Quality of Available Mates, Education and Intra-Household Bargaining Power

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Summary

This paper further explores the role of sex ratios on spouses' bargaining power, by focusing on educational attainment in order to capture the qualitative aspect of mate availability. Using Census and Current Population Survey data for U.S. metropolitan areas in year 2000, a quality sex ratio is constructed by education brackets to test the effect on the intra-household bargaining power of couples in the corresponding education bracket. We argue that a relative shortage of suitably educated women in the spouse's potential marriage market increases wives' bargaining power in the household while it lowers their husbands'. Additionally, we test the prediction that this bargaining power effect is greater as the assortative mating order by education increases. We consider a collective labor supply household model, in which each spouse's labor supply is negatively related to their level of bargaining power. We find that higher relative shortage of comparably educated women in the couple's metropolitan area reduces wives' labor supply and increases their husbands'. Also, the labor supply impact is stronger for couples in higher education groups. No such effects are found for unmarried individuals, which is consistent with bargaining theory.

Keywords: Education, Intra-Household Bargaining Power, Labor Supply

JEL Classification: D12, J12

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I. Introduction

This paper examines the effects that quality sex ratios by educational attainment have on spouses' labor supply and bargaining power. There is evidence in the literature that the availability of potential mates in local marriage markets, measured by the raw number of men relative to the number of women, affects the bargaining power and allocation of resources in already formed couples (e.g. Chiappori et al. 2002, Angrist 2002). In this study, we want to further explore the role of sex ratios on bargaining power by constructing a refined measure of the availability of men and women based on mate quality. We utilize educational attainment, a valuable trait in marriage by which individuals appear to assortatively match, as a qualitative indicator (Weiss and Willis 1997, Qian 1998). We consider local marriage markets by metropolitan area and construct a sex ratio by three education brackets (high-school graduates, some college and college-college plus), within which individuals usually sort. Within the framework of a collective labor supply household model, we test whether this quality sex ratio affects the intra-household bargaining power of couples in the corresponding education bracket through an income effect on both spouses (Chiappori et al. 2002). That is, when the sex ratio is favorable to the wife, (i.e. there is a relative scarcity of women in her education bracket) the distribution of gains from marriage is shifted in her favor. In particular, according to models of collective household behavior, if a higher number of qualified men in the wife's marriage group of reference increases female intra-household bargaining power, then one would expect a reduction in wives' labor supply, and an increase in husbands' labor supply. Additionally, we also test the theoretical prediction that the bargaining power effect of such a sex ratio is greater as the assortative mating order by education increases (Iyigun and Walsh 2005).

Do local sex ratios by education group represent an outside opportunity affecting spousal bargaining power? Do spouses' labor supplies depend on what happens in their neighborhood? Is it better to be the only educated woman in a world of men? Common sense would answer no, however matching theory and our results actually yield the opposite answer: one is better off when is in short supply!

We use Census data by metropolitan area for the year 2000 to build our sex ratios and data from the March Supplement of the Current Population Survey (CPS) for the year

2000 to test our labor supply prediction on married couples (using unmarried individuals as control group). Our identification strategy consists of estimating the effects of education sex ratios on husbands' and wives' labor supply for households that were married prior to the year 2000 and comparing changes in their labor supply behavior cross-sectionally across the US metropolitan areas.

Our empirical analysis reveals that married women significantly reduce their supply of market labor, while their husbands increase theirs as the corresponding education sex ratio becomes more favorable to women: a decrease of 78 and 166 annual hours for "some college" and "college-college plus" wives, respectively, and an increase of 53 and 129 in their husbands' (high-school graduates do not exhibit any significant impact). Consistent with the hypothesis of a stronger effect for higher education brackets, we also find that couples with "college-college plus" wives exhibit a significantly stronger impact of the quality sex ratio on their bargaining power than couples with "some college" wives, whose estimated quality sex ratio coefficient is in turn larger than that for high school graduates. Our bargaining power interpretation is strengthened by the fact that unmarried men and women do not exhibit any significant reaction to the quality sex ratio on their labor supply.

The findings presented here are consistent with theories where higher sex ratios increase female bargaining power in the marriage market. Additionally, this evidence represents the first empirical support of the bargaining power effect of a quality sex ratio by education, and its stronger impact on couples with higher levels of educational attainment.

