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In Sickness and in Wealth: Psychological and Sexual Costs of Income Comparison in Marriage*

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Abstract

As the percentage of wives outearning their husbands grows, the traditional social norm of the male breadwinner is challenged. The upward income comparison of the husband may cause psychological distress that affects both partners' mental and physical health in ways that impact decisions on marriage, divorce, and careers. This paper studies this impact through sexual and mental health problems. Using wage and prescription medication data from Denmark, we implement a regression discontinuity design to show that men outearned by their wives are more likely to use erectile dysfunction (ED) medication than their male breadwinner counterparts, even when this inequality is small. Breadwinner wives suffer increased insomnia/anxiety medication usage, with similar effects for men. We find no effects for unmarried couples or for men who earned less than their fiancée prior to marriage. Our results suggest that social norms play important roles in dictating how individuals respond to upward social comparisons.

Keywords: Social comparison; marriage; intimacy; happiness; family; gender roles; sexual identity; sexuality; emotion in relationships; family; romantic relationships; regression discontinuity

The percentage of American wives who outearn their husbands has grown from 4% to 22% in the last twenty years (Fry & Cohn, 2010), with similar patterns in other countries (Bloeman & Stancanelli, 2008). While this trend may reflect better educational and career opportunities for women (Goldin, 2006), as well as changes in marriage patterns (Schwartz & Mare, 2005), it also has major implications for psychological and physical health because it dramatically changes income comparisons in marriage. Social psychology, economics, and sociology have demonstrated both that spouses and romantic partners provide highly relevant social comparison points (Beach & Tesser, 1993; Pinkus, Lockwood, Schimmack, & Fournier, 2008) and that income is a particularly salient dimension for comparison (Clark & Oswald, 1996; Luttmer, 2005).

Existing research in social psychology suggests that income comparison in marriage might substantially impact both spouses. Much of this work has been based on Tesser's (1988) self-evaluation maintenance (SEM) model, which he and colleagues (Beach et al., 1996) extended toward comparisons in romantic couples. In the SEM model, spouses might respond negatively to upward comparison in highly relevant tasks that are self-defining, but positively in tasks that are less important to the self. Romantic or emotional closeness further amplifies these effects, but may also produce empathetic effects, where the impact of comparison on the other reflects back to the partner (Beach and Tesser, 1993).

This theory, combined with survey-based and laboratory research (Beach et al., 1998; Mendolia, Beach, & Tesser, 1996), suggests that upward comparison, even on self-defining tasks, might have minimal negative consequences in marriage. Pinkus et al. (2008), through survey and laboratory studies, even argue that the collective identity of the couple may make upward comparisons *positive* for the low-performing partner. Yet both Beach et al. (1998) and Pinkus et al. (2008) find some evidence of a negative impact of upward social comparison for men on highly-relevant tasks, including career concerns. What if the romantic relationship itself, through

norms of gender roles in marriage (e.g. Eagly, 1987), renders upward comparison on career and income dimensions negative for men?

In fact, considerable evidence exists that upward comparisons by men on the dimension of income can yield significant costs in marriage because they violate traditional social norms of male breadwinners. When women outearn their husbands, it challenges the traditional social norms and roles of the man as economic provider and female income as supplemental (Eagly, Wood, & Diekman, 2000; Johannesen-Schmidt & Eagly, 2002; Zelizer, 1994). These couples may respond by disguising and pooling finances (Atkinson & Boles, 1984; McRae, 1987), suffer lower marital satisfaction (Gray-Little & Burks, 1983), and fail to balance housework and marital power to correspond to wives' earnings (Pollak, 1988). Men have strong preferences for outearning their wives and less desire than women for high-earning partners (Hitsch, Hortascu, & Ariely, 2010; Zuo, 1997). Surveys show men frequently suffer depression when outearned by their wives (Crowley, 1998), partially explaining why marriages with female breadwinners are correlated with increased marital disruption and spousal abuse (Atkinson, Greenstein, & Lang 2005; Heckert, Nowak, & Snyder, 1998). These survey results are consistent with a much broader literature demonstrating both the costs of upward comparisons (e.g. Tesser, Millar, & Moore, 1988; Wheeler & Miyake, 1992) and the intensity of such comparisons with socially-close others (e.g. Tesser, 1988).

In the current research we focus on an important manifestation of the psychological costs of wage comparison in marriage: sexual health. Marital sex is a frequent medium for social exchange tied to financial or social resources (Baumeister, Catanese, & Vohs, 2001). Male sexual desire and behavior is tied to cultural and social factors such as patriarchy, money, and social networks (Cornwell & Laumann, 2011; Hill, 1997; Kitzinger, 1987), potentially causing men to suffer reduced sexual desire or dysfunction when perceiving their traditional provider role to be usurped. In fact, the medical literature has shown that anger and frustration can lead to serious sexual problems such as erectile dysfunction (ED) (Levy, 1994), a problem also linked to

unemployment and decreased household income (Laumann, Paik, & Rosen, 1999). Similarly, work in social psychology has shown the link between sexuality and gender role conformity (Rohlinger, 2002; Sanchez, Crocker, & Boike, 2005).

We also examine related manifestations of the psychological costs of wage comparison: insomnia, anxiety, and depression. Given existing work linking these problems to spousal incomes, and their role as potential mediators for sexual dysfunction, we examine whether increases in mental health issues are also observable when marital income norms are violated. While we examine the impact of upward income comparison on male mental health, an additional benefit is that we can study how this norm violation also impacts female health. Given existing evidence on empathetic responses to spouses' negative comparisons (e.g. Lockwood, Dolderman, Sadler, & Gerchak, 2004; Pinkus et al., 2008), women may also suffer psychologically from the negative effects of wage comparison on their husbands.

We examine the relationship between marital income comparison and sexual and mental health using income and prescription medication data for over 200,000 married Danish couples from 1997-2006. We first use linear regression analysis to simply describe the relationship between relative income and ED medication usage, controlling for demographic, family, and medical factors that also might impact ED. Our results show a strong relationship between relative income among couples where the woman outearns her husband and ED medication usage, but little relationship in couples with a primary male breadwinner. Furthermore, we find initial evidence of a discontinuity at the income equality point, where ED medication is significantly higher for men who are slightly outearned by their wives than for those who slightly outearn them, and that this effect is smaller for unmarried cohabitating couples.

This initial analysis is limited by its inability to control for individuals intentionally choosing their partners and careers based on their attitudes toward female breadwinners. It is also limited by omitted variables that might impact both relative wages and ED medication usage, such as unobserved medical issues or job-specific stressors. To address these issues, we employ a quasi-

experimental regression discontinuity design that allows us to compare control and treatment groups immediately on either side of the point of marital income equality (Thistlewaite & Campbell, 1960). This analysis allows for a flexible relationship between income inequality and ED medication, while examining the discrete increase in medication usage observed near the point where women begin to outearn their husbands. This approach minimizes the limitations of the initial analysis, since couples close to this income equality point are observed to be identical apart from small differences in relative wages. The results from regression discontinuity analysis show that even small differences in relative income are associated with large changes in ED medication usage when they shift the marriage from a male to a female breadwinner.

Furthermore, we find that this effect does not exist for unmarried cohabitants, suggesting that the social construct of marriage plays a critical role in how men view wage comparison. We also find that the effect only exists for couples where the man outearned the woman prior to marriage, suggesting that men who knowingly marry high-earning females suffer no psychological costs from future income comparison. We also find some evidence that the impact of wage comparison on sexual dysfunction decreases with the age of the husband, despite increased base rates of ED medication usage. This result, presented in an online appendix, is consistent with existing literature on higher testosterone increasing threats to masculinity (e.g. Willer, Rogalin, Conlon, & Wojnowicz, 2012). Furthermore, wives who outearn their husbands have an increased likelihood of using benzodiazepine medication for anxiety and insomnia, and husbands suffer both increased benzodiazepine and anti-depressant usage. These results suggest that upward comparisons in marriage and other relationships can directly impact psychological and physical health when they violate salient social norms.

EMPIRICAL ANALYSES

Data

We identify the sexual cost of marital income comparison using two datasets linked through individual social security numbers in Denmark. Denmark, which ranks 14th in the United Nations Development Programme's Gender Empowerment Measure (GEM), is a conservative setting in which to study traditional gender roles because of its progressive gender attitudes. Despite this, prior studies in the Netherlands, Sweden, and Denmark suggest that the cultural norm of male breadwinners is still relevant to northern Europe (Sainsbury, 1996; Sorenson & Dahl, 2012). The major benefit of studying Denmark is that the nearly complete Danish social security system enables accurate matching of individual-level databases. The first dataset, the Integrated Database for Labor Market Research (IDA), contains the Danish government's annual demographic information from the third week of November for all individuals in Denmark from 1980-2007.

