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# CAN ALCOHOL MAKE YOU HAPPY? A SUBJECTIVE WELLBEING APPROACH

## **Abstract**

There are surprisingly few discussions of the link between wellbeing and alcohol, and few empirical studies to underpin them. Policymakers have therefore typically considered negative wellbeing impacts while ignoring positive ones, used gross overestimates of positive impacts via a naïve ‘consumer surplus’ approach, or ignored wellbeing completely. We examine an alternative subjective wellbeing method for investigating alcohol and wellbeing, using fixed effects analyses of the associations between drinking and wellbeing within two different types of data. Study 1 examines wave-to-wave changes in life satisfaction and past-week alcohol consumption/alcohol problems (CAGE) from a representative cohort of people born in Britain in 1970, utilising responses at ages 30, 34 and 42 (a sample size of 29,145 observations from 10,107 individuals). Study 2 examines moment-to-moment changes in happiness and drinking from an iPhone-based data set in Britain 2010-13, which is innovative and large (2,049,120 observations from 31,302 individuals) but unrepresentative. In Study 1 we find no significant relationship between changing drinking levels and changing life satisfaction ( $p=0.20$ ), but a negative association with developing drinking problems (-0.18 points on a 0-10 scale;  $p=0.003$ ). In contrast, Study 2 shows a strong and consistent moment-to-moment relationship between happiness and drinking events (+3.88 points on a 0-100 scale;  $p<0.001$ ), although associations beyond the moment in question are smaller and more inconsistent. In conclusion, while iPhone users are happier at the *moment* of drinking, there are only small overspills to *other* moments, and among the wider population, changing drinking levels across several years are not associated with changing life satisfaction. Furthermore, drinking problems are associated with lower life satisfaction. Simple accounts of the wellbeing impacts of alcohol policies are therefore likely to be misleading. Policymakers must consider the complexity of different policy impacts on different conceptions of ‘wellbeing’, over different time periods, and among different types of drinkers.

## **Keywords**

subjective wellbeing, happiness, policy evaluation, longitudinal analysis; Britain

## Introduction

While alcohol can lower wellbeing – globally, alcohol is the fifth biggest risk factor for premature death and disability (Lim et al, 2012), as well as having a contributing role to a range of social problems and economic costs (ANONYMOUS 2006) – it is also clearly a source of pleasure.

However, there are few empirical studies of links between wellbeing and alcohol (see below), and almost no academic discussion of the implications for policy (rare exceptions being Keane, 2009; Room, 2000).

This lack of evidence is an obstacle to developing evidence-based alcohol policies. The main existing approach for looking at the wellbeing impacts of drinking is the ‘consumer surplus’ approach – but the naïve form that has sometimes been used by policymakers is based on flawed assumptions that produce large overestimates of the positive wellbeing impacts of drinking while largely ignoring negative wellbeing impacts (see below). For example, in relation to recent UK Department of Health proposals to introduce minimum unit pricing, the Treasury conducted an impact assessment using this approach, and found that the costs of minimum pricing (via a loss of positive wellbeing) outweighed its benefits, temporarily halting the policy until a critical note was received from outside experts.

Conversely, other studies estimate the negative wellbeing impacts of drinking while ignoring any positive impacts. Recent studies have found new ways to value negative wellbeing impacts of alcohol, including wellbeing-related ‘harms to others’ (Johansson et al., 2006; Laslett et al., 2010), and reduced health-related quality-of-life among people with an alcohol use disorder (Johansson et al., 2006). However, positive wellbeing impacts are barely mentioned. For example, the leading *ex ante* impact assessment of alcohol policies, the Sheffield Alcohol Policy Model, estimates that a 50p minimum price in Britain would lead to wellbeing benefits worth more than £2bn over 10 years (Purshouse et al., 2009, p112), while ignoring positive wellbeing impacts.

A new direction is necessary to contribute to evidence-informed policy. This paper therefore outlines an alternative ‘empirical wellbeing’ approach to looking at the link between alcohol and wellbeing,

and presents the results of the approach applied to a nationally representative cohort study (Study 1) and an innovative smartphone-based data set (Study 2).

## Methods for estimating wellbeing impacts

### Consumer surplus method

To the extent that previous studies have estimated anything beyond purely negative wellbeing impacts of alcohol, they have used a naïve version of ‘consumer surplus’ (Aslam et al., 2003; cebr, 2009).

This starts from the assumption that consumers receive benefits to their individual welfare – ‘utility’ – from drinking that are at least as large as the money they spend. Crucially, they also receive a ‘surplus’ of utility beyond what they pay – i.e. the money that they would have been willing to pay for that drink if the price was raised – which has been argued to be a measure of the ‘pleasure of drinking’ (Aslam et al., 2003:35).

The implication is that involuntary (policy-induced) reductions in alcohol consumption will reduce wellbeing, in two ways:

1. *Extra spending*: people pay a higher price for the drinks that they continue to consume, so the surplus beyond the price they pay will be reduced.
2. *Reduced drinking*: people will stop consuming some drinks, for which they previously received a utility surplus.