A number of alternative explanations are also considered. The geographical variation in the relative number of men and women by education may capture differences in local labor market opportunities for women, in marital gains from specialization and in welfare programs. Also, our quality sex ratio includes married and same-sex partners, who do not represent available mates. We argue that those phenomena cannot consistently explain our results, given their patterns, our intra-household bargaining predictions and the empirical evidence.

The paper is organized as follows. Section II describes the theoretical framework. Section III describes the empirical specification and data. Section IV presents the

empirical results. Section V considers alternative explanations for the findings. Section VI concludes the paper.

II. Theoretical Background

There are two strands of economic literature that relate to our study. One strand focuses on the impact of distribution factors, such as the sex ratio on intra-household bargaining power, and tests their effects on spouses' labor supply behavior (Chiappori et al. 2002, Chiappori et al. 2005). While most empirical research on sex ratios examines the effects of marriage, those studies develop the collective household model and demonstrate theoretically that favorable outside marriage market opportunities increase a spouse's bargaining power through an income effect, measured as a reduction in labor supply (the opposite happening to the other spouse). Because married men and women have the option of seeking a divorce and re-marrying, more numerous potential mates in the spouse's marriage market of reference should enhance the bargaining power of those already married to the extent that it enhances their opportunities outside the marriage (Chiappori et al. 2002, Lundberg and Pollak 1996). Our paper specifically refers to this theoretical framework. Empirically, Chiappori et al. (2002) find that higher sex ratios reduce wives' labor supply and increase the husbands', using 1990 state Census and PSID data. In a study on immigrants to the United States, Angrist (2002) argues that his empirical results are consistent with theories where higher sex ratios increase female bargaining power in the marriage market. He finds that higher sex ratios are associated with lower female labor force participation; the effect is larger where marriage within the same ethnic group is more prevalent. Using data at both household and aggregate level, Grossbard-Shechtman (1993) and Grossbard-Shechtman and Neideffer (1997) show that a sex ratio increase reduces the labor force participation and hours worked of married women. Finally, a relevant theoretical result is provided by Iyigun and Walsh (2005), who incorporate assortative spousal matching into the collective household model and find that sex ratios have a stronger impact on intra-household allocations as the assortative rank of couples rises.

The second strand of literature that relates our paper concerns the spousal sorting by educational attainment and the gains to marriage from education. Spouses have

increasingly similar educational attainment than in the past, especially among highly educated people (Qian 1998). Mare and Schwartz (2005) report that today husbands and wives are roughly 4 times as likely to have a spouse who shares their educational background as they are to be married to someone who does not, educational homogamy being particularly strong for college graduates. Strong sorting based on educational attainment is also documented by Weiss and Willis (1997), with the additional finding that similarity in schooling increases marriage stability. Schooling also has cross-productivity effects on spouses; wives' education is found to increase the productivity and wages of their husbands and vice-versa (Tiefenthaler 1997, Benham 1974, Chiappori et al. 2005).

However, none of those studies explores how the distribution of educational attainment of men and women in the marriage market affects intra-household bargaining power, nor tests whether the impact is increasing with higher educational rank of couples. Analyzing those effects of *quality* sex ratios by education is the focus of our paper.

III. Empirical Specification and Data

Identification Strategy

Our main sample consists of married couples with both spouses between 22 and 60 years of age. According to the theory, if the scarcity of educated women in the local marriage market enhances women's bargaining power in the household, then the labor supply of wives should decline and the labor supply of their husbands should rise. Additionally, couples in higher education categories should experience a stronger impact on their labor supplies relative to other education categories. We also consider unmarried men and women in the same age bracket, focusing on singles as a "control" group. Singles' labor supplies should not be affected by changes in intra-household bargaining power[1]. We include intact couples only if both spouses are actually present. We exclude widowed and separated couples to keep a clear distinction between multiple and one decision maker households. For the same reason, we exclude singles that are not the head of their own household, even though their sample size significantly decreases.

[1] If they plan to marry in the future they may mildly experience a possible bargaining power effect in expected value.

