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A Quantile Regression Approach

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Christoph M. Schmidt and Harald Tauchmann[1]

Heterogeneity in the Intergenerational Transmission of Alcohol Consumption – A Quantile Regression Approach

Abstract

This paper addresses the question of whether the effect of parental drinking on children's later consumption of alcohol – which is frequently found to be of positive sign – exhibits a certain pattern of heterogeneity. In particular, if this effect is more prominent in the upper tail than elsewhere in the distribution of children's alcohol consumption, conventional regression analyses that focus on the mean effect may substantially underrate parental drinking as a risk factor for children's later alcohol abuse. In our empirical application, we address this issue by applying censored quantile regression methods to German survey data. The supposed pattern of heterogeneity is indeed found in the data, at least for daily parental drinking. In addition, the intergenerational transmission of alcohol consumption exhibits gender-specific heterogeneity.

JEL Classification: C14, I12, J62

Keywords: Alcohol consumption; intergenerational transmission; heterogeneity; censored quantile regression

May 2010

1 *Christoph M. Schmidt, RWI, Ruhr-University Bochum, and CEPR London; Harald Tauchmann, RWI.* – *We are grateful to GESIS (Leibniz Institute for the Social Sciences) and IFT Munich (Institute for Therapy Research) for providing the data as well as to Jochen Kluve, Sandra Schaffner, Marcus Tamm and, in particular, Manuel Frondel for many helpful comments. This work has been supported in part by the Collaborative Research Center "Statistical modeling of nonlinear dynamic processes" (SFB 823) of the German Research Foundation (DFG).* – *All correspondence to Harald Tauchmann, RWI, Hohenzollernstr. 1-3, 45128 Essen, Germany, e-mail: harald.tauchmann@rwi-essen.de.*

1 Introduction and Literature Review

Parental influence on children's drinking behavior is a well-established finding in empirical research on substance abuse.[1] In fact, children's consumption of alcohol is frequently found to be positively correlated with the level of parental drinking, cf. Ennett and Bauman (1991), Rice and Sutton (1998), Zhang et al. (1999), Beal et al. (2001),Van Gundy (2002), Tauchmann et al. (2006), and Komro et al. (2007).[2] In some cases, though, just one parent's influence turns out to be significant and/or only sons or daughters are affected. Very few analyses do not find a significantly positive parental influence, e.g. Yun (2003).

Yet, the magnitude of such effects seems to be less clear and requires additional discussion beyond the existing literature, as the vast majority of papers focus on qualitative results. A major reason is that determining whether such effects are harmful to children's physical and behavioral health or whether they merely represent the intergenerational transmission of a normal social behavior is far from easy. For instance, Tauchmann et al. (2006) find that children with a father who drinks alcohol daily consume roughly four grams of alcohol more a day than children of non-drinking fathers. The effect of maternal drinking is of similar magnitude. Though the estimated coefficients are clearly significant in statistical terms, four grams of alcohol merely represent half a standard drink[3]: Compared to consumption levels that are typically regarded as risky consumption – i.e. more than 30 grams a day for males and more than 20 grams for females (DHS, 2003) – parental

[1] This question has primarily been addressed by medical scientists, sociologists, and social psychologists. In contrast, genuine economic analyses seem to be rather rare in this field. For instance Jones et al. (1999), address a related question – the effect of parental drinking on children's behavioral health. Yet, the effects on children's alcohol consumption are not addressed.

[2] Yet one caveat remains in any analysis addressing the intergenerational transmission of consumption patterns: a positive correlation of parents' and children's behavior may reflect both (i) learning from parents and (ii) shared environmental factors and shared genetic disposition.

[3] For Germany, 10 grams of alcohol is typically defined a standard drink (DHS, 2003).

influence seems to be of rather moderate importance.[4] It appears that parental drinking can hardly be blamed to be the prime reason for a child's (later) alcohol-related problems. Yet, this is only true if parental drinking exhibits a uniform effect on children's consumption habits. If, however, the effect of parental drinking is heterogeneous, some children may badly be affected by the drinking behavior of mothers or fathers, even though the average effect appears to be rather moderate. In other words, parents might bear a greater responsibility when consuming alcohol than the estimated (average) effects on children's consumption seem to indicate.

This paper is concerned with a particular type of potential heterogeneity. Its focus is on the question of whether the importance of parental influence varies with the level of children's alcohol consumption. If the impact of parental drinking is particularly strong for high consumption levels, parents' drinking habits may have more harmful effects than indicated by the average transmission effect. If, in contrast, such a pattern is not found, or if the parental influence diminishes with the intensity of children's alcohol consumption, then parental drinking may represent just a minor risk factor to alcohol abuse. Moreover, we address the issue of gender-specific heterogeneity. Thus, we examine males and females separately and analyze both the transmission from paternal and maternal drinking to the offspring's later alcohol consumption.

[4]The German Centre for Addiction Issues (DHS) distinguishes four risk categories for daily alcohol intake: (i) "low-risk consumption", i.e. $<$ 30g for males and $<$ 20g for females, (ii) "risky consumption", i.e. 30g to 60g for males and 20g to 40g for females, (iii) "dangerous consumption", i.e. 60g to 120g for males and 40g to 80g for females, (iv) "heavy consumption", i.e. $>$ 120g for males and $>$ 80g for females. The WHO defines "low-risk consumption" less restrictively for males, allowing for up to 40g of pure alcohol.