Using this logic, the economic consultants NERA in a report for the Greater London Authority estimated that the pleasure of drinking was worth over £2bn in London (Aslam et al., 2003), while the economic consultants cebr in a report for SAB Miller estimated that a 5% reduction in the consumption of moderate drinkers in the UK would cost £600m/pa (cebr, 2009).

However, the general assumptions on which these estimates are based – perfect rationality, perfect information and perfect foresight – are naïve compared to those made by contemporary welfare

economists in the light of evidence from behavioural economics (Cawley & Ruhm, 2011). The assumptions are even more challenging when applied to alcohol. While dependence has been shown to be potentially ‘rational’ in the terms of Becker and Murphy’s theory, it seems unlikely that addicts consistently make consumption decisions that maximise their own welfare (e.g. Bernheim & Rangel, 2004). Non-addicted drinkers can also less easily be assumed to be optimising their welfare as they become more intoxicated. Given that the majority of all drinks in the UK are consumed beyond the Government’s recommended weekly or daily limits (AUTHOR 2009), policymakers’ use of naïve consumer surplus estimates is difficult to justify.

This does not mean that the consumer surplus approach to cost-benefit analysis is fundamentally invalid. Modern welfare economists have produced extensions of the standard model to deal with imperfect information, present-biased preferences, temptation, addiction (Bernheim & Rangel, 2004; Cawley & Ruhm, 2011), and ‘suspect’ choices in general (Bernheim & Rangel, 2007). The challenge, however, is calibrating these models with reliable evidence on *which* choices are suspect. To the extent that alcohol studies have taken account of ‘suspect’ choices, they have made implausible adjustments, e.g. assuming that policies have *no* wellbeing impacts on heavy drinkers whatsoever (cebr, 2009, p46). More sophisticated revisions to the consumer surplus approach have been suggested for tobacco and gambling. The Australian Productivity Commission (1999:5.20-5.21) assumed that in the absence of addiction, gambling addicts would behave like non-addicted regular users. While defensible for gambling, this is still fundamentally arbitrary, and considers only addiction rather than intoxication. A more sophisticated recent study (Ashley et al., In Press) uses a series of assumptions to estimate how much people would smoke if they were non-addicted and fully took account of smoking-attributable reduced life expectancy. However, this method only presently exists for tobacco, and further work will be needed to see if it can be convincingly applied to the more complex consequences of drinking.

### Subjective wellbeing method

The main alternative to the consumer surplus approach is the subjective wellbeing approach, which investigates how far drinking makes people *describe themselves* as (un)happier. Using people’s self-

reported wellbeing has proved a contentious idea (MacKerron, 2012a), primarily because it is unlikely to be a perfect measure of actual wellbeing. Not only are there questions about how far we have insight into our own levels of happiness, but different people are likely to interpret survey questions on wellbeing differently and even to construct ‘happiness’ differently, confounding attempts to understand reported wellbeing through differences in people’s lives (Wilkinson, 2007).

However, many of these problems can be minimised through better research design, such as focusing on *changes* within a culture – or even within *a single individual*, as we do below – which are likely to have greater validity (MacKerron, 2012a). We believe that subjective wellbeing approaches are one valuable perspective on wellbeing, a view shared by bodies such as the UK Treasury (Fujiwara & Campbell, 2011), and reflected in the burgeoning field of ‘happiness studies’.

Wellbeing is a multidimensional construct, including (but not limited to) both emotional wellbeing at a particular moment — “*the frequency and intensity of experiences of joy, fascination, anxiety, sadness, anger, and affection that make one’s life pleasant or unpleasant*” (Kahneman & Deaton, 2010:16489) — and a person’s wider satisfaction with their life, a cognitive reflection beyond individual moments. It cannot be assumed that any cause has identical impacts on each conception of wellbeing (Kahneman & Deaton, 2010).

This may be particularly true for alcohol because short-term pleasures and pains may overflow beyond the moment of drinking. There are negative short-term overflows via hangovers, and overflows on multiple timescales via health/social harms. More positively, it is often suggested that alcohol improves sociability, with real-world interactions reported to be more agreeable with alcohol (aan het Rot et al., 2008), laboratory studies showing a reduction in social anxiety (Battista et al., 2010), and qualitative research describing ‘anticipatory pleasures’ and ‘retrospective bonding’ around drinking (Brown & Gregg, 2012). However, the scale, dose-response and timing of some of these overflow effects is unclear.

A further issue is that average impacts are likely to conceal considerable heterogeneity. Partly this is because the response to alcohol is ‘biphasic’, with different effects in the ascending and descending

limbs of the blood alcohol curve – stimulant effects seem to be restricted to increasing intoxication, whereas sedative effects predominate during decreasing intoxication (Martin et al., 1993) – and with different impacts at different doses. There has been a temptation to suggest that all of the pleasures of drinking come with ‘moderate’ consumption rather than intoxication, but the strong form of this claim has been subject to critique (Keane, 2009; Room, 2000). Instead, heavier drinkers report greater stimulant and lower sedative effects (King et al., 2011), and people expect greater levels of both happiness and misery at higher levels of consumption (Adey et al., 2010).

