

## Are Risk Preferences Stable?

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**T**he dictum “De gustibus non est disputandum” of Stigler and Becker (1977) has shaped economics for decades. They wrote: (p. 76) “[O]ne does not argue about tastes for the same reason that one does not argue over the Rocky Mountains—both are there, will be there next year, too, and are the same to all men.” Stigler and Becker (p. 89) argue that changes in individual behavior can and should be explained by changes in prices, incentives, or constraints, with no need for allowing changes in preferences “with the endless degree of freedom they provide.”

This essay in part follows the Stigler and Becker approach by maintaining the assumption that individuals maximize utility based on preferences and constraints, and thus neglects more radical abandonments of the standard economic model of individual decision-making such as the use of heuristics (for example, Tversky and Kahneman 1974; Gigerenzer and Gaissmaier 2011). However, in contrast to the conceptual arguments in favor of stability of preferences by Stigler and Becker (1977), we take the view that the extent to which preferences are stable is ultimately an empirical question. In particular, the focus will be on one core dimension of individual preferences: attitude towards risk. In recent years, economists have started to investigate the stability of risk preferences and the evidence has been growing rapidly.

In this paper, we first discuss key methodological prerequisites for an empirical research agenda on the stability of risk preferences: validated measures of

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risk preferences and a precise definition of preference stability. The strict definition of preference stability in economics implies that individual risk preferences are constant over time. We then proceed by offering an alternative conceptual framework for preference stability that builds on research regarding the stability of personality traits in psychology. The definition of stability used in psychology implies high levels of rank-order stability across individuals and not that the individual will maintain the same level of a trait over time. Preference parameters are considered as distributions with a mean that is significantly but less than perfectly stable, plus some systematic variance. This framework accommodates evidence on systematic changes in risk preferences over the life cycle, due to exogenous shocks such as economic crises or natural catastrophes, and due to temporary changes in self-control resources, emotions, or stress.

Research on the stability of (risk) preferences is conceptually at the heart of microeconomics. But in addition, systematic changes in risk preferences have vital real-world consequences, because an individual's willingness to take risks predicts aspects of labor market and health outcomes, addictive behaviors, investment, and migration decisions (Barsky, Juster, Kimball, and Shapiro 1997; Hong, Kubik, and Stein 2004; Bonin, Dohmen, Falk, Huffman, and Sunde 2007; Anderson and Mellor 2008; Kimball, Sahm, and Shapiro 2008; Jaeger, Dohmen, Falk, Huffman, Sunde, and Bonin 2010; Dohmen and Falk 2011; Becker, Deckers, Dohmen, Falk, and Kosse 2012; Dawson and Henley 2015; Hsieh, Parker, and van Praag 2017). For example, more risk-averse individuals are less likely to be self-employed and to invest in stocks, and countries with higher aggregate risk aversion have a lower total factor productivity (Dohmen, Falk, Huffman, Sunde, Schupp, and Wagner 2011; Falk, Becker, Dohmen, Enke, Huffman, and Sunde 2017). The empirical evidence implies that individuals become more risk-averse over the life cycle. Thus, aging societies are likely to have lower levels of self-employment and total factor productivity as well as more conservative saving, investment, and voting behavior, with important implications for macroeconomic performance and political outcomes such as labor market protection or the implementation of reforms. Moreover, economic crises and downturns have been shown to increase risk aversion, possibly reducing self-employment and investments in stocks, which in turn can amplify macroeconomic downturns. In finance, this pattern of countercyclical risk aversion (that is, investors are more risk-averse during recessions than booms) offers an explanation for the long-standing puzzle that the equity risk premium seems to be higher during recessions than booms (Shiller 1981; Campbell and Shiller 1989; Cochrane 2011). As a final illustration, evidence that stress, fear, or cognitive load induce temporarily elevated levels of risk aversion has important implications for consumer protection laws, suggesting a case for cooling-off periods in insurance contracts, for example. In sum, understanding systematic changes in individual risk preferences over time seems to be key for policy design, as well as for a better understanding of individual decision-making and macroeconomic outcomes.

Once we accept the possibility of systematic change in risk preferences, an array of fundamental questions arises: How can we evaluate alternative policy options

or perform welfare analyses when individuals' preferences lack complete stability? Can and should policymakers make use of the malleability of risk preferences to promote behavior changes that are deemed desirable (such as giving up smoking or avoiding teenage pregnancies)? Can economists benefit from insights in personality psychology on the degree of stability and malleability of personality traits, a concept somewhat related to economic preferences? We will touch upon these questions before we conclude by pointing out directions for future research.

