46] Author's own calculation using the raw data from "Fertility:Fewer children, older moms" http://www.statcan.gc.ca/pub/11-630-x/11-630-x2014002-eng.htm

Table A6: Estimates for the probability of having a newborn baby

	β_0	β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8
Low-educated	-12.866	7.573	-1.281	-.104	4.430	-1.297	-.878	3.623	-1.435
s.e.	. 1.931	1.259	.203	.228	.730	.244	.307	.880	.284
High-educated	-16.874	10.003	-1.636	-.602	2.858	-.638	-1.584	3.495	-1.274
s.e.	1.327	.845	.134	.142	.492	.155	.214	.782	.239

Table A7: Predicted probability of a birth, $\hat{\pi}_b(t, k, a, x_w^{edu})$, (unit: %)

		Mother's age									
		24	26	28	30	32	34	36	38	40	42
Low-educated	$k=0$	11	14	15	16	15	13	10	7	4	3
	$k=1, a=1$	10	13	14	14	14	12	9	6	4	2
	$k=1, a=2$	32	31	29	24	19	13	8	4	2	1
	$k=2, a=1$	5	6	7	7	7	6	4	3	2	1
	$k=2, a=2$	13	13	11	9	6	4	2	1	1	0
High-educated	$k=0$	9	13	16	17	17	14	11	8	5	2
	$k=1, a=1$	5	7	9	10	10	8	6	4	3	1
	$k=1, a=2$	28	33	35	34	31	25	18	11	6	3
	$k=2, a=1$	2	3	4	4	4	3	3	2	1	0
	$k=2, a=2$	14	15	15	13	10	7	4	2	1	0

Table A8: Distribution of women aged 23 by children characteristics, (unit: %)

N. of children Have an infant	none -	one yes	one no	two yes	two no	three either
Low-educated	55.85	8.85	18.02	6.26	8.49	2.53
High-educated	73.31	8.18	11.47	3.96	1.55	1.54

The sample is not restricted to the "married".

A.3 Estimation of rental rates distributions

For the distribution of rental rates, I use the hourly wage at age 23 as a proxy for the rental rate as in Section 2. A sample is restricted to married individuals aged 23 who are paid employee and not student. Assuming that the price of human capital follows a log-normal distribution, I estimate the mean and variance of the distribution using Maximum Likelihood. The following specification is estimated separately for men and women:

$$\ln p_i = \mu_0 + \mu_1 \mathbb{I}(LowEdu_i) + \epsilon_i, \quad \epsilon_i \sim N(0, \sigma^2).$$

The estimates are reported in Table A9. In this paper, I view this gender wage gap as exogenously present upon the entry into the labour market. A discussion about what causes this exogenous gender wage gap is beyond the scope of this paper.

Table A9: Estimates for the distribution of rental rates

Estimates	μ_0	μ_1	σ
Married only (men)	2.714	-0.155	0.375
s.e.	(.044)	(.058)	(.020)
Married only (women)	2.546	-0.263	0.364
s.e.	(.026)	(.035)	(.013)
Any marital status (men)	2.687	-0.162	0.390
s.e.	(.016)	(.021)	(.007)
Any marital status (women)	2.523	-0.206	0.375
s.e.	(.014)	(.021)	(.007)

A.4 Calibrated moments

The procedure to calculate simulated moments is as follows. First, for a given set of parameter values, the household problem is numerically solved backward from age 62 to age 23. Then, 1,600,000 couples' life-cycles are simulated. Each couple begins with a set of initial state variables that is randomly selected based on the parameterized distributions. A couple makes decisions using the decision rules solved from the model, and their state variables are updated based on their decisions and the realizations of a series of stochastic shocks. I construct simulated cross-sectional data by letting the cross-sectional age structure of the simulated sample replicate the empirical counterpart in SLID. Also, I generate simulated six-year-long longitudinal data of the cross-sectional sample as in SLID.

Using the simulated data, I calculate simulated moments and the distance between the simulated and data moments. The measure of distance I use is the sum of squared percentage deviations of the simulated moments from the data moments: $\sum_j \left(\frac{d_j - m_j}{d_j}\right)^2$ where d_j is the j^{th} data moment and m_j is a corresponding simulated moment.