Heterogeneity is also likely because the pleasures (and pains) of drinking are often due to our own expectations and the reactions of people around us (Room, 2000). This not only means that drinkers’ expectations may influence wellbeing, but that the relationship between alcohol and wellbeing will vary considerably across different cultures (Peele & Grant, 1999), particularly for the social consequences that are most closely bound up with expectations. Alcohol may therefore have different impacts on different concepts of wellbeing, when measured over different time periods, or for different population groups. While we return to this in the Discussion, we primarily focus directly on ways of considering the average effects of drinking on subjective wellbeing.

#### Empirical studies of alcohol and wellbeing

There are no reviews of the impact of alcohol on wellbeing (unlike for depression; see Boden & Fergusson, 2011, which suggests a non-linear causal impact of drinking). A number of individual studies exist, but these are primarily cross-sectional studies where the direction of causality is unclear.

Two types of longitudinal study have been conducted:

- The first looks at the lagged impact of drinking on later wellbeing. Among adolescents, alcohol use either has no significant effect (Mason & Spoth, 2011) or is associated with lower later wellbeing (Newcomb et al., 1986); while among young adults, studies variously find that greater levels of drinking are associated with *higher* later wellbeing (net of the effect of adverse consequences; Molnar et al., 2009); *lower* later wellbeing (controlling for genetic factors; Koivumaa-Honkanen et al., 2012); or no effect (Bogart et al., 2007). However, while

this approach captures slowly-acting effects, it seems unlikely to capture shorter-term pleasures of drinking.

- The second type of study looks at the immediate association of drinking with wellbeing, but further controls for time-invariant unobserved factors using fixed effects ('FE') modelling (see below). Only two such studies have been conducted, both using the Russian Longitudinal Monitoring Survey (Graham et al., 2004; Massin & Kopp, 2014); Massin & Kopp's more robust study finds no relationship between alcohol consumption and wellbeing among women, but that heavier drinking men have lower life satisfaction.

However, there are few longitudinal studies of adults, and even these face challenges of causal inference due to the lengthy lags between waves. Moreover, we would expect cross-cultural variation in the cultural associations of alcohol and pleasure, but the only FE studies are from Russia. The remainder of the paper therefore presents two studies using FE analyses of UK data, providing longitudinal data on the short-term relationship between alcohol and wellbeing in Britain for the first time.

## Study 1: Cohort data

### Methods

#### Design

To investigate the association between drinking and wellbeing, the analysis uses FE models that examine how far within-person changes in drinking are associated with within-person changes in wellbeing. The strength of FE models is that they remove unobserved, time-invariant confounding, and as a result have been recommended for studying both the impacts of alcohol (French & Popovici, 2011) and influences on wellbeing (Ferrer-i-Carbonell & Frijters, 2004). In Study 1, we use FE analyses of a conventional cohort dataset with gaps of several years between waves.

## Participants

The most suitable British study is the British Cohort Study 1970 ('BCS70'), a cohort study based on 17,000 babies born in the UK in a week in 1970, who barring emigration, death, non-contact or non-response, have been followed-up at regular intervals. For this analysis we focus on three face-to-face waves, 1999-2000 (age 30), 2004 (age 34) and 2012 (age 42), available from the UK Data Service (Study Numbers 5558, 5585 and 7473).

## Data analysis

We assume the underlying model:

$$LS_{it} = \alpha + \beta_{Alc}ALC_{it} + \beta_x x'_{it} + u_i + \varepsilon_{it} \quad (1)$$

where  $LS_{it}$  is life satisfaction for person  $i$  at time  $t$ ,  $ALC_{it}$  is a measure of alcohol consumption,  $x'_{it}$  is a vector of time-varying control variables,  $u_i$  are unobserved individual fixed effects,  $\varepsilon_{it}$  is an error term uncorrelated with  $ALC_{it}$  or  $x'_{it}$ , and  $\alpha$  and  $\beta$  are parameters to estimate.

The conventional cross-sectional OLS estimator of  $\beta_{Alc}$  cannot estimate the unobserved person effect  $u_i$ , which results in a bias to the extent that there are stable characteristics of respondents that influence both drinking and life satisfaction but are not observed in  $X'_{it}$  (e.g. personality traits).

Longitudinal data offers us the potential to overcome this by using the fixed effects estimator, which looks at the within-person differences in each term:

$$(LS_{it} - \overline{LS}_i) = \beta_{Alc}(ALC_{it} - \overline{ALC}_i) + \beta_x(x_{it} - \overline{x}_i)' + (\varepsilon_{it} - \overline{\varepsilon}_i) \quad (2)$$

where  $\overline{LS}_i$  is the within-person average of life satisfaction,  $\overline{ALC}_i$  is the within-person average of alcohol consumption, and  $\overline{x}_i'$  is the within-person averages of each of a vector of control variables.