2 The Data

2.1 Data Sources

Our empirical analysis is based on German survey data, originating from the "Population Survey on the Consumption of Psychoactive Substances in Germany"[5] collected by IFT (Institute for Therapy Research) Munich; see Kraus and Augustin (2001) for a detailed description. The data originally comprises eight separate cross-sections at the level of individual consumers, collected by mail at irregular intervals in the years 1980, 1986, 1990, 1992, 1995, 1997, 2000, and 2003. The sample size varies significantly from 4 455 in 1992 to 21 632 in 1990. While the first two surveys concentrate solely on West Germany, the 1992 survey deals exclusively with the former East German GDR. All other waves cover Germany as a whole. Before 1992, only German citizens were interviewed; immigrants not holding the German citizenship were disregarded. Later on, the entire German-speaking population became the survey's target group, irrespective of citizenship. The data provides comprehensive information with respect to various legal as well as illicit drugs regarding prevalence, frequency and intensity of consumption, consumption habits and age at first use. Additionally, detailed information on socioeconomic characteristics is provided along with information on attitudes towards several drug-related issues.

Both, the questionnaire and the study's target population have changed over time. The first wave focuses on teens and young adults aged 12 to 24. In subsequent waves, the upper age limit was successively raised up to 39 in 1990. Since 1995, the target population has consisted solely of adults aged 18 to 59. This was accompanied by the respondents family background increasingly becoming a minor issue.

[5] "Bundesstudie Repräsentativerhebung zum Gebrauch psychoaktiver Substanzen in Deutschland". The data is provided through "GESIS – Leibniz Institute for the Social Sciences".

Therefore, parental drinking habits are not reported in waves after 1992. Consequently, our analysis has to rely on data collected in 1980, 1986, 1990, and 1992. In contrast to the majority of related analyses mentioned in Section 1, we do not focus on contemporaneous effects from parental drinking on the alcohol-related behavior of adolescent children. Rather, we are interested in the effects on children's later consumption after they have typically left the parental home. Thus, we do not consider individuals younger than 16 years for estimating the model. After excluding observations with missing data, the sample consists of 23 362 individuals. Among these, 11 624 are males and 11 738 are females.

2.2 Variables

In our empirical analysis, current consumption of alcohol serves as dependent variable. It is defined in terms of grams of alcohol intake per day, which is calculated from the reported glasses of beer, wine and spirits consumed on average per week. For this, standard values for beverages' alcohol content are used: One glass of beer (0.3l) contains 12 grams of alcohol, one glass of wine (0.25l) 20 grams, and one glass of spirits (0.02l) 5.6 grams. According to our definition, 18.6 percent of respondents – 11.0 percent among males and 26.1 percent among females – are non-drinkers, i.e. these individuals report that they usually do not drink a single glass of beer, wine or spirits per week.This does not rule out occasional consumption of alcohol. In the following, we refer to non-drinkers as censored observations.

Table 1 displays comprehensive descriptive statistics for this variable. From this it becomes obvious that the distribution of alcohol intake is heavily skewed to the right. The average consumption is 16.3 grams for men and 6.4 form women. Yet, the corresponding median consumption is much lower, 10.5 and 3.7 grams, respectively. The skewness of the distribution is even stronger for the females' sub-sample

Table 1: **Descriptive statistics for current alcohol consumption [grams per day]**

	All	Males	Females
percentiles: 1st	0.00	0.00	0.00
5th	0.00	0.00	0.00
10th	0.00	0.00	0.00
25th	2.51	4.57	0.00
50th	6.29	10.51	3.66
75th	14.51	21.60	8.57
90th	28.46	38.29	15.66
95th	40.69	51.43	21.71
99th	72.11	86.74	42.86
mean	11.37	16.34	6.45
standard deviation	15.38	18.54	9.05
minimum	0.00	0.000	0.00
maximum	206.86	206.86	169.71
skewness	3.35	2.72	4.37
share of non-drinkers	0.186	0.110	0.262
number of observations	23 362	11 624	11 738

than for the males' sub-sample, taking values of 4.4 and 2.7, respectively. The vast majority of respondents report consumption levels below the threshold levels of risky consumption. This holds for 84.2 percent of individuals among males and even 94.3 percent among females. Yet, small groups of respondents report consumption levels that by far exceed these threshold of 30 and 20 grams, respectively – more than 200 grams a day at the extreme – and have to be regarded as harmful to health by all means. In short, focusing on average or median consumption alone does not reveal any alcohol abuse in the sample.

The key explanatory variables are the alcohol consumption of fathers and mothers. In our data, it is not the parents who are interviewed on their contemporaneous consumption. Rather, it is the respondents who are asked about their parents' drinking habits during the time when they were still living in the parental home. Only individuals who still live in the parental home report contemporane-

Table 2: **Descriptive statistics for parental drinking patterns**

	All		Males		Females	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
father's drinking habits						
father never drinker	0.183	0.387	0.175	0.380	0.191	0.393
father monthly drinker	0.239	0.427	0.242	0.428	0.237	0.425
father weekly drinker	0.261	0.439	0.269	0.443	0.252	0.434
father daily drinker	0.317	0.465	0.314	0.464	0.320	0.466
number of obs.	20 867		10 383		10 484	
mother's drinking habits						
mother never drinker	0.508	0.500	0.499	0.500	0.514	0.500
mother monthly drinker	0.286	0.452	0.294	0.455	0.277	0.448
mother weekly drinker	0.135	0.342	0.140	0.347	0.131	0.337
mother daily drinker	0.071	0.257	0.067	0.249	0.075	0.264
number of obs.	22 266		11 093		11 173	

Note: Statistics for those individuals that have grown up with the relevant parent.

ous parental drinking. As a consequence, the available information about parental drinking is qualitative rather quantitative. More precisely, with respect to both parents, respondents are asked whether their father or mother drank: (i) (almost) never, (ii) several times a month, (ii) several times a week, or (iv) (almost) daily. In our regression analysis the first possible choice serves as reference category while the latter three enter the model as dummy variables.[6] Albeit these indicators representing a rather rough measure of parental consumption, the frequency by which children watch their parents drink appears to be of greater importance to intergenerational transmission, than the precise quantity of alcohol consumed. We interact parental consumption habits with an indicator variable for having grown up with this parent in order to make sure that only those parental habits enter the analysis that could have influenced children's consumption behavior. Table 2 displays key descriptive statistics for these variables.