## Prerequisites for a Research Agenda on the Stability of Risk Preferences

### Measurement of Risk Preferences

In recent years, economists have started to turn attention to validating their measures of risk preferences—that is, to explicitly documenting (instead of assuming) that commonly used measures of risk preferences fulfill crucial criteria such as internal and external validity (for example, Dohmen et al. 2011; Falk, Becker, Dohmen, Huffman, and Sunde 2016). *Internal validity* (or “convergent validity”) implies that different measurement tools of risk preferences (for example, survey-based self-report measures and experimental measures) map into the same underlying construct “risk preferences” and offer a coherent description of the same individual. Measured risk preferences are *externally valid* (or have predictive or behavioral validity) if they have predictive power for actual risky behaviors. For example, Dohmen et al. (2011) document that self-reported risk preferences are a reliable predictor of investment in stocks, self-employment, participation in sports, and smoking, as well as actual risk-taking in an incentivized lottery experiment.

Well-established tools for measuring risk preferences have emerged that allow for comparing distributions of risk preferences across studies and populations. Two approaches prevail: self-reports and incentivized experiments.<sup>1</sup> A prototypical example of a self-reported questionnaire measure is the corresponding question in the German Socio-Economic Panel that is answered using an 11-point Likert scale: “How do you see yourself: are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?” (Wagner, Frick, and Schupp 2007). Some of the most widely used experimental approaches to measure risk preferences encompass Holt and Laury's (2002) price list approach, Gneezy and Potters' (1997) risky investment task, as well as Binswanger's (1980) and Eckel and Grossman's (2002) choice between different gambles. In these experiments, individuals typically choose between different two-outcome lotteries in which higher expected payoffs come at the cost of a higher variance of payoff (that is, more risk).

<sup>1</sup>A third approach infers willingness to take risks from field behavior such as investment decisions. However, such measures do not provide an isolated measure of risk preferences but reflect risk preferences, beliefs about the extent of riskiness of a given behavior, and opportunities to engage in a given behavior, all at the same time.

There are clear-cut tradeoffs between using self-reported survey or incentivized experimental measures of risk preferences (see also Charness, Gneezy, and Imas 2013). Experimental economists consider experiments as the methodological gold standard for measuring preferences since experiments observe real choices with real incentives in well-controlled decision situations that are comparable across individuals. By assigning probabilities to each outcome, experimental measures precisely quantify the risks under consideration, while survey measures might capture risk perception on top of risk preferences. However, experimental measures are costly and time-consuming to implement in large representative samples. Therefore, they often rely on single-item measurement, making them more prone to measurement error. In Gerhardt, Schildberg-Hörisch, and Willrodt (2017), my coauthors and I measure risk preferences by the monetary amount that is needed to make an individual indifferent between two-outcome lotteries with varying expected payoffs and payoff spreads (“risk premium”). We find pairwise Pearson’s correlation coefficients on within-subject risk premia in four different choice lists (that is, within the same experimental task format) that range between 0.27 to 0.57. Administering multiple measures of risk preferences to the same individuals, Frey, Pedroni, Mata, Rieskamp, and Hertwig (2017) document partial correlations among seven different experimental measures that are below 0.1 on average compared to around 0.2 among 22 different self-report measures. From this perspective, it’s not a surprise that survey measures tend to outperform experimental measures in terms of external validity (for example, Dohmen et al. 2011; see also Mata, Frey, Richter, Schupp, and Hertwig in this issue, who generally take a more skeptical view on experimental measures).

Typically, economists use measures of risk preferences that aim at eliciting an “overall” risk preference, reflecting the common assumption in economics that a single risk attitude governs risk-taking in all risk-related domains such as financial investments, and health- or job-related risks. However, the existence of a single risk preference across all risk-related domains is not undisputed (for example, Weber, Blais, and Betz 2002; Hanoch, Johnson, and Wilke 2006).<sup>2</sup> In a representative sample of the German population, Dohmen et al. (2011) find correlations of about 0.5 across different risk domains such as financial matters, health, career, sports and leisure, and car driving as well as for general risk preference and domain-specific ones. They take this finding as evidence that risk preferences across domains are correlated strongly, but far from perfectly.

In my view, the recent economic research on measurement of risk preferences lays the groundwork for studying stability of risk preferences (for a more skeptical judgment, see Friedman, Issac, James, and Sunder 2014). Nevertheless, there is still a lot of scope for improvement in measurement tools for (risk) preferences. In particular, economists can benefit from adopting the psychometric standards applied to personality traits in psychology for the case of economic preferences (Borghans,

<sup>2</sup>Weber, Blais, and Betz (2002) provide a domain-specific risk-taking (DOSPERT) scale whose 40 items measure risk-taking in the domains of recreational, health/safety, social, and ethical risk; gambling; and investments.

Duckworth, Heckman, and Bas ter Weel 2008). For example, economists should search for the measures with highest test–retest stability in shorter time intervals in panel data in order to reduce measurement error and apply them more broadly. Moreover, if information from multiple survey items, multiple experiments, or both kinds of measurement tools are combined to obtain a single measure of individual risk preference, it may help reduce measurement error.

### **Definition of Preference Stability in Economics**

In economic theory, stability of preferences is defined as stability at the level of the individual (as opposed to stability of the distribution of preferences in a given population). Stability of risk preferences implies that, in the absence of measurement error, one should observe the *same* willingness to take risks when measuring an individual’s risk preferences repeatedly over time. Indeed, a standard approach in economics is to attribute any changes in measured risk preferences to measurement error and to consider them as meaningless noise.

