

# Empowerment Effects and Intertemporal Commitment of Married Couples: Evidence from Japanese Pension Reform\*

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## Abstract

Without imposing functional form assumptions on preferences or technology, this study investigates a household's commitment to a resource allocation by exploiting a 2007 Japanese pension reform allowing divorced women to claim a portion of their husband's pension benefits while keeping the household's total benefits unchanged. Although the reform should not affect a couple's decision-making under full commitment, we find that it increased wives' leisure and decreased their market and domestic work. This suggests that wives were able to increase their welfare by exploiting an improved outside option, and thus commitment to resource allocation is less than complete.

Keywords: family; bargaining power; risk sharing; pension; divorce law

JEL codes: D13, D91, H31, J12, K36

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# 1 Introduction

Economists have long been interested in the extensive economic gains from marriage, including the joint use of public goods, specialization and self-insurance of household members. The self-insurance is especially important for the personal security of household members, as the effects of business cycles can be severe when job displacement risks are not completely insured (Krebs, 2007). While these risks can be mitigated by conventional unemployment insurance, they can also be hedged by income pooling through marriage, although inter- and intra-family insurance would not completely absorb income shocks (Altonji et al., 1992; Hayashi et al., 1996). In addition, marriage also allows an individual to insure other risks such as longevity risks through the heritage of his/her partner (Kotlikoff and Spivak, 1981).

In order to realize these economic gains, however, marriage partners must be able to commit to their initial resource allocation plan, and the traditional unitary model of household decision making implicitly requires this by assuming the household is a single decision maker. However, when marriage partners have distinct preferences, this introduces a potential conflict in their incentives that can lead to a “hold-up” problem whereby one partner might deviate from the initial allocation plan by exploiting a changed situation to improve his or her individual welfare. Should this occur, a couple cannot fully enjoy the fruits of marriage, as Dufwenberg (2002) theoretically finds that a couple’s failure to commit to a resource plan leads to a failure to specialize and an under-accumulation of human capital. Further, Voena (2015) finds that divorce and property division laws can affect both asset allocation and female labor force participation. From these studies, we see that a couple’s lack of commitment can make it difficult for a household to achieve the first-best resource allocation, or *ex ante* efficiency. Economic gains from family formation thus depend on the degree of commitment.

Since the seminal work of Chiappori (1988), research in household decision making has shifted from the unitary model to the collective one in which household members have individual preferences and the resource allocation of the household is obtained through bargaining.<sup>1</sup> However, studies of bargaining in family decision-making have typically adopted a static collective framework that is silent about dynamic issues such as divorce or changes in the viability of an outside option for each household member. In adapting the collective model to a dynamic setting, Mazzocco (2007) argues that differing preferences among household members could result in a lack of commitment because the partners have an incentive to deviate from the initial plan as uncertainty is resolved. Since bargaining position is fixed under full commitment but is allowed to fluctuate under limited commitment so that household members may attempt to

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<sup>1</sup>Apps and Rees (1997), Browning and Chiappori (1998), Chiappori (1992), Chiappori (1997), and Blundell et al. (2005) developed the collective model, while others such as Angrist (2002), Attanasio and Lechene (2014), Aura (2005), Cherchye et al. (2012), Duflo (2003), Francis (2011), Ponczek (2011) have tested and rejected the unitary model. Aronsson et al. (2001) is one of the few studies that has not rejected the unitary model.

improve their situation when outside options change, the degree of commitment is testable by examining within-household variation in bargaining position.

These empirical tests of the degree of commitment are of interest not only in relation to the economic benefits of marriage, but also for their practical implications in the specification of life-cycle models. While the limited commitment model is more general than the full commitment model, its complexity leads to a computational burden in obtaining a solution (Chiappori and Mazzocco, 2017). Consequently, studies typically attempt to limit this burden through simplifying assumptions such as full commitment (Casanova, 2010), a single agent (Adda et al., 2017), or functional form impositions on the Pareto weight (van der Klaauw and Wolpin, 2008).<sup>2</sup> While full commitment may be a good approximation of reality if any resource allocation distortions associated with hold-up problems are relatively minor, researchers need to consider the extent to which the full commitment assumption drives their results. If distortions exist, the model should allow for the possibility of incomplete commitment.

Another reason why limited commitment should be considered is that full commitment has not been supported by some recent empirical studies. For example, in their studies of dynamic models nesting the full-commitment case, Mazzocco (2007) and Lise and Yamada (2018) both find the evidence inconsistent with full commitment, with Lise and Yamada (2018) finding that household members do update their bargaining position, but only when the participation condition for marriage is binding. In another study, Blau and Goodstein (2016) test degree of commitment by examining whether an unexpected inheritance affects the relative bargaining position and household behavior, controlling for household budget and any expected inheritance. Since a couple under full commitment fixes its bargaining position at marriage, it should not be affected by any unexpected shock when preferences and budget constraint are held constant. However, they find mixed results, with full commitment rejected in some specifications but not others.<sup>3</sup> Notwithstanding the mixed results, an advantage of the Blau and Goodstein (2016) approach, compared to the above two studies, is its non-parametric identification method. For example, Mazzocco (2007) assumes the bargaining position to be independent of the level of assets, and Lise and Yamada (2018) assume an interior solution for time-allocation to estimate their structural model. In contrast, if unexpected shocks only affect bargaining position, it is not necessary to specify the forms of the household objective function or home production technology.

This study contributes to the literature on household decision-making by testing the degree of commitment without relying on any *a priori* assumptions about functional form and by using a Japanese dataset that allows us to exploit a major pension reform as a natural experiment

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<sup>2</sup>Studies that do allow for incomplete commitment include Voena (2015) and Low et al. (2018)

<sup>3</sup>These mixed results are attributed to a lack of statistical power, as inheritance is a rare event. Because inheritance amount has been shown to suffer from serious measurement error (Laitner and Sonnega, 2010), the receipt of an inheritance is used instead, which lowers the statistical power. Additionally, as the study examines several full commitment null hypotheses one-by-one under various specifications, the statistical inference seems difficult to interpret.

using a difference-in-differences (DD) estimation methodology. The Japanese pension reform of 2007 allowed a couple to divide their pension benefits upon divorce. Prior to the reform, since the bulk of public pension benefits in Japan are proportional to labor earnings, a dependent spouse specializing in home production would have found it difficult to live only on her own pension benefits after divorce. The reform addressed this issue by allowing the spouse with fewer pension records to claim a portion of the partner's pension records tracked during the marital period. For our purposes, several features of the reform are beneficial for testing the degree of commitment of a household. Firstly, the reform allows for sharing of pension benefits while keeping the total amount of the benefits unaffected. The unexpected shock thus does not change the household budget, which facilitates our identification of the degree of commitment. Secondly, the pension division applies only to the public pension insurance that covers permanent employees, which leaves a dependent wife of a self-employed spouse unaffected. Thirdly, the maximum share of pension benefits after division is 50 percent, which means that if both spouses are permanently employed and of a similar age, there is very little room for pension balancing. This allows us to use these households as a control group for the counterfactual inference required for our difference-in-differences (DD) estimation strategy.

Following the framework of Mazzocco (2007), we first constructed a dynamic collective model to investigate the effect of the pension reform under both full and limited commitment, finding that only couples without full commitment were affected. We tested several of the model's predictions. First, as the reform is expected to mostly affect couples in which the husband's pension benefits are large, and since most young couples have not yet accumulated substantial benefits, the reform is most likely to affect elderly couples.<sup>4</sup> Second, low net worth households are more likely to respond to the reform because pension benefits comprise only a small share of the total assets of high net worth households that would be divided upon divorce. Third, as noted by Chiappori and Mazzocco (2017), the dynamic collective model implies that household members re-bargain their resource allocation only when one member's participation condition is binding. We tested this prediction using young couples, whose current period participation condition is unlikely to bind because they cannot receive pension benefits for several decades.

We then conducted empirical analysis by using DD estimation with the *Keio Household Panel Survey* (KHPS), a household panel survey in Japan. The treatment group consists of households in which the husband was a permanent employee and the wife was not, the control group consists of all other households. The results of our DD estimation do not support the full-commitment model. Consistent with the model's prediction, we did not find any significant impact on young couples, but elderly wives aged 50–59 increased their leisure time by 5 hours

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<sup>4</sup>In a study of the reform using relatively young couples of 48 years and younger, Sakamoto (2008) finds no policy impact.

per week (or 5 percent) by decreasing equally their market and domestic work. The elasticities of those outcomes to the life-time pension benefits received upon divorce are 0.05, 0.20 and 0.05, respectively. A subsample analysis of home ownership as a proxy for individual assets showed that those wives who were most affected by the reform were those who did not own a home, which is also consistent with the model's prediction. Finally, the model passed several tests of the common trend assumption of our identification strategy including a placebo test, a specification with a group-specific linear trend, and a triple-differences estimation using young households as an additional comparison group.

A limitation of the study is that the test of full commitment relies on the assumption that couples do not eventually divorce. This limitation is not unique to this study, however, and is typically imposed throughout the literature either explicitly or implicitly (Blau and Goodstein, 2016; Lise and Yamada, 2018; Mazzocco, 2007). When divorce is possible and seems on the horizon, spouses have an incentive to prepare for this future divorce (Mazzocco et al., 2006), which means that the household allocation plan can be contingent on the post-divorce economic situation even under full commitment. This concern would appear to be negligible for elderly couples in Japan, however, due to the low annual and life-time divorce rates of 0.3 and 3.0 percent, respectively, for Japanese wives aged 55. Therefore, we believe that this assumption cannot be the main driver of our findings.

Additionally, when we take the rejection of the full commitment model as a given, this study highlights the difficulty in making a commitment, as couples fail to achieve full commitment even within a stable marital relationship. This limited commitment implies that *ex ante* efficient allocation is not necessarily *ex post* efficient and, as a result of this inconsistency, a hold-up problem may occur. The resulting inefficiency could be more serious among young couples because their relatively higher divorce rates indicate that the participation condition is likely to bind. If this is the case, then household behavior including human capital accumulation and investment in children may be distorted by a fluctuation in the bargaining position, and this also makes risk-sharing among household members difficult.