Table A10: Time allocations by children characteristics (% of time endowment)

		Without kids			With an infant			Older kids only		
		M	H	L	M	H	L	M	H	L
High-edu	data	33.6	13.7	52.7	35.6	24.6	39.8	34.0	18.9	47.1
Men	model	36.2	11.9	51.9	36.6	21.6	41.8	34.3	19.2	46.6
High-edu	data	30.3	17.0	52.7	9.8	50.4	39.8	23.3	29.5	47.2
Women	model	31.0	16.0	52.9	12.9	52.2	34.9	26.8	25.7	47.5
Low-edu	data	32.7	12.8	54.5	34.0	21.9	44.1	33.8	16.4	49.8
Men	model	35.5	11.9	52.6	35.4	21.9	42.7	32.3	19.7	47.9
Low-edu	data	24.4	22.7	52.9	6.4	54.9	38.7	19.7	30.2	50.1
Women	model	26.5	17.5	56.0	7.5	56.0	36.5	18.8	29.6	51.6

M=market work, H=home work, and L=Leisure. Time endowment=5,840 hours per year.

Table A11: Five-year wage growth rates conditional of five years of full-year,full-time employment

		Men			Women		
Age group		25-34	35-44	45-54	25-34	35-44	45-54
Low-educated	data	7.7	5.4	4.9	10.6	6.7	5.4
	model	7.6	5.5	4.8	6.7	5.3	4.3
High-educated	data	14.3	11.1	6.3	17.6	12.7	9.0
	model	9.3	5.4	3.9	11.9	6.5	4.0

Table A12: Employment transition rates

		Low-edu Men			Low-edu Women			High-edu Men			High-edu Women		
$t \to t+1$		N	PY	FY	N	PY	FY	N	PY	FY	N	PY	FY
N	data	79.6	10.2	10.2	86.2	10.2	3.6	76.8	8.1	15.1	79.2	12.1	8.7
	model	79.0	7.0	14.0	84.1	7.1	8.8	74.2	5.7	20.0	70.4	12.1	17.5
PY	data	10.4	31.4	57.7	12.4	58.4	29.1	8.1	33.9	58.0	7.3	64.2	28.5
	model	12.7	24.1	63.2	22.0	49.9	28.1	4.8	22.2	73.0	11.0	51.3	37.7
FY	data	1.4	5.4	93.2	2.2	10.8	87.0	0.8	3.3	95.9	2.1	9.8	88.2
	model	2.1	5.2	92.7	6.8	10.4	82.7	1.8	4.9	93.3	5.0	9.9	85.1

N= Non-employment, PY= Part-Year employment, and FY= Full-Year employment.

Table A13: Fraction of people having negative wage growth after a full-year full-time work

	Men		Women	
	Lo	Hi	Lo	Hi
Data	12.0	11.0	10.0	9.0
Model	8.9	8.8	10.5	10.0

Figure 5: Average time spent in leisure by number of children

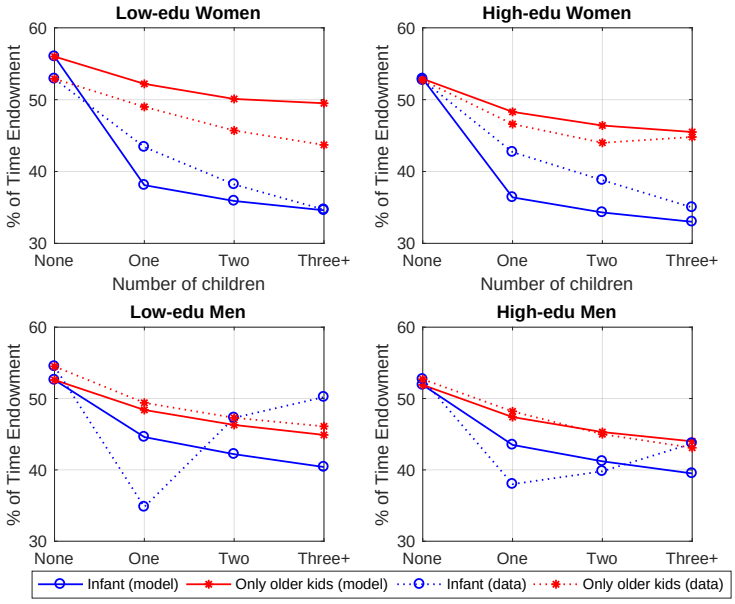

Table A14: Employment rates of married women by number of children, (unit: %)