[6] An extended model specification makes use of the fact that this information is available not only for parental alcohol consumption in general but also specifically for three different beverages, i.e. beer, wine, and spirits; see Subsection 4.2.

In addition to the variables capturing parental drinking habits, we also include several control variables in our model. These are gender, age, age squared, living in West-Germany, parental education, parental marital status, number of children at parents' home as well as the way individuals have grown up, reflecting the social background of the family. Through the interaction of parental education with dummy variables indicating that the respondent has grown up with the parent, we allow parental education to have an effect only if the respondent has grown up with the parent. Variables often controlled for, such as the respondent's own education, marital and labor market status, number of children, current living situation and income, are deliberately not used as explanatory variables because of their potential simultaneity with individual drinking behavior.

3 The Econometric Approach

We use a quantile regression approach in order to identify heterogeneity in the intergenerational transmission of drinking behavior. That is, rather than identifying the average effect of parental drinking on the conditional mean of children's alcohol consumption, we investigate the effect on the entire conditional distribution. Following Cameron and Trivedi (2005), the concept of quantile regression can roughly be characterized as follows: For any quantile θ of the distribution of alcohol consumption, a regression function is fitted such that alcohol consumption conditional on the explanatory variables is less than or equal to the value of the regression function with probability θ.[7]

Our data comprise a substantial share of non-drinkers. Thus, the variable alcohol consumption is censored at zero. This is also the reason why standard linear quantile regression, first introduced by Koenker and Bassett (1978), is not applica-

[7] Koenker and Hallock (2001) provide an intuitive overview of quantile regression.

ble. Instead, we employ its generalization to the censored case by Powell (1984, 1986). While Powell (1984) deals with median regression for censored data, Powell (1986) generalizes his original approach to arbitrary quantiles. For any considered quantile θ, the suggested estimator $\widehat{\beta}_\theta$ is:

$$\widehat{\beta}_\theta \equiv \arg\min_{\beta} \left\{ \frac{1}{N} \sum_{i=1}^{N} h_i(\theta) \left(y_i - \max \left\{ 0, x_i' \beta \right\} \right) \right\}, \tag{1}$$

where for the multiplier $h_i(\theta)$

$$h_i(\theta) = \begin{cases} \theta - 1 & \text{if} \quad y_i - \max \left\{ 0, x_i' \beta \right\} < 0 \\ \theta & \text{else} \end{cases} \tag{2}$$

holds. Following the usual notation, y_i is the endogenous variable, left-censored at zero, and x_i is a vector of regressors with i indicating observation units. N indicates the sample size. From (1) and (2), the close analogy to the linear least absolute deviations estimator becomes obvious. Specifically, (1) coincides with this familiar estimator for $\theta = 0.5$ and if $\max \left\{ 0, x_i' \beta \right\}$ is replaced by $x_i' \beta$, i.e. if an uncensored endogenous variable y_i is considered.

Conventional gradient methods are not applicable to quantile regression in general (Koenker and Hallock, 2001). Rather, linear programming methods (Armstrong et al., 1979) are required for estimation. For solving the optimization problem (1), which is more involved than ordinary quantile regression because of censoring, we apply an iterative procedure proposed by Buchinsky (1994). This simple algorithm is based on a series of ordinary quantile regressions. More specifically, in the jth iteration equation (1) is solved for $\widehat{\beta}_\theta^j$ through linear programming using those observations for which $x_i' \widehat{\beta}_\theta^{(j-1)} > 0$ holds. Convergence is achieved when the set of

observations does not change in two consecutive iterations.[8] Reported standard errors and confidence intervals are based on bootstrapping using 100 resampling iterations.

Evidently, other empirical approaches than quantile regression allow for heterogeneity in effects, too. In fact, the choice of a non-linear model specification will always result in non-constant, i.e. heterogenous marginal effects. However, the virtue of quantile regression is that – a priori – it does not assume heterogeneity and does not impose a certain pattern of heterogeneity on the estimated effects. Hence, quantile regression represents an appropriate econometric approach if existence and shape of heterogeneity in effects – across the values of the dependent variable – is of primary interest.

4 Estimation Results

4.1 The Basic Model

As a starting point, we estimate a conventional tobit model that explains the current level of alcohol consumption. The estimated tobit-coefficients are used to calculate a marginal effect $\Phi\left(x_i'\hat{\beta}/\hat{\sigma}\right)\widehat{\beta}_k$ for each percentile of $x_i'\widehat{\beta}$. These estimates serve as reference to our further analysis. Subsequently, a series of censored quantile regressions is run, beginning with the percentile right above the proportion of censored observations. Percentiles higher than the 95th one are not considered, because the identification of effects becomes increasingly poor as θ approaches the value of one. The estimation procedure is run separately for males and females.

Quantile regression generates huge amounts of regression output. Yet, our focus

[8] We use a modified version of the stata-ado-file CLAD (Censored Least Absolute Deviations), see Jolliffe et al. (2000).

