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# Pension Reforms and Couples' Labour Supply Decisions <sup>\*</sup>

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## Abstract

To determine how wives' and husbands' retirement options affect their spouses' (and their own) labour supply decisions, we exploit (early) retirement cutoffs by way of a regression discontinuity design. Several German pension reforms since the early 1990s have gradually raised women's retirement age from 60 to 65, but also increased ages for several early retirement pathways affecting both sexes. We use German Socio-Economic Panel data for a sample of couples aged 50 to 69 whose retirement eligibility occurred (i) prior to the reforms, (ii) during the transition years, and (iii) after the major set of reforms. We find that, prior to the reforms, when several retirement options were available to both husbands and wives, both react almost symmetrically to their spouse reaching an (early) retirement age. This speaks in favour of leisure complementarities. However, after the set of reforms, when retiring early was much more difficult, we find no more significant labour supply reaction to the spouse reaching a retirement age, whereas reaching one's own retirement age still triggers a significant reaction in labour supply. Our results may explain some of the diverse findings in the literature on asymmetric reactions between husbands

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and wives to their spouse reaching a retirement age: such reactions may in large parts depend on how flexibly workers are able to retire.

**Keywords:** retirement coordination; labour market participation; household decisions; regression discontinuity design.

**JEL Classification Numbers:** J22, J26.

# 1 Introduction

Increasing longevity and declining fertility have led many industrialised countries to increase normal retirement ages and make early retirement schemes less generous, thereby motivating individuals to retire later (see Section 4.4.4 in [Blundell et al. 2016](#), for a survey). Recent literature on this topic raises an additional important context: household-level coordination of labour market exits. Indeed, rising female labour force participation over the last few decades means that retirement decisions frequently involve both partners in heterosexual couples. As a result, in addition to directly affecting the targeted individuals, changes in retirement age may also indirectly affect spousal labour supply decisions.

In fact, a wife’s (husband’s) exogenous retirement decisions may affect her husband’s (wife’s) labour supply in several ways, including income loss to the family, which should increase the labour supply if leisure is a normal good. For example, a husband still able to work after his wife retires because of an adverse health shock would contribute to a negative correlation between the two spouses’ labour force participation indicators. On the other hand, this correlation could also be positive if leisure complementarities between spouses result in the wife’s planned retirement changing the husband’s preference for leisure versus consumption, thus leading to a reduction in the husband’s labour supply and to coordinated joint retirement ([Hurd 1990](#), [Coile 2003](#)).

Our paper contributes to a small but burgeoning literature on couples’ retirement coordination that uses exogenous variation in spousal retirement status (e.g. [Lalive and Parrotta 2017](#), [Selin 2017](#), [Stancanelli 2017](#), [Atalay et al. 2019](#), [Bloemen et al. 2019](#), [Kruse 2020](#), [Carta and De Philippis 2021](#), [Johnsen et al. 2022](#)). We add to this literature by studying a particularly interesting case of Germany where the costs of retirement coordination were lower before major early retirement reforms than in other countries. This is both due to multiple retirement options in Germany and the fact that early retirement in Germany does not necessitate an actuarial reduction in pension benefits. There is no consensus in the literature, as far as symmetry of reactions of husbands and wives to their respective spouses’ retirement is concerned. Early structural studies find a

higher response of husbands’ reacting to wives’ retirement than vice versa (e.g. [Zweimüller et al. 1996](#), [Gustman and Steinmeier 2000](#), [Coile 2003](#), [Gustman and Steinmeier 2004](#), for Austria and for the United States, respectively). This result has been confirmed in some recent studies (e.g. [Stancanelli 2017](#), [Carta and De Philippis 2021](#), for France and for Italy, respectively). For Australia, however, [Atalay et al. \(2019\)](#) find symmetric effects of two retirement reforms—one for men one for women—on the retirement decisions of the spouses. There are, however, also studies finding only wives reacting to husbands’ retirement, but not vice versa (e.g. [Lalive and Parrotta \(2017\)](#), [Hersche et al. \(2018\)](#) for Switzerland, [Sand and Lichtman-Sadot \(2019\)](#) for Israel, and [Kruse \(2020\)](#) for Norway, but see [Johnsen et al. \(2022\)](#) as an exception for Norway when incomes of both spouses are similar).

In this paper, we show that the symmetry of spouses’ reactions to the other spouses’ reaching a retirement age may depend on how flexibly workers can retire. Our results are consistent with leisure complementarities for both spouses, but constraints/costs to early retirement preventing such joint retirement from being an optimal decision. We demonstrate this by showing how spouses’ reactions to their partner reaching a typical retirement age differs before and after major early retirement reforms in Germany. In particular, we use household panel data for Germany to estimate the effect of husbands’ and wives’ crossing key (early) retirement ages on both their own labour supply and the labour supply of their spouse.

In doing so, we exploit two types of natural experiments: first, we estimate multi-cut-off regression discontinuity designs, in that we examine how husbands and wives react when they or their spouses cross key retirement age thresholds, that is 60, 63, and 65. [Bonsang and Van Soest \(2020\)](#) also use a similar specification by focusing on these three ages 60, 63, and 65, but do so in a different context of home production and retirement using SOEP data. Based on German administrative data, [Seibold \(2021\)](#) also observes a spike in retirements around these three age thresholds. Hence, we include these retirement age thresholds for both wives and husbands in both labour supply equations.

Reactions to the age thresholds are useful to identify leisure complementarities, be-

cause they are likely to encourage spouses to plan a co-ordinated retirement yielding a more positive wife/husband retirement correlation than that generated by an unexpected health event, which might even be negative. Second, we split the sample into groups of birth cohorts who were (i) not affected by early-retirement reform, (ii) affected by early retirement reforms mainly pertaining to men (because most women in these cohorts could still retire earlier than men) and (iii) affected by earlier retirement reforms pertaining to both men and women. The reforms generally delayed the age at which a person could retire for a specific reason and still receive a full pension, such that still retiring at the pre-reform early retirement age implied a reduction of the pension level. Moreover, using a two-way fixed effects model, we control for fixed household-specific effects and survey-year effects and thus take unobserved household and time heterogeneity into account.

We find that before the set of early retirement reforms, husbands' and wives' reactions to their spouse reaching early retirement age are almost symmetric: depending on the sample and the specification, when the spouse reaches age 60, between 4.5 and 6.3 percent of husbands (both numbers statistically significant) and between 3.0 and 4.5 percent of wives (only the latter number statistically significant) leave the labour market. After the set of reforms, these effects diminish and become insignificant, except for one coefficient (1.7 percent for wives in sample 1) which is statistically significant. Consistent with this finding is that after the set of reforms, we observe both husbands and wives reacting more strongly to their own crossing the age 65 (or age 63) normal retirement age and less to their spouses' crossing the age 60 (or age 63) threshold than before the set of reforms. Our results thus suggest that there are preferences for joint retirement in couples and they may be roughly symmetric. However, joint retirement of couples is more likely to be observed if the pension system facilitates flexible early retirement schemes. Once Germany made early retirement more costly, neither husbands nor wives show a significant labour supply response to their partner turning age 60 any more. Instead, their retirement seems to be driven more by their own crossing age thresholds 63 and 65, which—given age differences in couples—might make joint retirement when one partner crosses the age 60 threshold, almost impossible.

The remainder of the paper is structured as follows: Section 2 briefly describes the German pension system and the female retirement age reform exploited in the study, after which Section 3 explains the endogeneity of a wife’s labour supply to her husband’s labour supply decision. Section 4 then introduces the data, Section 5 outlines the regression discontinuity design, and Section 6 reports the empirical results. Section 7 concludes the paper by relating our findings to the relevant literature.

## 2 Institutional Background

Although 65 was the standard retirement age for the cohorts in our sample, early retirement without actuarial deduction was possible under certain conditions, which some of the literature calls “retirement entry regimes” or “pathways to retirement” (Riphahn and Schrader 2021). Figures 1a and 1b show the shares of new pensions by pathways to retirement for men and women, respectively, during the period 1995 to 2020, using data every 5 years. The figures demonstrate that more than half of new pensions are due to pathways to retirement earlier than at the normal retirement age. This can be seen by comparing the orange area, which shows the share of new pensions due to retirement at the “normal retirement age”, to the other pathways. Furthermore, the share of the pathways changes over time, which is also due to several pension reforms, some of which we will discuss in the rest of this section.

Table 1 exhibits some of the most important pathways to retiring before the “normal” retirement age of 65, which have experienced significant reforms during our study period: one could retire as early as age 60 “due to unemployment”, or alternatively at age 63 if one had been “long-term insured” (for at least 35 years) in the public pension system. In 2012, a new pathway to early retirement was introduced for the “very long-term insured” (for at least 45 years) and soon after made more generous, to partially counteract a reform of the pension for the “long-term insured”.<sup>1</sup> For reasons of “severe disability”, workers

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<sup>1</sup>In 2014, the pathway to retirement for the “very long-term insured” was made more generous by lowering the early retirement age for some cohorts, such that cohorts born before 1953 could already retire at age 63 if they were eligible for this pathway. But for cohorts born between 1953 and 1964, the retirement age associated with this pathway was successively increased by two months each year to reach 65 again.

were able to retire at age 60. In addition, there exists an even more important programme under which one can retire at any age due to “reduced capacity to work”, which we do not list in Table 1. Despite of some reforms concerning eligibility and determination of pension deductions, this pathway to retirement did not experience a change in age restriction for the cohorts we study. The mentioned pathways to retirement existed for both sexes. However, there was an additional retirement option at age 60 for women with at least 10 years of mandatory contributions (since age 40) and at least 15 years of active social security insurance. This option applied to about half of all women (Engels et al. 2017).<sup>2</sup>

A remarkable feature of the pathways to early retirement described in the previous paragraph was the absence of any actuarial discount for a longer expected pension period due to retirement before the normal retirement age of 65. The only reason workers choosing to retire before age 65 received a lower pension was a lower number of “earnings points” they would accumulate due to early retirement. These “earnings points”, which mainly depend on earnings accumulated during social-security-relevant employment (although parental leave or unemployment spells may also accumulate “earnings points”), are the main driver of the pension received in the German public pension formula. In sum, the lack of actuarial pension adjustment made these pathways to early retirement particularly attractive in Germany.

As shown in Table 1, there have been reforms to all the mentioned pathways to early retirement than at the normal retirement age of 65. In general, what happened was that the age at which workers could choose a pathway to early retirement was increased successively, in most cases up to the age of 65, which—being the normal retirement age—was almost equivalent to abolishing this pathway to early retirement. We write “almost equivalent” because in general, it was still possible to retire at the “old” early retirement age, but doing so resulted in a lower pension, that is a discount of 0.3 percent per month (3.6 percent per year) of discrepancy between the “reformed” and the actual age of early

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<sup>2</sup>For large parts of the sample, especially women who are not working any more, we cannot determine whether they belong(ed) to any of these groups, and so we do not split the sample based on these characteristics.



retirement.

In particular, for “retirement due to unemployment” and “retirement for women”, the age of retirement associated with these pathways has been successively raised from 60 to 65 for the 1937 to 1941 and the 1940 to 1944 birth cohorts, respectively, whereas for “retirement due to long-term insurance” the age of retirement associated with this pathway has been successively raised from 63 to 65 for the 1937 to 1938 birth cohorts. The age of retirement during the transition period was usually raised monthly, depending on the month of birth, and the discount on the pension level for retiring at the old early retirement age of 60 or 63 respectively was raised by the above-mentioned 0.3 percent usually each month during the transition period. Note, however, that from the birth cohort 1952 onwards, this option to still retire early—albeit with a discount on the pension level—was abolished, so that since then, the pathways to early retirement “due to unemployment” and “for women” do not exist any more.

