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Political and Social Consequences of Qualification Mismatches: A bounding approach to status inconsistency

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Abstract

Many employees work in jobs that do not match their level of formal education. Status inconsistency theory (SIT) argues that such mismatches result in stress, dissatisfaction, political alienation, and social withdrawal. Status inconsistency may therefore pose a threat to social cohesion. However, extant SIT scholarship does not fully appreciate the consequences of an identification problem due to the perfect collinearity among the effects of occupation, education, and their mismatch. I review the literature and show that prior findings depend on implicit theoretical assumptions that are often implausible once spelled out. To overcome this problem, I propose a new approach to the study of mismatches that builds on recent advances in the modelling of age, period and cohort effects. I demonstrate how a set of relatively weak assumptions that are transparently grounded in sociological theory allows for (partial) identification of mismatch effects. The empirical analysis draws on comparable large-scale survey data from the United Kingdom (UKLHS) and Germany (GSOEP), two countries with a very different institutional organization of education to job matching. Compared with previous research, I use theoretically justified identifying assumptions and provide more rigorous evidence by addressing non-random selection into mismatch. Constrained regression models show mismatch effects on work-related identities, satisfaction, and organizational integration. Contra SIT, my results suggest that the effects of mismatches do not arise from cognitive dissonance but from an expectation formation mechanism. I find only weak evidence that mismatch effects spill over into the political domain. Despite large institutional differences, the results are similar across countries.

Introduction

As social beings, humans use comparisons to others to evaluate their own abilities, the rewards they receive for their efforts, and their standing in the social hierarchy (Festinger 1954). Two of the most important and easily observable markers of ability and success in modern societies are educational credentials and occupational status. Both thus figure prominently in individuals' evaluation of their social standing, their abilities and the fairness of the social order (Evans and Kelley 2004). But what if the two markers yield conflicting assessments? This is the situation of under- and overqualified employees, i.e. workers in occupations below or above their level of training. For the over- and the underqualified, the status implied by education and the status implied by occupation do not line up (Rohrbach-Schmidt and Tiemann 2016; Sloane, Battu, and Seaman 1999; Vaisey 2006).

Following the seminal work of Lenski (1954), sociologists have extensively debated the consequences of such status-inconsistent employment situations for individuals and societies. A rich body of theory suggests that such inconsistencies may lead to stress, dissatisfaction, social withdrawal, opposition to achievement ideology, political alienation, and in the last consequence to societal instability (Goffman 1957; Vaisey 2006; Voces and Caínzos 2020). More recently, scholars in adjacent fields like public health and organizational studies have become interested in status inconsistency to explain increased levels of stress (Dudal and Bracke 2019) and poor health (Nyberg et al. 2019).

In this article, I argue that much of the existing empirical work to addresses this important topic suffers from estimating statistical models that correspond poorly to the theoretical structure of the problem. These issues are rooted in the difficulty to empirically separate the effects of someone's education, occupation, and their mismatch since the three terms are linearly dependent: a mismatch is the difference between education and occupation (Blalock 1966). To nevertheless identify mismatch effects, previous work relies on strong, mostly implausible and highly consequential

assumptions that are rarely spelled out and justified. Instead, they usually remain hidden in the technicalities of the respective statistical model used. For instance, some models require the true effect of education on an outcome to be zero, while others assume that education and occupation have strictly equal effects. If these assumptions are violated, the reported mismatch effect deviates from the true one. It thus comes as no surprise that such *ad-hoc* fixes have led to widely varying conclusions across studies.

Status-inconsistencies are not only an interesting phenomenon in its own right. Due to their close connection to education and occupation, they concern two of the most important variables sociologists use to describe individuals' position in the social world. Hence, the status inconsistency problem is potentially relevant to large parts of the discipline. In fact, the standard omission of status inconsistency terms from sociological and political science models that contain both education and occupation is a possibly far-reaching assumption directly affecting results. Moreover, the structure of the identification problem is not unique to status inconsistency (Blalock 1967). Analyses of the effects of age, period, and cohort (Fosse and Winship 2019b), of social mobility (Gugushvili, Zhao, and Bukodi 2019; e.g., Präg and Richards 2019), and of many other research topics are plagued by analogous problems. A principled understanding of the status inconsistency problem contributes to finding strategies for reliable identification in these applications.

Motivated by these considerations, I introduce a new bounding approach to mismatch-effect-identification that builds on recent advances in the modelling of age, period and cohort effects (Fosse and Winship 2019b). The bounding approach makes explicit use of relatively weak, and more importantly, transparent assumptions to partially identify mismatch effects. In robustness checks, I extend this approach to fixed-effects panel analysis. This step additionally addresses the problem of non-random selection into mismatched employment and thus brings us closer to a causal identification of mismatch effects.

To test whether mismatch-effects in line with status inconsistency theory are present, I use the bounding method to analyze data from two comparable longitudinal population surveys with large sample sizes, the United Kingdom Longitudinal Household Study (UKLHS; Buck and McFall 2011) and the German Socio-Economic Panel Study (GSOEP; DIW 2017). The UK and Germany are interesting cases to study, because of the large differences that exist in their labor markets and education systems (see e.g. Hall and Soskice 2001 or; Kerckhoff 1995 for classic arguments). In the UK's general skills regime pathways between education, training and occupation are poorly defined, whereas Germany's occupation specific labor markets with their occupation- and even job-specific training are in many ways the polar opposite (Heisig 2018; Bol and Weeden 2015; Müller and Gangl 2003). In line with this general picture, the incidence of nominal mismatches is higher in the UK than in Germany, where occupational profiles are, on the other hand, institutionally and cognitively more salient (Longhi and Brynin 2010; Morgado et al. 2016). If there is any contextual variation in the relationship between mismatches and political attitudes, one would expect it to be present in this comparison—stronger in coordinated Germany's occupational skills system and weaker in the liberal UK's general skills system.

Given an extensive and inconclusive literature exists on status inconsistency, I highlight three theoretical and empirical contributions of this study. First, it shows that under plausible assumptions, there are indeed discernable effects of mismatch on well-being, identity, and social integration, even net of education and occupation. Second, the empirical patterns I find are hard to reconcile with the predictions of orthodox SIT: There is no evidence that role ambiguity and cognitive dissonance play a dominant role. Moreover, the results document that mismatch-effects on *political* attitudes and behaviors are small at most. Third, I show that these patterns are surprisingly similar in two relatively different societies.

Theory and previous research

Status inconsistency theory

Qualification mismatches were first investigated as a source of political dissatisfaction in the context of sociological SIT (Lenski 1954). The micro-mechanism proposed by SIT starts from the premise that actors seek to achieve cognitive consonance in their self-image, and that this is hampered by incongruous positions on different dimensions of social status. Status dimensions investigated by SIT include occupational status, education, race/ethnicity, income, and membership in elite associations (Stryker and Macke 1978). Here, I concentrate on occupation and education which have been the most central concern of SIT. According to SIT four channels can be distinguished, through which status inconsistency [endnote 1 here] creates psychological stress and potentially results in political unrest: First, status inconsistency implies uncertainty about one's identity and status. Overqualified workers, for instance, may ask themselves whether their social standing is that implied by their prestigious degree, or that implied by their mediocre job. SIT argues that this situation creates cognitive dissonance, which in turn leads to stress (Festinger 1954; Geschwender 1968). Second, status inconsistency makes it hard for others to determine the appropriate role of actors in social interactions, and hence makes it less likely that actors experience interactions as rewarding: inconsistency results in interactional role ambiguity (Lenski 1956). Third, status inconsistency in terms of education and occupation can take the form of overqualification, which implies that past expectations about the future have not been realized. Such "underrewarded inconsistency" leads to frustration (Geschwender 1968). The fourth and final causal relationship hypothesized by SIT is that status inconsistent individuals externalize these sources of stress and seek to change the social environment that they blame for their dissatisfaction (Goffman 1957). Originally, analysts hypothesized that this would result in left-wing activism and voting, but some also argue that frustration can be expressed by endorsing far-right politics (Stryker and Macke 1978).