## 2 Institutional Background

### 2.1 Japanese Pension System and the Reform of 2007

In order to better understand the context of the study, this section describes the Japanese public pension system and the reform of 2007. The Japanese public pension system consists of three insurance policies, the Employee pension (*kosei nenkin*), the Mutual Aid pension (*kyosai nenkin*) and the National pension (*kokumin nenkin*). The first two policies cover permanent employees (i.e., full-time workers not hired under a time-limited contract) in the private and

public sectors, respectively,<sup>5</sup> but are otherwise identical, so we hereafter refer to them collectively as the Employee pension insurance. Within the Employee pension insurance, participants aged under 70 pay pension premiums as long as they earn labor income, with the amount of the premium proportional to their labor income. The age of eligibility for benefits is around 60, depending on sex and birth cohort, with the age of eligibility for men higher than women and for a recent cohort higher than an earlier cohort (for details, see Table A1). The pension benefits consist of two parts: a basic part and a proportional part, with the basic part depending only on the number of years for which the participant paid premiums, and the proportional part depending on earnings and duration of premium payments prior to retirement. The National pension covers those who are not covered by the Employee pension, which includes mainly the self-employed, part-time employees and dependent wives, all of whom pay premiums until they turn 60 and become eligible for benefits at age 65. The National pension is similar to the basic component of the Employee pension, except for the age of eligibility and the participants in each respective plan.

Before the pension reform of 2007, the Japanese pension system was thought to be inequitable because spouses were not allowed to claim any fraction of the pension benefits of their partners should they divorce. While a homemaker wife played an important role in enabling her husband to specialize in market work, she previously had no access to his pension benefits. As the average monthly National pension benefit in 2007 was only about 540 U.S. dollars,<sup>6</sup> a homemaker would have difficulty living only on her own pension benefits after divorce.

In order to address this issue, a reform was approved in 2004 and enacted on April 1st, 2007 to permit divorcing spouses to divide the proportional part of the household's Employee pension records tracked during the marital period.<sup>7</sup> Although the proportion of the household pension record claimed by either party is determined by agreement between the spouses, the division must range between 0-50 percent, as the spouse with the smaller pension cannot claim more than half of the total and there is no room for division if the records of both spouses are equal. If the spouses fail to agree on division, a rate is provided by the courts. In 99 percent of cases in 2007, this rate was 50 percent<sup>8</sup>, consistent with the asset division rule which divides assets accumulated during the marital period equally.<sup>9</sup> Since a divorced homemaker is now assured

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<sup>5</sup>In addition to permanent employees, the pension plans cover part-time employees who work more than three-quarters of the hours per day and days per month worked by a full-time employee. For example, if a full-time employee works eight hours per day and twenty days per month, then a part-time employee working more than six hours per day and fifteen days per month participates in either the Employee or Mutual Aid pension.

<sup>6</sup>The Employee pension paid out about 1,610 U.S. dollars per month on average. Source: Japanese Ministry of Health, Labour and Welfare: [http://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000106808\\_1.html](http://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000106808_1.html)

<sup>7</sup>The basic part of the pension is not based on income and so is not divisible.

<sup>8</sup>Source: Supreme Court of Japan; [http://www.courts.go.jp/vcms\\_1f/20513001.pdf](http://www.courts.go.jp/vcms_1f/20513001.pdf).

<sup>9</sup>A second pension reform was implemented in 2008 that allows a dependent wife (or husband) to claim half of the total household Employee pension records tracked after May 1st, 2008 should they divorce. This reform, which applies to households in which the wife's annual income is less than about 13,000 U.S. dollars, has a fixed

of at least some income beyond her basic pension, the post-divorce situation is said to have improved.

Several features of the 2007 pension reform help to facilitate our analysis. Firstly, as the reform does not change the total amount of pension benefits received by a household, it does not affect the household budget under marriage, which allows us to isolate changes in allocations due to bargaining. Secondly, as the reform provides a better outside option to dependent wives, we can investigate whether this change affects commitment. Thirdly, as the pension reform leaves some households unaffected, the policy design allows us to create treatment and control households for the counterfactual inferences required for our DD estimation. Since the pension reform applies only to Employee pension records, it does not affect the self-employed, who are covered by the National pension. Additionally, when both spouses are permanent employees, they each have their own Employee pension record and so the pension splitting opportunities are marginal. Hereafter, we refer to this latter type of household as a “dual-permanent” household.<sup>10</sup> As discussed below, households either “dual-permanent” or with one self-employed spouse were used to control for the economic trend in absence of the reform.

## 2.2 Divorce Law in Japan

Although Japanese divorce law in principle requires mutual consent before a couple may divorce, enforcement is not strict and so in practice it may operate similar to a unilateral divorce. Under Article 770 of the Japanese Civil Code, a judicial divorce is permitted if a spouse: (i) has committed an act of unchastity; (ii) has been abandoned in bad faith; (iii) is of unknown whereabouts and for at least three years it has not been clear whether s/he is dead or alive; (iv) is suffering from severe mental illness and there is no prospect of recovery; or (v) has any other grave concern making it difficult to continue the marriage. While the fifth point is ambiguous, the Ministry of Justice has issued a guideline that allows a couple to divorce after five years of separation. As a result, a spouse who wishes to divorce may simply end cohabitation with his/her partner and file a suit for divorce after the required time has elapsed.

As for the distribution of assets upon divorce, the property division rule in Japan assures divorcees equal division of those assets for which they both “contributed” in obtaining, but it is not necessary for this contribution to be monetary, whereas other assets are divided on basis of the title. For example, if a wife specializes in home production and has no earnings, her

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division ratio of 50 percent. However, considering that the first pension reform applies to the entire Employee pension records tracked during the marital period, the function of this second reform is, at most, supplementary, as it does not apply to pension records before May 1st, 2008. As its impact on household behavior is likely to be negligible, our analysis focused only on the impact of the first reform.

<sup>10</sup>Explicitly excluded are those households in which the husband is a permanent employee and the wife works part-time, as part-time employees are typically not covered by the employee pension. Even if a wife working part-time is covered by the employee pension, however, the amount of her pension records is likely to be much less than that of a husband who is a permanent employee.

domestic work is regarded as a contribution to purchasing housing. On the other hand, the asset division does not apply to assets accumulated before marriage or obtained via inheritance. Since asset division is implemented based on holdings at the time of divorce or at the end of cohabitation if a couple separates prior to divorce, separation can be an effective strategy to divorce without mutual consent, as a spouse can file for divorce several years after the end of cohabitation but asset division is implemented as if the couple had divorced at the beginning of the separation.

### 3 Model

In this section, we provide a model to describe how a couple responds to the pension reform under full and limited commitment. Consider the following 3-period problem for a 2-member household ( $j = 1, 2$ ) in which the couple marries in the 1st period and may or may not choose to divorce in the 2nd or 3rd period. The household members supply market and domestic labor in the 1st and 2nd periods and retire in the 3rd period. A fraction  $\tau$  of labor earnings is collected as a pension premium, and the couple receives the pension benefits  $b_{j3}$  in the 3rd period. Each spouse derives his or her welfare from private consumption  $c_{jt}$  and leisure  $l_{jt}$ , where the consumption good is produced by domestic labor  $h_{jt}$  and there is a market good  $g_t$ . We assume unilateral divorce, so divorce is possible without mutual consent. We denote member  $j$ 's asset and pension benefits upon divorce as  $a_{jt}^D$  and  $b_{jt}^D$ , respectively.

We now define full and limited commitment. A couple achieves “full commitment” if the *participation condition* that the value of the marriage for each member is greater than or equal to the value of divorce is required only at the initial period, whereas the degree of commitment is said to be “limited” if the participation condition must be satisfied at each period. Thus, under limited commitment, both members must be satisfied with the marriage at each period; otherwise, an unsatisfied member may threaten to divorce to increase his/her consumption or leisure, even if that member does not intend to carry through with the divorce. Here, we assume that the couple does not ever divorce. The case of actual divorce is discussed in Section 7.



The household problem under full commitment is

$$\max_{(c_{jt}, l_{jt}, b_{jt}, g_t, a_{t+1})} \mu E_1 \left[ \sum_{t=1}^3 \beta^{t-1} u_1(c_{1t}, l_{1t}, \theta_{1t}) \right] + (1 - \mu) E_1 \left[ \sum_{t=1}^3 \beta^{t-1} u_2(c_{2t}, l_{2t}, \theta_{2t}) \right], \quad (1)$$

$$\text{s.t. } c_{1t} + c_{2t} = F(h_{1t}, h_{2t}, g_t), \quad (2)$$

$$a_{t+1} = (1 + r_t) a_t + \sum_{j=1}^2 (1 - \tau_{1t})(1 - l_{jt} - h_{jt}) w_{jt} - g_t \quad (t = 1, 2), \quad (3)$$

$$b_{j,t+1} = (1 + r_t) b_{jt} + \tau_{1t}(1 - l_{jt} - h_{jt}) w_{jt}, \quad (4)$$

$$0 \leq l_{jt} + h_{jt} \leq 1, \quad l_{j3} + h_{j3} = 1, \quad (5)$$

where  $\theta_{jt}$  is match-specific utility,  $w_{jt}$  is  $j$ 's market wage,  $r_t$  is the risk-free interest rate,<sup>11</sup> and the total time is normalized to one. Since the couple marries in the 1st period, the initial-period participation condition is summarized in the Pareto weight  $\mu$ . Solving this problem backwardly, we observe that the household allocation plan is contingent on total assets  $a_t + b_{1t} + b_{2t}$  but not on the composition of those assets  $(a_t, b_{1t}, b_{2t})$ . Hence, the solution to the problem is

$$x_{jt}(\Omega_t) = \tilde{x}_{jt}(a_t + b_{1t} + b_{2t}, \theta_{1t}, \theta_{2t}, w_{1t}, w_{2t}) \quad (x \in \{c, l, h\}; j \in \{1, 2\}), \quad (6)$$

where  $\Omega_t = (a_t, a_{1t}^D, a_{2t}^D, b_{1t}, b_{2t}, b_{1t}^D, b_{2t}^D, \theta_{1t}, \theta_{2t}, w_{1t}, w_{2t})$  is the set of state variables.

