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*Debate*

# GETTING READY FOR THE MARRIAGE MARKET? FURTHER COMMENT

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Grimps & Schneider (2012) again question our finding that divorce risk has an impact on the weight of the married. Unfortunately, they get it wrong the second time as well.

As we emphasized in our previous response (Lundborg *et al.*, 2012), their use of the statistical multilevel approach (Schneider & Grimps, 2012) was inadequate, as their analysis suffered from too few clusters at the national level. Recognizing our critique, they now employ the generalized estimation equation (GEE), admittedly being more suited than previous efforts to handle the data structure at hand. In their re-estimation of the original model, they use gender-specific data on divorce risks reported by the United Nation instead of the Lundberg *et al.* (2007) calculated common divorce risks, their reason for separate estimations for men and women being that '... the risk of divorce differs noticeably between men and women...' (Grimps & Schneider, 2012). Apparently, this claim needs some clarification. At any point in time, in monogamous heterosexual marriages, there are certainly as many married males as females in a population, and equally many men and women are under the risk of divorce. However, since there is often an age difference between man and wife within marriage, gender differences in divorce risk *by age* will be observed at an aggregate level. Having said that, it should be noticed that their new results reinforce our hypothesis that the divorce risk affects the weight of the married; in addition, the estimated effect of divorce risk on body weight is found to be stronger for men than for women (Grimps & Schneider, 2012, Table 3). Grimps & Schneider (2012) conclude: 'Our former findings prove to be not robust and could be a product of the shortcomings of the multilevel analysis.' In other words, using correct techniques, they now find strong support for our hypothesis that divorce risk affects the weight of the married.

They do not settle for this, however. Instead, they introduce a new model, in which the share of people being overweight (regardless of marital status) in the countries under study is included as an explanatory variable (Grimps & Schneider, 2012, Table 4). The effect of divorce risk then appears no longer significant, once again inclining them to

cast doubt on the general hypothesis that the divorce risk influences the incentives of the married to be slender and thereby ultimately their weight. However, as will be demonstrated below, we seriously question this last procedure on both theoretical and empirical grounds.

First, we object to their theoretical justification for introducing the fraction of overweight people as an explanatory variable. Grimps & Schneider (2012) argue that it is '... noteworthy that singles as well as married people belong to the marriage market, as people may keep searching for a new partner independent of their marital status...'. It is therefore '... necessary to control for the body weight composition of the marriage market, which includes married people as well as singles.' In our opinion, though, there is no firm ground for assuming that married and single people all belong in the same manner to the marriage market. There is substantial evidence that people who marry do so with the intention of the marriage holding and that they, hence, to a considerable extent withdraw from the marriage market. In Sweden, which, according to the new data on divorce used by Grimps & Schneider has the highest divorce risks in the studied sample, there were, during the period 2006–2010, in total about 246,000 marriages, 107,000 marriages that ended by divorce and 148,000 by the death of a spouse (Statistics Sweden, URL: www.scb.se). There are, on average, more than twice as many marriages as divorces every year, and more marriages end with the death of a spouse than end with divorce. Together with the more limited divorce rates in the rest of Europe, this clearly indicates that, for Europe as a whole, most marriages are still 'till death us do part'. Of the registered married Swedish population, as per December 2010, about 998,000 men and 978,000 women had married once during the period 1969–2010, whereas 111,000 men and 109,000 women had married at least two times and only 12,000 men and 11,000 women more than twice. (Data provided by Statistics Sweden to the Swedish news agency (TT), who published a figure 'So many times have we gotten married' (*Så många ganger har vi gift oss*) on 10th June 2011. Statistics Sweden has provided us with the raw data, and it is obtainable via request to the authors; note that the gender discrepancy is due to cross-border marriages, i.e. that more men than women marry someone who is not registered as a Swedish citizen by the authorities.) Therefore, we do not expect married people overall to be as active in the marriage market as singles; if they were, they certainly seem to be extremely unsuccessful. In fact, our main argument (Lundborg *et al.*, 2007, 2012) is that married people are less active in the marriage market but still have incentives to stay prepared for a future re-entrance into this market, depending on their divorce risk. Naturally, people may start looking out more actively for alternative partners towards the end of a creaking marriage, and some may be on 'the hunt' throughout their entire marriage, but overall we suggest that marriage implies that marriage-market activity is limited.

Second, we object to their new empirical formulation, since it includes a serious statistical fault. The main hypothesis to be tested states that the divorce risk, here approximated by national figures, affects incentives and thereby also the weight of the married (but not the singles). By assumption, this implies that the divorce risk also influences the national average weight and, hence, also the fraction of overweight, not only among the married but also in the population at large (since married people are included in this population). Thus, the measure of national overweight is rather an endogenous variable, partly determined alongside the presumed dependent

variable of interest (weight of the married) by one of the exogenous variables (national divorce risk).