		none	one	two	three+
Low-edu	(data)	77.1	70.4	66.0	53.7
	(model)	76.6	62.6	61.7	54.7
High-edu	(data)	91.0	82.4	78.8	71.4
	(model)	92.2	81.5	79.8	77.2

A.5 The role of probabilities of human capital depreciation

In this section, I examine the role of the probability of human capital depreciation δ in the decomposition analysis and policy experiments. The results presented in the main text use the counterfactual economy where both men and women have men's parameter values. In the calibrated economy, men's δ is much higher than women's one. With the parameter values, many married couples decide to choose to have only one parent use parental leave. In this section, I present results of a decomposition analysis to explain the gap of take-up rates between the benchmark economy and a counterfactual economy where both men and women have men's parameter values, except for the probabilities of human capital depreciation δ. I let all people to have women's δ. I let both men and women have women's values for that parameter.

Table A15: Take-up behaviour when all gender differences are removed

	Benchmark		Men's values		Women's values		Men's values but δ	
Educational type	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers	Fathers	Mothers
Individual								
Low-educated	11.4	93.4	60.3	57.1	69.5	65.4	67.9	67.4
High-educated	10.2	93.4	50.8	49.8	60.2	64.6	68.2	72.7
Household								
(lo, lo)	6.8	93.5	46.2	46.0	51.7	51.3	55.0	57.9
(lo, hi)	14.1	89.9	72.3	28.2	83.8	36.7	78.5	54.1
(hi, lo)	6.4	93.2	27.2	73.2	27.4	85.6	45.7	80.7
(hi, hi)	11.0	95.3	56.8	59.4	68.2	76.9	73.9	80.8

A pair of husband's and wife's education, (ϵ_h, ϵ_w), represents a household education type. hi denotes the high-educated who are college graduates, and lo denotes a lower education level.

Table A16: Decomposition of the gender gap in take-up rates

(a) Take-up rates by individual educational type (%)

	Benchmark	All Removed*	Change (2)-(1)	Home Productivity (Infant), η_1	Rental Rates of Human Capital, μ_h	Prob. a Fall in Human Capital, δ_w^ϵ	Prob. a Rise in Human Capital, ψ_h^ϵ	Weight on Leisure, γ_h
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fathers' take-up rates (%)								
Low-edu (a)	11.4	69.5	58.1	28.1(28.7%)	18.4(12.1%)	19.0(13.1%)	15.8(7.6%)	9.1(-3.9%)
High-edu (b)	10.2	60.2	50.0	28.7(36.9%)	16.4(12.4%)	21.6(22.8%)	10.3(0.2%)	8.2(-4.0%)
Mothers' take-up rates (%)								
Low-edu (c)	93.4	65.4	-28.0	90.1(11.6%)	91.6(6.3%)	91.9(5.2%)	91.8(5.8%)	93.5(-0.5%)
High-edu (d)	93.4	64.6	-28.8	81.7(40.8%)	89.1(15.0%)	93.2(0.8%)	91.5(6.7%)	94.7(-4.5%)
Gender differences (%p)								
Low-edu (c)-(a)	82.0	-4.1	-86.1	62.1(23.1%)	73.2(10.2%)	73.0(10.5%)	75.9(7.1%)	84.4(-2.7%)
High-edu (d)-(b)	83.2	4.4	-78.8	53.0(38.3%)	72.7(13.3%)	71.6(14.7%)	81.2(2.6%)	86.5(-4.2%)

(b) Take-up rates by household educational type (%)