Each of the four causal channels in original SIT has implications that are to a large degree testable in separation. The first channel implies that *any* mismatch should lead to dissatisfaction and stress, regardless whether it is one of over- or underqualification—failure or unusual success. The second channel, role ambiguity, implies that mismatch should affect not only cognitive states, such as life satisfaction, but should additionally affect social behavior, such as membership in voluntary organizations. The third channel implies that effects of overqualification should be stronger than those of underqualification, since it is especially when realized states fall short of anticipated ones that disappointment can be expected. The implication of the fourth channel, finally, is that mismatch has effects not only on purely personal outcomes, such as wellbeing or job-related identities, but results in political attitudes and behaviors that aim at changing society. This discussion shows that verbal statements of SIT are sensible, intuitive, and describe potentially important consequences. SIT therefore deserves empirical scrutiny. However, it is its translation into a formal framework that exposes profound conceptual challenges.

The fundamental identification problem of mismatch theory

Conceptual and methodological difficulties in inconsistency research are due to a fundamental identification problem. I argue that this problem is, while partially methodological, primarily a theoretical concern. The basic problem is already apparent in Lenski's seminal statement of the basic hypothesis of status inconsistency research: "individuals characterized by a low degree of status [consistency] differ significantly in their political attitudes and behavior from individuals characterized by a high degree of status [consistency], *when status differences in the vertical dimensions are controlled.*" (Lenski 1954:405f. my italics). The key point in this statement is that a third variable—the degree of consistency, which is itself a function exclusively of education and occupation—is proposed to influence experiences, attitudes, and behavior, net of education and occupation. Applied to an example, Lenski's hypothesis suggests that a lower-level hotel-manager with a college degree in business administration experiences less life-satisfaction than one, who

underwent the vocational training typical for his position, conditional on their respective actual levels of education, and that this is because the former perceives a dissatisfying difference between her high-status education and her relatively lower status occupation, whereas the two fall together for the latter.

In order to illuminate the fundamental identification problem, I now introduce a simple formal framework to represent Lenski's conjecture. I concentrate on two dimensions of status, education and occupation, and on linear relationships. This is because the identification problem is limited to the linear components of the relationships. Any non-linear deviations from them are identified, a fact I discuss below (see also Fosse and Winship 2019b). A linear version of Lenski's hypothesis can be represented as proposing a non-zero mismatch coefficient β_{MM} in the theoretical model:

$$Y = \beta_E X_E + \beta_O X_O + \beta_{MM}(X_E - X_O) + \epsilon, \quad (\text{Eq. 1})$$

where Y is the outcome of interest, and X_E and X_O are education and occupation, two different metric standardized dimensions of social status, for instance job prestige and years of education. $(X_E - X_O)$ represents the linear mismatch term X_{MM} . It is positive for overqualified and negative for underqualified workers. Eq.1 describes how Y arises from combinations of X_E and X_O according to the parameters β_E , β_O , and β_{MM} . Returning to my example, the term $X_{MM} = (X_E - X_O)$ is zero for the hotel manager with the required vocational education, because the status of his education and his occupation are identical. However, $X_{MM} = (X_E - X_O)$ is positive for the college graduate, because the status of her occupation is lower than that of her education. If β_{MM} is nonzero, as hypothesized by Lenski, this third term will affect Y above and beyond X_E and X_O for the mismatched graduate.

The framework of Eq.1 is important, because it shows that unconstrained tests of Lenski's hypothesis are empirically unidentified. Three distinct parameters $(\beta_E, \beta_O, \beta_{MM})$ govern the relationship between just two independent variables (X_E and X_O) and the outcome (Blalock 1966). This means that given identical observed combinations of education and occupation (X_E and X_O), an infinite

number of combinations of β_E , β_O , and β_{MM} could potentially result in the same Y . For the hotel-managers, this means that the same observed values of life-satisfaction (e.g. $Y_{\text{matched}} = 12.5$, $Y_{\text{mismatched}} = 10$) could result from identical independent variables (e.g. with the relative statuses as $X_{E,\text{college}} = 15$; $X_{E,\text{voctrain}} = 10$ and $X_{O,\text{hotel man.}} = 10$) through radically different data generating processes (e.g. with $\beta_E = .5$, $\beta_O = 0.75$, and $\beta_{MM} = -1$ (Example 1) or with $\beta_E = -0.75$, $\beta_O = 2$, and $\beta_{MM} = 0.25$ (Example 2)). [endnote 2 here] The differences between college-educated and non-college educated hotel managers could be caused by a negative mismatch effect or could be observed *despite a positive* mismatch effect. In the following, I introduce a strategy to decide between these two, *a priori* equally plausible solutions.

The fundamental problem of mismatch research is that because different causal processes can produce the same observable data, the data and empirical models alone cannot reveal the causal process that actually generated the data. In order to empirically identify mismatch effects, making one or the other theoretical assumptions is indispensable. The two important questions are therefore: which theoretical assumptions has prior research implicitly made to identify mismatch effects, and which theoretical assumptions should we make or not make to identify plausible mismatch effects? As I will show below, all prior work is indeed characterized by such theoretical assumptions, most of which have remained implicit. More importantly, many of the assumptions made by prior work are implausible, once made explicit.

Substantive assumptions in mismatch methodologies

Empirical studies of mismatch effects are always confronted with the fundamental identification problem. The literature on status inconsistency has used different strategies to estimate mismatch effects anyhow. In the following, I document how dominant methodological approaches in mismatch research amount to imposing a constraint on Eq. 1. In other words, each methodology relies on substantive assumptions about the nature of mismatch effects. If these assumptions are

not met, estimates of mismatch effects are biased. The fact that the various strategies mechanically lead to different results explains the confusion that plagues the literatures on mismatches.

Early methods in inconsistency research relied on fitting cross-tables, the so called square additive models (Duncan 2005). It can be shown that such methods uncover the true parameters only if β_{MM} , the linear mismatch term, is zero in reality (Blalock 1966). As is well known, this makes the largely negative body of evidence produced by the square additive model literature questionable (Hendrickx et al. 1993). Despite its introduction as a solution to the problems of additive models, the same is true for studies relying on Hope's (1975) diamond model. Not only does it require a non-trivial reformulation of SIT, it only uncovers the true mismatch effects of the general model in Eq.1 if parameters $\beta_E = \beta_O$ (Hendrickx et al. 1993). Hope's model returns inconsistency effects, *whenever* the education effect is stronger than the occupation effect, and vice versa. In line with this weaker criterion, empirical studies using Hope's methodology report strong and widespread inconsistency effects (e.g. Wilson 1979).

