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Comparing the Risk Attitudes of U.S. and German Farmers

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The view of an entrepreneur put forth by classical economists (Knight, quoting von Thunen, Part I, Chapter II, paragraph 8) is of a person who is rewarded for ‘(1) ... [taking] certain risks which cannot be insured against and (2) the extra productivity...due to ... his sleepless nights when he is planning for the business.’ Given these demands placed upon entrepreneurs, and the relative freedom of occupational choice afforded in many nations, we might expect that entrepreneurs tend to have higher levels of risk tolerance and planning acumen. Indeed, theoretical models predict that the risk tolerant will choose entrepreneurship over wage labor (Kihlstrom and Lffont; Cressy) while empirical studies confirm that risk tolerant individuals disproportionately begin and sustain entrepreneurial enterprises such as self-employment and small business ownership (van Praag and Cramer; Wang and Hanna; Xiao et al.).

Farming enterprises face uninsurable risk and require sleepless nights of planning that can only be executed by the farmer. However, many developed countries have government-sponsored programs that stabilize farm incomes or reduce farming risks that were, in times past, uninsurable. A fundamental question is whether such programs have affected the distribution of risk tolerance of farmers, particularly in light of recent research suggesting that risk tolerance is a heritable trait (Cesarini *et al.*) and given evidence that farmers often beget farmers (Laband and Lentz). Such a causal effect of farm programs could present a previously-unconsidered long-term impact on the sector. Such an impact may not be desirable, as some suggest that lower ambient risk tolerance leads to lower wages and returns (Khilstom and Laffont; Friedman).

In this paper we ask a simpler though related question: how does the risk tolerance of farmers compare with that of self-employed small business owners? To answer these questions, we use a robust survey measure of risk tolerance first developed and administered in the German Socioeconomic Panel (SOEP) and later validated with financially-binding experiments (Dohmen *et al.*). We find U.S. and German farmers report a similar distribution of risk tolerance even after controlling for several major confounding characteristics such as gender, age and income. Furthermore, in both Germany and the United States, we find business owners are significantly more risk tolerant than farmers even after controlling for several major confounding demographic characteristics. While the data and analysis do not yield a refutable causal link, the finding stimulates questions concerning the role of farm programs and the unusual nature of entry into farming in shaping the underlying distribution of key farmer characteristics such as risk tolerance.

Beyond the role of risk attitudes in aggregate sectoral performance, farmers’ risk attitudes may play a critical role in a broad array of decisions, ranging from supply response (Just), input use (Roosen and Hennessy), insurance coverage (Moschini and Hennessy), marketing (Pennings and Garcia), technology adoption (Feder) and borrowing (Leatham and Baker). While there is an extensive literature on the estimation of risk preferences of farmers, little is known about the heterogeneity of risk preferences within farm populations or across countries. Hence, our work contributes by comparing the distribution of risk attitudes of farmers between countries and between farmers and important domestic reference populations such as business owners.

In addition this work contributes to an expanding literature that considers the role of risk attitudes in the decision to form and sustain entrepreneurial enterprises, which are often proxied by small business ownership and self employment (van Praag and Cramer; Wang and Hanna; Xiao et al.; Hryshko, Luengo-Prado and Sorensen). However, much of this literature focuses on activities in the general population with little attention paid to agriculture, which faces a distinct entry process and sector-specific government programs, and little attention paid to possible differences across countries.

Risk Attitude Measurement

Following Dohmen *et al.* we use the following survey question to assess individual risk tolerance: “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?” Respondents provide a single response from an 11-point scale anchored by the words “Don’t like to take risks” for the lowest value and “Fully prepared to take risks” for the largest value. Dohmen *et al.* analyze 22,000 responses to this question as administered by the 2004 SOEP study. They find the survey responses to be significantly correlated with stock ownership, occupational choice, traffic offenses and migration as well as significantly correlated with the behavior of a smaller sample of respondents (N=450) in a financial-binding economic experiment commonly used to elicit risk aversion parameters. Furthermore, Lonnqvist *et al.* find this measure to exhibit strong test-retest stability.