	Benchmark	All Removed*	Change (2)-(1)	Home Productivity (Infant), η_1	Rental Rates of Human Capital, μ_h	Prob. a Fall in Human Capital, δ_w^ϵ	Prob. a Rise in Human Capital, ψ_h^ϵ	Weight on Leisure, γ_h
(ϵ_h, ϵ_w)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(lo, lo)								
Husband (a)	6.8	51.7	45.0	10.1(7.4%)	8.9(4.6%)	9.8(6.7%)	7.6(1.9%)	6.4(-0.8%)
Wife (b)	93.5	51.3	-42.2	89.6(9.3%)	90.7(6.6%)	91.5(4.8%)	91.4(4.9%)	93.8(-0.7%)
(lo, hi)								
Husband	14.1	83.8	69.6	39.4(36.3%)	24.5(14.9%)	24.5(15.0%)	20.8(9.6%)	10.8(-4.8%)
Wife	89.9	36.7	-53.1	70.8(36.0%)	81.0(16.7%)	89.8(0.1%)	84.6(9.9%)	93.2(-6.2%)
(hi, lo)								
Husband	6.4	27.4	21.0	9.4(14.5%)	7.6(5.6%)	9.1(13.0%)	6.1(-1.4%)	6.0(-1.6%)
Wife	93.2	85.6	-7.6	91.1(26.9%)	93.2(0.0%)	92.8(4.7%)	92.4(10.3%)	93.0(2.4%)
(hi, hi)								
Husband (c)	11.0	68.2	57.2	32.8(38.1%)	18.2(12.6%)	24.2(23.1%)	11.2(0.3%)	8.6(-4.1%)
Wife (d)	95.3	76.9	-18.4	87.4(43.4%)	93.2(11.3%)	95.0(1.8%)	95.2(0.6%)	95.6(-1.4%)
Gender differences (%p)								
(lo, lo) [(b)-(a)]	86.7	-0.5	-87.2	79.5(8.3%)	81.8(5.6%)	81.7(5.8%)	83.8(3.4%)	87.3(-0.7%)
(hi, hi) [(d)-(c)]	84.3	8.8	-75.5	54.6(39.4%)	75.0(12.3%)	70.7(18.0%)	84.0(0.4%)	86.9(-3.5%)

Values in parentheses present percentages of the change in column (3) that is explained by each gender difference in columns (4) to (8).
* In column (2) everyone has women's parameter values, except the maximum durations of leave available to them due to maternity leave.

Table A17: Interactions among explanations

(a) Take-up rates by individual educational type (%)

	Benchmark	All Removed	Change (2)-(1)	$\eta_1 + \mu_h$	$\eta_1 + \delta_w$	$\eta_1 + \mu_h + \delta_w$
	(1)	(2)	(3)	(4)	(5)	(6)
Fathers' take-up rates (%)						
Low-edu (a)	11.4	69.5	58.1	41.9(52.6%)	45.5(58.8%)	60.1(83.8%)
High-edu (b)	10.2	60.2	50.0	44.7(69.0%)	54.6(88.8%)	70.6(120.8%)
Mothers' take-up rates (%)						
Low-edu (c)	93.4	65.4	-28.0	82.7(38.2%)	85.5(28.2%)	75.8(62.9%)
High-edu (d)	93.4	64.6	-28.8	69.0(84.7%)	79.3(49.1%)	67.1(91.3%)
Gender differences (%p)						
Low-edu (c)-(a)	82.0	-4.1	-86.1	40.8(47.9%)	40.0(48.9%)	15.7(77.0%)
High-edu (d)-(b)	83.2	4.4	-78.8	24.3(74.7%)	24.7(74.3%)	-3.5(110.0%)

(b) Take-up rates by household educational type (%)

