Individuals' values over the lifecycle: Does consistency matter?*

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Abstract

Values capture what is important to an individual and shape economic behaviors. Yet, no attention has been paid to the fact that individuals hold a variety of values and that there may be costs when these are not consistent with each other. This paper examines why and how individuals reconcile their values, both over time and across different categories, when values are inter-dependent and shocked by life-changing events. I develop a model in which an agents adjust her values simultaneously when an experience occurs in her life, thus leading to spillover effects across values. Bringing the model to cohort data, I assess the impact of several life events—parenthood, sickness and unemployment—on values. The empirical results suggest that (i) individuals adjust their values over the lifecycle due to life events, and (ii) spillover effects across values do exist and are sizeable.

Keywords: Values dynamics; Cognitive dissonance; Spillover effects; Simultaneous equations model.

JEL Classification: A13, D63, D91, Z10.

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1 Introduction

Values are personal beliefs about what is important in individuals' lives and therefore characterize the motivational bases of attitudes and preferences (Schwartz 1992, 2012).[1] The latter then influence individuals' behaviors, such as social interactions, political preferences and economic decisions. For instance, universalism—which is the understanding, appreciation, tolerance, and protection for the welfare of all people and for nature—can explain the left-right divide in terms of preferences for redistribution (Enke et al. 2020). Studying the dynamics of values is therefore crucial to understand the decision-making process of economic agents.

The dynamics of values are driven by life-changing events. For instance, one could expect that having a girl rather than a boy as first child can change new parents' value about security—which characterizes attitudes toward authority or preferences for social order.[2] Similarly, having a cancer can reduce the matter of achievement—which is the personal success through demonstrating competence according to social standards.[3] Existing literature has focused on this kind of relationship where one particular experience affects a single value, through an attitude or a preference (Piketty 1995, Fernández et al. 2004, Alesina et al. 2018, i.a.). Prior work does not explain the why and the how of this kind of relationship but only focuses on the observed outcome.

In this paper, I analyze why and how individuals reconcile their values, both over time and across different categories, when values are inter-dependent and shocked by life-changing events. This paper fills the gap in the literature by tackling two main issues. First, prior work focuses on changes in attitudes and preferences as outcome variables instead of values, hence, they only observe the manifestation of a value change in a particular context rather than the value change *per se*. For instance, a stronger preference for social order can be a manifestation of an increase in the attachment to values about security. Being able to observe the change in security allows to deduce changes in related preferences or attitudes such as attitudes toward authority. Thus, the dynamics of values help to understand *why* attitudes

[1] Values differ from personality traits. Personality traits describe how individuals behave across time and situations, while values refer to what they consider important. See Schwartz (2012) for a discussion on how values relate to attitudes, beliefs, traits and norms.

[2] For instance, Washington (2008) shows how daughters can influence their legislator fathers' voting on women's issues. Grinza et al. (2017) argue that entry into parenthood significantly shifts women's attitudes toward more conservative views. Similarly, Bolzendahl and Myers (2004) and Cunningham et al. (2005) find that entry into parenthood reduces the support for egalitarian roles for women and men in families.

[3] See, for instance, Peteet (2000) who discusses the relationship between cancer and the meaning of work, in a context where the loss of occupational identity becomes a source of anxiety and depression. Moran et al. (2011) show that cancer survivors have lower employment rates and work fewer hours than other similarly aged adults which can be due to consequences on life purpose and limitations in ability to work (Short et al. 2005, 2008a,b, Bradley et al. 2002, 2005, i.a.).

and preferences change due to life experiences. Second, the literature assumes that values are independent by considering that the direct effect embodies the whole impact of a life experience on a given value. Yet, the positioning of an individual along several distributions of values is not random, implying that values are inter-dependent (Acemoglu and Robinson 2021). I show that inter-dependence between values influences the way an individual adjusts values after a life event, leading to indirect effects that I define as *spillover* across values. Thus, taking into account the inter-dependence between values details *how* values, hence attitudes and preferences, adjust following life experiences.

I first develop a model where the dynamics of values is disciplined by two anchoring forces: *time consistency* and *group consistency*. The former indicates that one prefers her today's values being close to her yesterday's values, that is, that values be consistent over time. This induces rigidity by shaping how values adjust over time after a life-changing event that brings new information. The latter relates to the proximity of values held within the group with which we identify, hence, one prefers values to be consistent with those of her group. Both consistencies are based on the concept of cognitive dissonance introduced by Festinger (1957) as individuals seek to avoid the psychological burden of having values that are dissonant with either their past values or their group.

The setup features a consistency trade-off between time consistency and group consistency. A life-changing event consists in an information shock on values at the end of a period. After the shock, the individual has to reset her values subject to both time and group consistencies. With endogenous group membership, she will consider identifying with another group, which may imply resetting her values toward the ones of this new group. For this to occur, the information shock needs to be sufficient to make this costly convergence process more desirable than keeping the previous group identity, hence, there is a trade-off. When values are independent, the agent adjusts her shocked values *independently* by simply minimizing the distance between her past values (time consistency) and the values of the group to which she decides to belong (group consistency).

The inter-dependence between values distorts the consistency trade-off. When values are linked within groups, the agent adjusts her values *simultaneously* as the relative weight of both consistencies depends on the inter-dependency between values.[4] When there are two values that are positively correlated across groups, the trade-off is in favor of the group consistency as the dissonance with the current group is more costly to the individual. Conversely, when values are negatively correlated, the cost to identify with another group after an information shock is lower, hence, the trade-off is in favor of time consistency. As a result,

[4]The inter-dependency between values is exogenous to the agent and reflects the mapping of values in the society; see Roccas and Sagiv (2010) for the importance of the cultural context.

an initial information shock on one value can trigger a spillover effect on another value when the agent starts to identify with another group.

I test the prediction of the theory about the existence of spillover effects by using data from two British cohort studies in which I measure individuals' values at several ages. I use principal component analysis to show that the variation in the answers to a large set of questions about attitudes can be captured by two main dimensions. These dimensions coincide with the motivational types of values introduced by Schwartz (1992, 2012). The first dimension captures *conservation* versus *openness to change*—the preference for stability, security, tradition and conformity versus the openness to new experiences related to self-direction and stimulation—which can be summarized by conservatism versus progressivism. The second dimension reflects *self-transcendence* versus *self-enhancement*—values associated to care for and concern about others such as universalism and benevolence versus the self-interest and ambition linked to achievement and power—which can be summarized by collectivism versus individualism.

The identification of values' dynamics is challenging. I estimate separately the effect of two exogenous and non-reversible life events—the sex at birth of the first child and to have ever had cancer—on both individuals' values—conservation and self-transcendence. To examine the presence of spillover effects, I instrument conservation by the information shock associated to the life event and look at the impact on self-transcendence. The identification relies on the assumption that each life event does not provide any information shock on self-transcendence. This identification assumption may be violated for many life events. For instance, to have ever been unemployed is likely to generate information shocks on both values, hence, the spillover effects cannot be identified in this setting. To deal with the two-side effect of unemployment on values that threatens identification, I use a simultaneous equations model in which I instrument endogenous values with their own respective lags. Thus, the identification relies on symmetrical exclusion restrictions which assume that one value is not directly affected by the lag of the other value. Based on the simultaneous equations model, I can estimate and decompose the change in values due to the information shock (direct effect) and the change owing to spillover effects across values (indirect effect).

I also address the question of the endogeneity of the life-event with respect to values in the case of unemployment. From the theoretical framework, I derive an expression of this bias that is a scale multiplier of the direct and indirect effects, hence, of the total effect. I show that *i)* the bias can affect the magnitude of the total effect without changing the qualitative result, *ii)* it is still possible to provide a lower-bound estimate of the effect, and *iii)* the bias does not change the relative share of the total effect that is due to the direct and the spillover effects.

My empirical analysis yields three main results. First, values change over the lifecycle due to life-changing events. Both exogenous life events are associated with a significant increase in conservation. Similarly, individuals who have ever been unemployed hold more conservative values, but they are also more self-transcendence values thereafter. The magnitude of the latter being ten times larger than the former's one.

Second, spillover effects do exist and amount to a third of the magnitude of the information shock. After an increase in conservation due to a life-changing event, self-transcendence declines by a third of the increase in conservation.

Third, values are linked to each other in a non-reciprocal way. Once the framework is generalized to shocks that can affect both values at the same time, the spillover effects become non-reciprocal. As before, an increase in conservation fosters a *negative* spillover effect in self-transcendence; but an increase in self-transcendence generates a *positive* spillover effect on conservation. Thus, the adjustment process between values exhibits a spiral pattern that relates to the dynamic structure of value relations from the social psychology literature (Schwartz 2012).

This paper is the first to emphasize that neglecting the inter-dependence between values leads to underestimating to which extent life experiences affect the formation of values as it omits spillover effects. Thus, I contribute to the literature on the formation of beliefs which has so far focused on the relationship between one particular experience and a single attitude or preference (Piketty 1995, Fernández et al. 2004, Mayda 2006, Alesina et al. 2018, i.a.). The closest work is Zimmermann (2020) who shows that feedback drive the dynamics of motivated beliefs. My approach builds on his results in the sense that feedback are provided by people with whom individuals identify and share values, a mechanism that is similar to my focus on group consistency and the inter-dependency of values. These latter mechanisms compete with time consistency which captures the persistence of beliefs over time (Eyster 2002, Yariv 2002).

This paper adds to the literature on the formation and dynamics of beliefs. Prior work highlights inter-generational transmission (Bisin and Verdier 2001, 2011, Montgomery 2010, Hiller and Baudin 2016, Alan et al. 2017; i.a.) along with the role of cultural values (Ichino and Maggi 2000, Fernández et al. 2004, Guiso et al. 2006, Fernández 2007, Giuliano 2007, Chen 2013, Alesina and Giuliano 2014) and norms (Fehr and Falk 2002, Bardi and Schwartz 2003, Tabellini 2008) to explain how people form their beliefs. Recent work focuses on the development of beliefs during childhood (Fehr et al. 2013, Doepke and Zilibotti 2017, Bašić et al. 2020). Building on work that highlights the role of life experiences to explain belief formation, I provide an additional mechanism that is based on the concept of cognitive dissonance introduced by Festinger (1957) and McGuire (1960) and endogenous group

membership.

This paper fits into the literature on the consequences of cognitive dissonance in economics (Akerlof and Dickens 1982, Konow 2000, Bénabou and Tirole 2006). Prior work uses the concept to explain belief-behavior relationship. I, instead, consider its effects on the between-values relationship; either to avoid dissonance with the previous self or to avoid dissonance with the values of the group or across different sets of values. My approach is also inspired by the literature on identity in economics (Akerlof and Kranton 2005, 2010, Shayo 2009, Bénabou and Tirole 2011, Kranton 2016, Bonomi et al. 2021). Prior work shows the effect of group membership, hence identity related to individual's characteristics, on individual behavior (Charness et al. 2007, Sutter 2009). I motivate the underlying mechanism of group dissonance by endogenous group membership which reflects the choice of the agent. Thus, the agent decides with which group she prefers to identify according to her values with respect to those held in these groups.

My work also builds an additional bridge between the social psychology literature and the economic literature. Psychological determinants of economic behaviors have been mostly introduced through personality traits (Borghans et al. 2008, Almlund et al. 2011, Ferguson et al. 2011, Becker et al. 2012, Flinn et al. 2018, Todd and Zhang 2020). The *big-five* personality traits have been found to be quite stable over the lifecycle and therefore can hardly explain changes in individuals' decision-making process (Terracciano et al. 2006, 2010, Cobb-Clark and Schurer 2012). Thus, I introduce motivational types of values *à la* Schwartz (1992, 2012) as novel determinants of economic behaviors, which are more volatile than personality traits because of the impact of life experiences (Lönnqvist et al. 2011, Daniel et al. 2021). Yet, personality traits and values are related as they look at the same object, individuals, from different perspectives which are therefore complementary (Caprara et al. 2009, Fischer and Boer 2015, Parks-Leduc et al. 2015).

Lastly, my results relate to the literature on unemployment scarring as they open another potential explanation for this phenomenon. Unemployment is known to have consequences on well-being and health (Clark and Oswald 1994, Knabe et al. 2010, Nordt et al. 2015). Scarring emphasizes the depreciation of human capital and firm-specific skills as the main driver of future employment (Arulampalam et al. 2001, Clark et al. 2001, Gregg and Tominey 2005). I show that having ever been unemployed increases self-transcendence, and people with high self-transcendence are more likely to be unemployed, the framework provides a novel mechanism in which past unemployment could affect future employment through values.

The paper is organized as follows. Section 2 presents a theoretical framework that models the role of inter-dependence between values and sheds light on the consequences of omitting

this mechanism. Section 3 describes the cohort data, derives values from statements about attitudes and presents the life events that are used as information shocks in the paper. Section 4 shows the presence of spillover effects using instrumental variable regressions and discusses the identification assumption. Section 5 presents the simultaneous equations model to identify spillover effects when the information shock affects both values simultaneously, and discusses the consistency of values. Section 6 concludes the paper.

2 Theoretical framework

In this section, I develop a model to illustrate the role of dependent values when looking at the trade-off between the time consistency and the group consistency. I proceed in two steps. First, I describe the baseline model with only one value and show what happens when there is an information shock. Then, I replicate the process in a model with two values that are correlated between groups and show the difference with respect to the baseline model when there is an information shock.

2.1 Single-value model

Consider an agent that is characterized by one (motivational type of) value $a_t \in \mathbb{R}^2$ in period t. The agent considers her value with respect to the norm, namely, the average value within the reference population.[5] Hence, values are normalized to the population level, so that the mean value in the population is equal to zero. Suppose the population is sufficiently large in order to ensure *anonymity*, meaning that any change of value from the agent does not change the distribution. The agent belongs to group $s \in \{\underline{s}, \overline{s}\}$. The average values within both groups are respectively $\underline{a}$ and $\overline{a}$.[6] For the remaining of the paper, I set $\overline{a} > \underline{a}$ which implies that $\overline{a} > 0 > \underline{a}$ since values are standardized.

In any period t, the agent solves the following maximization program in order to determine her values and the group to which she belongs:

$$\max_{a_t, s_t} U_t(a_t, s_t) = -\eta_a \sqrt{[a_t - a_{t-1}]^2} - \phi_a \sqrt{[a_t - a^\star(s_t)]^2}, \tag{1}$$

[5]The reference population can be defined at several levels such as the city, the region, the country or, more broadly, the shared culture. See Roccas and Sagiv (2010) for the importance of the cultural context in the value-behavior relation. See, also, Bisin and Verdier (2011) for a survey on the economics of cultural transmission and Rapport (2014) for a survey on cultural heterogeneity in cultural anthropology.

[6]So far, I focus on individual life events, hence, the model is a partial equilibrium model. Thus, I suppose that the average values within each group are time invariant. An extension of the model would be to make them time-dependent, hence, sufficiently large shocks in one period, such as economic crises or global pandemic, would affect the average values. However, this extension goes beyond the scope of the paper and is intentionally left for future research.

where $a^\star(s_t) = \{\underline{a}, \overline{a}\}$ is the average value a within her group and $(\eta_a, \phi_a) \in (\mathbb{R}_+^\star)^2$ are parameters that account for the relative importance of each utility components.[7] Components of the utility function are expressed in one-dimension Euclidean distances.