While no previously published work has administered the SOEP risk tolerance question to a U.S. population,¹ other survey measures have been included on a number of large-scale surveys of the general U.S. population. The lifetime-income gamble question, for example, was included in the Health and Retirement Survey (HRS), the National Longitudinal Study (NLS) and the Panel Study of Income Dynamics (PSID). Hryshko, Luengo-Prado and Sorensen find that responses from PSID members predicted a wide variety of behaviors including business ownership while Barsky *et al.* find responses from the HRS significantly correlate to behaviors such as smoking, drinking, insurance coverage and stock ownership. An investment risk/return preference question has regularly been asked on the Federal Reserve Board’s Survey of Consumer Finances study to gauge individual risk tolerance. Wang and Hanna and Xiao *et al.* find individuals that own businesses are more risk tolerant than other individuals.

Other survey questions designed to measure risk preferences have been administered to narrow segments of farmers. For example, Fausti and Gillespie administer several risk attitude instruments to cattle farmers in Louisiana and South Dakota and find several measures to significantly correlate with investment behavior, alcohol use and tobacco use, while Pennings and Garcia administer a multi-item risk survey to Dutch hog farmers and find that the responses contribute to a global risk attitude construct that correlates with futures markets use.

¹ Fehr *et al.* report an average response for a U.S. population sample, but provide no information concerning the administration of the survey or analysis of the data. The authors (personal communication, August 28, 2010) have no additional information concerning the US sample data beyond the average reported.

Alternative approaches to estimating risk attitudes of farmers have included econometric models of individual (Saha, Shumway and Talpaz) and aggregate (Chavas and Holt) production decisions and experimental economic approaches (Binswanger; Just and Lybbert). Econometric approaches struggle to parse behavioral variation between that induced by risk preferences and that induced by technological or institutional constraints (Lence; Just and Pope). While increasingly popular, experimental approaches have largely been used with farmers in developing contexts due to the prohibitive cost of providing salient incentives to farmers in developed economies. Even within developing contexts, reaching a representative sample with the experimental apparatus remains a logistical challenge.

Survey approaches like the one we implement also face challenges. Survey administration may occur in settings where the researcher has little control over the environment faced by respondents (e.g., via a mail, phone or internet survey) and where respondents have no financial motivation to provide accurate responses. However, survey approaches are well developed in terms of accessing representative sample populations and providing an opportunity to ask questions that can help validate measures of interest (e.g., asking about risk-taking behaviors). Given the strength of emerging evidence on the validity of survey based measures of risk attitudes provided by Dohmen *et al.* and the paucity of nationally representative information concerning the risk attitudes of farmers, the SOEP measure is chosen for the current study.

Methods and Sample

German Farm and Non-farm Business Sample

Data were taken from the 2008 wave of the German SOEP study. The SOEP is a representative panel survey of the German population that started in 1984 that provides detailed information about all household members including the risk tolerance rating data described above. The 2008 wave includes information on 18,703 individuals in 10,530 households and includes 42 individuals who list farming as their occupation and 653 individuals who list non-farm non-freelance self-employment as their occupation, which, following the tradition of much research on entrepreneurship, we will classify as the German business owner sample.

U.S. Farm Operator Population

Data were collected by a mail survey administered by one of the authors during the first quarter of 2010. The postal addresses for the sample were provided by a commercial vendor who drew from a combination of industry and government sources to ensure a comprehensive sampling frame. The sample is balanced equally across four regions of the continental 48 states and targets farmers generating more than \$10,000 in annual gross farm income. The sample is stratified across gross farm income categories with oversampling of farmers in higher sales ranges to ensure enough total respondents from this smaller group of farmers. The sampling strategy creates county-level clusters, which are accommodated when constructing standard errors in all econometric work presented. The sample was weighted by farm size, region, age

and gender and assessed for remaining forms of bias. A total of 2,301 responses (43% effective response rate) contained complete data for the current analyses.