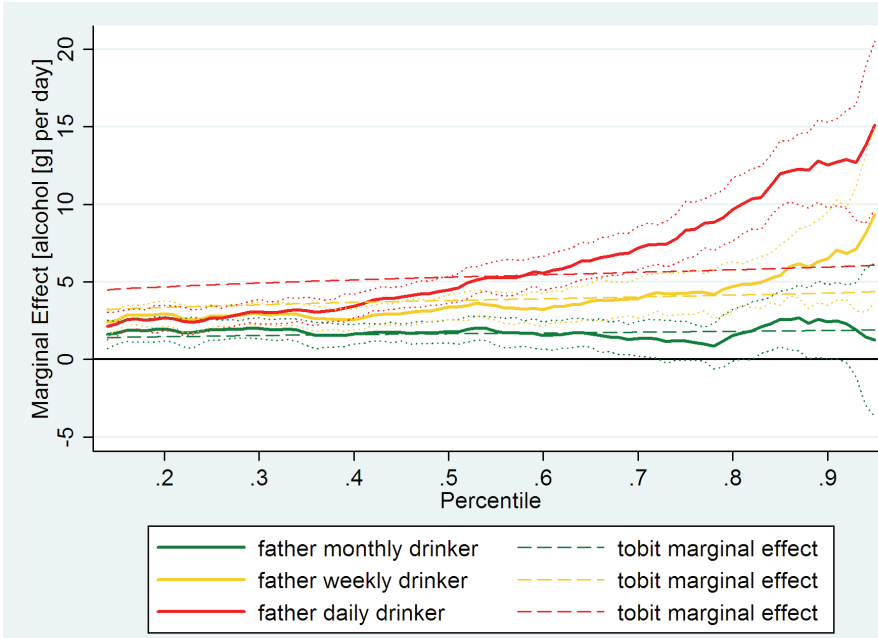

Figure 1: Effect of paternal drinking on sons' alcohol consumption

is on the coefficients attached to the variables describing parental drinking habits. Thus, rather than including huge summary tables with altogether thousands of estimated coefficients, we primarily rely on graphs for reporting our results.[9] Estimated effects from quantile regressions (solid lines) and tobit regressions (dashed lines) are plotted against the relevant percentile. For the former, 0.95-confidence intervals are indicated by dotted lines.

Figure 1 displays the effect of paternal drinking habits on sons' consumption of alcohol. It is apparent that the coefficient attached to the indicator "father drinks daily" steadily increases in the quantiles of the distribution of alcohol consumption.

[9] As a selection, tables of estimated coefficients for the tobit regression and the quantile regressions for the median and the 95th percentile are reported in Appendix A.1. Comprehensive tables of estimation results are available from the authors upon request.

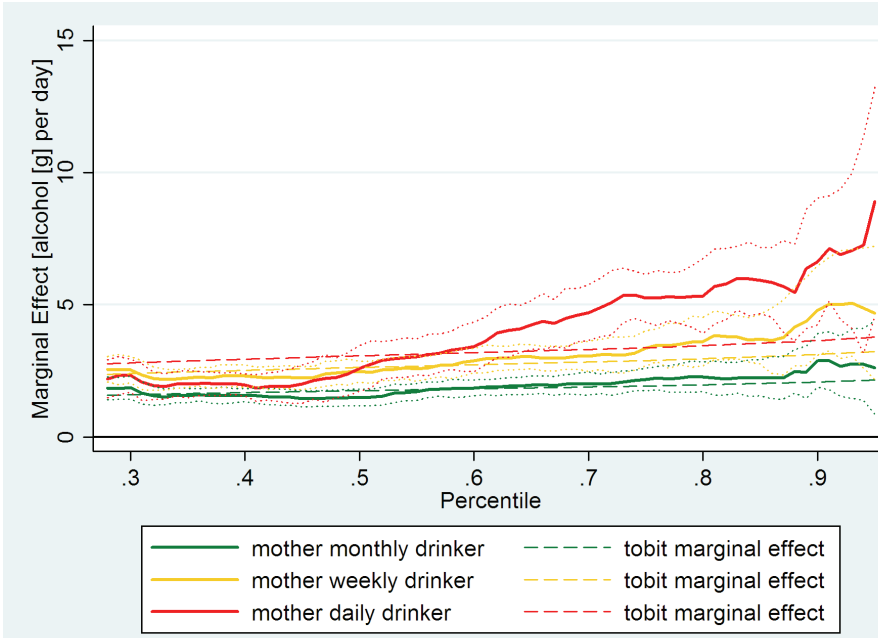

Figure 2: Effect of maternal drinking on daughters' alcohol consumption

In the 15th percentile, sons of fathers who drink daily consume 2.3 grams of alcohol more a day compared to sons of abstinent fathers. Yet, in the 95th percentile, this difference is as high as 15.1 grams. That is, in the upper tail of the distribution, the effect of a daily-drinking father accounts for one-half of the dose that is considered to be associated with significant health risks. Moreover, the estimated effects significantly exceed those obtained from a conventional tobit regression in the upper percentiles. Inversely, in the lower percentiles, the effects obtained by the quantile regression are substantially and significantly smaller than the tobit marginal effects are. Thus, quantile regression reveals a pronounced heterogeneity in the intergenerational transmission of alcohol consumption that is not captured by focusing on the mean of the distribution, e.g. by estimating a tobit model. Yet, this only holds for

the effect of daily paternal drinking. The effects of weekly and monthly drinking do not show the same pattern. For the latter, the effects obtained from quantile and tobit regressions do not show any substantial deviation from each other. For weekly paternal drinking, the effects obtained from quantile regression seem to increase more strongly in the considered percentile than the estimated tobit effects do. Yet, taking confidence intervals into account, this finding is not statistically firm. That is, heterogeneity that exceeds those that is incorporated in the tobit model is only found for the effect of daily paternal alcohol consumption.