The household problem under limited commitment is similar to the full commitment household problem (1) through (5) above, but additionally requires the participation conditions in periods 2 and 3:

$$u_j(c_{j2}, l_{j2}, \theta_{j2}) + \beta u_j(c_{j3}, l_{j3}, \theta_{j3}) \geq V_{j2}^D(a_{j2}^D + b_{j2}^D, w_{j2}), \quad (7)$$

$$u_j(c_{j3}, l_{j3}, \theta_{j3}) \geq V_{j3}^D(a_{j3}^D + b_{j3}^D) \quad (j \in \{1, 2\}), \quad (8)$$

where  $b_{jt}^D = b_{jt}$  under the pre-reform regime and  $b_{jt}^D = \frac{b_{1t} + b_{2t}}{2}$  under the post-reform regime. The 3rd-period problem is

$$V_3(\Omega_3) = \max \mu u_1(c_{13}, l_{13}, \theta_{13}) + (1 - \mu) u_2(c_{23}, l_{23}, \theta_{23}),$$

$$\text{s.t. } c_{13} + c_{23} = F(h_{13}, h_{23}, g_3),$$

$$g_3 = a_3 + b_{13} + b_{23}; \quad l_{j3} + h_{j3} = 1 \quad (j \in \{1, 2\}),$$

$$u_j(c_{j3}, l_{j3}, \theta_{j3}) \geq V_{j3}^D(a_{j3}^D + b_{j3}^D) \quad (j \in \{1, 2\}).$$

Denoting the Lagrange multiplier on the participation conditions by  $\lambda_j$  ( $\geq 0$ ), this problem is

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<sup>11</sup>Although, for simplicity, the amount of pension benefits is assumed to be accumulated in the same way as savings, the model identification result does not rely on this assumption.

rewritten as

$$\begin{aligned} & \max (\mu + \lambda_1)u_1(c_{13}, l_{13}, \theta_{13}) + (1 - \mu + \lambda_2)u_2(c_{23}, l_{23}, \theta_{23}), \\ & \text{s.t. } c_{13} + c_{23} = F(h_{13}, h_{23}, g_3), \\ & \quad g_3 = a_3 + b_{13} + b_{23}; \quad l_{j3} + h_{j3} = 1 \quad (j \in \{1, 2\}), \end{aligned}$$

where the  $\lambda_j = 0$  if member  $j$ 's participation condition is not binding. Thus, the couple re-bargains only when the participation condition of one member binds.

The main difference from the full commitment case is that the pension division rule upon divorce,  $b_{j3}^D$ , matters and this in turn implies that so does asset composition  $(b_{1t}, b_{2t})$ . Indeed, we observe in general that

$$\lambda_j = \lambda_j(a_{13}^D, a_{23}^D, b_{13}, b_{23}, \theta_{13}, \theta_{23}) \neq \lambda_j(a_{13}^D, a_{23}^D, b_{13} + b_{23}, \theta_{13}, \theta_{23}).$$

Since a similar argument applies to the 1st- and 2nd-period problems, the household allocation plan cannot be written as a function of total assets:

$$x_{jt}(\Omega_t) \neq \tilde{x}_{jt}(a_t + b_{1t} + b_{2t}, \theta_{1t}, \theta_{2t}, w_{1t}, w_{2t}) \quad (x \in \{c, l, h\}; j \in \{1, 2\}). \quad (9)$$

In order to consider the impact of the pension reform on the married couple, suppose that the reform is unexpectedly implemented at the beginning of the 2nd period. Under limited commitment, the initial allocation plan satisfies

$$\begin{aligned} & u_j(c_{j2}, l_{j2}, \theta_{j2}) + \beta u_j(c_{j3}, l_{j3}, \theta_{j3}) \geq V_{j2}^D(a_{j2}^D + b_{j2}, w_{j2}), \\ & u_j(c_{j3}, l_{j3}, \theta_{j3}) \geq V_{j3}^D(a_{j3}^D + b_{j3}) \quad (j \in \{1, 2\}), \end{aligned}$$

but due to the change in pension division rule, the new participation conditions are

$$\begin{aligned} & u_j(c_{j2}, l_{j2}, \theta_{j2}) + \beta u_j(c_{j3}, l_{j3}, \theta_{j3}) \geq V_{j2}^D\left(a_{j2}^D + \frac{b_{12} + b_{22}}{2}, w_{j2}\right), \\ & u_j(c_{j3}, l_{j3}, \theta_{j3}) \geq V_{j3}^D\left(a_{j3}^D + \frac{b_{13} + b_{23}}{2}\right) \quad (j \in \{1, 2\}), \end{aligned}$$

and the 2nd-period participation condition is now more restrictive for member 2 if  $b_{12} > b_{22}$ .

Taking this into consideration, other things being equal, the greater is  $(b_{12} - b_{22})$ , the more likely the participation condition for member 2 will bind. Since the pension division upon divorce applies only to the pension records during the marital period, a young couple does not have many divisible pension benefits (i.e.  $b_{12}$  is small), suggesting that elderly households are more likely to be affected by the reform. On the other hand, suppose that the initial allocation

plan satisfies the 2nd period participation condition but does not satisfy the 3rd period one. In this case, the main impact is on the 3rd period allocation because the 3rd period participation constraint cannot hold without adjusting the allocation at that period. The 2nd period allocation is then affected due to consumption smoothing.

The above discussion implies that the main impact of the pension reform should be observed after the reform is implemented, and young households are unlikely to show substantial change in allocation in the reform year even if they re-bargain their future resource allocation. Furthermore, given the concavity of the value function, the value of divorce is sensitive to the amount of pension benefits when the amount of other assets available upon divorce is small. This suggests that a couple with few assets other than pension benefits will be most affected by the reform.

## 4 Data and Identification Strategy

### 4.1 Data

This study utilized data from the *Keio Household Panel Survey* (KHPS) provided by the Keio University Panel Data Research Center. The KHPS is an annual household-level panel survey of households beginning in 2004 and consisting of 4,000 households (3,000 married and 1,000 single). Each year, the survey is conducted at the end of January, and respondents are asked about their usual time allocation as well as background information such as age, sex, family composition and employment status. As Japan's fiscal year begins in April, each implementation of the survey inquires about the previous fiscal year, with KHPS 2004, for example, asking about respondent behavior in 2003. Accordingly, KHPS 2004 includes data on the socio-economic status of respondents before the 2004 pension reform approval, and KHPS 2008 and succeeding waves represent household behavior after the enactment of the reform.

Although ten waves (KHPS 2004 through 2013) were available, we restricted our main sample to KHPS 2005 through 2008. As KHPS 2004 does not include information about time spent on childcare, the domestic labor supply in this wave is inconsistent with other waves, so we used this first wave only to obtain background information. We also excluded KHPS 2009 through 2013 from our sample because of two external events: the global financial crisis of 2008, the impact of which seems difficult to distinguish from that of the 2007 pension reform, and the Great East Japan Earthquake of 2011, which very likely caused heterogeneous effects across households. The set of households chosen for the analysis sample was selected according to the following criteria: (1) spouses who married before 2004<sup>12</sup>, who live together, and who

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<sup>12</sup>We did not include newly married couples in our sample because in 2004, these couples may have known about the pension reform at the time of their marriage and so within-household variation in bargaining position is not identifiable for those households.

were both aged 30–59 in 2007; (2) a time allocation that meets the constraint of 168 hours; and (3) the lack of any missing key variables for our analysis. In empirical studies, we used family size, the number of children and a indicator variable for children aged less than or equal to six to control for household heterogeneity. The variables of interest are time allocation, leisure, market labor supply and domestic labor supply<sup>13</sup>, which were measured as the average hours per week.

DD estimation, which separates the impact of a specific policy from the counterfactual time trend that would have been faced by the treatment group had there not been any treatment, requires that the analysis sample of households be divided into a treatment group and a control group. We defined the treatment group as households in which the husband was permanently employed but the wife was not because those households would have been most affected by the pension reform. The control group consisted of the remaining households; that is, “dual-permanent” households and households in which the husband was self-employed.<sup>14</sup> The “dual-permanent” households consist of households in which both members are permanent employees, so households in which the wife works for part-time jobs are excluded. The treatment status of each household was fixed throughout the sample period by using the employment status in 2003, one year before the approval of the reform.

## 4.2 Sample and Treatment Group Validity Checks

From the sample descriptive statistics shown in Table 1, we can see that there are some differences between the treatment and control households, with the average treatment household slightly younger and having more children than the control household. Further, while leisure time is similar, wives in treatment households work less in the market and longer in domestic production than those in control households, while husbands in treatment households work longer in the market and less in domestic production.<sup>15</sup> Although these differences may signal potential heterogeneity between the two groups, our identification strategy is robust to this heterogeneity, for DD estimation with household fixed effects controls for heterogeneity in preferences as long as the differences demonstrate the same trend over time. In addition, we also implemented a triple differences (DDD) estimation (discussed in Section 6.4) that is robust to a violation of this common trend assumption.

Before implementing our difference-in-differences (DD) estimation strategy, we confirmed graphically the common trend assumption required to identify the average treatment effect on

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<sup>13</sup>Domestic labor supply consisted mainly of meal preparation, laundry, grocery shopping, cleaning and child-care.

<sup>14</sup>Households in which the wife was a permanent employee and the husband was not would also have been affected by the pension reform, but as the impact would be in the opposite direction of that of our treatment group, and since the size of this subset was very small, we included this type of household in the control group.

<sup>15</sup>See Table A2 for descriptive statistics of time-allocation before and after the reform.