The following equations for labor supply were estimated separately for wives and husbands:

$$h^f = h^f(\ln w^f, \ln w^m, y\ , X\ , EduRatio\ , EduRatio * dySC, EduRatio * dyCC) + \varepsilon^f$$
$$h^m = h^m(\ln w^f, \ln w^m, y\ , X\ , EduRatio\ , EduRatio * dySC, EduRatio * dyCC) + \varepsilon^m$$

We have also estimated a corresponding labor supply equation for unmarried women and men, using the same specification (without spousal variables):

$$h^u = h^u(\ln w^u, y\ , X^u, EduRatio\ , EduRatio * dySC, EduRatio * dyCC) + \varepsilon^u$$

EduRatio is our sex ratio, which is constructed by three education categories, two races and metropolitan areas. To each individual, we assign the corresponding ratio of the number of men over the number of women in his/her own race and educational category, living in his/her metropolitan area. For couples, our sex ratio, EduRatio corresponds to the number of men over women that are of the same race and education category as the wife of each household. As to race, we focus on black and white individuals and on couples where spouses are of the same race, assuming that the relevant marriage market is limited to one's own race[2]. The coefficient of EduRatio will be common to both races, since to each observation we assign the sex ratio of its own race, and we include both races in our main sample. We consider the following education categories: high-school graduates (HS), some college (SC) and college graduate- college plus (CC). HS includes people with high-school diploma, or equivalent; SC includes individuals with some college, but no degree or associate degree; and CC refers to bachelor's degree and above. We exclude high-school dropouts from our analysis because our sample should be homogeneous, and high-school dropouts are reported to have different traits, socioeconomic characteristics and marriage market prospects from graduates (Wolpin 1999, Rumberger 1983). Moreover, the hardest marriage market barrier to cross is between dropouts and high school graduates (Qian 1998). We compute our sex ratio including men and women aged 18 to 64. It is reported that measures of the sex ratio

[2] Our results are robust to the inclusion of Asians, with the white sex ratio as marriage market of reference for them.

based on broad age ranges are satisfactory and may be preferable to sex ratios computed for narrower age ranges (Fosset and Kiecolt 1991)[3].

The interactions of EduRatio with the dummy variables for the education brackets SC and CC (dySC and dyCC) capture the differential effect of our sex ratio for higher education categories. The education dummies refer to the education of the wife. Our identification strategy of the bargaining power effect consists of estimating the coefficient of EduRatio and capturing the differential effect by education category through the coefficients of the interaction terms. The impact of the education sex ratio on the labor supply of high-school graduates is captured by the coefficient of EduRatio (impact for the omitted category). The summation of this coefficient and the coefficient of the interaction term SC (CC) measures the impact of the education sex ratio on the labor supply of some-college (college-college plus) people. Therefore, checking the significance of the interaction terms tests for the additional impact on couples in the SC (CC) category.

The other regressors are the wage rate w^i (of spouse *i* or of unmarried individual *u),* household non-labor income y, and X. X includes age, experience, education of each spouse, a dummy variable for race, number of household members and number of (young) children in the family. X also includes state unemployment rate, state total labor force participation and female labor force participation (with children younger than six), to control for the level of economic activity in a state and especially for employment opportunities. We add two measures of the prevalence of same-sex unmarried households by metropolitan area, for homosexuals and for lesbians, in order to keep our education sex ratio as closely related to the heterosexual marriage markets as possible. The dependent variable in our labor supply regressions is annual hours worked, which is defined as total annual hours worked on the longest job held in 1999. Only households in which both spouses have positive hours of work are included in our samples. All female

[3] Research shows that people consider mates drawn from relatively broad age ranges. While mean age differences between husbands and wives are relatively small, there is considerable variation around this central tendency as many marriages involve larger age differences. Competition and substitution across age categories is considerable (Fosset and Kiecolt 1993). Sex ratios accounting for wives being younger than husbands are reported to have the same impact (Chiappori et al. 2002). We also computed the sex ratio for the age bracket 18 to 44 and got similar results.

labor supply regressions also exhibit the same results when run with Heckman MLE to correct for sample selection.

The labor supply estimation uses robust standard errors clustered by metropolitan area, which allow for correlation of household observations within metropolitan areas. Our specifications do not use a differences-in-differences estimator since husbands' and wives' regressions, as well as singles', are run separately from one another. As such, they should not suffer from the understated standard errors highlighted by Bertrand, Duflo, Mullainathan 2004. At any rate, clustering by metropolitan area should rectify such an underestimation, if at all present.