### 3 Theoretical Considerations

Coordinated (joint) retirement is an example of leisure complementarity within a household, one that is theoretically consistent with both unitary and collective household models (see [Vermeulen 2002](#), [Vermeulen et al. 2006](#), for an overview of the two theoretical approaches). Whereas in the unitary model, the household is the unit of analysis, with spouses acting as one unit to optimise their joint utility function; in the collective model, each household member maximises his or her own utility. In this section, therefore, we develop a static model in the spirit of [Lalive and Parrotta \(2017\)](#) to study the labour supply decisions of couples nearing retirement. In this collective model, which contains both cooperative and noncooperative components, each spouse has his or her own utility function (noncooperative element) but they both share joint household consumption (cooperative element), meaning that consumption decisions are not based on their individual incomes. This model is thus one of noncooperative bargaining by which each spouse maximises his or her own utility function subject to the constraint that

family consumption does not exceed family income (cooperative element). Our outcome of interest is the effect of one spouse's retirement-relevant characteristics on the other spouse's labour supply decisions (i.e., when to retire), which cross-effect we express as a reduced-form representation.

First, following [Gustman and Steinmeier \(2000, 2004\)](#), we define the wife and husband's respective utility functions as

$$U_w = C + e^{(X^w \beta_w + \theta_w L^h + \xi_w)} L^w \quad \text{and} \quad U_h = C + e^{(X^h \beta_h + \theta_h L^w + \xi_h)} L^h. \quad (1)$$

Here, each spouse's utility function depends on the joint lifetime household consumption  $C$ , the leisure time of both wife  $L^w$  and husband  $L^h$ , and the characteristics of each spouse,  $X\beta$ , which includes age, educational level, and own and spouse's health status, with  $\xi$  denoting the individual fixed effect.

After marriage, the two spouses live for a finite  $T^w$  and  $T^h$  years, respectively, so that  $l^w = T^w - L^w$  and  $l^h = T^h - L^h$  denote their working years. Both maximize their utility separately subject to the lifetime household budget constraint given by

$$C = W_w(T^w - L^w) + W_h(T^h - L^h) + r(l_w)W_w L^w + r(l_h)W_h L^h + A \quad (2)$$

where  $W_w$  and  $W_h$  denote the compensation amounts for each spouse who works for  $l^w$  and  $l^h$  years, of which the pension replacement rate,  $r(l)$ , is a function.  $A$  denotes any joint family assets.

Family decision making proceeds as follows: both spouses first make a decision on lifetime consumption based on the family budget constraint, after which each selects his or her own labour supply taking the other's optimal labour supply as a given to maximize his or her own utility function. As regards labour supply decisions specifically, the wife maximizes (1) subject to (2) obtaining the following first-order condition:

$$e^{(X^w \beta_w + \theta_w L^h + \xi_w)} = W_w(1 - r(l_w)) - \frac{dr}{dL_w} W_w L^w$$

After an analogous derivation for the husband, we simplify our calculation by assuming that the derivative of  $r$  with respect to years of working is close to zero, which allows us to obtain the wife's and husband's optimal leisure time as follows:

$$L^w = T^w - r^{-1} \left( 1 - \frac{e^{(X^w \beta_w + \theta_w L^h + \xi_w)}}{W_w} \right) \quad \text{and} \quad L^h = T^h - r^{-1} \left( 1 - \frac{e^{(X^h \beta_h + \theta_h L^w + \xi_h)}}{W_h} \right) \quad (3)$$

Equation (3) describes the best response functions by showing that each spouse's labour supply depends on that of their partner, as well as their own characteristics and potentially some of their spouse's. Nonetheless, by demonstrating the interrelation of husbands' and wives' labour supply decisions, the model hints at the potential endogeneity of the wives' labour supply in regressions modelling the husbands' labour force participation. In particular, such endogeneity will cause bias if unobserved factors driving the two spouses' labour supply correlate with each other. We will therefore limit ourselves to estimating reduced-form equations by regressing our proxy for retirement on reaching typical retirement ages (of oneself as well as one's spouse). Because we have no information on number of years in retirement  $L_w$  and  $L_h$  but do have data on labour force participation, we estimate the effect of a spouse reaching typical retirement ages on the other spouse's labour supply decision.

## 4 Data and Descriptive Results

We choose the German Socio-Economic Panel (SOEP) using information from the 1984–2019 SOEP data set (Goebel et al. 2019) to identify 27,234 observations for 4,687 couples in which the male partner is aged 55 to 69 and the female partner is aged 50 to 69 in our first sampling scheme (to be explained below). In our second sampling scheme, we observe 14,899 observations for 1,868 couples. Although Engels et al. (2017) successfully used German pension insurance data to demonstrate that the raised female pension age (and/or early retirement penalties) motivated women to retire later, these data do not enable spousal identification. Because men are on average older than their wives, we also keep couples in the sample where women are as young as age 50 in order to stabilise our

estimates. Our sample also contains cohabiting heterosexual couples, but, for simplicity, we refer to the partners throughout the discussion as husband and wife.<sup>3</sup>

In the SOEP data, we observe age to the month, because both the month of interview and the month of birth are recorded in our data. This will be important for the regression discontinuity design below. Couples where one partner’s age is out of the stated ranges are irrelevant to our research design and are hence not included in the sample in the respective calendar years. Because our sample is collected during the years 1984 to 2019, birth cohorts 1915 to 1969 are in the stated age ranges at least some time during this period. For birth cohorts 1930 to 1955 (restricted such to save space), Table A1 of the Appendix reveals which cohorts experience which age during our observation period.

We use two sampling schemes, illustrated in Tables 2 and 3. In the first sampling scheme, we select couples born within specific birth year intervals, defined on the state of the pension reforms discussed in Section 2. According to sampling scheme 1, the “Pre-Reform Sample” comprises couples where both husband and wife are born up to the year 1936, as none of the previously discussed pension reforms affected these cohorts, as shown in Table 2. The “Male Reform Sample” comprises couples where both husband and wife are born between 1937 and 1941. The labelling “Male Reform Sample” is somewhat imprecise, because wives of cohorts 1940 and 1941 are affected by the phasing in of the reform raising the pension age for women. Still, because wives are typically a few years younger than their husbands, we need to have a wide enough interval of birth years to obtain a reasonably representative sample of couples born in this period. Our final sample under sampling scheme 1, the “Male-Female Reform Sample” uses couples from birth cohorts born in 1945 or later. We thus do not use birth cohorts 1942 to 1944 for whom the pension age for women was successively raised to 65.

Sample means for these three subsamples under sampling scheme 1 are provided in Table 4. As expected, participation rates in the “Male-Female Reform Sample” are higher than in the “Pre-Reform Sample”, because the former cohorts are younger. The

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<sup>3</sup>Observations where a man is not living with a woman in the same household are deleted from the sample, for example when a couple splits up. For 87 and 14 observations under sampling schemes 1 and 2, respectively, we observe a change in the partner. We have checked that our main results are robust to excluding these 87 and 14 observations where the couple composition changes.

gap in participation rates between men and women is larger amongst the older “Pre-Reform Sample”, which also confirms expectations, given recent trends in female labour force participation rates. In all subsamples and for both husbands and wives, we have observations on both sides of the typical retirement age thresholds 60, 63, and 65, as the means of the corresponding dummy variables are always between 0 and 1. Wives on average are between one and two and a half years younger than their husbands.

Only allowing couples in the sample where both spouses are born within a rather short birth year interval raises the question of the representativeness of our sampling procedure. As a robustness check and to take account of the fact that wives tend to be younger than their husbands, we use a second sampling scheme, where we shift the birth year intervals of wives forward by three years. Table 3 illustrates the second sampling scheme in connection with the pension age reforms. The “Pre-Reform Sample” thus contains husbands born up to 1936, whereas their wives may be born up to 1939. In such defined couples, neither husbands and wives are affected by any of the discussed pension reforms. The “Transition Sample” contains husbands born between 1937 and 1940 with wives born between 1940 and 1944. Both husbands and wives experienced reforms of early retirement schemes that made retirement at age 60 costlier through discounts in the pension received. The “Post-Reform Sample” consists of husbands born between 1949 and 1953 and wives born between 1952 and 1956. For these couples, the pension reforms discussed here have been mostly completed: women born in 1952 or later could not retire under the “retirement for women” scheme at the age of 60 any more, not even with a discount. For these cohorts, therefore, the available retirement schemes were identical to the ones for men.<sup>4</sup>

The sample means for the subsamples under sampling scheme 2 are displayed in Table 5: The age gaps between husbands and wives are slightly larger than for the subsamples of sampling scheme 1, namely between about 2 and 3 years. Another fact worth mentioning is that the “Post-Reform Sample” under sampling scheme 2 is of similar size as the first

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<sup>4</sup>Note that there were still some reforms playing out, such as a very gradual increase of the regular retirement age as well as of the age of retirement under the “retirement due to invalidity” scheme. There were also gradual shifts in the retirement due to “long-term insurance” and “very long-term insurance”.

two subsamples of this sampling scheme, whereas the “Male-Female Reform Sample” in sampling scheme 1 contains many more observations than the first two subsamples under this sampling scheme. The reason is that the “Male-Female Reform Sample” only has an age, but not a year of birth restriction for the younger cohorts, whereas the “Post-Reform Sample” starts with comparatively young birth cohorts and only contains five birth year cohorts for each sex.

For our further empirical analysis, we proxy retirement status by using an indicator for whether a person is participating in the labour force (employed or unemployed, a proxy for not being retired) or not (out of the labour force, proxy for being retired). Figures 1 and 2 plot labour force participation rates by age for husbands and wives for the three subsamples for sampling schemes 1 and 2 respectively. For both husbands and wives, labour market participation is higher at virtually every age for the third subsamples, which are the “Male Reform Sample” (sampling scheme 1) and the “Post-Reform Sample” (sampling scheme 2) than for the “Pre-Reform Samples”. This difference is larger for wives than for husbands. In addition, for both husbands and wives and for both sampling schemes, we observe that the drop in labour force participation becomes weaker at age 60 and stronger at age 65.<sup>5</sup> A more formal investigation of how husbands and wives react to their own and their spouses’ crossing typical retirement ages before and after the implementation of early retirement reforms is examined in the econometric analysis below.