We match the IDA dataset to a second dataset, the Danish Register of Medicinal Product Statistics (RMPS), maintained by the Danish Medicines Agency. This database includes all medical prescriptions for the entire Danish population from 1995 to 2007. This combination of demographic and medical data has previously been used by Dahl, Nielsen and Mojtabai (2010) and Dahl (2011). Denmark is ideal for studying the impact of relative income on health because employment and income changes will not greatly influence access to medical care. Medication requires some small payment from patients, but public support for low-income patients ensures that payment amounts decrease heavily with the number of prescriptions. Visits to general physicians are free of charge.

The linked IDA and RMPS databases allow us to identify annual wage-based income and drug prescriptions for all wife and husband pairs as well as for cohabitating heterosexual couples and homosexual domestic partners. Using the World Health Organization's drug classification classes (Anatomical Therapeutic Chemical (ATC) Classification System), the RMPS database

allows us to identify sexual dysfunction across time through the observation of prescriptions of PDE-5 inhibitors, which is the first line treatment for erectile dysfunction (ED) (Sandner, Hütter, Tinel, Ziegelbauer, & Bischoff, 2007): sildenafil (ATC: G04BE03 (Viagra)), tadalafil (ATC: G04BE08 (Cialis)) or vardenafil (ATC: G04BE09 (Levitra)). For our dependent variable, we use a dummy variable that takes a value of one if a man has at least one prescription of the three ED medications in the year following income reporting. It is important to note that prescriptions reflect those who have sought treatment for sexual problems; we cannot observe those suffering but unwilling to seek treatment. Our use of PDE-5 inhibitors as a proxy for sexual dysfunction does not allow us to distinguish between newly occurring sexual dysfunction or pre-existing conditions for which the patient is newly seeking medical treatment. PDE-5 inhibitors are in some cases used for pulmonary hypertension (Sandner et al., 2007), but this condition occurs predominantly in females and typically forces early retirement, limiting the impact on our study.

To more directly test psychological costs, we also examine the use of two different types of medication classified by ATC-classes, following Dahl, Nielsen and Mojtabai (2010) and Dahl (2011). Insomnia and anxiety are treated with benzodiazepine-related medications (ATC: N05CF and N05BA). Anxiety and depression are treated with selective serotonin re-uptake inhibitors (SSRI) (ATC: N06AB). For alternative dependent variables, we create dummy variables for each of these two medication classes, for both the husband and wife. Each variable takes a value of one if the spouse held a prescription for that drug class in the year following income reporting.

In Table 1, column 1 we present summary statistics for our main sample consisting of all married heterosexual couples where both spouses are between ages 25 and 49 and where both spouses have full-time jobs. We focus on this age group for two reasons. First, there is selection bias for younger men and women due to choices to attend university and for older couples to retire early. This selection bias means that younger or older couples who are both working full time are unlikely to be representative of the broader population. Second, the base rate for ED medication is extremely low for younger couples and much higher for the older group.[1] We

include all couples within this central age range for every year between 1997 and 2006, with 569,257 unique couples and 2,831,779 total observations. All wages are inflated to 2010 price levels using a consumer price index for Denmark. To remove extreme outliers, we exclude couples with wage differences lower than the first and higher than the 99th percentile.[2]

In Figure 1, we plot the distribution of wage differences for our married sample using a kernel density function,[3] which creates a smoothed histogram. In Figure 2, we present kernel density distributions for male and female wage income. One concern in studying income comparison in marriage is that wage difference, our independent variable, is a difference score. While we will address this issue later, we first present Figure 3, which shows the relationship between marital wage difference and the wife's and husband's wages and household income. We create this figure by aggregating couples into bins of 10,000 Danish kroner (~ 1,750 USD) based on marital wage difference and plotting the average wages of the wife, the husband, and the total household for each bin. The three points exactly on the income equality line, for example, represent all couples where the husband's wages are between zero and 10,000 kroner more than his wife's wages. The solid dots, hollow dots, and hollow diamonds represent these couples' average household, male, and female wages, respectively.

We note several important observations about Figure 3. First, for wage differences between -200,000 and 200,000 kroner, household income is remarkably constant. This suggests that any results based on wage difference within this range are unlikely to be confounded by total household income. Second, and most importantly for our subsequent regression discontinuity analysis, both man and woman income are continuous through the point of income equality. This suggests that the point of marital income equality does not correspond with a discrete change in either the income of the husband or the wife. Figure 4 aggregates couples into bins of 10,000 kroner based on both the wage income of the wife and the husband, then separately plots the average ED medication usage for each bin.[4]

Descriptive Analysis of Relative Wages and ED Medication

We first provide a rough descriptive analysis of the relationship between relative wage income and ED medication usage across a broad range of income differences. While this analysis cannot suggest any causal relationship and cannot control for other factors such as choice of spouse or career, it provides an initial description of the association between ED medication usage and marital income. We employ linear probability models regressing the use of ED medication on relative income in marriage.[5] We specify these models as linear splines, where the linear relationship between ED medication and relative income is estimated separately for marriages with female breadwinners and for those with male breadwinners. The linear spline specification also allows for a discontinuous change in this relationship at the income equality point. We note that our model restricts this relationship to be linear on each side of the equality point, which we will relax later in the paper. Our fully-specified model is:

$$ED_{it+1} = \beta_0 + \beta_1(W_{it} - W_{jt}) + \beta_2 L_{ijt} + \beta_3(W_{it} - W_{jt}) * L_{ijt} + \beta_3 Y_t + \beta_4 D_{ijt} + \beta_5 F_i + \beta_6 H_{it} + \varepsilon_{ijt}$$

where ED_{it+1} is a dummy variable indicating the man *i* in year *t* has a prescription for sildenafil, tadalafil, or vardenafil the following year, $(W_{it} - W_{jt})$ is the difference between the wage incomes of the man *i* and woman *j* in year *t*, and L_{ijt} is a dummy variable indicating the man makes less than the woman. The remaining matrices (groups of variables) represent control variables for time (year dummies Y_t), husband and wife demographics (D_{ijt}), family ED predisposition (F_i), and related health problems (H_{it}).

Heterosexual Married Couples: We present our results for married couples in columns 1 – 3 of Table 2, with coefficients and p-values for the wage variables in parentheses.[6] Coefficients are multiplied by 100 for presentation purposes to reflect percentage changes of ED medication.[7] Column 1 presents the model with only time controls. In column 2, we add demographic controls, including the age and education of both spouses, total household income, and the logged number of children for three categories: ages 0-5, 6-13, and 14-17. We also control for family disposition--whether or not the husband's father has ever been prescribed medication for ED. Finally, in

column 3 we add controls for medications that may either impact erectile dysfunction or else reflect an underlying medical condition that impacts it. For these controls, we include dummy variables reflecting the use of drugs for heart conditions and diabetes.[8] Diabetes is treated with insulin and insulin analogues (ATC: A10), while heart conditions are treated with beta blocking agents (ATC: C07) and statins (ATC: C10) (McVary, 2007).

The results in all three columns demonstrate two notable associations between wage differences and ED medication. First, while ED medication increases with the absolute value of the wage difference for both female and male breadwinner households, the magnitude of this effect is much larger when the woman outearns her husband. While each additional 1,000 kroner increases the probability of ED medication for male breadwinners by only 0.0004 percent in our fully-controlled model 3 (b = .0004, p < .001), the marginal effect when women earn relatively more is 0.011 percent (b = -.0015, p < .001).[9] Even this marginal impact is small, but given the mean ED medication usage of 0.6 percent, it implies that a wage difference of 100,000 kroner (~16,000 USD) is associated with a doubling of ED medication usage --- a medically and socially significant relationship. We note that the model implies that men who greatly outearn their wives also have increased usage of ED medication. While this could be due to many factors, the relationship between male income and ED medication in Figure 4 suggests it may be related to increased stress from higher earning jobs (Laumann et al., 1999).

The second, and perhaps more important, association is at the point of wage equality. The coefficient for the dummy variable indicating that the man earns less suggests that simply being left of the equality point is associated with increased ED medication of 0.06 percent (b = .065, p < .01), which is a ten percent increase from the 0.6 percent population mean. This suggests that there is discretely higher ED medication usage when the man earns slightly less than his wife, compared to if he earned slightly more. An alternative specification addresses concerns that the wage difference coefficient reflects underlying relationships between ED medication and the individual wages of either the husband or wife. The model, adapted from Edwards (1994), is

presented in the online appendix and supports our preliminary findings of increasing ED medication usage in marriages with female breadwinners.

