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Earnings Trajectories After Divorce: The Legacies of the Earner Model During Marriage

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Abstract

Divorce marks the legal endpoint of a marital union. While divorce is increasingly seen as a ‘clean break’, the past marital history of the couple may nevertheless shape their present conditions. In particular, there may be a legacy of a highly gendered division of labour during marriage that may affect the ex-spouses’ earning trajectories beyond the date of divorce. Using register data from the German Pension Fund, we examine the earning trajectories of heterosexual couples who filed for a divorce in 2013 (24,616 men and 24,616 women). Using fixed-effects and matching techniques, we compare the earning trajectories of divorcees with those of a control group of married persons in the period spanning two years before and two years after divorce. In particular, we examine how the earner models divorcees followed during marriage shaped their future earning trajectories. Our results show that, on average, the earnings of a divorced woman in a male breadwinner constellation increased after divorce, while the earnings of her male ex-spouse declined. Nevertheless, large gender differences in earnings persisted: 2 years after separation, a divorced woman who had been in a male breadwinner constellation was, on average, earning 72% less than her ex-spouse. We discuss our findings against the background of recent policy reforms in Germany, which assume that ex-partners should be economically ‘self-reliant’ after divorce.

Keywords Divorce · Employment · Fixed-effects · Earnings · Germany · Matching

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Introduction

A divorce or separation is a turning point in a person's life course. As well as marking the endpoint of a romantic relationship, a divorce generally means that the couple will no longer be living in a joint household (Thomas et al., 2017). The partners' resources are no longer pooled, and their assets are generally split (Boertien & Lersch, 2021). In recent years, governments are increasingly adopting the concept of a 'clean break', in which the partners' financial obligations and claims terminate upon divorce (Martiny, 2012; Miles & Scherpe, 2020). Germany is also moving in this direction. In 2008, the German government enacted a 'maintenance reform', which emphasised the economic independence of both parties after divorce. The reform bill refers to the principle of self-reliance (*'Eigenverantwortung'*), which implies that the divorcees should earn their own income, and should no longer rely on alimony payments from an ex-spouse for subsistence. While ex-spousal support awards were fairly generous prior to this reform, the courts now grant support in exceptional cases only (such as when a custodial divorcee has children under age three). This reform was motivated by the belief that in Germany, the compatibility of childrearing and employment has improved in recent years, and the division of labour has become more equal within couple households.¹

However, despite the terminal nature of a divorce, the ex-partners share a joint past that may continue to be relevant over time. The ex-spouses' past decisions—such as the decision that one of the partners would reduce his/her labour market participation to focus on taking care of the couple's children—cannot be undone, but they continue to influence the ex-partners' employment and career options after divorce. This paper uses data from the German pension registers to examine how the earner models divorcees followed during marriage affected their employment trajectories after divorce. We analyse the earnings and marital histories of 24,616 heterosexual ex-couples (24,616 men and 24,616 women), all of whom filed for divorce in the year 2013. We have selected that particular year because it is recent enough to allow us to study the behaviour of the members of a divorce cohort who were separated after the enactment of the abovementioned reform, which assumes that both parties can be economically independent after divorce. We did not select a later divorce cohort because the observation window for examining their post-divorce behaviour would have been more limited.

Our study adds to the large body of longitudinal research that has investigated the economic ramifications of divorce and separation (Bonnet et al., 2021; Hogenboom, 2022; Burkhauser et al., 1991; Damme et al., 2009; Duncan & Hoffman, 1985; Kalmijn, 2005; Boertien & Lersch, 2021; McManus & DiPrete, 2001; Raz-Yurovich, 2013; Thielemans & Mortelmans, 2019; Weiss, 1984). These studies have shown that after a divorce or separation, women tend to expand their employment activities, and often earn more than they did while married, particularly in countries such as Germany (Bröckel & Andreß, 2015; Damme et al., 2009). However, the

¹ The draft law speaks of 'geänderte Rollenverteilung innerhalb der Ehe' (changing division of labour within marriage) (<https://dserver.bundestag.de/btd/16/018/1601830.pdf>).

research findings on the effects of divorce or separation on men's employment and earnings have been less conclusive than those for women (Covizzi, 2008; Kalmijn, 2005; McManus & DiPrete, 2001). Moreover, only a few studies have examined how the earner models divorcees followed during marriage affects their subsequent life courses (see, however, Bonnet et al., 2021; Hogendoorn, 2022).

This paper contributes to the literature in several ways. *First*, we use large-scale register data to examine how specialisation within marriage affected the ex-spouses' earning trajectories after divorce. *Second*, we contribute to the sparse literature on men's behaviour after divorce by comparing the earnings of women and men who were previously married. *Third*, while most prior studies on this topic have been based on separate samples of women and men, we go beyond previous research by using couple data, i.e. we follow ex-couples over time. Thus, the data provide us with a precise account of the gender pay gap by comparing a divorced woman's earnings with that of her ex-husband at the same moment in time.

Although the use of register data has many advantages, it also has several disadvantages that should be mentioned upfront. While we have precise longitudinal earnings records that allow us to compare earnings before and after divorce on the couple level, we do not have any information on whether the earnings emanated from part-time or full-time employment. Moreover, while we have precise marital histories for the divorcees, we do not have this information for the 'never divorced'. This may be regarded as a minor concern, as the analysis uses a fixed-effects approach that relies on the within variation of individuals who underwent a divorce. As we will demonstrate later in the paper, the lack of a suitable 'control group' could still seriously bias the fixed-effects models. For that reason, we devote considerable attention to selecting a suitable control for this investigation. We generate it through the use of matching techniques. Thus, the empirical analysis is based on a combination of fixed-effects and matching techniques (for a similar strategy, see Arkhangelsky & Imbens, 2019; Hogendoorn, 2022; Jones & Lewis 2015).

Prior research

Divorce, Separation, and Household Income

In recent decades, the body of scholarly literature on the economic consequences of divorce and separation has grown substantially. It was, in particular, the increasing availability of longitudinal surveys since the 1980s that boosted research in this area (Burkhauser et al., 1991; Duncan & Hoffman, 1985; Weiss, 1984). Most of these earlier studies were conducted by scholars with a strong interest in poverty research. As a result, these authors were less concerned with how divorce affects individual employment careers and earnings, and were more interested in examining the extent to which household income and government transfers ameliorate some of the negative consequences of divorce and separation. A consistent finding of this body of research is that women typically experience a sharp decline in equivalent household income after union dissolution (Burkhauser et al., 1991). While the observation that divorce has adverse effects on women's economic standing is difficult to dispute, the

evidence on the effects of divorce on men's economic well-being is more ambivalent. Scholars have found that in some countries, including in Germany, men's equalised household income tends to increase substantially after divorce (Andreß et al., 2006).

Concerns have been raised that some of these findings may be sensitive to the use of equivalent scales that standardise household income (Boll & Schüller, 2021; Bonnet et al., 2021). After a divorce, household size shifts because the ex-spouses split into different households. As the couple's children usually reside with their mother after a union dissolution, the observed gender differences are sensitive to the use of an equivalent scale, and thus to the weights that are used to account for the presence of children in the household (Boll & Schüller, 2021, p. 19; Bonnet et al., 2021). The findings of studies that have examined the subjective economic well-being of divorcees do not support the assumption that divorce boosts the economic standing of male divorcees. These studies generally reported that both women and men experience a decline in subjective economic well-being following a divorce or union dissolution, although the effect tends to be slightly more pronounced for women than for men (Leopold, 2018). In a recent paper, Bonnet et al. (2021) used French register data to examine the household income of women and men after divorce, and found that about one-half of all men and three-quarters of all women experience a decline in their equalised income (after tax and transfers). The authors also observed stark differences between ex-couples depending on the earner models they previously followed, which were operationalised over the share each partner contributed to the household income during the marriage. While the 'secondary earner' (regardless of gender) generally experienced a decline in his/her equalised household income after union dissolution, the 'main provider' (who contributed more than 80% of the household income) usually saw an increase in his/her equalised household income.

Divorce, Separation, and Individual Earnings

A separate, but related strand of literature has examined how divorce and separation affect individual employment and earning careers. Most of these studies found that divorce usually leads to changes in female employment and earnings, particularly in countries where married women tend to be less attached to the labour market. For example, based on survey data from the U.S., Tamborini et al. (2015) reported that women's earnings increase substantially after divorce. Similarly, using data from the Divorce in Flanders Survey, Thielemans and Mortelmans (2019) found that in the years immediately after divorce, women's employment rates rise sharply. In a cross-national study, Van Damme et al. (2009) observed more modest employment effects for some countries, but large positive employment effects for West Germany.

By contrast, the results for men suggest that union disruption negatively affects their earnings and employment rates. However, the magnitude of the effects found differs greatly across studies and outcome variables. In an analysis of register data from Israel, Raz-Yurovich (2013) reported that while men's employment stability (defined as continuous employment throughout a given year) tends to deteriorate after a union dissolution, divorce does not affect men's earnings or their salary

growth rates. In a study based on Dutch survey data, Kalmijn (2005) found that men's risk of unemployment increases after divorce. These results are corroborated by the findings of Covizzi (2008), who, using data from the Swiss Household Panel, found that union dissolution has a more pervasive effect on men's than on women's likelihood of being unemployed, and that poor health is an important intervening variable (see also Biotteau et al., 2019; Couch et al., 2015).