U.S. Nonfarm Business Population

Data were collected by a commercial vendor during August and December of 2010, as part of a weekly omnibus survey. The sampling frame is derived from a comprehensive listing of the addresses of nearly all households serviced by the U.S. Postal Service. Those with available telephone listings are invited to participate via phone while those without available telephone listings are invited via letter to either call in to a toll-free number to complete the survey or to complete the survey online.² The sample is stratified across four U.S. census regions and oversamples areas with higher Latino populations. Finally, the sampling strategy creates county-level clusters, which are accommodated when constructing standard errors in all econometric work presented. The sample is weighted to account for the multi-phase design and to resemble the U.S. adult population in terms of age-by-gender, education, census region and race. A total of 1,019 responses contained complete data for the current analyses.

As part of the general population survey, each individual is asked “Are you the owner or part owner of a small business?” Those answering in the affirmative (10.8%, s.e. = 1.2%)³ were asked the for the gross sales level of the business during the previous calendar year (2009) and asked to choose among size categories identical to those given to U.S. farmers to assess gross farm sales during 2009.

Occupation and Risk Tolerance

A key element of the analysis involves comparing the risk attitudes of farmers to nonfarm business owners. Like farmers, the population of business owners undertakes managerial tasks that are not easily delegated and bear the uninsurable risk of firm survival. Theoretical work by Khilstrom and Laffont predicts that risk tolerant individuals will choose business ownership over wage labor and that larger firms will be directed by more risk tolerant individuals. Several studies have correlated the risk attitudes of individuals to small business activity. Most confirm a significant positive correlation between risk tolerance and business entry (Caliendo, Fossen and Kritikos) and business operation (Dohmen *et al.*; Hryshko, Luengo-Prado, and Sorensen; Cramer *et al.*; Van Praag and Cramer; Colombier *et al.*; Wang and Hanna).

Business selection models also postulate that wealth may affect who becomes a business owner, either by loosening liquidity constraints that directly hamper business entry (Evans and Leighton) or by increasing risk tolerance via preferences that exhibit decreasing absolute risk

² The effects of format (phone versus internet) on responses to our key measure of risk attitude were tested and found to be insignificant.

³ The U.S. Census (2010) reported a total of 27.1 million businesses in 2007 and an adult population of approximately 230.1 million, suggesting an expected rate of small business ownership of about 11.8%, which falls in the 95% confidence interval of our estimate.

aversion (Cressy). Evans and Leighton as well as Evans and Jovanovic use data from the NLS to show that, all else equal, people with greater family assets are more likely to switch from employment to self-employment, while Holtz-Eakin, Joulfaian and Rosen document how inheritance increases the odds of survival by entrepreneurial firms while Blanchflower and Oswald show that self-employment is higher among individuals who had received inheritances.

Entry into farming is dominated by the children of farmers who often have access to familial land assets and human capital critical to successful farm entry. Compared to other small business owners, the children of farmers were nine times more likely to enter their parent's profession than the children of other small business owners in the United States (Laband and Lentz). Blanchflower and Oswald find significant though less dramatic results within a sample from the United Kingdom in which they are also able to control for inheritance size. Hence, differences in the ambient risk tolerances between farmers and non-farm business owners may reveal the importance of land succession and other farm-sector institutional and governmental influences on the selection process for farmers.