The time-invariant term drops out of equation (2), with  $\beta_{Alc}$  therefore being unaffected by any unobserved, stable individual characteristics. Given that time-varying confounding is still possible, however, the analysis below also controls for a number of time-varying likely influences on wellbeing. All analyses were conducted using Stata version 12 using the command XTREG.

## Measures

Life satisfaction is obtained via self-completion using the question “*Here is a scale from 0-10 where '0' means that you are completely dissatisfied and '10' means that you are completely satisfied. Please enter the number which corresponds with how satisfied or dissatisfied you are about the way your life has turned out so far.*” Some economists have argued that such measures are the best available proxy for ‘utility’ (Fujiwara & Campbell, 2011), and we take this to be an adequate measure of wellbeing. Following standard practice, this is treated as a continuous rather than ordinal outcome variable (Ferrer-i-Carbonell & Frijters, 2004).

Drinking is measured through the question, “*In the last seven days, that is not counting today but starting from last [day], how much [drink] have you had?*”, repeated for beer, wine, spirits, fortified wines and alcopops. Our main analyses use a consistent conversion of drinks into units of alcohol, while a sensitivity analysis uses a changing unit conversion over time to account for changes in drink size and strength (see Web Appendix S1). Main analyses use categories of past-week alcohol consumption (following the same gender-specific categories as Purshouse et al., 2009) alongside a dummy term for longer-term non-drinkers (those who say they never drink); sensitivity analyses also variously use quadratic drinking terms, drinking frequency and alcohol problems (the CAGE scale, ‘CAGE’ referring to the questions used in this screening questionnaire; see Web Appendix). Further details of these alcohol variables are given in Web Appendix S1.

The analysis further controls for a number of time-varying factors that influence wellbeing (Fujiwara & Campbell, 2011), including marital status, children, economic status, travel-to-work time, work hours, longstanding illness, tenure, religiosity, income, smoking, pregnancy, and survey wave; derivation/descriptive statistics are given in Web Appendix S1. The resulting estimates are therefore net of any impact of drinking on longstanding illness or smoking.

## Results

The results are shown in Table 1 below. Looking first at the OLS results without adjustment for controls (Column 2), life satisfaction peaks among light drinkers, where it is 0.29 points ( $p < 0.001$ ) greater than among non-abstainers who drank nothing in the past week. With adjustment (Column 3), life satisfaction peaks among heavier drinkers, when it is 0.14 points ( $p = 0.02$ ) greater than zero-drinkers. In both cases, however, life satisfaction in the heaviest drinking group drops markedly.

When we control for time-invariant unobserved characteristics, however, the results change. In the unadjusted FE model, increases in drinking beyond 1 unit/wk are associated with *reduced* life satisfaction (significantly so from 14(female)/21(male) units), reaching a 0.26 point fall in the heaviest-drinking group ( $p = 0.002$ ). In the final models that control for both unobserved time-invariant (via fixed effects) and observed time-varying factors (via controls), we see a similar pattern, but this is weaker and not statistically significant (heaviest drinking group  $p = 0.15$ , joint  $p = 0.20$ ).

Despite covering the UK rather than Russia, the pattern of OLS and FE results are similar to Massin & Kopp (2014:Figure 1). Their OLS models also showed a significant curvilinear relationship, but their FE models only showed a statistically significant finding for the top-quartile of male drinkers ( $> 29$  units/wk), who had 0.05 points lower life satisfaction on a five-point scale compared to abstainers, similar to the 0.13 points on an eleven-point scale here.

*[Table 1 about here]*

Table 2 shows parallel models for alternate measures of alcohol consumption. Frequency of drinking does *not* have a relationship with wellbeing in the FE models, but developing alcohol problems (only available at ages 30 and 34) is associated with reduced wellbeing ( $p = 0.003$  in FE model), mirroring Binder & Coad (2013).

*[Table 2 about here]*

Several sensitivity analyses were conducted. When splitting by gender, the impact of alcohol in the FE analyses is concentrated among men, as found by Massin & Kopp (2014). However, the effect in men does not reach significance ( $p=0.23$ ); the patterns in general are similar between genders; and when directly testing the differences between men and women, these are far from statistical significance. None of the further sensitivity analyses substantively influence the results: effectively identical results are found when we use quadratic alcohol consumption; when we use different assumptions for the unit content of alcoholic drinks; or when including additional controls (poor health and social support) only available in certain waves. Details of these sensitivity analyses are given in Web Appendix S3.

## Study 2: Event-level data

### Methods

#### Design

Study 1 found no significant relationship between changes in drinking levels/frequency and changes in life satisfaction, but that developing alcohol problems is associated with lower life satisfaction. However, we know that drinking may have different impacts on different aspects of wellbeing over different timescales, and this requires a different type of data. We therefore make use of a unique smartphone-based dataset – ‘Mappiness’ – that enables us to examine the association of drinking with happiness *at a given moment*, compared to other moments.