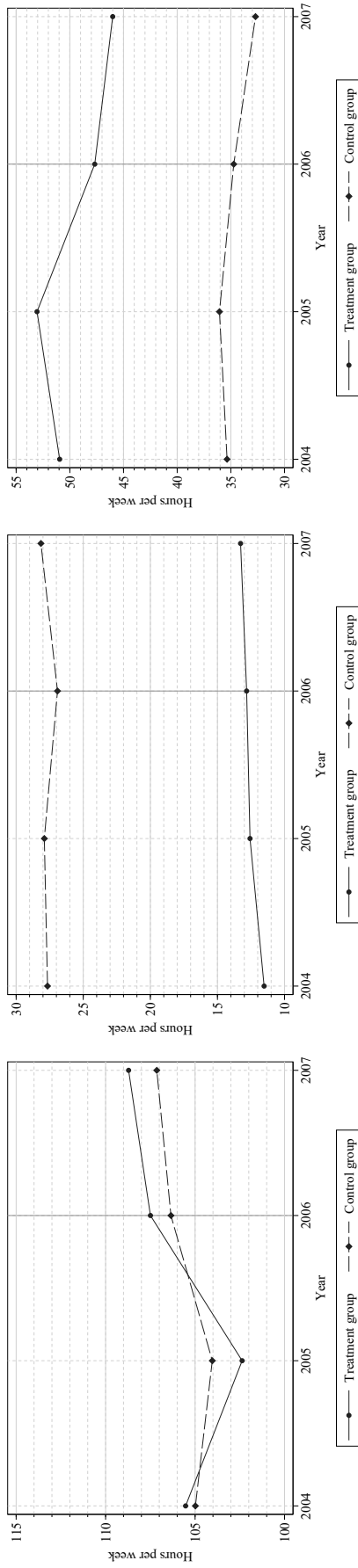
Table 1: Descriptive Statistics of KHPS Sample

	Wife		Husband		Household	
	Treatment (1)	Control (2)	Treatment (3)	Control (4)	Treatment (5)	Control (6)
Leisure	105.86 (32.63)	105.51 (29.02)	118.46 (19.14)	120.59 (21.96)		
Market Labor Supply	12.49 (15.30)	27.65 (21.71)	46.72 (18.41)	43.85 (20.79)		
Domestic Labor Supply	49.65 (35.23)	34.84 (29.22)	2.82 (5.82)	3.56 (7.16)		
Age	42.87 (7.64)	44.72 (7.67)	45.06 (8.01)	47.24 (7.83)		
Family Size					4.04 (1.21)	4.07 (1.39)
Number of Children					1.72 (0.96)	1.52 (1.00)
Children under 6 Years Old					0.24 (0.43)	0.17 (0.38)
Marital period					15.77 <sup>i</sup> (8.25)	17.53 <sup>ii</sup> (8.66)
Observations	2,868	1,812	2,868	1,812	2,868	1,812

Note: The table shows means and standard deviations, with the latter in parentheses. Time allocation was measured as the average hours per week. i) Sample size was 2836. ii) Sample size was 1776.

treated (ATT). Figure 1 shows trends in the time allocation of each spouse and highlights several points relevant to our analysis. First, as is also seen in the descriptive statistics, the amount of time allocated to various activities differs between the treatment and control groups. In particular, there are relatively large differences between the two groups in the market and domestic labor supplies of wives, with the typical wife in the treatment group working more hours in the household and fewer in the market than a typical wife in the control group. With control variables and fixed effects, DD estimation can account for these differences in the absolute levels of time allocation as long as the common trend assumption holds. Second, and more importantly, the treatment and control groups show a similar trend before the pension reform, which supports the common trend assumption required for our DD estimation.

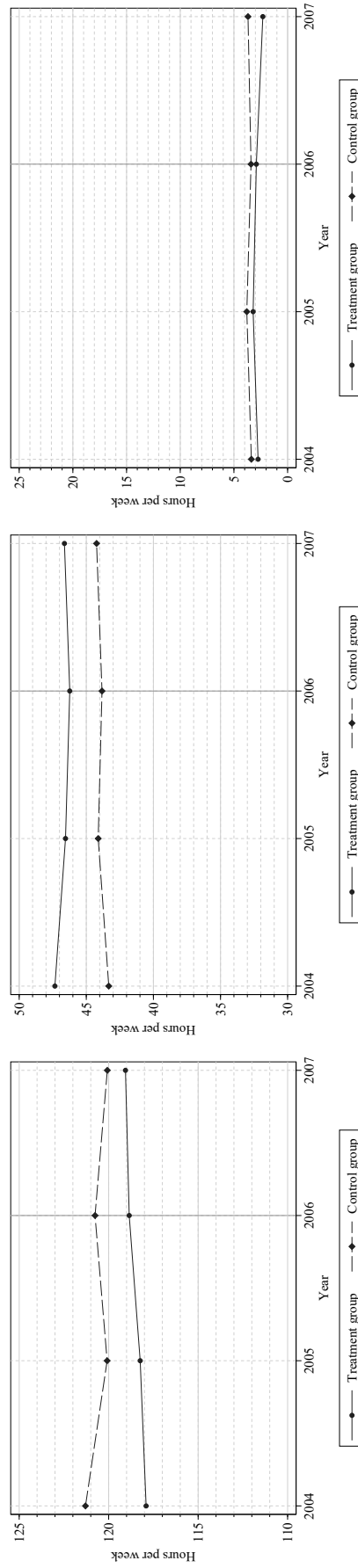
While it is difficult to see any large impact of the pension reform from Figure 1, the policy impact becomes clear when heterogeneity in the age of the wife is considered. In particular, the impact of the reform on a wife's allocation to leisure is striking (Figure 2). In the most elderly group (wives aged 50-59), the time allocated to leisure increases by about 5 hours in the treatment group, while showing a pre-reform trend similar to the control group (Figure 2a).



(a) Leisure: Wife

(c) Market Labor Supply: Wife

(e) Domestic Labor Supply: Wife



(b) Leisure: Husband

(d) Market Labor Supply: Husband

(f) Domestic Labor Supply: Husband

Figure 1: Time Trend in Market Labor Supply, Domestic Labor Supply and Leisure

Data Source: The *Keio Household Panel Survey*

Note: This figure shows the yearly trend in the time allocation of wives and husbands. The solid lines represent the time allocation of individuals in the treatment group while the dotted lines represent individuals in the control group. The vertical lines highlight 2006, one year before the pension reform was enacted.

In contrast, in the other age groups, the treatment and control groups both show a similar time trend before and after the pension reform (Figures 2b and 2c). These observations support our contention that the pension reform appears to have had a substantial impact on elderly households but a limited impact on younger households.

### 4.3 Regression Framework for Difference-in-Differences Analysis

We applied a difference-in-differences (DD) estimation strategy to investigate the causal impact of the 2007 Japanese pension reform. The treatment group consisted of households in which the husband was a permanent employee in 2003 and the wife was not, whereas the control group consisted of all other households. The estimation equation was specified as

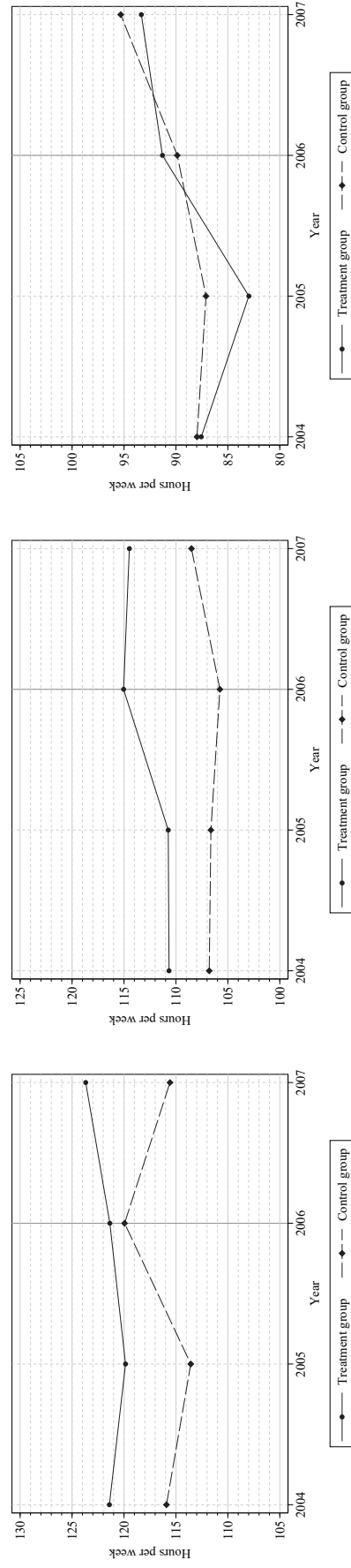
$$y_{it}^j = \delta_1^j After_t \cdot Treatment_i + x'_{it} \beta^j + \sum_{t=2005}^{2007} \gamma_t^j d_t + c_i^j + u_{it}^j, \quad (10)$$

where  $i$ ,  $j$  and  $t$  denote each household, each household member and the year, respectively. Dummy variables include  $After_t$ , which takes one if  $t = 2007$ ,  $Treatment_i$ , which takes one if household  $i$  is in the treatment group, and  $d_t$ , which is a year dummy variable. The control variables  $x_{it}$  are a constant and household characteristics, which include the squared ages of both spouses, family size, the number of children and a dummy variable indicating whether the household has children aged 6 or younger.<sup>16</sup>  $c_i^j$  is household fixed effects. Note that  $After_t$  is equivalent to  $d_{2007}$ , and household fixed effects absorb the treatment dummy variable,  $Treatment_i$ , which was fixed according to employment status in 2003. The dependent variable,  $y_{it}^j$ , is the allocation to leisure, market labor supply, and domestic labor supply of spouse  $j$  of household  $i$  in year  $t$ .

The coefficient of interest is  $\delta_1^j$ , which represents the household time allocation response to the pension reform and is key to test the degree of commitment. Under full commitment, a couple's consumption plan is contingent on its total assets and, given that amount, asset composition is irrelevant. As the couple does not respond to the reform,  $\delta_1^j$  is expected to be zero. Under limited commitment, however, the couple's consumption plan is contingent on each member's asset share upon divorce, so  $\delta_1^j$  is not equal to zero, assuming that the participation conditions are violated in some households due to the reform. Hence, if  $\delta_1^j$  is different from zero, we reject the full commitment model. Since the theoretical model suggests that the pension reform will have heterogeneous effects according to the wife's age, we therefore estimated equation (10) by

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<sup>16</sup>Although we did not include wage rates in the empirical model since those of non-labor participants are unobserved, our estimates do not suffer from any bias as long as the (potential) wage rates are uncorrelated with the treatment status, conditional on household fixed effects, year dummy variables and other control variables. Since the treatment status was fixed over the period, we believe that this conditional independence assumption is not restrictive.



(a) Wife Aged 50-59

(b) Wife Aged 40-49

(c) Wife Aged 30-39

Figure 2: Time Trend in Time Allocated to Leisure by Age of Wife

Data Source: The *Keio Household Panel Survey*

Note: Yearly trend in the time allocated to leisure by wives are presented for each age group. Solid lines represent the treatment group and dotted lines represent the control group. The vertical lines indicate 2006, one year before the pension reform was enacted.



dividing the sample into three groups: an elderly group of households with wives aged 50–59 in 2007, a middle-aged group with wives aged 40–49, and a young group with wives aged 30–39.<sup>17</sup>

By estimating by the age of the wife, it allows us to investigate how spouses might update their bargaining positions. For example, if we find no policy impact on the time allocation of younger households, this suggests that those households display some degree of commitment, which is consistent with the model in which the re-bargaining occurs only when the participation condition is binding. We must remember, however, that this specific test may lack statistical power, for even if the younger household does re-bargain its resource allocation plan, the effect may be too small to detect due to the small policy impact on the outside option of a young wife.