We assume sorting within education brackets. We computed the extent of sorting in our own sample, and found that the spouses' correlation across education brackets is about .53, and 58 % of our couples have spouses within the same bracket (high-school graduates, some college and college-college plus). Those figures are very similar to the literature acknowledging education assortative mating, so our assumption seems plausible. In fact, Weiss and Willis (1997) find that the correlation in educational attainments of spouses is on average .57 and report that this strong correlation is similar in magnitude to the correlations found in many other samples in the United States and other countries. We further checked for sorting by education brackets by empirically testing whether spouses in our main sample are at all affected by sex ratios of other education groups. A labor supply regression with one sex ratio for each education bracket and no interaction term yields a non-significant impact of those ratios for either spouse. We interpret this outcome as evidence of marital sorting within education brackets[4].

Data

Estimation is carried out on the March Supplement of the Current Population Survey (CPS) for the year 2000. The 2000 U.S. Census is used to construct our education sex ratio by education brackets, race, and age groups. Husbands and wives from single-family households were extracted from the CPS into separate files. Records in these files were then matched on the household ID code to create a single observation for each

[4] We also tried to include one sex ratio for each education bracket in our main specification and found the same pattern of results for our EduRatios of interest and three non-significant coefficients for the additional common ratios.

married couple. Data on labor force activity, income and any variable of interest at the household level are taken from the March Supplement, to which we merge data on education ratios from the Summary File 4 of the Census. Summary File 4 (SF4) contains information compiled from the questions asked to a sample of all people and housing units and is released as individual files for each of the 50 states, the District of Columbia, Puerto Rico, and for the United States overall. We use the cross-tabulations by sex, age, race and educational attainment to construct separate education ratios for the black and white population, aged 18 to 64 by metropolitan area[5]. There are 276 U.S. metropolitan areas excluding Puerto Rico. Merging those to the CPS data and excluding the metropolitan ratios' outliers (top and bottom 2 %) leave us with 173 metropolitan areas. The state unemployment rate, state total labor force participation and female labor force participation are retrieved from the Bureau of Labor Statistics. The two measures of the prevalence of same-sex unmarried households come from table PCT21 of SF4 and are at the metropolitan level. The Census records a household as a same-sex union if the relationship to the householder is specified as "unmarried partner". We construct two ratios, the number of homosexual unions out of the total number of households and the number of lesbian unions out of the total number of households. In our sample, the covariate education is derived from the education categories that the CPS provides[6]. Finally, CPS weights are used to make the sample representative of the US population and economy.

Table 1 presents the descriptive statistics for the main variables by demographic. In our sample, men on average work more annual hours than women and earn a higher hourly wage, while they have very similar levels of education. On average, husbands are two years older than wives. As to our education sex ratio by metropolitan area, there are more white women graduating from high school, or having some college education, than

[5] The age brackets in SF4 (PCT65) are 18-24; 25-34; 35-44 and 45-64 and the education categories are: less than 9th grade; 9th- 12th grade-no diploma; high school graduate-high school diploma, or the equivalent; some college but no degree; Associate degree; Bachelor's degree; Master's degree; Graduate or professional degree.

[6] Those are: less than 1st grade; 1st-4th grade; 5th or 6th grade; 7th or 8th grade; 10th grade; 11th grade; 12th grade-no diploma; high school graduate-high school diploma, or the equivalent; some college but no degree; associate degree in college-occupational/vocational program; associate degree in college-academic program; bachelor's degree; master's degree; professional school degree and doctorate degree.

white men. On the other hand, there are more white men than women holding a college degree or above. The pattern is somewhat different for the black population: fewer black women hold a high school diploma relative to black men but they are more numerous in the "some college" and "college-college plus" categories.

IV. Results

IV.1 Main evidence

The main results are shown in **Table 2**. The estimated effects of our quality sex ratio are positive for husbands and negative for wives, as predicted by the theory. Additionally, couples with CC wives exhibit a stronger response to the quality sex ratio on their bargaining power than couples with "some college" wives. In turn, SC wives estimated quality sex ratio coefficient is larger than for high school graduates wives. The point estimates in our sample indicate that a 10 percentage point increase in the education sex ratio reduces SC wives' annual labor supply by about 7.8 hours (p-value = .01), while their husbands' is increased by 5.4 hours per year (p-value = .006). As to couples with CC wives, their coefficients for the education sex ratio show a decline in wives' labor supply by 16.6 hours (p-value = .009), and an increase in their husbands' by 13.0 hours per year (p-value = .005). The evidence clearly shows that for both husbands and wives the estimates for the "college-college plus" are greater than for "some college", the coefficients being statistically different from each other for each spouse. This suggests that changes in the sex ratio of one's education group have a stronger effect on bargaining power if one is highly educated.