Results

Figure 1 presents the distribution of raw risk tolerance ratings by occupation and by country where the risk tolerance ratings are placed into one of three categories: low (ratings of 1-4), medium (5-7) or high (8-11). Key differences quickly emerge from this figure. For example, the modal category for farmers in both the U.S. and Germany is the medium risk tolerance category while the modal category for business owners in both the U.S. and Germany is the high risk tolerance group. Statistical tests using this three-way categorization confirm these visual observations. A χ^2 test of equal distribution across risk tolerance categories and across all four groups yields a test statistic of 66.78 ($\chi^2(6)$, $p < 0.001$). A similar test pooling all farmers and all business owners yields a test statistic of 62.82 ($\chi^2(2)$, $p < 0.001$) suggesting strong cross-occupational differences. However, similar tests between U.S. and German farmers ($\chi^2(2) = 0.29$, $p = 0.87$) and between U.S. and German business owners ($\chi^2(2) = 3.48$, $p = 0.18$) suggest no cross-country differences within occupational categories.

Tobit Models

Examination of the raw ratings data above suggest cross-occupational differences in risk tolerance but cross-cultural similarity of risk tolerance within occupation. However, the summary statistics reported in Table 1 suggest significant differences between groups in key demographic and personal characteristics. For example, U.S. farmers are significantly less female and older than all other groups. Furthermore, most research correlates both gender and age with reported risk tolerance, suggesting that the patterns in the distribution of risk tolerance across the group in Figure 1 may be driven by demographic differences in these groups rather than due to individual's occupation or country.

To further isolate the strength of association between country or occupation and risk tolerance we estimate a tobit model of risk tolerance with available characteristics as covariates

(Table 2). For example, in the first columns, we report the coefficients and robust standard errors of a tobit model using all German observations of risk tolerance. In addition to occupation, we control for gender, age, household income and marital status. Despite controlling for any differences in these other characteristics, the dummy variable for farming has a significant, negative correlation with risk tolerance. Note the magnitude of the effect is similar to that of the magnitude of gender, which is a well known correlate of risk tolerance.

In the middle columns, we explore the U.S. sample via a tobit model featuring covariates for gender, age, race, education, income, and business size as measured by sales. As with the German tobit model, we find that farming continues as a negative, significant correlate with risk tolerance despite controlling for these other characteristics. The magnitude of the effect is also non-trivial and is larger than effects such as race and education.

Finally, by pooling data across farmers from the U.S. and German datasets, we estimate a tobit model of risk tolerance that controls for gender, age, income, and education in addition to the role of the country. The country of operation has no significant correlation with reported risk tolerance, confirming the intuition of the visual comparison of raw ratings.

Discussion and Summary

These results provide a first glimpse at the distribution of risk attitudes drawn from nationally representative samples of farmers and business owners from the United States and Germany. The findings stimulate questions concerning the role of farm programs and the unusual nature of entry into farming (often via inheritance) in shaping the underlying distribution of key farmer characteristics such as risk tolerance. For example, Key and Roberts find that government payments significantly reduce the odds of farm exit in the United States. This might help explain why farmers are, in general, likely to be less risk tolerant than non-farm business owners in the United States. For example, one might imagine fewer exits due to government payments creates an older age profile within the sector which, due to the effect of age on risk tolerance, creates a population with less risk tolerance than small business owners in sectors without such government support. Furthermore, government payments may encourage less risk tolerant children of farmers to continue on in farming where similar children of non-farm business owners, who do not have access to government programs that stabilize income flows from non-farm businesses, may choose other career paths with less turbulent income streams.

In addition, entering farming may entail significantly less risk than non-farm businesses due to inheritance tendencies in the agricultural sector. Farmers are often the children of farmers and often acquire the family land, whereas there is less evidence that crucial assets for non-farm businesses are handed down across generations. Evans and Leighton and Evans and Jovanovic use data from NLS and Current Population Surveys to show that, all else equal, people with greater family assets are more likely to switch from standard employment to self-employment, while Holtz-Eakin, Joulfaian and Rosen document how inheritance increases the odds of survival by entrepreneurial firms. Blanchflower and Oswald show that self-employment is markedly higher among an English cohort if they received inheritances or were the child of a farmer.