## 5 Results

### 5.1 Baseline Results

Table 2 reports the empirical results of the DD estimation showing the household response to the reform by age group. In the most elderly group, consisting of households with wives aged 50–59, the wife’s allocation to leisure increased by 5.0 hours per week, or 4.8 percent. This increase in leisure was associated with a roughly equal decrease in market labor supply and domestic labor supply. Although the effect on labor supply was not statistically significant here, we found that this effect was statistically significant and the size of the estimates were similar in the triple-differences (DDD) estimation discussed in Section 6.4. Furthermore, the estimates in this age group were jointly different from zero at 10 percent significance level, so our statistical inference is not a consequence of testing multiple hypotheses one-by-one.

These estimation results imply that the elderly spouses fail to completely commit to their initial allocation plan due to conflicting incentives, which leads us to reject the full commitment model of household behavior. While one might consider complete commitment as a good approximation if re-bargaining effects were negligible, we found substantial re-bargaining in the form of a 5-percent change in the wife’s leisure. We thus conclude that the model with limited commitment is a better approximation of actual household behavior. Additionally, we found that home production played a non-negligible role in re-bargaining. Specifically, if we had instead defined leisure as non-market hours, we would have missed about half of the change in the wife’s time allocation. As shown in Blundell et al. (2005), the level of home production depends on the marginal willingness of each spouse to pay, and thus, contribution to home production is an important bargaining domain.<sup>18</sup>

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<sup>17</sup>Another approach would have been to categorize households by marriage duration instead of age, as the amount of divisible pension records depends on marriage duration, but this would have been problematic because the marital period is likely to be correlated with match quality. Indeed, in equations (7) and (8), we see that the higher the match-specific utility  $\theta_{j,t}$ , the less likely the participation conditions are to be binding.

<sup>18</sup>Blundell et al. (2005) discuss the public good provision under a cooperative framework. Although we specified

Table 2: The Effect of Pension Reform: Difference-in-Differences Estimation

<b>Wife</b>				
Age Group	Leisure (1)	Market Labor Supply (2)	Domestic Labor Supply (3)	Observations [Households]
50–59	4.976** (2.509)	-2.363 (2.136)	-2.613* (1.435)	1,333 [442]
40–49	-0.322 (1.878)	2.166 (1.491)	-1.844 (1.578)	1,804 [575]
30–39	-3.265 (3.445)	1.475 (1.637)	1.790 (3.153)	1,543 [490]
30–59	0.797 (1.530)	0.695 (0.997)	-1.492 (1.288)	4,680 [1,507]
<b>Husband</b>				
Age Group	Leisure (4)	Market Labor Supply (5)	Domestic Labor Supply (6)	Observations [Households]
50–59	1.014 (2.180)	-0.171 (2.109)	-0.842 (0.567)	1,333 [442]
40–49	-0.935 (2.056)	1.259 (2.004)	-0.324 (0.504)	1,804 [575]
30–39	1.615 (2.361)	-0.811 (2.293)	-0.805 (0.874)	1,543 [490]
30–59	0.376 (1.281)	0.312 (1.243)	-0.688* (0.371)	4,680 [1,507]

Note: The table shows the estimation results of equation (10) by the age group of the wife. Only the estimated values of  $\delta_1^j$  are reported, with standard errors clustered by each household in parentheses.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

In order to gauge the magnitude of the policy impact, we consider the amount of pension benefits that a wife can access from her husband upon divorce. Suppose that the annual value of the divisible pension benefits for a wife aged 55 is 4.8 thousand U.S. dollars, which was the average amount among those who were eligible for benefits in 2014 (i.e., wives who were older than 53 when the pension reform was enacted)<sup>19</sup>, the wife's age of eligibility for pension benefits is 60, and she marries at 28 and dies at 86, which reflects the average lifespan of women in Japan.<sup>20</sup> Setting the interest rate  $r = 0.01$ , the present value of benefits for a wife aged 55 is

the home production good as a private good, we can easily modify our model so that both private and public goods are produced at home without changing the main predictions.

<sup>19</sup>Source: Japanese Ministry of Health, Labour and Welfare; [http://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000106808\\_1.html](http://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000106808_1.html).

<sup>20</sup>Data Source: <http://www.mhlw.go.jp/toukei/saikin/hw/jinkou/geppo/nengai07/> and <http://>

90.5 thousand U.S. dollars. Given that the annual amount of her National pension benefits is 6.5 thousand US dollars beginning at age 65, this pension reform changes the present value of her total pension benefits from 92.0 thousand to 182.6 thousand US dollars, which is almost a 100 percent increase. This back-of-the-envelope calculation indicates that the wife's leisure, market work and domestic work elasticities to the life-time pension benefits upon divorce are 0.05, 0.20 and 0.05, respectively. Since the reform does not change total benefits, these effects are not due to any wealth effect but can be attributed solely to the re-bargaining effect. Furthermore, since the wife may have other assets at her disposal, the elasticity to the assets at her disposal upon divorce could be even larger.

Unlike with elderly couples, we did not find any statistically significant changes in time-allocation among the younger households, and the estimates for the two younger groups were also jointly insignificant (Table 2). It is worth noting that these two younger groups correspond to the households in the Sakamoto (2008) study, which does not find any policy impact of the reform. This is consistent with the model's prediction that the current-period participation condition is unlikely to bind for younger households. Firstly, the pension division applies only to the records tracked during marriage, which is short for young households. Secondly, as the pension benefits do not count as collateral, a divorcing wife is not able to immediately receive the present value of any future pension benefits but must wait until retirement.<sup>21</sup> Thirdly, the discounted future value of the divorce receipts for a young wife would be low, which again makes the current-period participation condition unlikely to bind. For all these reasons, the possible division of pension benefits is less relevant to a younger wife, resulting in almost no impact of the reform on her household resource allocation. Even if the participation conditions at future periods bind under the current allocation, the impact on the current-period resource allocation is only through consumption-smoothing, not through the direct impact of the re-bargaining. As a result, the resource allocation would be gradually adjusted to minimize the deviation from the *ex ante* efficient allocation.

This discussion is in line with Lise and Yamada (2018), who argue that small shocks do not trigger re-bargaining. Since any possible improvement in welfare is too small for a young wife to initiate divorce, her bargaining position is not updated. Consequently, the reform has virtually no impact on young households, for it affects neither the budget set nor the utility weight on each member. We must recall, however, that this view of the way to update bargaining power should be treated with caution, since it can possibly be due to a lack of statistical power in testing minute changes in time allocation.

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[www.mhlw.go.jp/toukei/saikin/hw/life/life07/index.html](http://www.mhlw.go.jp/toukei/saikin/hw/life/life07/index.html).

<sup>21</sup>Exceptions to this include borrowing against future benefits through the Welfare and Medical Service Agency and the Japan Finance Corporation. For more detail, see <http://hp.wam.go.jp/home/tabid/36/Default.aspx> and <https://www.jfc.go.jp>.

## 5.2 Home Ownership and Net Housing Value

Another prediction from our model is that the impact of the reform depends on the amount of household assets other than pension benefits because the assets obtained through pension division would be negligible for high net worth households. In Japan, the property division rule assures divorcing spouses equal division of assets for which they both contributed in obtaining, and one of the most important non-financial household assets is the family home. The interpretation of the law is that a home purchased during the marital period would be divided among the spouses if they divorced, but if it was acquired either before marriage or through an inheritance or gift, it would belong to a single spouse and would not be divided.

The impact of the pension reform on a dependent wife's option outside of marriage is therefore likely to also depend on the value of any property that she would obtain upon divorce. If the value of property is high, the pension benefits divided from her husband would be only of marginal importance to her. As a result, the pension reform would be expected to have a negligible impact on a wife with other real assets and a substantial impact on a wife with no property. Another possible interpretation is that home ownership could also work as a commitment device that makes divorce undesirable relative to staying married. In such cases, a household with home ownership would likely have a higher degree of commitment than one without.

To test this prediction, we divided the most elderly age group into two subgroups according to the household's net housing value and home-ownership.<sup>22</sup> To this end, we first calculated the net value of all houses and plots of land using the self-evaluated value of these properties less the remaining debt from acquiring them.<sup>23</sup> We then assigned a property value to each spouse according to the property rights from housing and land, and then divided the most elderly group into two subgroups: wives with positive property values and those without. Given the above discussion, we would expect the reform to have a substantial impact only on wives without a positive property value.

Table 3 highlights the heterogeneous effects of the pension reform on wives according to the value of the property they own. The leisure of wives whose net housing value was non-positive substantially increased by 9 hours per week while their market and domestic labor supply decreased by 4 and 5 hours, and these estimates were jointly significantly different from zero. In contrast, the hours allocated to both leisure and production by wives with positive property value were not affected in any statistically significant way and, furthermore, the point estimates were almost zero. Although we could not reject the null hypothesis that the response to the reform was the same across the two groups in terms of time allocation at the 10 percent level

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<sup>22</sup>Although it would have been possible to conduct this subsample analysis on the basis of household assets or savings, we chose home ownership because the title to properties other than housing was not available in our dataset. Consequently, we could not distinguish the fraction of savings divided upon divorce from the fraction of savings accumulated before marriage or accumulated through inheritance.

<sup>23</sup>We omitted the top and bottom two percent of the property values to alleviate any influence of outliers.

Table 3: Subsample Analysis by Housing Value and Property Rights (Wives Aged 50–59)

	Housing $\leq 0$ (1)	Housing $> 0$ (2)
<i>Dependent variable</i>		
Leisure	9.116** (4.342)	-0.593 (4.487)
Market work	-4.083 (3.319)	-0.314 (4.200)
Domestic work	-5.033* (2.753)	0.906 (2.006)
p-value of joint test	0.086	0.900
p-value of $H_0$ : same impact in (1) and (2)	0.156	
Observations	495	500
Households	165	164

Note: The table shows the estimation results of equation (10) for the most elderly age group of the wife, by subsamples defined by net housing value, where the top and bottom two percents of the property values of wives are excluded to eliminate outliers. Only the estimated value of  $\delta_1^j$  is reported. Standard errors clustered by each household are in parentheses. The p-value for the joint test against the null hypothesis that the response to the reform is, in terms of time allocation, the same across two groups is less than 0.1.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

(with p-value 0.16), we believe that this is due to the relatively small sample size. These estimation results thus seem to suggest that those who were mainly affected by the reform were wives with poor options outside of marriage, which is well explained by the collective model with limited commitment. To sum up, this subsample analysis further supports the rejection of the full commitment model.