The agent seeks to avoid two psychological costs, namely, *time inconsistency* and *group dissonance*. The former implies that the agent prefers when her today's values are close from her yesterday's values, thus, she suffers from a utility loss the further her value in period t is from her value in period $t-1$, i.e. $a_t - a_{t-1}$. The literature on social psychology shows that individuals tend to resist to change their attitudes, beliefs and values through behaviors such as cognitive inertia or belief perseverance, providing empirical evidences of such a component in agent's utility; see Kunda (1990) for a review of biased information processing through which people maintain their beliefs.

The latter psychological cost implies that the agent prefers to hold values that are close to norms within the group to whom she belongs, hence, having a disutility the further her value is from the average value within her group, i.e. $a_t - a^\star(s_t)$. The consistency with the group—to avoid group dissonance—refers to the concept of conformity warp in the social economics literature, meaning that individuals are warped away from their optimal behavior, here values, because they have to conform to the norm; see Burke and Peyton Young (2011) for a survey on the role of social norms and individual behaviors in presence of norms.

The optimal value satisfies both the time and group consistencies, hence, it is equal to the weighted average between the agent's value in previous period and the average value in her group. It corresponds to the first-order condition that solves the maximization program (1), namely,

$$a_t(s_t) = \frac{\eta_a a_{t-1} + \phi_a a^\star(s_t)}{\eta_a + \phi_a}. \tag{2}$$

Thus, the optimal value depends on the group to which the agent decides to belong, hence, to identify.

Suppose the agent has an initial value a_0 but cannot identify to an other group. She belongs to a group with $a^\star$ as the group-average value. The dynamics of a in period t is derived from equation (2) and correspond to

$$a_t = a^\star + \left(\frac{\eta_a}{\eta_a + \phi_a}\right)^t (a_0 - a^\star). \tag{3}$$

It is straightforward to show that the value converges toward the average of the group, i.e.

[7] These parameters are assumed to be homogeneous within the population, although they might differ across groups of individuals. More extensively, the emergence of heterogeneity in the relative importance of each component would be an interesting point that I leave for future research.

$\lim_{t\to+\infty} a_t = a^\star$, at a rate of convergence

$$\lim_{t\to+\infty} \frac{|a_{t+1} - a^\star|}{|a_t - a^\star|} = \frac{\eta_a}{\eta_a + \phi_a} < 1.$$

Thus, leading to Proposition 1. Proof in appendix A.

Proposition 1 *Any individual converges to the average value within her group and the speed of convergence depends positively on the relative weight of the group consistency (with respect to the time consistency) in the utility function.*

Let allow the agent to choose her group. So far, I do not consider any uncertainty in the ability to identify with a group neither any direct cost. She compares both indirect utilities to determine which group she prefers, i.e. $U_t(\overline{s}) - U_t(\underline{s})$. Using the utility function from the maximization problem (1) along with the optimal value in equation (2), I obtain

$$U_t(\overline{s}) - U_t(\underline{s}) = -\gamma_a \left(\sqrt{[a_{t-1} - \overline{a}]^2} + \sqrt{[a_{t-1} - \underline{a}]^2} \right), \tag{4}$$

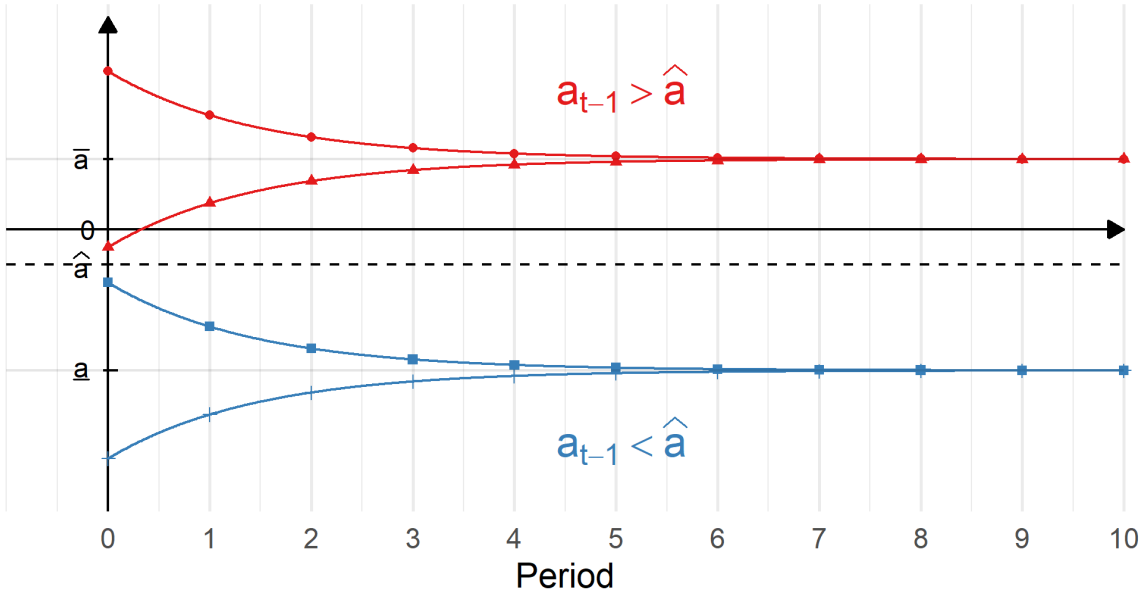
where $\gamma_a \equiv 2\eta_a\phi_a/(\eta_a + \phi_a) > 0$. The agent weakly prefers her group to the other as long as her indirect utility in this group is greater or equal to the one she would get in the other.

Let $\tilde{a}_{t-1}$ be the *indifference value* which is defined as the value in $t-1$ such that the agent is indifferent between both groups in period t, i.e. $U_t(\overline{s}) - U_t(\underline{s}) = 0$. Using equation (4), the indifference value is $\tilde{a}_{t-1} = \hat{a}$, where $\hat{a} \equiv (\overline{a} + \underline{a})/2$ is the *midpoint value*. The midpoint value refers to the middle of the distance between the average values in both groups. Figure 1 illustrates the value convergence for several initial values a_0. In the single-value model, as long as the value in previous period a_{t-1} is greater (resp. smaller) than the midpoint value $\hat{a}$, the agent prefers to belong to group $\overline{s}$ (resp. $\underline{s}$). Therefore, in absence of shocks, the agent converges toward a steady state value which corresponds to the average value within her group. What happens when there is a shock?

Similarly to the indifference value, we define the *indifference shock* $\Delta\tilde{a}_{t-1}$ as the shock in $t-1$ such that the agent is indifferent between both groups in period t, namely, $\Delta\tilde{a}_{t-1} \equiv \tilde{a}_{t-1} - a_{t-1}$. To illustrate the idea, suppose the agent belongs to the group $\underline{s}$ and she is in her steady state in initial period. Thus, her initial value is the average-group value, i.e. $a_0 = \underline{a}$. There is a shock Δa_0 at the end of this period such that her value becomes $a_0' = \underline{a} + \Delta a_0$. How large has the shock to be for the agent to change group in the next period and converge toward the other group-average value?

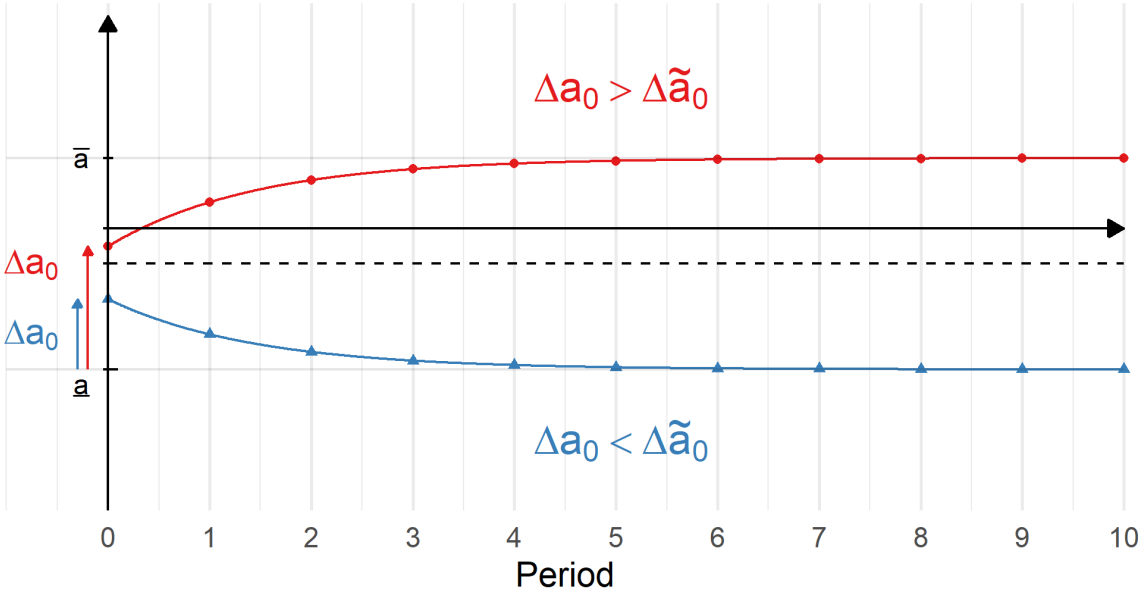
In the single-value model, the magnitude of the shock has to be greater than the midpoint distance between $\underline{a}$ and $\overline{a}$ when the agent is in a steady state. Thus, $\Delta\tilde{a}_0 = \hat{a} - \underline{a} = (\overline{a} - \underline{a})/2$.

Figure 1: Value convergence and endogenous group membership in the single-value model.



Notes: This figure presents the convergence of one value toward the average value within the group according to the initial value a_0 with respect to the midpoint value $\hat{a}$.

Figure 2: Value convergence after a shock in the single-value model.



Notes: This figure presents the value convergence after a shock in a_0 according to the magnitude of the shock Δa_0.

Figure 2 depicts the value convergence after a shock. When the shock is sufficiently large, i.e. $\Delta a_0 > \Delta \tilde{a}_0$, the agent identifies to the other group because the psychological cost induced

by the group dissonance with her initial group becomes too high after the shock. Hence, she converges toward this new-group average value. This result leads to Proposition 2. Proof in appendix A.

Proposition 2 *For any individual, it always exists a shock such that she prefers to identify with the other group.*

The single-value model delivers two main results. First, any individual converges to the average value within her group. The length of time to convergence depends on two components: the rate of convergence and the distance with the group-average value. The relative weight between both parameters η_a and ϕ_a determines the rate of convergence. The greater is η_a, the more costly is the time inconsistency with respect to the group dissonance, hence, the faster the convergence. The further the current value is from the group-average value, the slower the convergence.

Second, it is always possible to find a shock such that an individual starts to identify to the other group. The shock requires two conditions to be satisfied: its direction has to be toward the other-group average value and the magnitude has to be sufficiently large. The magnitude depends on the distance between both groups in terms of value and the current value of the individual. The larger is the distance, the greater has to be the shock. When the current value is in a steady state, the magnitude corresponds to the midpoint distance. Otherwise, the closer she is from the the midpoint value, the smaller has to be the shock.

2.2 Two-value model

We aim to understand the difference in terms of values dynamics when there are two values instead of one. Suppose there are two (motivational types of) values $V_t = (a_t, b_t) \in \mathbb{R}^2$. Consider the same utility function as before but including the second value b_t. The maximization program of the agent becomes:

$$\begin{aligned}\max_{a_t, b_t, s_t} U_t(a_t, b_t, s_t) = &- \eta_a \sqrt{[a_t - a_{t-1}]^2} - \phi_a \sqrt{[a_t - a^\star(s_t)]^2} \\ &- \eta_b \sqrt{[b_t - b_{t-1}]^2} - \phi_b \sqrt{[b_t - b^\star(s_t)]^2},\end{aligned} \tag{5}$$

where $v^\star(s_t) = \{\underline{v}, \overline{v}\}$ is the average-group value $v \in \{a, b\}$ and $(\eta_a, \phi_a, \eta_b, \phi_b) \in (\mathbb{R}^\star_+)^4$ are parameters that account for the relative importance of each utility components. The agent seeks to avoid the same psychological costs as before, namely, time inconsistency and group dissonance, but on two values instead of one. The optimal values are identical to the single-value model, hence, the weighted average between the past value and the average

value within the group:

$$a_t(s_t) = \frac{\eta_a a_{t-1} + \phi_a a^\star(s_t)}{\eta_a + \phi_a}, \qquad \text{and} \qquad b_t(s_t) = \frac{\eta_b b_{t-1} + \phi_b b^\star(s_t)}{\eta_b + \phi_b}.$$

Thus, the dynamics of values are also identical to equation (3). It is therefore straightforward to show that Proposition 1 holds. So far, nothing changes with respect to the single-value model although we add one value.

The difference in this setup arises from the inter-dependency between both values. There exist two groups, $\underline{s}$ and $\bar{s}$, in which the average values are respectively $(\underline{a}, \underline{b})$ and $(\overline{a}, \overline{b})$. Since values are standardized in the population, it implies that $\underline{v}$ and $\overline{v}$ have opposite signs. We have set the average value a in both groups such that $\overline{a} > 0 > \underline{a}$. Thus, the inter-dependency between values is captured by the sign of $\overline{b}$ (or equivalently by the sign of $\underline{b}$). If $\overline{b}$ is positive, then both values are positively correlated in the population. Otherwise, they are negatively correlated. Does the inter-dependency between values affect the conditions under which the agent changes group?

Suppose the agent belongs to the group $\underline{s}$ and she is in the steady state such that $a_0 = \underline{a}$ and $b_0 = \underline{b}$. There is an information shock on value a at the end of the initial period, hence, $a_0' = \underline{a} + \Delta a_0$. In period $t = 1$, the agent has to choose whether she wants to stay in her group or change for the other group. Her values depend on this choice. If she decides to stay in her current group, her indirect utility is

$$U_1(\underline{s}) = -\gamma_a \sqrt{(\Delta a_0)^2}. \tag{6}$$

Otherwise, she changes her group and gets the following indirect utility:

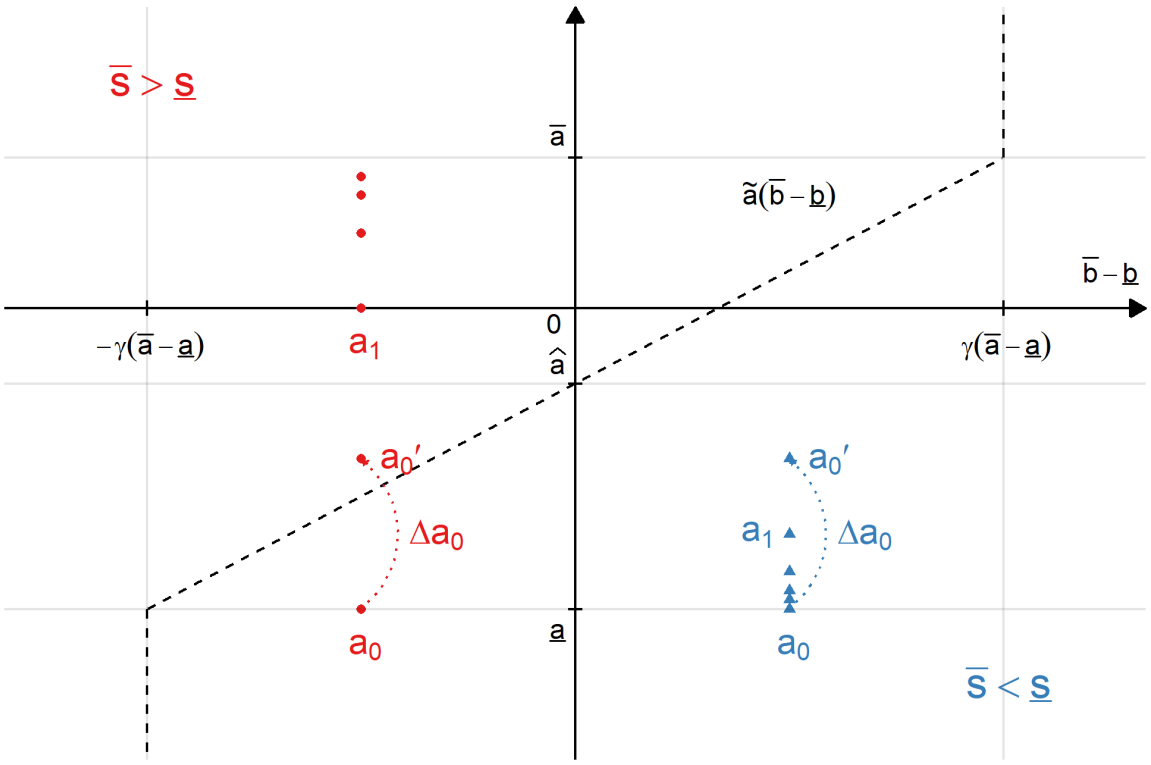
$$U_1(\bar{s}) = -\gamma_a \sqrt{[\Delta a_0 - (\overline{a} - \underline{a})]^2} - \gamma_b \sqrt{[\overline{b} - \underline{b}]^2}, \tag{7}$$

where $\gamma_b \equiv 2\eta_b\phi_b/(\eta_b + \phi_b) > 0$.