A third perspective on mismatch-effects, the so-called ORU decomposition (Over-, Required, and Undereducation), was pioneered in economics (Duncan and Hoffman 1981). ORU models split the education term (E) in a classic wage equation, which stands for the years of education a worker has actually attained, into three components: required education, the amount of education that is required in a worker's job (R , to which I here refer to as O for "occupation" in order to maintain consistency with the SIT literature); overqualification (OQ), the years of education of a worker beyond of what is required, and underqualification (UQ), the years of education a worker is short of requirements, resulting in the wage equation

$$Y = \beta_0 + \beta_{OQ}OQ + \beta_OO + \beta_{UQ}UQ + \epsilon. \quad (\text{Eq. 2})$$

The β_{OQ} and β_{UQ} parameters in this model allow analysts to investigate whether mismatched workers differ from matched workers with respect to Y (wages in a traditional ORU analysis or other outcomes in sociological applications) in an occupation with the same education requirements.

This is because variation in OQ/UQ implies variation in attained education (E) as required education (O) is held constant. Within the Lenskian framework of Eq. 1, Eq. 2 splits up the linear mismatch term $\beta_{MM}(X_E - X_O)$ into $\beta_{OQ}OQ$ and $\beta_{UQ}UQ$, that is, it allows for a nonlinearity in mismatch effects. Since only two linear effects, β_O and the shared linear component in β_{OQ} and β_{UQ} must be estimated, the model is uniquely identified. An ORU model can, without any problem, be interpreted descriptively: non-zero β_{OQ} and β_{UQ} document *differences* between matched and non-matched workers. But if these differences are interpreted as causal mismatch-*effects* in the Lenskian sense (i.e., as a separate mismatch effect in the generation of the data), Eq. 2 amounts to assuming that Eq. 1's, attained education term is zero, $\beta_E = 0$. Substantively, this means that education does not play any role *beyond* occupational positions and potential mismatch. In this view, an enduring, independent role of socialization through education for later life outcomes is excluded. When the goal is to estimate mismatch-effects according to Lenski's definition, an ORU strategy should therefore not be unthinkingly applied to sociological questions. Many attitudes and behaviors of interest to sociologists are relatively stable and partially formed by educational experiences, meaning $\beta_E \neq 0$ in the generative process (see Sears and Brown 2013 for reviews). For these outcomes, ORU models reflect reality poorly, and will yield estimates of β_O , β_{OQ} and β_{UQ} that diverge from the true generative values. It is therefore of interest that one of the more recent and influential studies on mismatch effects in sociology relies on the ORU decomposition. In it, Vaisey (2006) shows that workers in the United States, who are overqualified are more politically liberal and less achievement oriented than workers in a similar job, who are not inconsistent. This approach is descriptively valid, informative, and carefully interpreted in the paper. Nevertheless, an ORU approach cannot provide estimates of net mismatch effects. Below I introduce a strategy to test whether the findings reported by Vaisey are plausibly due to mismatch proper in the Lenskian sense.

The empirical strategy relied upon by public health researchers, who have contributed the majority of recent mismatch effects research, uses a similar regression-framework to the ORU decomposition (e.g. Dudal and Bracke 2019; Dunlavy, Garcy, and Rostila 2016; Smith et al. 2012; Zhu and Chen 2016). That being said, the precise empirical specifications, and hence the implied theoretical assumptions, vary. Often, however, the mismatch models used in public health research exclude the main effect of occupation—analogueous to how ORU models exclude the main effect of education, that is they estimate an equation of the form $Y = \beta_0 + \beta_{OQ}OQ + \beta_E E + \beta_{UQ}UQ + \epsilon$ (e.g. Dudal and Bracke 2019). They thereby commit to the assumption that people's current occupation is unrelated to their health status. But if in reality occupation does affect health outcomes, this effect will be attributed to mismatch. However, few articles reflect on this strong theoretical commitment. While many studies in this literature report associations between mismatch and health-outcomes (Bracke, Van De Straat, and Missinne 2014; Dudal and Bracke 2019; Dunlavy et al. 2016; but c.f. Smith et al. 2012), it is therefore not clear, how much evidence of health consequences of qualification-mismatches, net of occupation, there actually is.

A recent development in sociological studies of status inconsistency, and of topics with similar identification problems, is the revival of the diagonal reference model (DRM; e.g., Präg and Richards 2019; Kaiser and Trinh 2021), which is sometimes presented as a possible way out of identification impasses. The DRM was introduced by Sobel (1981) in reaction to the shortcomings of square additive models. My concern here is with its use for mismatch-studies, but I highlight that similar considerations also apply in other applications. The DRM was explicitly developed to allow identification under conditions of perfect collinearity and allows simultaneously considering two status dimensions and a mismatch parameter. However, the point estimates for the mismatch-parameter it returns necessarily rely on restrictions of the main effects of education and occupation. Unfortunately, the DRM remains poorly understood (but see Hendrickx et al. 1993). As a result, it

is unclear by which theoretical assumptions it arrives at a unique solution in a given application. [endnote 3 here] Moreover, ongoing investigations suggest that, similar to the square additive model, the DRM often forces the linear component of mismatch effects to zero (Fosse and Pfeffer 2019). It is therefore not surprising that two recent applications find limited or absent inconsistency effects: Jin et al. (2019) report that the incongruence between perceived political power and economic wealth they find in many of their Chinese respondents does not harm their wellbeing. Voces and Caínzos (2020) find limited negative effects of overeducation on work-related outcomes, but no effects on general wellbeing in Spain. In any case, the theoretical assumptions implicit in DRM applications need to be made transparent in terms of a general mismatch model such as Eq. 1. If they are not, reported empirical findings of DRM studies hinge on unknown assumptions about the substantive process studied.

The last strategy of interest is that of Zhang (2008) who proposes a test of SIT for the case of inconsistencies in income and education. Zhang's model formalizes interesting theoretical innovations. [endnote 4 here] Most important for the present purpose, however, is that his models are only identified, because he constrains the effect of inconsistency to have the same sign, regardless of the direction of a mismatch. Note that similar to the square additive model, constraining inconsistency effects to be symmetric assumes that the true linear component of the mismatch effect is zero. Nevertheless, Zhang reports negative inconsistency effects on indicators of satisfaction and social integration, suggesting the presence of non-linearities in β_{MM} .

This review shows that existing studies often employ identification strategies that rely on questionable assumptions about the causal process studied. It has also become apparent that the inconclusiveness of mismatch research is partially rooted in the fact that published results are a function of the methodological framework chosen. In the following I introduce an approach that forces analysts to make necessary identifying assumptions transparent and allows modelers and readers to

judge their plausibility against substantive knowledge. I then apply this approach in an empirical analysis.

The bounding approach to mismatch-effects

In proposing a new approach to mismatch-analysis, I follow recent work in the context of modeling age, period, and cohort (APC) effects (Fosse and Winship 2019b, 2019a). The bounding-approach developed by Fosse and Winship (2019b) is based on the idea that prior knowledge can be used to formulate explicit constraints on some of the parameters of a model that is empirically non-identified. If some values can be discarded *a-priori* on theoretical grounds, this limits the range of values other parameters in the model can take.