## 6 Validity Check of the Identification Assumption

### 6.1 Placebo Test

While the common trend assumption required for DD estimation to identify the ATT is not directly testable, it is worth considering what might occur if this assumption was violated. For example, if the results in Table 2 were driven entirely by a business cycle unique to the treatment group, we would observe its impact throughout all age groups. However, we found significant changes in the time allocation in the most elderly age group while not in the other groups, so our results are unlikely to be explained by an economic shock that would have influenced only the treatment group.

In order to further confirm the validity of the common trend assumption, we estimated placebo effects of the policy by counterfactually assuming that the reform was enacted in 2005 and 2006 as well as in 2007. Specifically, we estimated the following equation for each age group:

$$y_{it}^j = \sum_{t=2005}^{2007} \delta_{1t}^j d_t \cdot Treatment_i + x'_{it} \beta^j + \sum_{t=2005}^{2006} \gamma_t^j d_t + c_i^j + u_{it}^j. \quad (11)$$

Since  $\delta_{1,2005}^j$  and  $\delta_{1,2006}^j$  represent placebo policy effects, they should be zero when time trends are common across the groups. If they are different from zero, the common trend assumption may be violated. In the following analysis, we focus on the time allocation of the wife since we found close to null effects for the husband in our DD analysis (Columns 4–6 in Table 2).<sup>24</sup>

Table 4 shows the estimates of  $\delta_{1t}^j$  in equation (11) for the wives. Consistent with our baseline results, we found a significant impact on the most elderly age group but a smaller impact on the other age groups.<sup>25</sup> In terms of the coefficients on the placebo years, the estimates of these coefficients were not statistically different from zero in the most elderly and youngest households, supporting the common trend assumption. However, in the middle-aged group, the leisure of the wife significantly decreased in 2006, which could potentially indicate a violation of our identification assumption. Since leisure is defined as the residual hours after production activities, however, an increase in leisure and a decrease in domestic labor supply are merely systematic, as her market hours did not change. Further, as we tested a total of 12 hypotheses that each placebo coefficient is zero, it is not unlikely that one of them might be rejected at a 5 or 10 percent significance level even if all of them are true. In fact, we could not reject the null hypothesis that the placebo coefficients are all zero, with p-value 0.36.

However, we still cannot completely negate the possibility of the violation of the common trend assumption, so to further address this issue, we explicitly allowed for a linear time trend specific to the treatment group. The first column in Table 5 shows the estimation results. We see that the estimate for leisure is quantitatively similar to the baseline result and although market and domestic labor supply estimates differ from the baseline, the standard errors tend to be large and the signs are the same as the baseline. Considering that we have only one treatment year out of the four sample period, it seems natural that the estimates would become imprecise, and so the robust result for leisure thus supports our contention that our estimation result is not driven

<sup>24</sup>As the husband in the treatment group was typically a full-time employee, it appears to have been difficult for him to have changed his hours worked. Furthermore, there were many households in which the husband did not engage in any household production. As a result, changes in bargaining power caused by the pension reform may not have been substantial enough for these husbands to deviate from the corner solution. However, our estimation results do not immediately suggest that the pension reform had no impact on husbands, as their levels of consumption may have declined, both in terms of private and public goods.

<sup>25</sup>The estimates were jointly significant in the most elderly group. Moreover, we rejected the null hypothesis that the 9 coefficients on  $Treatment \times d_{2007}$  are all zero, where the three restrictions are redundant since the time allocation sums up to 168.

Table 4: Placebo Test for the Wives

Age Group: 50–59	Leisure (1)	Market Labor Supply (2)	Domestic Labor Supply (3)
$Treatment \times d_{2007}$	5.733* (2.998)	-1.659 (2.527)	-4.074** (1.882)
$Treatment \times d_{2006}$	-0.992 (2.587)	2.957 (1.944)	-1.965 (2.009)
$Treatment \times d_{2005}$	3.199 (2.656)	-0.832 (2.158)	-2.367 (1.890)
Observations	1333	1333	1333
Households	442	442	442
Age Group: 40–49	Leisure (4)	Market Labor Supply (5)	Domestic Labor Supply (6)
$Treatment \times d_{2007}$	1.138 (2.641)	3.103 (1.894)	-4.240* (2.193)
$Treatment \times d_{2006}$	4.705* (2.751)	0.378 (1.729)	-5.084** (2.376)
$Treatment \times d_{2005}$	-0.431 (2.546)	2.412 (1.718)	-1.981 (2.109)
Observations	1804	1804	1804
Households	575	575	575
Age Group: 30–39	Leisure (7)	Market Labor Supply (8)	Domestic Labor Supply (9)
$Treatment \times d_{2007}$	-3.809 (4.623)	2.032 (2.201)	1.777 (4.135)
$Treatment \times d_{2006}$	0.902 (4.342)	0.745 (2.109)	-1.647 (4.022)
$Treatment \times d_{2005}$	-2.635 (3.887)	0.882 (1.895)	1.753 (3.679)
Observations	1543	1543	1543
Households	490	490	490

Note: The table shows the estimation results of equation (11), checking the pre-time trend for the wives. Standard errors clustered by each household are in parentheses. Only the estimated values of the interaction terms between the treatment dummy variable and year dummy variables are reported.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

by a violation of the identification assumption.

## 6.2 Sensitivity to specification and sample restriction

One potential cause of differing time trends between the treatment and control groups would be a change in family structure. In particular, the typical treatment household tends to have a larger family and younger children than the control household (Table 1). Although in the baseline specification we controlled for family size, the number of children, whether households had a child under 6, and household fixed effects, it is possible that these were insufficient to completely remove the impact of changes in family structure. Thus, we controlled for family structure by using fourth-order polynomials of family size and number of children, dummy variables indicating whether or not the household had a child aged 0–6, 7–12 and 13–18, and interaction terms between these polynomials and the dummy variables. Despite this flexible specification, we obtained estimation results that were qualitatively and quantitatively identical to the baseline results (Column 2 in Table 5). Therefore, any potential changes in family structure seem not to be a concern for our identification strategy.

A second potential violation of the common trend assumption could occur because in the baseline estimation the control group included wives who were permanent employees in 2003 whereas the treatment group did not. Since it is conceivable that the time allocation trend of wives with permanent employment differs from those with part-time or no employment, as an additional confirmation of our baseline results, we excluded wives with permanent employment from our sample and re-estimated the baseline DD equation (10). The third column of Table 5 shows that the leisure time of the wife in the most elderly age group increased while her market hours and domestic work hours decreased in response to the pension reform. Furthermore, the magnitude of the estimates is comparable with those from the baseline result. As before, none of the estimates for the younger two groups are statistically significant. These findings suggest that differences in time-use were not the main driver of our baseline results.

As discussed in Section 3, the key to identifying the degree of commitment of spouses to an initial resource allocation plan is intra-household variation in bargaining position caused by the pension reform. Though approved in 2004 and enacted into law in 2007, discussion of the reform began several years earlier, with published newspaper articles about the reform appearing as early as 1998. It is thus possible that some people aware of the potential reform before 2000 (Figure A1) may have married in the early 2000's already anticipating that the division of pension records upon divorce might be allowed in the future. If this were the case, then the pension reform of 2007 would be unsuitable as an identification strategy, as it would be difficult to separate the changes in bargaining position after marriage from the bargaining position at marriage. Consequently, as couples that potentially anticipated the pension division reform would need to be excluded from the analysis, we implemented a subsample analysis



Table 5: Robustness checks using households with wives aged 50–59

<i>Dependent variable</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Leisure	5.837* (3.531)	5.198** (2.530)	5.833* (3.052)	4.930* (2.574)	4.976** (2.509)	5.890** (2.509)	5.654* (3.162)
Market work	-5.229* (2.863)	-2.608 (2.201)	-2.524 (2.697)	-2.164 (2.225)	-2.363 (2.136)	-2.935 (2.180)	-4.361* (2.400)
Domestic work	-0.608 (2.223)	-2.590* (1.378)	-3.309** (1.681)	-2.767* (1.464)	-2.613* (1.435)	-2.955** (1.411)	-1.293 (2.280)
p-value of joint test	0.173	0.069	0.076	0.088	0.090	0.035	0.146
Method	DD	DD	DD	DD	DD	DD	DDD
Group-specific linear trend	X						X
Flexible family structure		X					
Wives with permanent employment	X	X		X	X	X	X
Wives with husbands in large firms	X	X	X		X	X	X
Couples divorced btw. 2005 and 2012	X	X	X	X		X	X
Couples married before 1998	X	X	X	X	X		X
Observations	1333	1333	1104	1219	1328	1287	4680
Households	442	442	364	413	439	426	1507

Note: The table shows the estimation results of equation (10) and (12) with various specifications and sample restrictions, for the most elderly age group. Only the estimated value of  $\delta'_1$  is reported. Standard errors clustered by household are in parentheses. In the DDD analysis, the two young groups were used as the control.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

that limited the estimation sample to wives in the most elderly group who married in 1997 or earlier. As the results (Column 6 in Table 5) are identical to the baseline, the issue of couples anticipating the pension reform at the time of their marriage appears to be inconsequential to our analysis.