In the common economic risk paradigm,<sup>3</sup> a single parameter is sufficient to characterize an individual’s risk preferences. The value of this single parameter differs across individuals, spanning the continuum from risk proclivity over risk neutrality to risk aversion, with a large majority of individuals being risk-averse (for example, Dohmen et al. 2011). In the subjective expected utility theory framework (Savage 1954), risk preferences are completely characterized by a parameter that describes the curvature of an individual’s utility function. Similarly, in the model-independent concept of risk apportionment (Eeckhoudt and Schlesinger 2006), an individual is classified as risk-averse if that individual prefers a particular lottery to a mean-preserving spread of that lottery. Conversely, an individual who prefers the mean-preserving spread over the original lottery is classified as risk seeking. The intensity of a subject’s risk attitude is measured by the monetary amount—the “risk premium”—that is needed to make the subject indifferent between a lottery and a given mean-preserving spread of that lottery. In both approaches, the standard economic definition of stability of risk preferences implies that, in the absence of measurement error, one should obtain the same estimate of the parameter of interest (curvature parameter or risk premium) when measuring an individual’s risk preferences repeatedly.

### **Concepts of Stability of Personality Traits in Psychology**

In personality psychology, “traits” are defined as enduring patterns of behavior, thought, and emotion that are relatively stable over time but differ across individuals (Roberts 2009).<sup>4</sup> Personality traits and economic preferences are related in the

<sup>3</sup>In this article, we neglect alternative theories of decision-making under risk or uncertainty such as prospect theory (Kahneman and Tversky 1979) or ambiguity aversion (Ellsberg 1961). However, many arguments put forward in this article apply to preferences under prospect theory or ambiguity as well.

<sup>4</sup>One commonly used taxonomy of personality traits are the Big Five: Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism (for discussion, see Costa and McCrae 1992).

sense that both are characteristics of an individual that are assumed to be important predictors for individual decision-making. Almlund, Duckworth, Heckman, and Kautz (2011) and Borghans et al. (2008) provide thoughtful introductions to personality psychology for economists and discuss the relation between economic preferences and personality traits in more depth.

Personality traits are considered stable if they meet the criterion of *rank-order stability*. Rank-order stability implies consistency in the rank ordering of individuals according to the intensity of a given trait across repeated measurements and is typically measured by correlations: in this setting, those who are most risk-averse at one time also tend to be most risk-averse at later times. While a high level of rank-order stability is a defining aspect of a trait, mean-level stability is not. *Mean-level stability* refers to consistency in the average level of a trait over time. It is important to stress that the concept of mean-level stability refers to an “average level” or central tendency in repeated measurement, not an exactly constant parameter value. However, personality psychologists acknowledge the existence of systematic changes in the average level of a trait within individual over time. Such changes might occur due to aging, new experiences, or traumatic events, for example.

Opposing the more traditional conception of personality traits being characterized by a mean or central tendency (measured with some error), Fleeson (2001) argues that personality traits should be conceived as density distributions. He offers three lines of evidence that within-person variability in traits is too large and too systematic to be ignored. First, on average, within-person variability in traits over time is as large as variability in traits between individuals. Second, within-person variability is not only measurement error but represents predictable individual differences in reactions to changes in the situation (“conditional traits”). Finally, for a given individual and a given personality trait, both mean and standard deviation of the distribution are parameters that are stable over time. According to this view, “trait concepts are not threatened in their usefulness by the existence of within-person variability, because of the equally large degree of distributional stability” (p. 1019).

## **Conceptual Framework and Empirical Evidence**

Most studies that report results on the stability of adults’ risk preferences in panel data document correlations of an individual’s risk preferences across time that are significantly positive but typically moderate (Dohmen, Lehmann, and Pignatti 2016; for a detailed and excellent review, see Chuang and Schechter 2015). The reported correlations range from 0.18 to 0.68 for time horizons varying from a few days to five years. About half of the studies use incentivized experiments as opposed to hypothetical experiments or survey questions. In contrast, correlations of risk preferences over time in Chuang and Schechter (2015), Horowitz (1992), Lönnqvist, Verkasalo, Walkowitz, and Wichardt (2015) are largely positive, but not significant. In this symposium, Mata et al. report correlations of risk preferences

of about 0.5 for any yearly time horizon of up to 10 years based on data from the German Socio-Economic Panel (SOEP).

This evidence about the stability of risk preferences can be interpreted as the glass being half-full or half-empty. It is half-full in the sense that the available empirical evidence implies that individual risk preferences do represent a persistent characteristic of an individual that is at least moderately stable over time: correlations over time in panel data are nearly exclusively positive, typically significant, and of medium or large size. It is half-empty because the correlations of risk preferences over time are low enough to cast doubt on the empirical validity of the strict stability definition typically put forward in economics. However, it is important to stress that less-than-perfect correlations in panel data do not provide unequivocal evidence in favor of changing risk preferences. Even if risk preferences were perfectly stable, measurement error in risk preferences could cause low correlations in panel data over time. But given the additional evidence on systematic changes in risk preferences as individuals advance in age, as well as due to exogenous shocks such as economic crises or temporary variations in self-control, emotions, or stress, it seems unlikely that measurement error alone is responsible for the substantial deviations from perfect correlations. Instead, it seems plausible that people's risk aversion changes.