## 5 Methodology

In examining how the two spouses’ labour supply decisions interact, we apply a combined regression discontinuity and two-way fixed effects model. Our approach focuses on the three threshold ages of 60, 63, and 65 for both wives and husbands where retirement

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<sup>5</sup>Male labour force participation in the age group 55 to 64 is comparatively high in Germany by OECD standards, with an increasing trend between 2010 and 2019 ([OECD 2020](#)). Male labour force participation in this age group was 77 percent according to this source in Germany in 2016, whereas it was 56 , 59, 66, 70, 72, 83, and 86 percent in France, Poland, Italy, USA, UK, Sweden, and Japan in the same year, respectively.

becomes increasingly likely.<sup>6</sup> We use these thresholds as the basis for a regression discontinuity design. Then, we estimate an equation that includes second-order polynomials for both husbands' and wives' ages. In our regressions, we thus include six binary indicators: equal to 1 when the wife is at least 60 ( $AGE^{60w}$ ), 63 ( $AGE^{63w}$ ), and 65 ( $AGE^{65w}$ ) years of age; and the husband is at least 60 ( $AGE^{60h}$ ), 63 ( $AGE^{63h}$ ), and 65 ( $AGE^{65h}$ ) years of age, respectively, and zero otherwise. The six discontinuities at the respective age thresholds combined with the continuous second-order polynomials for both spouses' ages constitute our regression discontinuity specification. Furthermore, we control for fixed household-specific effects to take unobserved household heterogeneity into account using SOEP longitudinal household survey data. The dependent variable  $participating_{it}$  is a binary indicator for whether or not individual  $i$  at year  $t$  is participating in the labour force (working or unemployed). The reduced-form estimating equations are as follows:

$$\begin{aligned}
participating_{it}^h = & \\
& \alpha + \rho_1^h AGE_{it}^{60h} + \rho_2^h AGE_{it}^{63h} + \rho_3^h AGE_{it}^{65h} + \beta_1^h age_{it}^h + \beta_2^h (age_{it}^h)^2 \\
& + \rho_1^w AGE_{it}^{60w} + \rho_2^w AGE_{it}^{63w} + \rho_3^w AGE_{it}^{65w} + \beta_1^w age_{it}^w + \beta_2^w (age_{it}^w)^2 \\
& + \theta^h X^h + \theta^w X^w + \mu_i + \lambda_t + \epsilon_{it}
\end{aligned} \tag{4}$$

$$\begin{aligned}
participating_{it}^w = & \\
& \tilde{\alpha} + \tilde{\rho}_1^w AGE_{it}^{60w} + \tilde{\rho}_2^w AGE_{it}^{63w} + \tilde{\rho}_3^w AGE_{it}^{65w} + \tilde{\beta}_1^w age_{it}^w + \tilde{\beta}_2^w (age_{it}^w)^2 \\
& + \tilde{\rho}_1^h AGE_{it}^{60h} + \tilde{\rho}_2^h AGE_{it}^{63h} + \tilde{\rho}_3^h AGE_{it}^{65h} + \tilde{\beta}_1^h age_{it}^h + \tilde{\beta}_2^h (age_{it}^h)^2 \\
& + \tilde{\theta}^h X^h + \tilde{\theta}^w X^w + \tilde{\mu}_i + \tilde{\lambda}_t + \tilde{\epsilon}_{it}
\end{aligned} \tag{5}$$

where a tilde above a coefficient indicates that  $\tilde{\alpha}$  and  $\alpha$  are separate coefficients, with the superscripts  $w$  and  $h$  referring to wives and husbands, respectively. Under

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<sup>6</sup>See [Bonsang and Van Soest \(2020\)](#) who uses a similar specification by focusing on these three ages 60, 63, and 65, but does so in a different context of home production and retirement using SOEP data. Based on German administrative data, [Seibold \(2021\)](#) also observes a spike in retirements around these three age thresholds.

the model assumptions, the coefficients  $\rho_1^h$ ,  $\rho_2^h$ , and  $\rho_3^h$  ( $\tilde{\rho}_1^w$ ,  $\tilde{\rho}_2^w$ , and  $\tilde{\rho}_3^w$ ) are the own effects of the husband (wife), and  $\rho_1^w$ ,  $\rho_2^w$ , and  $\rho_3^w$  ( $\tilde{\rho}_1^h$ ,  $\tilde{\rho}_2^h$ ,  $\tilde{\rho}_3^h$ ) are the cross effects of the wife (husband) reaching the age thresholds of 60, 63, and 65 on the husband's (wife's) labour force participation probability, respectively. The  $\beta$  coefficients are those of the running variables ( $age^h$  and  $age^w$ ) of the regression discontinuity design and their squares, while the  $\theta$  coefficients refer to the other control variables. The additional vectors of control variables  $X^h$  and  $X^w$  include the survey year dummies and each spouse's years of education and satisfaction with personal health.

The main regressions will be accompanied by robustness checks, which will include estimates of the effects using dummy variables for each age in years for own effects, and regression discontinuity estimates for cross effects. This specification is as follows:

$$\begin{aligned}
participating_{it}^h = & \\
& \alpha + \sum_{k=56}^{69} \rho_k^h AGE_{it}^{kh} + \beta_1^h age_{it}^h \\
& + \rho_1^w AGE_{it}^{60w} + \rho_2^w AGE_{it}^{63w} + \rho_3^w AGE_{it}^{65w} + \beta_1^w age_{it}^w + \beta_2^w (age_{it}^w)^2 \\
& + \theta^h X^h + \theta^w X^w + \mu_i + \lambda_t + \epsilon_{it}
\end{aligned} \tag{6}$$

$$\begin{aligned}
participating_{it}^w = & \\
& \tilde{\alpha} + \sum_{k=51}^{69} \tilde{\rho}_k^w AGE_{it}^{kw} + \tilde{\beta}_1^w age_{it}^w \\
& + \tilde{\rho}_1^h AGE_{it}^{60h} + \tilde{\rho}_2^h AGE_{it}^{63h} + \tilde{\rho}_3^h AGE_{it}^{65h} + \tilde{\beta}_1^h age_{it}^h + \tilde{\beta}_2^h (age_{it}^h)^2 \\
& + \tilde{\theta}^h X^h + \tilde{\theta}^w X^w + \tilde{\mu}_i + \tilde{\lambda}_t + \tilde{\epsilon}_{it}
\end{aligned} \tag{7}$$

where  $AGE_{it}^{kh}$  ( $AGE_{it}^{kw}$ ) denotes a binary indicator equal to 1 when the husband (wife)  $i$  is at least age  $k$  at year  $t$ . Note that age is measured in months, not in years, so that we still control linearly for age by including the variable  $age_{it}$ .

As an additional robustness check, we will perform an alternative specification with



dummy variables for each age in years together with the additional control variables included in the main regressions as follows:

$$\begin{aligned}
participating_{it}^h = & \\
& \alpha + \sum_{k=56}^{69} \rho_k^h AGE_{it}^{kh} + \beta^h age_{it}^h + \sum_{l=51}^{69} \rho_l^w AGE_{it}^{lw} + \beta^w age_{it}^w \quad (8) \\
& + \theta^h X^h + \theta^w X^w + \mu_i + \lambda_t + \epsilon_{it}
\end{aligned}$$

$$\begin{aligned}
participating_{it}^w = & \\
& \tilde{\alpha} + \sum_{k=51}^{69} \tilde{\rho}_k^w AGE_{it}^{kw} + \tilde{\beta}^w age_{it}^w + \sum_{l=56}^{69} \tilde{\rho}_l^h AGE_{it}^{lh} + \tilde{\beta}^h age_{it}^h \quad (9) \\
& + \tilde{\theta}^h X^h + \tilde{\theta}^w X^w + \tilde{\mu}_i + \tilde{\lambda}_t + \tilde{\epsilon}_{it}
\end{aligned}$$

All specifications allow for couple fixed effects  $\mu_i$  and  $\tilde{\mu}_i$ , calendar year fixed effects  $\lambda_t$  and  $\tilde{\lambda}_t$ . Standard errors are also clustered at the couple level.

## 6 Results

Tables 6 and 7 show the reduced-form regression coefficients for the age discontinuities at the typical retirement ages 60, 63 and 65 for samples 1 and 2, respectively. The first three columns show the labour force participation estimates for husbands, the last three columns the labour for participation for wives. As we are mainly interested in the “cross effects”, that is how husbands react to their wives’ reaching typical retirement ages and vice-versa, we highlight the cross-effects which are reported in the lower left and upper right parts of the tables. In addition, we graphically display the estimation results by displaying all estimated coefficients (whether statistically significant or not) in Figures 5 to 8.

As shown in Table 6 (sampling scheme 1), in the “Pre-Reform” sample, when the generosity of early retirement schemes still allows workers of both sexes to retire flexibly,

both husbands and wives significantly reduce their labour supply when the spouse reaches age 60: wives reduce their labour supply by 4.5 percentage points (significant at the 10 percent level) when the husband reaches age 60, whereas husbands reduce their labour supply by 6.3 percentage points (significant at the 5 percent level), when the wife reaches age 60. Hence, in this setting, the cross effects between husbands and wives are almost symmetric, as found by [Atalay et al. \(2019\)](#) for Australia. As might be expected—as husbands are more than a year older than their wives in the “Pre-Reform” sample in sampling scheme 1—wives also reduce their labour supply by 6.5 percentage points (significant at the 5 percent) level when their husbands reach age 63. The corresponding estimate for husbands when their wives reach age 63 is smaller at statistically insignificant 2.7 percentage points.

How do these almost symmetric cross effects in labour supply (when the spouse reaches age 60) change for the cohorts affected by reforms to the early retirement schemes? As shown in Table 6, the cross effects become much smaller and mostly statistically insignificant, most notably for husbands, but also for wives: for the “Male Reform” and “Male-Female Reform” sample, the coefficients for the wives crossing age 60 are close to zero in the labour supply regression for husbands and not statistically significant. In the regression for wives, the coefficients for the husband crossing age 60 are an insignificant minus 2.2 percentage points in the “Male Reform” and minus 1.7 percentage points (significant at the 10 percent level) in the “Male-Female Reform” sample. Still, the point estimate of minus 1.7 percentage points for the “Male-Female Reform” sample is only slightly more than a third of the point estimate of minus 4.5 percentage points for the “Pre-Reform” sample. Note that the wives’ labour supply reaction to the husbands’ crossing the age 63 threshold also becomes close to zero and statistically insignificant in the “Male-Female Reform” sample. These findings confirm that the reforms making early retirement more costly to workers decreased or even eliminated the cross-effects of one spouse reacting to the other crossing an age threshold for an early retirement scheme. It might also have made these cross effects less symmetric by eliminating the husbands’ reactions to their wives’ crossing age 60, whilst there is still a small reaction of the wives’

labour supply to their husbands' crossing the age 60 threshold.

Figures 5 and 6 illustrate these results graphically: they exhibit, for husbands and wives, respectively, the own effects on the left and the cross effects on the right. Whereas the cross effects at age 60 are smaller in the “Male-Female Reform” sample (grey bars) than in the “Pre-Reform” sample (blue bars), the own effects for crossing age 65, that is the normal retirement age, become larger (the bars left of the vertical line in the red box). Table 6 shows that only in the “Male-Female Reform” sample are the own effects for crossing age 65 statistically significant at the 1 percent level. The estimates in Table 6, displayed in Figures 5 and 6, also show that both husbands and wives react more strongly to their own crossing age 65 than crossing age 60 in the “Male-Female Reform” sample, whereas the reverse is true in the “Pre-Reform” sample. Taken together, this shows that the cohorts in the “Male-Female Reform” sample retired later and reacted more to their own retirement incentives and less to their spouses' crossing early retirement ages.

How robust are our results to a more flexible specification of the age-labour supply profile? In Tables A2 and A3 in the Appendix, we report results of the specifications with dummy variables for each age for own effects, but regression discontinuity estimates for cross effects, which we are most interested in. The estimates are displayed graphically in Figures A1 to A4 in the Appendix. Whereas the point estimates are lower for the own effects (now modelled by dummy variables for each age), the point estimates for the cross effects as well as their statistical significance, especially for sampling scheme 1, are rather similar in Table A2 to our main estimates in Table 6. In particular, point estimates for the cross effects at age 60 in Table A2 are almost identical to the ones in Table 6 for both husbands and wives, at minus 5.2 and minus 4.6 percent, respectively (both significant at the 1 percent level). For the “Male-Female Reform” sample, only the cross effect for wives remains significant, albeit at a low level of minus 1.5 percent. In sampling scheme 2, none of the cross effects is statistically significant (Table A3) but point estimates are similar to the ones in our main specification (Table 7).

The results are also robust to modelling the age-labour supply profile by age dummy variables for both own and cross-effects. These results are shown in Tables A4 and A5 in

the Appendix. Although most of the own effects are still smaller than our main estimates, the general tendency to retire later after the reforms still prevails for both husbands and wives. Moreover, the cross-effects when the spouse crosses the age 60 threshold are larger than in our main estimates and statistically significant in both sampling schemes 1 and 2 in the “Pre-Reform” samples. In the “Male-Female Reform” and “Post-Reform” samples, however, they become statistically insignificant with almost all estimates close to zero.