The role of inheritance and government programs in shaping risk preferences among farmers may be important when considering the performance of the sector. Kihlstrom and Laffont develop a general equilibrium model in which individuals must either become entrepreneurs or work for entrepreneurs and show that the more risk tolerant will become entrepreneurs and, among entrepreneurs, the more risk tolerant will operate larger firms. This pattern is confirmed for the U.S. data analyzed here (no such data was available in the German samples). Friedman (1953) postulated that societal wealth will be greater (though more unequal) when a society is composed of more risk tolerant individuals.

Our own work here is limited in several domains, however. First, the small number of observations of German farmers and U.S. business owners limits the precision of our estimates concerning the correlates of risk tolerance. Additional waves of the SOEP may uncover German farmers not currently included in this sample while additional survey work in the U.S. may bolster our sample of U.S. business owners. Second, cross-cultural comparisons are limited by the lack of consistently-coded characteristics for our German and U.S. samples. Finally, the exact role of agricultural inheritance and farm programs in shaping the distribution of risk preferences will require a more explicit model of selection into farming and more data before any discussion of causality or structure can be entertained.

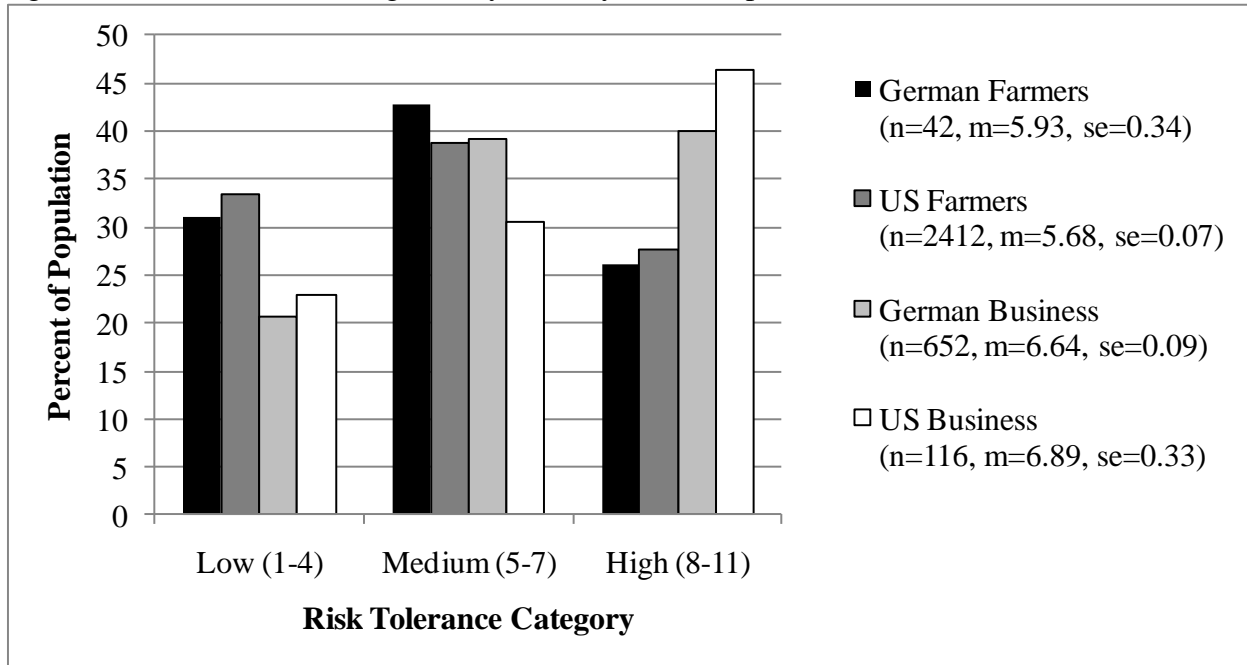
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Figure 1. Risk Tolerance Categories by Country and Occupation.



Notes: Risk tolerance is measured using SOEP risk question, which yields a rating on a scale from 1 (not willing to take risks) to 11 (fully prepared to take risks) and displayed in three categories outline in the graph. Abbreviations are n = number of observations, m = group mean, se = standard error of mean. German farmer and German business data taken from 2008 SOEP responses. US farmer and US business data taken from surveys conducted in 2010 by one of the authors.