Unmarried Heterosexual Cohabitants: As a comparison point, we use an alternative sample of cohabitating heterosexual couples.[10] The descriptive statistics for this sample are presented in column 2 of Table 1. We run our fully-controlled model from column 3 of Table 2, and present this for cohabitating couples in column 4. The results show similar linear relationships between relative wages and ED medication on both sides of the equality point (b = .0004, p < .001; b = -.0012, p < .001), but no statistically significant jump in ED medication usage at the equality point (b = .024, p = .405). This suggests that while there may be some underlying relationship between income and ED medication, there is no discrete psychological shock to a man of being outearned by a unmarried female partner. These results suggest that either marriage makes men more sensitive to upward income comparisons with their partners, or alternatively that men who are comfortable with a breadwinning partner choose not to marry.

Regression Discontinuity Design

Identifying the direct psychological impact of female breadwinners on male sexual health is difficult, because any correlation between the two could be explained by spouse and career choices, low male earnings from other health problems impacting sexual health, or lifestyle choices predicting both health and earnings. While our earlier models tried to control for these factors through medical data and alternative samples, there are almost certainly still unobserved factors that are influencing our results. An experimental design randomly assigning men and women to marriages might resolve some of these issues but is infeasible for reasons of practicality and ethics.

Instead, we employ a quasi-experimental sharp regression discontinuity (RD) design, which involves assigning individual observations to a treatment (e.g. female breadwinner) or control (e.g. male breadwinner) group based on a continuous assignment variable (e.g. marital wage

difference) (Berk & Rauma, 1983; Imbens & Lemieux, 2008). Those observations above (or below) some discrete threshold in the assignment variable are assigned to the treatment group, while the others are considered controls. Examples of such threshold assignments include vehicle emissions limits (Pierce & Snyder, 2012), minimum seniority levels during layoffs (Mark & Mellor, 1991) or a majority election vote share (Dal Bo, Dal Bo, & Snyder, 2008). In each case, being slightly above or below the threshold has a decidedly different impact on the outcome (e.g. passing a test, keeping a job, or winning an election).

Despite being developed in psychology (Thistlewaite & Campbell, 1960), the use of regression discontinuity in the discipline has been relatively sparse,[11] with more widespread implementation in economics and political science.[12] It has frequently, however, been advocated in psychology as an effective alternative to randomized experiments (Rutter, 2007; Shadish, Cook, & Campbell, 2002; West, 2009; West, Biasenz, & Pitts, 2000).

The continuous assignment variable in our model will be marital income difference, with the dependent variable as ED medication usage. We define our threshold as the exact point of income equality between husband and wife, based on a standard categorization of couple types (Winkler, McBride, & Andrews, 2005). A sharp RD design assumes that populations immediately on either side of the income equality threshold are nearly identical, since they differ only by small magnitudes in the continuous variable that assigns them to either side. The two groups near the threshold form pseudo-control (male breadwinner) and pseudo-treatment (female breadwinner) groups defined by the discrete threshold, so long as the assignment of the subject to either side is based solely on this variable (income difference). We thereby examine whether the psychological "treatment" of being outearned by a wife predicts sexual problems represented by increased prescriptions of ED medication.

Although relative marital income may have a complicated relationship with ED for reasons mentioned above, these reasons are unlikely to have a discrete impact at the point of equality. Any impact at this point we therefore interpret as the psychological impact on the man

of being outearned by his wife. An additional advantage of this design is that it addresses the potential interpretation problems with difference score measures mentioned earlier in the text. So long as spousal incomes are continuous at the point of wage equality (which Figure 3 demonstrates), any discontinuous impact in wage difference cannot be explained by the individual wage components.

Our implicit assumption is that the population of couples where the husband barely outearns his wife is equivalent on all other characteristics to the population where she barely outearns him. To test this assumption, we present Table 3, which represents those populations where each spouse earns within 30,000 Danish kroner (~5,000 USD) of one another (n = 409,341). As expected, the prescription drug variables are all higher for the group where the wife earns more. We present the difference in ED medication usage for these two groups in Figure 5, with 95 percent confidence intervals. Medication usage is higher for couples where the wife earns more (mean=0.77 percent) than for those where the man earns more (mean=0.70 percent; $p < 0.01$). More importantly, nearly every other variable is identical for the two groups---an important assumption in RD models (Lee, 2008). The lone exception is wife education, which is slightly higher in the group where the wife outearns her husband.

We first study the psychological and sexual cost to men using the ED drug dummy as our dependent variable. Using logistic regression, we measure the discrete impact of the psychological treatment at the point of income equality on the likelihood of using ED medication. That is, we estimate the discrete increase in medication for men earning just less than their wives, compared to the control group of men earning just more than their wives. This approach is similar to the discrete increase in ED medication observed in our earlier linear spline models, but is more robust to any non-linear relationship between wage difference and the ED medication. Similar to Table 2, we will identify this discrete increase as the coefficient for the *man earns less* dummy variable.

Our RD design models all variables other than our discrete treatment variable (*man earns less)* as part of a continuous function. Since it is important to allow this function the flexibility to be nonlinear, we use fourth-order (quartic) polynomial smoothing for the wage difference, which involves including *wage difference* and its squared, cubed, and fourth-order values as independent variables. We include the full set of control variables from our earlier linear models, including age, education, the ages and number of children, father ED prescriptions, year and regional dummies, medications with known ED side effects and comorbidity. Since the quartic polynomial should provide sufficient functional flexibility, any statistically-significant positive coefficient on *man earns less* reflects a discontinuity or jump in ED medication usage that suggests psychological and sexual costs from a man earning just less than his wife.

We present a graphical representation of this model in Figure 6, which plots wage differential (man-woman) against probability of ED medication. Like earlier figures, each point represents the average ED medication rate for all couples with wage differentials within 10,000 Danish kroner (~ 1,750 USD). Lines represent predicted quartic polynomial relationships between wage differential and medication probability on either side of the income equality point, with dashed lines representing 95 percent confidence intervals.[13] The discontinuity at income equality is clearly visible. Couples where the wife outearns her husband (to the left of equality) have considerably higher ED medication usage than those where the husband earns more (to the right of equality). Figure 7 repeats the process using smaller bins of 5,000 kroner. The fitted lines are more precisely estimated due to greater numbers of bins, although the plots are noisier due to fewer observations per bin. We again observe a discontinuity, where men earning just less than their wives (the treatment group) have higher usage of ED drugs than do the control group.

Male Sexual Health: We present the results from our logistic regression models for ED medication in columns 1-3 of Table 4 for married couples. Column 1 includes only year and wage-difference polynomial controls, while columns 2 and 3 add additional controls similar to Table 2. The impact of the discrete treatment at wage equality, or *man earns less*, is statistically

significant in our fully-controlled model (3) (b = .111, p = .002, OR = 1.12).[14] The odds ratio indicates that the odds that men who are barely outearned by their wives use ED medication are 1.12 times larger than the odds for those who earn slightly more (an increased risk of approximately ten percent). It is important to note that similar to our earlier models, we include controls for medications used to treat diabetes, cholesterol, and heart conditions, thereby ruling out these health conditions as driving our result.[15] To test for differential effects across age groups, we repeat our fully-controlled model (3) separately for couples with husbands age 18-34, 35-49, and 50-65. These results, presented in the online appendix, suggest that the impact of upward wage comparison on male sexual health decreases as they age, which is consistent with higher testosterone levels increasing threats to masculinity (Willer et al., 2012).

For robustness, we alternatively use separate quartic polynomials on each side of the equality point, with no substantial change in the results presented in column 4 (b = .122, p = .039, OR = 1.13). Similarly, to account for concerns about the use of a difference score as a running variable, we use quartic polynomials for both husband and wife wages as our assignment variables. The coefficient for the threshold (column 5) is smaller but is consistent with other models and remains statistically significant (b = .072, p = .022, OR = 1.08).[16] Column 6 presents an alternative linear specification, which is more traditionally used in regression discontinuity models and is consistent in magnitude and significance. Finally, column 7 presents a kernel regression model, where we also test the robustness of our model to narrowing the bandwidth (range) of data on which model is tested.[17] For a bandwidth of -200,000 and 200,000 kroner wage difference, the results are very similar and statistically significant (b = .051, p = .044), while smaller bandwidths produce similar coefficients with slightly weaker statistical significance.