To make her decision, she compares both indirect utilities, i.e. $U_1(\bar{s}) - U_1(\underline{s})$, given the correlation between values in the population. Figure 3 provides a mapping of choices of the agent according to the inter-dependency between values. The right-hand side of the figure corresponds to cases in which both values are positively correlated in society (i.e. $\overline{b} - \underline{b} > 0$), whereas the left-hand side refers to cases in which they are negatively correlated (i.e. $\overline{b} - \underline{b} < 0$). The dashed line corresponds to the indifference value which is a function of the distance between both group-average values, i.e. $\tilde{a}(\overline{b} - \underline{b})$.

The figure delivers two results. First, it shows that Proposition 2 does not hold when

Figure 3: Mapping of choices in the two-value model.



Notes: This figure presents the mapping of choices the agent makes given the correlation between values in the population. The x-axis corresponds to the gap between both group averages in terms of value b. The y-axis corresponds to the value a. The dash line refers to the indifference value and indicates the frontier between both agent's choices. The dotted curve shows the information shock Δa_0. Appendix A provides the details to derive the figure.

there is an inter-dependent value that is too much discriminating between both groups. It means that, in this case, it is not possible to find a shock sufficiently large such that the agent prefers to identify to the other group. Hence, it implies Proposition 3.

Proposition 3 *If a value poorly discriminates groups with respect to the other, then this value is not relevant in the choice of the individual and information shocks have no effect on individual's group membership.*

When the gap between groups in terms of value b is too large in absolute terms, i.e. $\left|\overline{b} - \underline{b}\right| > \gamma(\overline{a} - \underline{a})$, it indicates that the polarization between both groups in terms of b is so important that the value a is not relevant. In this case, the agent chooses her group regardless of any information shock that could affect a because the group dissonance with respect to b generates a psychological cost that cannot be offset by any other consideration than keeping up with the group.

Second, neglecting the inter-dependency between values leads to a misunderstanding of the consistency trade-off in individual choices. When values are both relatively discriminant, Proposition 2 holds, and the agent may change her group after an information shock. This decision depends on the new value a_0' with respect to the indifference value $\tilde{a}$, as in the single-value model. However, in the two-value model, the indifference value corresponds to a distorted version of the midpoint value. This distortion is introduced by the inter-dependency between values. Thus, the indifference value becomes

$$\tilde{a} = \hat{a} + \frac{\overline{b} - \underline{b}}{2\gamma},$$

where $\gamma \equiv \gamma_a/\gamma_b$. Note that the single-value model is a special case of the two-value model in which the b value is orthogonal to the a value in society. The figure shows that when both values are positively (resp. negatively) correlated in society, the shock has to be large (resp. small), with respect to the single-value model's shock, for the agent to change group. For instance, when the correlation is positive, the inter-dependence between values gives more weight to the group consistency with respect to time consistency. Conversely, when the correlation is negative, the consistency trade-off is in favor of the time consistency because the psychological cost due to the group dissonance is dampen by the inter-dependency of values.

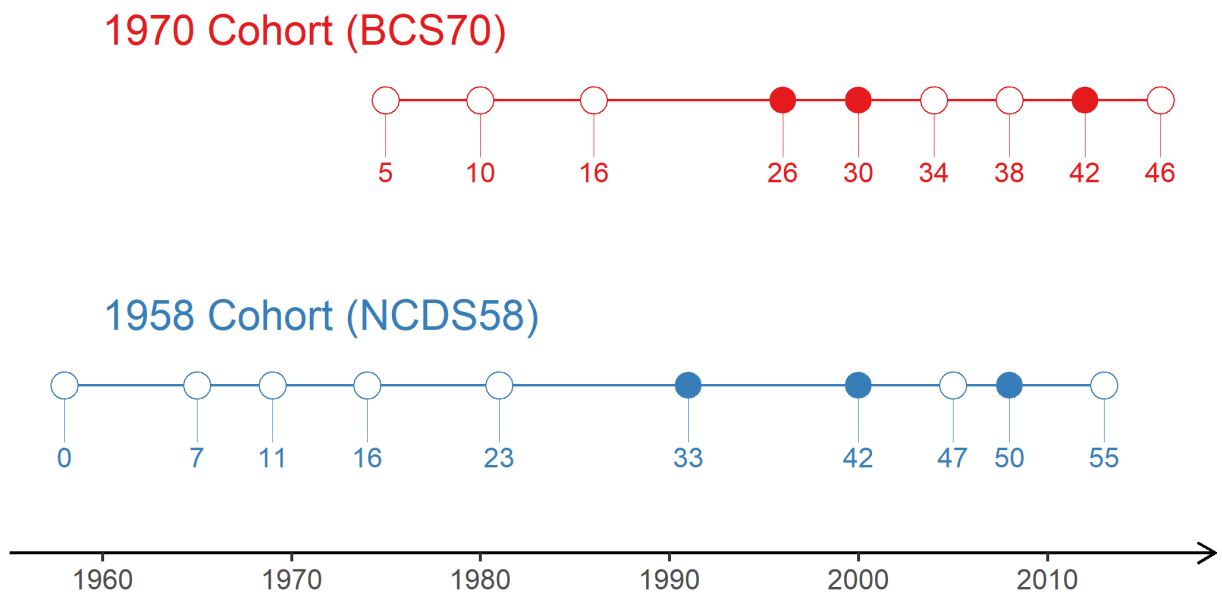
The two-value model delivers two main results. First, the interdependence between values distort the consistency trade-off and the consequences of the information shock in terms of values dynamics depend on how both values are linked to each other. Second, an information shock on one value can trigger a *spillover effect* on another value when the agent starts to identify with another group. Suppose an information shock that affects only one value but not the other. When the information shock is sufficiently large, the agent identifies to the other group and change both of her values toward those of the new group. Hence, I turn to empirical analysis in order to test for the existence of spillover effects across values.

3 Data

3.1 Sample

I use two mature British cohort studies that have been widely used in social sciences-related works. The National Child Development Study (NCDS58) is a cohort of individuals born during a same week in March 1958. The British Cohort Study (BCS70) is composed of those born during a same week in April 1970. Cohort members were born in England, Scotland

Figure 4: Timing of interviews.



Notes: This figure presents the timing of interviews for the NCDS58 and BCS70 cohorts. Circles correspond to interviews and numbers under them indicate the age of cohort members during this interview. Full circles correspond to interviews for which attitudes can be derived. The horizontal arrow at the bottom of the figure represents the years.

and Wales.

Both cohorts participated to several interviews at different ages. Figure 4 presents the ages at which cohort members may have been interviewed and the corresponding years. The full circles on the figure indicate interviews from which attitudes can be derived, thus I will focus on those years for the remaining of the paper. I define four periods according to the decade in which individuals belong, i.e. their twenties, thirties, forties or fifties. For the BCS70 cohort, I refer to period 1 for the interview at the age of 26, to period 2 for the one at 30, and to period 3 for the one at 42. For the NCDS58 cohort, periods start at period 2 for the interview at the age of 33, then period 3 corresponds to the one at 42 and period 4 refers to the one at 50.

One of the main issue with cohort studies is attrition. Cohort members do not participate at every interviews and therefore some individuals are either missing at some interviews or lost definitely at some point. Table 1 presents the responses rates by periods of interest. The second period interview is the one with the greater response rate, i.e. with 64.1% for the NCDS58 cohort and 59.2% for the BCS70 one. This latter, when BCS70 cohort members are 30, has been conducted at the same time as the third period interview for the NCDS58 cohort, when they are 42, so in year 2000. Thus, they share the same set of statements about attitudes.

Table 1: Number of individuals and response rates by periods.

	BCS	NCDS
Initial	19006 (100%)	17885 (100%)
Period 1	9003 (47.4%)	
Period 2	11261 (59.2%)	11469 (64.1%)
Period 3	9841 (51.8%)	11419 (63.8%)
Period 4		9790 (54.7%)
All	6115 (32.2%)	8107 (45.3%)

Notes: Response rates between parentheses. The last row corresponds to individuals who have been interviewed at all periods.

3.2 From statements to attitudes

I derive attitudes from individuals' answers to statements. These statements cover several topics and can be grouped into categories that correspond to attitudes towards (in alphabetical order): Anti-Racism (AR), Authority (A), Children (C), Environment (E), Inequality Aversion (IA), Information Technology (IT), Learning (L), Morale (MOR), Political Cynicism (PC), Work-Ethic (WE), and Working Mother (WM). The full list of statements are reported in Appendix B. Some examples of statements are the following:

(A2) *For some crimes the death penalty is the most appropriate sentence*;

(MOR3) *Couples who have children should not separate*;

(PC1) *None of the political parties would do anything to benefit me*;

(WE1) *Having almost any job is better than being unemployed.*

At each interview, cohort members answer to these statements using a 5-level scale (strongly disagree/disagree/neither agree nor disagree/agree/strongly agree). I attribute them a score for each statement between -2 and 2 according to the answer. I compute the average score among all the statements by attitude categories for each individual at each period. I standardize each attitude score at the cohort and period level. Thus, each individual belongs to a cohort and has, for each period, a standardized score for each attitude.

Nonetheless, the number of available statements depends on the cohort and the period. Table 2 summarizes the number of available statements at each interview. Thus, interviews do not necessary share the same set of statements, except when the BCS70 are 30 and the NCDS58 are 42 because interviews were performed using the same questionnaires.

Table 2: Number of available statements at each interview

	BCS70			NCDS58		
Attitude	26	30	42	33	42	50
Authority	4	6	3	6	6	3
Anti-Racism		5	2	5	5	3
Children		4	2	2	4	
Environment		3	2	3	3	3
Inequality Aversion	1	7	5	7	7	3
Info. Techno.		4			4	
Learning		4			4	
Morale	3	6	3	6	6	3
Political Cynicism	3	3	3	3	3	3
Work Ethic	2	3	3	3	3	3
Working Mother		5	2		5	

Notes: This table presents the number of available statements in each attitudes at each age for the NCDS58 and BCS70 cohorts. Details on statements are reported in the appendix, see tables B.1, B.2 and B.3 in appendix B.

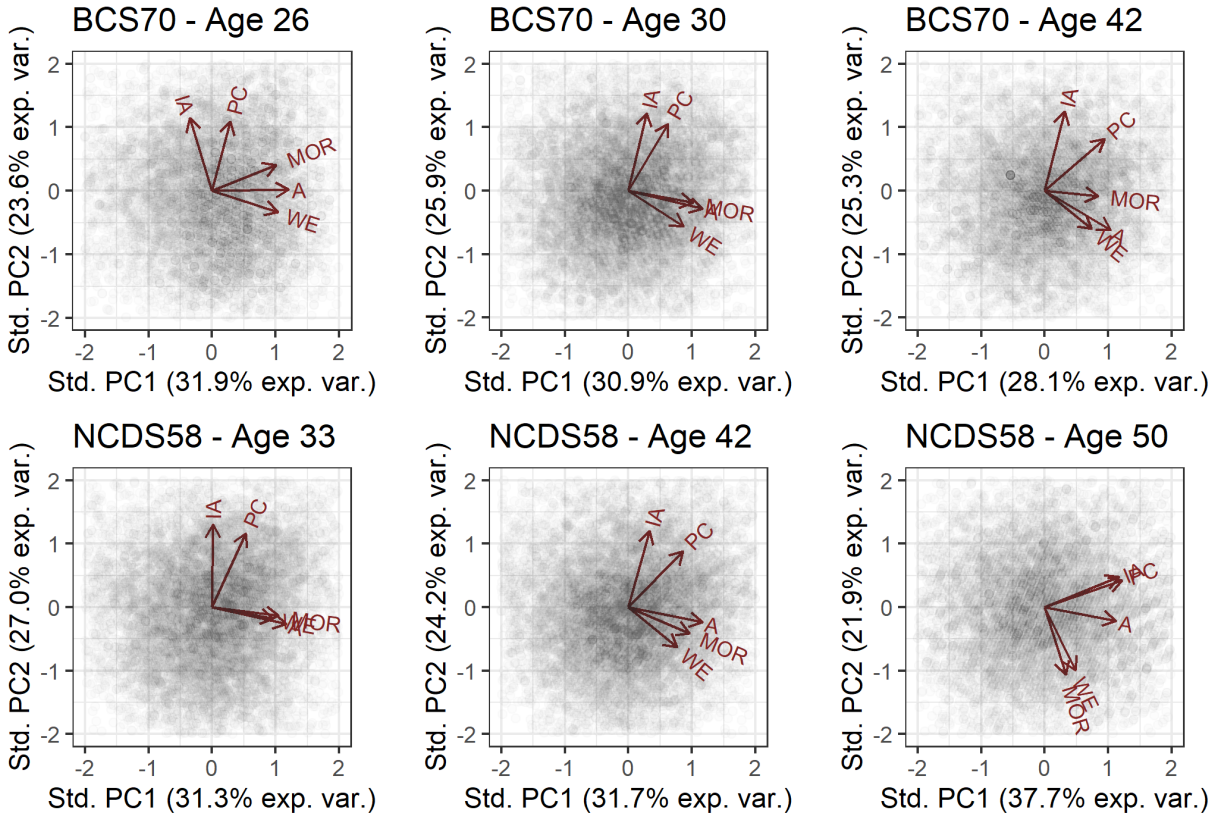
3.3 From attitudes to motivational types of values

I derive motivational types of values from attitudes. I focus on the five attitudes that are available in all interviews in order to have the same baseline for each period of both cohorts. These attitudes are Authority (A), Inequality Aversion (IA), Morale (MOR), Political Cynicism (PC) and Work Ethic (WE).