## 7 Discussion and Conclusions

This paper uses German SOEP data to investigate how husbands and wives react not only to their own reaching a typical (early) retirement age, but also to their spouse’s reaching a typical (early) retirement age before and after a period of several early retirement reforms. It is these cross effects that we are mostly interested in. We find evidence for leisure complementarities between husbands and wives in that during the “Pre-Reform” period, when several pathways to early retirement were still comparatively easily available, husbands and wives react almost symmetrically to their spouses’ reaching age 60 (“cross effects”). The point estimates for a labour market participation indicator regressed on—amongst others—an indicator for the spouse being 60 years of age is around minus 5 percentage points for the “Pre-Reform” period cohorts. This implies that about one in 20 spouses retires when the other spouse reaches age 60. This effect becomes smaller or disappears for the cohorts affected by the early retirement reforms, which have made early retirement costlier. In addition, we observe that wives but even more so husbands increasingly react to the later earlier retirement age 63 and the normal retirement age of 65 (“own effects”) during and after the course of the retirement reforms.

Our results suggest that some findings in the literature on the asymmetry of cross effects, in that husbands might react to wives’ reaching a retirement age differently than vice versa, cannot simply be interpreted as evidence of asymmetric leisure complementarities, as observed labour supply choices depend both on preferences and constraints. The contribution of our paper is to show that the observed symmetry of these cross ef-

fects during a period of very flexible and generous early retirement disappears after early retirement reforms in Germany, which made early retirement costlier and less flexible. As the slight variation of the results between sampling schemes shows, age differences between spouses, which we implicitly control for in our regressions, may also play a role. Our main results are robust to different functional form specifications.

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**Table 1**  
**Sketch of Reforms of (Early) Retirement Schemes**

Born	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952
60 in	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
65 in	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
<b>Ret. due to unemployment</b>	60	60	60	61	62	63	64	65	65										x
Early retirement with a discount				60	60	60	60	60	60	60	60	60	61	62	63	63	63	63	x
<b>Ret. due to long-term insurance</b>	63	63	63	64	65	65	65	65	65	65	65	65	65	65	65	65.25	65.33	65.42	65.50
Early retirement with a discount				63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63
<b>Ret. due to very long-term insurance</b>																65	64	63	63
Early retirement with a discount																			
<b>Ret. due to invalidity</b>	60	60	60	60	60	60	60	61	62	63	63	63	63	63	63	63	63	63	63.5
Early retirement with a discount								60	60	60	60	60	60	60	60	60	60	60	60.5
<b>Ret. for women</b>	60	60	60	60	60	60	61	62	63	64	65	65	65	65	65	65	65	65	x
Early retirement with a discount							60	60	60	60	60	60	60	60	60	60	60	60	x
<b>Normal retirement age</b>	65	65	65	65	65	65	65	65	65	65	65	65	65	65.08	65.17	65.25	65.33	65.42	65.50

*Notes:*

*Source:* Table created on the basis of information taken from Steffen, Johannes (2021): Sozialpolitische Chronik, Berlin, <http://www.portal-sozialpolitik.de> and the laws cited therein.

**Table 2**  
**Graphical Illustration of Sampling Scheme 1 Based on Sketch of Reforms of (Early) Retirement Schemes**

	Pre-Reform Sample			Male Reform Sample					Not in Sample			Male-Female Reform Sample							
Born	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952
60 in	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
65 in	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
<b>Ret. due to unemployment</b>	60	60	60	61	62	63	64	65	65										x
Early retirement with a discount				60	60	60	60	60	60	60	60	60	61	62	63	63	63	63	x
<b>Ret. due to long-term insurance</b>	63	63	63	64	65	65	65	65	65	65	65	65	65	65	65	65.25	65.33	65.42	65.50
Early retirement with a discount				63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63
<b>Ret. due to very long-term insurance</b>																65	64	63	63
Early retirement with a discount																			
<b>Ret. due to invalidity</b>	60	60	60	60	60	60	60	61	62	63	63	63	63	63	63	63	63	63	63.5
Early retirement with a discount								60	60	60	60	60	60	60	60	60	60	60	60.5
<b>Ret. for women</b>	60	60	60	60	60	60	61	62	63	64	65	65	65	65	65	65	65	65	x
Early retirement with a discount							60	60	60	60	60	60	60	60	60	60	60	60	x
<b>Normal retirement age</b>	65	65	65	65	65	65	65	65	65	65	65	65	65	65.08	65.17	65.25	65.33	65.42	65.50

Notes:

Source: Table created on the basis of information taken from Steffen, Johannes (2021): Sozialpolitische Chronik, Berlin, <http://www.portal-sozialpolitik.de> and the laws cited therein.

**Table 3**  
**Graphical Illustration of Sampling Scheme 2 Based on Sketch of Reforms of (Early) Retirement Schemes**

	Pre-Reform Sample			Transition Sample					Not in Sample							Post-Reform Sample			
Born	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952
60 in	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
65 in	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
<b>Ret. due to unemployment</b>	60	60	60	61	62	63	64	65	65										x
Early retirement with a discount				60	60	60	60	60	60	60	60	60	61	62	63	63	63	63	x
<b>Ret. due to long-term insurance</b>	63	63	63	64	65	65	65	65	65	65	65	65	65	65	65	65.25	65.33	65.42	65.50
Early retirement with a discount				63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63
<b>Ret. due to very long-term insurance</b>																65	64	63	63
Early retirement with a discount																			
<b>Ret. due to invalidity</b>	60	60	60	60	60	60	60	61	62	63	63	63	63	63	63	63	63	63	63.5
Early retirement with a discount								60	60	60	60	60	60	60	60	60	60	60	60.5
<b>Ret. for women</b>	60	60	60	60	60	60	61	62	63	64	65	65	65	65	65	65	65	65	x
Early retirement with a discount							60	60	60	60	60	60	60	60	60	60	60	60	x

*Notes:*

*Source:* Table created on the basis of information taken from Steffen, Johannes (2021): Sozialpolitische Chronik, Berlin, <http://www.portal-sozialpolitik.de> and the laws cited therein.

**Table 4**  
**Sample Means – Sampling Scheme 1 (Same Birth Cohorts Limits)**

	Pre-Reform	Male-Reform	Male-Female Reform
husband participating	0.31	0.34	0.66
wife participating	0.18	0.25	0.64
age husband	63.84	63.21	60.91
age wife	62.37	62.33	58.14
husband older than 60	0.79	0.77	0.52
husband older than 63	0.60	0.54	0.30
husband older than 65	0.45	0.36	0.19
wife older than 60	0.68	0.71	0.33
wife older than 63	0.49	0.46	0.16
wife older than 65	0.34	0.29	0.09
years of education husband	11.23	11.87	12.73
years of education wife	10.16	10.98	12.21
health husband	6.07	6.11	6.22
health wife	5.92	5.99	6.28
calendar year	19.94	20.02	20.13
Observations	4,577	3,813	18,844

*Notes:.*

*Source:* German Socio-Economic Panel (SOEP), 1984-2019; own calculations.

**Table 5**  
**Sample Means – Sampling Scheme 2 (Wives Younger Birth Cohorts than Husbands)**

	Pre-Reform	Transition	Post-Reform
husband participating	0.30	0.35	0.61
wife participating	0.21	0.34	0.65
age husband	63.96	63.20	61.52
age wife	61.78	60.84	58.66
husband older than 60	0.79	0.77	0.61
husband older than 63	0.62	0.53	0.38
husband older than 65	0.47	0.36	0.23
wife older than 60	0.65	0.58	0.40
wife older than 63	0.45	0.33	0.18
wife older than 65	0.28	0.18	0.06
years of education husband	11.35	11.98	12.93
years of education wife	10.32	11.20	12.30
health husband	6.05	6.02	6.13
health wife	5.89	6.04	6.32
calendar year	19.95	20.03	20.13
Observations	6,390	4,435	4,074

*Notes:*

*Source:* German Socio-Economic Panel (SOEP), 1984-2019; own calculations.

**Table 6**  
**Sampling Scheme 1 - Regression Coefficients of the Age Thresholds**

	Regressions for Husbands			Regressions for Wives		
	Pre-Reform	Male- Reform	Male- Female Reform	Pre-Reform	Male- Reform	Male- Female Reform
Age60_h	-0.222*** (.031)	-0.241*** (.035)	-0.061*** (.01)	-0.045* (.026)	-0.022 (.032)	-0.017* (.009)
Age63_h	-0.164*** (.026)	-0.103*** (.029)	-0.179*** (.014)	-0.065*** (.019)	-0.058* (.026)	-0.012 (.012)
Age65_h	-0.041** (.018)	-0.025 (.025)	-0.147*** (.017)	-0.005 (.014)	0.003 (.017)	-0.008 (.013)
Age60_w	-0.063** (.029)	-0.007 (.033)	-0.005 (.013)	-0.226*** (.03)	-0.334*** (.038)	-0.076*** (.012)
Age63_w	-0.027 (.023)	-0.017 (.027)	-0.015 (.017)	-0.009 (.016)	0.003 (.023)	-0.144*** (.016)
Age65_w	-0.013 (.018)	0.021 (.02)	0.016 (.018)	0.009 (.013)	0.002 (.019)	-0.064*** (.018)
nt	4,577	3,813	18,844	4,577	3,813	18,844
n	536	427	3,724	536	427	3,724

*Notes:* The table shows regression discontinuity estimates for the age 60, 63, and 65 thresholds for both husbands (“\_h”) and wives (“\_w”). The regressions also contain a second-order polynomial for both husbands’ and wives’ age, couple and calendar year fixed effects, as well as husbands’ and wives’ years of education and subjective health indicators. \*\*\*, \*\*, and \* indicate statistical significance at the 1, 5, and 10% levels, respectively.

*Source:* German Socio-Economic Panel (SOEP), 1984-2019; own calculations.

Table 7

**Sampling Scheme 2 - Regression Coefficients of the Age Thresholds**

	Regressions for Husbands			Regressions for Wives		
	Pre-Reform	Transition	Post- Reform	Pre-Reform	Transition	Post- Reform
Age60_h	-0.214*** (.027)	-0.212*** (.032)	-0.069*** (.024)	-0.030 (.022)	-0.010 (.028)	0.016 (.018)
Age63_h	-0.157*** (.022)	-0.103*** (.026)	-0.164*** (.034)	-0.067*** (.018)	-0.037 (.025)	-0.015 (.025)
Age65_h	-0.046*** (.016)	-0.069*** (.024)	-0.128*** (.032)	-0.004 (.013)	-0.011 (.021)	-0.038 (.027)
Age60_w	-0.045** (.025)	-0.022 (.027)	0.031 (.03)	-0.255*** (.025)	-0.276*** (.03)	-0.025 (.024)
Age63_w	-0.018 (.017)	0.001 (.021)	0.007 (.036)	-0.007 (.013)	-0.048** (.022)	-0.166*** (.034)
Age65_w	-0.008 (.015)	-0.014 (.019)	0.055 (.039)	0.003 (.011)	-0.007 (.023)	-0.008 (.04)
nt	6,390	4,435	4,074	6,390	4,435	4,074
n	756	479	633	756	479	633

*Notes:* The table shows regression discontinuity estimates for the age 60, 63, and 65 thresholds for both husbands (“\_h”) and wives (“\_w”). The regressions also contain a second-order polynomial for both husbands’ and wives’ age, couple and calendar year fixed effects, as well as husbands’ and wives’ years of education and subjective health indicators. \*\*\*, \*\*, and \* indicate statistical significance at the 1, 5, and 10% levels, respectively.

*Source:* German Socio-Economic Panel (SOEP), 1984-2019; own calculations.