Our regression discontinuity models consistently show that married men who are slightly outearned by their wives are on average eight to ten percent (e.g. 0.66 percent vs. 0.6 percent) more likely to use ED medication that those who slightly outearn their wives.

Alternative Samples: We reran our regression discontinuity design with our alternative sample of heterosexual unmarried cohabitants, using a logistic regression model with full controls. We present these results in Table 5, column 1. We again find no evidence of a discontinuity (b = -.032, p = .650, OR = .968), which is consistent with marriage being critical in defining the social norm of female breadwinner. We present the average ED medication usage for both the primary married sample and the heterosexual cohabitant sample together in Figure 8, collapsing all couples into 10,000 kroner bins, and adding fitted quartic polynomials and 95 percent confidence intervals. The discontinuity from Figures 6 and 7 is evident for married couples, while there is no evident discontinuity for unmarried cohabitants. These results suggest that marriage plays some role in defining the social norm of male breadwinner, since we observe no apparent ED costs in unmarried men with higher-earning cohabitants.

Selection Models: Given that people do not randomly choose their spouse (Burdett & Coles, 1997; Eagley, Eastwick, & Johannesen-Schmidt, 2009), we separate our married sample into two groups: those where the fiancée (wife) outearned the fiancé (husband) prior to the marriage, and those where the man was the higher premarital earner. We identify these groups based on the year prior to marriage, which restricts our sample to only those couples who were not married to their current spouse in the first year of our data. One would expect that men who married high-earning fiancées would not be psychologically impacted by later, unfavorable wage differences. We implemented our fully-controlled regression discontinuity models separately on these two samples and present the results in Table 5, columns 2 and 3. In column 2, where the woman was the higher premarital earner, the impact of being outearned post-marriage is not statistically significant (b = -.053, p = .682, OR = .949). In contrast, column 3, which presents the sample where the man was the higher premarital earner, the impact is statistically significant and twice as large as the effects observed in early models (b = .221, p = .027, OR = 1.247). The odds ratios indicate that being outearned by a spouse increases the likelihood of ED medication usage by approximately twenty percent near the income equality point. Together, these results suggest that

breadwinner status is only associated with ED medication usage for those men who did not knowingly marry a female breadwinner. Men who knowingly married a female breadwinner appear to suffer no costs from being outearned.

Mental Health: Our analysis suggests a distinct psychological cost to men from being outearned by their wives. Men appear to suffer increased ED at precisely the point where wives start outearning them. Yet what is the impact on the wife, given existing evidence in social psychology on empathetic impacts on partners in romantic relationships (e.g. Lockwood et al., 2004; Pinkus et al., 2008)? This question is particular important given the observation of decreased happiness in American women despite growth in earnings and opportunity (Stevenson & Wolfers, 2009). Furthermore, recent work has shown links in spouses' negative moods and hormones (Fletcher, 2009; Saxbe & Repetti, 2010). We test the impact on wives' and husbands' mental health by regressing anxiety/depression and insomnia medications using our earlier regression discontinuity logit models.

Columns 4 and 5 of Table 5 present results from fully-controlled logistic regression models predicting the impact of female breadwinner status at the point of wage equality on wife anxiety/depression and insomnia medications. Results for SSRI drugs are not statistically significant (b = -.017, p = .359, OR = .983), but benzodiazapine has a small but statistically significant increased likelihood for women who slightly outearn their husbands (b = .046, p = .003, OR = 1.047). We can only speculate whether this insomnia and anxiety come from direct psychological costs or as spillovers from the reduced psychological or sexual health of husbands, and what role it might play in the sexual health of both partners. We also present the same models for husbands' mental health in columns 6 and 7, which show a similar increase in both benzodiazepine and SSRI usage in men just below the point of income equality (b = .047, p = .009, OR = 1.048; b = .055, p = .016, OR = 1.056). These results, which show increased psychotropic drug usage among men who are outearned by their wives, are consistent with the psychological costs we previously observed manifested through erectile dysfunction.[18]

Robustness Tests

Fuzziness in the Discontinuity: Our use of the treatment threshold as the exact point of income equality is referred to as a "sharp" RD design. In traditional sharp RD implementation, all individuals on one side of the threshold are believed to be treated while all others remain untreated. There are several important reasons why we might believe this is not the case for our setting. The first is that not all husbands who are outearned will suffer psychological or sexual costs. Second, not all husbands who do suffer such costs will be "treated" at the same level of marital income difference. Some husbands may feel emasculated even if they earn slightly more than their wives, while others may be unaffected so long as they earn within a certain amount of their wife. Third, not all men will have exact information about the income of both themselves and their spouse. While information on wage income is readily observable through paychecks and tax filings in Denmark, we acknowledge that for the (likely few) marriages where the wife handles all the financial and tax documentation, husbands may be unaware of relative wage income.[19]

These reasons all suggest that the discontinuity may be more "fuzzy" than "sharp", which would typically suggest the use of a fuzzy regression discontinuity design. In a fuzzy RD design, the treatment effect is not assumed to change from zero to one exactly at the threshold. Instead, the probability of treatment is assumed to increase across the continuous assignment variable (in this case wage difference) near the threshold, with a smaller discrete jump in this probability at the threshold. Thus, in estimating a fuzzy RD design, the sharp threshold is typically used as an instrumental variable for observed treatment in a two-stage least squares regression (2SLS) (Hahn, Todd, & Van Der Klaauw, 2001). While this fuzzy model fits our setting much better than the sharp RD design, we are unable to implement this design because we cannot directly observe treatment, or which men are psychologically impacted by upward wage comparison with this wives.

In order to better understand the nature of the "fuzziness" in our treatment, we rerun our fully-controlled sharp RD model using linear probability models (Table 4, column 6) 101 times, increasing the threshold in each iteration by 1,000 kroner from a minimum of -50,000 to 50,000. Figure 9 presents the discontinuity estimates (coefficients on the threshold dummy) for each iteration with 95 percent confidence intervals. As the figure shows, a sharp discontinuity is statistically significant at the five percent level for a range of thresholds near income equality, with the magnitude (and statistical significance) highest near 9,000 kroner. We draw two conclusions from these results. First, the fuzziness of the discontinuity is indeed substantial, such that the severe drop in ED medication usage as the man outearns his wife occurs over a range of approximately 30,000 kroner. Second, the average wage difference at which men view themselves as losing breadwinner status appears to be slightly higher than equality, which suggests that as previous work has argued (Nock, 2001; Winkler, McBride, & Andrews, 2005), many men need to significantly outearn their wives to avoid psychological and sexual costs from violating marital norms. We believe future work, combining survey-based instruments (to measure actual treatment) with medical data, could allow a more effective implementation of the fuzzy RD design.

Testing for Sorting: Given the fuzziness observed in the discontinuity, and our inability to observe true treatment, we are concerned that couples near the wage equality threshold may be intentionally sort to one side or the other by basing income or career decisions on the relative income of the spouses. A wife, for example, might be less aggressive in pursuing a promotion or salary increase if it were to increase her wages to slightly more than her husband. Similarly, a husband might work harder or change jobs in order to regain his breadwinner status. This identification concern, noted in both psychology and economics (Lee & Lemieux, 2010; Shadish, Cook, & Campbell, 2002; West, Biesanz, and Pitts, 2000), would weaken any causal inference in the quasi-experimental design. We address this concern in two ways. First we present the frequency distribution of wage differences for our primary married sample in Figure 10, using

bins of 1,000 kroner. If there were significant endogenous sorting, we would expect a discontinuity in frequencies at the point of equality as couples sorted to one side or the equality point. We note that the distribution is reasonably continuous, although there appears to be a slight bump in frequency just to the right of equality. This suggests that a few couples may be choosing to allow the husband to slightly outearn the wife. We note, however that this selection bias, if it exists, would likely bias against our results, since we would expect the husbands most likely to be effected by being outearned to sort from the left to the right of the equality point.

To more formally test this continuity, we follow the suggestion of McCrary (2008) and run a sharp RD design on the density of the running variable (wage difference), using a flexible linear regression with quartic polynomial smoothing (similar to Table 4, Column 4) for all couples between -100,000 and 100,000 kroner in wage difference.[20] We find a small discontinuity, where the number of couples per 1,000 kroner interval jumps by approximately 188 at the point of income equality. This small increase, compared to an average bin density of 2,650, suggests that a small percentage of couples may be intentionally moving from the female to the male breadwinner side. Given the small size and direction of the discontinuity, we do not believe this can explain our results, but caution that this discontinuity, plus the high number of identical marital wages explained earlier, suggests that better understanding this sorting process is important future work.