I use a Principal Component Analysis (PCA) to reduce the dimension of attitudes. PCA increases the interpretability of vectors while minimizing the information loss. By focusing on the two first components, which are orthogonal due to the PCA, I can interpret them as the two main values that discriminate and, therefore, characterize individuals in their attitudes.

The other principal components act as a kind of residuals. Although they might be incorporated to the analysis, Proposition 3 states that a value needs to be sufficiently discriminatory between groups in order to be relevant in the decision-making process after an informational shock. The two first principal components capture more than 50% of the explained variance in attitudes, which makes the discriminatory power of the other principal components not relevant. Therefore, I focus on the two first components. PCA allows to determine values by summarizing attitudes through dimension reduction which reduces the noise in attitudes, hence, this noise is relegated to the unused components that explain the smaller part of the variance and are not relevant.

Figure 5: Two first principal components of the PCA to derive values from attitudes.



Notes: This figure presents the direction of the two first principal components. Details on the eigenvectors are available in tables C.1 and C.2, respectively for the BCS70 and NCDS58 cohorts. Attitudes are Authority (A), Inequality Aversion (IA), Morale (MOR), Political Cynicism (PC) and Work Ethic (WE).

I perform PCA at the cohort and period level. Figure 5 presents the eigenvectors of the two first principal components. Links between attitudes are fairly stable across cohorts and periods. These principal components explain more than 50% of the variance in attitudes. I interpret both of them as the two-dimensional structure of universal motivational types of values, as introduced by Schwartz (1992, 2012)—see Figure C.1 in the appendix.

Focusing on the first principal component (PC1), the x-axis directions of vectors highlight attitudes that characterize *conservation*, in the terms of Schwartz (1992), which is the preference for stability, security, tradition and conformity. In terms of attitudes in the data, they reflect taste for Authority, Morale and Work Ethic. Thus, the value which discriminates the most between individuals is *conservation* (versus *openness to change*). The second principal component (PC2) is orthogonal to the previous dimension of values at the cohort-period level. Focusing on the y-axis directions of vectors, they indicate attitudes that characterize *self-transcendence*. This motivational type of values refers to the care and concern about others, reflecting universalism and benevolence. In these data, this value is associated with

attitudes toward Political Cynicism and aversion for Inequality and Work Ethic. Therefore, the second value that discriminates the most individuals is *self-transcendence* (versus *self-enhancement*).

I make a projection of both principal components for all individuals at each period. Thus, each cohort member has a Conservation score ($Cons$) and a Self-Transcendence score ($Trans$) at each period. By construction, both scores are standardized at the cohort-period level and *orthogonal*. Thus, the values are not inter-dependent *per se*. The inter-dependency arises with socio-economic characteristics—such as gender, education, etc.—once they are introduced as control variables. These covariates capture several dimensions of groups to which individuals identify, hence, it creates inter-dependency between values as they are correlated among groups.

3.4 Life events as informational shocks

We are interested in life events that generate an information shock on conservation ($Cons$) or self-transcendence ($Trans$) in order show whether there exist spillover effects or not. The type of life events that I have to consider to test this hypothesis requires two properties: *exogeneity* and *non-reversibility*. On the one hand, the life event has to be exogenous so that values at previous period do not influence the likelihood that the life event occurs. On the other hand, the life event has to be non-reversible. Otherwise, the probability to reverse the event is likely to be endogenous which would bias the estimate of individual's values at the time of interviews.

In this regard, I focus on two life events that satisfy both properties, namely, *to have ever had cancer* and *to have a girl as first child conditional on having a baby*. The former life event is exogenous in the sense that values, such as conservation and self-transcendence, do not affect the probability to have cancer—excluding individuals with a lung cancer. It is also non-reversible because I compare individuals who have *ever* had cancer with respect to people who never had one. The focus is set on the information shock on values related to the fact that people have known they have a cancer, not on the illness *per se* as someone might have one without knowing it.

For the latter life event, I consider a sub-sample that only contains individuals who have at least one baby, hence, I compare those who gave birth to a girl as a first child with those who got a boy. Thus, the life event is exogenous to values because the probabilities of child's

sex at birth are fifty-fifty, assuming that sex-selective abortion is very rare in the UK.[8] Once the baby is born, the life event is non-reversible because it has occurred and remains for ever. I do not also consider adopted child because the sex may be decided by parents and therefore linked to values and preferences (Dahl and Moretti 2008). I also exclude stillborn babies because the socialization of parents with the baby does not occur.

I only focus on the first child as fertility decisions for the following children might be linked to the sex of the eldest child and values, e.g. a preference for diversity in children birth sex. Moreover, some parents may have a boy as first child and a girl thereafter. Some changes in values may be specific to have a girl even though she is not the first baby. Thus, this is likely to produce a lower-bound estimate and also to reduce the statistical power of effects of this life event on values.

In the later of the paper, I study the role of unemployment on values as it is an sizeable information shock in individuals' life. Nonetheless, I cannot use it as a life event to show the existence of spillover effects among values because it does not satisfy both properties. First, individuals change their activity status quite often and, therefore, the effect of unemployment on values is all the time affected by these changes in status. Second, the likelihood to be unemployed is clearly endogenous to values. For instance, individuals with high work ethic, so high conservation and low self-transcendence, have a lower probability to be unemployed as they are less likely to quit their job with respect to people with low work ethic.

3.5 Variables and summary statistics

For life events, I focus on three of them: to have had a girl as first child, to have ever had cancer, and to have ever been unemployed. $GirlFirst$ is a dummy variable that equals one if the sex of the first child is female, and 0 if it is a male. $GotCancer$ is also a dummy variable that equals one if the individual has ever had a cancer by the time of the interview. $BeenUnemp$ is a dummy variable that equals one if the individual has ever been unemployed at least one month by the time of the interview. Activity status are derived from the full activity histories to the nearest month since cohort members are 16 years old. These data are available for all cohort members until the last interview they have participated in. When individuals were missing in previous interviews, interviewers asked them about their activities during the period until then.

I consider several socio-economic characteristics as control variables that will introduce

[8] Dubuc and Coleman (2007) argue that sex-selective abortion occurs among mothers born in India and living in Britain. They show that sex ratios at birth have always been one point lower for Asian groups in England and Wales before 1990. Although this issue raises several social and economic concerns, it does not statistically affect my results as they represent a minority in the data.

Table 3: Summary statistics.

	NCDS58 - N = 30,552					BCS70 - N = 27,906				
Variable	Mean	SD	Min	Max	NA	Mean	SD	Min	Max	NA
Period 1 - Twenties						0.31	0.46	0	1	0
Period 2 - Thirties	0.35	0.48	0	1	0	0.40	0.49	0	1	0
Period 3 - Forties	0.37	0.48	0	1	0	0.29	0.45	0	1	0
Period 4 - Fifties	0.28	0.45	0	1	0					
Female	0.51	0.50	0	1	0	0.53	0.50	0	1	0
Education - Primary	0.62	0.49	0	1	0	0.52	0.50	0	1	0
Education - Secondary	0.19	0.39	0	1	0	0.19	0.39	0	1	0
Education - Tertiary	0.20	0.40	0	1	0	0.29	0.46	0	1	0
Girl First	0.49	0.50	0	1	7199	0.48	0.50	0	1	14789
Got Cancer	0.03	0.16	0	1	0	0.01	0.12	0	1	0
Been Unemployed	0.34	0.48	0	1	0	0.21	0.41	0	1	0

Notes: This table presents the descriptive statistics of variables used in the study. Values and attitudes are not displayed in this table as they are standardized.

the inter-dependency between values. Among them, I use the sex at birth of cohort members and their level of education based on the highest academic qualification they obtained. $Female$ is a dummy variable that equals one if the cohort member is born as a female. I regroup education levels into three categories that characterize primary, secondary and tertiary education levels ($Educ$).

Table 3 presents the descriptive statistics for the NCDS58 and BCS70 cohorts. Both cohorts contain respectively 30,552 and 27,906 observations. Period variables corresponds to dummy variables to determine the decade in which individuals are.

4 Empirical results

The empirical work aims to investigate the presence of spillover effects across values and how they behave. I proceed in several steps. First, I investigate the effect of both exogenous life events, which characterize the informational shocks, on conservation and self-transcendence values but independently. I observe that only the conservativeness is affected. Second, I show the presence of spillover effects by instrumenting conservative values with the life event. Third, I raise the issue of two-side effect in the case of unemployment as unemployment does affect both values at the same time, hence, the identification using instrumental variables does not hold in this setting.

Table 4: Effect of life events on values.

	Linear regression - OLS			
	GirlFirst		GotCancer	
	(Cons)	(Trans)	(Cons)	(Trans)
Life event	0.032**	0.000	0.088***	0.019
	(0.013)	(0.012)	(0.034)	(0.032)
Value_{t-1}	0.545***	0.486***	0.560***	0.502***
	(0.006)	(0.005)	(0.005)	(0.005)
R^2	0.371	0.261	0.392	0.267
Adj. R^2	0.371	0.260	0.392	0.266
Num. obs.	23354	23354	32885	32885

Notes: $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. Standard errors between parentheses. Control variables include gender, education (primary, secondary, tertiary), cohort fixed effects and period fixed effects. Male in the NCDS cohort in his forties with primary education as the reference group. GirlFirst and GotCancer are the life events. In GirlFirst regressions, parents who have had a boy as a first child are the reference group. In GotCancer regressions, individuals who never had a cancer are the reference group. Table D.1 in the appendix presents all the coefficients.

4.1 Effect of life events on values

I estimate *independently* with OLS the effect of the life event $z \in Z = \{GotCancer, GirlFirst\}$ on value $v \in V = \{Cons, Trans\}$ for an individual i in period t with the following equation:

$$v_{it} = \alpha + \beta \times z_{it} + \eta \times v_{i,t-1} + X_i\delta + u_{it} \tag{8}$$

where X are control variables including gender, education, along with period and cohort fixed effects.

Table 4 summarizes the coefficients. Coefficients associated to the life event are positive and significant in both (Cons) columns; while they are not significant in (Trans) ones. Parents who have had a girl as first child, instead of a boy, tend to hold more conservative values, about 0.032 standard deviation, without any statistical difference in their values about self-transcendence. Individuals who have ever had a cancer seem to be more conservative, by 0.088 standard deviation, although they do not differ from others in terms of self-transcendence versus self-enhancement.

Coefficients associated to the lag of the value lie around 0.55 standard deviation for conservation and around 0.49 standard deviation for self-transcendence. This pattern indicates that conservative values are more correlated over periods than self-transcendence values. In terms of the theoretical framework, it provides evidences that the time consistency may be

Table 5: IV Estimate of the spillover effect.

	IV regression - 2SLS			
	GirlFirst		GotCancer	
	(Stage 1)	(Stage 2)	(Stage 1)	(Stage 2)
Life event	0.032**		0.088***	
	(0.013)		(0.034)	
$\widehat{\text{Cons}}_t$		−0.319***		−0.345***
		(0.009)		(0.007)
Value_{t-1}	0.545***	0.481***	0.560***	0.491***
	(0.006)	(0.005)	(0.005)	(0.005)
R^2	0.371	0.297	0.392	0.312
Adj. R^2	0.371	0.296	0.392	0.312
Num. obs.	23354	23354	32885	32885

Notes: $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. Standard errors between parentheses. Control variables include gender, education (primary, secondary, tertiary), cohort fixed effects and period fixed effects. Male in the NCDS cohort in his forties with primary education as the reference group. GirlFirst and GotCancer are the life events. In GirlFirst regressions, parents who have had a boy as a first child are the reference group. In GotCancer regressions, individuals who never had a cancer are the reference group. Table D.2 in the appendix presents all the coefficients.

more important in terms of conservative values.

4.2 Spillover effects

To test the existence of spillover effects, I estimate instrumental variable (IV) regressions using two-stage least squares (2SLS). I assume that the informational shock associated to the life event (z) affects the conservative value ($Cons$) but not the self-transcendence ($Trans$). Thus, by instrumenting $Cons_t$ with z—conditional on $Cons_{t-1}$—in a first stage, I am able to test whether there is spillover effect in the second stage in which I regress $Trans_t$ on the predicted $Cons_t$—conditional on $Trans_{t-1}$. The two stages of the 2SLS estimate can be written as:

$$Cons_{it} = \alpha_1 + \beta_1 \times z_{it} + \eta_1 \times Cons_{i,t-1} + X_i\delta_1 + \varepsilon_{it}, \qquad \text{(IV - Stage 1)}$$

$$Trans_{it} = \alpha_2 + \beta_2 \times \widehat{Cons}_{it} + \eta_2 \times Trans_{i,t-1} + X_i\delta_2 + u_{it}, \qquad \text{(IV - Stage 2)}$$

where $\widehat{Cons}$ are the predicted $Cons$ and X are control variables including gender, education, along with period and cohort fixed effects.

Table 5 summarizes the coefficients for the IV regressions. In both first-stage regressions,

the information shock on conservation due to the life event is positive and significant. To have a girl instead of a boy as a first child increases conservation by 0.032 standard deviation, while to have ever had a cancer raises conservation by 0.088 standard deviation.

In both second-stage regressions, the spillover effect is negative and significant. For the first life event, a one-standard-deviation increase in conservation decreases self-transcendence by 0.319 standard deviation; while an increase of the same magnitude for the second life event also reduces self-transcendence by 0.345 standard deviation. As the values associated to self-transcendence decrease, it means that those related to self-enhancement increase.

Both exogenous and irreversible life events show that if spillover exist, they account for a third of the information shock. Nonetheless, the identification relies on the assumption that the information shock, associated to the life event, does not directly affect self-transcendence, i.e. $Trans \perp z$. Nonetheless, this assumption is likely to be too strong, even for those life events.

The identification of the spillover effect in the latter estimates relies on the exclusion restriction that assumes that the information shock characterized by the life event affects only one value. This assumption does not hold for any information shock that would have two-side effect, that is, would affect both values at the same time. Thus, I turn to simultaneous equations model which provides less restrictive assumptions for identification.

5 Simultaneous equations model

To generalize the role of inter-dependency between values, I test the presence of spillover effects in a context where informational shocks can change both values. I consider a Simultaneous Equations Model (SEM) in which individuals' values are jointly determined, also determined by their own previous values and related to individual characteristics. Each observation consists in an individual i observed in period t. With two values, the structural form of the SEM can be written in matrix notation as

$$V_{i,t}\Gamma = z_{i,t}\Theta + V_{i,t-1}H + X_iB + U_{i,t} \tag{9}$$

where $V_{i,t} = \begin{bmatrix} Cons_t & Trans_t \end{bmatrix}$ is the matrix of dependent values in period t; $\Gamma = \begin{pmatrix} 1 & -\gamma_2^1 \\ -\gamma_1^2 & 1 \end{pmatrix}$ describes the relation between values; z is a dummy vector which indicates whether the life event Z occurred; $\Theta = \begin{pmatrix} \theta_1 \\ \theta_2 \end{pmatrix}$ captures the effect of the life event on each value;

$H = \begin{pmatrix} \eta_1 & 0 \\ 0 & \eta_2 \end{pmatrix}$ describes the relation between a value in period t and this same value in period $t-1$; X are the individual characteristics vector including the intercept; B corresponds to all coefficients that are associated to X; and U is a matrix of the error terms.