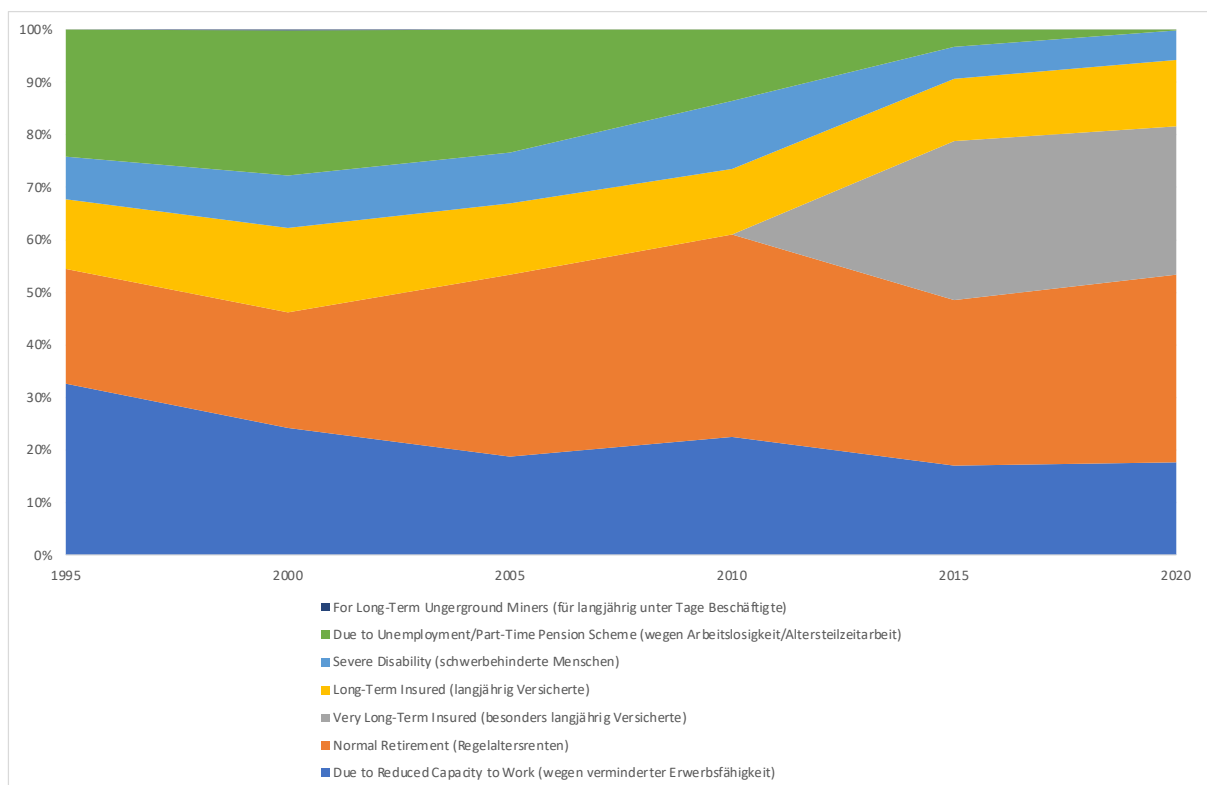


Fig. 1a. New Pensions By Pension Type/Pathway to Retirement – Men

Source: Deutsche Rentenversicherung (2021), p.63; own illustration based on data every five years.

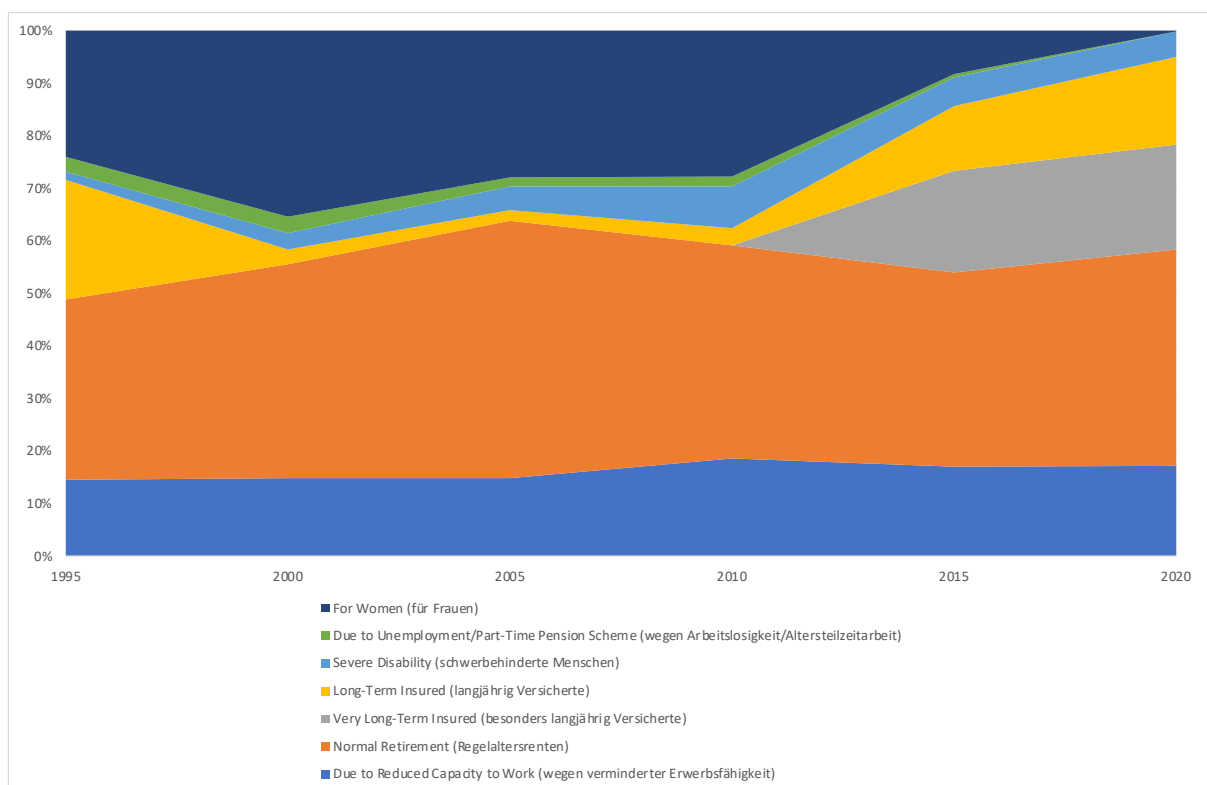


Fig. 2a. New Pensions By Pension Type/Pathway to Retirement – Women

Source: Deutsche Rentenversicherung (2021), p.64; own illustration based on data every five years.



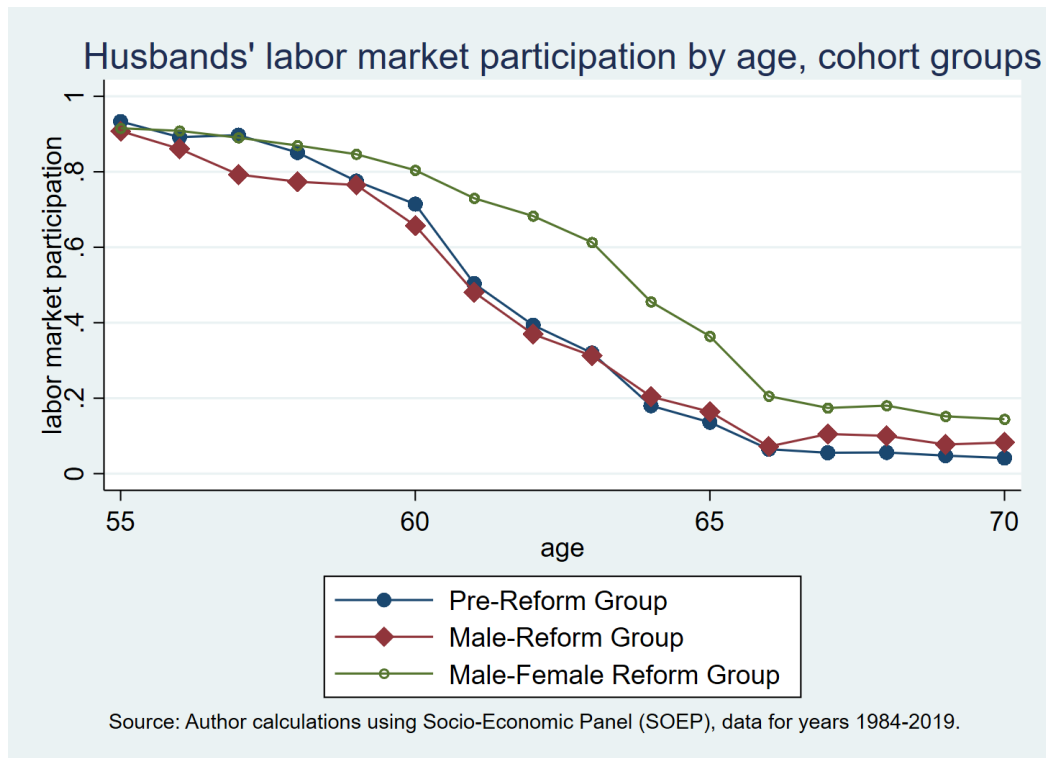


Fig. 3a. Sampling Scheme 1 – Husbands' Labor Force Participation By Age  
*Source:* German Socio-Economic Panel (SOEP), 1984-2019; own calculations.

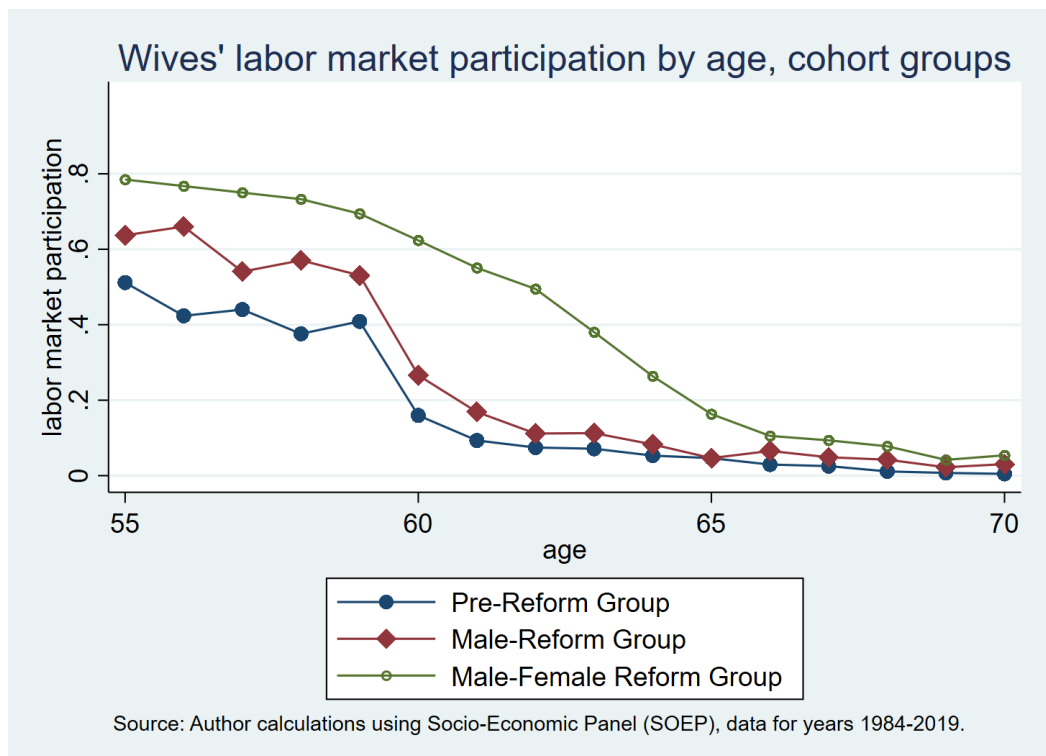


Fig. 3b. Sampling Scheme 1 – Wives' Labor Force Participation By Age  
*Source:* German Socio-Economic Panel (SOEP), 1984-2019; own calculations.