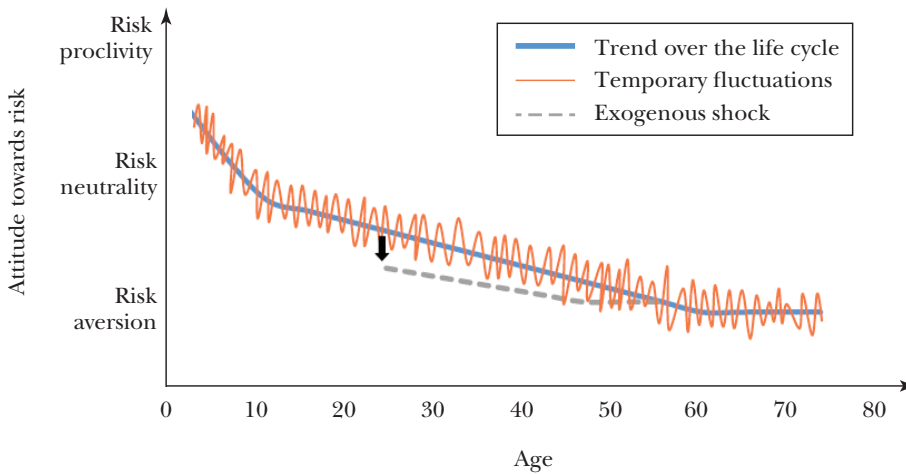
### **A Conceptual Framework for Preference Stability**

In the following, we suggest a framework for studying several possible reasons why an individual's risk aversion may change. The standard economic definition of stability of an individual's risk preferences—absolute stability of a single parameter that is sufficient to characterize an individual's risk preferences—is relaxed in several respects, building on concepts from personality psychology. In particular, we extrapolate Fleeson's (2001) concept of personality traits as distributions to the case of economic preferences and replace the single, constant parameter by a distribution that is characterized by mean and variance (ignoring further moments for the sake of simplicity). Moreover, we do not assume perfect mean-level stability (consistency in the average level of a trait over time). Figure 1 illustrates this framework. For expositional clarity, it focuses on a representative individual and ignores the substantial heterogeneity in risk preferences across individuals. The sketched effect sizes are inspired by empirical findings, and we provide some detailed estimates for each source of variation in risk preferences from selected studies below.

First, the solid line in Figure 1 shows continuous change in the mean-level of risk preferences, reflecting empirical evidence that individuals become more risk-averse over the life cycle. Second, the figure also allows for abrupt mean-level changes in individual risk preferences—as observed in the presence of exogenous shocks like economic crises, natural catastrophes, or violent conflict. This possibility is shown by the dashed line that represents a downward shift of the solid line. Third, the figure displays a distribution around that mean that could be represented by a variance. The variance of the preference distribution allows for temporary variation in risk preferences, which is in line with empirical evidence that temporary



Figure 1

**Illustration of the Framework for Studying the Stability of Risk Preferences**

*Note:* This figure illustrates a framework for studying several possible reasons why an individual's risk aversion may change. The solid line shows continuous change in the mean-level of risk preferences, reflecting empirical evidence that individuals become more risk-averse over the life cycle. The dashed line represents a possible downward shift of the solid line for abrupt mean-level changes in individual risk preferences—as observed in the presence of exogenous shocks like economic crises. The jagged line represents temporary variation in risk preferences, in line with empirical evidence that temporary variations in emotions, self-control, or stress cause temporary variation in risk preferences around a baseline or average level.

variations in emotions, self-control, or stress cause temporary variation in risk preferences around a baseline or average level.

Before I discuss the evidence concerning these three reasons for instability of risk preferences, I should stress that this framework does not propose to treat risk preferences as completely stochastic. Age-related changes in adults' risk preferences are modest in size and take place slowly. Exogenous shocks are rare events. Temporary changes in self-control, stress, and emotions induce only temporary, typically small changes in risk preferences. As a result, individual risk preferences are moderately stable over time and sufficiently persistent to be considered an individual trait. However, their degree of stability is too low to be reconciled with the assumption of perfect stability in neoclassical economic theory. Moreover, because change in risk preferences is systematic, it should not be dismissed as meaningless noise.