The starting point of a bounding analysis is that even though single parameters of a general mismatch-model in the form of Eq.1 (i.e., $Y = \beta_E X_E + \beta_O X_O + \beta_{MM}(X_{MM}) + \epsilon$) are not uniquely identifiable from the data, combinations of them are (O'Brien 2014). In the case of mismatches, we can identify the empirical parameters θ_1 and θ_2 , with

$$\theta_1 = \beta_E + \beta_O \text{ and} \tag{Eq. 3}$$

$$\theta_2 = \beta_{MM} - \beta_O, \tag{Eq. 4}$$

where the β s are the coefficients from Eq. 1 (see Appendix A for details on the derivation of this and the following result; Fosse and Winship 2019b). The fact that θ_1 and θ_2 are uniquely identified from the data creates dependencies in the parameter space that analysts can exploit to arrive at partial identification of a parameter of interest. By making an informed assumption about the sign (and the magnitude) of β_E and β_O , it is possible to create finite bounds around empirical estimates of β_{MM} . Concretely, by simple rearranging of Eq.3 and Eq.4, we get two restrictions in terms of β_O and β_E that any β_{MM} compatible with the data has to satisfy:

$$\beta_{MM} = \beta_O + \theta_2 \text{ and} \quad (\text{Eq. 5})$$

$$\beta_{MM} = \theta_1 + \theta_2 - \beta_E. \quad (\text{Eq.6})$$

If it can now be assumed that β_O is larger than some minimal value, $\beta_O > \beta_O^{min}$, and similarly that $\beta_E > \beta_E^{min}$, we know that

$$\theta_1 + \theta_2 - \beta_E^{min} < \beta_{MM} < \beta_O^{min} + \theta_1, \quad (\text{Eq. 7})$$

which represent the bounds within which the true linear mismatch effect lies. In other words: if prior knowledge suggest that the true main effects of education and occupation are larger than some values, this results in finite bounds for the linear mismatch effect. The same holds if both education and occupation effects are negative and can be assumed to be *below* some value. Instead of relying on implicit, *ad-hoc* or unknown constraints to arrive at point identification, the Fosse and Winship approach allows using weaker, theoretically justifiable, and, most importantly, transparent constraints to identify a range of values for the parameters of interest that are consistent with the theoretical assumptions (represented by β_O^{min} and β_E^{min}) and the data (represented by θ_1 and θ_2 in Eq. 7). Here, I exploit these ideas for the analysis of status inconsistencies, but similar approaches can also be applied to the study of social mobility effects and other research topics with analogous identification challenges.

Identifying assumptions

Since they directly affect results, β_O^{min} and β_E^{min} , have to be carefully specified. Large literatures in sociology and political sciences have shown that the social and political attitudes and behaviors that have occupied SIT theorists vary strongly and partially independently with education and occupation (e.g. Sears and Brown 2013). Extant research is also clear about the fact that education and occupational status co-vary with these outcomes in the same directions. Both higher occupational position and higher education, for instance, predict higher participation in civil society

(Verba, Nie, and Kim 1978). Therefore Eq. 7 is applicable: constraints on the sign of β_E and β_O in Eq. 1 will result in finite bounds for the estimates of the linear mismatch parameter β_{MM} .

It is important to note that the width of identification bounds depends on the amount of prior information available. However, it is difficult to extract from existing research precise lower bounds for the main effects of education and occupation. In the analysis below, I employ the following relatively conservative constraints:

$$\frac{\beta_E}{3} < \beta_O^{min} < 3\beta_E, \text{ which implies that } \frac{\beta_O}{3} < \beta_E^{min} < 3\beta_O \quad (\text{Eq. 8})$$

In other words, I assume that the effect of occupation is at most three times as strong as that of education and vice versa. This leaves plenty of room for empirical differences to play out: If β_O were 1, β_E could range between 0.3 and 3. While plausible, this choice of relative weights is admittedly arbitrary. I therefore present results obtained using other, even less restrictive values in Supplement G.

One exception to this discussion is job satisfaction. The satisfaction with one's current job is arguably not directly affected in a linear way by one's level of education—net of mismatch. For this outcome, I thus employ the alternative constraint of $\beta_E = 0$. This assumption results in point-identification of the linear mismatch-term, since the full version of Eq.1 collapses to the conventional ORU-model (minus the non-linearities).

A visual summary of identification conditions in mismatch research

The mismatch-graph in Figure 1 brings together the elements of my discussion in the spirit of an APC-graph as introduced in Fosse and Winship (2019b). Figure 1 shows the three-dimensional space of all combinations of the parameters β_E , β_O , and β_{MM} from the general model given in Eq.1. Because of the perfect collinearity of these dimensions, this space can be represented in two dimensions (note that the β_{MM} -axis is inverted). The identification problem furthermore implies that all actually possible combinations of β_E , β_O , and β_{MM} in any mismatch-model will lie on a line

with slope -1, which Fosse and Winship call the “solution line”: the dashed line in Figure 1 (Fosse and Winship 2019b). Given the same, data, different constraints on Eq.1, will lead to different solutions with parameter-combinations on, but never off the solution line. The solution line represents the important result that while empirically under-identified mismatch models like Eq.1 cannot *uniquely* identify a *single* solution, they can still *rule out a great number of possible solutions*—all those parameter combinations off the line— and thus simplify the identification problem to finding a point or a range on that line.

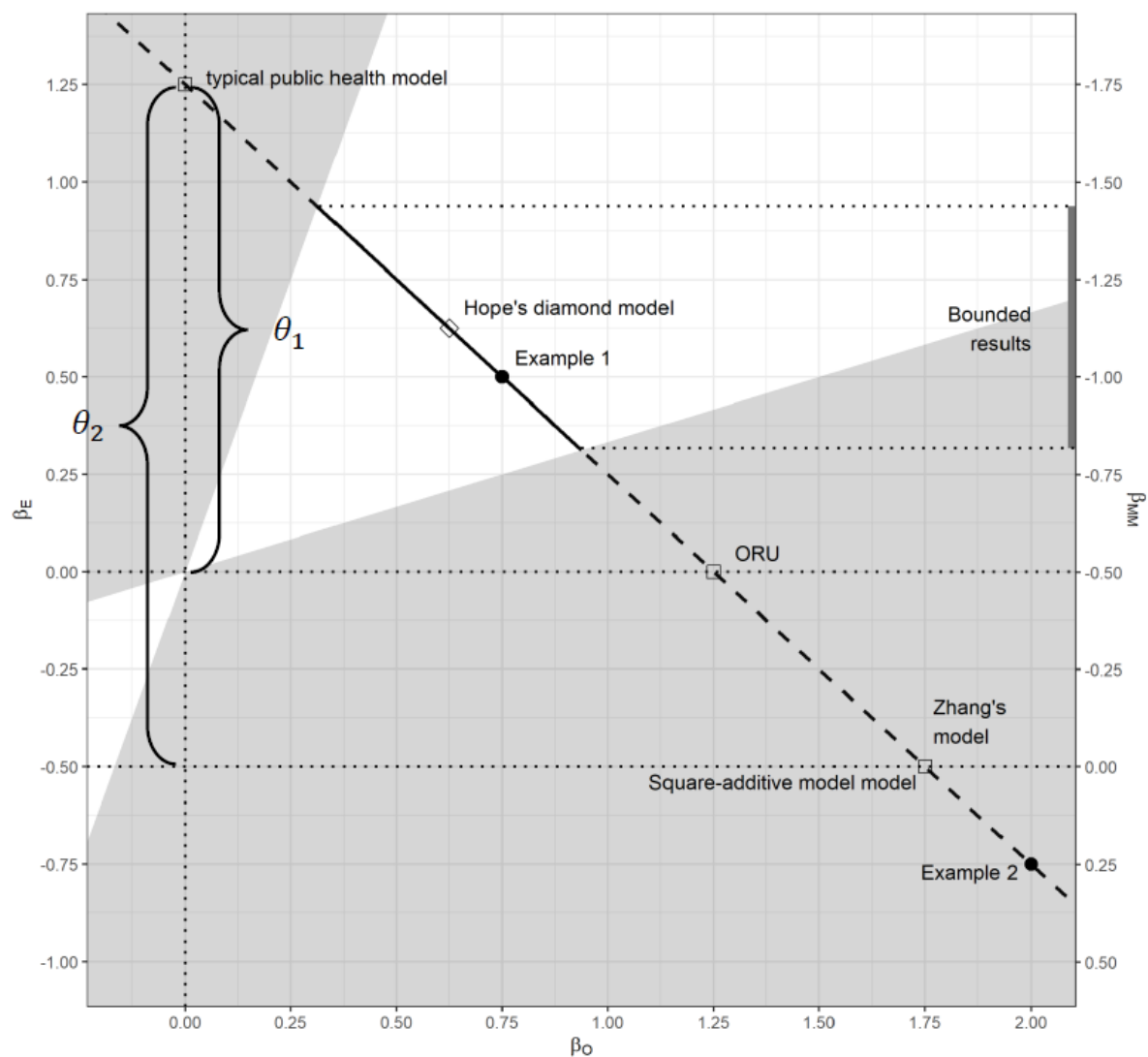
Empirical information from the data is represented by the values of θ_1 and θ_2 , which can geometrically be interpreted as the respective intercepts of the solution line on the β_E and the β_{MM} axes. θ_1 and θ_2 give the empirically possible value of β_E or β_{MM} , respectively, when β_O is 0 (compare Eq.3 and Eq.4 above). Different θ_1 and θ_2 change the scaling of the axes in different empirical applications. Figure 1 represents the values of θ_1 and θ_2 implied by the fictional data on matched and mismatched hotel-managers from above ($\theta_1 = \beta_E + \beta_O = 1.25$ and $\theta_2 = \beta_{MM} - \beta_O = -1.75$).
[endnote 5 here]