The signal conveyed by the education sex ratio about the quality of outside marriage market opportunities is more powerfully received by highly educated wives and husbands because education is positively related to other important mate attributes such as wealth, income and success in life. The availability of valuable mates in the marriage market represents a more credible threat for spouses that are per se high-quality mates than the sex ratio for lower education brackets. This is in line with the prediction by Iyigun, Walsh (2005), in which imbalances in the sex ratios become more relevant for intra-household allocations as the rank of couples in the assortative order rises, measured here by educational attainment. Moreover, our results also match evidence in the

literature of stronger educational homogamy for highly educated men and women (Qian 1998). For instance, today college graduates have become increasingly likely to marry one another rather than marry non-college graduates. The probability of having a spouse with the same educational background is 4 times higher than the possibility of marrying to someone who does not (Mare, Schwartz 2005). Finally, high-school graduates do not show any significant response to changing ratios[7].

As to the size of our sex ratio effects, those changes correspond to a 4.4 (9.3) percent reduction of the average annual hours worked by "some college" ("college-college plus") married women[8] and to a 2.3 (5.7) percent increase for their corresponding husbands'. These effects are sizable, given the acknowledged rigidities in the husbands' labor supply and the frequency of the reported labor supply peaking around 40 hours of work per week. In particular, the impact on husbands is remarkable since traditional family analyses do not emphasize husbands' response to the sex ratio, even less so, their labor supply increasing with it.

We also estimated the impact of our quality sex ratio on a sub-sample of couples that did actually sort in marriage by education bracket, i.e. on couples where wives' education belongs to the same education bracket as their husbands'. We found a similar pattern of results as in our main specification.

The bargaining power effect is also estimated on unmarried individuals, separately for men and women. Their labor supply regressions show no significant impact of the education sex ratio, as theory would predict. Both men and women exhibit economically negligible and statistically insignificant coefficients of the sex ratio by education brackets and of its interactions (**Table 2**). No additional impact is found for "some college" and "college-college plus". At any rate, all their coefficients are different from the couples' sample, which emphasizes the bargaining power effect on husbands and wives. Only the coefficient concerning the impact on high-school graduates has a

[7] Couples where the wife is a high-school graduate do not seem to be affected by the relative number of men and women that are high-school graduates in their metropolitan area. The absence of such a bargaining power effect may be due to the lack of sorting behavior by this demographic group; it may also be due to strong rigidities in the labor supply schedules of such low-educated couples. See subsection IV for a more detailed discussion.

[8] This decline in wives' labor supply does not appear to be driven by women less attached to the labor force being in the labor market and working fewer hours. Female participation in the labor market does not exhibit any positive significant impact of the bargaining power effect of the quality sex ratio.

large magnitude, especially for single men. However, the coefficients are never significant and the singles' very small sample size may explain the imprecise estimate[9].

The empirical results are consistent with theories where higher sex ratios increase female bargaining power in the marriage market. Furthermore, this evidence represents the first empirical support of the bargaining power effect of a quality sex ratio by education and of its stronger impact especially as higher levels of educational attainment are considered. Further evidence presented below, together with the discussion of various alternative explanations, should help making this claim convincing.

IV.2 Race

Running our main labor supply specification on the sub-sample of white couples yields the same results as the full sample regressions (**Table 4**). The education sex ratio[10] has a negative effect on wives' labor supply and positive effects on husbands', with a significantly stronger impact for the "college-college plus" than for "some college". The coefficient of high-school graduates is not significant. Specifically, "some college" wives experience a reduction in their annual hours of 76.6 (p-value = 0.03) while their spouses increase theirs by 42.2 (p-value = 0.05). Moreover, wives in the highest education category reduce their annual hours worked by 171.7 hours (p-value = 0.01), and their spouses experience an increase of 136.3 annual hours (p-value = 0.01). The very small black population in the CPS didn't allow us to run the same regressions for only black couples. Nevertheless, in our full sample, we ran a similar regression to check whether the bargaining power effect of our within-race quality sex ratio varies across races. Each of the three variables concerning the sex ratio by education is interacted with a dummy variable for race, in order to capture a possible differential effect. No evidence of a different impact across races was detected; however, the several sex ratio coefficients in that regression became highly collinear.