Multiplying equation (9) by the inverse of the Γ matrix leads to the reduced form of the SEM such as

$$V_{i,t} = z_{i,t}\Phi + V_{i,t-1}\Psi + X_i\Pi + \epsilon_{i,t}, \tag{10}$$

where $\Phi = \Theta\Gamma^{-1}$, $\Psi = H\Gamma^{-1}$, $\Pi = B\Gamma^{-1}$, and $\epsilon = U\Gamma^{-1}$.

Identification. The *rank condition* is satisfied for both equations because the number of excluded endogenous variables in the reduced form, i.e. either $Cons_t$ or $Trans_t$, is equal to the number of excluded exogenous variables in the structural form, i.e. either $Trans_{t-1}$ or $Cons_{t-1}$. Thus, the SEM can be identified.

The identification relies on the assumption that $Cons_{t-1}$ does not affect $Trans_t$ and that $Trans_{t-1}$ does not affect $Cons_t$. As I suppose that values are permanently adjusted over time in order to have consistent values, it implies that, for instance, any change in $Trans_{t-1}$ can affect $Cons_t$ only through $Cons_{t-1}$. In addition, the *order condition* is also satisfied for both equations because the number of excluded exogenous variables, i.e. $Cons_{t-1}$ and $Trans_{t-1}$, is also equal to the number of included endogenous variables, i.e. $Cons_t$ and $Trans_t$. Therefore, the SEM is exactly identified.

In the SEM, the identification assumption requires that one value is not directly affected by the lag of the other value. Thus, this assumption is less restrictive compared to the one in the IV approach for which the information shock had to only affect one value and not the other.

Decomposition of the total effect. From the reduced form equation (10), it is possible to decompose the total effect of the life event z on value $v \in V = \{v, -v\}$ as the sum of a direct effect (information shock) and an indirect effect (spillover effect), namely

$$\phi_v = \underbrace{\tilde{\gamma}_v^v \times \theta_v}_{\text{Direct effect}} + \underbrace{\tilde{\gamma}_v^{-v} \times \theta_{-v}}_{\text{Indirect effect}}, \tag{11}$$

where ϕ_v is the total effect of the life event Z on value v, $\tilde{\gamma}_v^v$ is the element on the diagonal of Γ^{-1} associated to the value v, $\tilde{\gamma}_v^{-v}$ is the off-diagonal element of Γ^{-1} on the same column, while θ_v and θ_{-v} are respectively the information shocks associated to the life event Z on values v and $-v$ from the structural form.

Estimation method. I use a 2SLS estimation method to estimate the SEM. Thus, I instrument the endogenous variables of each equation with all exogenous variables from

all equations. In a first step, I estimate the reduced form in equation (10) and obtain the predicted values, i.e. $\widehat{Cons}_t$ and $\widehat{Trans}_t$.

In a second step, I estimate the structural form in equation (9) in which I replace the endogenous variables with the predicted values obtained in the first step. Thus, I estimate the following system of equations:

$$\widetilde{V}_{i,t}\Gamma = z_{i,t}\Theta + V_{i,t-1}H + X_iB + U_{i,t}$$

where $\widetilde{V}_{i,t} = \begin{bmatrix} v_t & -\hat{v}_t \end{bmatrix}$ in which v_t is the dependent value and $-\hat{v}_t$ encompasses the predictions of the endogenous value from the first step estimate. The 2SLS estimates of the simultaneous equations model for all the life events, which are analyzed below, are available in Appendix D.

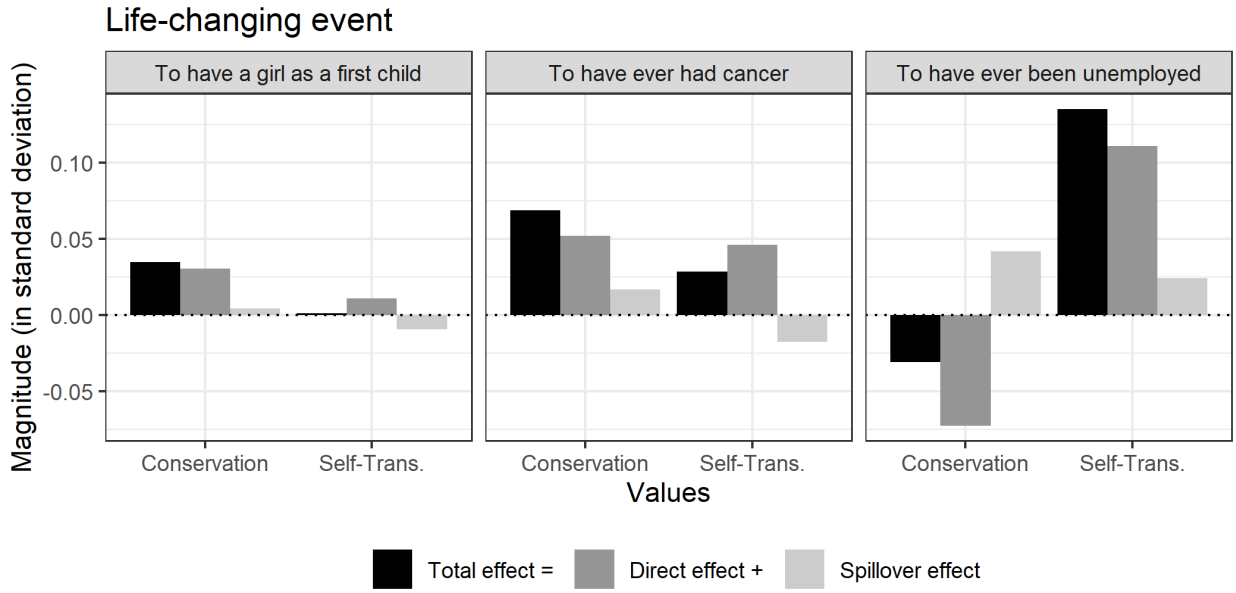
5.1 Effect of life events on values

I start by examining the decomposition of the total effect for both exogenous and non-reversible life events. First, I decompose the total effect of having a girl, instead of a boy, as first child on values. Second, I also decompose the total effect of having ever had a cancer on values. Then, I look at the effect of having ever known unemployment on values and discuss the bias due to the endogeneity issue. Figure 6 summarizes the decomposition of the total effect of these three life events.

Having a girl as first child directly increases conservative values by 0.03 standard deviation and self-transcendence by 0.011 standard deviation. Due to the consistency of values, about 14% of the increase in conservation is amplified by the raise in self-transcendence that has a positive impact on conservatism. Meanwhile, the increase in conservation totally offsets the increase in self-transcendence, leading to a total effect that is negative although close to zero. Thus, due to the consistency of values and therefore the offsetting effect, self-transcendence does not increase when an individual gets a girl as first child rather than a boy, while conservation does increase.

Having ever had cancer increases conservation by 0.052 standard deviation and self-transcendence by 0.046 standard deviation. Due to values consistency, the increase in self-transcendence also increases conservative values through the spillover effect by 0.017 standard deviation, which represents a fourth of the total effect of the life event on conservation. Meanwhile, part of the effect on self-transcendence is offset by the spillover effect of the life event through conservation. As conservation raises, it also decreases self-transcendence by -0.018 standard deviation which corresponds to more than a third of the direct effect of having ever had a cancer on self-transcendence. Thus, without the consistency of values, the

Figure 6: Decomposition of the effect of life-changing events on values.



Notes: This figure presents the decomposition of the total effect of each life-changing event on both values, Conservation and Self-Transcendence. The magnitude of each effect is expressed in standard deviation. Decompositions are respectively derived from tables D.7, D.8 and D.9.

increase in self-transcendence would have been 61.9% much larger.

Focusing on the third panel of figure 6, those who have ever been unemployed experience a direct decline in conservatism, i.e. an increase in openness to change, by -0.073 standard deviation and a direct increase in self-transcendence by 0.111 standard deviation. The spillover effect of the decline in conservatism increases the self-transcendence by 0.024 standard deviation Thus, the self-transcendence raises by 21.7% due to the spillover effect. Meanwhile, the increase in self-transcendence leads to a positive spillover effect on conservative values which offsets half of the direct raise in openness to change. As a result, the increase in conservation is dampen by the spillover effect whereas self-transcendence increases substantively.

In the extension of the theoretical framework in Appendix F, I show that there is a bias when measuring the effect of an endogenous life event—such as unemployment—on values and I derive its expression. The bias does not affect the relative share of the total effect due to the direct and spillover effects, neither the sign of the latter. However, the bias may affect the magnitude of the effect. In an extreme case of endogeneity of unemployment to values, the magnitudes have to be multiplied by a factor of 2/5, whereas feasible scenarii are likely to lie with a scale factor ranging from 1 (no endogeneity) to 2/3.

5.2 Role of the consistency of values

Values consistency drives the magnitude of the spillover effects of life events on values. In the simultaneous equations model, the matrix Γ captures the relation between values within the structural form. Once we consider the estimated reduced form for the decomposition, the spillover effects appear through Γ^{-1}. For instance, in the case of the girl-first life event, the Γ matrix corresponds to

$$\Gamma = \begin{pmatrix} 1 & 0.329 \\ -0.365 & 1 \end{pmatrix} \implies \Gamma^{-1} = \begin{pmatrix} 0.893 & -0.294 \\ 0.326 & 0.893 \end{pmatrix}.$$

In the case of the other life events, the coefficients associated to the matrix Γ are very close to these ones.[9] Thus, the effect of the life event Z on values is derived from the matrix product of $\Theta = \begin{pmatrix} \theta_{Cons} & \theta_{Trans} \end{pmatrix}$ and the propagation matrix Γ^{-1} that accounts for spillover effects. Considering the effect of the life event Z on both values as a homogeneous system of first-order linear differential equations leads to

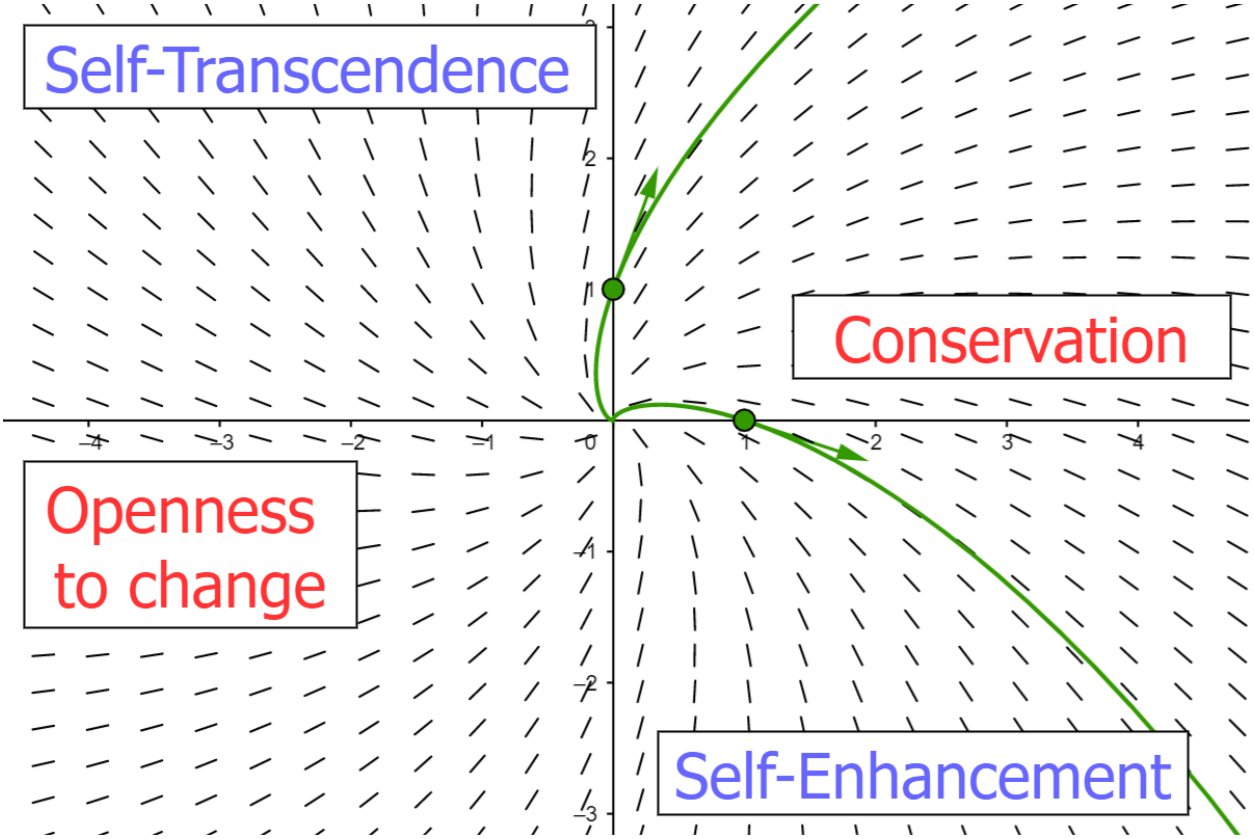
$$\begin{aligned} x' &= 0.893x + 0.326y, \\ y' &= -0.294x + 0.893y, \end{aligned}$$

where x and y are the magnitudes of both information shocks from Θ, whereas x' and y' corresponds to the net effects on values from Φ.

Solving this system, it leads to complex eigenvalues with positive real parts. This is due to the facts that, in Γ, the coefficients on the diagonal are equal to one and both off-diagonal coefficients have opposite signs. Figure 7 describes the phase plane of this system. Green dots are set to 1 on both axis, thus, the green arrows describes what happens for a one-standard-deviation increase on either the x-axis or the y-axis, i.e. in conservation or in self-transcendence. An increase in conservatism has a negative spillover effect on self-transcendence while an increase in self-transcendence has a positive spillover effect on conservatism. Thus, the relationship between values is *not reciprocal* because of the spiral pattern in the system of first-order linear differential equations that is derived from the propagation matrix Γ.

[9] See tables D.5 and D.6 in the appendix from which the Γ matrix can be derived.

Figure 7: Phase plane of the relation between values.



Notes: This figure presents the phase plane of the homogeneous system of first-order linear differential equations that describes the relationship between conservation (versus openness to change) and self-transcendence (versus self-enhancement) values. Green arrows decompose the direct effect and the indirect effect, i.e. spillover effect, due to an increase of 1 standard deviation in each value.

6 Summary and concluding remarks

An extensive literature has studied the effect of life experiences on beliefs—such as preferences or values—but supposing that they are independent. I present a framework that jointly analyzes the dynamics of values over the lifecycle when life events provide information shocks on values in a context where values are correlated in society. My results suggest that values inter-dependence plays an important role as individuals seek to be consistent in the dynamics of their values and with respect to values held in the group to which they identify. I show that spillover effects account for a third of the magnitude of information shocks on values after life-changing events.

The main limitation of the paper relates to the non-reciprocal pattern of the spillover effects across values. They are the result of several forces among individual's values which try to achieve cognitive consistency. Although I show that spillover effects exist, the observed

spiral pattern remains a puzzle that I intend to address in future research.

This paper raises an issue that as not been considered yet, namely, the consistency among values at the individual level in a context of inter-dependent values which could be incorporated in future work in order to study the complex effects of socio-economic decisions (labor supply decisions, educational choices, i.a.) or life events (disease, discrimination, i.a.) on values. Consistency may also be the ground for future research to investigate the mechanisms of the rising polarization in beliefs, values and preferences.

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Appendices

A Model details

This appendix presents the details of the theoretical framework.