Figure 1 can be used to compare the consequences of the assumptions made by different identification strategies. Figure 1 shows the estimated β_{MM} for different models obtained from the same fictional data, all of which lie on the solution line. They range from $\beta_{MM} = -1.75$ for the typical regression model in public health research (which assumes that $\beta_O = 0$) to the Zhang/square additive model result of $\beta_{MM} = 0$, with the diamond model’s $\beta_{MM} = -1.125$ (under the assumption that $\beta_E = \beta_O$) and $\beta_{MM} = -.5$ for the ORU model (which assumes that $\beta_E = 0$) falling in between. DRM results would also fall on the solution line but due to the model’s lack of theoretical clarity it is unclear where. Given the wide divergence of results obtained using different models from the same data, the inconclusiveness of the mismatch literature is not surprising.

Assumptions and results of the bounding strategy, finally, are visualized by the shaded areas, which mark the parameter space for which the theoretical constraint $\frac{\beta_E}{3} < \beta_O < 3\beta_E$ is untrue.

Parameter combinations in the gray area are excluded *a priori*, because they are not consistent with prior knowledge about the causal process generating the data. Figure 1 represents the possible estimates that are consistent with the fundamental nature of the mismatch problem (represented by the solution line), the empirical information obtained from the data (the values of θ_1 and θ_2), and the theoretical constraints (the shaded areas) as the solid stretch of the solution line outside the shaded area of the graph. In the hotel-manager example, linear mismatch, i.e. the β_{MM} of Eq.1, has a strictly satisfaction-decreasing effect on hotel-managers (the β_{MM} -scale is inverted): Given our assumptions about the main effects of education and occupation, the patterns in the data are only compatible with a β_{MM} in the interval $[-0.4375; -0.8125]$, visualized as the highlighted range on the right axis. It is this range that I seek to estimate in the empirical analysis. In the hotel-manager data, the constraints are thus consistent with the causal process of Example 1, which proposed a negative effect of mismatch. However, we can discard the causal process proposed by Example 2: a positive mismatch effect $\beta_{MM} = 0.25$ is not compatible with $\frac{\beta_E}{3} < \beta_O < 3\beta_E$ and thus lies in the gray space of implausible solutions.

Figure 1 The geometry of identification in mismatch models



Note: Values in the graph corresponds to the fictional data from the example used in the text, with $\theta_1 = 1.25$ and $\theta_2 = -1.75$. The dashed line gives the solution line. The gray area marks parameter combinations inconsistent with theoretical constraints under the bounding approach. The solid black line covers the range of model outcomes consistent with data and constraints. Markers give the results for different empirical strategies.

Data and methods

I base my empirical estimates of mismatch effects on two harmonized data sources from two countries: the UK Longitudinal Household Study 2009-2016 (UKLHS; Buck and McFall 2011) and the German Socio-Economic Panel Study 1984-2016 (SOEP; DIW 2017). UKLHS and SOEP are comparable sources of data in that both are longitudinal surveys of private households with high-

quality fieldwork. Both studies rely on similar sampling strategies, questionnaire design, and often even use the same items. I restrict the analytical sample to non-self-employed working men and women between the ages of 20 and 60, who are not currently enrolled in full-time education or training. For the main analysis, I restrict the SOEP sample to the years after 2004, because important control variables were collected only after that date. Throughout, I employ the post-stratification weights provided with the data to account for unequal sampling and attrition probabilities.

Measuring education, occupation and mismatch

I rely on a generalized version of the ORU decomposition to test SIT claims and to model the effects of vertical qualification mismatch (see below). In contrast to standard ORU models, this model allows including a separate term for the main effect of education. My central independent variables are measures of actual education (E), typical education in someone's occupation (O) and of mismatch. I rely on virtual years of education and the so-called realized matches approach to identify the typical education in an occupation (which is called the "required" education in the ORU-literature; see Capsada-Munsech 2019 for an overview of measurement approaches, and Section B in the Online Supplement for details on the coding of years of education). Concretely, I distinguish occupations using the 3-digit ISCO88 classification and estimate the mean years of education in each occupation in the post-stratified UKLHS and SOEP samples as a measure of typical education. Overqualification (OQ) and underqualification (UQ) are defined as explained above, that is as $OQ = E - O$, if $E - O > 0$ and 0 otherwise, and as $UQ = O - E$, if $O - E > 0$ and 0 otherwise. Against the ORU-literature, I do not regard O as a measure of *skill*-requirements, a practice that has been criticized (Halaby 1994). Empirical investigations reveal that measures based on the realized matches approach show only moderate correlations to direct indicators of skill-use and to other measures of qualification mismatch (Capsada-Munsech 2019; Rohrbach-Schmidt and Tiemann 2016). Nevertheless, the realized matches approach is appropriate

for testing the claims of SIT. At its core, SIT makes claims about social comparison processes. This contrasts with mismatch research, for instance in economics, that is mostly concerned with skill-utilization. SIT is interested in the qualification profile of an occupation that is regarded as *socially* appropriate or normal and thus forms a point of reference in status evaluations. The socially normal qualification level of an occupation is better captured by mean years of education than by the more specific task and skill-focused measures proposed by scholars of the labor market (e.g. Rohrbach-Schmidt and Tiemann 2016). The conceptual proximity between occupation-typical education and status is also true empirically: The correlation between the occupation mean years of education, the O under a realized matches approach, and the ISEI (Ganzeboom, De Graaf, and Treiman 1992), an accepted measure of occupational status, is $r = 0.87$ in Germany and $r = 0.81$ in the UK in the respective 2014 waves of my sample.