Now, we switch our focus to the intergenerational transmission of alcohol consumption from mothers to their daughters. Figure 2 displays our estimation results. The pattern of effects resemble those for the effect of paternal drinking on sons' consumption levels. In the entire distribution, the effect of weekly and monthly maternal drinking does not significantly deviate from the corresponding tobit point estimate. In contrast, for daily maternal alcohol consumption, quantile regression yields a definite effect on daughters' later drinking behavior that strongly increases in the quantile being considered. Moreover, in the upper tail of the distribution, the magnitude of the estimated by far effect exceeds its counterpart from the tobit model. In the 95th percentile, the effect of daily maternal alcohol consumption reaches the values of 8.9 grams per day. Similar to the transmission from fathers to male offspring this accounts for roughly one-half of a precarious daily dose.

Turning to cross-gender intergenerational transmission, that is effects from maternal drinking to sons and from paternal drinking to daughters we get a less informative picture; see Appendix A.2 for the relevant Figures. Though Figures 5 and 6 seem to indicate that for the quantile regression model the effects daily parental drinking increase more strongly in filial consumption than for the tobit one, these findings are statistically not significant. In general, estimation results suffer from

large standard errors. This especially holds for the upper quantiles. Here, some distinct jumps (Figure 5) in the point estimates indicate a lack of robustness. Thus, the analysis does not confirm a pronounced heterogeneity in cross-gender intergenerational transmission of drinking habits.

4.2 Model Extensions and Robustness Check

However, especially the finding of only daily parental consumption exerting heterogeneous effects raises the question of whether our results actually capture heterogeneity in intergenerational transmission but not heterogeneity in consumption levels among parents within the same category of consumption. In particular, daily alcohol consumption may represent quite different behavior. For instance, cases of severe alcohol abuse as well as regularly having one glass of wine for dinner fall in this category. More technically speaking, if the true relationship of parental and filial alcohol consumption were linear in consumption levels, yet parental consumption is imprecisely measured as a categorial variable (almost never, monthly, weekly, daily) quantile regression may misleadingly point at heterogeneous effects for the following reason: Due to the linear relationship, children whose parents drink much will – on average – be located in higher quantiles of the consumption distribution than children whose parents drink less. This also holds conditional on a particular category of parental consumption. Thus, the effect of, say, daily paternal drinking – compared to not drinking fathers – seems to be particularly strong for sons in the upper quantiles of the distribution. However, high estimated coefficient's values for the upper quantiles may actually stem from unobserved, yet high paternal consumption levels. While the lack of quantitative information about parental alcohol consumption limits the opportunity for addressing this issue, we still follow two strategies to check for the robustness of our previous results.

Firstly, we estimate an alternative model specification that includes an additional category describing parental alcohol consumption. The corresponding indicator takes the value one for parents who drink two or more different alcoholic beverages a day. We take this variable as a rough indictor for heavy drinking. Since heterogeneity is likely to be particulary strong within the group of daily drinking parents, excluding heavy drinking parents from this category should exert a substantial effect on the estimation results if these result indeed did capture heterogeneity among parental consumption levels. Only 3.3 percent of fathers and 0.7 percent of mothers fall into this additional category. As a consequence, estimation results for the alternatively specified model suffer from large standard errors, particularly if the impact of maternal drinking is concerned.[10] Still, the key results of significant heterogeneity in the transmission of drinking patterns from fathers to sons and mothers to daughters for daily drinking parents is confirmed by the alternatively parameterized model; see Appendix A.3 for the relevant Figures 7 and 8. Even the magnitude of effects does not change much when another category of parental drinking is included. Thus, although parental consumption levels still are imprecisely measured, we conclude that our results from quantile regression primarily capture heterogeneity in effects rather than hidden heterogeneity in parental drinking behavior.

Our second approach rests on the idea of approximating the unobserved distribution of parental alcohol consumption by the observed distribution for the filial generation, that is creating a continuous proxy-variable for unobserved parental alcohol intake. To this end, we fit an ordered response model – separately for fathers and mothers – explaining parental consumption categories by (i) those parental characteristics that already enter the equation of primary interest and in addition by

[10] "Ugly" peaks in bootstrapped confidence intervals, see Figure 7, indicate that for some quantiles the coefficients are poorly identified.

(ii) parental smoking status (never-, ex-, current smoker), (iii) a dummy indicating whether the parent is still alive at the time of the survey, (iv) indicators capturing parental character traits such as being affectionate, strict, calm, manipulable, cheerful, angry, appreciative, short-spoken, and inspiring (retrospectively assessed by the respondent/child), (v) a general assessment of the parent-child-relation (very poor ... very good), (vi) parent's age at death (if already died), and (vii) parent's year of birth.[11] Some of these variables are not available for the years 1980 and 1986, hence we restrict this analysis to the samples for 1990 and 1992. Almost any of the aforementioned characteristics turns out to be a highly significant predictor of parental alcohol consumption. Subsequently, we sort the observations by (i) the consumption category that is observed for the relevant parent and (ii) within each category by the linear prediction calculated from the ordered regression results. Finally, we match the consumption level from the corresponding quantile of the corresponding filial consumption distribution to each observation, except for those that fall into the category "parent never drinks".[12] For these, the proxy for parental consumption is set to the value of zero. Correspondingly, we consider the distributions of sons' and daughters' drinking levels conditional on strictly positive consumption. As for categorial measure of parental drinking, the linear proxy enters the analysis as interaction term with the dummy indicating that the individual has grown up with the relevant parent.