Proof of Proposition 1. The value converges as $\lim_{t\to+\infty} a_t = a^\star$ since $(\eta_a, \phi_a) \in (\mathbb{R}_+^\star)^2$. The rate of convergence $\eta_a/(\eta_a + \phi_a)$ is a decreasing in ϕ_a/η_a. The smaller the rate of convergence, the faster the speed of convergence. Therefore, the speed of convergence is an increasing function of the relative weight of the group consistency with respect to the time consistency in the utility function. ■

Proof of Proposition 2. $\forall s_t \in \{\underline{s}, \overline{s}\}, \forall a_t \in \mathbb{R},\ \exists \Delta a_t > \Delta\tilde{a}_t$ such that $\lim_{t\to+\infty} a_{t+1} = a^\star(-s_t)$ ■

Details to derive figure 3. Suppose both values are positively correlated in society, thus, $\overline{b} > 0 > \underline{b}$. There are three cases of interest about the shock Δa_0. First, the shock is negative, i.e. $\Delta a_0 < 0$. Hence, $\Delta a - (\overline{a} - \underline{a}) < 0$ which implies that the sign within the first square brackets of equation (7) has to be inverted. The indirect utilities become $U_1(\overline{s}) = -\gamma_a \left[(\overline{a} - \underline{a}) - \Delta a_0\right] - \gamma_b \left[\overline{b} - \underline{b}\right]$ and $U_1(\underline{s}) = \gamma_a \Delta a_0$. Thus,

$$U_1(\overline{s}) > U_1(\underline{s}) \ \Leftrightarrow\ \overline{b} - \underline{b} < -\gamma(\overline{a} - \underline{a}).$$

Second, the shock is positive and large, i.e. $\Delta a_0 > \overline{a} - \underline{a}$. Hence, $\Delta a_0 - (\overline{a} - \underline{a}) > 0$. The indirect utilities become $U_1(\overline{s}) = -\gamma_a \left[\Delta a_0 - (\overline{a} - \underline{a})\right] - \gamma_b \left[\overline{b} - \underline{b}\right]$ and $U_1(\underline{s}) = -\gamma_a \Delta a_0$. Thus,

$$U_1(\overline{s}) > U_1(\underline{s}) \ \Leftrightarrow\ \overline{b} - \underline{b} < \gamma(\overline{a} - \underline{a}).$$

Third, the shock is positive but small, i.e. $\Delta a_0 \in [0, \overline{a} - \underline{a}]$. Hence, $\Delta a_0 - (\overline{a} - \underline{a}) < 0$ which implies that the sign within the first square brackets of equation (7) has to be inverted. The indirect utilities become $U_1(\overline{s}) = -\gamma_a \left[(\overline{a} - \underline{a}) - \Delta a_0\right] - \gamma_b \left[\overline{b} - \underline{b}\right]$ and $U_1(\underline{s}) = -\gamma_a \Delta a_0$. Thus,

$$U_1(\overline{s}) > U_1(\underline{s}) \ \Leftrightarrow\ \Delta a_0 > \Delta\tilde{a}_0 \equiv \frac{\overline{a} - \underline{a}}{2} + \frac{1}{\gamma}\frac{\overline{b} - \underline{b}}{2}.$$

When the informational shock is larger than the indifference shock $\Delta\tilde{a}_0$, the agent identifies to the other group. The indifference value is therefore

$$\tilde{a}_0 = \frac{\overline{a} + \underline{a}}{2} + \frac{1}{\gamma}\frac{\overline{b} - \underline{b}}{2},$$

which is an increasing function of the distance between both group-average value b. When both values are negatively correlated in society, i.e. $\overline{b} < 0 < \underline{b}$, the indifference value becomes

a decreasing function of the distance between both group-average value b.

B Statement details

This appendix presents the details of statements according to attitudes. These details have been split into three tables, namely, tables B.1, B.2 and B.3.

Table B.1: Statements details by attitudes - Part 1/3.

Variable	Question	Rev
Authority (A)		
A1	The law should be obeyed, even if a particular law is wrong?	
A2	For some crimes the death penalty is the most appropriate sentence?	
A3	Censorship of films and magazines is necessary to uphold moral standards?	
A4	People who break the law should be given stiffer sentences?	
A5	Young people today don't have enough respect for traditional British values?	
A6	Schools should teach children to obey authority?	
Anti-Racism (AR)		
AR1	It is alright for people from different races to get married?	
AR2	I would not mind if a family from another race moved in next door to me?	
AR3	I would not mind if my child went to a school where half the children were of another race?	
AR4	I would not mind working with people from other races?	
AR5	I would not want a person from another race to be my boss?	X
Children (C)		
C1	Unless you have children you'll be lonely when you get old?	
C2	People can have a fulfilling life without having children?	X
C3	Having children seriously interferes with the freedom of their parents?	X
C4	People who never have children are missing an important part of life?	
Environment (E)		
E1	Problems in the environment are not as serious as people claim?	X
E2	We should tackle problems in the environment even if this means slower economic growth?	
E3	Preserving the environment is more important than any other political issue today?	

Notes: The *Rev* column indicates whether the scale has been reversed in the analysis.

Table B.2: Statements details by attitudes - Part 2/3.

Variable	Question	Rev
Inequality Aversion (IA)		
IA1	Big business benefits owners at the expense of the workers?	
IA2	Private schools should be abolished?	
IA3	Management will always try to get the better of employees if it gets the chance?	
IA4	The time has come for everyone to arrange their own private health care and stop relying on the NHS?	X
IA5	Ordinary working people do not get their fair share of the nation's wealth?	
IA6	Government should redistribute income from the better off to those who are less well off?	
IA7	There is one law for the rich and one for the poor?	
Information Technology (IT)		
IT1	Computers at work are destroying people's skills?	X
IT2	Computers enrich the lives of those who use them?	
IT3	Every family should have a computer?	
IT4	Learning to use a computer is more trouble than it's worth?	X
Learning (L)		
L1	You are more likely to get a better job if you do some learning, training or education?	
L2	For getting jobs, knowing the right people is more important than the qualifications?	X
L3	Learning about new things boosts your confidence?	
L4	The effort of getting qualifications is more trouble than it's worth?	X
Morale (MOR)		
MOR1	Divorce is too easy to get these days?	
MOR2	Married people are generally happier than unmarried people?	
MOR3	Couples who have children should not separate?	
MOR4	Marriage is for life?	
MOR5	All women should have the right to choose an abortion if they wish?	X
MOR6	It is alright for people to have children without being married?	X

Notes: The *Rev* column indicates whether the scale has been reversed in the analysis.

Table B.3: Statements details by attitudes - Part 3/3.

Variable	Question	Rev
Political Cynicism (PC)		
PC1	None of the political parties would do anything to benefit me?	
PC2	It does not really make much difference which political party is in power in Britain?	
PC3	Politicians are mainly in politics for their own benefit and not for the benefit of the community?	
Work-Ethic (WE)		
WE1	Having almost any job is better than being unemployed?	
WE2	If I didn't like a job I'd pack it in, even if there was no other job to go to?	X
WE3	Once you've got a job it's important to hang on to it even if you don't really like it?	
Working Mother (WM)		
WM1	A pre-school child is likely to suffer if his or her mother works?	X
WM2	All in all, family life suffers when the mother has a full time job?	X
WM3	Children benefit if their mother has a job outside the home?	
WM4	A mother and her family will all be happier if she goes out to work?	
WM5	A father's job is to earn money; a mother's job is to look after the home and family?	X

Notes: The *Rev* column indicates whether the scale has been reversed in the analysis.

C Principal component analysis

This appendix presents the principal components eigenvectors from the Principal Component Analysis (PCA) in section 3. Table C.1 presents the eigenvectors for the BCS70 cohort, while table C.2 displays those for the NCDS58 cohort.

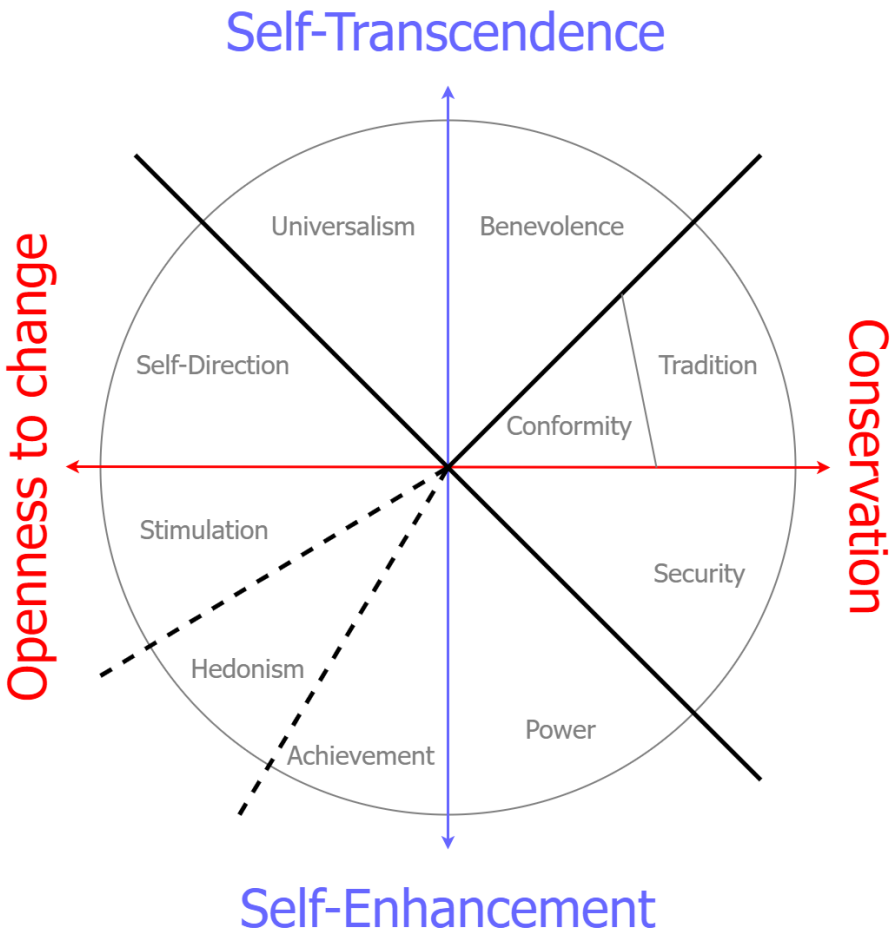
Table C.1: Principal components eigenvectors for the BCS70 cohort.

	PC1	PC2	PC3	PC4	PC5
Age 26					
Authority	0.622	0.011	0.136	-0.146	-0.757
Inequality Aversion	-0.182	0.686	-0.533	0.348	-0.303
Morale	0.521	0.244	-0.453	-0.513	0.449
Political Cynicism	0.149	0.656	0.695	0.065	0.245
Work Ethic	0.535	-0.200	-0.093	0.769	0.272
Standard deviation	1.262	1.087	0.929	0.866	0.783
Proportion of Variance	0.319	0.236	0.173	0.150	0.123
Cumulative Proportion	0.319	0.555	0.727	0.877	1.000
Age 30					
Authority	0.614	-0.162	-0.050	0.281	-0.718
Inequality Aversion	0.153	0.702	0.013	-0.638	-0.278
Morale	0.534	-0.109	-0.678	-0.202	0.450
Political Cynicism	0.326	0.605	0.221	0.592	0.359
Work Ethic	0.456	-0.321	0.699	-0.351	0.276
Standard deviation	1.243	1.137	0.918	0.827	0.797
Proportion of Variance	0.309	0.259	0.169	0.137	0.127
Cumulative Proportion	0.309	0.568	0.736	0.873	1.000
Age 42					
Authority	0.570	-0.360	-0.004	-0.519	-0.526
Inequality Aversion	0.172	0.722	0.172	0.280	-0.584
Morale	0.462	-0.048	-0.749	0.466	0.079
Political Cynicism	0.517	0.474	0.122	-0.368	0.598
Work Ethic	0.406	-0.350	0.628	0.548	0.135
Standard deviation	1.184	1.124	0.968	0.882	0.787
Proportion of Variance	0.281	0.253	0.187	0.156	0.124
Cumulative Proportion	0.281	0.533	0.721	0.876	1.000

Table C.2: Principal components eigenvectors for the NCDS58 cohort.

	PC1	PC2	PC3	PC4	PC5
Age 33					
Authority	0.607	-0.150	0.155	-0.546	0.535
Inequality Aversion	0.006	0.730	-0.072	0.353	0.580
Morale	0.548	-0.077	0.551	0.591	-0.201
Political Cynicism	0.276	0.654	0.053	-0.414	-0.567
Work Ethic	0.504	-0.102	-0.815	0.237	-0.122
Standard deviation	1.250	1.162	0.901	0.851	0.741
Proportion of Variance	0.313	0.270	0.162	0.145	0.110
Cumulative Proportion	0.313	0.583	0.745	0.890	1.000
Age 42					
Authority	0.605	-0.141	-0.156	0.369	0.674
Inequality Aversion	0.173	0.713	0.178	-0.559	0.342
Morale	0.500	-0.245	-0.542	-0.534	-0.333
Political Cynicism	0.446	0.521	0.038	0.480	-0.546
Work Ethic	0.395	-0.375	0.805	-0.187	-0.144
Standard deviation	1.258	1.101	0.916	0.875	0.775
Proportion of Variance	0.317	0.242	0.168	0.153	0.120
Cumulative Proportion	0.317	0.559	0.727	0.880	1.000
Age 50					
Authority	0.531	-0.134	0.063	-0.816	-0.173
Inequality Aversion	0.554	0.296	-0.075	0.441	-0.637
Morale	0.157	-0.663	-0.716	0.152	0.018
Political Cynicism	0.578	0.264	-0.063	0.170	0.750
Work Ethic	0.229	-0.620	0.689	0.296	0.033
Standard deviation	1.373	1.046	0.945	0.804	0.694
Proportion of Variance	0.377	0.219	0.179	0.129	0.096
Cumulative Proportion	0.377	0.596	0.775	0.904	1.000

Figure C.1: Two-dimensional structure of universal motivational types of values



Notes: This figure reproduces the two-dimensional structure of motivational types of values from Schwartz (1992, 2012).

D Estimates

This appendix presents the additional regression tables of the paper. Table D.1 presents the long-version table of the regression table 4 in the paper. Table D.2 presents the long-version table of the regression table 5 in the paper. Table D.3 presents the linear regression of having ever been unemployed on values. Table D.4, D.5, and D.6 present the details of the 2SLS estimates of the SEM for, respectively, the girl-first, got-cancer, and been-unemployed life event. Tables D.7, D.8, and D.9 summarize the decomposition of the total effect from the SEM for, respectively, the girl-first, got-cancer, and been-unemployed life event. Figure D.1 summarizes the decomposition of the total effect of girl-first life event by parent. Figure D.2 summarizes the decomposition of the total effect of girl-first life event by education level. Figure D.3 summarizes the decomposition of the total effect of been-unemployed life event according to the current activity status.

Table D.1: Effect of life events on values.