Outcomes

In order to comprehensively capture the relevance of mismatch, I consider nine different facets of social, political and occupational behavior, involvement, identities, satisfaction, and trust. While the items I rely on are designed to capture identical concepts in the two surveys, it is important to note that sometimes the wording is not strictly identical in SOEP and UKHLS. The Online Supplement B documents the questions and response categories used in the two countries.

Table 1 shows how many data points, from how many respondents the two datasets provide on these variables. These figures equal the sample sizes my models can draw on. Since many variables were collected in different waves, my analytical samples differ for different dependent variables, and in Germany for different specifications.

Trust, satisfaction with democracy, job and life satisfaction, and the respective importance of politics/one's profession were measured using standard Likert scales in both questionnaires. In order

to increase comparability between these measures, I z-standardize them, so that one unit corresponds to one sample specific standard deviation.

Left vote, *far-right vote*, and *member of an organization* are binary variables that indicate whether a respondent expresses left-wing/far-right voting intentions or reports being the member of at least one organization. I refer readers to Supplement B for details on my coding of parties. A caveat is in order regarding the identifiability of mismatch-effects on left-voting. In both Britain and Germany, class-voting is in decline. The left vote is moving from those with less education to the highly educated, and differences by occupation are at least decreasing (Brenke and Kritikos 2017; Evans and Tilley 2017). While I am not aware of studies documenting that the direction of the *causal effect* of education or occupation on left voting has changed, these trends nevertheless put the proposed identifying assumptions into question. As it has been central to SIT theory, I nevertheless include left-voting as an outcome, but note that the respective results will have to be treated with caution.

		Trust	Satisfaction democracy	Job satisfaction	Life satisfaction	Im- portance politics	Im- portance profes- sion	Vote left party	Vote far-right party	Member organiza- tion
UKHLS	N _{Obs}	14 789	22 112	84 428	77 446	20 528	21 599	59 687	59 687	11 838
	N _{Res} p	14 789	14 964	25 955	24 334	14 631	15 227	20 749	20 749	11 838
SOEP	N _{Obs}	25 771	17 353	124 858	124 858	40 624	40 682	45 928	45 928	21 368
	N _{Res} p	17 383	13 331	28 377	28 377	22 597	22 619	14 157	14 157	14 332

Table 1 Sizes of analytical samples

Control variables

I control for a rich set of personal characteristics, including age, age-squared, measures of cognitive ability, BIG-5 personality, risk aversion, locus of control, parental occupation, parental education, immigration background, gender, as well as for region and survey year. Details on the measurement of these variables can be found in Online Supplement B. I conducted separate analyses by gender, but results were largely identical. Gender specific results can be found in

Supplement F. Not all controls were measured in all years or for all respondents. If information is missing, I carry forward the latest observation of a respondent. If a control variable has never been measured, I rely on 10 imputations from a chained equations model (van Buuren 2007). The multiple imputation models take into account all variables that feature in the analysis models and additional variables that may help to reduce prediction uncertainty.

Modelling strategies

I estimate a generalized version of the cross-sectional ORU decomposition on pooled samples using the partial identification strategy described above: the E-ORU specification. This empirical model corresponds closely to the general theoretical mismatch model in Eq. 1. As an additional robustness check, I also estimate a specification of this model that includes person-specific fixed-effects: the ORU-FE specification. While more complex, this version addresses confounding by unobserved time-constant variables. I describe this model in detail and report its results in Appendix H. The E-ORU model is given by the equation

$$Y = \beta_0 + \beta_O O + \beta_E E + \beta_{OQ} OQ + \beta_{UQ} UQ + \sum \beta_{X_j} X_j + \epsilon, \quad (\text{Eq. 9})$$

where O , E , OQ , UQ refer to the variables discussed above and X_j is the j^{th} control variable. This specification corresponds to a general mismatch-effects model like in Eq. 1, which contains a perfect linear dependency between O , E , and the shared linear component of OQ/UQ . I rely on the constraints in Eq. 8 to partially identify Eq. 9. In other words, I assume that the effect of education is neither more than three times larger nor three times smaller than that of occupation. I refer to this as the E-ORU specification since it contains all four terms of E , OQ , O and UQ simultaneously. I report results with O , E , OQ , and UQ in a years-of-education-metric, while the constraints in Eq. 8 refer to standardized coefficients. In the E-ORU specification, the bounded OQ and UQ parameters reflect the change in the outcome associated with one additional year of under- or overeducation, net of actual education, required education, and other covariates. Geometrically, they

correspond to the highlighted range on the β_{MM} axis of Figure 1, plus the non-linear difference between over- and underqualification effects. The E-ORU model is estimated using constrained least squares. I base inference on standard errors that are clustered at the person-level.

The E-ORU specification addresses the linear dependency of O, E and MM. However, as a cross-sectional model, it is susceptible to confounding from unobserved variables. I address this problem in an additional robustness check, which leverages longitudinal information in the data using a person-fixed-effects (FE) approach. This design, which is described in detail in Appendix H eliminates all person-level time-constant confounders and thus brings us closer to a causal interpretation.