	Benchmark	All Removed	Change (2)-(1)	$\eta_1 + \mu_h$	$\eta_1 + \delta_w$	$\eta_1 + \mu_h + \delta_w$
(ϵ_h, ϵ_w)	(1)	(2)	(3)	(4)	(5)	(6)
(lo, lo)						
Husband (a)	6.8	51.7	45.0	18.8(26.7%)	21.1(31.9%)	34.5(61.7%)
Wife (b)	93.5	51.3	-42.2	79.8(32.6%)	83.6(23.6%)	70.8(53.7%)
(lo, hi)						
Husband	14.1	83.8	69.6	57.6(62.4%)	60.9(67.2%)	77.1(90.5%)
Wife	89.9	36.7	-53.1	52.6(70.2%)	68.1(41.0%)	52.5(70.4%)
(hi, lo)						
Husband	6.4	27.4	21.0	15.5(43.3%)	19.6(62.9%)	33.8(130.8%)
Wife	93.2	85.6	-7.6	87.6(74.1%)	89.2(52.5%)	83.9(122.1%)
(hi, hi)						
Husband (c)	11.0	68.2	57.2	50.9(69.8%)	61.9(89.0%)	78.4(117.9%)
Wife (d)	95.3	76.9	-18.4	77.3(97.9%)	85.0(56.0%)	74.3(114.3%)
Gender differences (%p)						
(lo, lo) [(b)-(a)]	86.7	-0.5	-87.2	61.0(29.5%)	62.4(27.9%)	36.3(57.8%)
(hi, hi) [(d)-(c)]	84.3	8.8	-75.5	26.4(76.6%)	23.2(80.9%)	-4.1(117.0%)

Values in parentheses present percentages of the gap in column (3) that is explained by each column. Parameter η_1, μ, and δ_i denote relative home productivity in the presence of an infant, means of rental rates, and probabilities of a fall in human capital, respectively.

A.6 Policy Experiments

Table A18: Take-up rates by income replacement rate

(a) Benchmark Durations: 17/0/35 weeks of Mat./Pat./Par. Leaves

(ϵ_h, ϵ_w)	(lo, lo)			(lo, hi)			(hi, lo)			(hi, hi)		
Replacement rate ρ	Husb.	Wife	Gap	Husb.	Wife	Gap	Husb.	Wife	Gap	Husb.	Wife	Gap
Baseline rate=0.55	6.8	93.5	86.7	14.1	89.9	75.8	6.4	93.2	86.8	11.0	95.3	84.3
0.01	6.0	88.6	82.6	13.8	79.0	65.2	6.1	89.9	83.8	9.2	89.1	79.8
0.33	6.6	92.1	85.5	13.3	85.8	72.5	5.8	91.6	85.8	10.2	92.7	82.6
0.70	7.4	94.1	86.7	13.5	94.7	81.2	6.7	95.4	88.7	12.2	97.4	85.2
0.85	7.5	95.9	88.3	15.5	96.3	80.8	7.7	96.5	88.8	15.0	98.4	83.4
1.00	8.4	96.8	88.4	17.2	98.1	80.9	8.8	97.3	88.6	18.7	99.3	80.6

(b) Short Paternity Leave: 17/6.5/28.5 weeks of Mat./Pat./Par. Leave

(ϵ_h, ϵ_w)	(lo, lo)			(lo, hi)			(hi, lo)			(hi, hi)		
Replacement rate ρ	Husb.	Wife	Gap	Husb.	Wife	Gap	Husb.	Wife	Gap	Husb.	Wife	Gap
Baseline rate=0.55	6.8	93.5	86.7	14.1	89.9	75.8	6.4	93.2	86.8	11.0	95.3	84.3
0.01	6.3	88.3	82.0	14.0	79.0	65.1	6.1	90.3	84.2	9.0	89.2	80.2
0.33	6.5	91.8	85.3	13.7	85.8	72.1	6.0	91.7	85.7	10.2	92.5	82.3
0.70	6.8	94.8	88.1	17.6	94.3	76.6	7.1	95.5	88.4	17.7	97.5	79.8
0.85	7.7	96.2	88.4	21.0	96.4	75.4	9.0	96.5	87.5	24.5	98.5	74.0
1.00	9.6	96.6	87.0	26.1	97.8	71.8	12.8	97.3	84.5	32.7	99.3	66.6

A pair of husband's and wife's education, (ϵ_h, ϵ_w), represents a household education type. hi denotes the high-educated who are college graduates, and lo denotes a lower education level.