	Linear regression - OLS			
	GirlFirst		GotCancer	
	(Cons)	(Trans)	(Cons)	(Trans)
Intercept	0.217***	−0.160***	0.181***	−0.103***
	(0.027)	(0.025)	(0.020)	(0.019)
Female	−0.194***	0.073***	−0.172***	0.015
	(0.013)	(0.012)	(0.011)	(0.010)
Educ. Secondary	−0.286***	−0.040**	−0.278***	−0.031**
	(0.017)	(0.016)	(0.014)	(0.014)
Educ. Tertiary	−0.522***	−0.033**	−0.501***	−0.029**
	(0.017)	(0.015)	(0.014)	(0.013)
Life event	0.032**	0.000	0.088***	0.019
	(0.013)	(0.012)	(0.034)	(0.032)
Value_{t-1}	0.545***	0.486***	0.560***	0.502***
	(0.006)	(0.005)	(0.005)	(0.005)
R^2	0.371	0.261	0.392	0.267
Adj. R^2	0.371	0.260	0.392	0.266
Num. obs.	23354	23354	32885	32885

Notes: $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. Standard errors between parentheses. Male in the NCDS cohort in his forties with primary education as the reference group. GirlFirst and GotCancer are the life events. In GirlFirst regressions, parents who have had a boy as a first child are the reference group. In GotCancer regressions, individuals who never had a cancer are the reference group. Table 4 in the paper summarizes the coefficients.

Table D.2: IV Estimate of the spillover effect.

	IV regression - 2SLS			
	GirlFirst		GotCancer	
	(Stage 1)	(Stage 2)	(Stage 1)	(Stage 2)
Intercept	0.217***	0.014	0.181***	0.025
	(0.027)	(0.024)	(0.020)	(0.019)
Female	−0.194***	−0.025**	−0.172***	−0.062***
	(0.013)	(0.012)	(0.011)	(0.010)
Educ. Secondary	−0.286***	−0.182***	−0.278***	−0.187***
	(0.017)	(0.016)	(0.014)	(0.014)
Educ. Tertiary	−0.522***	−0.330***	−0.501***	−0.358***
	(0.017)	(0.017)	(0.014)	(0.014)
Life event	0.032**		0.088***	
	(0.013)		(0.034)	
$\widehat{\text{Cons}}_t$		−0.319***		−0.345***
		(0.009)		(0.007)
Value_{t-1}	0.545***	0.481***	0.560***	0.491***
	(0.006)	(0.005)	(0.005)	(0.005)
R^2	0.371	0.297	0.392	0.312
Adj. R^2	0.371	0.296	0.392	0.312
Num. obs.	23354	23354	32885	32885

Notes: $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. Standard errors between parentheses. Control variables include gender, education (primary, secondary, tertiary), cohort fixed effects and period fixed effects. Male in the NCDS cohort in his forties with primary education as the reference group. GirlFirst and GotCancer are the life events. In GirlFirst regressions, parents who have had a boy as a first child are the reference group. In GotCancer regressions, individuals who never had a cancer are the reference group. Table 5 in the paper summarizes the coefficients.

Table D.3: Effect of having ever been unemployed on values.

	Linear regression - OLS	
	(Cons)	(Trans)
Intercept	0.173^{***}	-0.161^{***}
	(0.021)	(0.020)
Female	-0.167^{***}	0.031^{***}
	(0.011)	(0.010)
Educ. Secondary	-0.278^{***}	-0.029^{**}
	(0.014)	(0.014)
Educ. Tertiary	-0.501^{***}	-0.032^{***}
	(0.014)	(0.013)
Been Unemp	0.025^{**}	0.183^{***}
	(0.012)	(0.011)
Value_{t-1}	0.561^{***}	0.492^{***}
	(0.005)	(0.005)
R^2	0.392	0.272
Adj. R^2	0.392	0.272
Num. obs.	32885	32885

Notes: $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. Standard errors between parentheses. Control variables include gender, education (primary, secondary, tertiary), cohort fixed effects and period fixed effects. Male in the NCDS cohort in his forties with primary education as the reference group. Been Unemp. is the life event. Individuals who have never been unemployed are the reference group.

Table D.4: 2SLS estimate of the SEM for the girl-first life event.

	2SLS regression			
	Reduced form (Stage 1)		Structural form (Stage 2)	
	(Cons)	(Trans)	(Cons)	(Trans)
GirlFirst	0.034^{***}	0.001	0.034^{***}	0.012
	(0.013)	(0.012)	(0.013)	(0.012)
Cons_{t-1}	0.549^{***}	-0.174^{***}	0.617^{***}	
	(0.005)	(0.005)	(0.006)	
Trans_{t-1}	0.189^{***}	0.481^{***}		0.541^{***}
	(0.006)	(0.005)		(0.006)
$\widehat{\text{Cons}}_t$				-0.317^{***}
				(0.009)
$\widehat{\text{Trans}}_t$			0.393^{***}	
			(0.012)	
R^2	0.399	0.297	0.399	0.297
Adj. R^2	0.399	0.296	0.399	0.296
Num. obs.	23354	23354	23354	23354

Notes: $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. Standard errors between parentheses. Control variables in all regressions include cohort, period, gender and education.

Table D.5: 2SLS estimate of the SEM for the got-cancer life event.

	2SLS regression			
	Reduced form (Stage 1)		Structural form (Stage 2)	
	(Cons)	(Trans)	(Cons)	(Trans)
GotCancer	0.068^{**}	0.028	0.058^{*}	0.052^{*}
	(0.033)	(0.031)	(0.033)	(0.031)
Cons_{t-1}	0.568^{***}	-0.193^{***}	0.640^{***}	
	(0.004)	(0.004)	(0.005)	
Trans_{t-1}	0.181^{***}	0.491^{***}		0.553^{***}
	(0.005)	(0.005)		(0.005)
$\widehat{\text{Cons}}_t$				-0.340^{***}
				(0.007)
$\widehat{\text{Trans}}_t$			0.369^{***}	
			(0.010)	
R^2	0.417	0.312	0.417	0.312
Adj. R^2	0.417	0.312	0.417	0.312
Num. obs.	32885	32885	32885	32885

Notes: $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. Standard errors between parentheses. Control variables in all regressions include cohort, period, gender and education.

Table D.6: 2SLS estimate of the SEM for the been-unemployed life event.

	2SLS regression			
	Reduced form (Stage 1)		Structural form (Stage 2)	
	(Cons)	(Trans)	(Cons)	(Trans)
BeenUnemp	-0.030^{**}	0.135^{***}	-0.081^{***}	0.125^{***}
	(0.012)	(0.011)	(0.012)	(0.011)
Cons_{t-1}	0.567^{***}	-0.189^{***}	0.638^{***}	
	(0.004)	(0.004)	(0.005)	
Trans_{t-1}	0.183^{***}	0.484^{***}		0.545^{***}
	(0.005)	(0.005)		(0.005)
$\widehat{\text{Cons}}_t$				-0.332^{***}
				(0.007)
$\widehat{\text{Trans}}_t$			0.377^{***}	
			(0.010)	
R^2	0.417	0.315	0.417	0.315
Adj. R^2	0.417	0.315	0.417	0.315
Num. obs.	32885	32885	32885	32885

Notes: $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. Standard errors between parentheses. Control variables in all regressions include cohort, period, gender and education.

Table D.7: Decomposition of the effect of having a girl first on values.

	Direct and indirect effects		Total effect
Value (v)	$\tilde{\gamma}_v^{Cons} \times \theta_{Cons}$	$\tilde{\gamma}_v^{Trans} \times \theta_{Trans}$	ϕ_v
Conservation ($Cons$)	**0.030**	0.004	0.034
	(100.0)	(13.8)	(113.8)
Self-Transcendence ($Trans$)	-0.010	**0.011**	0.001
	(-89.9)	**(100.0)**	(10.1)

Notes: Magnitudes in standard deviations. Direct effects in bold. Relative share with respect to the direct effect in percent between parentheses.

Table D.8: Decomposition of the effect of having ever had a cancer on values.

Value (v)	Direct and indirect effects		Total effect
	$\tilde{\gamma}_v^{Cons} \times \theta_{Cons}$	$\tilde{\gamma}_v^{Trans} \times \theta_{Trans}$	ϕ_v
Conservation ($Cons$)	**0.052**	0.017	0.069
	(100.0)	(32.5)	(132.5)
Self-Transcendence ($Trans$)	-0.018	**0.046**	0.029
	(-38.1)	**(100.0)**	(61.9)

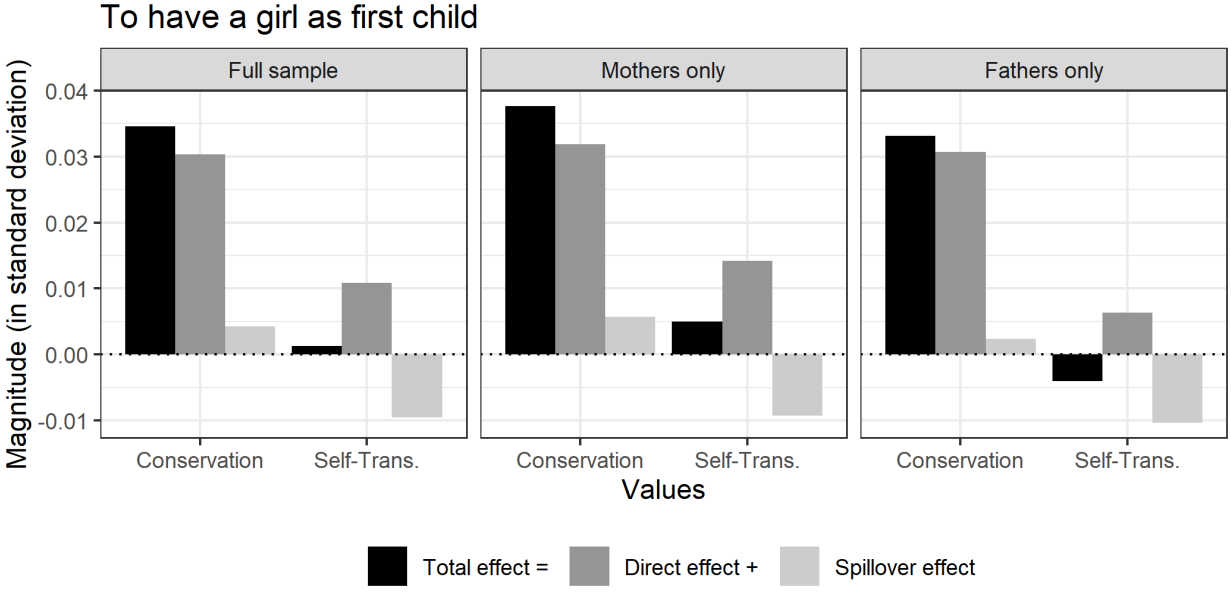
Notes: Magnitudes in standard deviations. Direct effects in bold. Relative share with respect to the direct effect in percent between parentheses.

Table D.9: Decomposition of the effect of having ever been unemployed on values.

Value (v)	Direct and indirect effects		Total effect
	$\tilde{\gamma}_v^{Cons} \times \theta_{Cons}$	$\tilde{\gamma}_v^{Trans} \times \theta_{Trans}$	ϕ_v
Conservation ($Cons$)	**-0.073**	0.042	-0.031
	(100.0)	(-57.2)	(42.8)
Self-Transcendence ($Trans$)	0.024	**0.111**	0.135
	(21.7)	**(100.0)**	(121.7)

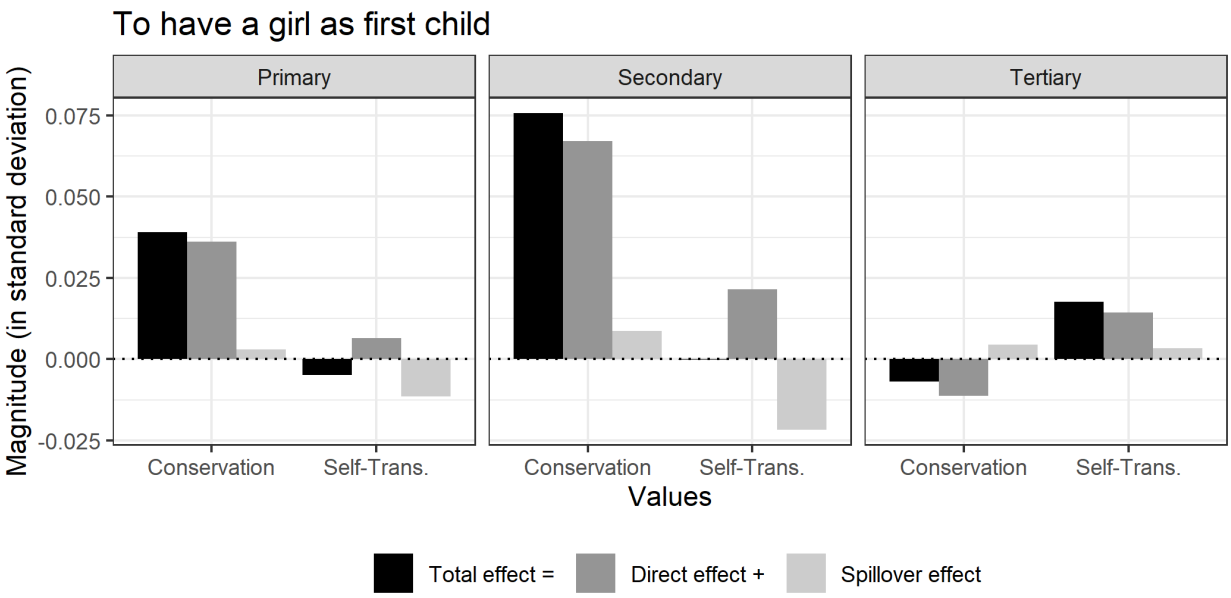
Notes: Magnitudes in standard deviations. Direct effects in bold. Relative share with respect to the direct effect in percent between parentheses.

Figure D.1: Decomposition of the effect of the girl-first life event by parent.



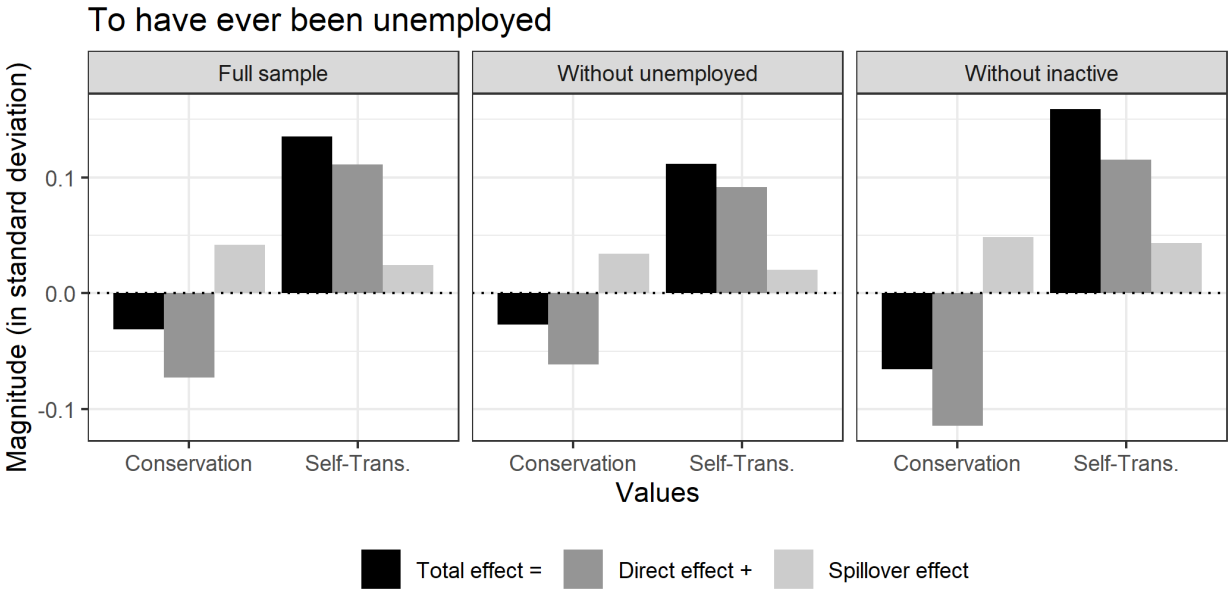
Notes: This figure presents the decomposition of the total effect of the girl-first life event on both values, Conservation and Self-Transcendence, according to the parent. The magnitude of each effect is expressed in standard deviation.