To illustrate the implications of Grimps & Schneider treating the fraction of overweight as an exogenous rather than endogenous variable, let us, for the sake of argument, assume that BMI among the married is a function of divorce risk (DR) and an error term. We emphasize that we will employ this extremely simplified and stripped model, neglecting other covariates and intra-class correlations, for just one purpose – to highlight the statistical problem at hand. We will certainly also stress that this problem is universal in the present setting and extends, of course, into more sophisticated formulations.

Formally, the empirical model may be written as:

$$\mathrm{BMI}_{ij}^{M} = \alpha + \gamma\,\mathrm{DR}_j + e_{ij},$$

where the BMI of a married individual $i$ in country $j$ is merely a function of the divorce risk in country $j$ ($\mathrm{DR}_j$) and an individual-specific error term ($e_{ij}$).

Assume further that there are $m$ married people in a specific country and that their BMIs are distributed according to some well-behaved probability-distribution function so that the fraction of overweight married people $O_j^M$ could be written as:

$$O_j^M = 1 - P^M\left(\mathrm{BMI}_{ij}^{M} \le x\right) = 1 - P^M\left(\alpha + \gamma\mathrm{DR}_j + e_{ij} \le x\right) = 1 - F_{\mathrm{BMI}_j^M}(x),$$

where $x$ is the threshold value for being classified as overweight, $1 - P^M\left(\mathrm{BMI}_{ij}^{M} \le x\right)$ denotes the probability of being overweight and $F_{\mathrm{BMI}_j^M}$ is the cumulative distribution function of BMI for the married in country $j$. Note that since all married individuals within a country are assumed to face the same divorce risk, the shape of this distribution is given by the distribution of the error term ($e$), and the divorce risk just shifts the location of this distribution on the BMI scale. The BMI of an unmarried individual $k$ in country $j$ is independent of divorce risk and is determined by an error term ($u_{kj}$), implying that the fraction of overweight among the singles ($O_j^S$) is given by some distribution ($F_{\mathrm{BMI}_j^S}$).

$$\mathrm{BMI}_{kj}^{S} = \beta + u_{kj}. \quad O_j^S = 1 - P^S\left(\mathrm{BMI}_{kj}^{S} \le x\right) = 1 - P^S\left(\beta + u_{kj} \le x\right) = 1 - F_{\mathrm{BMI}_j^S}(x)$$

Given that there are $n$ singles, the fraction of overweight people in the population ($O_j^P$) is given by the fraction of overweight married and single individuals weighted by their respective population size:

$$O_j^P = \frac{mO_j^M + nO_j^S}{m+n} = \frac{m\left[1 - F_{\mathrm{BMI}_j^M}(x)\right] + n\left[1 - F_{\mathrm{BMI}_j^S}(x)\right]}{m+n}$$

Controlling for the fraction of overweight in the population in estimating the influence of divorce risk on BMI, which is exactly what Grimps & Schneider attempt to do, implies the following model:

$$\mathrm{BMI}_{ij}^{M} = \alpha + \gamma\mathrm{DR}_j + \delta O_j^P + e_{ij} = \alpha + \gamma\mathrm{DR}_j + \delta\,\frac{m\left[1 - F_{\mathrm{BMI}_j^M}(x)\right] + n\left[1 - F_{\mathrm{BMI}_j^S}(x)\right]}{m+n} + e_{ij}$$

Since $F_{\mathrm{BMI}_j^M}(x) = P^M(\alpha + \gamma \mathrm{DR}_j + e_{ij} \leq x)$, the added variable, the country-specific fraction of overweight people ($O_j^P$), is clearly not exogenous as it, by the assumptions of the hypothesis to be tested, is a function of the independent variable of main interest, divorce risk. As it is an outcome variable just as is BMI, it will distort the estimate of the true impact of divorce risk on BMI. It is also noteworthy that the 'automatic' association between divorce risk and the fraction of overweight increases in the fraction of people being married $m/(m+n)$ and according to the data at hand this fraction amounts to $0.84 \approx 6336/(6336 + 1187)$, i.e. the total figures on married and singles used by Schneider & Grimps (2012) and Grimps & Schneider (2012). Hence, in the last model estimated by Grimps & Schneider (2012), significant parts of the hypothesized influence of divorce risk on BMI is bound to spill over on the construct of the fraction of overweight in the population. In order to test the main hypothesis, their empirical model is simply inadequately formulated.

So, concluding, we again commend Grimps & Schneider for their effort. However, whereas the last part (Table 4) of their analysis in the Grimps & Schneider (2012) rejoinder apparently is ill-founded and statistically flawed for the purpose of testing the main hypothesis, their proper re-analysis (Table 3) of the data at hand indeed adds further evidence to and strengthens our hypothesis that the divorce risk affects the incentives to stay slim within marriage. For the present being, new data and further analysis seem necessary in order to revise that hypothesis.

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