Estimated quantile regression functions largely confirm the results we have previously gained from using an ordered variable describing parental alcohol intake. That is, maternal drinking exerts a clearly significant and positive effect on daughters' later drinking levels that clearly increases in the quantiles of the filial drinking

[11] The latter two enter the regression linearly and as squared values.

[12] Using the linear prediction directly as proxy for parental alcohol intake is likely to greatly underrate the heterogeneity in parental drinking levels, since the distribution of parental consumption is presumably as skewed as the observed one for the filial generation.

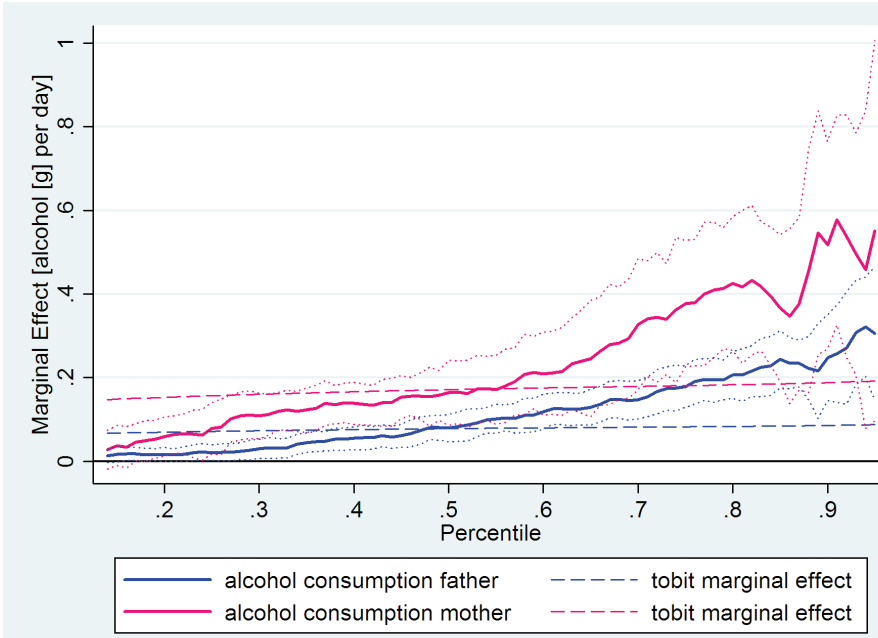

Figure 3: Effect of linearized parental drinking on sons

distribution. For the 95th percentile, the estimated effect is roughly fife times larger than for the median. Moreover, taking standard errors into account, the estimated heterogeneity in effects is clearly significant, see Figure 4. A similar picture is found for the effect of paternal drinking on sons' later alcohol consumption, see Figure 3. The estimated effects exhibit a substantial increase in the distribution of filial alcohol consumption, where the estimated effect is roughly four times larger for the 95th percentile compared to the median. Once again, the estimated heterogeneity is statistically clearly significant.

As for the model using a categorial measure of parental drinking, the evidence is less clear for cross-gender intergenerational effects. While the point estimates argue in favor of pronounced heterogeneity being present, this result is not clearly sup-

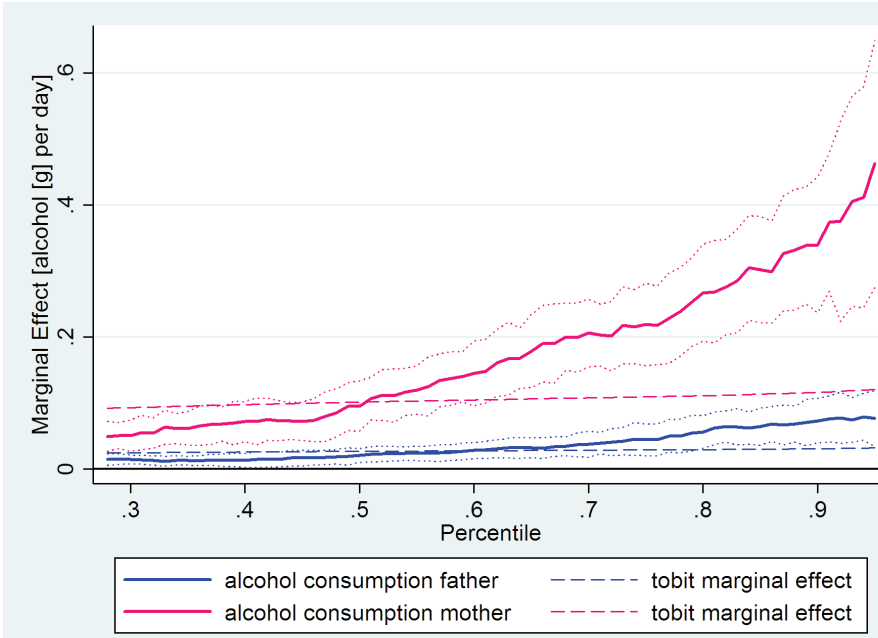

Figure 4: Effect of linearized parental drinking on daughters

ported by the estimated standard errors. That is for rather large quantile-regions, the estimated 0.95-intervals of confidence overlap the marginal effects calculated from the benchmark tobit model or, at least, are very close to them.

Evidently, this approach is not free from limitations as it "measures" parental consumption with error, which is the nature of a proxy variable. Yet, measurement error represents a serious problem to quantile regression (Chesher, 2001). Nevertheless, simulation results suggest that the effect of measurement error on the shape – which is of prime importance to the present analysis – of the estimated quantile regression function is likely to be moderate if measurement error is uncorrelated with the true value of the incorrectly measured explanatory variable (Chesher, 2001). Thus, using the continuous proxy for parental drinking, discussed above, provides

a reasonable basis for checking the validity of our previous results.