### **6.3 Another Policy Change: The Mandatory Retirement Age**

Another consideration in interpreting our estimation results is the enactment in 2006 of the Elderly Employment Stabilization Law (EESL) affecting the mandatory retirement system in Japan. From 2006, the Japanese government through the enactment of the EESL has required firms to comply with a scheme to raise the mandatory retirement age to 65 in order to fill the gap between the existing mandatory retirement age of 60 and the pension eligibility age of 65. Specifically, the EESL allows those born in 1946 to remain employed until age 63, those born in 1947 or 1948 until age 64, and those born in 1949 or later until age 65. The new law did not force firms to raise the mandatory retirement age but instead provided them with three options to continue to employ workers who would otherwise need to retire: (1) raise the mandatory retirement age; (2) extend or renew employment contracts; or (3) abolish mandatory retirement. According to the Ministry of Health, Labour and Welfare, more than 80 percent of firms chose option 2 rather than either raising or abolishing the mandatory retirement age.<sup>26</sup>

It is expected that the EESL would increase the labor force participation rate of elderly people hired as full-time employees. Kondo and Shigeoka (2017) show that it has indeed increased the ratio of salaried workers aged over 60, but the impact is rather small at only 3 percentage points and is seen only in large firms ( $\geq 500$  employees), perhaps because small and medium firms had already abolished or raised the retirement age. Additionally, they find that contract renewals tend to be associated with a substantial decline in wages, which discourages employees from continuing to participate in the labor force. Despite the apparent limited impact of the EESL, it could nevertheless bias our estimates due to the similarity of the target populations. Those born in 1946 became 60 years old in 2006, and a main target of the EESL was full-time employees, so the pension reform enacted in 2007 presumably affected the same employees. Given that the effect of the EESL was to increase the future earnings of the husband, this wealth effect could potentially decrease the current market labor supply of the wife and increase her leisure. Since those affected by the EESL are employees at large firms, we excluded them from the sample and re-estimated the baseline empirical model (10). As this subsample analysis (Column 4 in Table 5) replicated the baseline results, the EESL also does not seem to be a main driver of our findings.

One further possibility is that the EESL may potentially have an indirect affect on younger employees. Since the EESL requires firms to continue to employ workers who would other-

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<sup>26</sup>Data Source: <http://www.mhlw.go.jp/toukei/list/11-23c.html>.

wise retire at age 60, it is conceivable that firms might accommodate this new requirement by decreasing the number of young employees, either by not hiring new graduates or by letting go of part-time employees. Conversely, if elderly workers and young workers are viewed as complementary, then firms could increase the number of young employees as a result of the EESL. Ohta (2012) and Kondo (2016) report negative correlations between the proportions of employees aged over 60 and of female part-time workers, potentially suggesting that the EESL has created a crowding-out effect. However, since our control group includes part-time employees, such an indirect impact of the EESL is controlled by our DD estimation to a certain degree. Furthermore, as long as the EESL affects young and old female part-time employees in a similar manner, DDD estimation (described next) partials out any potential indirect impact of the EESL so that any potential biases caused by the EESL are likely to be small.

## 6.4 Triple Differences Estimation

As the characteristics of the 2007 pension reform suggest that it had little effect on anyone other than elderly households, this is an opportunity to implement triple differences (DDD) estimation, which is more robust than DD estimation since the third difference can partial out any time trend specific to the treatment group. We must be careful in interpreting DDD estimates, however, as DDD estimation removes any policy impact that is common across the young and elderly households in the treatment group. In particular, as some estimates for the oldest and middle-aged group were similar (Table 2), DDD estimation could underestimate the policy impact. Thus, the biases in DDD estimation would make the null hypothesis of full commitment difficult to reject, and so, the resulting hypothesis test would be rather conservative.

For DDD estimation, we introduced two younger age groups as additional controls and introduced a dummy variable,  $Old_i$ , which takes one if the wife was over 50 in 2007. Then, we estimated

$$y_{it}^j = \delta_1^j DDD_{it} + \delta_2^j After_t \cdot Treatment_i + \delta_3^j After_t \cdot Old_i + x'_{it} \beta^j + \sum_{t=2005}^{2007} \gamma_t^j d_t + c_i^j + u_{it}^j, \quad (12)$$

where  $DDD_{it} = After_t \cdot Treatment_i \cdot Old_i$ , and  $\delta_1^j$  represents the impact of the pension reform. In order to accommodate any arbitrariness in the choice of the control group, we estimated equation (12) by using two subsamples as well as the entire sample, with one subsample consisting of the most elderly group and the second youngest group and the other consisting of the most elderly group and the youngest group.

In estimating equation (12), we found that the leisure of the wife increased more than 5 hours per week, which was statistically significant irrespective of the choice of control group (Table 6). While the estimate using wives aged 30–39 as the control group is relatively larger (Column

7), the size of other two estimates are comparable to the results of the DD estimation (Columns 1 and 4). Hence, we are confident that the results from both DDD and DD estimation provide sufficient evidence to reject the full commitment model. Meanwhile, the market labor supply of the typical wife decreased by 4–4.5 hours, a result that was robust to change in control groups. Moreover, the sign of the DDD estimate is in line with those of the baseline DD estimates, though its magnitude is somewhat greater than the baseline and similar to the DD estimate which allowed for a linear time trend specific to the treatment group. All in all, considering the robustness of our findings, it appears that the wives' market hours decreased due to the changes in the value of divorce to her.

In contrast to market work, we observed relatively large variation in the DDD estimates of the impact on domestic work, and the estimates were not statistically significant. However, the sign of the coefficient was still negative in all three cases, as it was with the DD estimate. Furthermore, the estimate became smaller when we used the second most elderly age group as the control group, and this is consistent with our earlier discussion that DDD estimation possibly underestimates the policy impact by filtering out effects common among elderly and younger households.

A final consideration is that while we maintained the identification assumption that there was no time trend specific to the treatment group in the most elderly age group, the DDD estimates would fail to recover the ATT if this assumption did not hold. Thus, to check the sensitivity of our estimates, we implemented a further DDD estimation while allowing for a linear time trend specific to the most elderly age group and also to the treatment group. Under the identification assumption, the resulting estimates would likely be similar to the DDD estimates obtained from the empirical model without those group-specific time trends and, indeed, we found an almost identical result with this specification (Column 7 in Table 5). To sum up the above discussion, a comprehensive series of the robustness checks further supports our rejection of the full commitment model.

## 7 Divorce

In Section 3, we assumed that a couple does not eventually divorce, and the identification result indeed relies on that assumption. In this section, we thus examine the case when divorce does occur. With a positive probability of divorce, the household objective function becomes

$$\begin{aligned} \mu E \left[ \sum_{t=1}^3 \beta^{t-1} \left\{ (1 - D_t) u_1(c_{1t}, l_{1t}; \theta_{1t}) + D_t V_{1t}^D (a_{1t}^D + b_{1t}^D) \right\} \right] \\ + (1 - \mu) E \left[ \sum_{t=1}^3 \beta^{t-1} \left\{ (1 - D_t) u_2(c_{2t}, l_{2t}; \theta_{2t}) + D_t V_{2t}^D (a_{2t}^D + b_{2t}^D) \right\} \right], \end{aligned}$$

Table 6: The Effect of the Pension Reform on the Wives: Triple Differences Estimation

Control Group: Wife Aged 30–49			
Dep. Var	Leisure (1)	Market Labor Supply (2)	Domestic Labor Supply (3)
DDD	5.658* (3.147)	-4.278* (2.399)	-1.380 (2.265)
Observations	4,680	4,680	4,680
Households	1,507	1,507	1,507
Control Group: Wife Aged 40–49			
Dep. Var	Leisure (4)	Market Labor Supply (5)	Domestic Labor Supply (6)
DDD	5.233* (3.113)	-4.565* (2.597)	-0.669 (2.117)
Observations	3,137	3,137	3,137
Households	1,017	1,017	1,017
Control Group: Wife Aged 30–39			
Dep. Var	Leisure (7)	Market Labor Supply (8)	Domestic Labor Supply (9)
DDD	7.636* (4.380)	-3.911 (2.701)	-3.725 (3.665)
Observations	2,876	2,876	2,876
Households	932	932	932

Note: The table shows the estimated values of  $\delta_1^j$  in equation (12) for wives, with standard errors clustered by each household in parentheses.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

where  $D_t$  is a decision to divorce, which is an absorbing state, and  $D_1 = 0$  as we focus on a married couple. In this case, each spouse cares about their welfare after potential divorce even under full commitment, and consequently, this concern about divorce makes the household behavior contingent on the share of assets upon divorce. Note that this caveat is not unique to this study but is typical in the literature.<sup>27</sup>

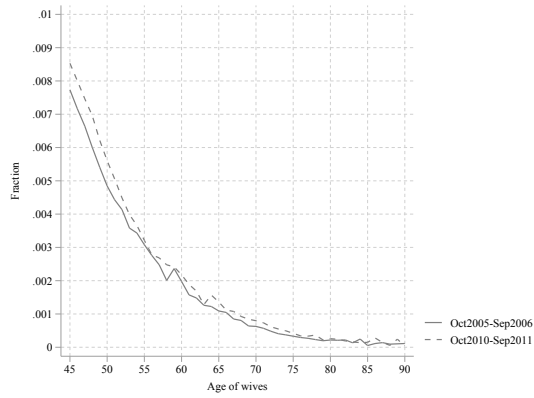
One possible interpretation of our results is that the pension division system might have affected the wife's actions prior to divorce and thus our estimates reflect that rather than the effects of re-bargaining. For example, it seems plausible that a housewife planning to divorce may begin working in order to prepare for her life after divorce, and Mazzocco et al. (2006) suggest that wives in the United States tend to start working about two years before divorce so as to accumulate human capital. Since the Japanese pension reform provided an additional income source after divorce, this might eliminate the need for a wife to work before (and possibly after) the divorce. In this scenario, her market hours would decline after the reform and her leisure would increase, which is compatible with our estimation results but unrelated to changes in her bargaining position.

Reflecting on the above situation, however, it seems difficult to explain our findings entirely by such “divorce-concern” behavior due to the low probability of divorce in Japan, particularly among elderly households. Figure 3a illustrates the annual divorce rate of elderly households before and after the reform and shows, for example, that 3 in 1000 couples with wife aged 55 divorced the next year. This probability declines rapidly as the age of the couples rises, becoming less than 0.1 percent at age 70. Although we are referring here to cross-sectional data, from this we calculated a life-time divorce rate at each age of the wife (Figure 3b). While the life-time probability of divorce is relatively high for young wives because both the annual divorce rate and life expectancy are high, this is not true of elderly wives, whose life-time divorce rate at age 55 is only about 3 percent. Since the value of divorce under full commitment affects household behavior only through the decision to divorce, these low probabilities of divorce suggest that our baseline model without divorce approximates reality well and our estimation results do not seem to be driven entirely by “divorce-concern” behavior.