Results

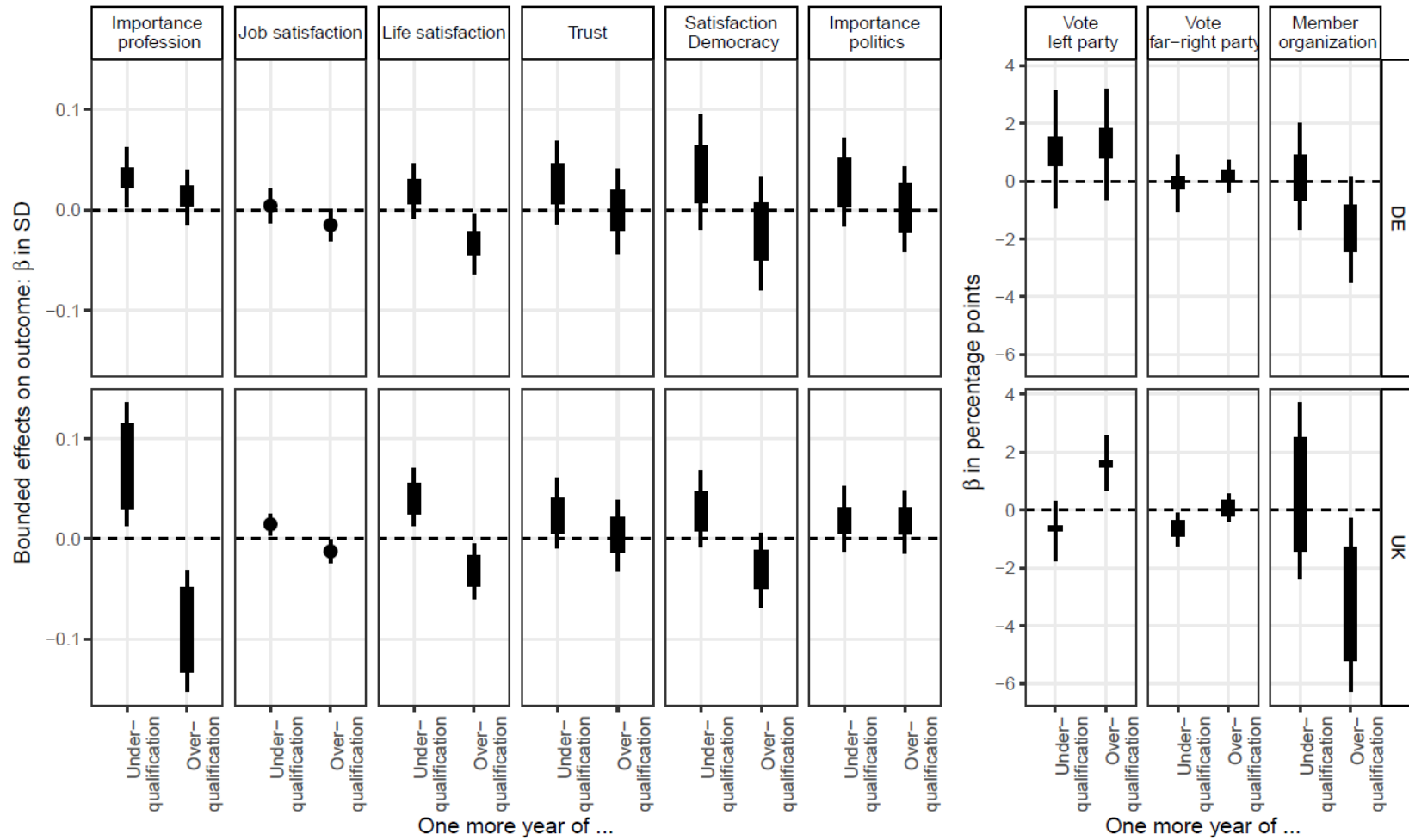
E-ORU estimates of mismatch-effects

SIT argues that inconsistency causes role ambiguity and cognitive dissonance. Hence it expects negative effects of both under- and overqualification on social integration, measures of satisfaction, and job identification. Moreover, it argues that the dissatisfaction caused by status inconsistency extends into the political realm and causes disaffection and possibly extremist radicalization. Can we find evidence that mismatched workers are affected by these dynamics? In the following, I report results from the E-ORU specification and then briefly review the fixed-effects results of the ORU-FE model, which are described in detail in Online Appendix H.

Figure 2 shows the bounded estimates of under- and overqualification effects on different outcomes obtained from the E-ORU specification. Columns of the panels in Figure 2 correspond to different outcomes and rows to different countries. The left bar-marker in each box gives estimates for over-, the right marker estimates for underqualification. Most effects correspond to the expected change for a one education-year change in mismatch expressed in standard deviations of the outcome. The three rightmost columns, which refer to binary outcomes, measure effect sizes in expected

percentage point change. The bars in Figure 2 correspond to the highlighted range on the β_{MM} axis in Figure 1. They represent the range of values that mismatch effects can possibly take given theoretical constraints and empirical data. I refer readers to Supplement E for a comparison of these results to those obtained from a conventional ORU decomposition.

Figure 2 Bounded estimates of attitudes and behaviors among mismatched workers



Note: Bars give the range of mismatch-parameters compatible with data and theoretical assumptions ($\frac{\beta_E}{3} < \beta_O < 3\beta_E$ or $\beta_E = 0$ (job satisfaction)). Constrained least squares models estimated on pooled data. 95% confidence intervals based on cluster-robust standard errors and ten imputations. Results controlled for personal characteristics

I find that overqualification is associated with lowered life satisfaction, a lower likelihood of organizational membership, and, in the, UK with a clearly decreased salience of workers' professional identity and an increased probability to express voting intentions for a left-wing party—if one is to accept the potentially problematic identifying assumptions for left-voting. Underqualification, on the other hand, goes along with a heightened professional identity, and in the UK also with increased life satisfaction, and a lower likelihood to support the extreme right. The strength of these associations is often small, but arguably of substantive importance. A median effect size of about 0.03 SD implies that somebody who is overqualified by three years, which roughly corresponds to the difference between the main educational categories, reports about a tenth of a standard deviation lower life satisfaction than someone with a similar occupation and job, who is not mismatched.

For all other variables, I cannot safely conclude effects of mismatch. Either the identification bounds, represented by the bars, or the confidence intervals overlap with zero. For these variables, the data I analyze could have been produced by a version of Eq. 1 with a mismatch term of zero. I need to highlight, however, that, especially in my application, a *failure to refute* the null-hypothesis of no mismatch-effect does not imply *support* for the null hypothesis. My tests are very conservative, because prior knowledge about the true main effect of education and occupation is weak. In fact, for virtually all dependent variables, data generating processes that imply non-zero mismatch effects are compatible with the data. To rule out mismatch effects in these cases, or to show their existence, stronger assumptions, or more data, are necessary.

Such stronger assumptions are available for one dependent variable: job satisfaction. I have argued that there is no plausible direct effect of education on job satisfaction. Using this constraint, the “job satisfaction” column in Figure 1 demonstrates that overqualification is associated with lower job satisfaction, whereas underqualification goes together with higher satisfaction in the UK.

The first conclusion to draw from the empirical analysis is that the proposition of mismatch-effects without any linear component is not unequivocally borne out by the data. For a majority of all dependent variables, I find that over- and underqualification are associated with an outcome in opposing directions, even though my empirical model does not require such a pattern. Out of 18 country/outcome combinations analyzed, only three (importance profession and left voting in Germany and importance politics in the UK) show under- and overqualification effects clearly into the same direction, as would be required by the assumption of $\beta_{MM} = 0$. This casts doubt on results obtained from the square additive model, from Zhang's model, and on Lenski's original formulation.

This is also an important finding for status inconsistency research on a theoretical level. While mismatches are clearly consequential for many outcomes, it does not appear to be the first and second psychological mechanisms proposed by status inconsistency theory, i.e. role conflict and cognitive dissonance, that result in dissatisfaction and withdrawal. It is not generally inconsistency per se that causes discontent. Rather, the negative consequences of mismatches expected by SIT are only present among the overqualified. This pattern is compatible with the third channel discussed above. It predicts opposing consequences for under- and overqualification as a result of an expectation formation mechanism: Discontent arises because prior expectations of occupational advancement, as instilled by education and training, have not been met. The underqualified, vice versa, report, if anything, *higher* levels of satisfaction.

My results are less clear about the fourth mechanism in SIT, which claims that mismatch-experiences in the occupational domain spill over into the domain of political attitudes and behaviors. While all work-related indicators are clearly connected to mismatches in the E-ORU model, such patterns are weaker for political variables, which hardly reach statistical significance. Nevertheless, the pattern I find largely mirrors the results for personal variables: higher satisfaction with the political system among the under- and decreased satisfaction among the

overqualified. What seems rather robust, however, is that the overqualified are less likely to be members of organizations.

Robustness checks

Identifying assumptions

One potential point of skepticism regarding these findings arises from the fact that in the E-ORU model mismatch effects are partially identified by explicit assumptions about the relative importance of education and occupation. How sensitive are my conclusions to these assumptions? I provide results for weaker assumptions in Online Supplement G. Here I note that the core of my results, i.e. those for job and life satisfaction, professional identity, left-vote and organizational membership, are substantively unaffected by the choice of identifying assumptions.

Accounting for time-constant between-person heterogeneity

SIT expects mismatches to *cause* certain social and political attitudes and behaviors. My analyses, however, can possibly only demonstrate *correlations* between mismatch and these outcomes. While the results I present take into account many potential confounding factors, there might be unmeasured social or psychological factors that both affect the likelihood of status-inconsistency and of holding the political and social outcomes of interest. I test the robustness of my results in the face of such concerns using fixed-effects models that control for all time-constant heterogeneity between individuals, and thus address a major threat to causal identification. The patterns, reported in detail in Online Appendix H, confirm the interpretation of the cross-sectional analysis. I find that outcomes close to the employment relationship change with mismatch changes. Increases in overqualification go together with decreases in job satisfaction and a falling subjective importance of one's profession, as shown by identification bounds consistently in the negative for these outcomes. But regarding attitudes and behaviors relating to politics, there is hardly any evidence for an effect of mismatch-changes, or, for that matter, of

occupation changes, at all. Similar to the pooled regressions, differences between countries, finally, appear to be negligible in the fixed-effects specification.