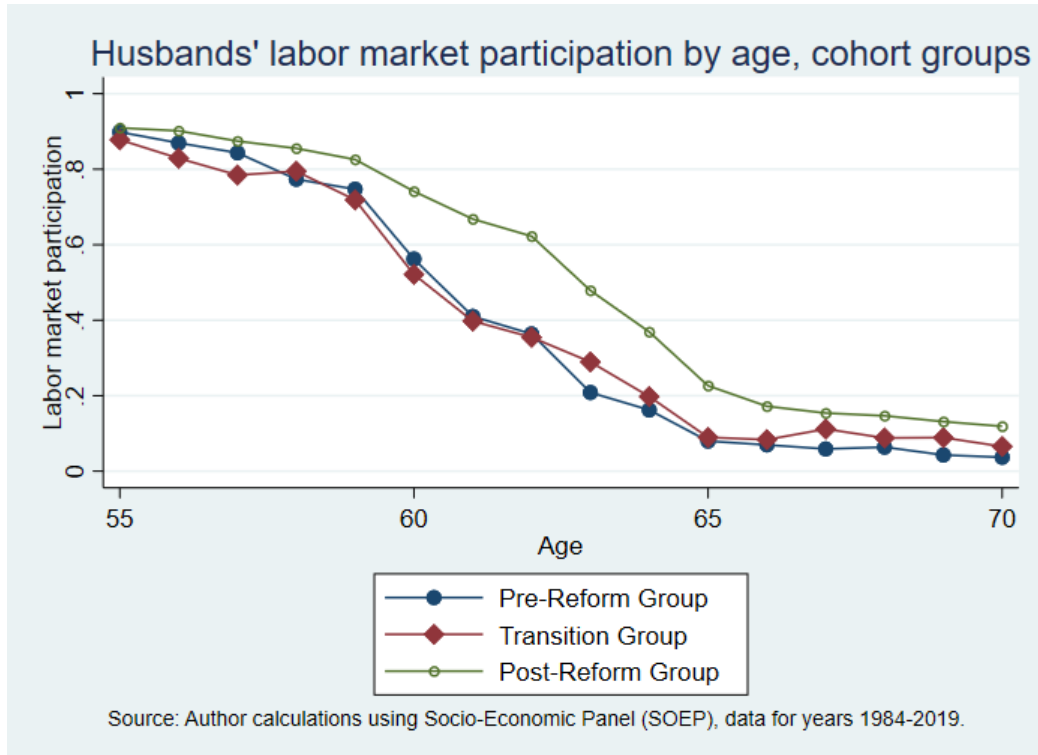


Fig. 4a. Sampling Scheme 2 – Husbands' Labor Force Participation By Age  
*Source:* German Socio-Economic Panel (SOEP), 1984-2019; own calculations.

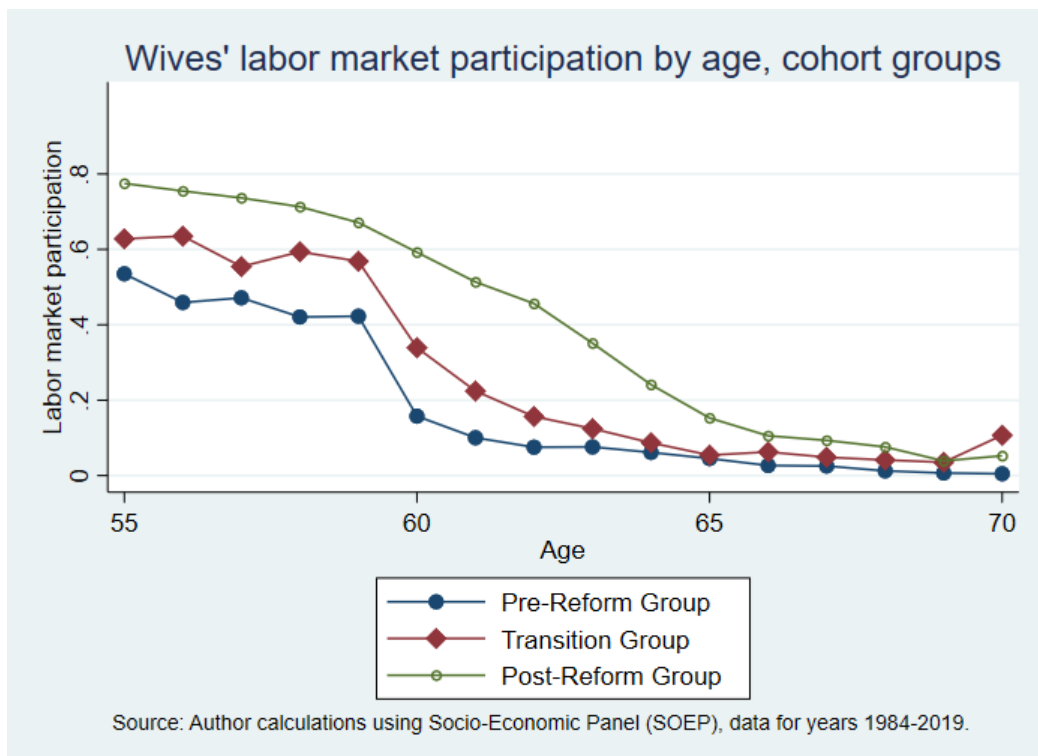


Fig. 4b. Sampling Scheme 2 – Wives' Labor Force Participation By Age  
*Source:* German Socio-Economic Panel (SOEP), 1984-2019; own calculations.

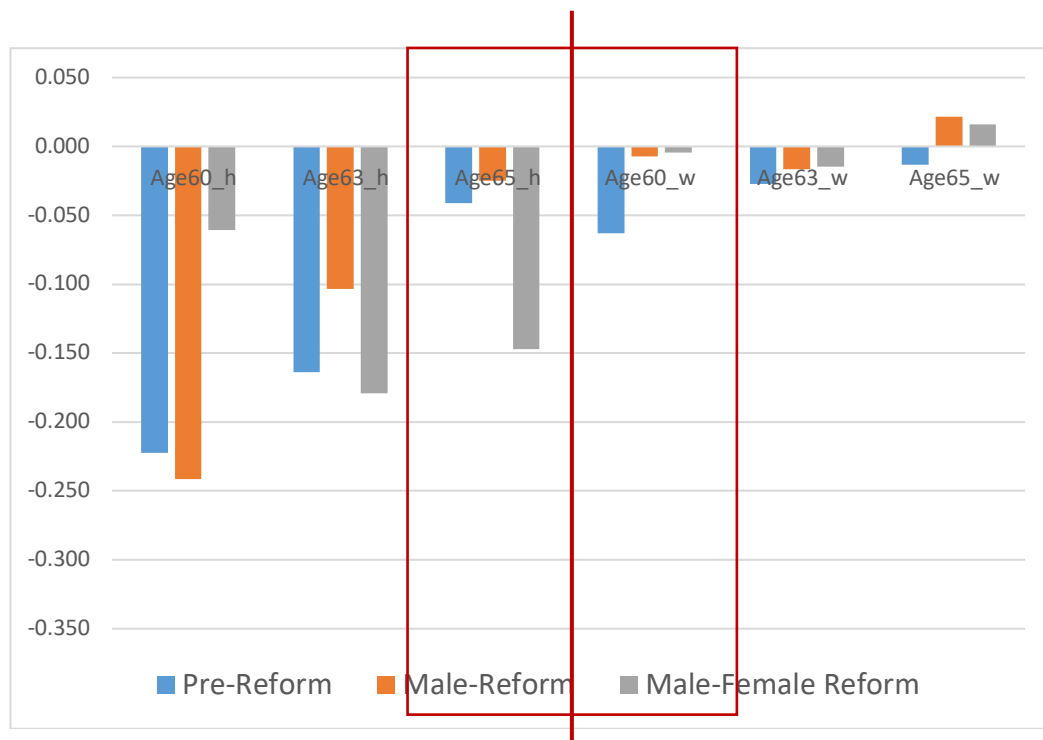


Fig. 5. Sample 1 - Husbands' Own Effects on the Left – Wives' Effects on Husband on the Right – Fixed Effects estimates  
Source: German Socio-Economic Panel (SOEP), 1984-2019; own calculations.

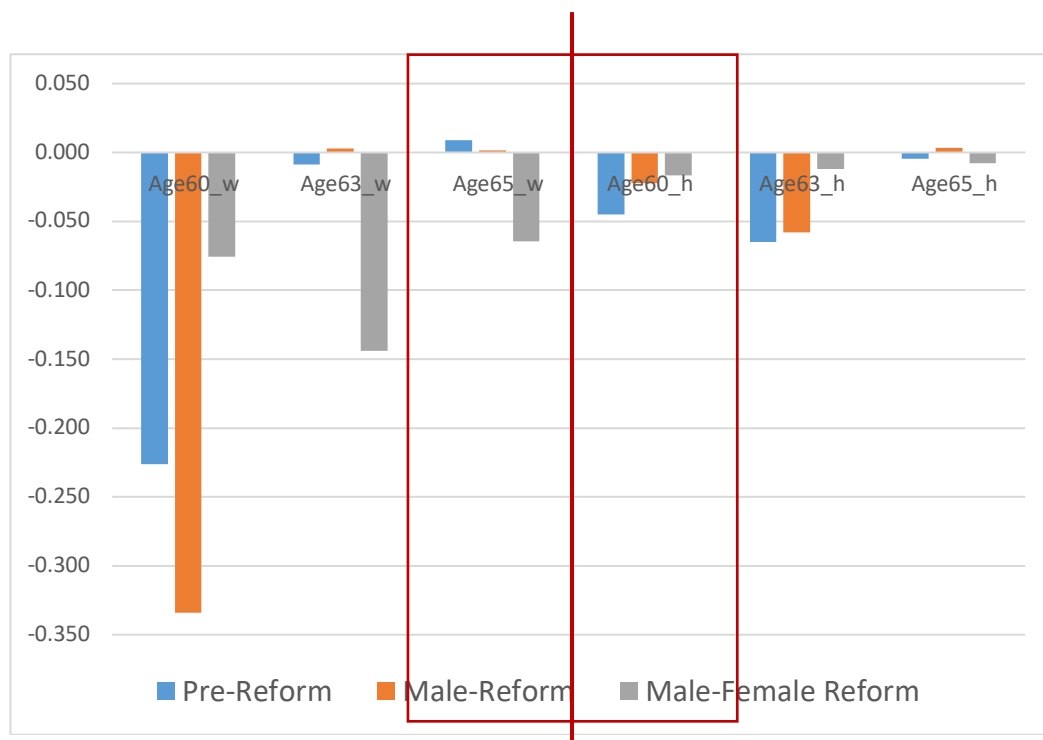


Fig. 6. Sample 1 - Wives' Own Effects on the Left – Husbands' Effects on Wives on the Right – Fixed Effects estimates  
Source: German Socio-Economic Panel (SOEP), 1984-2019; own calculations.