IV.3 Impact for older and younger couples

[9] The estimated negative coefficient for single women and positive for single men may be due to some of them planning to marry in the future and thus mildly experiencing a possible bargaining power effect in expected value (although not different across education brackets).
[10] For the white sub-sample, EduRatio is computed using data only for white men and women.

The bargaining power effect of our sex ratio by education is also estimated on sub-samples of older couples and younger couples, using the same specification as above. We actually find an interesting pattern (**Table 3**). Couples in their late thirties and above exhibit a stronger impact of the sex ratio for "some college" than in the entire sample, and an even higher response for the "college-college plus" category, especially for wives. The associated decline in wives' labor supply is 82 annual hours for SC and 259 annual hours for CC. The role of high-school graduates sex ratio is still negligible. On the contrary, for couples in their twenties and early thirties the bargaining power effect is significant for high-school graduates while not being different across education brackets, and it is greater than all the coefficients for the entire sample and for the "old" sub-sample (the decline in wives' labor supply is 750). We believe that those results reflect different informational values about the quality of potential mates that educational attainment conveys at different stages of life. When young, education is not yet a good predictor of quality such as wealth and success in life because one hasn't had time to extract the benefits from education yet. The sex ratio in one's education group matters, also for high-school graduates, but there is no stronger impact for high brackets because more education cannot convey much more prosperity information. Also, high-school graduates do show a sorting behavior, probably because at such young an age, high-school graduates are actually more likely to marry individuals in their education category, if not because they know and interact with more such people. Instead, at older ages education becomes a better proxy for economic prosperity because there was time to establish social status and wealth. Especially if one has a high educational attainment, the signal given by the education sex ratio is very quality-informative, so that the effect of such outside marriage market opportunities on bargaining power is very strong. Education matters more in marriage choices when prosperity is directly at stake: this is the case for "older" couples looking at their marriage prospects, since the benefits from education are already present. Evidence from the literature actually suggests that later age at union promotes stronger educational homogamy. In particular, men and women aged 30 or above are less likely to be with partners with a different level of educational attainment than are persons in their twenties (Qian 1998).

IV.4 High-school graduates

Bargaining power in households where the wife is a high-school graduate does not seem to be affected by the relative number of men and women that are high-school graduates in their metropolitan area. Possibly, those individuals do not exhibit assortative sorting behavior by education because the bracket is too narrow and they may also look for mates "above", in the "some college" pool. To test this hypothesis, we thus constructed a modified quality sex ratio, in which couples with a high-school graduate wife are associated with the sex ratio of high-school graduates plus "some college" men and women. We kept the assumptions about the assortative mating of the other two groups of individuals "some college" and "college-college plus". There is no evidence to support the hypothesis. The bargaining power effect for them is not significant for husband or wife, while for "some college" and "college-college plus" couples it remains significant, and with an increasing impact along educational brackets. High-school graduates do not appear to "think" assortatively in terms of outside marriage market opportunities or match with "some college" individuals. We suggest that this lack of an education sex ratio effect on current high-school graduates could be due to the fact that high-school graduates do not have good marital prospects in terms of their educational attainment, so they just do not sort and are not affected by the specific quality dimension "education". This is in line with the empirical evidence from the literature that mainly highly educated men and women are likely to marry each other (Qian 1998). Additionally, it is compatible with the theoretical prediction (Iyigun Walsh 2005) of an increasing bargaining power effect of the sex ratios as the assortative order rises, which is empirically supported by our main results: for low ranks such as high-school-graduates, the impact can be negligible.