While it cannot establish causality by itself, my longitudinal analysis is consistent with causal mismatch effects on work-related identities, job satisfaction and organizational integration—even when all time-constant heterogeneity between subjects is considered. However, I do not generally find symmetric negative effects of mismatch, as would be expected under the cognitive dissonance and role ambiguity explanation of mismatch effects. What is more, the German data suggests that underqualification likely increases organizational integration—a finding that runs directly against the predictions of role ambiguity arguments. All things considered, the results of the more conservative longitudinal models are thus in line with the conclusions from the cross-sectional analysis.

Conclusion

Do qualification-to-job mismatches have consequences for the social and political attitudes of affected workers? This study provides novel evidence on the old status inconsistency problem using two high quality panel data sets from Germany and the United Kingdom. I advance beyond prior research by using theoretically justified and transparent assumptions to identify the effects of mismatch and by exploiting longitudinal data for moving towards more rigorous identification. In the process, I introduce a novel framework that clarifies the fundamental identification problem in mismatch research and allows flexible and transparent specification of identifying assumptions.

Methodologically, my analysis underlines the mechanic dependence of reported empirical findings in the mismatch literature on the identifying assumptions chosen: Implicitly fixing one or the other parameter in a mismatch-model to permit identification, as all empirical models necessarily do, directly affects the size of the estimated mismatch-effect. My review of the

published literature suggests that many conclusions reached by mismatch scholarship are due to underappreciated and often implausible assumptions about the data generating process. Building a more robust evidence base will only be possible if scholars of mismatch and of structurally similar phenomena, such as social mobility effects, acknowledge and transparently communicate necessary assumptions. To build confidence in their results, researchers need to make a theoretical argument, why particular constraints apply to a given problem.

Empirically, I find that under weak and plausible assumptions, mismatched differ from matched workers beyond what is implied by their differing occupations and qualifications in well-being, identity, and social integration. Mismatch or inconsistency is therefore an important concept in studying the subjective experience of social stratification. Conservative fixed-effects estimators, which tackle confounding by individual characteristics, confirm the core of my cross-sectional findings. While I show that mismatch or status inconsistency does have important consequences for the individual, my analyses nevertheless refute some of the core hypotheses of status inconsistency theory. First, I find that the most important psychological mechanism assumed by status inconsistency theory, cognitive dissonance, is unlikely to account for the observed patterns. The predicted pattern of dissatisfaction, distance from professional roles, social withdrawal, and political opposition is evident only for the overqualified. The underqualified, however, despite their mismatch, are more satisfied, identify more with their professional role and are not more critical of the democratic system. In this sense, undereducation does not seem to be a problematic condition. All this suggests that it is not role incongruences as such, but the specific experience of underachievement that is at the root of the strains described by status inconsistency theory. These findings are consistent with results of studies of effects of intergenerational mobility, where—in contrast to longstanding theoretical arguments—upward mobility is found to be associated with positive outcomes (e.g. Gugushvili et al. 2019). Second, while scholarly interest in inconsistency was triggered by a concern for the wider political and societal consequences of pervasive mismatch, my analyses fail to provide strong evidence for such a

relationship. Especially the fixed effects results suggest that any link between mismatch and political dissatisfaction is weak and not causal.

The results of my analyses are very similar between the institutionally relatively distinct UK and Germany. Methodologically, this builds confidence into my core results, as it demonstrates that conclusions can be replicated using a different survey study and slightly different questionnaire wording. Substantively, the evident similarity in patterns suggests that status-evaluations are surprisingly little affected by different institutional settings—at least in the context of the two high-income, European market economies that I study.

The substantive contributions of this study may appear somewhat paradoxical. On the one hand, the analyses demonstrate that classic inconsistency theory as pioneered by Lenski is hardly suited to explain the experience of mismatched workers. On the other hand, however, the main result of this study—that a mismatched employment situation affects the wellbeing of individuals beyond occupation and education—provides an occasion for sociology to reinvigorate research into the multi-dimensionality of social status. The experience of falling short of institutionalized expectations, but also of exceeding them, seems to provide workers with an independent source of strain, or satisfaction, respectively.

About the Author

Jonas Wiedner is postdoctoral fellow at the WZB Berlin Social Science Center. His doctoral dissertation at the University of Cologne investigates qualification mismatch from a social stratification perspective. Jonas Wiedner's research interests cover labor markets, residential mobility and neighborhood infrastructures, with a focus on immigrants and their descendants. His latest publication "Immigrant Men's Economic Adaptation in Changing Labor Markets: Why Gaps between Turkish and German Men Expanded, 1976–2015" appeared in *International Migration Review*.

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Endnotes

1 I use the terms inconsistency and mismatch interchangeably. I speak of inconsistencies, when I refer to the SIT-literature, and of mismatches, when other scholarship is concerned.

2 This is shown by the following calculations, which plug in the respective values into Eq. 1., once for the first set of parameters and once for the second set:

$$\begin{aligned} Y_{\text{matched}} &= 12.5 = .75 * 10 + .5 * 10 - 1(10 - 10) \\ &= 2 * 10 - 0.75 * 10 + 0.25(10 - 10) \\ Y_{\text{mismatched}} &= 10 = .75 * 10 + .5 * 15 - 1(15 - 10) \\ &= 2 * 10 - 0.75 * 15 + 0.25(15 - 10) \end{aligned}$$

3 The DRM builds on a cross-tabulation of the two status dimensions, where cell-means of the outcome are modelled. In this context, individuals falling onto the diagonal are matched, those off the diagonal are mismatched (Sobel 1981). The intuition behind the DRM is often communicated by referring to the fact that the counterfactual against which potential mismatch-effects in off-diagonal cells are judged is a weighted combination of outcome-values in the respective matched cells of row and column (the “diagonal reference”). However, this explanation begs the question what the substantive assumptions in the calculation of weights within the framework of Eq. 1 are. In practice, the weights are fitted using non-linear least-squares estimation, i.e. with the criterion that unexplained variance is minimized. But given a non-identified data generating process, such as Eq. 1 weights can easily be found that saturate the linear components of the table by just using information from rows and columns, even when the data was generated using a mismatch term. It is unclear, how the DRM safeguards against this possibility. More research is needed on the theoretical assumption implied by the DRM.

4 Zhang argues that social and cognitive processes triggered by status-inconsistency lead individuals to discount the importance of the lower status dimension. “That is, the role of position on one dimension is substituted to a certain degree by the roles of positions on other dimensions as these positions rise.” (Zhang 2008:157f.). Zhang therefore includes a multiplicative interaction term into the inconsistency model, which drastically changes the results. While this argument is interesting, I here focus on the identifiability of the main effect of inconsistency, which also affects Zhang’s model. Further research should investigate the role of possible substitution effects within the bounding framework I propose.

5 This solution is true for the data generating processes in Example 1 ($\theta_1 = 1.25 = 0.75 + 0.5$ and $\theta_2 = -1.75 = (-1) - 0.75$) and in Example 2 ($\theta_1 = 1.25 = 2 + (-0.75)$ and $\theta_2 = -1.75 = 0.25 - 2$).