#### Procedures

The ‘Mappiness’ data uses the Experience Sampling Method (ESM), one of several techniques used to obtain ongoing reports of everyday experience (Hektner et al., 2007). Rather than the traditional method of recruiting a sample and providing them with a diary or computer, Mappiness uses a sample of existing iPhone users who chose to download the Mappiness app. Users are then beeped at regular but random moments (the default is twice/day between 08:00-22:00), giving them a brief questionnaire about how happy they are, who they are with, and what they were doing just prior to

their response (see Web Appendix S4 the full questionnaire). Because the device is already integrated into users' daily lives, the additional burden on respondents is minimal, enabling a sample orders of magnitude larger than conventional ESM studies.

Responses were treated as valid if they were begun within an hour of the beep being sent and completed within five minutes. Validity is therefore dependent on whether respondents had the device with them, were in an area with data reception, were able to hear the signal, and were able and willing to respond. The valid response rate to signals was 48.4% amongst active participants (MacKerron, 2012b, p170), which is lower than those usually reported for diary methods. However, this is partly because we reject delayed and therefore unreliable responses that are reconstructed from memory at a later point — a serious problem in diary-based studies (Stone & Shiffman, 2002).

### Participants

Unlike conventional ESM studies, the Mappiness sampling is opportunistic – it relies on iPhone users voluntarily downloading the Mappiness app. The main spike in downloads was associated with Mappiness being featured in the UK App Store for two weeks. Recruitment was also facilitated by media coverage of the app, including TV/radio (e.g. BBC1) and in newspapers (e.g. The Independent's "50 best apps"), as well as through social media (for further details, see MacKerron, 2012b).

After excluding non-UK responses, the total sample here contains 2 million individual responses, collected from 31,302 individual users across 2010-2013, which MacKerron & Mourato (2013:59) believe to be "*the largest ever achieved by an ESM study*". Given the self-selection into the sample and the restriction to iPhone users, it is unsurprising that the sample is unrepresentative of the UK population: participants are more likely to be young (two-thirds are under 35) and wealthy (median income is £48,000, almost twice the UK median) (MacKerron, 2012b:167).

## Data analysis

Our analysis again uses FE models, as above. The short gap between responses also allows us to test for reverse causation where people respond 2+ times in the same day. For these cases we model the relationship between drinking and wellbeing after 6pm, controlling for their earlier happiness:

$$(H_{it} - \bar{H}_i) = \beta_{Alc}(DRK_{it} - \overline{DRK}_i) + \beta_H(LH_{it} - \overline{LH}_i) + \beta_x(x_{it} - \bar{x}_i)' + (\varepsilon_{it} - \bar{\varepsilon}_i) \quad (3)$$

where  $\bar{H}_i$  is the within-person average of happiness,  $\overline{DRK}_i$  is the within-person average of the drinking dummies,  $\overline{LH}_i$  is the average of happiness earlier in the day, and the other terms are as in equation 2. We here use the cluster-robust sandwich estimator to calculate standard errors, which is robust to moment-to-moment correlations in the error term. While dynamic (lagged) FE models violate the assumption that the error is uncorrelated with the regressors, this bias becomes ignorable where the number of time periods is moderately large (Roodman, 2009); a sensitivity analysis restricts the sample to those providing  $\geq 20$  relevant observations.

## Measures

Wellbeing is measured by the question, “*do you feel... happy?*”, which respondents complete using a slider from 0 (‘not at all’) to 100 (‘extremely’). Drinking is measured by the question, “*Just now, what were you doing?*”, listing 41 different activities including ‘*drinking alcohol*’, and allowing respondents to select as many activities as apply. Drinking was reported in 5.0% of responses (giving 103,036 drinking episodes), in 91.0% of which they reported doing other activities in parallel, primarily ‘Talking, chatting, socialising’ (49.2% of all drinking episodes), ‘Watching TV/film’ (31.2%), and ‘Eating, snacking’ (27.9%); see Web Appendix S4 for further details. Given the broad focus of Mappiness and the need to keep the questionnaire short, no data is available on drinking behaviour within each occasion.

Aside from controlling for all time-invariant factors using FE models, we control for a variety of moment-specific factors, including: what people were doing (40 activities), who they were doing it with (7 types), time of day (three-hour blocks split by weekday vs. weekend/bank holiday), location

(inside/outside/in vehicle and home/work/other), and how many responses the participant has previously given. OLS estimates also include time-invariant controls for gender, employment status, marital and relationship status, household income, general health, children, single parent status, region, age and age squared at baseline. Derivations/descriptive statistics are given in Web Appendix S5.

## Results

The moment-to-moment association of alcohol and wellbeing in this unrepresentative panel of iPhone users is shown in Table 3. Looking first at the OLS results (Columns 2-3), we can see that drinking alcohol is associated with considerably greater happiness at that moment – 10.79 points on a 0-100 scale in the unadjusted model ( $p < 0.001$ ), and 3.65 points in the adjusted model ( $p < 0.001$ ). Looking at the FE results (Columns 4-5), there is a similar decline between the unadjusted and adjusted models; it is unsurprising that part of the raised happiness when drinking is because it comes alongside other factors that are happiness-inducing. Still, in the final (adjusted FE) model, drinking alcohol is associated with a happiness gain of nearly 4 points ( $p < 0.001$ ), compared to the same people when they are not drinking.