V. Alternative explanations

Sex ratios as proxy of local labor market opportunities

It may be possible that the labor supply of married women falls not as a result of the bargaining power effect of mate availability by education brackets, but due to poor local economic opportunities for women. High values of our quality sex ratio by metropolitan area may suggest male workers outnumbering female workers and a local

labor market with gloomy perspectives in female opportunities. Similarly, it could be that more educated women, whose labor supply is high, live in metropolitan areas where there are better job opportunities for them, so that the negative coefficient of our education ratio represents labor market fluctuations instead of bargaining power. There are at least three reasons to believe that local economy does not provide a plausible alternative explanation for our findings. First, our labor supply regressions include individuals' wages and experience, state unemployment rate, total labor force participation rate and female labor force participation rate, which help account for the effects of variation in labor market opportunities, specifically for women. Second, it is difficult to understand why the labor supply of men married to those women, but not other men, should be higher in those metropolitan areas if it were just a labor market fluctuation. Third, single women with similar demographic and labor market characteristics did not experience the same impact of the sex ratios as married women.

Sex ratio including married and same-sex partners

It may seem that our education sex ratio does not capture the actual availability of mates in a local marriage market because both married individuals and same-sex partners, are included in the computation of our variable. Its lack of significance in our unmarried samples may be attributed to large percentages of unmarried men or women having same-sex partners. We believe that our ratio of the total number of men and women present in a metropolitan area does represent a reliable sex-ratio for three main reasons. First, there is considerable evidence in the literature that relatively little benefit is realized from refinements such as computing sex ratios separately by marital status (Fosset and Kiecolt 1991; Freiden 1974). Second, we control for the prevalence of same-sex unmarried households using Census data and constructing two ratios: the number of homosexual relationships out of the total number of households and the number of lesbian relationships out of the total number of households. With those measures at the metropolitan area, we make sure that our education sex ratio is an index of the tightness of the heterosexual marriage markets. Finally, to the extent that the sizes of the male and female homosexual populations vary together, their impact on the validity of the sex ratio would be reduced (Fosset and Kiecolt 1991).

Marital gains from specialization

It is well known that if the education of the husband is higher than the wife's, there are gains from the wife specializing in household production and thus working less in the labor market (Becker 1981, Chiappori et al. 2006). Our quality sex ratio may capture the presence of those gains, showing that when the education gap of married couples increases (i.e. the number of highly educated men increases, married women's labor supply decreases and their husbands' increases). However, this link cannot represent an alternative explanation to our bargaining power interpretation for three reasons. First, our sample consists of already married couples, and the sex ratio counts all men and women regardless of their marital status, while the specialization effect should be present only for couples formed after any sex ratio change. When we restrict our sample to "older" couples, likely to have married many years prior to 2000, our bargaining power interpretation still holds. Second, we consider positive assortative mating within education brackets, so that men and women are affected by fluctuations in the sex ratio only in their own education group. In this case, the education gap of potential spouses, and the corresponding gains from specialization would be very small. Third, when we restrict our sample to couples that did indeed perfectly sort by those education brackets, (i.e. no peculiar gain from specialization should be present for them) our results still hold.

Welfare programs for women

Welfare programs favorable to women may discourage female labor supply or increase the bargaining power of married women by enhancing the value of single motherhood. However, by definition, welfare programs benefit only low-income households, while our results hold for all levels of income. In particular, when low-income households are removed from our samples, there is still a significant decrease in married women's labor supply and increase in their husbands', with differential impacts across education brackets, also in the white sub-sample. Additionally, there is no reason why the pattern of the main welfare benefits such as AFDC, EITC and mandated benefits should vary across metropolitan areas to be more favorable to women in areas where women are relatively scarce. Regardless, the controls for income, wages, and number of

children should capture welfare mechanisms and effects of welfare eligibility in our main regressions.

VI. Conclusions

This paper further explores the role of sex ratios on bargaining power, by constructing a quality sex ratio by education brackets and testing whether it affects the intra-household bargaining power of couples in the corresponding education brackets, within the framework of a collective labor supply household model. Additionally, we also test the prediction that the bargaining power effect of our sex ratio is greater as the assortative mating order by education increases. Using CPS and Census data for year 2000, we find that married women significantly reduce their supply of market labor, while their husbands increase theirs as the corresponding education sex ratio becomes more favorable to women. Consistent with the hypothesis of a stronger effect for higher education brackets, couples with “college-college plus” wives exhibit a stronger impact of the quality sex ratio on their bargaining power than couples with “some college” wives, whose estimated quality sex ratio coefficient is in turn larger than for high-school graduates. Our bargaining power interpretation is strengthened by the fact that unmarried men and women do not exhibit any significant impact of the sex ratio on their labor supply. Alternative explanations such as local labor market opportunities, marital gains from specialization, welfare programs, and inclusion of married and same-sex partners in the sex ratio, are rejected.