DISCUSSION AND CONCLUSION

In this paper we provide evidence that there is a distinct psychological and sexual cost to upward income comparisons in marriage. We observe a sharp increase (approximately 10%) in the use of erectile dysfunction drugs when women slightly outearn their husbands, compared to when they are slightly outearned. Similarly, we see wives near the point of income equality having increased stress or insomnia when they are the primary breadwinner. Furthermore, the increase in ED medication usage continues as the gap between the wages of the wife and husband

increases. These results are consistent with a broad literature suggesting psychological and sexual costs from men losing their traditional marital role of breadwinner. More broadly, they suggest that the impact of upward social comparison in marriage depends on which partner is looking upward, as social norms in marriage dictate the traditional role of the husband as financial provider. While we cannot observe the exact psychological mechanisms that yield sexual dysfunction, anxiety, and insomnia, our use of medication to identify psychological costs from social comparison is unique. Future work must rely on complementary survey and experimental methods to further explore which mechanisms are driving this effect.

We do not believe our results to be inconsistent with recent work by Beach et al. (1998) or Pinkus et al. (2008), who found evidence for positive benefits from upward comparisons in couples. In fact, the measures of affect in Pinkus et al. (2008) following upward and downward career comparisons, while not statistically significant, are consistent with our results. Individuals in their first study had lower affect following upward career comparison than after downward comparisons. Similarly, the second study in Beach et al. (1998) shows that a man's mood decreases when recalling a self-relevant task on which his wife outperformed him, even when that task was also relevant for his wife. Social norms of breadwinning make income a highly relevant dimension, which suggests consistency between the studies and our field evidence. We believe our study complements their work by showing that the specific impact of social comparison in relationships depends on the dimension of comparison. Couples may indeed benefit from upward comparisons on many dimensions due to empathy (Beach & Tesser, 1993) and shared outcomes or identity (Aron, Aron, Tudor, & Nelson, 1991), but when those upward comparisons conflict with prevailing social norms of gender roles, they are likely to produce negative psychological outcomes both for the individual with lower performance and for their partner who empathizes with them.

It is important to note that our regression discontinuity models necessarily identify this relationship at the point of income equality. But the data in Figure 6 and the estimates in Table 2

suggest that this effect may continue to worsen as the income gap grows, although we must be cautious in our interpretation of the purely psychological impact at other points due to selection and omitted variable bias. We must also exercise caution in this broader relationship due to the difficulty in interpreting difference scores, and the strong relationship between male income and ED medication observed in Figure 4. Finally, we note that the fuzziness of the treatment observed in Figure 9, as well as the small level of sorting suggested by Figure 10, make our identification less precise than many regression discontinuity models and require us to use wider bandwidths than are typically recommended (Imbens & Lemieux, 2008). While we believe the fuzziness and sorting problems bias against our findings, thus making the results more remarkable, we also caution the reader that causal inference is difficult in our setting.

It is also important to note that we expect this problem to be considerably larger in countries with stronger patriarchal norms. Denmark is one of the most progressive countries on women's issues, yet we still observe a significant role of traditional gender norms, consistent with recent work by Sorenson and Dahl (2012). We can only imagine how much more severe these problems may be in countries where social norms of male breadwinners are uniform and primary to the family social construct.[21]

We in no way suggest that the trend toward female breadwinners is socially harmful; greater equality and opportunity for women present undeniable economic and social benefits and are part of long historical trend toward greater female involvement in the labor force (Goldin, 2005). Nor do we argue that all men will respond to upward income comparisons negatively; many husbands are proud of and attracted to high-earning wives, which is likely why we don't see a larger or sharper impact in our data. Yet recent evidence suggests that gender role attitudes have changed little in the past twenty years (Cotter, Hermsen, & Vanneman, 2011). If social norms against female breadwinners continue to be strong, increasing female income will produce real costs in marriage, including the anxiety, insomnia, and erectile dysfunction identified here. These costs may be understated in our study, given that many women may never pursue high-

paying careers due to social pressure for them to either work in the home or serve as secondary earners. Finally, we emphasize that ED and sexual health more generally have many causes, and that our findings do not discount the importance of any of them.

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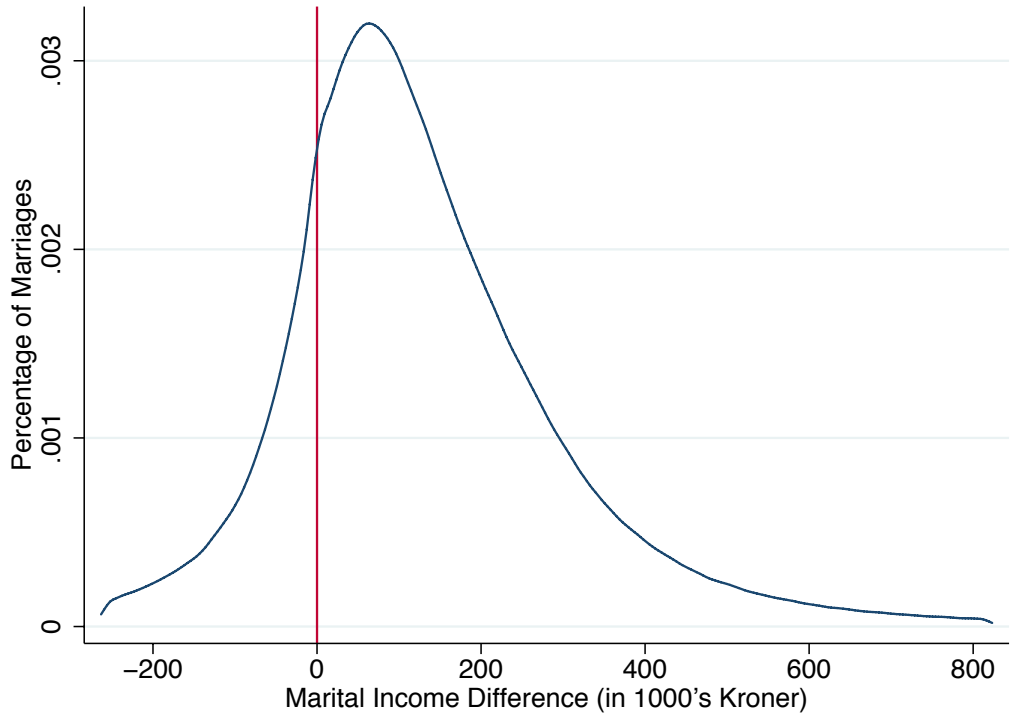

Figure 1: The distribution of wage income differences in Danish marriages
Note: Epanechnikov kernel density function. Includes all married couples between ages of 25 and 55, where both spouses are fully employed. Wage differences are husband minus wife wages.

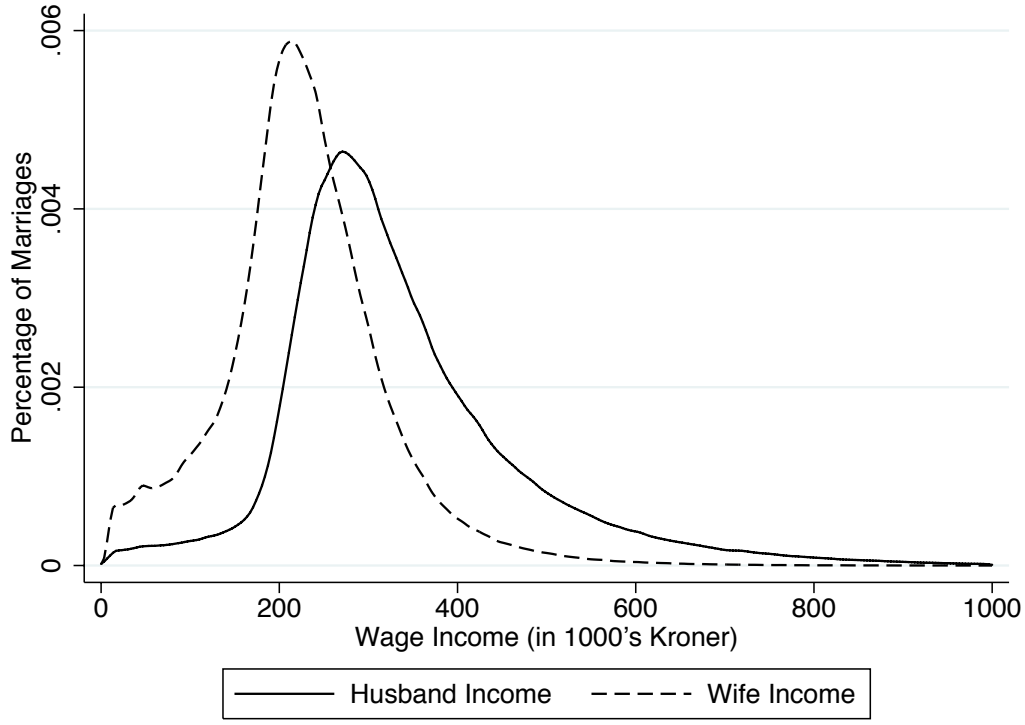

Figure 2: The distribution of Danish spousal wage income

Note: Epanechnikov kernel density function. Includes all married couples between ages of 25 and 55, where both spouses are fully employed.