*[Table 3 about here]*

We can also see whether this association is partly explained by reverse causation, by controlling for happiness earlier in the same day (comparing Column 7 to Column 6, which is estimated on the same evening-only subsample). Earlier happiness does predict drinking (see Table S13 in Web Appendix S6), and in Table 3 we can see that the impact of drinking declines slightly from 3.64 to 3.30 points when controlling for this – but is still moderately large and statistically significant ( $p < 0.001$ ). (Similar results are found if we restrict the sample to people providing 20+ observations). In general this suggests that the effect is robust to reverse causation, at least on this timescale.

We also tested whether the same results were found for different subgroups on different occasions, by interacting drinking simultaneously with person and occasion characteristics. Perhaps surprisingly, there were only relatively small differences in the happiness-inducing effect of alcohol between men and women, or when looking at different times of day, on weekdays vs. weekends, or with different people (see Web Appendix S6). However, there were greater differences according to what people were doing while drinking: drinking had the greatest impact when it came alongside otherwise unenjoyable activities (traveling/commuting, waiting), and only increased the happiness of already-enjoyable activities by smaller amounts (socialising, making love). The greatest differences, though, were by age: drinking made most difference to the happiness of younger people (averaging across different types of drinking occasions, alcohol raised their happiness by 7.3 points), and least happiness to the oldest (3.0 points). This may reflect heterogeneity in the wellbeing impact of drinking by level of intoxication, drinking expectations, and/or peer responses (discussed above).

#### Overspills from the moment of drinking

In contrast to the null association of drinking levels/frequency with life satisfaction from BCS70, these results suggest that people are happier when they are drinking. It is unclear if this is solely because of people's raised happiness at the moment of drinking, or whether there is a wellbeing 'overspill' from the moment of drinking to other moments. To test this, we changed the data structure from moments into periods by (i) averaging the moment-to-moment responses over weeks/months; then (ii) using FE models to see if people were happier in the weeks/months in which they drank more often.

We must bear in mind that these estimates are more subject to time-varying confounding than the other models – the available Happiness controls are focused on moment-to-moment rather than month-to-month influences on happiness. Weeks/months in which people drank more frequently also have greater enjoyable tasks (e.g. socialising) and fewer unenjoyable activities (e.g. working), with a few exceptions (see Web Appendix S6), which may indicate that there are other characteristics of these periods that explain the apparent overspill. It is also difficult to construct the appropriate

counterfactual for periods without alcohol; people are likely to replace drinking with a different leisure activity, but it is difficult to predict what this would be.

Bearing this in mind, average happiness was higher in the weeks/months in which people drank more often (models M1/M3 in Table S17 in Web Appendix S6). However, the more interesting results are in models M2/M4, which look at average happiness *excluding the moments of drinking*. These show a slight overspill, with people reporting greater levels of happiness in weeks/months in which they drink more often. However, the size of these effects is relatively small (a peak effect of  $< \frac{1}{2}$  point on a 0-100 scale;  $p=0.02$  by week and  $p=0.01$  by month); and moreover the effects are non-linear, such that there is little difference between the 2<sup>nd</sup> and 5<sup>th</sup> quintiles of drinking frequency (among drinkers). This non-linearity may be because alcohol has a primarily positive effect on wellbeing at the moment of drinking, but more mixed overspill onto wellbeing at other moments. For example, this could indicate hangover effects, although in a further sensitivity analysis, we found no impact of the previous night's drinking on happiness (albeit a moderate impact on awokenness; see Web Appendix S6).

## Discussion

There has been a surprising inattention to wellbeing issues in the academic literature on alcohol. Previous studies have either estimated certain negative wellbeing impacts and been unable to estimate positive ones (Johansson et al., 2006; Purshouse et al., 2009), or used a naive form of the 'consumer surplus' approach that makes assumptions that are difficult to defend (Aslam et al., 2003; cebr, 2009). It has not yet been demonstrated whether more sophisticated consumer surplus estimates can be convincingly applied to alcohol.

In this paper, we present two new fixed effects (FE) estimates using an alternative 'subjective wellbeing' approach:

- Study 1 examined the relationship between drinking and life satisfaction across multiple-year transitions in the 1970 British Cohort Study ('BCS70'). The main specifications suggested

that there is no relationship between drinking level/frequency and life satisfaction, but a wellbeing penalty for those with alcohol problems. This is similar to the only previous such study, which uses Russian data (Massin & Kopp, 2014).

- Study 2 examined the moment-to-moment relationship between drinking and happiness, using innovative smartphone-based data ('Mappiness') among an innovative and large but unrepresentative sample of iPhone users. This suggested that people are noticeably happier at the moment they are drinking, agreeing with previous laboratory studies that show a positive impact of alcohol on mood (Martin et al., 1993). However, people are only slightly happier at non-drinking moments in the weeks/months in which they drink more often.