Institutional Background and Research Question

Family Policies and Maintenance Regulations

Whether and, if so, how divorce affects the ex-spouses' employment and earning careers depends on the country context, the prevailing gendered employment patterns, and the policies that regulate post-separation behaviour. The German government has introduced important policy reforms in recent years, including the expansion of day care for children under age three as well as the implementation of an earnings-related parental leave benefit system in 2007. Various studies have shown that these reforms have had a sizeable impact on mothers' full-time employment rates (Geyer et al., 2015), and on fathers' uptake of parental leave (Geisler & Kreyenfeld, 2019).

Despite these developments, maternal and paternal employment patterns in Germany still differ greatly. While most fathers work full time, most mothers substantially reduce their working hours after their first child is born. Similarly, the division of household labour has remained strongly gendered, although there are signs that fathers are starting to perform more childcare (Köppen & Trappe, 2019). While the recent reforms signal the German government's clear commitment to the dual-earner model, other policies have remained in place that support the married breadwinner family model. Among these policies is the option of 'income splitting', which allows married couples to file their taxes jointly. Due to the progressive tax schedule in Germany, this system provides substantial benefits to married couples, especially when the earnings of the two partners differ (BMFSFJ, 2021). A further peculiarity of the German system is the treatment of 'marginal employment', a category that includes jobs that generate earnings of €450 or less per month. Because marginal employment is exempt from taxation and from social security contributions, it does not provide workers with public health or unemployment insurance coverage.² As a married person can be included in the public health insurance coverage of his/her spouse, marginal employment is mainly attractive for married people. In sum, there are several benefits that accrue to married couples, and particularly to those in male (and female) breadwinner constellations. As these benefits are forfeited upon divorce, the employment patterns of couples in breadwinner constellations may be expected to change the most after divorce.

² They are exempt from contributions to health, old-age care, and unemployment insurance. Until 2013, they were also exempt from pension contributions.

Some of the adverse effects of divorce are buffered by the possibility of collecting ex-spousal maintenance payments. In line with the logic of a conservative male breadwinner regime, the German regulations shielded the ‘weaker part’ in a marriage from the loss of the support of the male breadwinner. Until recently, this system was (from the perspective of the claimant) among the most generous in Europe. Ex-spousal support payments were granted based on the logic that ‘marital solidarity’ extends beyond the breakdown of a union, and that ex-spousal maintenance payments should reflect the prior standard of living of the couple. The ‘caregiving spouse’ was not obliged to be employed before the couple’s youngest child turned eight years old, and was expected to work on a part-time basis only when the child was between ages eight and 15. Thus, the resident parent was not expected to be in full-time employment until the youngest child was 15 years old, and it was only at that point that the refusal to take up full-time work could be used as a reason to curb ex-spousal support payments.

In 2008, a major reform came into force. Instead of ‘spousal solidarity’, the reform emphasised the principle of the self-reliance (*‘Eigenverantwortung’*) of the ex-partners after divorce. Whereas previously the resident parent was not obliged to be employed until the couple’s youngest child was eight years old (or to be full-time employed until the child was 15 years old), the threshold at which the resident parent had to be employed was lowered to the youngest child’s third birthday. Under the reform, the amount and particularly the duration of ex-spousal support were sharply reduced, with support generally being provided only in the period immediately after the divorce (Peschel-Gutzeit, 2008; Röthel, 2009). Several observers argued that the reform would be disadvantageous for women; that it was too radical; and that it ignored ‘factual societal conditions’, i.e. that mothers are still the main providers of care (Lenze & Funcke, 2016). Thus, the assumption underpinning the reform that the resident parent would become ‘economically self-reliant’ did not seem to match the realities in Germany, where most married couples still practiced a rather traditional division of labour. In 2013, the regulations were adjusted, with a clause being added to the law that allowed for ex-spousal support to be granted in hardship cases, such as in cases in which the couple had been in a very long marriage with a very unequal division of labour.

There is little existing empirical evidence on how the maintenance reform affected divorcing couples in practise. Although the law went into effect nationwide in January 2008, it seems likely that there were differences between areas of jurisdiction in how rigorously the new regulations were applied. Based on a cursory assessment of the ex-spousal alimony cases that went to appeal, it appears that not all judges immediately embraced the new regulations (Willenbacher, 2010, p. 381). Unfortunately, social science surveys do not provide comprehensive insights into alimony payments. Estimates based on the German Family Panel suggest that the share of female divorcees with children who received ex-spousal support declined from around 10% in 2009/10 to 3% by 2018/19.³ Moreover, the official court statistics indicate that there has been a rapid decline in cases related to ex-spousal

³ Own estimates based on the German Family Panel (Huinink et al., 2011).

maintenance since the reform was enacted. For example, the share of family court proceedings that dealt with ex-spousal support decreased from 12% in 2006 to 4% in 2019 (Statistisches Bundesamt, 2020).⁴

Apart from providing ex-spousal support, the non-resident parent is obliged to pay child maintenance, with the amount varying depending on the income of the non-resident parent. Currently, the question of whether maintenance regulations should better account for shared physical custody arrangements is being debated. However, only a very small share of divorced parents in Germany practice shared physical custody (Walper et al., 2021). In the overwhelming majority of cases, the couple's children live with their mother after divorce, while the other parent has a 'right of contact' ('*Umgangsrecht*'). Like in other countries, a large fraction (roughly 40%) of non-resident parents in Germany pay none or only a portion of the child maintenance they owe (Hubert et al., 2020), usually because the non-resident parent is unable to pay or the resident parent wants to avoid conflict or contact with the non-resident parent (Andreß et al., 2003).

Research Question and Expectations

There are conflicting factors that determine the earnings trajectories of divorcees. On the one hand, divorce usually entails the loss of the economies of scale of living in a joint household. This may prompt divorcees to enter the labour market or to expand their working hours. On the other hand, the health of divorcees may deteriorate due to the stress they experience as a result of the union dissolution. This may help to explain why the earning trajectories of divorcees have been found to be less steep than those of a control group of people who did not undergo a divorce. Thus, the loss of economies of scale and the risk of a deterioration in health are among the factors that affect the earnings and employment choices of all divorcees. In addition, there are other factors that are specific to the earner models ex-couples followed while married. These factors are listed in a stylised fashion in Table 1 and described in more detail below.

Primary Earner in a Single-Earner Model

We assume that the earnings of the primary earner in a single-breadwinner constellation will decline after divorce (*Hypothesis 1*). The economic incentives for individuals in single-breadwinner constellations change markedly upon divorce. First, the pressure on the prime earner to guarantee the economic security of the household eases after divorce. As a result, s/he may be more likely than before to turn down less attractive opportunities to advance in his/her career. Most importantly, the prime earner loses the privileges s/he had under the tax and transfer system. During marriage, the main earner is not fully taxed, as s/he receives a tax credit if his/

⁴ These proceedings also include pending cases as well as re-negotiations of ex-spousal support of past divorcees.

Table 1 Factors that lead to a decrease/increase in earnings/employment after divorce in Germany

	Factors that result in a decrease in earnings/employment	Factors that result in an increase in earnings/employment
Primary earner in single-earner model	Taxation (shift from joint to individual taxation) Alimony payments	Loss of economies of scale
Secondary earner in single-earner model	Depreciated human capital Care obligations	Loss of economies of scale Loss of free health insurance coverage Taxation (shift from joint to individual taxation)
Dual-earner couple	Alimony payments (non-resident parent)	Loss of economies of scale
Low-income couple	Alimony payments (non-resident parent)	

her spouse is earning less or is not working.⁵ These benefits are lost upon divorce, such that each increase in earnings is taxed more heavily than before, which may, in turn, create negative incentives for the main earner to expand his/her employment or to advance in his/her career. If the couple has dependent children, the non-resident parent is also obliged to pay a child maintenance amount that is based on his/her monthly net income. It has been hypothesised that in response to these incentives, some divorcees deliberately reduce their employment engagement to avoid having to pay alimony (Andreß et al., 2003).

Secondary Earner in a Single-Earner Model

While we expect the earnings of the prime earner to decrease after divorce, we expect the earnings of the secondary earner to increase (*Hypotheses 2a*). First, the secondary earner faces pressure to earn his/her own living. Second, the earnings of the secondary earner are less heavily taxed after divorce than during marriage, which creates additional incentives for the secondary earner to participate in the labour market, to increase his/her working hours, or to invest in career advancement. In Germany, significant shares of married women are not employed or are only marginally employed. These women lose their access to free health insurance coverage through their ex-spouse when they divorce, which creates an additional incentive for them to search for regular employment. However, there are other incentives for divorced women that operate in the opposite direction. Marital specialisation usually leads to a devaluation of human capital for the party who specialises in domestic work. As a result, it may be difficult for the secondary earner to find well-paid employment and achieve economic independence. Furthermore, joint physical custody arrangements are still rare in Germany. In most cases, the couple's children continue to reside with the parent who had previously been the main caregiver. Thus, childcare responsibilities may be an additional factor that inhibits the labour market participation and the employment success of a divorcee who had previously been the secondary earner in a single-earner constellation. Thus, while the earnings of divorced women may increase, their income may still be insufficient to enable them to achieve 'economic self-reliance' (*Hypothesis 2b*).