Table 1. Mean Values of Characteristics Reported for Both Countries.

	---- U.S. Sample ----		----- German Sample -----	
	Farmers	Business Owners	Farmers	Business Owners
Risk Tolerance Rating	5.68 <i>a</i>	6.89 <i>b</i>	5.93 <i>a</i>	6.64 <i>b</i>
% Female	6.3 <i>a</i>	58.0 <i>b</i>	23.8 <i>c</i>	28.9 <i>c</i>
Age (years)	58.0 <i>a</i>	46.1 <i>b</i>	45.9 <i>b</i>	45.5 <i>b</i>
% HH Inc <\$50k	32.5 <i>a</i>	29.3 <i>a</i>	31.0 <i>a</i>	27.2 <i>a</i>
% HH Inc \$50 - \$100k	39.2 <i>a</i>	33.6 <i>a</i>	45.2 <i>a</i>	37.4 <i>a</i>
% HH Inc > \$100k	28.3 <i>a</i>	37.1 <i>a</i>	23.8 <i>a</i>	35.4 <i>a</i>
% Education ≥ College	27.8 <i>a</i>	42.2 <i>b</i>	19.0 <i>a</i>	22.9 <i>a</i>
N	2421	116	42	652

Notes: Risk tolerance is measured using SOEP risk question, which yields a rating on a scale from 1 (not willing to take risks) to 11 (fully prepared to take risks). Means within the same row that are not statistically distinct via pairwise testing share the same italicized letter. German farmer and German business data taken from 2008 SOEP responses. US farmer and US business data taken from surveys conducted in 2010 by one of the authors.

Table 2. Tobit Risk Tolerance Models.

<i>Variable</i>	German Sample		U.S. Sample		Farmer Sample	
	<i>Coef.</i>	<i>S. E.</i>	<i>Coef.</i>	<i>S. E.</i>	<i>Coef.</i>	<i>S. E.</i>
Female	-0.802***	0.196	-0.482	0.309	-0.847**	0.358
Age	0.004	0.009	-0.047***	0.006	-0.045***	0.007
White	--		-0.752*	0.404	--	
HH Income						
< \$50 k ^a	--		--		--	
\$50-\$100 k	0.373	0.231	1.079***	0.183	1.081***	0.187
>\$100 k	0.492**	0.236	1.441***	0.209	1.604***	0.207
Education						
≤ High School	--		-0.713***	0.188	--	
Some College ^a	--		--		--	
≥ College	-0.089	0.206	0.022	0.187	0.571***	0.172
Marital Status						
Married	0.329	0.302	--		--	
Separated	0.906*	0.539	--		--	
Single	0.611*	0.367	--		--	
Widow	1.224*	0.663	--		--	
Divorced ^a	--		--		--	
Business Sales						
<\$50 k ^a	--		--		--	
\$50k – \$100k	--		0.091	0.199	--	
\$100k - \$500k	--		0.612***	0.198	--	
\$500k - \$1 mil	--		1.345***	0.224	--	
>\$1 mil	--		1.981***	0.310	--	
Farmer	-0.766**	0.381	-0.881**	0.448	--	
American	--		--		0.101	0.379
Intercept	6.058***	0.563	8.552***	0.649	7.172***	0.502
Sigma	2.291	0.060	2.814	0.063	2.832	0.067
N	694		2416		2327	
Ln(likelihood)	-1539.16		-5471.39		-5625.83	
F-statistic	3.17***		26.39***		27.16***	

Notes: Dependent variable is risk tolerance rating from 1 to 11, with larger numbers indicating greater risk tolerance. Robust standard errors are reported. *, **, *** denote statistical significance at the 10, 5 and 1% levels. a – Denotes omitted category within group. German educational attainment data is limited to two categories – college educated or more and all others.