Various explanations for these results are possible. It may be that the results of Study 1 are less biased than Study 2, because the analysis of overspill effects in Study 2 is particularly vulnerable to confounding (the Mappiness data were not designed for analysis on this time frame). More fundamentally, alcohol may have different impacts on happiness (Study 2) vs. life satisfaction (Study 1), or on unrepresentative, relatively advantaged iPhone users (Study 2) vs. a nationally representative cohort of 30-42 year olds (Study 1).

The simplest interpretation of these results, though, is that alcohol has a noticeable impact on subjective wellbeing at the moment of drinking, but relatively little overspill to other moments, and a negative impact on those that develop alcohol problems. This also fits with our understanding of the plausible relationship between alcohol and wellbeing from the existing literature. In considering the implications of these findings for policy, it is necessary to begin with their limitations.

### Limitations

Study 1 adds to a sparse literature on the relationship between life satisfaction and alcohol, and Study 2 is the first to look at moment-to-moment fluctuations in drinking and happiness. Nevertheless, uncertainties remain. It is unclear whether the smartphone-based findings would be replicated if the study were repeated on a more representative sample. FE estimates have the strengths of accounting for unobserved, stable characteristics, and of overcoming between-person differences in the

interpretation of wellbeing measures. Yet they are still biased if there are unobserved *time-varying* factors that influence both drinking and wellbeing (e.g. traumatic life events), or if wellbeing conversely influences drinking (as in Boden & Fergusson, 2011). The BCS70 adjusted FE results may further be biased to the extent that they *over-control* for certain consequences of drinking, such as marital break-up and unemployment.

It is nevertheless unclear that alternate methods would produce more unbiased estimates.

Instrumental variable analyses are theoretically unbiased, but it appears unlikely that there are any convincing instruments available for alcohol (French & Popovici, 2011). Another alternative is to look at policy variation over time or between states/regions (e.g. Gruber & Mullainathan, 2005), but state taxes are more likely to indicate anti-alcohol sentiment than to approximate a natural experiment (French & Popovici, 2011). Moreover, interpreting findings would be further complicated by the likely non-linear impact of alcohol. For example, Yörük & Yörük (2012) use a regression discontinuity design to investigate students' wellbeing as they reach the minimum legal drinking age – but their null finding could either indicate no effect, or it could conceal light-drinking students becoming happier and heavier-drinking students simultaneously becoming less happy. The most useful further contributions to knowledge would seem to be from event-level data that contains more detail on the nature of consumption within each drinking occasion, but even here, uncertainties are likely to remain.

### Guidance for policymakers

The most plausible explanation of our results is that alcohol leads to gains in happiness at the moment of drinking, but little overspill to other moments, and reduced life satisfaction among those who develop alcohol problems. It should also be noted that we have focused on the impacts of alcohol on the wellbeing of the drinker, but a full account of the wellbeing impacts of alcohol policies must also consider considerable harms to others (Johansson et al., 2006; Laslett et al., 2010). Rather than trying to meet policymakers' requests for a single number, a better approach may be an evidence-informed narrative as to the possible impacts of alcohol policies on different measures of wellbeing for different

groups (as we recommended in (AUTHOR 2012), and as Room (2000) has argued). It is primarily policymakers' responsibility to trade these off against one another, which is no easy task.

In principle, this narrative could include estimates of the average wellbeing impacts of alcohol policies according to different wellbeing measures. For example, the state of the art in *ex ante* policy assessment, the Sheffield Alcohol Policy Model (Purshouse et al., 2009), combines estimates of the link between alcohol consumption and key outcomes (such as the present study) with estimates of the impact of policies on levels/patterns of alcohol consumption. However, Study 2 does not provide the type of risk functions (based either on binge-drinking or average consumption) used in the Sheffield model. It would take a further study with considerably greater event-level detail, combined with restructuring of the Sheffield model to accommodate event-level data, to produce estimates of net wellbeing impacts of different policies – and this may be more than researchers are able to provide, at least in the short-term.

A further difficulty is the likely heterogeneity in the wellbeing impacts of alcohol policies. Some drinking decisions will follow the classical economic assumptions of rationality and will be wellbeing-enhancing, while others – particularly those taken under addiction or intoxication – may be less so, and different policies will act differentially on these. We could speculate that a wellbeing-focused alcohol policy could 'nudge' intoxicated individuals into 'better' decisions, for example by encouraging smaller serving sizes and lower-strength drinks (requiring a greater number of deliberate decisions to become more intoxicated), or extra restrictions/charges for venues with high sound levels (which inhibit conversations and encourage faster drinking; Guéguen et al., 2008). Pre-commitment devices may also be possible, such as allowing individuals at the start of the evening to place spending limits on their bar tab, parallel to similar (if not necessarily effective; Ladouceur et al., 2012) policies for gambling. However, these are mere speculations, and further research and policy development is needed to consider their desirability and feasibility, particularly robust evaluations of real-world trials. Still, population-wide policies such as alcohol taxation may also improve wellbeing, following Gruber & Mullainathan's (2005) finding that likely-smokers were happier with higher cigarette taxes.