5 Conclusions

The analysis of the intergenerational transmission of alcohol consumption from parents to their children is the topic of this paper. Our empirical application is based on German survey data at the level of individual consumers. For quantifying the effect of parental drinking, we use a quantile regression technique, rather than a conventional regression analysis that focuses on the effects on average consumption.

This approach reveals pronounced heterogeneity in the intergenerational transmission that would remain hidden if the analysis were to have its focus on the mean of the distribution alone. In detail, the effect of daily parental drinking – compared to parental non-drinking behavior – on the children's later drinking habits increases sharply in the quantiles of the distribution of alcohol consumption. Roughly speaking, the estimated effects for the 95th percentile are more than three times larger than those for the median. In absolute terms, the effect in the 95th quantile reaches the value of 15 grams of alcohol per day for males and 9 grams of alcohol per day for females. This represents roughly half the dose that is considered the maximum for low-risk consumption. Compared to this, the estimated effects on mean and median consumption are moderate. Thus, according to our results, the impact of daily parental drinking is particularly strong for high consumption levels. This general picture is robust to using different approaches for measuring parental alcohol consumption.

Hence, our results suggest that (daily) parental alcohol consumption represents a greater risk factor for future alcohol abuse by children than estimated effects on

average consumption indicate. From this perspective, parents bear a great responsibility when consuming alcohol. Yet, this pattern of heterogeneity is only found for the effects of paternal drinking on sons and for the effects of maternal drinking on daughters. In contrast, cross-gender effects from fathers to daughters and from mothers to sons do not exhibit significant heterogeneity across the distribution of alcohol consumption. Thus, as in several previous studies, gender-specific heterogeneity in the intergenerational transmission of alcohol consumption is found in our data, too.

A Appendix

A.1 Selection of Summary Tables

Table 3: **Regression output for the males' sample**

	Tobit Regression		**Quantile Regression**			
			median		**95th percentile**	
Variable	Estimate	Std. Err.	Estimate	Std. Err.	Estimate	Std. Err.
father monthly drinker	2.117**	0.631	1.806**	0.389	1.259	2.538
father weekly drinker	4.854**	0.632	3.367**	0.409	9.331**	2.916
father daily drinker	6.767**	0.617	4.477**	0.441	15.113**	2.800
mother monthly drinker	2.725**	0.460	2.249**	0.332	-0.406	2.204
mother weekly drinker	4.917**	0.607	3.828**	0.567	3.730	2.569
mother daily drinker	3.975**	0.818	3.071**	0.714	2.600	4.096
year 1986	-0.172	0.663	-0.381	0.455	-2.257	2.746
year 1990	-0.986	0.545	-1.029**	0.379	-2.228	2.475
year 1992	7.858**	1.821	6.518**	1.885	15.605**	5.358
west	4.266*	1.666	3.361	1.764	10.051*	4.552
age	2.916**	0.246	2.190**	0.169	4.641**	1.191
$age^2/100$	-4.147**	0.459	-3.126**	0.337	-6.414**	2.270
parents married	-0.674	0.517	0.272	0.396	-5.104	2.657
father has low degree	0.701	0.624	0.610	0.469	3.454	3.104
father has medium degree	-0.118	0.780	0.272	0.532	1.938	3.888
father has high degree	-1.103	1.255	-0.147	0.752	-1.911	4.526
father has univ. degree	-0.146	0.878	0.855	0.606	-1.933	3.729
mother has low degree	-0.695	0.480	0.136	0.384	-6.316**	2.385
mother has medium degree	-0.326	0.625	-0.203	0.411	-1.177	3.185
mother has high degree	-2.363	1.305	-1.856*	0.885	-5.911	7.592
mother has univ. degree	-1.217	1.040	-1.422*	0.713	-1.161	4.001
grown up with mother	-3.633**	1.245	-2.044*	1.011	-13.680	8.389
grown up with father	-8.370**	2.175	-3.289*	1.492	-31.841**	10.929
grown up with both	4.686*	2.236	0.835	1.504	25.355*	11.283
no. children at parents' home	0.361**	0.131	0.190	0.108	1.322*	0.527
constant	-32.304**	3.615	-25.905**	2.830	-18.976	16.650
number of observations	11 624		11 624		11 624	
log-likelihood	-46 529		–		–	

Note: ** significant at the 1%-level; * significant at the 5% level.

Table 4: **Regression output for the females' sample**

	Tobit Regression		**Quantile Regression**			
			median		**95th percentile**	
Variable	Estimate	Std. Err.	Estimate	Std. Err.	Estimate	Std. Err.
father monthly drinker	1.598**	0.360	1.166**	0.194	-0.486	1.082
father weekly drinker	2.078**	0.362	1.266**	0.201	1.124	1.096
father daily drinker	2.547**	0.349	1.305**	0.184	2.703*	1.214
mother monthly drinker	2.652**	0.270	1.493**	0.166	2.617**	0.909
mother weekly drinker	3.977**	0.357	2.473**	0.203	4.686**	1.293
mother daily drinker	4.645**	0.446	2.592**	0.443	8.917**	2.214
year 1986	-2.897**	0.401	-1.186**	0.276	-7.718**	1.358
year 1990	-2.331**	0.322	-0.803**	0.199	-7.605**	1.395
year 1992	-0.078	0.866	0.987**	0.303	2.986	2.041
west	1.375	0.757	1.454**	0.200	10.783**	1.099
age	1.209**	0.141	0.772**	0.093	0.649	0.494
$age^2/100$	-1.552**	0.262	-1.044**	0.171	0.055	0.951
parents married	-0.284	0.293	-0.118	0.177	-2.741	1.423
father has low degree	0.594	0.358	0.357	0.202	1.705	1.046
father has medium degree	0.855	0.453	0.560*	0.248	2.241	1.391
father has high degree	1.058	0.733	0.639	0.363	2.263	1.919
father has univ. degree	1.773**	0.497	0.730**	0.282	4.433*	2.038
mother has low degree	0.411	0.280	0.232	0.170	1.102	0.894
mother has medium degree	0.486	0.355	0.368	0.193	1.738	1.270
mother has high degree	0.255	0.783	-0.026	0.346	3.154	2.512
mother has univ. degree	1.150*	0.586	0.859**	0.304	1.001	2.117
grown up with mother	-0.272	0.711	-0.369	0.402	-0.796	3.235
grown up with father	-0.011	1.306	-0.934	0.641	1.714	9.952
grown up with both	-2.326	1.341	-0.385	0.671	-5.847	10.117
no. children at parents' home	-0.157*	0.073	-0.050	0.040	0.018	0.255
constant	-15.712**	2.000	-9.345**	1.264	1.286	6.143
number of observations	11 738		11 738		11 738	
log-likelihood	-35 505		–		–	