**How Do Risk Preferences Evolve over the Lifetime?**

There is a clear pattern of risk preferences over the life cycle: as individuals grow older, they become less willing to take risks. Empirical evidence on risk preferences in childhood and adolescence is largely based on cross-sectional data and



documents systematic changes as children grow. At younger ages, children are more willing to take risks than adults, and a larger share of them behave in a risk-seeking manner (Deckers, Falk, Kosse, and Schildberg-Hörisch 2015; Levin, Hart, Weller, and Harshman 2007; Moreira, Matsushita, and Da Silva 2010; Paulsen, Platt, Huettel, and Brannon 2011). As children grow they become less willing to take risks and in adolescence their risk preferences converge to those of adults (Levin, Hart, Weller, and Harshman 2007; Levin, Weller, Pederson, and Harshman 2007; Paulsen et al. 2011).<sup>5</sup> For example, in Deckers et al. (2015), correlations range from 0.12 to 0.24 for a period of 16 months with an average initial age of 7.8 years, while Levin, Hart, Weller, and Harshman (2007) present a correlation of 0.38 over a three-year period with age ranges of 6–8 and 9–11.

These systematic changes in risk preferences during childhood and adolescence are in line with a standard model of skill formation (Cunha and Heckman 2007). The skills in this model include both cognitive and noncognitive skills—such as risk preferences, patience, self-control, and perseverance. Skill formation is modeled as a dynamic, multistage process. In contrast to a model of stable preferences, children's skills in this model change over time as the result of accumulating investments and the self-reinforcing and cross-fertilizing nature of skills.

From the onset of adulthood to old age, the trend to greater risk aversion continues but is less pronounced (Buccioli and Zarri 2015; Dohmen, Falk, Golsteyn, Huffman, and Wagner 2017; Josef, Richter, Samanez-Larkin, Wagner, Hertwig, and Mata 2016; Sahm 2012; Schurer 2015). Three studies have used panel datasets and disentangle birth cohort and period effects from age effects. Using large representative panel datasets like the DNB Household Survey from the Netherlands and the German Socio-Economic Panel in Germany, which include self-reported measures of the willingness to take risks, Dohmen et al. (2017) find that the willingness to take risks decreases linearly from early adulthood until approximately age 65, after which the slope becomes flatter. In terms of effect size, risk attitudes decrease by about 0.023 standard deviations for each additional year of age. Translating this age effect into an effect on life outcomes, Dohmen et al. (2017) predict that an increase in society's median age of 10 years implies 6 percent less self-employment or 2.5 percent less investment in stocks, *ceteris paribus*. Building on their work, Schurer (2015) documents that risk tolerance declines strongly for all socioeconomic groups from late adolescence up to age 45. From age 45 onwards, however, the risk tolerance of individuals with high socioeconomic status stabilizes or even increases, while the risk tolerance of individuals with low socioeconomic status continues to drop. Using panel data on hypothetical gambles on lifetime income from the US Health and Retirement Study, Sahm (2012) finds a modest decline in risk tolerance in a sample of older adults (age 45–70).

<sup>5</sup>However, Sutter, Kocher, Glätzle-Rützler, and Trautmann (2013) do not find a significant age trend when studying the risk preferences of 10–18 year-olds.

Because all three of these studies rely on self-reported measures of risk aversion, they do not allow for disentangling whether it is risk preferences, risk perceptions, or constraints (for example, having a higher number of dependents to worry about) that changes with age. Cross-sectional evidence based on hypothetical choices between lotteries (Donkers, Melenberg, and Van Soest 2001) and choices between safe payoffs and lotteries (reviewed in Mata, Josef, Samanez-Larkin, and Hertwig 2011) tends to confirm that risk aversion increases in age, although effect sizes are rather small. This line of research focuses on lotteries with given probabilities and well-defined, rather low payoffs, suggesting that changes in willingness to take risk by age at least partially reflect changes in risk preferences.

### **Do Exogenous Shocks Affect Risk Preferences Lastingly?**

The literature on how exogenous shocks such as natural disasters, violent conflict, or economic crises affect risk preferences is relatively new, but growing quickly.

For negative economic shocks such as the financial crisis in 2008–2009, the evidence rather consistently documents an increase in risk aversion, using a variety of methods. In terms of our framework, such an increase in risk aversion represents an abrupt mean-level change in individual risk preferences. Dohmen, Lehmann, and Pignatti (2016) document this result based on self-reported questionnaire measures of general risk preferences and representative survey data from Germany and Ukraine. Gerrans, Faff, and Hartnett (2015) work with data on financial investors from Australia, the United Kingdom, and the United States who filled out a psychological trait scale that also covers self-assessed financial risk tolerance. Guiso, Sapienza, and Zingales (forthcoming) measure the rise in Italian investors' risk aversion using both a measure of self-assessed financial risk-taking and hypothetical choices between a constant gamble paying €10,000 or zero with equal probability and a sequence of safe payments, similar to the price list approach. In terms of effect size, they find that the risk premium required to accept the risky gamble increased from €1,000 to €2,500 following the crisis. Similarly, the fraction of respondents who say they do not want to take any financial risk rises from 16 to 43 percent. Necker and Ziegelmeyer (2016), working with representative panel data on self-reported financial risk attitudes from Germany, document that households attributing losses to the crisis decreased their risk tolerance.