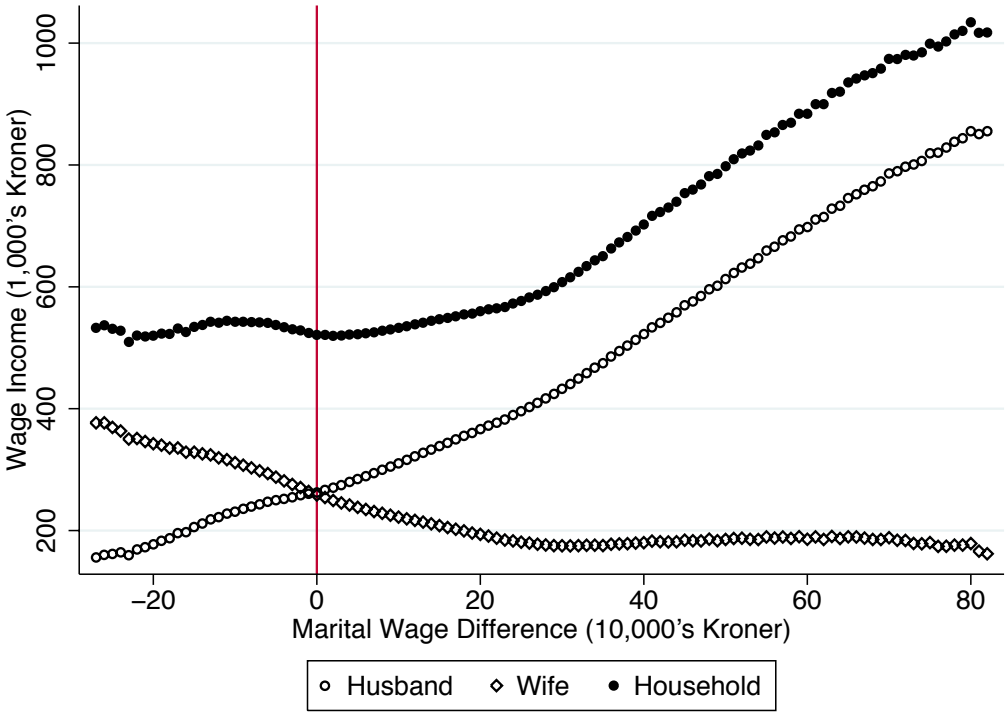

Figure 3: Continuous relationship between marital wage difference and spousal wages

Note: Each point represents all married couples between ages of 25 and 55, where both spouses are fully employed, within a range of 10,000 kroner.

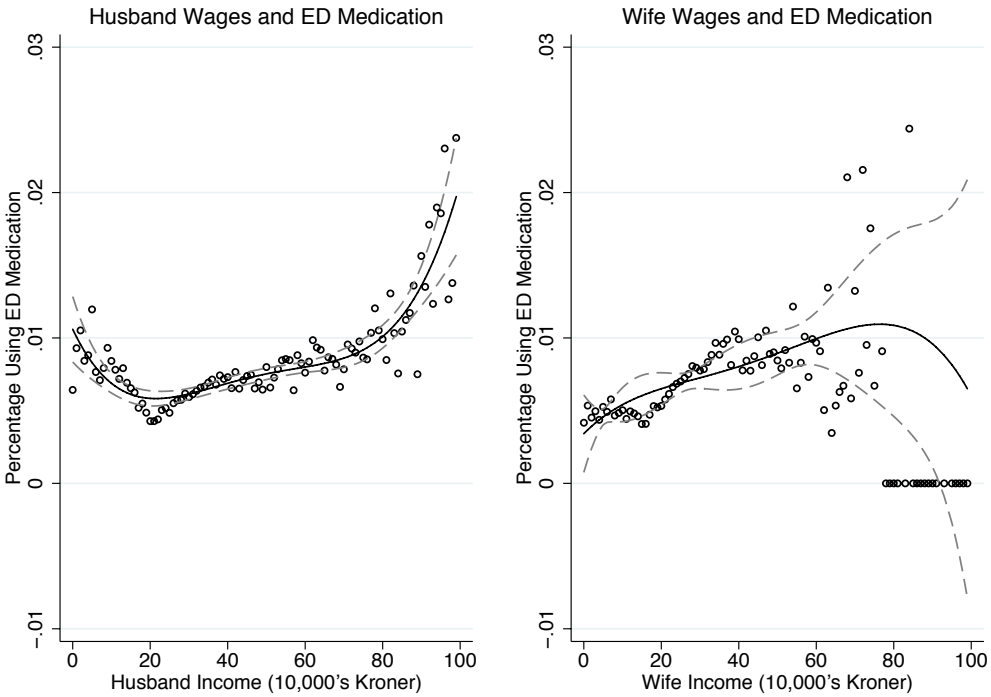

Figure 4: Relationship between spousal wages and ED medication usage

Note: Each point represents all married couples between ages of 25 and 55, where both spouses are fully employed, within a range of 10,000 kroner. Solid lines represent quartic regressions fitted to pooled bins, with dashed lines representing 95% confidence intervals. Not every point represents the same number of couples, with extreme values having high variance (and thus many zeros) due to extremely few couples. Graphs do not control for age, which is heavily correlated with both ED and income

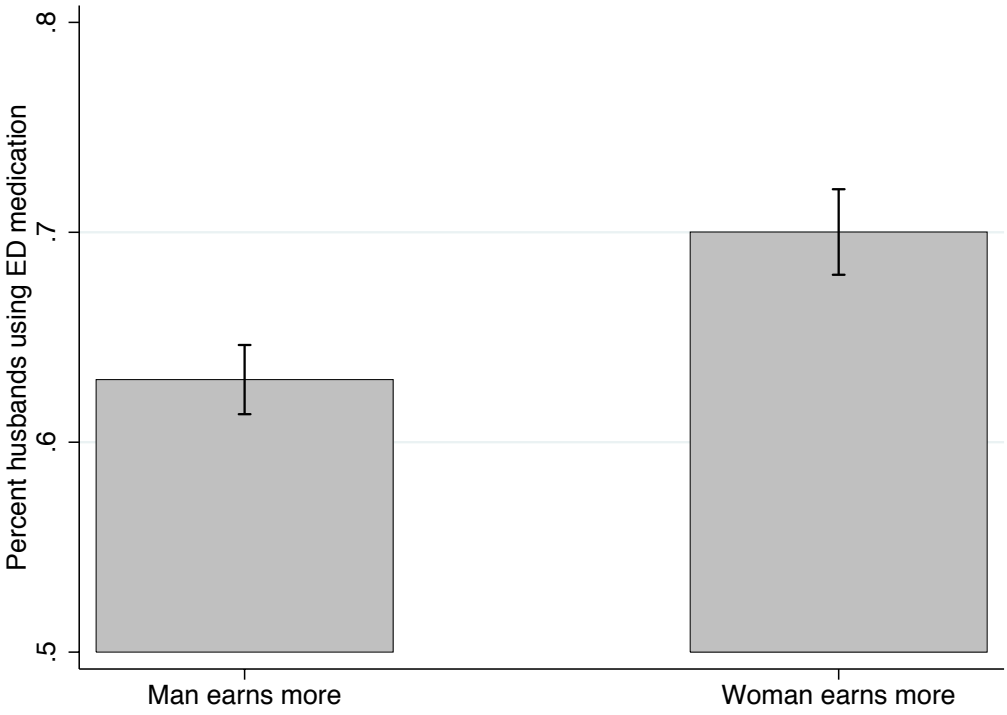

Figure 5: ED medication usage for heterosexual married couples with wage differences less than 30,000 kroner

Note: Includes all married couples between ages of 25 and 55, where both spouses are fully employed. Whiskers represent 95% confidence intervals.