Figure D.2: Decomposition of the effect of the girl-first life event by education.



Notes: This figure presents the decomposition of the total effect of the girl-first life event on both values, Conservation and Self-Transcendence, according to education. The magnitude of each effect is expressed in standard deviation.

Figure D.3: Decomposition of the effect of the been-unemployed life event according to the current activity status.



Notes: This figure presents the decomposition of the total effect of the girl-first life event on both values, Conservation and Self-Transcendence, according to the current activity status. The magnitude of each effect is expressed in standard deviation.

E Additional regressions

This appendix presents additional estimate of the effect of life events on values and attitudes.

I estimate independently with OLS the effect of the life event $z \in Z = \{GotCancer, GirlFirst\}$ on values $V = (Cons, Trans)$ for an individual i in period t with the following equations:

$$Cons_{it} = \alpha_1 + \beta_1 \times z_{it} + \eta_1 \times Cons_{i,t-1} + X_i\delta_1 + u_{it}$$
$$Trans_{it} = \alpha_2 + \beta_2 \times z_{it} + \eta_2 \times Trans_{i,t-1} + X_i\delta_2 + u_{it}$$

where X are control variables including gender and education. Table E.1 and E.2 summarize the coefficients for, respectively, having a girl as first child and having ever had cancer.

Table E.1: Values according to first child's sex.

	Linear regression - 5-attitude Principal Comp.					
	Conservative (Cons)			Self-Transcendence (Trans)		
	(1)	(2)	(3)	(1)	(2)	(3)
Intercept	0.263***	0.455***	0.217***	0.035**	0.135***	−0.064**
	(0.016)	(0.016)	(0.027)	(0.014)	(0.014)	(0.027)
Female	−0.293***	−0.289***	−0.194***	0.001	0.007	0.063***
	(0.013)	(0.013)	(0.013)	(0.012)	(0.012)	(0.013)
Girl first	0.026*	0.026**	0.032**	−0.010	−0.011	−0.002
	(0.013)	(0.013)	(0.013)	(0.012)	(0.012)	(0.013)
Educ. Secondary		−0.404***	−0.286***		−0.345***	−0.139***
		(0.017)	(0.017)		(0.015)	(0.017)
Educ. Tertiary		−0.890***	−0.522***		−0.308***	−0.126***
		(0.016)	(0.017)		(0.015)	(0.016)
Value_{t-1}			0.545***			0.350***
			(0.006)			(0.006)
R^2	0.016	0.098	0.371	0.001	0.022	0.144
Adj. R^2	0.016	0.097	0.371	0.001	0.022	0.144
Num. obs.	34440	34440	23354	34440	34440	23354

Notes: $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. Standard errors between parentheses. Male in the NCDS cohort with primary education and a boy as first child as the reference group.

The coefficient associated to $GirlFirst$ in table E.1 is positive and significant for $Cons$ while it is negative but non-significant for $Trans$. Thus, individuals who have had a girl as first child instead of a boy tend also to have more conservative values without change in their values about self-transcendence. The former effect is even more stronger once we introduce controls about education and lag of conservation. On average, parents who have had a girl instead of a boy as first child hold more conservative values by 0.032 sd.

Table E.2: Values according to getting cancer.

	Linear regression - 5-attitude Principal Comp.					
	Conservative (Cons)			Self-Transcendence (Trans)		
	(1)	(2)	(3)	(1)	(2)	(3)
Intercept	0.090***	0.312***	0.181***	0.034**	0.105***	−0.028
	(0.019)	(0.019)	(0.020)	(0.017)	(0.017)	(0.022)
Female	−0.164***	−0.150***	−0.172***	−0.057***	−0.050***	−0.022*
	(0.010)	(0.010)	(0.011)	(0.009)	(0.009)	(0.012)
Got cancer	0.111***	0.073**	0.088***	0.107***	0.096***	0.045
	(0.037)	(0.036)	(0.034)	(0.033)	(0.033)	(0.036)
Educ. Secondary		−0.370***	−0.278***		−0.241***	−0.169***
		(0.013)	(0.014)		(0.012)	(0.015)
Educ. Tertiary		−0.866***	−0.501***		−0.169***	−0.166***
		(0.012)	(0.014)		(0.011)	(0.014)
Value_{t-1}			0.560***			0.275***
			(0.005)			(0.005)
R^2	0.004	0.084	0.392	0.001	0.009	0.090
Adj. R^2	0.004	0.084	0.392	0.001	0.009	0.089
Num. obs.	58216	58216	32885	58216	58216	32885

Notes: $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. Standard errors between parentheses. Male in the NCDS cohort with primary education and who never had cancer as the reference group.

Focusing on the levels of education, coefficients reveal two patterns. First, a higher level of education is associated with lower conservative values, hence, greater openness to change. Coefficients are significantly different between the three levels of education. Second, individuals with secondary and tertiary levels of education hold more self-enhanced values with respect to those with primary education. Although, coefficients of the secondary and tertiary levels are not statistically different from each other. These patterns point out the fact that conservative values are much more discriminatory than self-transcendence according to the educational level, which is consistent with the ranking of principal components based on the explained variance.

In table E.2, the coefficient associated to $GotCancer$ is positive and significant for $Cons$ and $Trans$, except for the latter once I introduce the lag of the value. Thus, individuals who have ever had a cancer tend to hold more conservative and self-transcendent values. On average, individuals who went through this life event becomes more conservative by 0.088 sd. Coefficients associated to the level of education are close to those obtained in the previous table, showing once again the difference in terms of values between less and more educated individuals.

Since values are derived from attitudes, I look at the effect of these life events on attitudes

in order to understand which attitudes drive the observed shifts in values. Hence, I estimate independently with OLS the effect of the life event $z \in Z = \{GotCancer, GirlFirst\}$ on attitudes Y^j with $j \in \{A, IA, MOR, PC, WE\}$ for an individual i in period t with the following equation:

$$Y_{it}^j = \alpha_j + \beta_j \times Z_{it} + \eta_j \times Y_{it-1}^j + X_i \delta_j + u_{it}$$

where X are control variables. Table E.3 and E.4 summarize the coefficients for, respectively, having a girl as first child and having ever had cancer.

Table E.3: Attitudes according to first child's sex.

	Linear regression - Attitudes				
	(A)	(IA)	(MOR)	(PC)	(WE)
Intercept	0.133***	0.067***	0.136***	0.064***	0.071***
	(0.021)	(0.022)	(0.023)	(0.023)	(0.024)
Female	−0.083***	−0.040***	−0.171***	−0.132***	−0.070***
	(0.010)	(0.011)	(0.011)	(0.011)	(0.012)
GirlFirst	0.038***	0.009	0.004	0.002	0.007
	(0.010)	(0.011)	(0.011)	(0.011)	(0.012)
Educ. Secondary	−0.144***	−0.154***	−0.033**	−0.147***	−0.024
	(0.013)	(0.014)	(0.014)	(0.014)	(0.015)
Educ. Tertiary	−0.338***	−0.237***	−0.049***	−0.314***	−0.078***
	(0.013)	(0.013)	(0.014)	(0.014)	(0.015)
Attitude_{t-1}	0.558***	0.535***	0.533***	0.467***	0.405***
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
R^2	0.378	0.321	0.301	0.271	0.173
Adj. R^2	0.378	0.321	0.300	0.271	0.172
Num. obs.	23483	23443	23460	23458	23408

Notes: $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. Standard errors between parentheses. Male in the NCDS cohort with primary education and a boy as first child as the reference group.

Table E.3 indicates that having a girl as first child is associated with an increase in attitudes towards Authority (A) by 0.038 sd. One mechanism explaining this could be that parents internalize that their girl is more likely to be exposed to abuse or bad behaviors with respect to a boy, therefore, they increase their support towards a more authoritarian society. Other coefficients are also positive but not significantly different from zero. Since authority is strongly associated with conservation and much less with self-transcendence, see figure 5, it is consistent with the fact that we observe only a shift in the former and not in the latter in table 4.

Table E.4 shows that individuals who have ever had a cancer tend also to increase their attitudes towards Inequality Aversion (IA) by 0.043 sd., although not significant, and towards

Table E.4: Attitudes according to getting cancer.

	Linear regression - Attitudes				
	(A)	(IA)	(MOR)	(PC)	(WE)
Intercept	0.105***	0.027	0.073***	0.089***	0.046**
	(0.016)	(0.017)	(0.017)	(0.017)	(0.018)
Female	−0.057***	−0.062***	−0.143***	−0.120***	−0.041***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)
GotCancer	0.037	0.043	0.014	0.057**	0.006
	(0.026)	(0.028)	(0.029)	(0.029)	(0.031)
Educ. Secondary	−0.139***	−0.155***	−0.043***	−0.137***	−0.022*
	(0.011)	(0.012)	(0.012)	(0.012)	(0.013)
Educ. Tertiary	−0.325***	−0.251***	−0.065***	−0.297***	−0.089***
	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)
Attitude_{t-1}	0.585***	0.535***	0.538***	0.473***	0.429***
	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
R^2	0.408	0.317	0.305	0.273	0.189
Adj. R^2	0.408	0.317	0.305	0.273	0.189
Num. obs.	33094	33017	33062	33066	32986

Notes: $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. Standard errors between parentheses. Male in the NCDS cohort with primary education and who never had cancer as the reference group.

Political Cynicism (PC) by 0.057 sd. Sick individuals may become more dependent and rely more on institutions, they increase their support towards redistribution and scepticism about politicians who lead these institutions. The effect on other attitudes is not significantly different from zero. Since both attitudes are strongly associated with self-transcendence and slightly associated with conservation, see figure 5, it explains the increase we observe in both values for individuals who went through this life event in table 4.

F Extension of the theoretical framework

To quantify the effect of life events on values, we compare two individuals on the basis of their life trajectories and values. Suppose there exist two individuals i and j that are identical except in their initial value a_0, with $a_0^j > a_0^i$. Both individuals belong to the group $\underline{s}$. Let $\pi_t = \pi(a_t)$ be the probability that a life event occurs which is endogenous to the value a.

Suppose the information shock Δa_0—due to the life event—has the same magnitude for both individuals and would be sufficiently large such that both individuals would identify to the other group. The expected values a_1 and b_1 for the individual j are

$$\mathbb{E}(a_1^j) = \frac{\eta_a a_0^j + \phi_a \underline{a}}{\eta_a + \phi_a} + \pi(a_0^j)\left[\frac{\eta_a \Delta a_0 + \phi_a(\overline{a} - \underline{a})}{\eta_a + \phi_a}\right], \tag{12}$$

$$\mathbb{E}(b_1^j) = \frac{\eta_b b_0^j + \phi_b \underline{b}}{\eta_b + \phi_b} + \pi(a_0^j)\frac{\phi_b(\overline{b} - \underline{b})}{\eta_b + \phi_b}, \tag{13}$$

where $\mathbb{E}$ is the expectation operator. It is straightforward to show that these values are symmetrical for the individual i. Hence, the biases due to the endogeneity of values can be written as

$$\mathbb{E}(a_1^j) - a_1^j = \pi(a_0^j) \times \Delta A, \tag{14}$$

$$\mathbb{E}(b_1^j) - b_1^j = \pi(a_0^j) \times \Delta B, \tag{15}$$

where $\Delta A \equiv \frac{\eta_a \Delta a_0 + \phi_a(\overline{a} - \underline{a})}{\eta_a + \phi_a}$ is the direct effect of the life changing event on value a, and $\Delta B \equiv \frac{\phi_b(\overline{b} - \underline{b})}{\eta_b + \phi_b}$ is the spillover effect of the life event on value b.

Let $\Delta\mathbb{E}v_t$ be the difference in expected value v_t with respect to the true difference between both individuals, namely,

$$\Delta\mathbb{E}v_t \equiv \mathbb{E}(v_t^j) - \mathbb{E}(v_t^i) - (v_t^j - v_t^i) \tag{16}$$

Thus,

$$\Delta\mathbb{E}a_1 = \left[\pi(a_0^j) - \pi(a_0^i)\right] \times \Delta A, \tag{17}$$

$$\Delta\mathbb{E}b_1 = \left[\pi(a_0^j) - \pi(a_0^i)\right] \times \Delta B, \tag{18}$$

When the probability that the life event occurs is exogenous to values, i.e. $\pi(a_0^j) = \pi(a_0^i)$, there is no bias when estimating the difference between both individuals. However, in many cases such as unemployment, this probability is likely to be endogenous, i.e. $\pi(a_0^j) \neq \pi(a_0^i)$, which leads to a bias when gauging the effect of a life event on values.

Table F.1: Endogeneity bias.

	$\beta_a = \log(2)$						
a_0^j	-2	-1	-0.5	0	0.5	1	2
a_0^i	2	1	0.5	0	-0.5	-1	-2
$\pi(a_0^j)$	0.2	0.33	0.41	0.5	0.59	0.66	0.8
$\pi(a_0^i)$	0.8	0.66	0.59	0.5	0.41	0.33	0.2
$\Delta\pi$	-0.6	-0.33	-0.17	0	0.17	0.33	0.6

Notes: This table presents the magnitude of the endogeneity bias due to the difference in initial value a between two individuals. $\pi(a_0, \beta_a)$ corresponds to the probability derived from the binomial logistic function and $\Delta\pi$ to the difference in probabilities between both individuals.

The magnitude of the bias depends on two components: the difference in terms of probabilities that captures the degree of endogeneity of the life event with respect to values; and the magnitude of either the direct effect or the spillover effect. Although the endogeneity issue affect the magnitude of the total effect, it does not change the relative shares of the direct and spillover effects because it is a scale factor of the total effect.

In order to evaluate the magnitude of the bias, I assume that the probability $\pi(a_t)$ is an increasing function of a_t. The individual j is more likely to face the life event since $a_0^j > a_0^i$. For simplicity, let assume a binomial logistic function such that

$$\pi(a_0, \beta_a) = \frac{e^{\beta_a a_0}}{1 + e^{\beta_a a_0}}. \tag{19}$$

Note that the intercept has been omitted. Suppose a large endogeneity, namely, that the advantage in terms of probability that the life event occurs given by a higher value a has an odd-ratio about 2, which means that an individual with a one-standard-deviation increase in a_0 would be two times more likely that the life event occurs. As β_a corresponds to the log-odd ratio, it implies that $\beta_a = \log(2)$.

Table F.1 summarizes the size of the bias according to the gap in initial values between both individuals. Since $|\Delta\pi| < 1$, it implies that the endogeneity bias does not change the sign of the direct and indirect effects. The (2, -2) and (-2, 2) scenarii are extreme cases in which there is a high degree of polarization in terms of values such that both groups have respectively 2 and -2 standard deviations on average while the average value in the population remains 0. Even in those extreme cases, both the direct and spillover effects can be biased by at the most a scale factor of plus or minus 0.6.