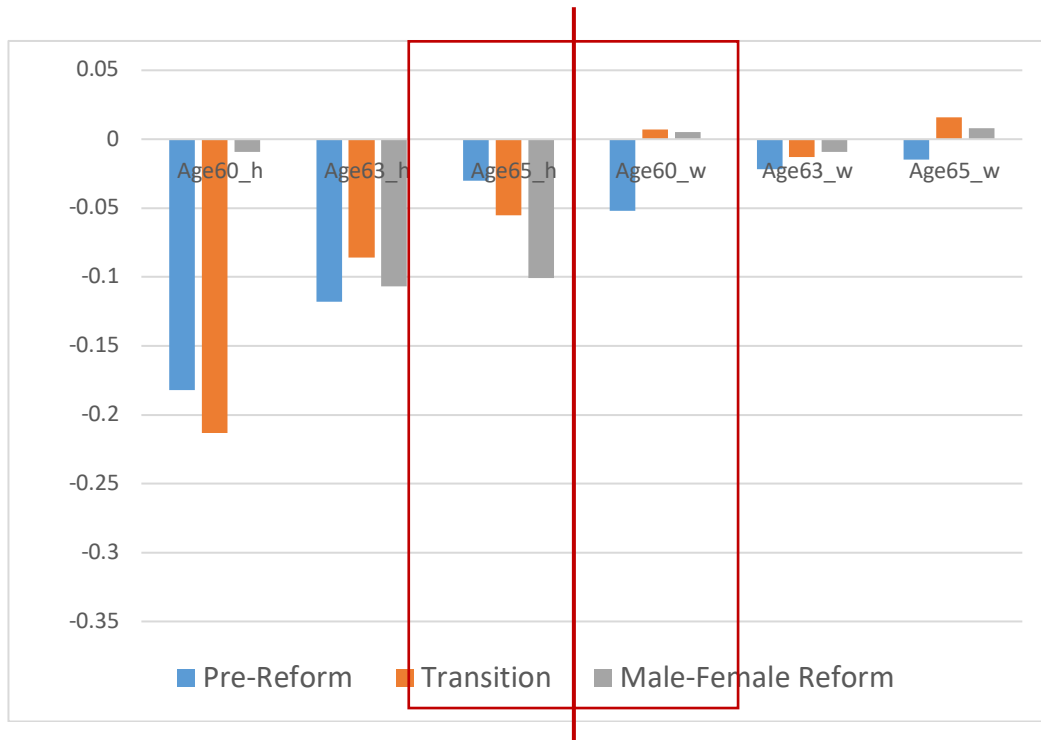


Fig. 7. Sample 2 - Husbands' Own Effects on the Left – Wives' Effects on Husband on the Right – Fixed Effects estimates

Source: German Socio-Economic Panel (SOEP), 1984-2019; own calculations.

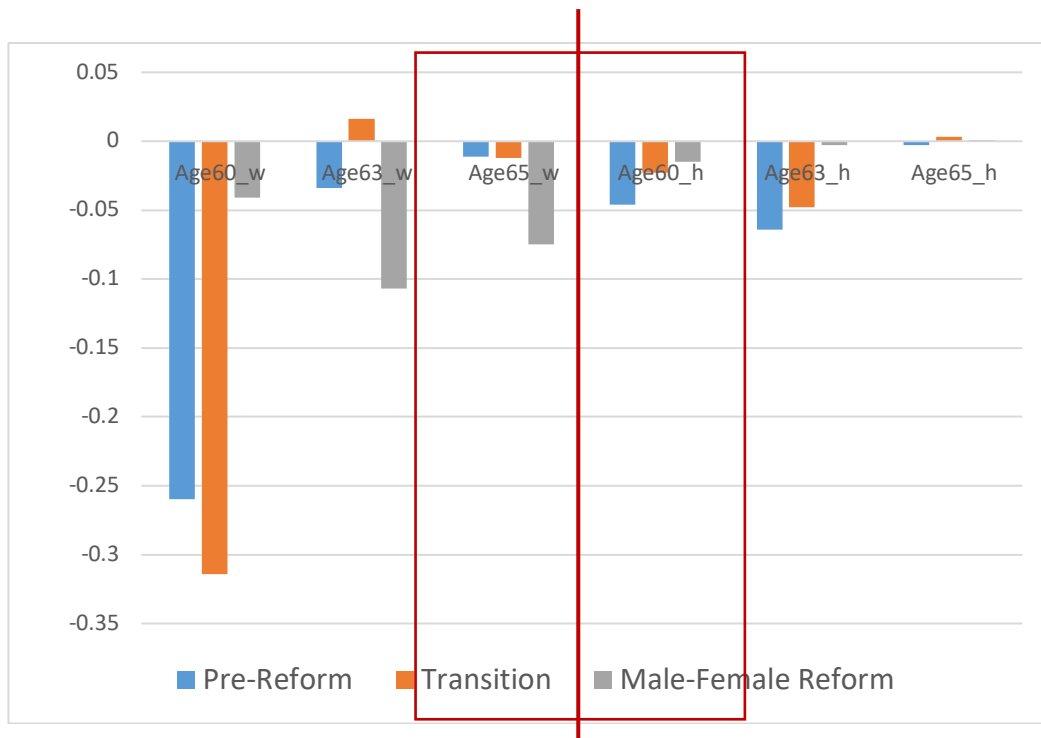


Fig. 8. Sample 2 - Wives' Own Effects on the Left – Husbands' Effects on Wives on the Right – Fixed Effects estimates

Source: German Socio-Economic Panel (SOEP), 1984-2019; own calculations.

Online Appendix

Table A1

Age by Year of Birth and Calendar Year for Selected Cohorts

calendar year/ year of birth	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955
1984	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29
1985	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
1986	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31
1987	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
1988	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
1989	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
1990	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
1991	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
1992	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
1993	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
1994	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
1995	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
1996	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41
1997	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42
1998	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43
1999	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44
2000	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45
2001	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46

continued on the next page.

**Table A1 (continued)**  
**Age by Year of Birth and Calendar Year for Selected Cohorts**

calendar year/ year of birth	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955
2002	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47
2003	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
2004	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49
2005	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50
2006	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51
2007	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52
2008	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53
2009	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54
2010	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55
2011	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56
2012	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57
2013	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58
2014	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59
2015	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60
2016	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61
2017	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62
2018	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63
2019	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64

**Table A2**  
**Sampling Scheme 1 – Specification With Dummy Variables for Each Age in Years for Own**  
**Effects and Regression Discontinuity Estimates for Cross Effects – Only**  
**Coefficients of Key Own and Spouse’s Age Threshold Effects Reported**

	Regressions for Husbands			Regressions for Wives		
	Pre-Reform	Male- Reform	Male- Female Reform	Pre-Reform	Male- Reform	Male- Female Reform
Age60_h	-0.182*** (0.039)	-0.213*** (0.039)	-0.009 (0.014)	-0.046* (0.027)	-0.023 (0.032)	-0.015* (0.009)
Age63_h	-0.118** (0.034)	-0.086** (0.034)	-0.107*** (0.018)	-0.064*** (0.019)	-0.048* (0.026)	-0.003 (0.012)
Age65_h	-0.030 (0.028)	-0.055 (0.035)	-0.101*** (0.020)	-0.003 (0.014)	0.003 (0.017)	0.001 (0.014)
Age60_w	-0.052* (0.030)	0.007 (0.033)	0.005 (0.013)	-0.260*** (0.038)	-0.314*** (0.041)	-0.041** (0.016)
Age63_w	-0.022 (0.023)	-0.013 (0.027)	-0.009 (0.017)	-0.034 (0.026)	0.016 (0.031)	-0.107*** (0.020)
Age65_w	-0.015 (0.018)	0.016 (0.020)	0.008 (0.018)	-0.011 (0.026)	-0.012 (0.030)	-0.075*** (0.020)
nt	4.577	3.813	18.844	4.577	3.813	18.844

*Notes:* \*\*\*, \*\*, and \* indicate statistical significance at the 1, 5, and 10% levels, respectively.

*Source:* German Socio-Economic Panel (SOEP), 1984-2019; own calculations.

**Table A3**  
**Sampling Scheme 2 – Specification With Dummy Variables for Each Age in Years for Own**  
**Effects and Regression Discontinuity Estimates for Cross Effects – Only**  
**Coefficients of Key Own and Spouse’s Age Threshold Effects Reported**

	Regressions for Husbands			Regressions for Wives		
	Pre-Reform	Transition	Post- Reform	Pre-Reform	Transition	Post- Reform
Age60_h	-0.148*** (0.034)	-0.179*** (0.040)	-0.023 (0.034)	-0.032 (0.022)	-0.016 (0.028)	0.007 (0.019)
Age63_h	-0.088*** (0.030)	-0.064* (0.035)	-0.125*** (0.039)	-0.067*** (0.019)	-0.023 (0.025)	-0.017 (0.026)
Age65_h	-0.013 (0.025)	-0.059* (0.035)	-0.078* (0.040)	-0.003 (0.012)	0.001 (0.020)	-0.039 (0.027)
Age60_w	-0.035 (0.025)	-0.011 (0.027)	0.032 (0.031)	-0.286*** (0.033)	-0.222*** (0.034)	-0.050 (0.036)
Age63_w	-0.016 (0.017)	-0.002 (0.021)	0.007 (0.036)	-0.030 (0.023)	0.016 (0.032)	-0.177*** (0.040)
Age65_w	-0.013 (0.025)	-0.059* (0.035)	-0.078* (0.040)	-0.003 (0.012)	0.001 (0.020)	-0.039 (0.027)
nt	6.390	4.435	4.074	6.390	4.435	4.074

*Notes:* \*\*\*, \*\*, and \* indicate statistical significance at the 1, 5, and 10% levels, respectively.

*Source:* German Socio-Economic Panel (SOEP), 1984-2019; own calculations.



**Table A4**  
**Sampling Scheme 1 – Specification With Dummy Variables for Each Age in Years – Only**  
**Coefficients of Key Own and Spouse’s Age Threshold Effects Reported**

	Regressions for Husbands			Regressions for Wives		
	Pre-Reform	Male- Reform	Male- Female Reform	Pre-Reform	Male- Reform	Male- Female Reform
Age60_h	-0.186*** (0.039)	-0.214*** (0.039)	-0.011 (0.014)	-0.093*** (0.032)	-0.001 (0.042)	-0.006 (0.014)
Age63_h	-0.117*** (0.035)	-0.082** (0.035)	-0.108*** (0.018)	-0.106*** (0.027)	-0.022 (0.031)	0.004 (0.015)
Age65_h	-0.029 (0.028)	-0.054 (0.035)	-0.101*** (0.020)	-0.053* (0.027)	0.005 (0.030)	0.002 (0.017)
Age60_w	-0.075** (0.033)	-0.020 (0.037)	0.019 (0.016)	-0.261*** (0.038)	-0.309*** (0.041)	-0.040** (0.016)
Age63_w	-0.043 (0.031)	-0.023 (0.035)	0.011 (0.019)	-0.035 (0.026)	0.020 (0.031)	-0.108*** (0.020)
Age65_w	-0.053* (0.028)	0.001 (0.033)	0.016 (0.020)	-0.012 (0.026)	-0.013 (0.030)	-0.076*** (0.020)
nt	4.577	3.813	18.844	4.577	3.813	18.844

*Notes:* \*\*\*, \*\*, and \* indicate statistical significance at the 1, 5, and 10% levels, respectively.

*Source:* German Socio-Economic Panel (SOEP), 1984-2019; own calculations.

**Table A5**  
**Sampling Scheme 2 – Specification With Dummy Variables for Each Age in Years – Only**  
**Coefficients of Key Own and Spouse’s Age Threshold Effects Reported**

	Regressions for Husbands			Regressions for Wives		
	Pre- Reform	Transition	Post- Reform	Pre- Reform	Transition	Post- Reform
Age60_h	-0.153*** (0.034)	-0.178*** (0.040)	-0.023 (0.034)	-0.047* (0.026)	-0.033 (0.039)	0.042 (0.031)
Age63_h	-0.088*** (0.030)	-0.063* (0.035)	-0.127*** (0.039)	-0.073*** (0.024)	-0.050 (0.034)	0.026 (0.033)
Age65_h	-0.013 (0.025)	-0.057 (0.035)	-0.077* (0.040)	-0.018 (0.022)	-0.031 (0.033)	-0.007 (0.035)
Age60_w	-0.059** (0.028)	-0.003 (0.034)	0.011 (0.040)	-0.287*** (0.033)	-0.220*** (0.034)	-0.049 (0.036)
Age63_w	-0.033 (0.026)	0.031 (0.032)	-0.001 (0.041)	-0.031 (0.022)	0.017 (0.032)	-0.178*** (0.040)
Age65_w	-0.032 (0.024)	0.003 (0.029)	0.028 (0.042)	-0.013 (0.023)	-0.001 (0.031)	-0.030 (0.045)
nt	6.390	4.435	4.074	6.390	4.435	4.074

*Notes:* \*\*\*, \*\*, and \* indicate statistical significance at the 1, 5, and 10% levels, respectively.