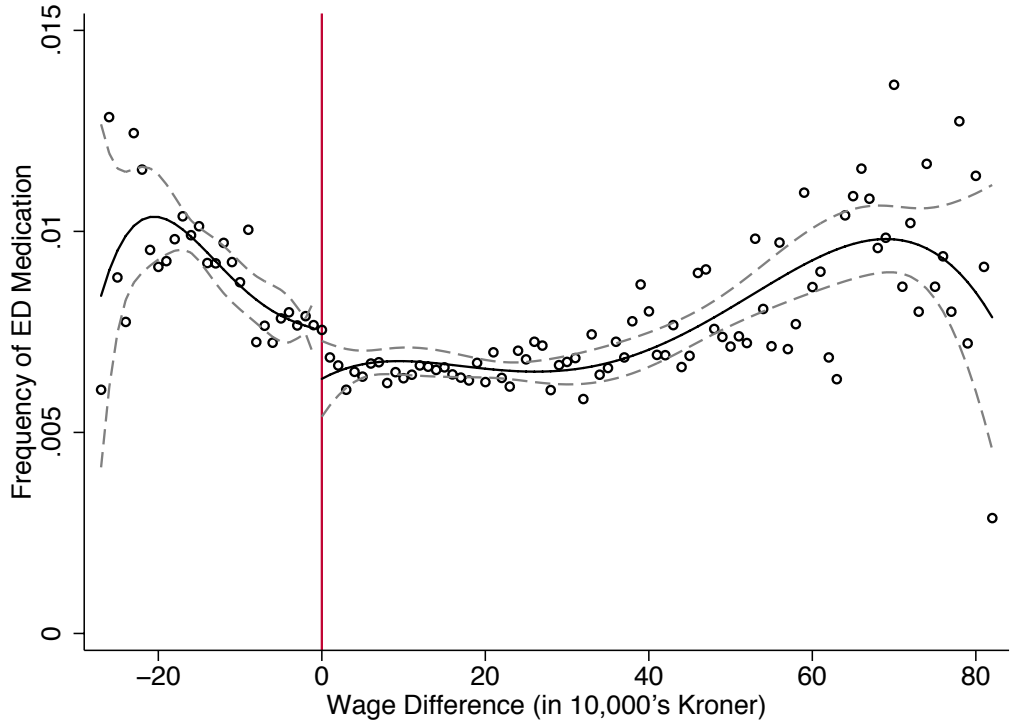

Figure 6: Regression discontinuity model of the relationship between marital wage difference and ED medication usage

Note: Each point represents all married couples between ages of 25 and 55, where both spouses are fully employed, within a range of 10,000 kroner. Wage difference is male minus female wages. Solid lines represent quartic spline regressions fitted to pooled bins, with dashed lines representing 95% confidence intervals. Not every point represents the same number of couples, with extreme values having high variance due to extremely few couples.

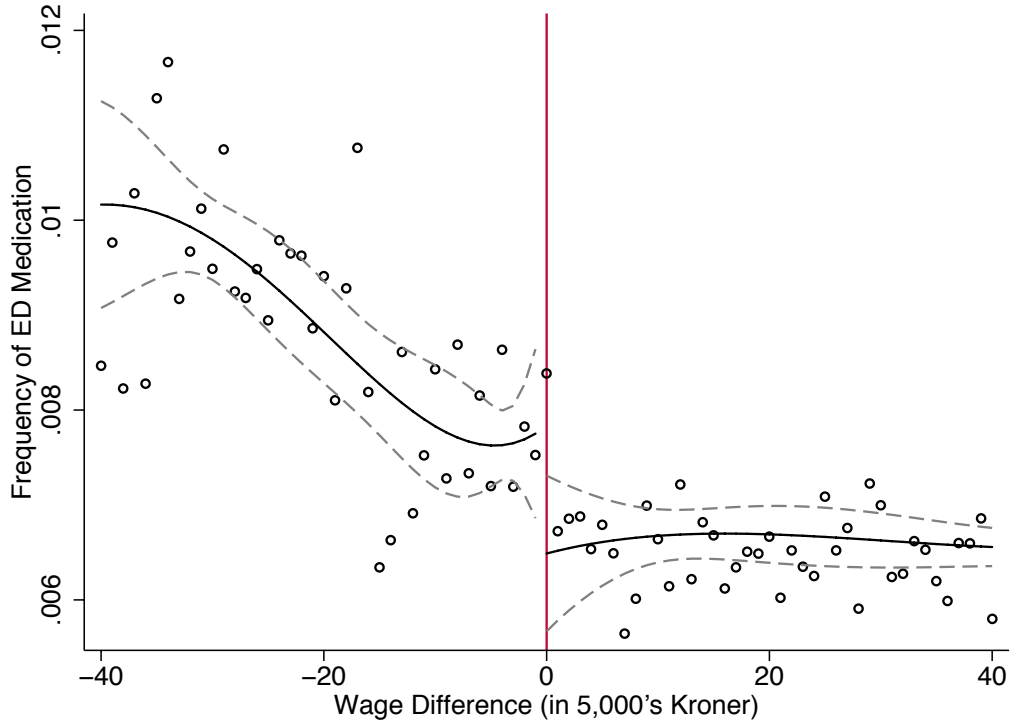

Figure 7: Regression discontinuity model with 5,000 kroner bins

Note: Each point represents all married couples between ages of 25 and 55, where both spouses are fully employed, within a range of 5,000 kroner. Wage difference is male minus female wages. Solid lines represent quartic spline regressions fitted to pooled bins, with dashed lines representing 95% confidence intervals. Not every point represents the same number of couples, with extreme values having high variance due to extremely few couples.

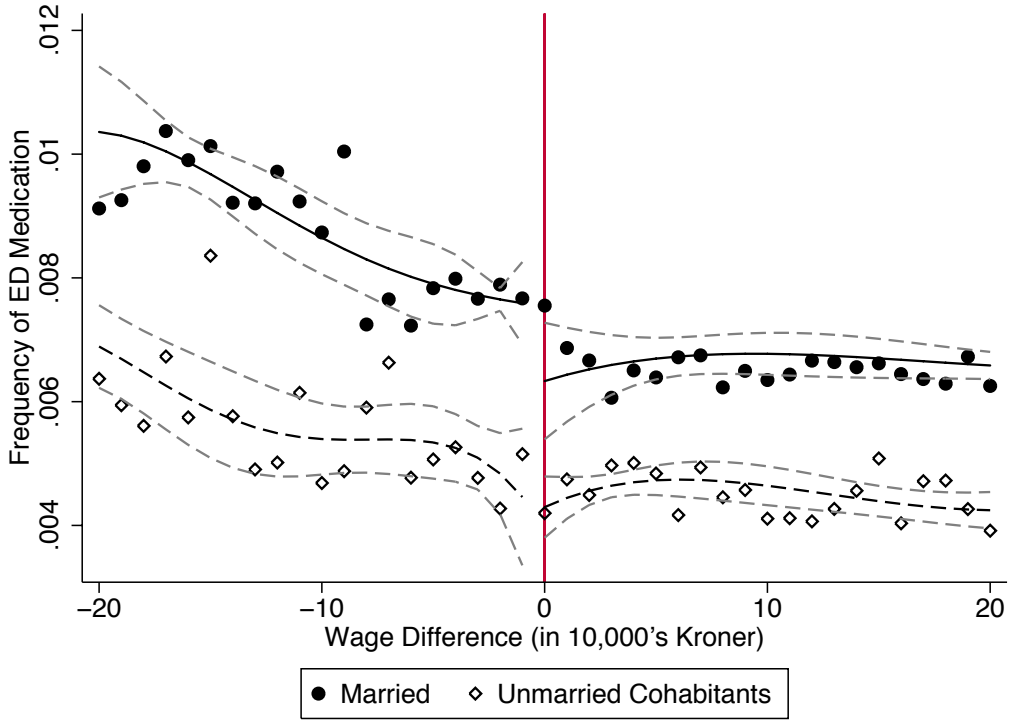

Figure 8: Regression discontinuity models of the relationship between ED medication and wage difference for married and unmarried cohabitants

Note: Each point represents all couples between ages of 25 and 55, where both partners are fully employed, within a range of 5,000 kroner. Wage difference is male minus female wages. Solid lines represent quartic spline regressions fitted to pooled bins, with dashed lines representing 95% confidence intervals. Not every point represents the same number of couples.