A potential concern about studies that estimate risk aversion by using the willingness to take financial risks is that it is hard to disentangle whether changes in the willingness to take financial risk reflect changes in risk preferences or beliefs about returns. For example, Weber, Blais, and Betz (2002) document reduced risk-taking of investors due to the financial crisis, which they attribute to changes in subjective expectations of risk and return as opposed to changes in risk preference—which they argue is rather stable in their data. Malmendier and Nagel (2011) provide evidence that is consistent with a beliefs channel, but does not rule out an effect of experiences on risk preferences. All studies suggest that changes in risk preferences due to the financial crisis are not mostly driven by changes in income or wealth

(see also Sahm 2012; Buccioli and Miniaci 2018).<sup>6</sup> Guiso, Sapienza, and Zingales (forthcoming) and Necker and Ziegelmeyer (2016) point at negative emotions as a possible channel for increased risk aversion.

Another strand of the literature studies the relationship between macroeconomic conditions and risk preferences in general, instead of focusing on shocks only. This literature provides evidence for continuous, typically modest, mean-level changes in risk preferences due to continuously changing macroeconomic conditions. For example, Buccioli and Miniaci (2018) use panel data from the representative Dutch Household Survey, self-reported attitudes towards financial risk-taking, and GDP, market returns, and unemployment rates as contemporaneous macroeconomic indicators. Sahm (2012) uses panel data on older adults (age 40–75), hypothetical gambles on lifetime income from the US Health and Retirement Study (HRS) as a measure of risk preferences, and an Index of Consumer Sentiment to proxy the business cycles. Both studies document that individuals are willing to take substantially larger risks during periods of economic growth and are more risk-averse during periods of recession. Malmendier and Nagel (2011) take a more long-term view and examine whether households differ in their willingness to take financial risks depending on the macroeconomic history they experienced over the whole course of their lives. Using repeated cross-section data from the US Survey of Consumer Finances from 1960 to 2007 and controlling for age and year effects, they show that households with higher experienced stock market returns express a higher willingness to take financial risk. More recent experiences receive higher weights, but even returns experienced decades earlier still have some impact. Based on their estimates, the authors extrapolate that for those aged 30 in 2008, the effect of the financial crisis will only have died away after 30 years, pointing at a rather slow fade-out of large shocks.

Research on how natural catastrophes or violent conflict affect risk preferences is inconclusive. The literature review by Chuang and Schechter (2015) finds that natural disasters such as earthquakes, famines, floods, droughts, hurricanes, and tsunamis have been found to either increase risk aversion, or decrease risk aversion, or to have no (consistent) effect on risk preferences. Likewise, the effects of conflict such as civil wars, riots, or political violence show contradictory results, suggesting that conflict may decrease risk aversion (Voors, Nillesen, Verwimp, Bulte, Lensink, and Van Soest 2012) or increase risk aversion (Callen, Isaqzadeh, Long, and Sprenger 2014; Kim and Lee 2014; Moya 2015). Currently, we can only guess about the reasons for these inconsistent results. A large share of the papers that document contradictory effects of violent conflict or natural disasters use experimental data from developing countries, but these tools were typically developed in the context of high-income countries. They may be more likely to produce noisy results in samples that are less educated, partly illiterate, or less used to abstract thinking (for example, Vieider forthcoming; Chuang and Schechter 2015). Moreover, the literature on the effects of natural catastrophes or violent conflict is suffering from a lack

<sup>6</sup>Moreover, major individual-level shocks such as changing labor market status do not seem to affect risk preferences (Sahm 2012; Dohmen, Lehmann, and Pignatti 2016).

of theoretical predictions about the circumstances under which we should expect an increase or decrease in an individual's willingness to take risks. This literature is growing quickly, and in the future, it may become possible to do a meta-analysis that could shed light on the reasons behind the divergent findings.

### **Are There Systematic but Temporary Variations in Risk Preferences?**

A rapidly growing body of research has investigated factors in the decision environment that go beyond prices and constraints, and which might cause systematic but temporary deviations from underlying "baseline risk preferences." This research can be broadly grouped into two areas: temporary variations in an individual's self-control resources, or temporary variation in emotions and stress.

In the area of self-control, a recent class of economic models posits that economic decisions are shaped by the interaction of "dual selves" or "dual systems": a deliberative or long-run and an affective or short-run system (for a review, see Alós-Ferrer and Strack 2014). Several of these models explicitly address decision-making under risk. In particular, lower current levels of self-control resources are assumed to shift the balance of power in favor of the risk-averse short-run self, at the cost of the risk-neutral long-run self. Thus, lower self-control is predicted to induce stronger risk aversion for stakes within a particular range (for example, Fudenberg and Levine 2006, 2011, 2012; Fudenberg, Levine, and Maniadis 2014).<sup>7</sup>