*Source:* German Socio-Economic Panel (SOEP), 1984-2019; own calculations.

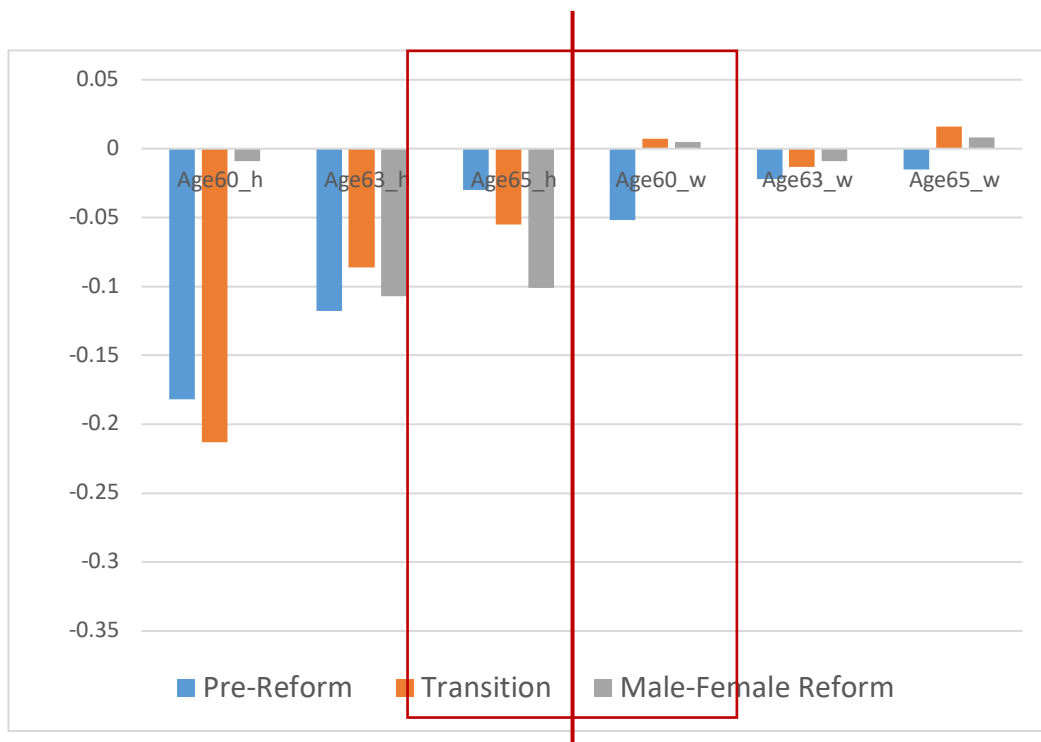


Fig. A1. Sampling Scheme 1 - Husbands' Own Effects on the Left – Wives' Effects on Husband on the Right – Fixed Effects estimates – Specification With Annual Dummy Variables for Each Age

Source: German Socio-Economic Panel (SOEP), 1984-2019; own calculations.

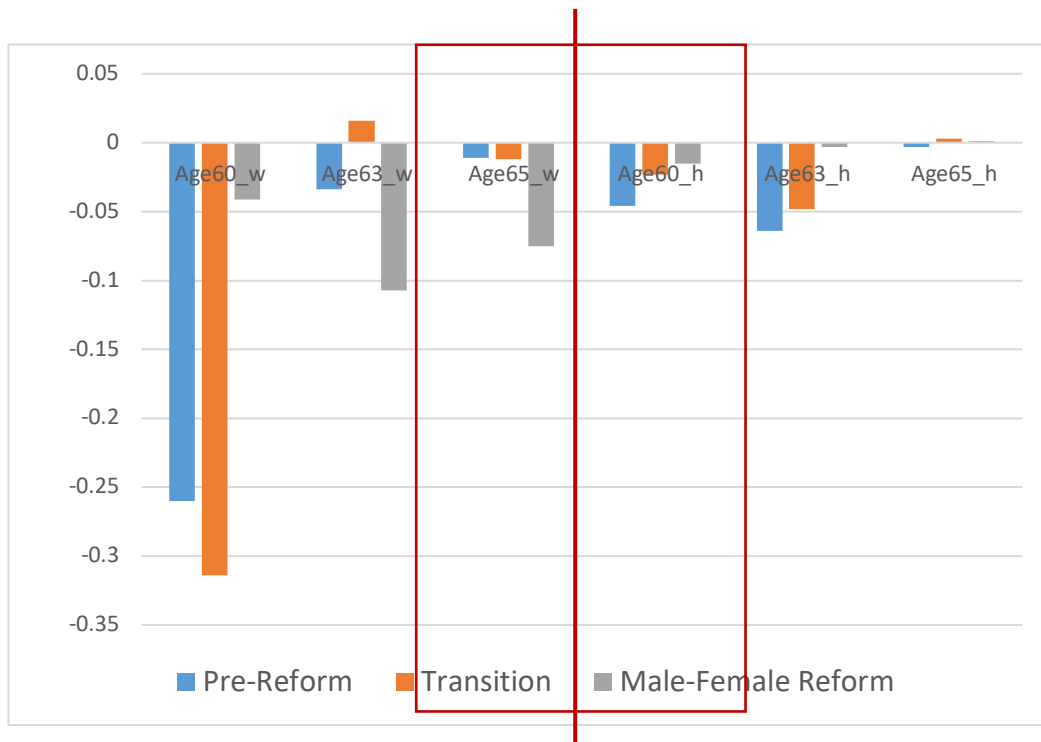


Fig. A2. Sampling Scheme 1 - Wives' Own Effects on the Left – Husbands' Effects on Wives on the Right – Fixed Effects estimates – Specification With Annual Dummy Variables for Each Age

Source: German Socio-Economic Panel (SOEP), 1984-2019; own calculations.

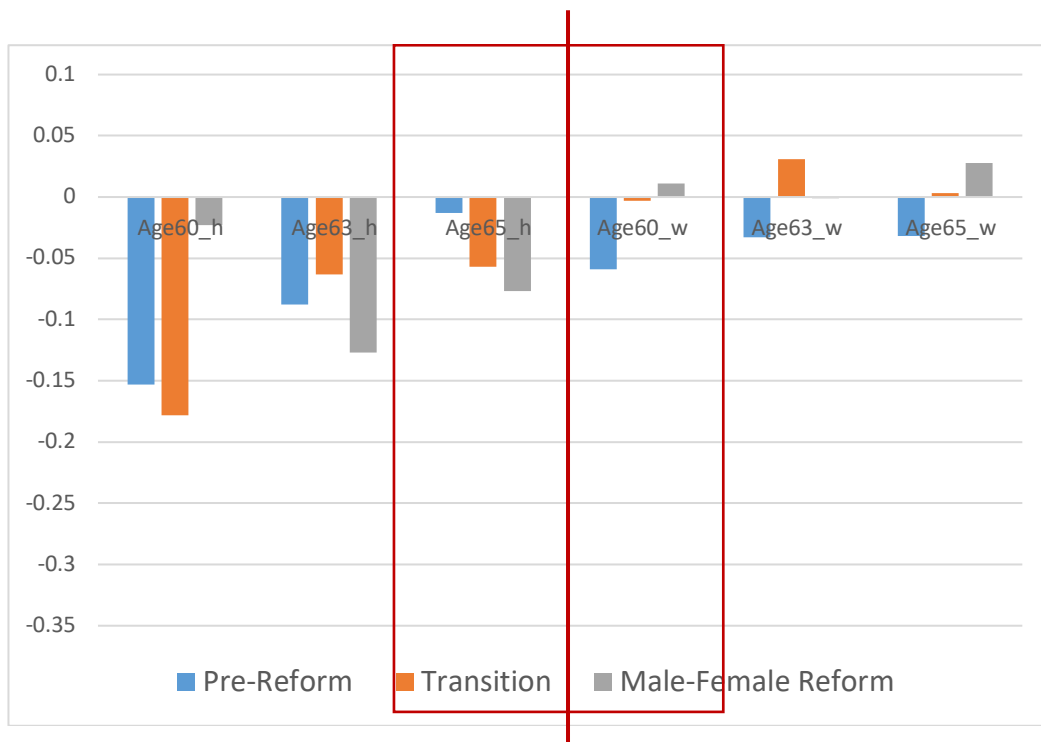


Fig. A3. Sampling Scheme 2 - Husbands' Own Effects on the Left – Wives' Effects on Husband on the Right – Fixed Effects estimates – Specification With Annual Dummy Variables for Each Age  
*Source:* German Socio-Economic Panel (SOEP), 1984-2019; own calculations.

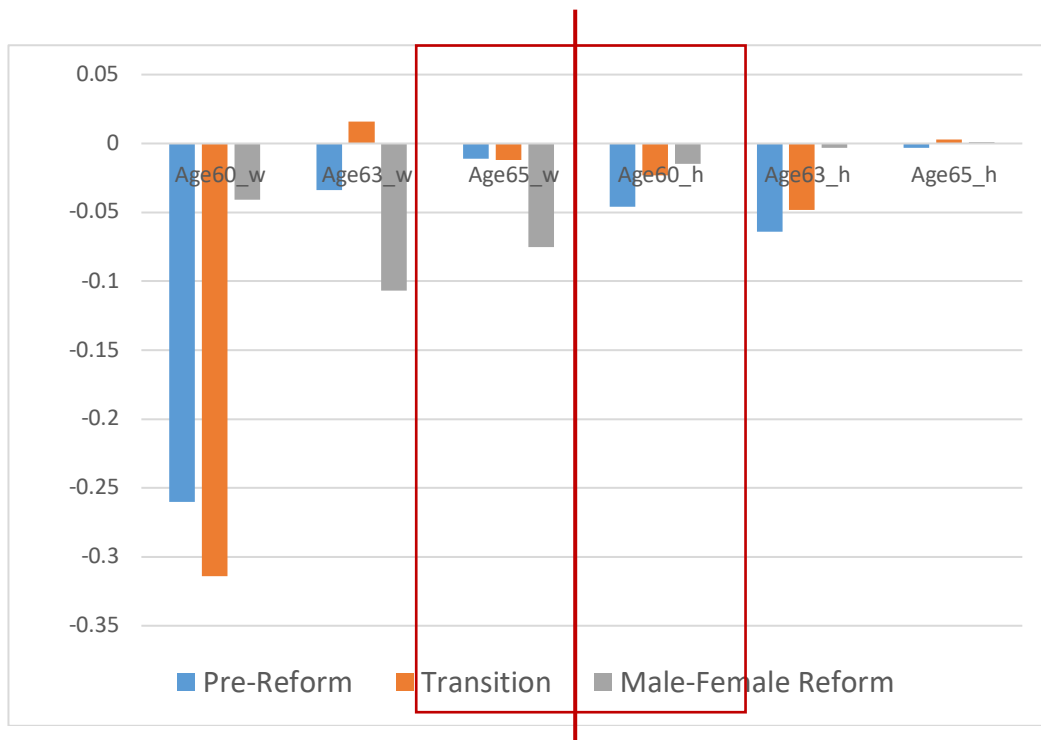


Fig. A4. Sampling Scheme 2 - Wives' Own Effects on the Left – Husbands' Effects on Wives on the Right – Fixed Effects estimates – Specification With Annual Dummy Variables for Each Age  
*Source:* German Socio-Economic Panel (SOEP), 1984-2019; own calculations.