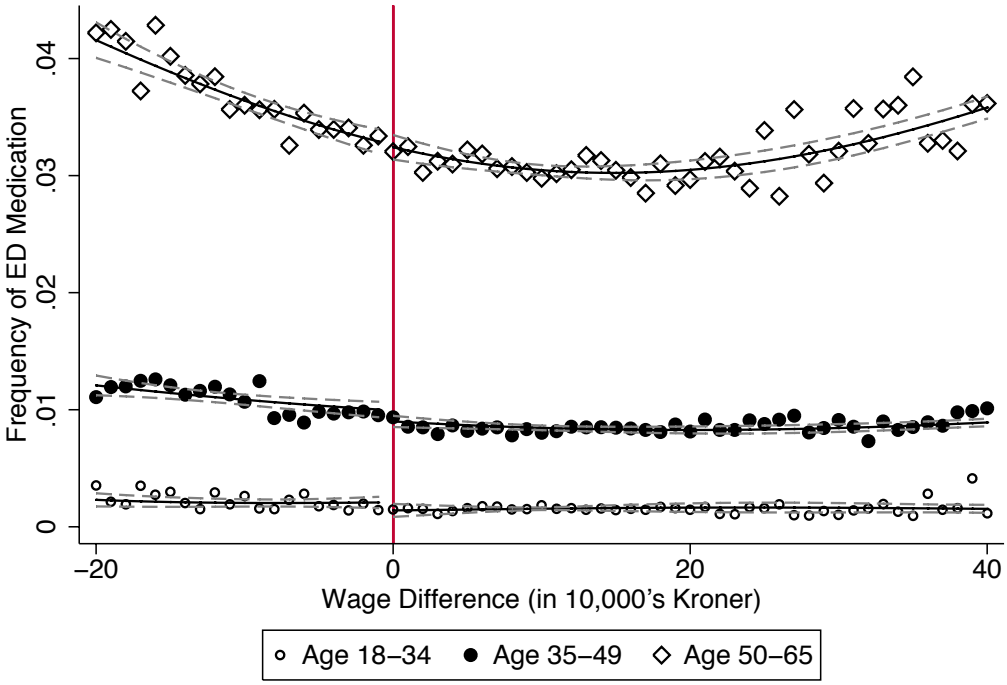

Figure 9: Estimated marginal change in ED medication at different regression discontinuity threshold choices

Note: A quartic regression discontinuity model was run for each wage difference threshold value between -50,000 and 50,000 kroner, in 1,000 kroner intervals. Wage difference is male minus female wages. The solid lines represent the discontinuity coefficient value. Dashed lines indicate 95% confidence intervals. Figure indicates the "fuzziness" of the discontinuity, which is largest at approximately 9,000 kroner.

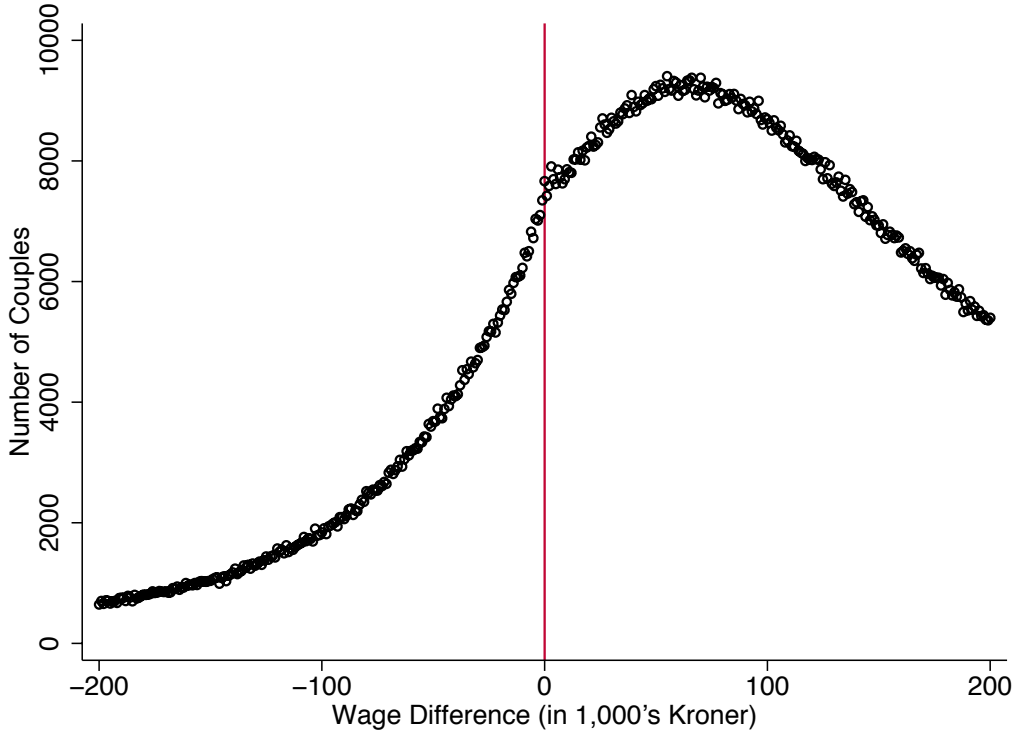

Figure 10: Distribution of wage differences for married couples

Note: Each point represents all married couples between ages of 25 and 55, where both spouses are fully employed, within a range of 1,000 kroner. Wage difference is male minus female wages. The distribution indicates that wage differences are generally continuously distributed, with a small cluster just to the right of the equality point.

Table 1: Descriptive statistics for married and unmarried cohabitant samples

	Married		Unmarried	
	Mean	S.D.	Mean	S.D.
Erectile dysfunction	0.007	0.083	0.005	0.069
Wage difference (WD) (1000s)	129.05	163.41	99.35	144.57
Female Breadwinner	0.184	0.388	0.227	0.419
Household Income	671,737	213,658	594,792	199,583
Man Income	337,854	136,227	347,071	136,135
Woman Income	229,032	93,448	247,721	108,784
Man Age	39.48	5.94	34.64	6.33
Woman Age	37.61	5.92	32.96	6.14
Man Education (Months)	158.1	28.6	156.7	27.5
Woman Education (Months)	156.2	27.3	157.1	26.1
Children (0-5 yrs)	0.545	0.427	0.459	0.661
Children (6-13 yrs)	0.771	0.844	0.354	0.653
Children (14-17 yrs)	0.272	0.515	0.098	0.331
Dad erectile dysfunction	0.024	0.153	0.027	0.162
Anti-depressants	0.019	0.136	0.008	0.091
Insomnia	0.029	0.168	0.022	0.148
Heart Condition	0.019	0.136	0.011	0.105
Diabetes	0.012	0.107	0.008	0.091
Observations	2,831,779		1,064,502	

Table 2: Linear models of the relationship between marital wage difference and ED medication

	Dependent Variable: Man Uses ED Medication			
	(1)	(2)	(3)	(4)
Sample:	Married Heterosexual	Married Heterosexual	Married Heterosexual	Non-Married Heterosexual
Explanatory Variables				
Man earns less	0.104***	0.071***	0.0648***	0.0242
	(0.000)	(0.005)	(0.009)	(0.405)
Wage difference	0.0001***	0.0003***	0.0004***	0.0004***
	(0.001)	(0.00006)	(0.000)	(0.000)
Wage difference X Man earns less	-0.0013***	-0.00016***	-0.0015***	-0.0012***
	(0.000)	(0.005)	(0.000)	(0.000)
Controls				
Year Dummies	Included	Included	Included	Included
Demographics	-	Included	Included	Included
Parent Health	-	Included	Included	Included
Physical Health	-	-	Included	Included
R^2	0.0016	0.0056	0.0115	0.0086
Observations	2,831,779	2,831,779	2,831,779	1,064,502

Note: All models use linear regressions. Robust standard errors are clustered at the level of the couple, with p-values in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01. All coefficients and standard errors are multiplied by 100 to represent percentages.

Table 3: Descriptive statistics for marriages within 30,000 kroner on each side of the income equality threshold

	Wife Earns More		Husband Earns More	
	Mean	S.D.	Mean	S.D.
Erectile dysfunction	0.0077	0.087	0.007	0.083
Man insomnia	0.033	0.179	0.03	0.171
Man depression	0.024	0.156	0.021	0.145
Woman insomnia	0.045	0.206	0.044	0.206
Woman depression	0.031	0.173	0.032	0.176
Wage difference (WD) (1000s)	-13.92	8.64	15.35	8.67
Man age	39.82	6.05	39.71	6.03
Woman age	38.03	5.9	37.87	5.93
Months of education (Man)	153.61	28.43	153.51	28.26
Months of education (Woman)	158.45	27.35	155.87	27.4
Children (0-5 yrs)	0.458	0.686	0.469	0.694
Children (6-13 yrs)	0.738	0.832	0.744	0.834
Children (14-17 yrs)	0.285	0.523	0.286	0.523
Household income	627,723	167,462	620,786	155,996
Observations	172,761		236,470	