Note: ** significant at the 1%-level; * significant at the 5% level.

A.2 Cross-gender intergenerational transmission

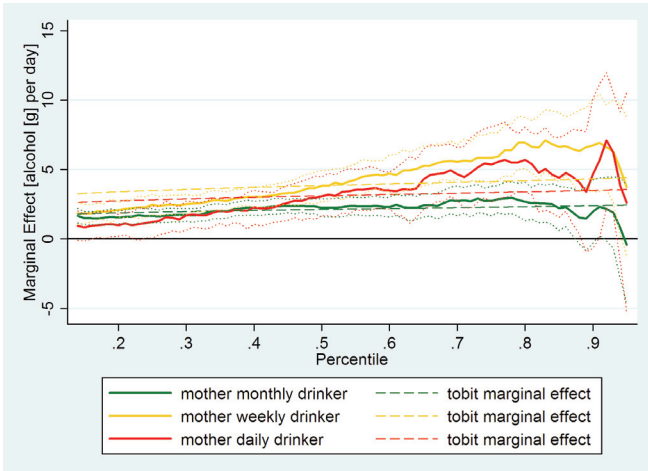

Figure 5: Effect of maternal drinking on sons' alcohol consumption

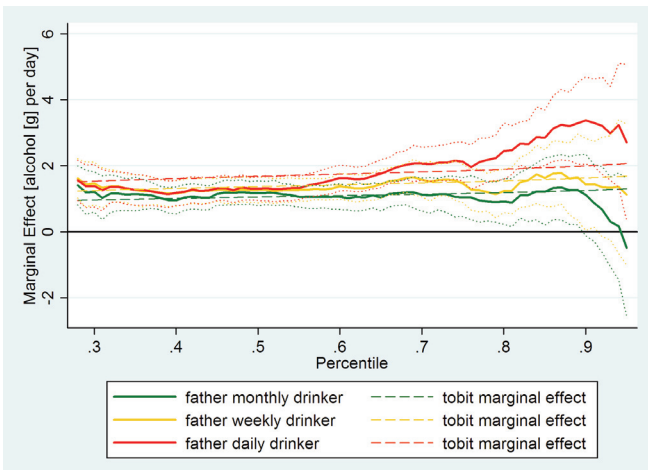

Figure 6: Effect of paternal drinking on daughters' alcohol consumption

A.3 Results considering the category "heavy parental drinking"

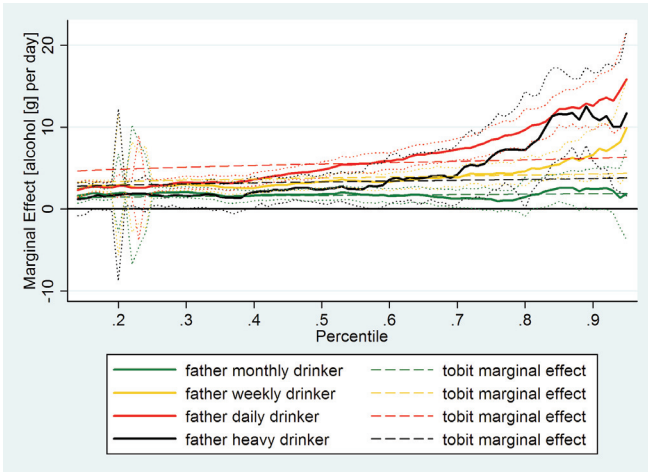

Figure 7: Effect of re-parameterized paternal drinking on sons

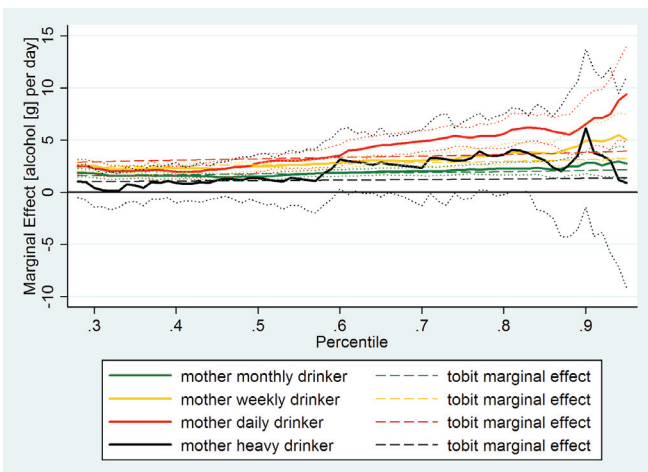

Figure 8: Effect of re-parameterized maternal drinking on daughters

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