Several laboratory experiments provide causal evidence on the link between self-control and risk preferences by using so-called "ego-depletion tasks" from social psychology (for meta-analyses, see Hagger, Wood, Stiff, and Chatzisarantis 2010; Carter and McCullough 2014; Hagger et al. 2016). Depletion tasks are based on the notion that exerting self-control in one activity consumes self-control resources, thereby increasing self-control costs in subsequent activities (Baumeister, Bratslavsky, Muraven, and Tice 1998). Increased self-control costs in turn will result in lower levels of self-control exertion and thus increase risk aversion according to the models of Fudenberg and Levine (2006, 2011, 2012) and Fudenberg, Levine, and Maniadis (2014). Measuring risk preferences via finely graduated choice lists, in Gerhardt, Schildberg-Hörisch, and Willrodt (2017), my coauthors and I explicitly test hypotheses from the Fudenberg–Levine model. We do not find any evidence for increased risk aversion after self-control depletion, but a small, consistent tendency towards increased willingness to take risks. The same tendency of increased risk-taking under ego-depletion is observed in Friehe and Schildberg-Hörisch (2017), where we measure risk preferences using the risky investment task by Gneezy and Potters (1997). Similarly, Stojić, Anreiter, and Carrasco Martinez (2013) do not find a significant effect of ego-depletion on risk preferences measured via price lists. Benjamin, Brown, and Shapiro (2013, Study 3) and Gerhardt, Biele, Heekeren,

<sup>7</sup>In this literature, the predictions of Loewenstein and O'Donoghue (2005) and Mukherjee (2010) refer to risk-related decision-making under prospect theory as opposed to expected utility theory: for example, Loewenstein and O'Donoghue (2005) predict that lower current levels of self-control induce risk aversion through more pronounced probability weighting.

and Uhlig (2016) use cognitive load manipulations (specifically, memorizing large numbers) that are expected to decrease self-control resources at the time of risky decision-making. Risk preferences are measured by a price list or multiple pairwise lottery choices, respectively. Both studies show that cognitive load induces significantly more risk-averse behavior. In terms of effect sizes, the riskier of two lotteries is chosen in 54 percent of choices in the cognitive load condition and 57 percent in the absence of cognitive load in Gerhardt et al. (2016).

Predictions on how emotions or stress should plausibly influence risk preferences are conflicting. In psychology, the Mood Maintenance Hypothesis (Isen and Patrick 1983) suggests that positive affect induces greater risk aversion, while negative affect leads to a higher willingness to take risks. (The term “affect” refers to conscious, subjectively experienced aspects of an emotion, apart from bodily changes.) The intuition is that individuals in good mood try to protect their good mood by avoiding risks, while individuals in bad mood take risks, trying to improve their mood. The Affect Infusion Model (Forgas 1995) posits the opposite effects. Since risk-related decision-making is a complex process that requires deliberation, this model posits an “affect-priming-mechanism” to be at work—that is, affect may indirectly influence decisions through its influence on selective attention to information or via associative processes. In particular, affect-priming predicts that subjects in bad mood will be more risk-averse than subjects in good mood since they are more attentive to downside risks.

With a few exceptions, empirical evidence on temporary shifts of risk preferences due to changes in emotions or stress tends to be in line with the Affect Infusion Model: that is, negative emotions like fear or stress are typically found to increase risk aversion in studies that establish causal relationships. Most empirical studies on the relation between risk preferences and emotions use a priming approach, so that the resulting shift in emotions can be treated as exogenous. For example, Guiso, Sapienza, and Zingales (forthcoming) induce fear by having students watch a horror movie, then measure risk preferences using a hypothetical choice-list format and find that on average treated students have a 27 percent higher risk premium than untreated ones. Using an incentivized, adapted risky investment task, Cohn, Englemann, Fehr, and Maréchal (2015) prime financial professionals with a financial boom-or-bust scenario and document that subjects are more fearful and substantially more risk-averse in the bust than in the boom condition. In particular, they invest on average 22 percent less into the risky asset in the bust condition than in the boom condition. Moreover, they expose university students to low or high levels of fear by threat of painless or painful electric shocks and show that those with lower levels of fear are willing to take significantly higher risks in ambiguous risky decisions. In Kandasamy et al. (2014), subjects are randomly assigned to taking placebo or hydrocortisone capsules which induce chronic stress over an eight-day period and make incentivized pairwise choices between lotteries. While there is no effect of acute stress (shown by the cortisol response 90 minutes after the first hydrocortisone capsule was taken) on risk preferences, sustained elevation of cortisol leads to greater risk aversion. Cahlíková and Cingl (2017) expose

a randomly chosen subset of participants to a psychosocial stressor in a standard laboratory stress-induction procedure, the Trier Social Stress Test for Groups, and measure risk preferences via multiple price lists. They find that acute psychosocial stress significantly increases risk aversion, a result that is mainly driven by men.<sup>8</sup>

## Implications and Conclusion

We started from the premise that it is ultimately an empirical question whether risk preferences are stable over time. The evidence stems from diverse strands of literature, covering the stability of risk preferences in panel data over shorter periods of time, life-cycle dynamics in risk preferences, the possibly long-lasting effects of exogenous shocks on risk preferences as well as temporary variations in risk preferences. Individual risk preferences appear to be persistent and moderately stable over time, but their degree of stability is too low to be reconciled with the assumption of perfect stability in neoclassical economic theory. Inspired by research in personality psychology, we have proposed a framework for preference stability that considers preference parameters as distributions and relies on rank-order stability without imposing mean-level stability. This framework is able to accommodate the empirical evidence on stability and change in risk preferences. Important next steps in research on the stability of risk preferences involve empirical, theoretical, and policy issues.