⁵ The 'income splitting system' means that earnings are summed up and the sum is divided by two before taxation. Due to the progressive tax schedule, this pooling is advantageous for couples where the spouses' earnings differ, as it leads to a lower overall tax burden than individual taxation. Assuming couples pool their resources, both partners in a married couple may profit from the system of income splitting. In practice, however, the earnings are taxed based on an individual tax bracket ('*Steuerklassen*'). The main earner often chooses the tax bracket #5, which means that his (and, in theory, also her) earnings are taxed less heavily, while the earnings of the secondary earner are taxed more heavily (for details, see BMSFJ 2021, Sect. 8). As a result, the net individual earnings of the primary earner are substantially higher in this system than in a system of individual taxation. The net earnings of the secondary earner, by contrast, would be lower than in a system of individual taxation.

Dual Earners

Dual-earner couples should be less affected by divorce than single-earner couples (*Hypothesis 3*). On the one hand, the increased costs of living in separate households could be an incentive for the individuals in this group to expand their employment activities. On the other hand, dual-earner couples are more likely than single-earner couples to share childcare obligations, which could be more difficult to organise when the parents are no longer living in a joint household. On balance, we do not expect to observe significant shifts in the employment patterns of dual-earner couples.

Low-Income Couples

Low-income couples are defined here as couples in which both partners were unemployed or had inadequate earnings during their marriage. As in the case of the double-earner couples, we do not expect to observe large divorce-related changes in the employment and earnings of the couples in this group (*Hypothesis 4*). Many of these couples were dependent on social benefits while married. As benefits are means-tested, the living situations of these couples are unlikely to change significantly after they divorce. For example, when the ex-partners move into separate households, their housing subsidies are adjusted accordingly. The obligation to pay child maintenance may further reduce the employment engagement of the non-resident parent, as a non-resident parent with little or no income is exempt from making these payments. Thus, if a non-resident parent works more and his/her earnings exceed a certain threshold, s/he will be immediately obliged to pay maintenance.⁶ Unfortunately, the data do not contain information on the children of these couples, or on where the children are living. However, as most children live with their mother after their parents separate, men are more likely than women to be obliged to pay maintenance. If there is any negative employment incentive associated with having child maintenance obligations, it should show up in a decline in earnings among divorced low-income men.

Data and Methods

Data and Analytical Sample

The empirical analysis presented in this paper is based on register data from the German Pension Fund. The German pension registers cover more than 90% of the

⁶ Child alimony depends on the earnings of the non-resident parent, whereby the payments decline with increasing earnings on a sliding scale. As a result, non-resident parents with low incomes are relatively heavily burdened by child alimony payments. However, non-resident parents with very low incomes are exempt from the payments. In 2020, the threshold was €1,160 per month for full-time employed non-residential parents and €960 per month if the non-residential parent was not working full time or was unemployed. https://www.olg-duesseldorf.nrw.de/infos/Duesseldorfer_Tabelle/Tabelle-2020/index.php

resident population in Germany, but members of certain professions (such as farmers and lawyers) and civil servants are not included. The pension registers have been used in the past for research on the labour market (Guertzgen & Hank, 2018), fertility behaviour (Hofmann et al., 2017), and the economic consequences of divorce (Brüggmann, 2020). We have combined two data files from the registers for our investigation (via linkage over a unique identifier) i.e. the VA statistics (*Versorgungsausgleichsstatistik*), which contain biographical information on the dates of marriage, separation, and divorce for the divorced population from 1977 to 2020 (Keck et al., 2019), and the AKVS statistics (*Aktiv-Versicherten-Statistik*), which include employment and earnings records for the years 2009 to 2015.

We have restricted our analytical sample to couples who filed for their first divorce in the year 2013. The disadvantage of analysing a single divorce cohort is that we are unable to examine long-term trends, such as how the patterns changed before and after the maintenance reform was enacted. The advantage of our approach is, however, that we are using a well-defined study population. While 2013 is a number of years after the date when the abovementioned reform of the maintenance law was implemented, it is early enough to ensure that we have sufficient time to observe the ex-spouses after their divorce. The divorcees' earnings and employment outcomes are estimated for a five-year period around the time of their separation, resulting in a panel structure from t_{-2} to t_{+2} (2011 to 2015).⁷

We have restricted the analysis to couples in which the man was between ages 30 and 55 at the time of separation (or, more specifically, when the divorce was filed). Thus, outliers who divorced very early in life are not considered. Moreover, divorces at older ages are not included, as these older individuals may have retired in our observation window. We also omitted shorter marriages (less than three years), as they are not fully covered in the data (for details, see Keck et al., 2019). In addition, we restricted the analysis to western Germany because the sample sizes for eastern Germany are much smaller (especially for the subsamples that we construct), and because non-marital childbearing is very prevalent in eastern Germany, which means that marriage and divorce are more selective (Konietzka & Kreyenfeld, 2002). We also excluded foreign nationals from the investigation because information on their employment, marital, and fertility careers may be incomplete in the registers, i.e. it may not be available for the period prior to migration. The final sample includes 24,616 divorced couples (24,616 men and 24,616 women).

Measures

The main outcome variable of interest is *annual gross earnings*. Earnings records are stored in the registers as earning points. One earning point denotes the average gross earnings of an employed worker in Germany. Individuals who were not

⁷ Note that the AKVS includes information for the reporting year as well as selective information for the previous year. Thus, data from 2009 and 2010 are used for the construction of the control group (see the appendix for details).

employed enter the calculation of the mean with zero earnings.⁸ We also present further variables that map each person's employment situation. *Employment* is operationalised over a binary variable that indicates whether the person was in regular employment for at least one day in a given year (not including marginal employment). We also account for *marginal employment*, as measured by whether the person was ever in marginal employment in a given year. In addition, we provide insight into *unemployment*, as measured by a binary indicating whether the person was ever unemployed in a given year. Finally, we take into consideration whether the person has ever been on *disability leave* in a given year. This variable is a crude indicator of an individual's health status. Disability leave is granted after a person has been on sick leave for 42 days, or if the person's child is sick. All variables are available on the couple level. Thus, we have information on the earnings and employment status of both (ex-) partners.

The key variable of interest is *divorce*. German divorce law includes a separation period, which means that the spouses have to be separated for at least one year before their marriage can be legally dissolved. Thus, a legal divorce may not be finalised until several months or even years after the breakdown of the union. The register data also contain information on the date when the divorce was filed (i.e. the date when the defendant received the divorce petition). We use the latter date, and refer to it as the separation date. Thus, our main process time is the duration since separation (date of when the divorce was filed).

We stratify the analysis by the *earner model* that the divorcees practiced during their marriage. We identified four different earner models based on the spouses' income from employment with social security contributions for two consecutive years prior to our observation window (2010 and 2011):

- In the *male breadwinner model*, the woman earned less than 0.5 pension points, while the man earned 0.5 pension points or more on average in 2010 and 2011.
- In the *dual-earner model*, both spouses earned at least 0.5 pension points.
- In the *female breadwinner model*, the man earned less than 0.5 pension points, while the woman earned 0.5 pension points or more.
- In the *both low-income model*, both spouses earned less than 0.5 pension points.

We used 0.5 pension points as a cut-off to define "inadequate earnings". Earnings below that level may result into being at elevated risks of poverty. In 2015, for example, 0.5 pension points resulted into monthly gross earnings of only 1,500 Euro.

⁸ We define 'non-employment' as periods in which a person does not have any labour market earnings that are 'pension-relevant'. In a few cases the person may have become a civil servant or farmer, and for that reason no longer appears in the data as an employed individual, even though s/he is still gainfully employed. In addition, earnings are capped in the registers due to the income threshold (ceiling) for social security contributions. The threshold was €66,000 in 2010 and increased to €72,600 in 2015. This means that changes in earnings due to divorce are not fully observed for high earners.

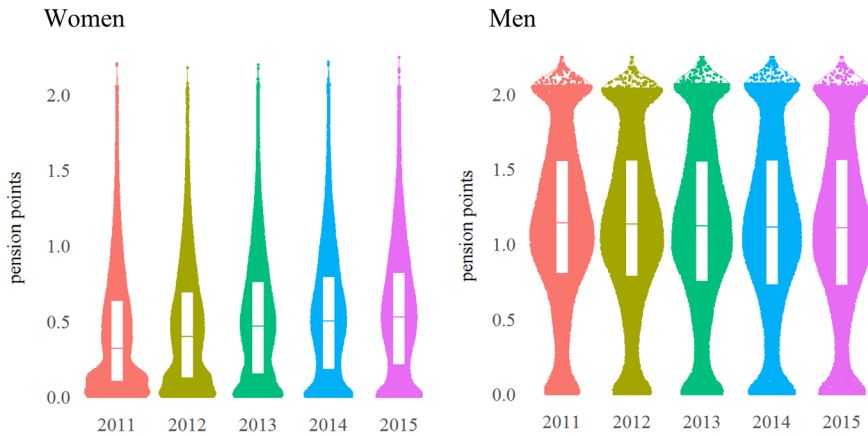


Fig. 1 Violin plots showing the distribution of earnings by years since separation and gender. West German women and men who filed for divorce in 2013. Note: one earning point is equal to the average gross wage in the given year. The vertical line in the violin plot indicates the mean value for the given year. The white area in the bar indicates the 25th and the 75th percentiles

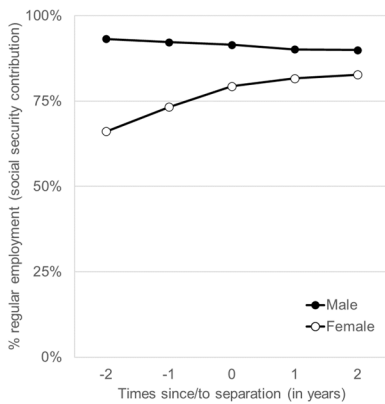
Descriptive Statistics

Figure 1 displays the distribution of earning points by gender and duration since separation by drawing on violin plots (Adler & Kelly, 2021). The mean earning points for divorced women (dash in the figures) increased from 0.41 two years prior to separation to 0.56 two years after. Over the same period, the mean earning points for divorced men decreased from 1.15 to 1.10, and thus by 4%. Nevertheless, male and female earnings did not approach parity in the observation window. The gender pay gap on the couple level was 64% two years before separation, and this gap shrank only slightly thereafter: two years after separation, a female divorcee was, on average, still earning 49% less than her ex-spouse.

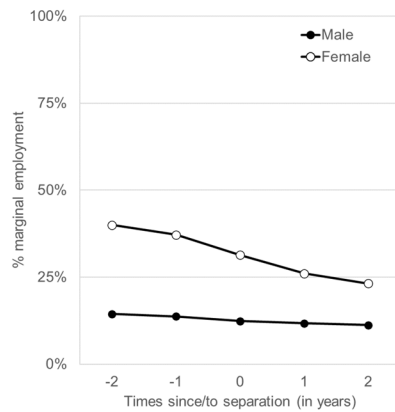
The advantage of using a violin plot (rather than a box plot) is that it maps the entire distribution. The figures reveal that there was a stark gender difference not only in mean earnings, but also in the distribution of earnings. A large fraction of women were in the low earning bracket, although this fraction slowly declined in the process of separation. The male distribution was characterised by a large fraction of men earning between average wages and 50% more than average wages. The figure also shows that earnings were capped in the registers (with most earnings at the upper end of the distribution) due to the income threshold. This affected a sizeable share of the men in the sample, but hardly any of the women.

Unfortunately, the register data do not include information on working hours. Thus, we cannot tell to what extent the changes in women's and men's earnings were related to changes in their working hours. However, some limited employment indicators are available, and are mapped in Fig. 2. The upper-left panel provides the regular employment rates (excluding marginal employment). The figure shows that the male regular employment rate (defined as the share working at least one day per year in regular employment) dropped slightly over time. It appears, however,

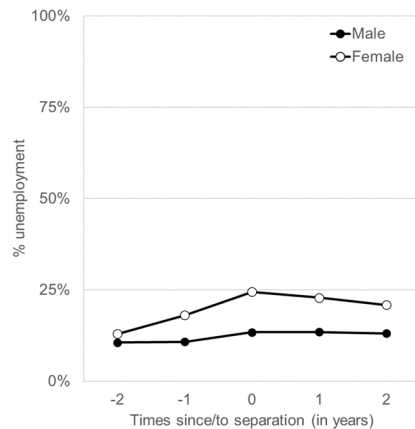
Regular employment (in %)



Marginal employment (in %)



Unemployment (in %)



Disability leave (in %)

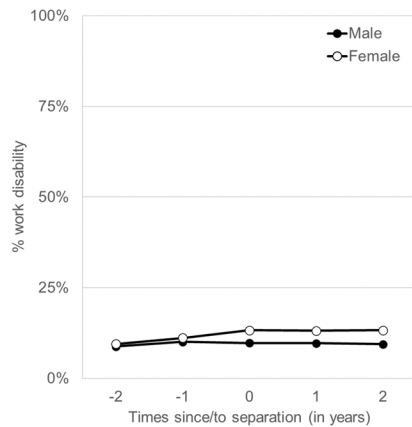


Fig. 2 Employment patterns around the time of separation by gender. West German women and men who filed for divorce in 2013. Source: VA 2020, AKVS 2011–2015

that divorce strongly incentivised women to enter the labour market, as the female employment rate increased from 66% two years prior to separation to roughly 83% two years after. While a gender gap in employment remained, by two years after separation, the ex-spouses had almost reached parity in terms of regular labour market participation. Much of the increase in women's regular employment was the result of a rapid decline in marginal employment around the time of separation (Fig. 2, upper-right panel).

Figure 2 (lower-left corner) provides insights into the unemployment trends among couples around the time of divorce. As this figure shows, female unemployment rose sharply, to around 24%, in the year of separation. This very large increase

in unemployment is likely attributable to more women becoming eligible for unemployment benefits after divorce, as these benefits are means-tested for individuals who have not been previously working or who are unemployed for a longer period of time. Many married women do not have access to these benefits because the earnings of their partner are included in the calculation of their eligibility. Moreover, by registering for unemployment, some of the divorced women in our sample who were previously covered by their ex-spouse's health insurance, and who lost this coverage upon divorce, may have regained access to health insurance.

Finally, the figure in the lower-right corner of Fig. 2 shows that the uptake of disability leave increased more rapidly for women than for men around the time of divorce. This may indicate that women's health was more strongly affected by divorce than men's health. However, caution is warranted in interpreting this finding, because parents may take disability leave to care for sick children as well as for themselves, and mothers are more likely than fathers to take leave for this reason. Thus, the increase in the uptake of disability leave among women may have been due to lone mothers having increased childcare obligations after separation, and needing additional days of leave to deal with their children's bouts of sickness. It should also be noted that lone mothers are eligible for more days of leave to care for sick children than married mothers.

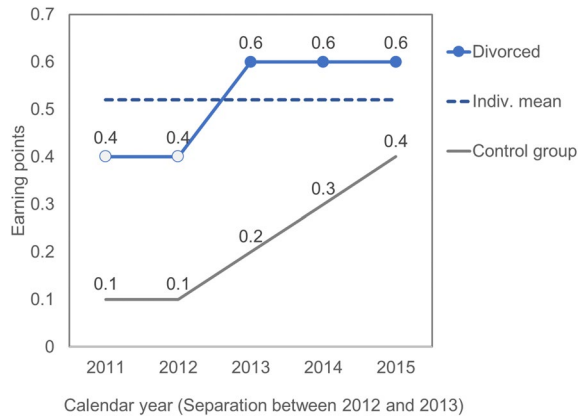
Analytical Strategy: Combining Fixed-Effects and Matching

In order to estimate the effect of separation on individual earnings, we use a fixed-effects approach. We model the earning trajectory by employing a dummy impact function (for details, see Brüderl & Ludwig, 2015; Ludwig & Brüderl, 2021). The regression can be formalised as follows:

$$y_{it} = \sum_{k=0}^k \beta_k D_{it}^k + X'_{it} \delta + \alpha_i + \varepsilon_{it}$$

y_{it} are the individual earnings that vary by time $t=2011, \dots, 2015$. D_{it}^k is a set of dummy variables that denotes whether the person was divorced. Note that we assume that people anticipate their divorce to some extent. Thus, we include not only treatment dummies for the time after divorce, but also treatment dummies for the two years prior to divorce. $X'_{it} \delta$ includes the time-varying covariates. We are, however, very limited in the time-varying covariates we can include. Ideally, we would have liked to include information on, for example, re-partnering, alimony payments, physical custody regulations, or the birth of a child. As we do not have such information, and the sole time-varying variable that we use in our modelling approach is age (dummy for single ages), α_i represents the time-constant individual traits and ε_{it} is the idiosyncratic error term.

The fixed-effects modelling draws on de-meaned data. That entails that the divorce effect is generated from the individual mean of the earnings during the observations window. Figure 3 displays a fictitious case to illustrate how the model operates. A female divorcee earned 0.5 earning points in the period 2011 to 2015. Her earnings were 0.1 points below her average earnings before her divorce, and

Fig. 3 Impact of divorce on earnings (2 fictitious cases)

were 0.1 points above the individual average earnings after her divorce, which suggests that her divorce caused her earnings to increase by 0.2 points on average. The figure illustrates that an analysis that solely relies on the within variation of divorcees may lead to biased results if there are strong ‘secular’ trends. In this example, earnings increased for all groups starting in 2013. In order to assess the ‘true’ impact of divorce on earnings, we need to compare divorcees with a suitable control group of people who did not divorce in the given time window. This is of vital importance in this context, as divorce tends to occur at ages when most individuals are still experiencing increases in their earnings. Furthermore, Germany has implemented major family policy reforms since 2005, which has likely contributed to an increase in the labour market participation of women with children. We have employed matching techniques to address this concern. Thus, we have constructed a suitable control group, which accounts for the fact that divorced women in Germany would have experienced increases in earnings and employment participation over time even if they had not divorced.

Matching on Future Divorcees

We have constructed a control group by drawing a sample of people who had not yet been divorced in our study period, but who divorced in 2018, 2019, or 2020. Here, we capitalise on the fact that our observation window spans the period from 2011 to 2015, but we have information on divorce until 2020. We follow an approach that is frequently used in the evaluation of labour market programs, in which the control group consists of people who have not been treated yet (Sianesi, 2004). The advantage of this approach is that we can use an array of marriage-specific variables to achieve a good fit (duration of marriage, age at first marriage, earner model during marriage) in the matching procedure (for details, see the appendix).

Most earlier matching algorithms used logistic regression to calculate the propensity score. The question of how these models should be specified has yet to be fully resolved, even though numerous covariate selection algorithms have been written to address this issue (Dehejia & Wahba, 1999; Hirano & Imbens, 2001; McCaffrey

Table 2 Sample statistics

	Divorced		Controls: future divorcees		Controls: total sample (robustness check)	
	Men	Women	Men	Women	Men	Women
Characteristics (mean)						
Earning points in 2011	1.15	0.41	1.16	0.41	1.15	0.41
Age in 2013	43.20	40.54	43.20	40.66	43.20	40.54
Marriage duration in 2013	14.88	14.88	14.80	14.80	–	–
Earner model in 2010/11 (in %)						
Male breadwinner	13,952 (57%)		16,517*)		–	–
Female breadwinner	963 (4%)		543*)		–	–
Dual earner	7,105 (29%)		7,212*)		–	–
Both low income	2,596 (11%)		1,853*)		–	–
Case number						
Persons	24,616	24,616	33,869	33,869	7,129,087	9,872,161
Person-years (2010 to 2015)	147,696	147,696	203,214	203,214	42,774,522	59,232,966

et al., 2004; West et al., 2000, pp. 69–70). Research has shown that simple logistic models are often not sufficient to balance covariates (Pirracchio et al. 2014; Westreich et al., 2010; Lee et al., 2010). Machine learning (ML) techniques are new, flexible, non-parametric ways of addressing the covariate selection problem. We used the R package ‘twang’, which uses the ML technique to achieve a match (for details, see Cefalu et al., 2021; McCaffrey et al., 2004).

Robustness Check: Matching on the Total Population

A disadvantage of the abovementioned matching approach is that the controls are drawn from future divorcees. Although that the divorce happened in the distant future, we cannot rule out the possibility that some of the individuals anticipated their own separation more than four year before it occurred. In a robustness check, we constructed a control group from the entire sample. We used a ‘simple’ propensity score matching approach to generate a control group (Rosenbaum & Rubin, 1985), because the massive sample size (more than 30 million person-years) did not allow us to employ more sophisticated matching techniques. We can, however, assume that the match is reasonably good because we have a large sample size, as well as detailed past employment, regional, and earnings information (for details, see the appendix).

Sample Statistics

Table 2 provides sample statistics of the treated individuals and the controls. It shows that the average duration of marriage (up to the date the divorce petition was filed) was 14.9 years, and the average age at separation was 43.2 for men and 40.5 for women. A majority of the divorced couples followed the male

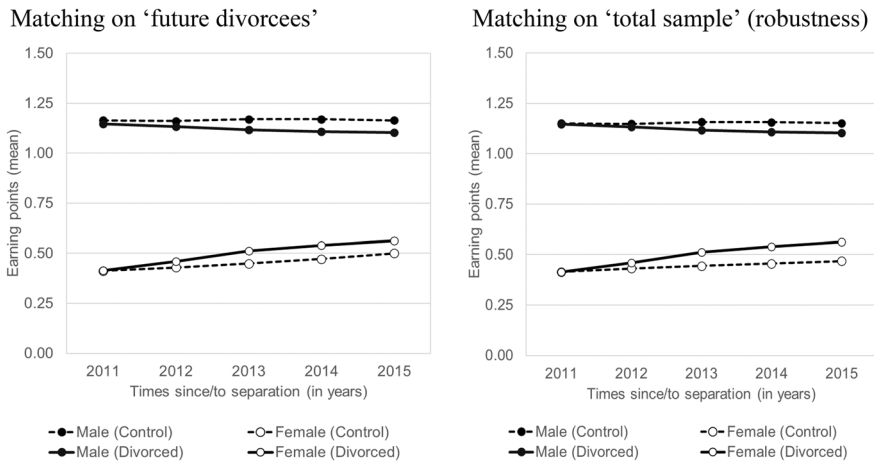


Fig. 4 Average earnings around the time of separation by gender. West German women and men who filed for divorce in 2013 and a control group

breadwinner model (57%), while a smaller share followed the dual-earner model (29%). Only 4% of the couples practiced the female breadwinner model. In 11% of the cases, neither of the spouses received more than 0.5 earning points, meaning that their earnings were 50% below average. The table also shows that the divorced group aligned well with the weighted treated group in terms of their ages and earnings at baseline (in 2011). This was particularly true for the sample that matched on future divorcees.

Figure 4 displays the average earnings of the divorcees as well as the earnings of the control group. The left panel provides the results of the analysis that used the future divorcees as a control group, while the right panel shows the results from the robustness check. Both figures display the same pattern. These findings support our assumption that the earnings of the control group increased over time. Thus, the fixed-effects analyses would be biased if they were based solely on the treated group (divorcees). The figure also shows that the bias ran in the opposite direction for women and men. For women, we would have overestimated the divorce effect, as the earnings of divorced women increased over time, while there was a similar ‘secular’ trend in the control group. For men, the patterns were different. We see a moderate decline in earnings in the group of divorcees. However, the effect appears to be much stronger if we consider that the control group experienced an increase in earnings over the same time period.

*As the control group is based on weighting techniques, providing a sample size for each earner model is not straightforward. The sample sizes are calculated by the effective sample size (ESS) ($ESS = \frac{(\sum_{i \in C} w_i)^2}{\sum_{i \in C} w_i^2}$), where w is the individual weight that is drawn from the weighting approach (for details, see Ridgeway et al., 2021).

Table 3 Results from fixed-effects models, beta coefficients. Outcome: earning points

		Time since separation				
		– 2	– 1	0	+ 1	+ 2
Male earner						
Female	Ref		0.039***	0.076***	0.084***	0.083***
Male	Ref		– 0.029***	– 0.048***	– 0.059***	– 0.058***
Dual earner						
Female	Ref		0.023***	0.052***	0.057***	0.058***
Male	Ref		– 0.026***	– 0.040***	– 0.047***	– 0.052***
Female earner						
Female	Ref		0.002	– 0.001	– 0.015	– 0.024
Male	Ref		0.023**	0.022	– 0.011	– 0.022
Both low/no earners						
Female	Ref		0.020***	0.024***	0.026***	0.027***
Male	Ref		0.024***	– 0.001	– 0.022*	– 0.035**

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Further control variable is age (in single ages).

Results

The results from the fixed-effects models are displayed in Table 3. We have estimated separate models by earner model. The only further control variable in the model is age, which is included in single ages. First, we focus on women and men who practiced the male earner model. Our expectation that we would observe larger changes in behaviour in this group was indeed supported by our analysis. Men's earnings declined by 0.058 earning points from two years before separation to two years after separation (a decrease of 4.5% in relative terms). This is equivalent to a decline in gross annual earnings of €2,050.⁹ The earnings of women in male breadwinner constellations increased by 0.083 earning points (or by 41.2% in relative terms or €2,940 per annum).

While our findings for the male breadwinner model fit our expectations, our hypothesis that divorce would not lead to any major changes for dual-earner couples was not fully confirmed. Although the patterns were less attenuated than they were in the male breadwinner constellation, we also find for couples in the dual-earner constellations, that women's earnings increased while men's earnings declined after divorce. For men, we witness a decline in earnings in the period two years prior to two years after separation of 0.052 earning points (or 3.8%). For women, the increase in these constellations amounts to 0.058 earning points (or 6.7%).

For the small group of women and men in other constellations (female breadwinner or both low income), we did not see any large changes in behaviour around the time of divorce. It is, however, noteworthy that while the absolute changes are

⁹ Earnings are calculated by multiplying the earning points with the average gross income (€ 35,363) from 2015 (Anlage 1 SGB VI: https://www.gesetze-im-internet.de/sgb_6/anlage_1.html).

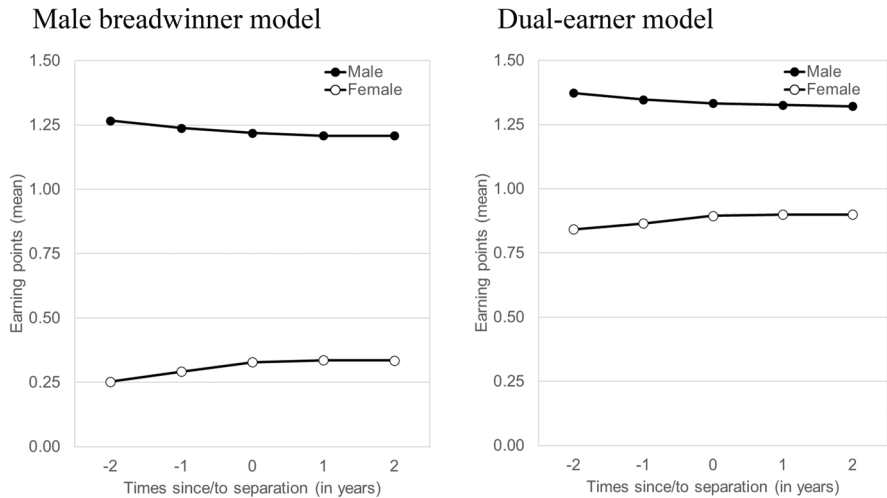


Fig. 5 Predicted earnings by duration since separation (see Table 3 for beta coefficients)

indeed small, relative changes are substantial in some instances. For example, when both spouses had low or no earnings before the divorce, female earnings increased by 0.027 earning points, which is an increase of 18.6% in relative terms. Male earnings declined by 0.035 earning points. In relative terms that is a decrease of 18.5% with respect to the reference year (t-2).

To get further insight into the magnitude of the earnings of the divorcees in the different earner constellations, we have calculated predicted values for the main earner models (dual-earner and male breadwinner models). Figure 5 shows that even in the dual-earner model, women and men started off at different base levels. The figures also indicate that while women's earnings increased strongly over the observation window, large gender differences persisted in both the male breadwinner model and the dual-earner model. However, gender differences are radically more pronounced in the male breadwinner model. Two years after separation, women in male breadwinner constellations were earning 66% less than the average wage. Based on this analysis, we can conclude that most women who had been in a male breadwinner constellation were not able to achieve earnings that would qualify them as 'self-reliant' in the two years after separation.

Conclusion

This paper examined the earnings of divorcees in western Germany. We sought to answer the question of whether and, if so, how the earner models men and women followed during their marriage affected their earnings trajectories after a union dissolution. We argued that German law increasingly demands that the previously married partners achieve economic independence, particularly since the implementation of the maintenance reform of 2008. This means that following a

divorce, the secondary earner in a single-earner constellation experiences immediate pressure to enter the labour market or to increase his/her working hours. In the German context, this pressure can be especially acute because single-earner couples have privileges that they lose when they divorce, such as the free co-insurance of the non-earning or marginally employed spouse in the health care system. We therefore argued that women who had been in a male breadwinner constellation face strong pressure to be economically independent after a divorce. However, whether these women are indeed able to achieve economic independence was an empirical question that had yet to be answered.

To provide evidence to help answer this research question, we used data from the German pension registers. We selected a homogenous cohort of couples, all of whom separated in the year 2013. Thus, we examined couples who experienced a divorce well after the implementation of the abovementioned maintenance reform, which requires both partners to achieve economic independence. Moreover, by selecting divorcees from only one divorce cohort, we made sure that the results were not driven by changes in behaviour across cohorts or time periods. An additional advantage of using these data was that they were on the couple level, which enabled us to directly compare the earnings of the ex-partners after divorce. Our descriptive investigation showed that the employment rates of male and female divorcees converged in the process of separation. This convergence was the result of a significant share of women transitioning from marginal to regular employment around the time of their divorce. However, women's rates of registered unemployment also rose sharply around the time of their divorce. While average female earnings increased in the process of divorce, substantial gender differences persisted. These differences were largest among divorcees who were previously in a male breadwinner constellation. In this group, the women earned roughly 66% less than the average wage, while the men earned 21% more than the average wage two years after their divorce.

An intriguing finding from our investigation was that men's earnings declined in the process of divorce. We adopted a rigorous causal approach to identifying the size of this 'divorce penalty'. Here, we employed a fixed-effects approach that we combined with matching techniques. Such an approach seemed warranted because a simple comparison of the earnings of divorcees before and after divorce may understate the true effects of divorce, as earnings generally increase across the life course.

While we identified a large and negative divorce penalty for men, explaining that pattern is more difficult. The main breadwinner's individual earnings are more heavily taxed following a divorce, which reduces his/her incentives to engage in career advancement. We therefore assumed that we would see a decline in the earnings of prime earners in single-earner constellations, while the earnings trajectories of dual-earner couples would be less affected by divorce. Indeed, male earnings in male-bread-winner constellations decline more strongly than in dual-earner constellations. Overall, however, one must conclude that there is a substantial and significant male divorce penalty for men in both dual-earner and in male breadwinner constellations.

Limitations

This paper adopted a causal approach by combining fixed-effects models with matching techniques. While we may have been able to produce fairly unbiased ‘divorce estimates’, we have not been able to uncover the mechanisms at play. We found that men’s earnings declined rapidly in the process of divorce. We attribute this decline to the economic incentives that we discussed in the theoretical part of this paper. However, as we also found a similar pattern in the dual-earner and male breadwinner constellations, it appears that other mechanisms contributed to these outcomes as well. It may be the case that men’s health was strongly affected by divorce, which resulted in a decline in their earnings. It is also possible that men were more engaged in childcare responsibilities after their divorce than they were before, which may have inhibited their career advancement. Although shared physical custody is rare in Germany, we cannot rule out the possibility that this mechanism was also at play.

Beyond health, maintenance payments, and physical custody, we were not able to control for patterns of re-partnering, and thus for whether the divorcees entered a new earner model. Another important limitation of our study was that we had no information on the number of children, and were therefore unable to investigate whether children moderated the relationship between divorce and earnings. In addition, having access to more refined information on the divorcees’ occupational status and working hours would have been desirable, as such data would have helped us better understand why the divorced women in our sample had earnings that were so far below average. Beyond the lack of additional variables, we also must note that the study population does not cover the total resident population in Germany, but only the population that has a pension account (roughly 90% of the population). Further, not all divorces are captured in the pension accounts (Keck et al., 2019). Finally, our focus has been on average changes in earnings. Under which conditions people see and increase, stagnation, or a decline in their earnings after divorce would have been an important additional perspective.

Despite these many limitations, our investigations provide clear and alarming evidence of the gender differences in earnings after divorce. By examining previously married couples, we provided evidence of the diverging fates of women and men in male breadwinner constellations. These couples still make up the majority of the freshly divorced couples in Germany. Although the women who had been in a male breadwinner constellation expanded their employment activities after their divorce, their earnings did not, on average, come close those of their ex-spouse. The maintenance reform that was enacted in Germany in 2008 was motivated by the belief that women would be able to achieve economic independence after divorce. Instead, our findings show that the majority of female divorcees in Germany are far from having the level of economic independence lawmakers assumed they would be able to attain.

Appendix I: Matching and weighting framework. Controls derived from ‘future divorcees’

In the following, we address the main procedures and assumptions of the matching and weighting framework.

TWANG

The R package “TWANG” contains a procedure to support causal modelling of observational data via the estimation and evaluation of propensity scores and associated weights. Propensity scores are estimated by gradient boosted models. Gradient boosted models (GBM) are machine learning approaches that take into account non-linearities and interactions among the covariates (for details, see Ridgeway et al., 2021).

Conditional Independence Assumption (CIA)

The CIA addresses the existence of unobserved covariates that simultaneously affect the treatment assignment and the outcome. In an observational study, we can control for observed covariates, but there may be unobserved factors that select people into treatment. The CIA holds only if all unobserved covariates have no impact on earnings or the selection into treatment. It is only then that the estimated treatment effect equals the true unbiased effect. We cannot rule out the possibility that there were unobserved covariates that biased our estimation.

Stable Unit Treatment Value Assumption (SUTVA)

The SUTVA addresses the possibility that the treated individuals will compete on the labour market with persons from the control group. The divorcees might have strong incentives to enter the labour market or to increase their working hours (if they are already employed) due to the financial burden of divorce. As a consequence, employers might substitute individuals from the control group with divorcees who are willing to accept lower wages or worse employment conditions. As a result, our estimated treatment effect might be distorted because the outcome of the controls serves as the counterfactual outcome of the divorcees. While this scenario is in principle possible, we believe that this effect would not be large, given that only around 200,000 divorces occur in Germany each year. The number of divorcees seems too low for their behaviour to affect the labour market options of married people. Thus, we assume the SUTVA holds.

Common Support Requirement

The common support is a requirement in the matching framework. However, it is less clear whether it is relevant in the weighting framework. Ridgeway et al., (2021:

Table 4 Balance statistics for subsamples before and after weighting (controls derived from ‘future divorcees’)

		N treat	N control	ESS treat	ESS control	SD max	SD mean
Both low earnings	Unweighted	2,596	33,869	2,596	33,869	4.9008	0.0927
	Weighted				1,852	0.7998	0.0235
Male breadwinner	Unweighted	13,952	33,869	13,952	33,869	1.7058	0.0386
	Weighted				16,517	0.1223	0.0082
Dual earner	Unweighted	7,105	33,869	7,105	33,869	5.6042	0.1092
	Weighted				7,212	0.1441	0.0108
Female breadwinner	Unweighted	963	33,869	963	33,869	14.8989	0.2039
	Weighted				543	4.5671	0.0476
All	Unweighted	24,616	33,869	24,616	33,869	0.2996	0.0165
	Weighted				25,943	0.0436	0.0055

SD standardised difference statistic, *ESS* effective sample size (for details, see Ridgeway et al., 2021)

p. 9), for example, argued that excellent covariate balance can be achieved, even when the propensity scores estimated for the treated and the control group overlap only a little. In our sample, the distribution of the propensity scores do not overlap perfectly, but they overlap to a large extent. Thus, in light of the argument by Ridgeway et al. (2021) and the fairly good overlap in our sample, we decided against trimming, and estimated the treatment effect without the common support requirement.

Balance Results

The balance results are important for assessing whether weighting removed systematic differences between the treated group and the control group. Our balance statistics are shown in Tables 4 and 5. Before weighting (Table 4), there are statistically significant differences between the groups for many variables. However, after weighting, the difference is greatly reduced. Only some minor outliers exceed 20% of a standard deviation (see Table 4 (column SD max and SD mean) and A2 (columns SD)). In particular, the small groups of “both low earnings” and the “female breadwinner” were difficult to weight, judged by the balance results.

Appendix II: Matching and Weighting Framework. Controls Derived from ‘Total Sample’

In the following, we provide the balance statistics for the analysis where the controls were derived from the ‘total sample’ (Fig. 4, right panel). We did not use here the TWANG framework as the computational burden would be too high due to the enormous sample size. Instead, we calculated the propensity scores via a simple logit estimation. We have chosen similar covariates as before (see Table 6), however, we

Table 5 Balance statistics of selected baseline covariates. Controls derived from 'future divorcees'

	Both low earnings		Male breadwinner		Dual earner		Female breadwinner		Full sample	
	Treated	SD	Treated	SD	Treated	SD	Treated	SD	Treated	SD
Marriage duration	13.05	0.00	14.54	0.03	16.14	0.02	15.38	0.19	14.88	0.01
Males pension adjustment (ep)	0.08	0.09	- 0.31	0.03	- 0.20	- 0.01	0.20	0.04	- 0.22	0.02
Age male	41.36	0.00	42.66	0.01	44.80	0.00	44.13	0.10	43.20	0.00
Age female	37.85	- 0.05	39.96	- 0.01	42.51	- 0.02	41.75	0.16	40.54	- 0.02
Dummy for giving birth in 2009	0.12	- 0.01	0.07	- 0.01	0.01	- 0.06	0.03	- 0.06	0.06	0.00
Dummy for giving birth in 2010	0.08	0.01	0.05	- 0.02	0.00	- 0.05	0.01	- 0.15	0.04	- 0.01
Dummy for giving birth in 2011	0.04	0.01	0.02	- 0.02	0.01	- 0.03	0.01	- 0.13	0.02	- 0.01
<i>Labour market outcomes in 2010</i>										
Male days regular employment	81.37	- 0.02	351.21	- 0.04	352.15	- 0.03	85.83	- 0.11	312.64	- 0.02
Male income regular employment	4183	- 0.08	39,270	- 0.01	42,311	- 0.04	4365	- 0.18	35,082	- 0.02
Male days mid-job	5.84	0.05	0.11	- 0.01	0.20	0.01	9.74	0.08	1.12	0.00
Male income mid-job	107.01	0.05	1.84	- 0.01	3.61	0.01	165.24	0.07	19.83	0.00
Male days marginal employment	50.08	0.01	32.12	0.00	26.86	0.01	69.71	- 0.04	33.96	0.00
Male income marginal employment	55.39	- 0.01	41.56	0.00	35.23	0.01	94.34	- 0.02	43.26	0.00
Male days of unemployment I	31.32	0.03	4.07	0.03	3.54	0.03	35.01	0.08	8.00	0.02
Male unemployment I benefits	1844	0.03	309	0.04	283	0.03	2171	0.09	536	0.02
Male days of unemployment II	15.84	0.01	0.23	- 0.01	0.04	- 0.03	5.25	- 0.07	2.02	- 0.01
Male days of work disability	11.64	0.07	3.06	0.03	3.76	0.04	12.12	0.11	4.52	0.03
Male benefits while in work disability	692	0.06	257	0.03	324	0.04	734	0.10	341	0.03
Male days of contribution for caring	0.16	0.00	0.08	0.01	0.22	0.02	1.33	0.00	0.18	0.01
Male benefits for care activities	1.16	- 0.01	0.48	0.01	1.38	0.02	11.83	0.01	1.26	0.00
Male days of voluntary contributions	8.49	- 0.05	0.04	- 0.05	0.13	- 0.01	12.89	0.09	1.46	0.00
Male days for childcare	0.32	- 0.02	0.01	- 0.01	0.01	- 0.03	0.79	- 0.05	0.07	- 0.01
Female days regular employment	71.11	- 0.03	92.96	- 0.03	351.10	- 0.01	347.15	0.15	175.11	- 0.03

Table 5 (continued)

	Both low earnings		Male breadwinner		Dual earner		Female breadwinner		Full sample	
	Treated	SD	Treated	SD	Treated	SD	Treated	SD	Treated	SD
Female income regular employment	2517	-0.09	3251	-0.04	25,263	0.01	26,846	0.11	10,450	-0.02
Female days midi-job	14.51	0.03	11.64	0.01	0.40	0.00	0.66	-0.02	8.27	0.01
Female income midi-job	242.77	0.03	204.13	0.01	7.49	0.01	16.06	0.00	144.09	0.01
Female days marginal employed	81.97	0.01	132.49	-0.02	43.33	0.02	39.85	-0.06	97.80	0.00
Female income marginal employed	112.31	-0.02	201.50	-0.03	58.65	0.03	51.07	-0.08	144.98	-0.01
Female days of unemployment I	8.51	0.01	8.50	0.01	1.69	0.02	2.46	0.07	6.30	0.01
Female unemployment I benefits	300.89	0.02	295.52	0.00	100.45	0.02	119.55	0.07	232.90	0.01
Female days of unemployment II	48.13	0.02	3.91	0.02	0.07	-0.02	1.53	-0.02	7.37	0.02
Female days of work disability	2.46	0.01	3.15	0.04	2.48	0.04	2.63	-0.01	2.86	0.03
Female benefits while in work disability	81.59	-0.02	114.71	0.03	165.36	0.04	174.02	0.00	128.16	0.02
Female days of contribution for caring	5.42	0.02	5.81	-0.01	1.44	0.00	1.03	0.01	4.32	0.00
Female benefits for care activities	45.68	0.03	45.06	0.00	9.07	0.00	6.06	0.00	33.21	0.01
Female days of voluntary contributions	0.70	0.03	0.23	-0.01	0.00	0.00	0.00	NA	0.21	0.00
Female days for childcare	4.22	-0.02	7.32	-0.01	0.29	-0.03	0.24	-0.09	4.69	-0.01
<i>Labour market outcomes in 2011</i>										
Male days regular employment	97.43	-0.03	351.29	-0.04	352.49	-0.03	110.24	-0.13	315.44	-0.03
Male income regular employment	5055	-0.10	40,465	-0.02	43,531	-0.05	5621	-0.21	36,253	-0.03
Male days midi-job	6.25	0.05	0.11	0.00	0.16	0.01	7.71	0.03	1.07	0.00
Male income midi-job	114.01	0.05	2.28	0.00	2.81	0.01	130.90	0.05	19.25	0.00
Male days marginal employed	47.13	0.00	33.20	0.00	26.17	0.00	68.17	-0.01	34.01	-0.01
Male income marginal employed	55.64	0.01	42.99	0.00	34.96	0.00	91.00	0.00	43.88	-0.01
Male days of unemployment I	19.89	0.06	3.49	0.04	2.41	0.02	16.55	0.06	5.42	0.03
Male unemployment I benefits	1091.12	0.07	274.62	0.04	193.81	0.03	910.77	0.06	362.29	0.03

Table 5 (continued)

	Both low earnings		Male breadwinner		Dual earner		Female breadwinner		Full sample	
	Treated	SD	Treated	SD	Treated	SD	Treated	SD	Treated	SD
Male days of unemployment II	106.24	0.01	0.21	-0.12	0.03	-0.14	21.38	0.03	12.17	0.01
Male days of work disability	10.02	0.06	4.27	0.03	4.49	0.04	13.97	0.17	5.32	0.03
Male benefits while in work disability	559.04	0.05	372.20	0.04	385.72	0.03	865.63	0.15	415.11	0.03
Male days of contribution for caring	0.26	0.00	0.08	0.01	0.15	0.02	1.27	-0.01	0.16	0.00
Male benefits for care activities	2.02	0.00	0.58	0.01	0.77	0.01	10.90	0.00	1.19	-0.01
Male days of voluntary contributions	8.19	-0.06	0.08	-0.02	0.09	-0.02	12.57	0.07	1.43	0.00
Male days for childcare	0.08	-0.06	0.00	-0.02	0.05	0.00	0.13	-0.07	0.03	-0.02
Female days regular employment	89.94	0.00	124.48	-0.01	354.59	-0.01	351.37	0.15	196.13	-0.01
Female income regular employment	3364	-0.04	4592	-0.01	27,117	0.03	28,454	0.11	11,897	0.00
Female days mid-job	14.68	-0.01	11.33	0.00	0.16	-0.02	0.19	-0.14	8.03	0.00
Female income mid-job	249.97	0.00	201.71	0.00	2.73	-0.02	2.75	-0.18	141.58	0.00
Female days marginal employment	81.64	0.00	125.30	-0.03	42.36	0.01	43.95	-0.01	93.57	-0.01
Female income marginal employment	111.19	-0.03	190.25	-0.03	56.42	0.02	57.19	-0.02	138.08	-0.02
Female days of unemployment I	8.09	0.02	7.32	0.03	1.48	0.04	3.06	0.08	5.55	0.03
Female unemployment I benefits	264.67	0.01	263.15	0.03	100.87	0.04	186.21	0.07	213.46	0.02
Female days of unemployment II	120.27	0.01	11.78	0.07	0.00	NA	0.02	-4.57	19.36	0.03
Female days of work disability	3.02	0.03	3.10	0.05	3.77	0.08	5.34	0.14	3.37	0.03
Female benefits while in work Disability	111.42	0.02	106.48	0.04	256.37	0.08	359.67	0.14	160.17	0.03
Female days of contribution for caring	5.15	0.03	5.67	-0.01	1.56	0.00	1.08	0.00	4.25	0.00
Female benefits for care activities	44.93	0.04	44.34	-0.01	11.35	0.01	6.05	-0.01	33.38	0.01
Female days of voluntary contributions	0.73	0.04	0.18	-0.02	0.01	0.01	0.00	NA	0.18	0.00
Female days for childcare	1.84	-0.02	3.27	0.00	0.07	-0.02	0.00	NA	2.07	-0.01
<i>Education</i>										

Table 5 (continued)

	Both low earnings		Male breadwinner		Dual earner		Female breadwinner		Full sample	
	Treated	SD	Treated	SD	Treated	SD	Treated	SD	Treated	SD
Male no information	0.43	-0.02	0.24	0.00	0.23	0.00	0.40	0.00	0.27	0.00
Male without school diploma	0.02	-0.03	0.01	0.01	0.01	0.03	0.01	-0.05	0.01	0.01
Male elementary school diploma	0.30	0.04	0.32	0.00	0.27	0.02	0.26	0.05	0.30	0.01
Male secondary school diploma	0.16	0.03	0.27	0.01	0.27	0.01	0.17	-0.09	0.25	0.00
Male high school diploma	0.08	-0.07	0.16	-0.03	0.22	-0.04	0.14	0.06	0.17	-0.02
Female no information	0.42	-0.03	0.26	-0.02	0.21	-0.03	0.26	-0.05	0.26	-0.02
Female without school diploma	0.02	0.01	0.01	0.01	0.01	0.01	0.01	-0.04	0.01	0.01
Female elementary school diploma	0.24	0.08	0.24	0.03	0.14	-0.01	0.13	-0.01	0.21	0.02
Female secondary school diploma	0.23	-0.02	0.35	-0.01	0.40	0.03	0.40	0.12	0.36	-0.01
Female high school diploma	0.09	-0.04	0.13	-0.01	0.24	0.00	0.20	-0.07	0.16	0.00
<i>Higher education</i>										
Male no information	0.41	-0.02	0.13	0.02	0.12	0.01	0.37	-0.01	0.16	0.01
Male without vocational training	0.11	0.04	0.06	0.00	0.04	0.01	0.07	0.05	0.06	0.01
Male vocational training	0.40	0.02	0.64	0.01	0.62	0.01	0.44	0.01	0.60	0.00
Male bachelor diploma	0.03	0.01	0.09	-0.01	0.10	0.00	0.05	-0.02	0.09	-0.01
Male master diploma	0.00	0.00	0.01	-0.01	0.01	-0.02	0.01	0.00	0.01	-0.01
Male master/technician college qualification	0.02	-0.13	0.08	-0.01	0.11	-0.02	0.04	-0.03	0.08	-0.01
Male doctorate	0.00	0.02	0.00	-0.01	0.01	-0.04	0.00	-0.04	0.00	-0.01
Female no information	0.38	-0.06	0.21	-0.02	0.09	-0.01	0.10	-0.10	0.19	-0.01
Female without vocational training	0.14	0.09	0.09	0.03	0.05	0.01	0.07	0.09	0.08	0.03
Female vocational training	0.44	0.01	0.65	0.00	0.75	0.01	0.74	0.04	0.66	0.00
Female bachelor diploma	0.01	-0.01	0.01	-0.01	0.03	0.00	0.02	0.01	0.02	-0.02
Female master diploma	0.00	0.02	0.00	-0.01	0.00	-0.02	0.01	0.03	0.00	0.00

Table 5 (continued)

	Both low earnings		Male breadwinner		Dual earner		Female breadwinner		Full sample	
	Treated	SD	Treated	SD	Treated	SD	Treated	SD	Treated	SD
Female master/technician college qualification	0.03	- 0.05	0.04	0.00	0.08	- 0.01	0.06	- 0.05	0.05	0.00
Female doctorate	0.00	0.04	0.00	- 0.01	0.00	- 0.01	0.00	0.01	0.00	0.00

Results from interaction terms and 357 region dummies are not displayed

Table 6 Balance statistics for men and men before and after weighting. Controls derived from ‘total sample’

	N treat	N control	ESS treat	ESS control	SD max	SD mean
Male						
Unweighted	24,552	7,080,886	24,552	7,080,886	2.2352	0.1391
Weighted				5,680,392	0.0073	0.0004
Female						
Unweighted	24,556	9,776,987	24,556	9,776,987	6.0321	0.1670
Weighted				6,223,675	0.0576	0.0007

SD standardised difference statistic

Table 7 Balance statistics for selected covariates

	Female sample			Male sample		
	Treated	p value	SD	Treated	p value	SD
Age	40.54	0.96	0.00	43.20	0.93	0.00
Dummy for giving birth in 2009	0.06	0.00	0.06			
Dummy for giving birth in 2010	0.04	0.94	0.00			
Dummy for giving birth in 2011	0.02	0.96	0.00			
<i>Labour market outcomes in 2010</i>						
Days regular employed	175.11	0.78	0.00	312.64	0.41	− 0.01
Income regular employment	10,450.41	0.83	0.00	35,082.35	0.61	0.00
Days mid-job	8.27	0.96	0.00	1.12	0.98	0.00
Income mid-job	144.09	0.96	0.00	19.83	0.98	0.00
Days marginal employed	97.80	0.92	0.00	33.96	0.99	0.00
Income marginal employed	144.98	0.92	0.00	43.26	0.97	0.00
Days of unemployment I	6.30	0.91	0.00	8.00	0.68	0.00
Unemployment I benefits	232.90	0.89	0.00	536.61	0.47	0.01
Days of unemployment II	7.37	0.96	0.00	2.02	0.92	0.00
Days of work disability	2.86	0.95	0.00	4.52	0.95	0.00
Benefits while in work disability	128.16	0.96	0.00	341.67	0.95	0.00
Days of contribution for caring	4.32	1.00	0.00	0.18	0.99	0.00
Benefits for care activities	33.21	1.00	0.00	1.26	0.99	0.00
Days of voluntary contributions	0.21	0.99	0.00	1.46	0.93	0.00
Days for childcare	4.69	0.98	0.00	0.07	1.00	0.00
<i>Labour market outcomes in 2011</i>						
Days regular employed	196.13	0.66	0.00	315.44	0.26	− 0.01
Income regular employment	11,897.56	0.73	0.00	36,253.05	0.44	− 0.01
Days mid-job	8.03	0.95	0.00	1.07	0.98	0.00
Income mid-job	141.58	0.95	0.00	19.25	0.98	0.00
Days marginal employed	93.57	0.80	0.00	34.01	0.89	0.00
Income marginal employed	138.08	0.82	0.00	43.88	0.90	0.00

Table 7 (continued)

	Female sample			Male sample		
	Treated	<i>p</i> value	SD	Treated	<i>p</i> value	SD
Days of unemployment I	5.55	0.94	0.00	5.42	0.94	0.00
Unemployment I benefits	213.46	0.95	0.00	362.29	0.94	0.00
Days of unemployment II	19.36	0.92	0.00	12.17	0.94	0.00
Days of work disability	3.37	0.95	0.00	5.32	0.93	0.00
Benefits while in work disability	160.17	0.95	0.00	415.11	0.93	0.00
Days of contribution for caring	4.25	0.96	0.00	0.16	0.99	0.00
Benefits for care activities	33.38	0.97	0.00	1.19	0.99	0.00
Days of voluntary contributions	0.18	0.99	0.00	1.43	0.98	0.00
Days for childcare	2.07	0.97	0.00	0.03	1.00	0.00
<i>Education</i>						
No information	0.26	0.99	0.00	0.27	1.00	0.00
Without school diploma	0.01	1.00	0.00	0.01	1.00	0.00
Elementary school diploma	0.21	0.99	0.00	0.30	1.00	0.00
Secondary school diploma	0.36	0.99	0.00	0.25	1.00	0.00
High school diploma	0.16	1.00	0.00	0.17	1.00	0.00
<i>Higher education</i>						
No information	0.19	1.00	0.00	0.16	1.00	0.00
Without vocational training	0.08	0.99	0.00	0.06	0.99	0.00
Vocational training	0.66	1.00	0.00	0.60	1.00	0.00
Bachelor diploma	0.02	1.00	0.00	0.09	1.00	0.00
Master diploma	0.00	1.00	0.00	0.01	1.00	0.00
Master/technician college qualification	0.05	1.00	0.00	0.08	1.00	0.00
Doctorate	0.00	1.00	0.00	0.00	1.00	0.00

Controls derived from 'total sample'

SD standardised difference. *p* values are from a t-test of equal means. Results from 357 region dummies are not displayed

did not include any interaction terms. The predicted propensity scores were then transformed into odd-weights.¹⁰ Balance results in Table 7 are based on these odd-weights. We also included here the *p* values from a t-test of equal means between the treated and controls. Despite the fact that we only use a simple matching approach, the balance results are fairly good.

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¹⁰ $ODD = TREAT + (1 - TREAT) * ps(1 - ps)$

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