Finally, the relationship of alcohol and wellbeing is not a given, but rather is partly culturally-determined (see above). Among other factors, marketing not only influences the pleasure of drinking – e.g. the perceived price of wine influences the pleasure of drinking (Plassmann et al., 2008) – but may also effect the anticipation and memory of consumption; as Adey et al (2010:662) put it, “consumers do not buy ethanol... they buy the anticipated effects of alcohol”. To the extent that policymakers can also control these expectations, then this may enable policies that e.g. reduce per-occasion alcohol consumption while maintaining an existing level of sociability and perceived pleasure. There is some evidence that it is possible to influence alcohol-related cognitions through individual-level interventions (Wiers et al., 2005). However, government attempts to engineer widespread ‘cultural change’ through policies ranging from content-based marketing restrictions to licensing changes have generally been less successful.

#### The role of wellbeing in alcohol policy

Some readers may accept the analysis thus far, but fundamentally question the relevance of wellbeing to public health policy. It is difficult to argue that societies should simply aim to maximise the momentary pleasure gained by individual consumption decisions. Moreover, people’s subjective views do not always map well onto those aspects of life that most people would hold to be important; Lelkes suggests that we should focus on ‘minimising misery’ rather than ‘maximising happiness’, given that unhappiness/dissatisfaction is more strongly related to objective circumstances (Lelkes, 2013). It is therefore quite possible to argue that subjective wellbeing should not be an explicit goal of policymaking – either on the grounds that we should focus more broadly on human needs (‘eudaimonic’ rather than hedonic wellbeing), or that ‘wellbeing’ is not sufficient grounds for the state to intervene in people’s lives.

All of these are valid points to be debated – and indeed, we share many of these concerns.

Nevertheless, the inattention to alcohol and wellbeing is becoming problematic. Policymakers currently have a choice between overestimating the wellbeing gains of alcohol policies (by valuing alcohol’s negative wellbeing impacts and ignoring positive impacts), underestimating them (by using implausibly naïve versions of the consumer surplus approach), or ignoring them altogether. Yet

policyholders and the public are often concerned about the wellbeing impacts of alcohol policies – and in the absence of any considered debate from academic researchers, they will be left clutching at the naïve approaches used by those outside of academia. Our hope is that this paper will spur at least a little further research and thought in order to provide a surer basis for these debates.

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***Table 1: Regression of life satisfaction (0-10 scale) on alcohol consumption***

	OLS Unadjusted	OLS Adjusted	FE Unadjusted	FE Adjusted
<b>Past 7 days' consumption</b>				
Zero consumption (ref group)	(ref)	(ref)	(ref)	(ref)
<1 unit/wk	0.25**	0.06	0.03	0.03
1-10 (male) / 1-7 (female) units	0.29**	0.12**	0.01	0.06
10-21 (male) / 7-14 (female) units	0.21**	0.13**	-0.05	0.03
21-35 (male) / 14-21 (female) units	0.15**	0.13**	-0.11*	-0.03
35-50 (male) / 21-35 (female) units	0.06	0.14*	-0.18**	-0.05
50+ (male) / 35+ (female) units	-0.38**	-0.00	-0.26**	-0.13
<i>Joint significance of terms</i>	**	**	**	<i>ns</i>
Never drink	-0.23**	-0.14*	-0.023	0.013
<i>n (person-waves)</i>	29145	25920	29145	25920
<i>n (persons)</i>	10107	9469	10107	9469

*Significance: \*\*=p<0.01; \*=p<0.05; +=p<0.10. See Web Appendix S2 for coefficients on controls.*

***Table 2: Regression of life satisfaction (0-10 scale) on other drinking measures***

	OLS Adjusted	FE Adjusted	OLS Adjusted	FE Adjusted
<b>Usual drinking frequency</b>				
Never nowadays (ref group)	(ref)	(ref)		
Monthly or less	0.10	-0.04		
Several times a month	0.23**	0.04		
2-3 times/wk	0.27**	0.05		
Most days	0.30**	0.00		
<i>Joint significance of terms</i>		**	<i>ns</i>	
Alcohol problems (CAGE)			-0.36**	-0.18**
<i>n (person-waves)</i>	25920	25920	19830	19830
<i>n (persons)</i>	9469	9469	8377	8377

*Significance: \*\*= $p < 0.01$ ; \*= $p < 0.05$ ; += $p < 0.10$ . See text for control variables.*

***Table 3: Regression of happiness (0-100 scale) on drinking alcohol at that moment***

	OLS Unadjusted	OLS Adjusted	FE Unadjusted	FE Adjusted	FE Evening-only subsample	FE Controlling for earlier happiness
Drinking alcohol	10.79**	3.65**	10.28**	3.88**	3.64**	3.30**
n (person-waves)	2,049,120	1,811,089	2,049,120	2,049,120	418,919	418,919
n (persons)	31,302	26,886	31,302	31,302	24,437	24,437

*Significance: \*\*= $p < 0.01$ ; \*= $p < 0.05$ . Control variables are given in the text, and coefficients in Web Appendix S6.*