For empirical research, an important next step would be to seek ways to reduce measurement error in risk preferences. There is a largely unexplored potential for economists to benefit from applying psychometric standards from personality psychology to measures of economic preferences (Borghans et al. 2008; Golsteyn and Schildberg-Hörisch 2017). In particular, it should become standard to measure a single construct like risk preferences with multiple items (experiments and/or questionnaire measures) and to average over those items in order to reduce measurement error. Economists should search for measures of risk preferences with the highest test–retest stability in panel data over shorter periods of time. Moreover, researchers should use measurement tools of risk preferences that have been validated in the context under consideration: for example, a study seeking to measure risk aversion in a largely illiterate sample should use a tool that has been validated in a similar sample.

<sup>8</sup>Among studies that do not find the connection described in the text, Conte, Levati, and Nardi (forthcoming) induce emotions using short film clips and then measure risk preferences by pairwise binary lottery choices and find that fear, sadness, anger, and joviality induce risk-seeking behavior. Also, using the Trier Social Stress Test for Groups, a between-subject design, and incentivized, binary choices between lotteries, Buckert, Schwioren, Kudielka, and Fieback (2014) observe stronger risk proclivity for gains, however only for the small subgroup of participants that show a robust cortisol response to acute stress. As Trautmann (2014) points out, the division of subjects exposed to the stress test into responders and nonresponders possibly induces selection problems and inhibits any causal claims.



As far as theory is concerned, research on the stability of risk preferences might ultimately result in an overarching model of endogenous risk preferences in which risk preferences evolve over time as a function of, among others, aging, exogenous shocks, and changes in the decision environment that encompasses situational factors such as the current level of self-control, stress, or emotions. By acknowledging that individual risk preferences are not carved in stone but may change under specific circumstances, economists would take an important step towards the view commonly held in psychology that the decision environment (beyond incentives and constraints) affects individual decisions.

For many research questions and circumstances, it will still be fine to adopt the simpler textbook model of stable risk preferences as an as-if approach and to investigate how individuals with given preferences react to changes in incentives and constraints. However, systematic changes in risk preferences over time severely complicate policy advice and welfare analysis. After all, policy advice is typically based on predicting (or in case of evaluation, retrospectively documenting) behavioral reactions to institutional changes under the assumption that preferences are stable. Preference changes are a major threat to that approach. To give just one example, consider policymakers who react to a financial crisis with a new regulation. If the financial crisis has induced the population to become more risk-averse, but public policy assumes constant risk preferences before and after the crisis, those proposing and analyzing the new policy will fail to predict behavioral responses adequately.

On the other side, acknowledging these systematic instances of changes in risk preferences opens up new possibilities for public policy. If exogenous shocks affect risk preferences lastingly, policymakers could expose individuals to positive “shocks” in their social environment. For example, such interventions might aim at reducing the high levels of risk proclivity that are associated with drug addiction, criminal activities, or teenage pregnancies. Gutman and Schoon (2013) and Kautz, Heckman, Diris, ter Wel, and Borghans (2014) survey evidence on the effects of interventions such as mentoring programs, social and emotional learning programs, center-based care, residential-based education programs, or programs aimed at improving parenting practices. Some of the surveyed interventions have been found to decrease overly risky *behaviors*, but no evaluation directly measures risk *preferences*. An important prerequisite for the successful timing of interventions in childhood and adolescence is identifying critical periods in which risk preferences are especially malleable (Cunha and Heckman 2007), an open challenge for future research.

Finally, a recognition that risk aversion may shift seems to imply that people have multiple preferences, leaving open the question of which kind of preferences public policy and welfare analysis should rely on. While this article has focused on the stability of risk preferences, similar lines of reasoning apply to other dimensions of economic preferences—in particular time preferences and social preferences—and empirical evidence concerning their stability and systematic instances of changes in these areas is starting to accumulate as well. Evidence of systematic preference changes over time deprives economics of a clean analytical foundation



for assessing the welfare impact of policies and behaviors, and there is no consensus for how to deal with the issue. For example, O'Donoghue and Rabin (2003), Thaler and Sunstein (2003), Glaeser (2006), O'Donoghue and Rabin (2006), Bernheim (2009), Bernheim and Rangel (2009), and Chetty (2015) propose highly divergent approaches for how to do welfare economics if choices do not unambiguously reveal preferences. Others have proposed turning away from welfare criteria that are based on preference satisfaction, suggesting an opportunity-based approach to welfare (as in Sugden 2004) or approaches rooted in happiness economics (for example, O'Donnell, Deaton, Durand, Halpern, and Layard 2014). Addressing the issue of how to conduct research and policy while acknowledging the reality of changing preferences seems certain to present difficult challenges.

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