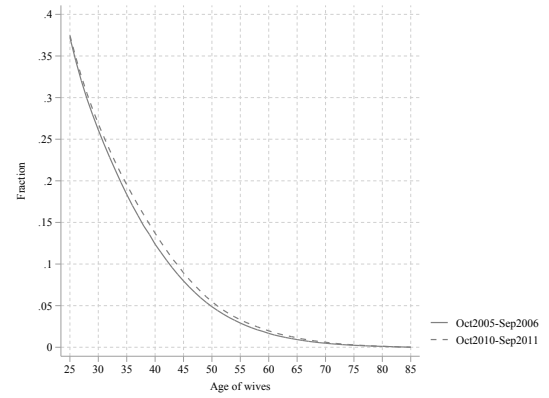
We also calculated the weight  $\omega_2^D$  put on the divorce value in the wife's value function. The

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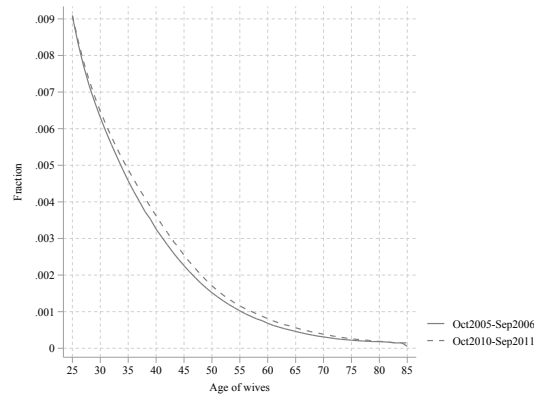
<sup>27</sup>Our limitation is the same as that of Blau and Goodstein (2016), while Mazzocco (2007) does not allow assets to be used for bargaining, and Lise and Yamada (2018) do not incorporate endogenous divorce behavior or human capital accumulation in their structural model so the “divorce-concern” behavior discussed by Mazzocco et al. (2006) is not addressed.



(a) Yearly divorce probability



(b) Life-time divorce probability



(c) Utility weight on the divorce state

Figure 3: Divorce probability and utility weight put on the divorce value

Source: *Vital Statistics and Census*.

weight of the wife aged  $t$  would be approximated by

$$\begin{aligned}\omega_2^D(t) &= \frac{\sum_{s=t}^T \beta^{s-1} \Pr(D_s = 1 | D_{s-1} = 0)}{\sum_{s=t}^T \beta^{s-1} \Pr(D_s = 1 | D_{s-1} = 0) + \sum_{s=t}^T \beta^{s-1} \Pr(D_s = 0 | D_{s-1} = 0)} \\ &= \frac{\sum_{s=t}^T \beta^{s-1} \Pr(D_s = 1 | D_{s-1} = 0)}{\sum_{s=t}^T \beta^{s-1}},\end{aligned}$$

with the imprecision due to the decision to divorce depending on a distribution of uncertainties. Figure 3c plots  $\omega_2^D$  at each age, showing that this weight is minute at all age points. It is still possible, however, that the weight on the divorce state could be large particularly among couples on the verge of divorce. To partially check if those couples are the driving force of our estimation results, we re-estimated our baseline regression excluding couples that divorced between 2005 and 2012, but the results were unchanged (Column 5 in Table 5). Hence, our results seem difficult to be explained by divorce concern behavior.

If we can accept that the full commitment model is rejected, our findings underline how difficult it is to make a commitment. Although the marital relationship of elderly couples in Japan tends to be stable and divorce is rare, even they fail to achieve full commitment. While a lack of substantial exogenous variation did not allow us to test the degree of commitment of young couples, we suspect that their comparatively less stable marital relationships would make commitment even more difficult. In fact, a high divorce rate may suggest that the participation conditions are likely to bind, so a young couple may have more opportunities to threaten divorce or to bring about a hold-up problem. We thus believe that a lack of commitment is a key feature of family decision making, and its economic consequences are worth considering in future empirical studies.

## 8 Conclusion

It appears that couples have difficulty committing to an initial resource allocation plan. By using a pension reform in Japan to create a natural experiment, we filled a gap in the literature by testing a full commitment model of household decision-making without imposing any specific functional form assumptions on preferences or home production technology. The results led us to reject the full commitment model, as elderly wives exploited their improved outside option to enjoy more leisure by reducing market and domestic labor. Consistent with the model's prediction, this impact was most striking among low net worth couples. Incomplete commitment, however, does not mean no commitment, and we found suggestive evidence that a couple does not respond to small shocks unless the participation condition binds. A lack of commitment thus seems to distort resource allocation and typically makes the first-best allocation difficult, if not impossible, to achieve. Therefore, future work should address the size of distortion in



long-term decision making such as human capital accumulation and investment in children as well as risk sharing. Finally, given the non-negligible impact of re-bargaining, we believe that model-based studies need to incorporate this feature of family decision making.

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## A Appendix

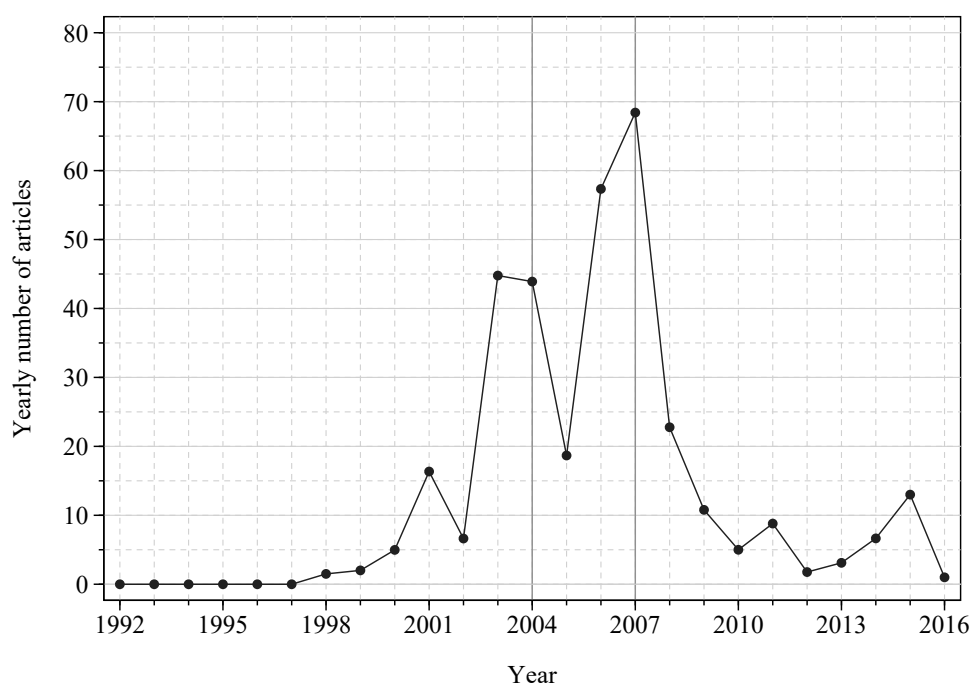


Figure A1: The Yearly Number of Newspaper Articles about Pension Division

Data Source: *Kikuzo II Visual*, *Maisaku*, *Semi-Annual Newspaper Issuer Report*, *Nikkei Telecom* and *Yomidasu Rekishikan*

Note: This figure shows the yearly number of newspaper articles about pension division on divorce published in the *Asahi*, *Mainichi*, *Nikkei* and *Yomiuri* newspapers, which are the prime national newspapers in Japan. The vertical axis shows the weighted sum of the number of the articles, where the annual yearly circulation of each newspaper was used as the weight and the weight on the number of the articles of *Yomiuri* newspaper was normalized to one. Due to data availability, the total number of articles in 2015 and 2016 was not weighted. The pension reform was voted in 2004 and enacted in 2007.

Table A1: Age of Eligibility for Employee Pension Insurance

Birth Cohort	Basic Part		Proportional Part	
	Men	Women	Men	Women
1940	60	60	60	60
1941	61	60	60	60
1942	61	60	60	60
1943	62	60	60	60
1944	62	60	60	60
1945	63	60	60	60
1946	63	61	60	60
1947	64	61	60	60
1948	64	62	60	60
1949	65	62	60	60
1950	65	63	60	60
1951	65	63	60	60
1952	65	64	60	60
1953	65	64	61	60
1954	65	65	61	60
1955	65	65	62	60
1956	65	65	62	60
1957	65	65	63	60
1958	65	65	63	61
1959	65	65	64	61
1960	65	65	64	62
1961	65	65	65	62
1962	65	65	65	63
1963	65	65	65	63
1964	65	65	65	64
1965	65	65	65	64
1966	65	65	65	65

Table A2: Changes in the Time Allocation of the Treatment Group and the Control Group

Leisure	Wife				Husband			
	Before (1)	After (2)	D (3)	DD (4)	Before (1)	After (2)	D (3)	DD (4)
Treatment Group	105.09 [33.48]	108.71 [29.10]	3.63** (1.49)	1.57 (2.30)	118.3 [19.41]	119.06 [18.09]	0.76 (0.87)	1.41 (1.49)
Control Group	105.09 [29.60]	107.14 [26.70]	2.06 (1.68)		120.73 [22.10]	120.08 [21.45]	-0.65 (1.27)	
Market Labor Supply	Before (5)	After (6)	D (7)	DD (8)	Before (5)	After (6)	D (7)	DD (8)
	12.27 [15.34]	13.28 [15.15]	1.01 (0.70)	0.37 (1.33)	46.74 [18.55]	46.63 [17.89]	-0.11 (0.84)	-0.60 (1.43)
Control Group	27.51 [21.57]	28.15 [22.22]	0.64 (1.25)		43.74 [20.84]	44.23 [20.61]	0.49 (1.20)	
Domestic Labor Supply	Before (9)	After (10)	D (11)	DD (12)	Before (9)	After (10)	D (11)	DD (12)
	50.64 [36.26]	46.01 [30.92]	-4.64*** (1.60)	-1.94 (2.43)	2.96 [6.16]	2.31 [4.26]	-0.65** (0.27)	-0.81* (0.47)
Control Group	35.4 [30.06]	32.71 [25.74]	-2.70 (1.69)		3.53 [7.19]	3.69 [7.05]	0.16 (0.41)	

Note: The table shows the means of leisure before and after the pension reform, their difference within each group, and a DD estimate, with standard deviations in brackets and standard errors in parentheses.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .