Public Insurance to Adverse Life-Events*

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November 2025

Abstract

This paper studies and compares the effect of different adverse life events – job loss, health shocks, divorce and spousal death – on individuals' income trajectories. We use an harmonized design across events in terms of methodology and data: stacked difference-in-difference with exact matching using exhaustive Dutch administrative registers. We compare their effect on primary and disposable household income in order to measure the public insurance to the shocks provided by the tax and transfer system. Both between different events and within different groups for a given event, we find that the importance of government insurance increases with the severity of the shock on primary income. We further decompose the insurance received and show that it is provided by the taxes and benefits system as a whole and not through event-specific insurance scheme.

JEL codes: H2, I1, J1, J2

*We thank Jonneke Bolhaar, Gabrielle Fack, Anne Gielen, Maud Hofland, Egbert Jongen, Janneke Pieters, Marianne Tenand, and Benedikt Vogt, as well as participants to seminars at the ENS Lyon, the Paris School of Economics, the Université Paris-Dauphine and the DIW for their valuable comments and suggestions. Remaining errors are our own. This project received funding from the Dutch Ministry of Social Affairs and Employment, for which we are grateful. We finally thank Statistics Netherlands for providing access to the data.

Life course trajectories can be profoundly affected by various adverse, disruptive events that can have significant and lasting effects on individuals' ability to earn. The impact of an adverse event depends not only on its nature and severity, but also on the resources available to cope with it. In particular, public insurance provided by the tax and transfer system as a whole, can play an important role in limiting the impact of adverse events and income inequality (De Nardi et al. 2021, Piketty et al. 2018).

There is a large literature documenting how income trajectories can be significantly and durably affected by adverse life events such as job loss (Deelen et al. 2018, Bertheau et al. 2023, Halla et al. 2020, Andersen et al. 2023), health shock (García-Gómez et al. 2013, Dobkin et al. 2018, Meyer & Mok 2019, Fadlon & Nielsen 2021), couple separation (Bonnet et al. 2021, Hogendoorn 2022) and widowhood (Fadlon & Nielsen 2021). Together, it draws a rather complete picture of how a specific life event in a given context can affect income through different channels, such as individual earnings but also spousal response and social protection. However, we know little about the relative impact of different life events. Available studies are specific in terms of institutional context, selected population, income concepts and econometric specifications.

In this paper, we analyze how individuals are affected by and insured against a broad set of adverse life events - job loss, health shock, couple separation and widowhood. Rather than analyzing each event separately, the novelty of this paper lies in the comparison across events made possible by the harmonized research design we implement.

Our focus is on a consistent sample of individuals of working age, taken from the same data source: administrative tax data from the Dutch population. We apply the same stacked difference-in-difference with exact matching estimation strategy, to each life event. We use income concepts that are consistent and comparable across events. Our approach is more extensive than recent comparatives studies (Stepner 2019, Andersen et al. 2020), because it includes a wider range of life events and provides a more detailed breakdown of public insurance received. Several original findings emerge from this unique comparative setting.

First key result, when looking at each event separately, we find very similar patterns. Primary income drops sharply and persistently after the events — from a 20% decline five years after divorce to a 40% decline five years after job loss. These losses are substantially reduced once taxes and transfers are taken into account: five years after the event, disposable income is only reduced by 7% for health shock to 10% for job loss.

The gap between primary and disposable effects shows that events with larger primary income losses receive larger absolute transfers and tax reductions, but at a roughly constant rate. Our second and main insight is then the following: the tax and transfer system provides an homogenous 75% insurance rate regardless of the severity of the shock.

Our third and final key insight is that public insurance against adverse life events does not come from specific schemes (e.g. unemployment insurance for job loss), but rather through the entire tax and benefits system. While benefits account for the majority of the insurance, reduced tax payments accounts for up to 50% of provided insurance one year after the event.

The remainder of the paper is structured as follows. Section I presents the analytical framework we use to analyze how individuals are affected from adverse life event. Section II presents the harmonized research we built to estimate the causal effect of events and Section III presents the empirical results. Section IV concludes.

I Analytical framework

This section lays out the analytical framework used to quantify how adverse life events affect household disposable income and the extent to which the tax and transfer system insures these shocks.

Decomposition of Household Disposable Income The analysis traces the impact of life events through a comprehensive decomposition of household disposable income. All income concepts are constructed from tax declaration and social security data. For household $h(i)$ of individual i at time τ, household disposable income can be fully decomposed into five components:

$$Y^{disp}_{h(i),\tau} = Y^{prim,id}_{i,\tau} + Y^{prim,sp}_{i,\tau} + Y^{prim,K}_{h(i),\tau} + Y^{ben}_{h(i),\tau} - Y^{tax}_{h(i),\tau} \tag{1}$$

This decomposition makes explicit how disposable income depends on individual labor income ($Y^{prim,id}_{i,\tau}$), spousal labor income $Y^{prim,sp}_{i,\tau}$, household capital income $Y^{prim,K}_{h(i),\tau}$, benefits received, and taxes paid ($Y^{ben}_{h(i),\tau}$ and $Y^{tax}_{h(i),\tau}$). Each component captures a different margin through which life events can affect household living standards, and together they form the foundation for understanding both the direct effects of events and the insurance provided by the tax and transfer system.

Some of the life events we consider – in particular couple separation and widowhood – also affects the composition of the household. We account for these changes by normalizing all income variables by a measure of household size in our main specification.[1] Doing so, we make the implicit assumption that all resources are shared equally by all members of the households.

Effect on primary income When an adverse life event occurs, its first impact is felt in household primary income through changes in individual earnings, spousal earnings, or household composition (in the case of divorce or widowhood). This primary income effect represents the initial shock to the household's economic circumstances, before any mitigation by the tax and transfer system. The decomposition of household disposable income then allows us to isolate this initial shock from the subsequent insurance provided by taxes and transfers.

For individual events (employment and health shocks), the primary income effect of an event is mainly determined by the impact on the individual affected by the event in question ($Y^{prim}_{i\tau}$). As we consider mostly adverse events, we expect a negative effect on income, which measures the extent to which the event reduces the ability to earn income. Second, there may be an effect of the shock on the income trajectories of other household members ($Y^{prim,sp}_{i,\tau}$). The effect on

[1] We use the scale computed by Statistics Netherlands.

the spouse's primary income can be positive if the spouse increases his or her labour supply to compensate for the loss of income, commonly referred to as the *added-worker effect*. There may also be a negative effect if the spouse is also affected by a shock at the same time, or if he or she reduces his or her labour supply to care for the affected spouse (*correlated effect*). Finally, there may be simultaneous events affecting the structure of the household (*correlated events*) and the income of the spouse (e.g. divorce following a job loss).

For household events (divorce and widowhood), the direct effect is determined by the relative effect on individual and spousal income. First-order effects are driven by the end of resource pooling within the couple: a loss of previously shared spousal income and a gain of previously shared own income. The overall effect depends mainly on the relative share of own income in the household before the event. Two other post-event margins can enter into the effect on primary household income: the formation of a new union (increase in spousal income) and the adjustment of individual labour supply to the change in living standards after the event. The latter can be positive or negative depending on the effect of the event on the post-union standard of living.

Disposable effect When facing an adverse life event, individuals are insured against drop in their primary income by the tax and transfer system.[2] Two mechanisms are at work (Stepner 2019). First, in the Netherlands as in many countries, various insurance schemes compensate for the income drop through additional public benefits. Benefits may be directly related to the realized income risk (e.g unemployment benefits in case of job loss) or part of global anti-poverty policies (e.g welfare benefits for low-income). Importantly, the definition of benefits in this analysis includes only monetary transfers and not in-kind benefits such as healthcare consumption. This implies that, on average, the drop in total gross income will be of smaller magnitude than the drop in primary income. A second insurance component is generated by the tax system: as individuals receive less primary income, they will also pay less taxes and social security contributions. The progressive structure of the income tax system creates an automatic insurance mechanism: as household income falls due to an adverse event, the taxes owed on that income fall as well, and this decline in taxes is larger for households facing higher marginal tax rates. This tax channel represents an important but sometimes overlooked component of public insurance against income shocks, operating automatically without requiring any explicit policy response or benefit application.

Public insurance By comparing the effect of life events on primary and disposable income, we can measure the insurance provided by the tax and transfer system. Insurance is defined as the fraction of euros lost after the event that are replaced by other sources. In our context, "other sources" refers specifically to public insurance operating through the tax and benefit system: increased benefits and reduced taxes that partially or fully compensate for the loss in primary income. With $\delta_{i\tau}^{Y}$ the effect of a life event on outcome Y for time period τ relative to the event, we define insurance as:

[2]See Appendix B for a detailed description of the main features of the Dutch tax and transfer system.

$$\mathcal{I}_\tau = 1 - \frac{\delta_\tau^{disp}}{\delta_\tau^{prim}} \tag{2}$$

This measure answers the question: "For each euro I lose in household primary income due to the life event, what fraction is replaced by the tax and benefit system?" It is expressed as a percentage or proportion, with values typically between 0 and 1 – though values above 1 are possible if the government more than fully compensates the initial loss, and negative values can occur if government policies amplify rather than mitigate the shock.

Following the decomposition of household disposable income presented in equation 1, the insurance effect can be straightforwardly decomposed into its benefit and tax components.

II Harmonized research design

A Data and life events

Data To apply this framework, we draw on comprehensive administrative data from Statistics Netherlands (CBS), which provides information on the full Dutch population. The data consists of a large set of administrative registers that can be merged across datasets using unique personal identifiers, enabling the construction of complete individual and household histories. The information retrieved about individuals encompasses marital status and household history (from 1995), employment income, disability, unemployment, welfare benefits, and pension income (including survivor benefits) extracted from tax and social security records (from 1999), and detailed healthcare expenditure (form 2009). Our main explained variables (primary and disposable income at the individual and household levels) are obtained from administrative data on income tax declarations. Specific information regarding the name and versions of the datasets we used are presented in Appendix E.

Adverse Life Events We focus on four adverse life events. Job loss presents specific measurement challenges. Our main definition identifies job loss through unemployment benefit take-up: an individual is considered to have lost their job in year t if they receive unemployment benefits in year t but not in t-1. Health shocks are defined as sharp increases in healthcare expenditure. In our baseline specification, we classify a health shock as an increase of at least €15,000 in annual healthcare spending from a low initial level, a threshold that corresponds approximately to the 95th percentile of yearly expenditure changes. Couple separation is measured using administrative records of legal union dissolution, which include both marriages and registered partnerships. Spousal death is captured straightforwardly through municipal death registers, which allow us to identify the termination of a union due to the death of one spouse. In Appendix D.1, we document at least one alternative definition for each of these life events.

B Research design

Estimation samples The analysis focuses on the working-age population, specifically individuals born between 1950 and 1989 who experience a life event between ages 25 and 55. We aim to retain the broadest possible sample, as our goal is to document the overall impact of adverse life events rather than to identify tightly defined causal effects. Nonetheless, several restrictions are required. First, we exclude events that occur in the same year as childbirth. Childbirth is strongly correlated with health shocks and has substantial independent effects on income trajectories, especially for women. When individuals experience multiple adverse events within the observation window, we analyze only the first one. This strategy captures the initial shock and traces all subsequent developments, including any additional events that may follow. Second, we restrict the sample to individuals observed continuously for the five years before and after the event. This balanced-panel requirement allows us to interpret the dynamics of the estimated effects but excludes individuals who die or migrate abroad during the observation period.

Identification strategy We use an event-study framework to identify the causal effects of life events on income trajectories. The staggered nature of the event-study design raises well-known identification challenges that have been extensively documented in recent econometric literature (De Chaisemartin & d'Haultfoeuille 2020). To address these challenges, we implement a stacked difference-in-differences approach (Cengiz et al. 2019) with matched control observations (Fadlon & Nielsen 2021). This methodology constructs clean comparison groups and avoids the problematic comparisons that can arise in standard two-way fixed effects specifications with staggered treatment timing.

For each treated individual experiencing a life event at time t_0, a control group is drawn from individuals who are not yet treated by a similar event (and who could be treated at least seven years after t_0). Controls are selected through exact matching on a comprehensive set of pre-event characteristics. Specifically, treated and control individuals must have identical values for gender, year of birth, and migration status, and belong to the same household type (singles, main earners in couples, or secondary earners in couples). They must also be in the same individual primary and household disposable income quartiles in both $t_0 - 4$ and $t_0 - 5$. For job loss specifically, an additional criterion requires controls to be employed one year before the hypothetical event, ensuring comparable labor market positions between treated and control individuals. From the set of exact matches, one control is randomly selected per treated individual. While using multiple controls could increase statistical efficiency, the large size of the Dutch administrative data provides sufficient precision with a single control per treated individual while keeping computational demands manageable. Only individuals for whom a suitable control is found are retained in the estimation sample. Appendix Table A.1 shows the impact of these successive restrictions on sample size. In Appendix D.2 we show that our results are robust to alternative identification strategies.

Event-study equation Using the matched sample described above, the following regression equation is estimated:

$$Y_{it} = \alpha_i + \lambda_t + \sum_{\tau \neq -4} \gamma_\tau \mathbb{1}[t - E_i = \tau] + \sum_{\tau \neq -4} \delta_\tau T_i \times \mathbb{1}[t - E_i = \tau] + \varepsilon_{it} \tag{3}$$

In this specification, Y_{it} represents the outcome variable observed for individual i at period t. The equation includes individual fixed effects α_i to control for time-invariant individual characteristics, and time fixed effects λ_t to account for aggregate trends affecting all individuals.

The variable T_i is a treatment dummy equal to one if individual i experiences the life event and zero otherwise. The indicator function $\mathbb{1}[t - E_i = \tau]$ creates a set of time-to-event dummies that equal one when the current period t is exactly τ periods away from the event date E_i. The reference period is set at $\tau = -4$, meaning all effects are measured relative to this baseline period.

The parameters of interest are the coefficients δ_τ, which capture the dynamic treatment effects at different points in time before and after the event. These coefficients measure how outcomes for treated individuals deviate from those of control individuals at each point in the event-time window, after accounting for individual and time fixed effects.

The inclusion of the γ_τ terms is particularly important in this design. Because treated and control individuals are matched on year of birth, these parameters effectively control for age effects. The design ensures that treated and control individuals are always compared at the same age and in the same time period, isolating the effect of the event itself from confounding age or period effects.

The event study analysis provides estimates of how life events affect each of the income concepts described above. By applying the difference-in-differences framework to different outcome variables—primary income, gross income, and disposable income—we can trace how the initial shock to market income is transformed through the tax and transfer system into the final effect on household living standards.

Specifically, for each income concept $inc \in \{prim, gross, disp\}$ and for each time period τ relative to the event, the estimation yields coefficients $\hat{\delta}_\tau^{inc}$ that measure the causal effect of the event on that particular income measure. The coefficient $\hat{\delta}_\tau^{prim}$ captures the direct effect of the event on primary household income—the immediate impact on market earnings before any government intervention. The coefficient $\hat{\delta}_\tau^{gross}$ shows the effect after benefits have been added, revealing how social insurance and redistributive transfers mitigate the initial shock. Finally, $\hat{\delta}_\tau^{disp}$ captures the net effect after both benefits and taxes have been applied, representing the ultimate impact on household living standards.

The identification of causal effects in this framework relies on the standard parallel trends assumption: in the absence of the life event, the income trajectories of treated and control individuals would have evolved in parallel. This assumption states that any systematic differences between treated and control individuals after the event can be attributed to the causal effect of the event itself, rather than to pre-existing differential trends. Empirical support for this assumption comes from examining pre-event trends.

III Public insurance to adverse life events

A Descriptive statistics

Table 1 presents some pre-event descriptive statistics for the treatment and control groups composing the estimation samples, for each life events we study.

Between events, estimation samples differ substantially in terms of size and characteristics, reflecting the fact the incidence of life events is not random across the population. The incidence of different life events varies considerably across the population. Job loss is by far the most common event. Divorce and health shocks each occur at similar frequencies. Widowhood is the least common event, reflecting both the younger age profile of the sample and low mortality rates in the Netherlands at those ages. Gender composition is generally balanced across most events, with one notable exception: widowhood predominantly affects women, who account for approximately 70% of these events. This gender imbalance reflects two factors: women tend to be younger than their spouses in couples, and women have longer life expectancies. In terms of income level, we observe slightly lower levels for widowhood, that may be due to the stronger prevalence of women.

Within events, treatment and control groups exhibit similar pre-event characteristics, which is expected given that we match on many observables. In particular, control and treatment groups have comparable income level. Importantly, this is also the case when looking at the evolution if the years before events. Appendix Figure A.1 presents the evolution of the primary household income around the event, for all shocks. Overall, income in the control and treatment groups evolve in parallel in the pre-event period. This provides evidence to support the parallel trend assumption at the heart of our identification strategy.

Table 1: Estimation samples

Life event	Job loss		Health		Separation		Widowhood	
Control/Treatment group	C	T	C	T	C	T	C	T
Demographic variables								
Age	38.77	38.74	44.62	44.04	39.92	39.87	48.81	48.81
Household size	1.61	1.59	1.60	1.59	1.74	1.75	1.69	1.67
Income variables								
Share employed	0.97	0.96	0.86	0.86	0.88	0.88	0.79	0.77
Labour income	26672	26954	26493	26341	23652	23463	19728	19714
Spousal labour income	20831	20473	20060	19968	23782	22876	24590	22750
Capital income	-1286	-1514	-606	-550	-1722	-2043	-629	-479
Primary income	46217	45913	45947	45759	45711	44296	43690	41985
Gross income	49607	49343	51109	50576	49329	48205	50012	49931
Disposable income	28210	27613	29023	28655	28003	27351	28626	28715
Nb of obs	5621625	5692295	227010	195095	2198610	2209490	360445	360220

NOTE: This table presents general descriptive statistics for the different estimation samples used in the analysis. C_g and T_g respectively refers to the control and treatment group (see section **??** for a description of the construction of the treatment and matched control group).

B The effect of adverse life events on income trajectories

We hereby present the effect of different life events on income trajectory by focusing on the comparison between events and on income that are more comparable between events, namely household primary and disposable income. In Appendix C we show detailed event-specific results, including the decomposition of household primary income into different margins such as individual and spousal earnings.

Average effect of life events Figure 1 shows the estimated effects of our selection of life events on household primary income (left) and household disposable income (right). The difference in euros between the income trajectories of the treatment and control groups is normalized with the level in t-4 as the reference and expressed as a proportion of the level of disposable income before the event. This means that the effect can be interpreted in percentages with respect to a baseline level of disposable income. For example, a job loss shock leads to a little more than a 40% decline in primary income in the first year after the event, but a 10% decline in disposable income in the same period. Several results from this figure are worth highlighting.

First, it provides some evidence to support the assumption of parallel trend identification. For all life events considered, the data show that income for control and treatment groups evolves in parallel during the pre-event period. This parallel evolution provides reassurance that the treatment and control groups are well-matched and that differential post-event trends can be interpreted causally. However, for most events, there is evidence of slight declines in income one or two periods before the event occurs. These "anticipation effects" can arise for several reasons. Unlike some studies that focus on sharp, unexpected shocks (such as mass layoffs or acute hospitalizations), this analysis uses broader event definitions to capture the full range of relevant life events. Some degree of anticipation is therefore natural: couples may separate gradually before legal divorce, health may slowly deteriorate before the sharp increase in health expenditure, and job loss may be preceded by declining work hours or wages. Importantly, the magnitude of these anticipation effects is very small compared to the size of the effects observed at and after the event time. Following the guidance of Rambachan & Roth (2023) on pre-trend assessment, these modest pre-event deviations do not pose a major threat to the interpretation of the results as causal effects of the life events. Moreover, in Appendix D.1 we present additional results with more exogenous but also more restricted definitions of life events. As expected, pre-trends are largely reduced but results remains qualitatively and quantitatively very close.

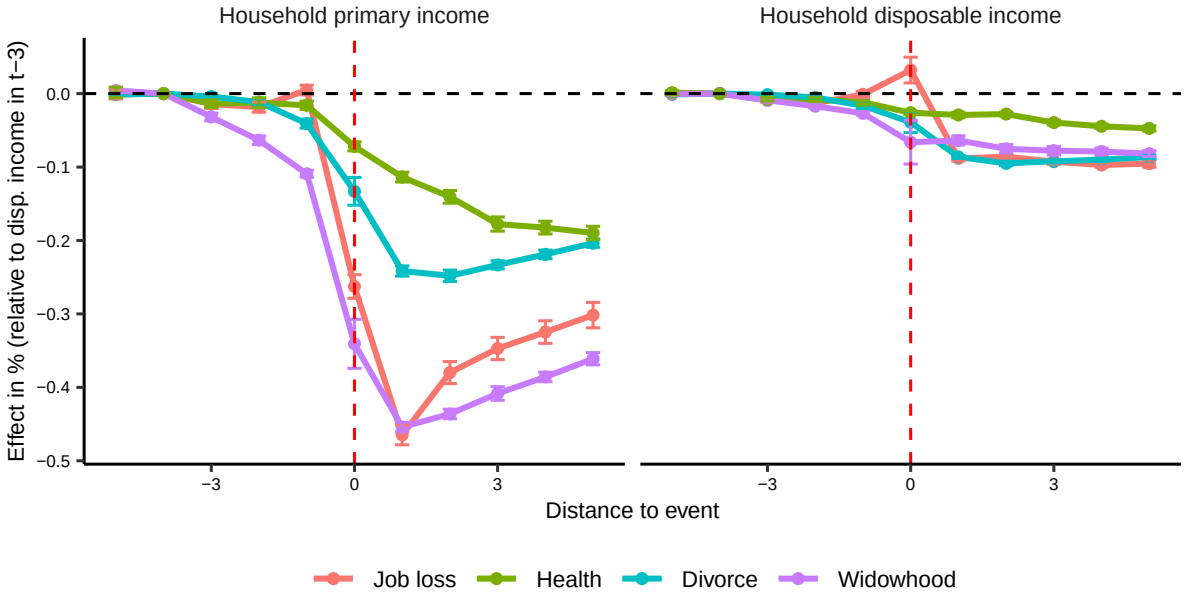
Second, looking at each event separately, we find qualitatively similar patterns. We observe a large drop in primary income at the time of the event, showing that all events considered have a significant and lasting impact on households' ability to earn income. We also observe that this drop is significantly reduced by the effect of taxes and benefits, as the estimated effect on disposable income is much smaller.

Third, when comparing different events, we find substantial variation in the effect of events on primary income. In the long run, we observe a gap of 25 percentage points between the

events with the largest effect (job loss, -40%) and the smallest (divorce, -20%). In the short run, the gap is even larger (-45% for job loss vs. -15% for health). This shows that the events we consider differently impact primary income trajectories, both in terms of magnitude and dynamics.

Fourth, we find that this gap between events is largely reduced when disposable income is considered. The range of estimates we obtain (from -12% for job loss to -7% for health shock in the long run) is much narrower than for primary income. This suggests that the tax and transfer system reduces the differences between events by providing relatively more insurance when the intensity of the effect of the event on primary income is relatively more important .

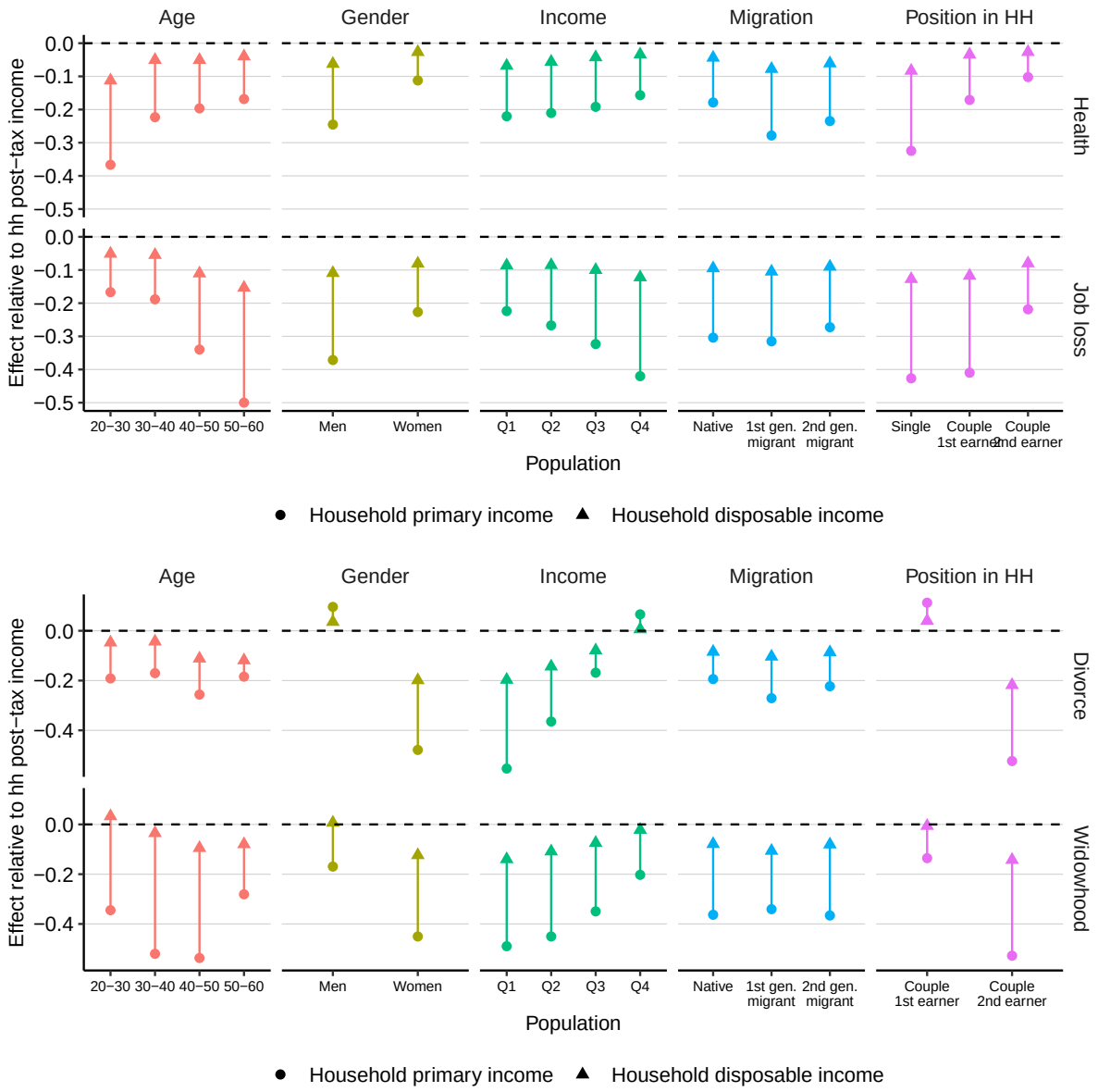
Figure 1: The effect of life events before and after taxes and benefits



NOTE: This Figure present the effect of different life events on household primary income (left panel) and disposable income (right panel).

Heterogeneity of the effect We compare outcomes across subgroups defined four years before the event: age, gender, household position, income quartile (by age and gender), and migration background. Equation (3) is estimated separately for each subgroup, and coefficients at event t+5 for primary and disposable household income are shown in Figure 2. Differences across groups are largely driven by income. Higher-income individuals, who tend to be older and contribute a larger share to total household income, experience larger effects after job losses – since they lose relatively more – and smaller effects after household-level shocks, as they benefit less from income pooling. Health shocks follow a different pattern, being more severe among younger individuals whose income levels are generally lower. No major differences are observed by migration background. The gap between primary and disposable income widens when the decline in primary income is greater, although some subgroups experience a significant drop in disposable income (older workers in the case of job loss, women in the case of divorce).

Figure 2: The effect of life events by subgroups



NOTE: This Figure presents the effect of life events on primary household income (round shape), disposable household income (triangle shape). The effect is measure from the estimated coefficient of equation 3 in t+5, for those different outcomes, rescaled by the baseline pre-event household disposable income.

C The relation between event severity and public insurance

From the estimated coefficients on primary and disposable income, we can construct our measure of insurance as presented in Section I. Appendix Tables A.2 and A.3 present the estimated insurance for different subgroups and different event-time. We plot this measure of insurance in the Figure 3, as a function of the effect of the event on primary income. Several patterns emerge from this analysis.

First, we observe heterogeneity in insurance rates across different types of shocks. On average, the tax and transfer system replaces approximately 75% of the initial loss in primary income. However, widowhood receives the highest level of insurance coverage, while divorce receives the lowest. Individual-level shocks such as job loss and health shocks receive intermediate levels of insurance that are similar to each other.

Notably, the degree of insurance provided does not decrease with shock severity: the relationship is flat or even mildly positive. Events that cause larger drops in primary income tend to receive proportionally more insurance from the tax and transfer system. The relationship suggests that the tax and transfer system provides progressive insurance, offering relatively more support to those facing more severe income losses.

However, this relationship does not fully explain differences in coverage by type of shock. While severity is an important determinant of insurance coverage, the specific nature of the shock matters more. The differences likely reflect both the design of targeted insurance programs—such as survivor benefits for widows and widowers—and broader features of the tax and benefit system that provide differential support depending on household composition and income sources.

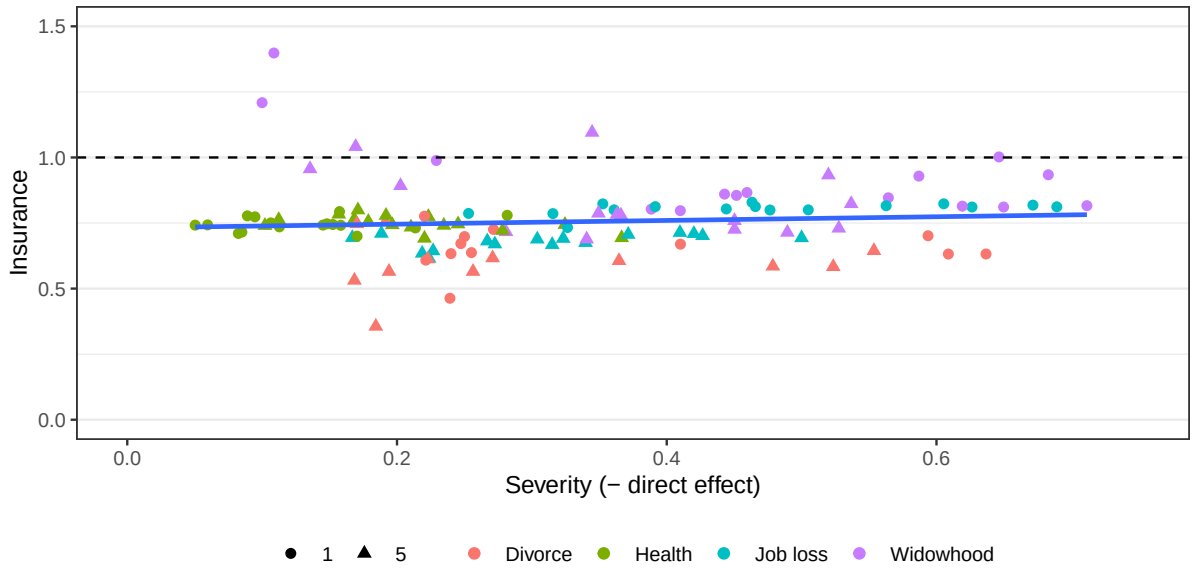
Note that the positive relationship we observe between the direct and insurance effects of an adverse event can be interpreted in two ways. First, it can illustrate the consumption smoothing objective of public insurance, which implies a positive relationship between the initial drop in income and the transfers received. Second, it can also be driven by the negative effect of the insurance itself on labour supply through income or substitution effects: the higher the insurance against a shock, the higher the moral hazard and the higher the associated drop in earnings.

D Decomposition of public insurance

Public insurance to adverse life events comes from two main sources: the decrease in taxes paid as primary income decreases and the increase in benefits received. Taxes can be further decompose between income and wealth taxes and social security contribution. Benefits can come from social insurance such as survivor or unemployment benefits, but also from any scheme individuals can become eligible to after a life event, such as welfare benefits. Using all the information included in the tax register, we can decompose the estimates public insurance, as presented in Figure 4.

We first observe that the insurance is provided by a relatively balanced combination of decreasing taxes and increasing benefits. The often overlooked insurance role of the tax system has been documented before by Stepner (2019). We show that is it particularly important for

Figure 3: Public insurance by primary effect in t+1 and t+5, by life event



NOTE: This figure presents the insurance rate provided by the tax and transfer system as a function of the primary income loss caused by each life event. Each point represents a specific subgroup (defined in Figure 2) at either t+1 (one year post-event) or t+5 (five years post-event). The insurance rate is calculated as the share of the primary income loss that is offset by taxes and transfers (see equation 2).

job loss and divorce, for which there is limited benefits available on the long run.

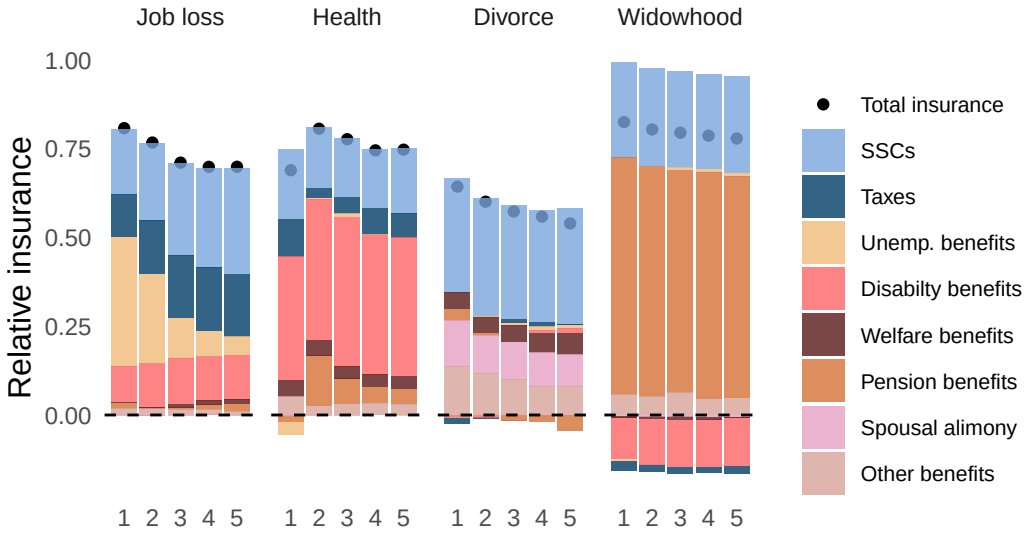
The second important take-away from this decomposition is the benefits side of insurance is also provided by multiple sources. Except for widowhood that is mostly covered by survival benefits, most events are covered by a mix of different benefits. Job loss is covered by both unemployment and disability benefits, the importance of the latter increasing progressively over time as eligibility to unemployment benefits fades out. Divorce, for which there is no formal dedicated insurance, is covered by a mix of spousal alimony, welfare and other benefits that include for example childcare or housing allowance targeted to low-income individuals.

IV Conclusion

This paper studies and compares the effect of different adverse life events – job loss, health shocks, divorce and spousal death – on individuals' income trajectories. For all events, public insurance plays a crucial role in reducing their impact on individuals' income trajectories, through both a decrease in taxes paid and the increase in benefits received. We also find that the importance of government insurance increases with the initial severity of the event, both across events, and within events over time and between subcategories of the population.

Our results have important implications for the design of public insurance against adverse life events. First, we show that the whole tax and transfer system - rather than event-specific schemes such as disability, unemployment, or survivors' insurance - needs to be accounted for when studying insurance to income shocks. Second, our analyses show a clear positive and

Figure 4: Decomposition of public insurance



NOTE: This Figure presents the public insurance rate as defined in section I as a function of the severity of the shock. Severity of the shock is measured from the direct effect of the shock on primary income. Each point is obtained for different life events, sub-population (gender, age, family composition, income level before the shock, migration origin) and period after the shock. The black line represents the linear fit of the points.

even linear relationship between the initial severity of the event and the insurance provided by the tax and transfer system. This linear relationship is not an explicit objective of the Dutch tax and transfer system, but rather a surprising consistency in the insurance provided to different populations for different shocks. It is the result of the complex interaction between the direct negative effect of adverse event on individuals' labour supply, the insurance they receive against this shock from different entities – household, family and government – and the effect of insurance itself on labour supply. More research is required to assess the relative importance of each channel, and the extent to which it varies across individuals and types of events.

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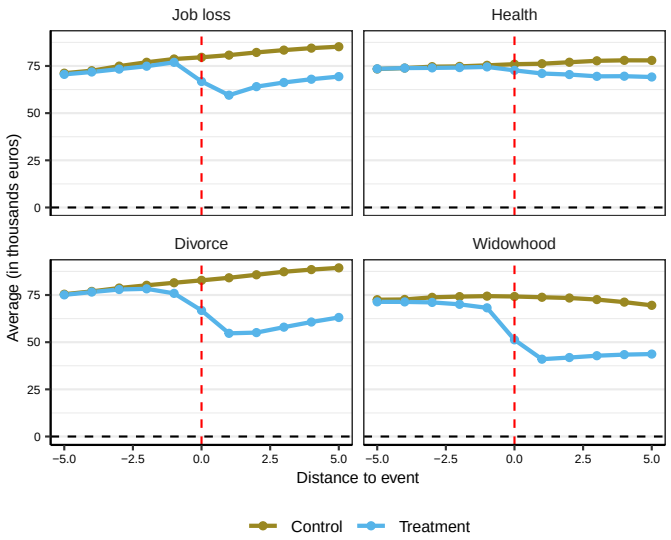
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Online appendix for Public Insurance to Adverse Life-Events

A Additional Figures and Tables

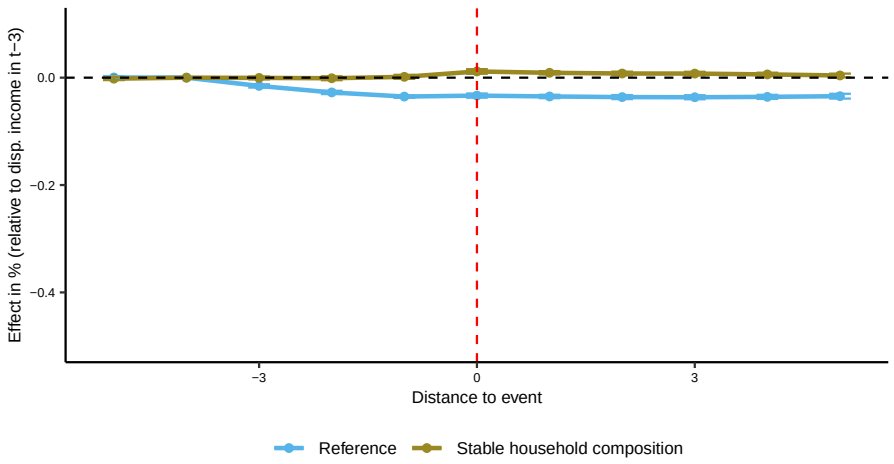
A.1 Additional Figures

Figure A.1: Average household primary income by event time, for control and treatment groups



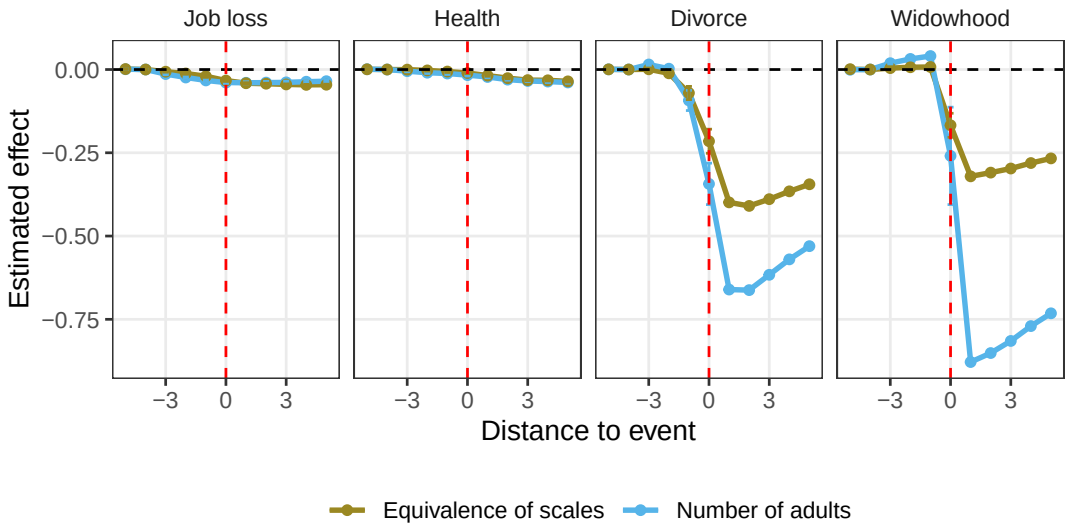
NOTE: This Figure presents the raw average for household primary income, before and after the event, separately for the control and treatment groups constructed for each life-events. For the treatment groups, the distance to event is equal to zero at the year of the event. The event dates of individuals of the control groups are based on their matched individuals from the treated groups.

Figure A.2: Added worker effect with stable household composition



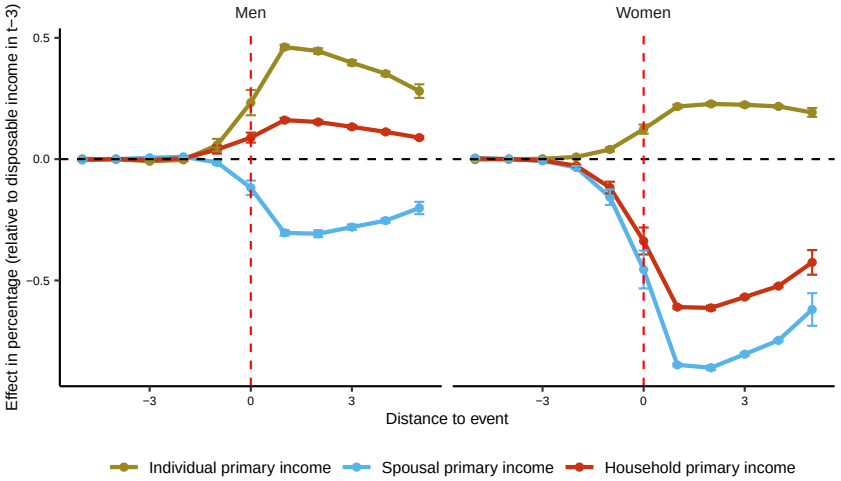
NOTE: This Figure presents the effect of individual life events on spousal labour supply, for two different types of estimation sample. The reference one corresponds to the main estimation sample used in Figure C.1a. In the stable one we remove all individuals who also faced a divorce in the observation window.

Figure A.3: Effect of life-event on household composition



NOTE: This Figure presents the effect of different life events on the household composition of impacted individuals, measured through three different indicators: the CBS equivalence of scale (yellow line), the total number of adults (blue line) and individuals (red line) in the household.

Figure A.4: The effect of divorce on income trajectories, by gender



NOTE: This Figure shows the estimated impact of separation on different components of individual and household primary income, separately for men and women. event. See Figure C.3 for details.

A.2 Additional Tables

Table A.1: Sample selection and sample size

		Job loss	Disability	Health	Divorce	Widowhood	Total
Inital sample	Number of id	1571785	755780	790688	553101	83823	3755177
	% removed						
Removing joint events	Number of id	1425267	598970	739099	533430	82791	3379557
	% removed	9	21	7	4	1	10
Matching with control ids	Number of id	1163824	487908	670986	452413	74456	2849587
	% removed	17	15	9	15	10	14
Balancing sample	Number of id	1138459	463226	597124	441898	72044	2712751
	% removed	2	3	9	2	3	4

NOTE: This Table presents the number of individuals in our sample, for different steps of the sample selection. Initial sample includes all individuals with facing an events, who are born between 1950 and 1989, and aged between 25 and 55 at the time of the event and with an event occurring in years 2008-2016. We then remove individuals with a joint birth event, individuals we cannot match to a control individual and individuals we continuously observe in the data five years before and after the event. For each step, we present the number of remaining observations and the share of individuals from the initial population that is removed.

Table A.2: Summary Table for direct and insurance effect of events

Life event	Job loss		Health		Separation		Widowhood	
Time horizon	t+1	t+5	t+1	t+5	t+1	t+5	t+1	t+5
Estimated effect								
Primary income	-12454.00	-8082.00	-3219.00	-5372.00	-6486.00	-5469.00	-12866.00	-10229.00
Household income	-2363.00	-2555.00	-824.00	-1343.00	-2316.00	-2320.00	-1808.00	-2315.00
Relative effect								
Primary income	-0.46	-0.30	-0.11	-0.19	-0.24	-0.20	-0.45	-0.36
Household income	-0.09	-0.10	-0.03	-0.05	-0.09	-0.09	-0.06	-0.08
Implied insurance								
Absolute insurance	0.81	0.68	0.74	0.75	0.64	0.58	0.86	0.77
Relative insurance	0.38	0.21	0.08	0.14	0.16	0.12	0.39	0.28

NOTE:

Table A.3: Summary Table by subgroups

	Life event	Job loss		Health		Separation		Widowhood	
	Time horizon	t+1	t+5	t+1	t+5	t+1	t+5	t+1	t+5
Age									
20-30	Pre-tax	-0.28	-0.37	-0.25	-0.17	-0.27	-0.19	-0.68	-0.34
	Post-tax	-0.06	-0.11	-0.05	-0.05	-0.07	-0.05	-0.05	0.03
	Insurance	0.78	0.69	0.79	0.69	0.73	0.75	0.93	1.1
30-40	Pre-tax	-0.16	-0.22	-0.35	-0.19	-0.22	-0.17	-0.65	-0.52
	Post-tax	-0.03	-0.05	-0.06	-0.05	-0.05	-0.04	0	-0.03
	Insurance	0.79	0.77	0.82	0.71	0.78	0.75	1	0.93
40-50	Pre-tax	-0.11	-0.2	-0.5	-0.34	-0.26	-0.26	-0.59	-0.54
	Post-tax	-0.03	-0.05	-0.1	-0.11	-0.09	-0.11	-0.04	-0.09
	Insurance	0.74	0.74	0.8	0.68	0.64	0.57	0.93	0.82
50-60	Pre-tax	-0.08	-0.17	-0.67	-0.5	-0.24	-0.18	-0.39	-0.28
	Post-tax	-0.02	-0.04	-0.12	-0.15	-0.13	-0.12	-0.08	-0.08
	Insurance	0.72	0.76	0.82	0.69	0.46	0.36	0.8	0.72
Position in HH									
Couple 1st earner	Pre-tax	-0.09	-0.17	-0.61	-0.41	0.15	0.11	-0.1	-0.14
	Post-tax	-0.02	-0.03	-0.11	-0.12	0.06	0.04	0.02	-0.01
	Insurance	0.77	0.8	0.82	0.71	0.61	0.64	1.21	0.96
Couple 2nd earner	Pre-tax	-0.05	-0.1	-0.32	-0.22	-0.64	-0.52	-0.71	-0.53
	Post-tax	-0.01	-0.03	-0.07	-0.08	-0.23	-0.22	-0.13	-0.14
	Insurance	0.74	0.74	0.79	0.63	0.63	0.58	0.82	0.73
Single	Pre-tax	-0.21	-0.32	-0.69	-0.43				
	Post-tax	-0.06	-0.08	-0.13	-0.13				
	Insurance	0.73	0.74	0.81	0.7				
Income									
Q1	Pre-tax	-0.16	-0.22	-0.33	-0.22	-0.59	-0.55	-0.65	-0.49
	Post-tax	-0.04	-0.07	-0.09	-0.09	-0.18	-0.2	-0.12	-0.14
	Insurance	0.74	0.69	0.73	0.62	0.7	0.64	0.81	0.71
Q2	Pre-tax	-0.15	-0.21	-0.39	-0.27	-0.41	-0.36	-0.56	-0.45
	Post-tax	-0.04	-0.06	-0.07	-0.09	-0.14	-0.14	-0.09	-0.11
	Insurance	0.75	0.73	0.81	0.68	0.67	0.61	0.85	0.76
Q3	Pre-tax	-0.09	-0.19	-0.46	-0.32	-0.22	-0.17	-0.44	-0.35
	Post-tax	-0.02	-0.04	-0.08	-0.1	-0.09	-0.08	-0.06	-0.07
	Insurance	0.78	0.78	0.83	0.69	0.61	0.53	0.86	0.79
Q4	Pre-tax	-0.08	-0.16	-0.63	-0.42	0.06	0.07	-0.23	-0.2
	Post-tax	-0.02	-0.03	-0.12	-0.12	0	0.01	0	-0.02
	Insurance	0.71	0.78	0.81	0.71	1.02	0.91	0.99	0.89
Migration									
1st gen. migrant	Pre-tax	-0.17	-0.28	-0.48	-0.32	-0.25	-0.27	-0.41	-0.34
	Post-tax	-0.05	-0.08	-0.1	-0.1	-0.08	-0.1	-0.08	-0.11
	Insurance	0.7	0.72	0.8	0.67	0.7	0.62	0.8	0.69
2nd gen. migrant	Pre-tax	-0.15	-0.23	-0.44	-0.27	-0.25	-0.22	-0.45	-0.37
	Post-tax	-0.04	-0.06	-0.09	-0.09	-0.08	-0.09	-0.07	-0.08
	Insurance	0.74	0.74	0.8	0.67	0.67	0.61	0.86	0.78
Native	Pre-tax	-0.11	-0.18	-0.47	-0.3	-0.24	-0.19	-0.46	-0.36
	Post-tax	-0.03	-0.04	-0.09	-0.09	-0.09	-0.08	-0.06	-0.08
	Insurance	0.75	0.76	0.81	0.69	0.63	0.57	0.87	0.78
Gender									
Men	Pre-tax	-0.15	-0.25	-0.56	-0.37	0.16	0.1	-0.11	-0.17
	Post-tax	-0.04	-0.06	-0.1	-0.11	0.06	0.04	0.04	0.01
	Insurance	0.74	0.75	0.82	0.71	0.6	0.63	1.4	1.04
Women	Pre-tax	-0.06	-0.11	-0.36	-0.23	-0.61	-0.48	-0.62	-0.45
	Post-tax	-0.02	-0.03	-0.07	-0.08	-0.22	-0.2	-0.11	-0.12
	Insurance	0.74	0.76	0.8	0.64	0.63	0.59	0.81	0.73

Note:

B Detailed institutional setting

In this Appendix, we provide a brief presentation of the Dutch tax and transfer system, focusing on the elements that are directly under the scope of our analyses, namely taxes and contributions on labour income and in-cash benefits. We then provide specific additional institutional context that are relevant for the different life-events we study.

General presentation of the Dutch tax and transfer system The Netherlands is a high income, high tax country with an extensive welfare state. In 2016,[3] national income was equal to €592 billion, around €44,000 per adult on average. Tax revenue amounted to 45% of national income, mainly composed of income taxes (15%), payroll taxes and mandatory health insurance premiums (12% of national income), and indirect taxes (12%). The Dutch income tax treats labour and capital income differently. Labour income is taxed according to a progressive schedule with a 52% top rate. The taxation of (income from) capital differs for large shareholdings (at least 5% of a company) and all other forms of wealth (excluding owner-occupied housing and pension wealth). In the former case, capital income (dividends and realised capital gains) is taxed at a 25% rate. In the latter case, a 1.2% tax is levied on the stock of net wealth with no further taxation of the income derived from this wealth. Payroll taxes consist of contributions related to health care and long-term care, contributions for unemployment and disability insurance, as well as contributions for sickness benefits. In addition, basic health insurance is mandatory and paid for through premiums and social security contributions. Government spending reached 43% of national income in 2016 and can be decomposed into in-kind benefits (20%), in-cash benefits (13%) and collective expenditure (10%). Cash benefits are mostly made up of benefits paid by social security insurance (9%) or social assistance (4%).

Taxation of families. A number of rules in the tax and benefit system take account of household characteristics. This means that in some cases the separation of couples can lead to important changes in the taxes paid or benefits received by individuals. Income taxes on labour income are calculated at the individual level and are therefore not directly affected by household composition. On the other hand, the eligibility and amount of some specific tax credits depend on the income level and structure of the household (single vs. couple, main vs. secondary earner, with or without children).[4] Eligibility for social assistance is also based on household resources, which may mean that some people become eligible after separation. As a result, low-income individuals will receive more benefits or tax credits after a divorce or a spousal death, while the opposite may be true for high-income individuals.

Couple separation Legal procedures regarding couple separation are similar for married couples and registered partnerships. We refer to Kabátek (2018) for a description of general rules and their evolution in recent years, and hereby focus on elements directly impacting ex

[3] This is the year covered by Bruil et al. (2022), from which the numbers presented here are taken.

[4] See de Boer & Jongen (2023) and de Boer et al. (2023) for a detailed presentation of these schemes.

spouses' standard of living, namely child and partner alimonies. In some cases, one of the spouses may have to pay child alimony, to compensate for the costs associated with raising children, and/or spousal alimony to maintain the standard of living after the divorce.

Unemployment insurance. The Netherlands has mandatory public unemployment insurance for all employees.[5] Both employers and employees contribute to the system. Unemployment benefits last up to two years, depending on employment history. For the full two years of eligibility, an individual has to have worked for at least 38 years. Benefits are 75% of the last earned wage in the first two months, and 70% thereafter, subject to a cap. The amount of benefits does not depend on a partner's income, or an individual's wealth. Like in most countries, eligibility to unemployment benefits in the Netherlands requires that individuals lost their job beyond their own fault (this includes cases where the employer initiates the layoff and the employee agrees on receipt of a severance payment). Individuals also need to be available for work immediately and need to search actively.

Disability and sickness insurance. The Netherlands has mandatory public disability insurance (DI), supplemented by privately funded, mandatory sick pay.[6] When an employee gets sick, the employer is responsible for paying sick pay for two years and for reintegrating the individual into their own job or another job more suited to their current health. If the employment contract is shorter than two years, the remaining period is taken over by a public short-term DI scheme. Individuals who recently lost their job and receive unemployment benefits, have a mandatory waiting period of one year. Sick leave is then paid by the Public Employment Service (PES). Benefits for sick leave are at least 70 percent of the last earned wage. In many collective bargaining agreements, sick pay is increased to 100 percent in the first year of sickness and kept at 70 percent in the second year. After this two years period, individuals enter an independent assessment procedure by the PES to determine DI eligibility.

Eligibility and the amount of benefits for DI is based on two components: the previous wage and hours and the remaining earnings capacity (i.e. the wage an individual can still earn and the hours they can still work). The larger the gap between these two, the higher the degree of disability and hence the higher the benefit level.The remaining earnings capacity is determined through a medical examination by a physician appointed by the PES and an interview with an occupational assessor. Full DI is granted if the physician determines that the applicant has no durable capabilities for work. If the applicant is still deemed able to work, their level of functional capabilities is determined using a standardized instrument (Garcia-Gomez et al. 2023). The occupational assessor then uses this information and a database of jobs to determine which jobs the applicant is still able to do, and for how many hours a week. This determines the remaining earnings capacity. Final benefit levels depend on the degree of disability. If it is

[5]Here we present the current policy state. There have been substantial reforms, most notably in the maximum duration from five years in 2003 to two years (see de Groot & van der Klaauw (2019) for an evaluation).

[6]We present the current policy state. There have been several reforms over the past twenty years, most notably in 2006 when much of the current system was implemented. Koning & Lindeboom (2015) provide an overview of the history of the Dutch DI system and discuss the reforms.

80% or higher, then benefits are set at 75% of the last earned wage. If the degree of disability is less than 35%, no DI is granted. If the degree of disability is between 35 and 80%, then partial DI is granted. Partial DI entitles applicants to up to two years of benefits equal to 75 to 70% of their last earned wage. During this period, labor income can supplement benefits, creating an incentive to return to work. After this period, a strong work incentive is introduced. If applicants earn at least 50% of their remaining earnings capacity, they keep the same benefit level as in the previous period (i.e. 70% of their last earned wage). If they earn less than this, their benefit level drops to 70% of the minimum wage multiplied with their degree of disability (25 - 55% of the minimum wage).

Social assistance. Social assistance is a last resort benefit for people who are not eligible for any other benefits. It is administered by the municipality and has strict eligibility and work requirements. The benefit amounts are 1,900 euros per month for multiple person households and 1,300 euros per month for 1-person households. Any other income is fully subtracted from the benefit amounts (including e.g. a gift, financial or otherwise, from a family member). Benefit amounts are scaled down the more adult people there are in the household to account for economies of scale. People who have household wealth of more than 15,000 euros in the case of a multiple person household or 7,500 euros in the case of a single household, are not eligible. Also, people who own a home are not eligible if the value of the house exceeds the mortgage by more than 63,000 euros.[7] Social assistance has strict work requirements. Individuals are required to accept any job within a three hour daily commute, and are required to be willing to move if they are not able to find a job in their area. Municipalities sometimes employ instruments to activate people, including sanctions, job search assistance or wage cost subsidies. Only single parents with kids younger than five years old or disabled people are exempt from search requirements.

Survivor insurance. Public insurance against the death of a spouse is provided by both the first (state) and second (occupational) pillars. The state insurance (*Algemene nabestaandenwet*, ANW) provides survival benefits, the eligibility and amount of which depend on the widow(er)'s income and characteristics (age, presence of children). The survivor receives a flat-rate benefit of 70% of the gross minimum wage, plus an additional 20% of the gross minimum wage if she or he is caring for a minor child (half-orphan benefit). Any income received by the survivor is partially or fully deducted from the survivor insurance, depending on the nature of the income and the type of benefit. There is no means test for the half-orphan's benefit, only for the flat-rate benefit of 70% of the minimum wage. Unemployment, sickness and disability benefits are fully deducted from public survivor insurance. Survivor benefits from other schemes (second and third pillar) are not deducted. Importantly, labour income is also partially deducted from public survivor benefits. For any labour income above 50% of full-time work at the minimum wage, benefits are deducted at a rate of 66%. As a result, individuals with incomes above 155%

[7] All amounts presented are nominal 2024 amounts. They are indexed twice a year.

of the gross minimum wage do not receive any survivor benefits.[8] Second pillar pension benefits vary between pension funds and depend on the pension rights accumulated by the deceased spouse.

Non-take up. Recent research shows that the non-take-up of social insurance is substantial (Dubois & Ludwinek 2015). In the Netherlands, non-take-up rates range from around 10-15% for rent benefits and child support to around 30-40% for income top-ups for people on social insurance such as welfare or unemployment benefits (Berkhout et al. 2018, Arbeidsinspectie 2023). Evidence also shows that primarily individuals with lower human capital find it more difficult to access social insurance. We do not measure non-take-up in our data, since we do not know who is eligible for benefits, but does not use them.

Non-take-up can affect our results in two directions. On the one hand, since some individuals eligible for insurance are not using it, the insurance we measure is lower than the potential insurance following an adverse life event. It only affects the social insurance part, however, since tax rates are automatically adjusted to lower primary incomes. While there is currently no evidence of non-take-up of large benefits like DI and UB, non-take-up of these benefits could affect our results because we define some events (disability, job loss) by take-up. In this case, we may underestimate the incidence of events. Since this is more likely to be the case for people who are i) more disadvantaged and ii) less compensated (because they underuse insurance), we could overestimate the insurance provided – our average would be above the population average that would include events with non-take-up.

[8] See Rabaté & Tréguier (2024) for a more detailed description of the scheme and its recent reforms, as well as an assessment of its effects on the labour supply of surviving spouses.

C Results by event

In this Appendix, we describe the estimates we obtain for each type of event separately. For each event, we present three sets of results. We first show the effect on primary household income and its three components, namely individual and spousal primary income and household capital income. Second, we present the insurance effect provided by benefits (gross income) and taxes (disposable income). Third, we present the estimated effect for different subgroups of the population. We also compare those results to what has been previously found in the literature.

C.1 Job loss

Effect on primary income Figure C.1a present the direct effect of the job loss. We observe a large initial drop in the household primary income (-40% compared to pre-event disposable income in t+1) with a slow recovery over time, while remaining large at the end of the observation period (-30% after five years). When decomposing the overall effect on household income between the individual and spousal primary income, we observe that the negative effect on individual income is reinforced by spousal income, which also decreases with the event. This suggests that negative correlated effects dominate potential added-worker effects. As mentioned above, negative correlated effect can stem from different channels: a direct negative effect on spousal labour supply or a correlated effect of the event on the household composition (e.g divorce). Appendix Figure A.3 presents the estimated effect of life events on household composition. We indeed observe a negative effect of job loss on household size, showing that this event is correlated with couple separation, as it as been shown in the literature. When we neutralize this household composition effect by estimating the effect of job loss on a sub-sample of individuals with stable household composition around the event, we find a positive added-worker effect (see appendix Figure A.2). This suggests that the negative effect we find combines a negative composition effect and a positive labour supply effect, with the former dominating the later.

Insurance effect When comparing the effect on primary income to the final effect on disposable income (Figure C.1b), we observe that the effect of job loss is significantly reduced by the tax and benefit system. On the short run, the effect on gross income is half as big as the effect on primary income. This illustrates the effect of social insurance, in particular unemployment insurance. As we move further from the event time, the gap between the estimated coefficient for primary and gross income decreases, as unemployment benefit rights exhaust and individual primary income increases. At the end of the period (t+5), there is still a significant effect of benefits, which is likely to be driven by residual unemployment benefits (from newly accumulated right because maximum duration is always below five years) or the use of alternative pathways such as disability benefits or welfare. The effect of the event on disposable income income is further reduced by the decrease in taxes, and is roughly stable over time, as is the effect on gross income, around -10% of the pre-event disposable income. Using those estimates,

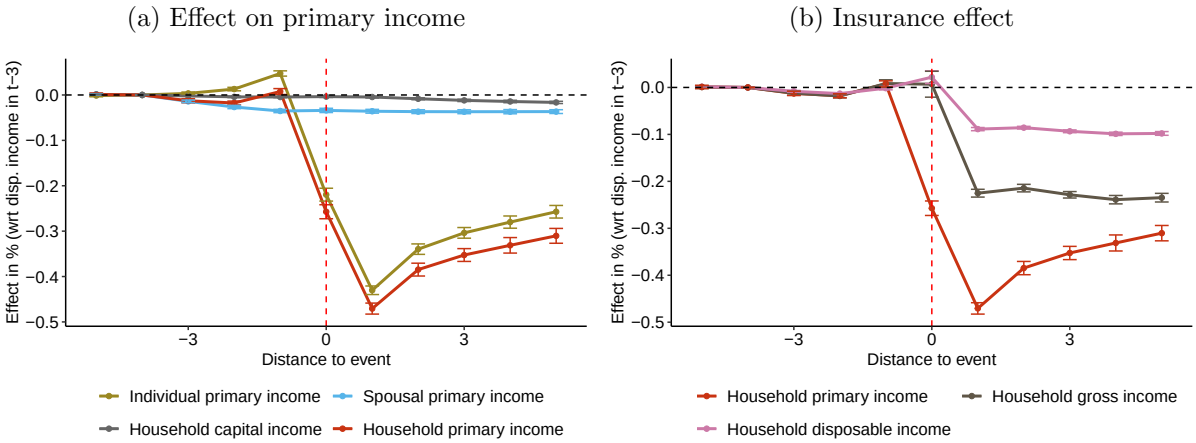
we compute the government insurance to job loss as defined in section **??**, and find a relative (resp. absolute) insurance I^{rel} (resp I^{abs}) of 69% (resp. 21pp) in the long run (see Appendix Table A.2)

Heterogeneous effects The effect of job loss on primary income is relatively larger for richer individuals (Figure 2). This can be explained by the fact that they have more stable jobs and lose relatively more when adverse events occur. Richer individuals may also earn a larger share of household income, implying a larger impact of the individual event on household primary income. This mechanism also explains why the effect is much smaller for the secondary earner in a couple (and for women): they are insured against the loss of their own income by the other resources available in the household. We find that the effect of job loss on primary income increases with age. The gradient can be explained by the correlation between age and income.

Comparison with the literature We focus on the following subset of the extensive literature studying the effect of job loss: Bertheau et al. (2023) for an international comparison of the effect on earnings, Cammeraat et al. (2023) for the focus on household response and added-worker effects, Stepner (2019) for the insurance effect of the tax and transfer system, and Halla et al. (2020) and Andersen et al. (2023) for recent extensive analyses encompassing those dimensions. The estimated effect on earning trajectories exhibits the same pattern as documented in other countries, with a sharp drop at the event time that is followed by a recovery but with persistent and large long term drop in earnings. With a long run drop of 30% in individual earnings (cf. Figure **??**), the impact we measure seems to be relatively high compared to what is found in other countries (Bertheau et al. 2023).[9] Our results are also consistent with the literature with respect to the *added-worker* effect, or spousal labour supply response to job loss. We find a small negative effect on spousal income, when recent papers find a small positive or insignificant added-worker effect. However, when we restrict the estimation to individual with stable household structure, as done e.g in Cammeraat et al. (2023) and Andersen et al. (2023), we also find evidence of such added-worker effect. The estimated reduction in the spouse's labour supply effect we obtain is then driven by couples' separation at the same time as the job loss event. This is in line with Halla et al. (2020), who find a small increase (+0.5 percentage points) in the probability of divorce following a job displacement. Finally, in terms on insurance provided by the tax and transfer system, we find a large difference between the effect of job loss on primary and disposable income, that is comparable in magnitude to what is found by Andersen et al. (2023) in Denmark, and bigger than what Stepner (2019) and Halla et al. (2020) respectively find for the US and Austria. This is consistent with the relative generosity of social insurance in each country. The Dutch system, through both unemployment insurance and alternative public scheme such as welfare benefits, provides substantial insurance against employment risk.

[9]Note that (Bertheau et al. 2023) uses a different definition of job loss based on mass lay offs. This may primarily select individuals with significant labour market attachment, for which are can expect job loss to have milder effect on earnings trajectories.

Figure C.1: The effect of life events on income trajectories: job loss



NOTE: This Figure shows the estimated impact of the job loss on different components of individual and household income. Panel (a) decomposes the direct effect of the event on primary income into individual and spouse's primary income. Panel (b) presents the government insurance against job loss by comparing its effect on primary, gross and disposable income. All coefficients are calculated by rescaling the income-specific estimates (δ_τ in equation (3)) by the average disposable income in the years preceding the event.

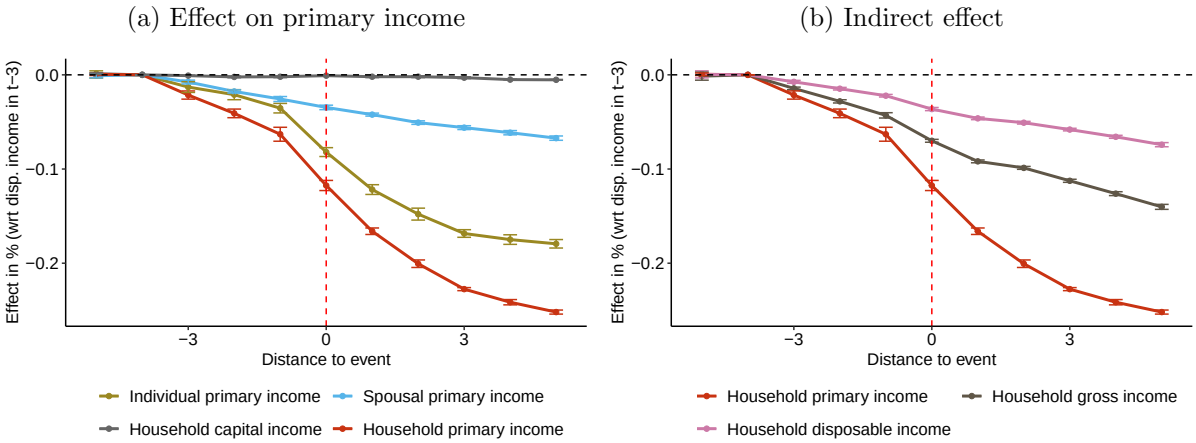
C.2 Health shocks

Effect on primary income The impact of the health shock on individual income trajectories is not as pronounced as for the other life events we consider. We observe a progressive decline in individual income, which is accentuated at the time of the event, but can also be observed before and after the event. The limited effect we observe may also be due to our definition of a health shock (see previous section), which may not capture disruptive events with a large and immediate impact on income trajectories. Another explanation lies in employer-provided health insurance: for workers, the reduction in hours and hence income is fully compensated in the first year and 70% in the second year (see section **??**) of the illness. As a result, health shocks i) for employed individuals and ii) with relatively short-term effects are mostly covered by employer insurance. As this insurance is recorded in the data as wage continuation, it does not lead to a reduction in primary income.

In addition to the drop in individual income, we also observe a significant drop in the labor supply of the spouse. This could be partly explained by contemporaneous changes in household structure, as suggested by the slight decrease in the number of individuals in the household around the event (Figure A.3). However, we still find a negative effect when focusing on a population with a stable household composition (Figure A.2). This could be explained either by correlated events between spouses (both spouses are affected by a health shock) or by a negative effect of the shock on the spouse's labour supply, e.g. due to additional care needs for family members.

Heterogeneous effects We find that the effect of a health shock on primary income declines with age (a 40% decrease for individuals aged 20–30 compared to 20% for those aged 50–60; see Figure 2). This pattern may reflect the fact that health shocks, as we measure them (large

Figure C.2: The effect of life events on income trajectories: health



NOTE: This Figure shows the estimated impact of health shock on different components of individual and household income. Panel (a) decomposes the direct effect of the event on primary income into individual and spouse's primary income. Panel (b) presents the government insurance against health shock by comparing its effect on primary, gross and disposable income. All coefficients are calculated by rescaling the income-specific estimates (δ_τ in equation (3)) by the average disposable income in the years preceding the event.

increases in health expenditures), tend to be more severe and consequential at younger ages. Since age is correlated with income, this could also explain why the effect of a health shock on primary income decreases across income quartiles. Individuals contributing a smaller share of household income (and women, on average) experience a smaller reduction in household primary income following a health shock, as they are partially insured against the loss of their own income through other household resources.

Insurance effect Public benefits and taxes largely reduce the direct impact of the health shock on household income, with the reduction from around 35% to around 5% of pre-event disposable income when going from primary income to disposable income. The insurance comes mainly from the transfer side and is likely to be driven by a significant proportion of individuals being eligible for disability benefits following a major health shock. In terms of the insurance measure, we find a relative insurance I^{rel} of 71% and an absolute insurance I^{abs} of 17pp five years after the event.

Comparison with the literature There is a large literature that studies the impact of health shocks on income trajectories. We focus on the following limited but illustrative sample of this literature: García-Gómez et al. (2013) for the Netherlands, Dobkin et al. (2018) for the US and Fadlon & Nielsen (2021) for Denmark. These papers all use different definitions of health shocks, which are arguably less predictable and more exogenous, such as hospitalisation for acute health events. They all observe a sharp, substantial and permanent drop in individual earnings, which is more pronounced in the US and Denmark. In both the Netherlands and Denmark, however, the decline in total household income is very limited, due to the wide access to public insurance against health shocks (universal health insurance and generous disability insurance for long-term health impairments). In line with this extensive public insurance, household insurance

through spousal labour supply is not observed in either case. As we do, García-Gómez et al. (2013) even find a negative effect, which they attribute to the additional care and household responsibilities of the healthy spouse. Conversely and consistently, Dobkin et al. (2018) find limited income insurance against health shocks and some evidence of an additional worker effect in the US context.

C.3 Couple separation

Effect on primary income The effect of couple dissolution on individuals' primary income trajectories is primarily determined by the income pooling hypothesis underlying our analysis. When household composition changes, the mechanical effect on household primary income can be attributed to two main components. The first is the loss of previously shared spousal income. When the spouse leaves, the household no longer benefits from his or her income, which had previously contributed to the household's collective resources. The second component is the gain of previously shared individual income, for symmetrical reasons. The individual no longer needs to share his or her income.In addition to these two components, households may have children. Income is shared between all members of the household and, after couple separation, the number of members depends on child custody arrangements. Overall, the change in household income after separation reflects the extent of an individual's contribution to the household's total income before separation. Specifically, there is no change in normalised household income if the individual's contribution to total household income before separation is proportional to the ratio of consumption units in the household after separation compared to before. Beyond this mechanical effect, individual income may also be affected by behavioural responses, such as changes in labour supply following separation. In addition, individuals may decide to remarry and thus benefit from the income pooling of a new spouse.

Figure C.3a presents the estimated combined effect of the different margins. The large drop in spousal income is largely compensated by the increase in individual income, yet the overall effect remains sizable (-25% of pre-event disposable income) and stable over time. We provide additional insights regarding the underlying mechanism in appendix Figures A.3 and **??**. The first one presents the evolution of the household composition following the divorce and shows that a significant share of divorcees remains in a couple or find a new partner in the years following the divorce. The second one presents the equivalent of Figure C.3 without any normalisation in the income variables. We observe that, on average, there is no individual labour supply response after divorce. In section **??** we show that this lack of labour supply effect hides substantial asymmetric effects by gender. In terms of dynamics, we observe a slight decrease in the effect of the event over time, driven by the increase in spousal income, through repartnering.

Heterogeneous effects We observe that the direct effect of divorce on primary income is much larger for secondary earners, women and low income individuals (Figure 2). We even observe a positive direct effect for men. This is due to the fact that the main driver of the effect

of such events is the end of resource pooling within the household. Individuals with a higher (or lower) share of household income are net contributors (or beneficiaries) to resource pooling before the event and therefore lose relatively less (or more) when it ends.

Insurance effect The initial drop in primary income is significantly reduced by the tax and benefits system, from 22% to 10% in t+5 (Figure C.3b). Roughly 40% of the effect is driven by increased benefits, and the rest by a reduction in taxes following the drop in gross income. It corresponds to a total insurance of 57% in relative terms (I^{rel}) and 13pp in absolute terms (I^{abs}). Additional benefits are likely to come from spousal alimony and other transfers individuals may become eligible to as single (or single parents), such as welfare.

Comparison with the literature To the best of our knowledge, only two papers have examined the effect of couple separation on income using an approach similar to ours: Bonnet et al. (2021) and Hogendoorn (2022). Although they do not provide an estimate for the whole population, they highlight the fact that the main driver of variation in household income after divorce is the extent of the individual's contribution to the household's total income prior to separation. Women whose average contribution to household income is lower than that of their spouse experience a drop in primary household income, while for their male counterparts it's a jump. The tax and transfer system can either mitigate or amplify the impact of the shock, depending on the individual's initial contribution to total household income (e.g. receipt or payment of alimony, progressivity of the tax system). As shown in Appendix Figure A.4, which presents the same results as Figure C.3a distinguished by gender, our findings are consistent with the literature.

C.4 Widowhood

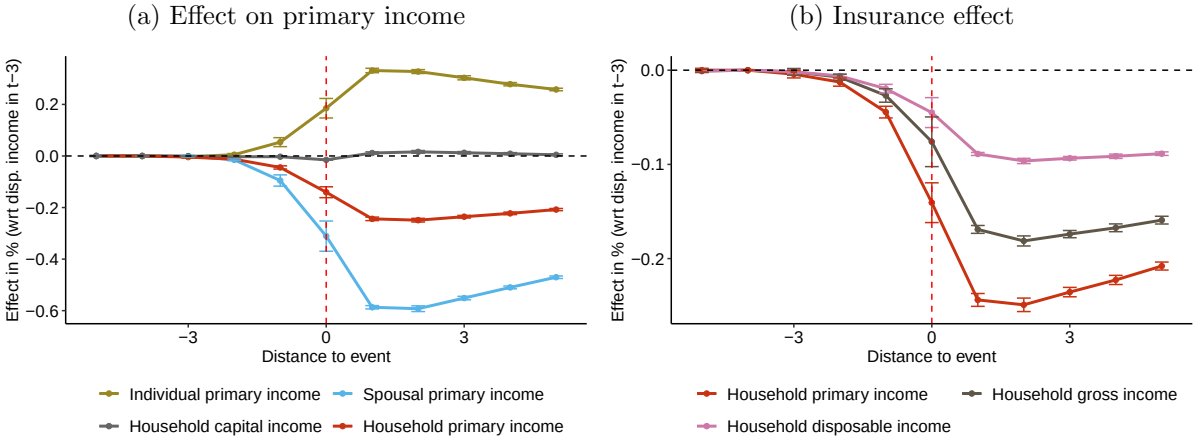
Effect on primary income The pattern observed for the direct effects of widowhood is qualitatively comparable to that obtained for couple separation, with the following three notable differences. First, the effects on individual and spouse's primary income are much less symmetric than in the case of divorce, with a much stronger effect of the loss of spouse's primary income leading to a large drop in household primary income (-40% in t+1). This is due to the fact that widowhood mainly affects women (in about 70% of cases, see Figure **??**), for whom the loss of spousal income is more significant. Second, individuals and especially women are less likely to remarry after widowhood than after divorce, as shown in Figure A.3. Third, in the case of widowhood, the increase in individual income generated by the reduction in household size is partly offset by a reduction in individual labour supply after the death of the spouse (see Figure **??**, which shows the effect without normalisation by household size). In terms of dynamics, we observe a slight decrease in the effect of the event over time, as the increase in spousal income (through repartnering) dominates the decrease in individual income (through reduced labour supply).

Heterogeneous effects Similarly to divorce, we find that the direct effect of widowhood on primary income is much larger for secondary earners, women, and low-income individuals (Figure 2). This reflects the fact that the main driver of these effects is the end of resource pooling within the household.

Insurance effect The large drop in primary income following widowhood is largely compensated by the tax and transfer system. In the long run, we observe a drop in disposable income of around 10% compared to an initial drop in primary income of 40%. This corresponds to a total insurance of 76% in relative terms (I^{rel}) and 28pp in absolute terms (I^{abs}). Most of the insurance is provided by benefits, which are likely to be driven by two main sources: the eligibility to social welfare and the access to survival benefits.

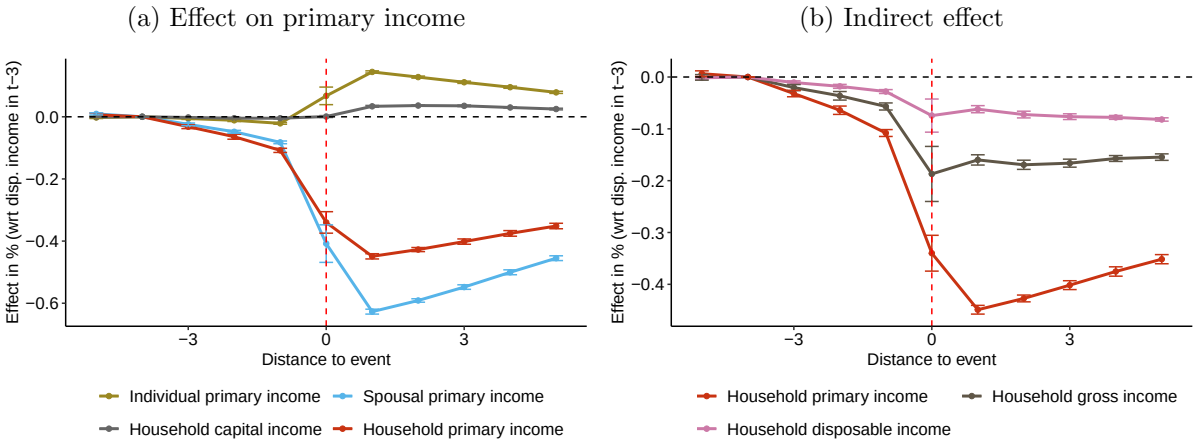
Comparison with the literature The only paper that examines the effect of the death of a spouse on income is Fadlon & Nielsen (2021). The authors focus on the labour supply response to a fatal health shock and, in contrast to us, find a positive effect. However, they suggest that the average increase in labour supply is driven by survivors who are less covered by social benefits. Combined with Rabaté & Tréguier (2024)'s finding that reducing access to survivor benefits increases female labour supply after the death of a spouse, and given that a significant share of our sample benefits from survivor insurance, our overall assessment of the effect of spousal death on earnings may be explained by the generosity of the welfare state, which is significantly higher in the Netherlands than in the United States.

Figure C.3: The effect of life events on income trajectories: couple separation



NOTE: This Figure shows the estimated impact of separation on different components of individual and household income. Panel (a) decomposes the direct effect of the event on primary income into individual and spouse's primary income. Panel (b) presents the government insurance against separation by comparing its effect on primary, gross and disposable income. All coefficients are calculated by rescaling the income-specific estimates (δ_τ in equation (3)) by the average disposable income in the years preceding the event.

Figure C.4: The effect of life events on income trajectories: widowhood



NOTE: This Figure shows the estimated impact of widowhood on different components of individual and household income. Panel (a) decomposes the direct effect of the event on primary income into individual and spouse's primary income. Panel (b) presents the government insurance against widowhood by comparing its effect on primary, gross and disposable income. All coefficients are calculated by rescaling the income-specific estimates (δ_τ in equation (3)) by the average disposable income in the years preceding the event.

D Sensitivity analyses

D.1 Sensitivity to event definition

In this appendix, we test the sensitivity our our results to alternative definitions of events. We focus on the events whose definition is less straightforward, namely divorce, job loss and health shocks

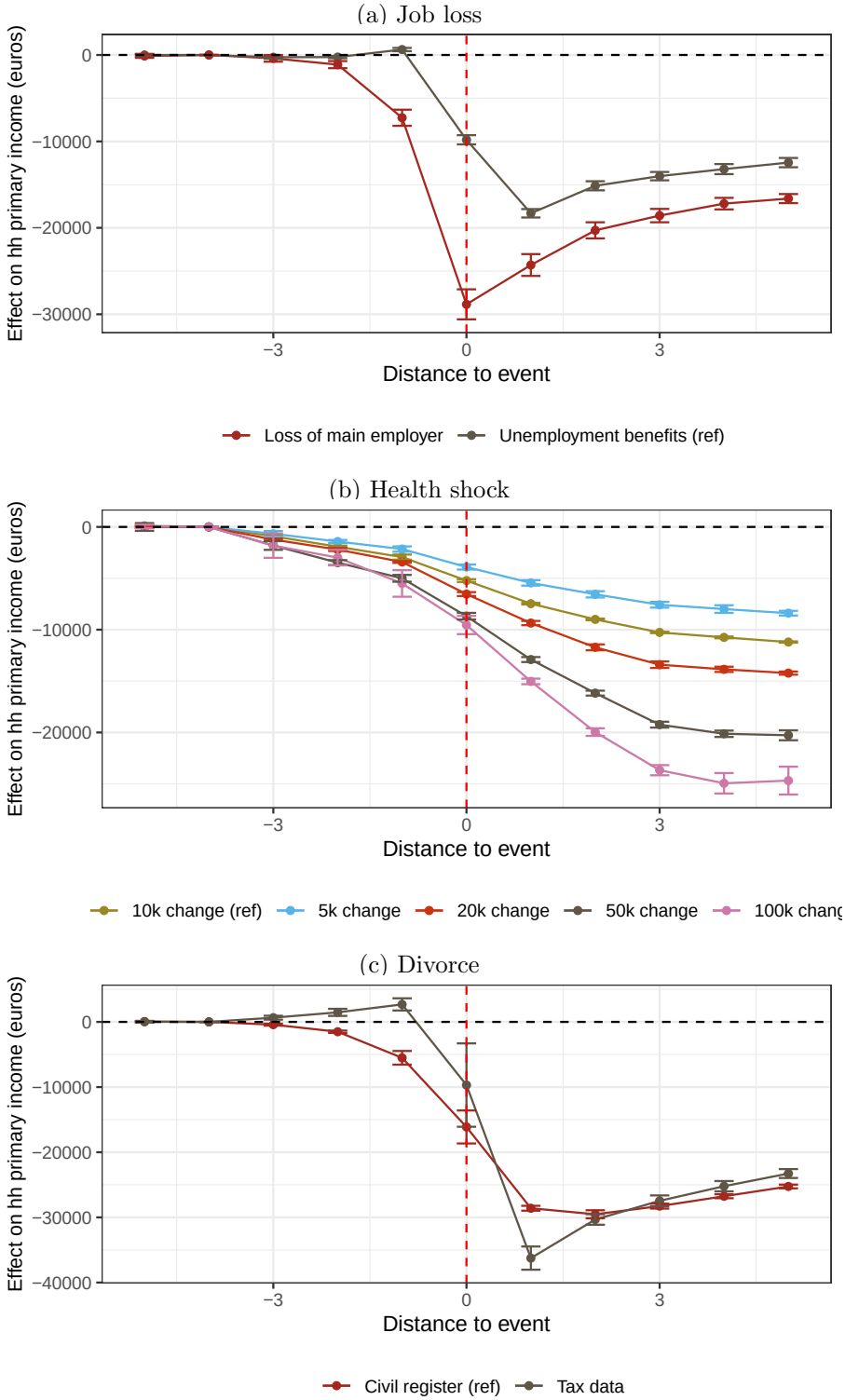
Alternative definition of job loss

As mentioned in Section II, we define job loss based on the take-up of unemployment benefits. This measure has two main limitations. First, we do not capture people who lose their jobs and do not receive unemployment benefits - because they find another job, are ineligible, or are eligible and do not claim. A second problem is that we may be capturing job losses in very unstable employment trajectories, which may not per se be the disruptive adverse life events we want to study. For this reason, we consider an alternative definition of job loss based on the one used in Andersen et al. (2023): the termination of a long-term employment relationship (two years) followed by a significant drop in labour earnings. Such a definition includes some individuals who do not pass through unemployment insurance and focuses on more disruptive events. A conceptual limitation of this alternative definition is that it is based directly on the outcome we want to study, namely the drop in individual earnings following the shock. For this reason, we do not use it in our main specification. Figure D.1a compares the estimated effect of job loss under these alternative definitions. They show the same pattern, namely a large drop in primary income at the time of the event, followed by a small recovery and a persistent negative effect in the long run. There are two main differences between the definitions. First, the estimated drop is slightly more pronounced with our alternative definition, reflecting the fact that it focuses on more consequential events. Second, the drop in income is sharper at t_0 with our alternative definition, which is directly related to our definition based on a drop in income at the time of the event.

Alternative definition of health shock

In the rest of the paper, we identify health shocks in the years for which we observe a €10,000 increase in health expenditure from one year to the next. Given the arbitrariness of such a definition, we test the sensitivity of our results to alternative thresholds for the increase in health expenditure, ranging from €5,000 to €100,000. We show in figure D.1b the estimated effect of the health shock under these different definitions. It appears that the effect of the health shock on income trajectories increases almost linearly with the increase in expenditure.

Figure D.1: Estimated effect of adverse life event: sensitivity to alternative events definitions



NOTE: This Figure shows the estimated impact of life events on primary income, for alternative definition of job loss (Panel (a)), health shocks (Panel (b)) and divorce (Panel (c)). See text for details on the definitions used.

Alternative definition of divorce

Our main definition of divorce is a legal one. However, as the timing of a legal divorce may differ from the actual separation and may overlook cohabitation arrangements, we also consider an alternative definition of couple separation derived from tax data. Specifically, we define a couple as separated if one partner changes their tax status from 'couple' to 'single' between two consecutive years. Figure D.1c suggests that couples often decide to separate several months before the legal process is finalised. The negative 'anticipation effect' observed when using the civil register definition is not present when using the tax data definition. Reassuringly, the long-term results remain similar regardless of the definition used to identify the separation shock.

D.2 Sensitivity to identification strategy

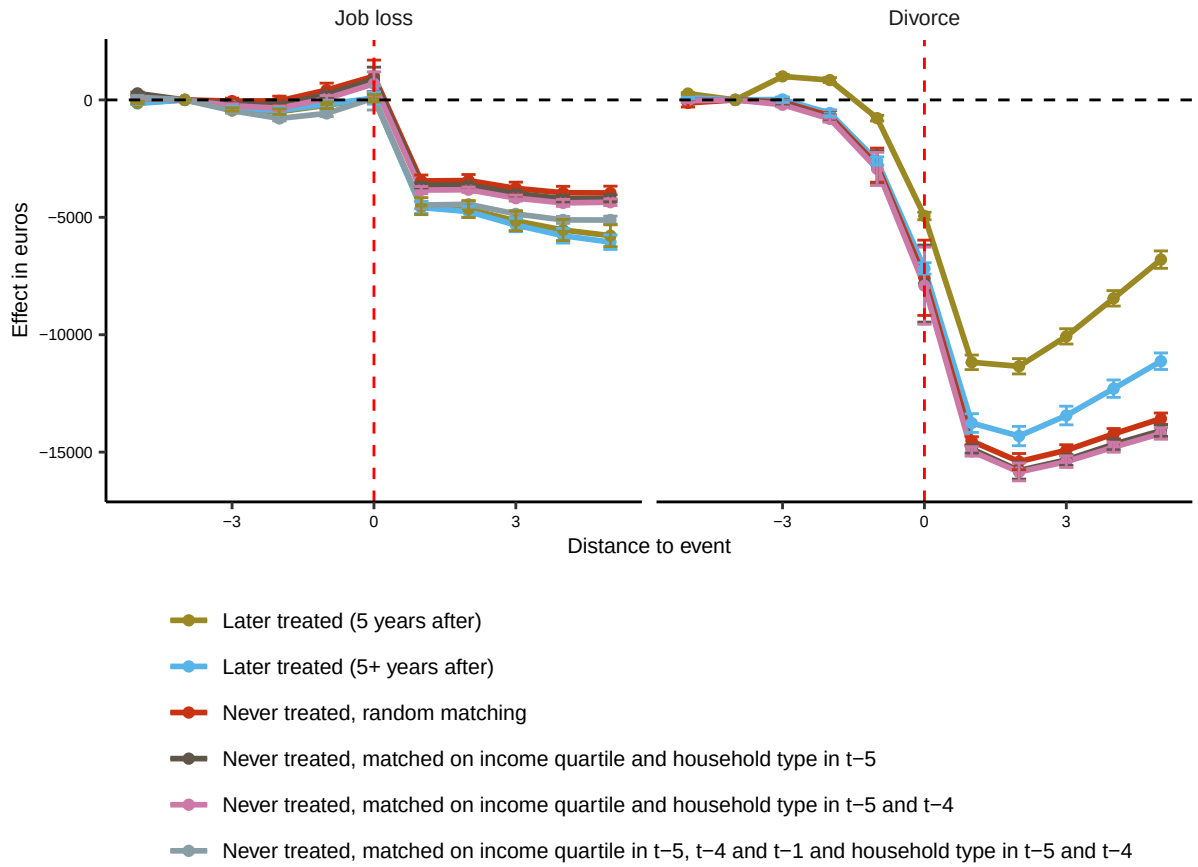
Sensitivity to control group definition In the main text, the control group is composed of *not-yet-treated* individuals: for each treated individual experiencing a life event at time t_0, a control group is drawn from individuals who have not yet experienced a similar event (and who would not be treated for at least seven years after t_0). We test the robustness of our results (for job loss and divorce) using an alternative definition of the control group. We use *later-treated* individuals: for each treated individual experiencing a life event at time t_0, a control group is drawn from individuals who will experience a similar event at time $t_0 + 5$. Using later-treated individuals is relevant if individuals selected into the treatment differ systematically from those who are never treated, as this choice helps neutralize selection effects. The identification assumption holds when the timing of the event is exogenous. We restrict treated and control individuals to be of the same gender and age.

Figure D.2 presents the results. Overall, the later-treated specification displays a pattern and magnitude similar to those obtained with the not-yet-treated estimation. For job loss, the control and treated groups exhibit more similar pre-shock income trajectories in the later-treated specification. This is consistent with the idea that individuals who experience a job loss at some point in their lives share more comparable income dynamics than those who never do. For divorce, however, later-treated individuals differ from the treated individuals in terms of their pre-divorce income dynamics. Low-income individuals face a higher risk of divorce (Kaplan & Herbst 2015), and may therefore separate earlier. In other words, the timing of divorce is not randomly distributed along the income distribution, implying that later-treated individuals are not a valid control group in this context.

Sensitivity to matching variables To assess the extent to which our matching variables account for selection into the event, we run an additional matching specifications in which we match only on gender and age. Recall that in our main specification we also match on we match on migration background, and household type and income level in both year $t_0 - 5$ and year $t_0 - 4$. The results are reported in Figure D.2, lines labelled "Not yet treated". They display very similar patterns and comparable magnitudes. However, matching on pre-event income

levels reduces the pre-event gap between treated and control individuals. This suggests that our main specification is likely to account effectively for selection into the event.

Figure D.2: Sensitivity to specification



NOTE: This Figures presents the estimated effect of life events on primary income for different specification. The specification used in the main results of the paper corresponds to the last one (grey curve). See text for details on the alternative specification estimated.

E Data

In this Appendix, we present details on the data sources we use in the empirical analysis. Table E.1 lists all the sources we use, and we subsequently provide more detailed information about each dataset. Information about the administrative on the micro datasets can be found on the CBS website (only available in Dutch).[10]

gbapersoontab[11]

This dataset contains demographic background data, such as gender, year of birth, and migration history, for the entire Dutch population who have been registered in the Basic Register of Persons (BRP) since 1 October 1994.

gbaoverlijdentab[12]

This dataset includes the date of death of all persons who were registered in the Basic Register of Persons (BRP) at the time of death since 1 October 1994. It also includes the date of death of non-residents who were once residents of the Netherlands after 1 October 1994, and whose death information is available in the Register of Non-Residents (RNI). The dataset is primarily sourced from the municipal registries (Gemeentelijke Basisadministratie Persoonsgegevens, GBA).

polisbus[13] and spolisbus[14]

This database covers all jobs in the Netherlands from 2006 onward, providing information on each employment spell. For each record, it includes details about the individual (such as wage, hours worked, and contributions) and the employer (such as sector and collective agreement).

integraal persoonlijk inkomen (IPI)[15]

The IPI data provide information on individual annualized income for the full universe of the Dutch population. Files originate from tax authorities and are available for the 2003–2010 period. From 2011 onward, they are replaced by INPATAB, due to revision of income statistics 2017. They include all labor income and capital income, as well as government transfers (e.g., UI, DI, pensions), and other transfers and income.

integraal huishoudens inkomen (IHI)[16]

The IHI data provide information on annualized income for the full universe of Dutch households. Files originate from tax authorities and are available for the 2003–2010 period. From

[10] Link to the CBS microdata information website.
[11] Link to gbapersoontab documentation in Dutch.
[12] Link to gbaoverlijdentab documentation in Dutch.
[14] Link to spolis documentation in Dutch.
[15] Link to ipi documentation in Dutch.
[16] Link to ihi documentation in Dutch.

2011 onward, they are replaced by INHATAB, due to revision of income statistics 2017. They include all labor income and capital income, as well as government transfers (e.g., UI, DI, pensions), and other transfers and income.

inpatab[17]

The inpatab data provide information on individual annualized income for the full universe of the Dutch population. Files originate from tax authorities and are available from 2011 onward. They include all labor income and capital income, as well as government transfers (e.g., UI, DI, pensions), and other transfers and income.

inhatab[18]

The inhatab data provide information on annualized income for the full universe of Dutch households. Files originate from tax authorities and are available from 2011 onward. They include all labor income and capital income, as well as government transfers (e.g., UI, DI, pensions), and other transfers and income.

vehtab[19]

The vehtab data provide information about the wealth of the full universe of the Dutch household. It is available from year 2006, and contains on a yearly basis the value of asset and debt owned, for different types of wealth (e.g financial assets, business assets, housing). The vehtab data do not cover all wealth in the national accounts, as pension wealth is not included. Depending on the type of wealth, the value is either observed (from tax data) or computed by Statistic Netherlands.

secm datasets[20]

The secm datasets provide detailed information on various types of monthly income received since 1999: employment wage (SECMWERKNDGAMNBEDRABUS), profit (SECMZLFMNDBEDRAGBUS), other activities (SECMOVACTMNDBEDRAGBUS), unemployment benefits (SECMWERKLMNDBEDRAGBUS), disability benefits (SECMZIEKTAOMNDBEDRAGBUS), other benefits (SECMSOCVOORZOVMNDBEDRAGBUS) welfare benefits (SECMBIJSTMNDBEDRAGBUS) and pension income (SECMPENSIOENMNDBEDRAGBUS).

These datasets are compiled by Statistic Netherlands using various administrative data sources, including taxes, social security, and pension funds. The initial format of the dataset is spell data, which provides information on the start and end dates of each income source, as well as the associated monthly amount. For each change in an individual's monthly income, a new line is added to the dataset. The secmbus dataset consolidates the different sources into

[17] Link to inpatab documentation in Dutch.
[18] Link to inhatab documentation in Dutch.
[19] Link to vehtab documentation in Dutch.
[20] Link to secm documentation in Dutch.

a single dataset that contains the main source of income and the associated amount for each spell.

zvwzorgkostentab[21]

This dataset records the health care expenditures in current euros incurred within the basic (mandatory) health insurance. Each observation corresponds to the health care expenditures incurred by one individual. The costs are those actually reimbursed by the health insurance companies. Data are available from 2009. If a type of care becomes reimbursed (or is removed from the list of reimbursed care) from one year to the other, its use will show in the data of one year but not in the data from the other year.

Table E.1: Datasets used

Content	**Name of dataset**	**Years**
Date of birth and gender	GBAPERSOONTAB	2023
Death	GBAOVERLIJDENTAB	2023
Civil status and date	GBABURGERLIJKESTAATBUS	2023
Households characteristics	GBAHUISHOUDENSBUS (V1)	2023
Linkage parent-child	KINDOUDERTAB (V1)	2023
Tax data		
Household tax data	IHI: Integraal huishoudens inkomen	2003-2010
Individual tax data	IPI: Integraal persoonlijk inkomen	2003-2010
Household tax data	INHATAB	2011-2022
Individual tax data	INPATAB	2011-2022
Individual income		
Unemployment benefits	SECMWERKLMNDBEDRAGBUS	2022
Disability and sickness benefits	SECMZIEKTAOMNDBEDRAGBUS	2022
Health data		
Health care expenditures	ZVWZORGKOSTENTAB	2009-2021

SOURCE: CBS microdata catalogue.

[21] Link to zvwzorgkostentab documentation in Dutch.