The findings presented here are consistent with theories where higher sex ratios increase female bargaining power in the marriage market. Additionally, this evidence represents the first empirical support of the bargaining power effect of a quality sex ratio by education and of its stronger impact as higher levels of educational attainment are considered.

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Table 1. Summary Statistics

	White		Black	
Variable	mean	std. dev	mean	std. dev
Education Ratio High School Graduates	0.98	0.06	1.22	0.63
Education Ratio Some College	0.89	0.04	0.94	0.43
Education Ratio College and above	1.02	0.06	0.95	0.48
Number of observations	173		173	

	Couples	
Variable	mean	std. dev
Hours worked by wife*	1775.59	679.24
Hours worked by husband*	2287.7	510
Log of wage of wife*	2.55	0.66
Log of wage of husband*	2.93	0.56
Age of husband	40.9	8.13
Age of wife	38.9	7.97
Education of husband	14.3	2.28
Education of wife	14.2	2.15
Household non-labor income	5396.18	13685.73
Number of children below age 6	0.34	0.63
Number of family members	3.39	1.15
Dummy for black	0.1	0.3
Number of observations	6198	

	Single Women		Single Men	
Variable	mean	std. dev	mean	std. dev
Hours worked*	1792.02	630.98	2122.07	556.56
Log of wage*	2.24	0.66	2.63	0.53
Age	33.35	8.01	37.1	8.27
Education	13.29	1.69	13.71	2.11
Household non-labor income	3016.43	5789.97	4326.6	9537.48
Number of children below age 6	0.47	0.69	0.1	0.39
Number of family members	2.73	1.01	2.38	0.84
Dummy for black	0.59	0.49	0.32	0.46
Number of observations	540		129	

The sample contains data from the March supplement year 2000 and U.S. Census 2000.
*For women and men with positive hours of work.

Table 2. Effect of Education Ratio on Annual Hours Worked, Couples and Singles

Estimated Coefficient / robust standard errors / sample size (significant estimates in bold)

	Wives	Husbands
Edu Ratio	-65.32	-86.68
	(-89.87)	(-96.13)
Edu Ratio*dy SC	**-78.29**	**53.56**
	(-30.01)	**(19.33)**
Edu Ratio*dy CC	**-166.21**	**129.80**
	(-62.87)	**(46.05)**
Number of observations	6198	6198
	Single Women	Single Men
Edu Ratio	186.71	784.78
	(271.31)	(707.54)
Edu Ratio*dy SC	-29.56	-109.27
	(99.45)	(246.57)
Edu Ratio*dy CC	37.36	-431.90
	(242.40)	(316.20)
Number of observations	540	129

The sample contains data from the March supplement year 2000
All tables report regressions run on the same set of covariates described in Section III
Single individuals are defined as those with marital status "never married".

Table 3. Effect of Education Ratio on Annual Hours Worked, White Couples

Estimated Coefficient / robust standard errors / sample size (significant estimates in bold)

	Wives	Husbands
Edu Ratio	78.42	-179.71
	(178.04)	(152.75)
Edu Ratio*dy SC	**-76.58**	**42.17**
	(35.19)	**(21.79)**
Edu Ratio*dy CC	**-171.71**	**136.29**
	(69.31)	**(52.51)**
Number of observations	5762	5762

The sample contains data from the March supplement year 2000
All tables report regressions run on the same set of covariates described in Section III.

Table 4. Effect of Education Ratio on Annual Hours Worked by Wives, by Age Group

Estimated Coefficient / robust standard errors / sample size (significant estimates in bold)

	Young couples	Old Couples
Edu Ratio	**-750.33**	26.96
	(363.82)	(83.65)
Edu Ratio*dy SC	-113.90	**-82.13**
	(75.14)	**(34.09)**
Edu Ratio*dy CC	30.33	**-259.54**
	(144.90)	**(88.67)**
Number of observations	1204	4074

The sample contains data from the March supplement year 2000
All tables report regressions run on the same set of covariates described in Section III.
Young couples are those with wives aged 22 to 31 and husbands aged 25 to 35; old couples wives are aged 32 to 55 and husbands 37 to 57.

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