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A MODEL OF LABOR SUPPLY, HOUSEHOLD PRODUCTION, AND MARRIAGE[1]

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ABSTRACT

This chapter presents a graphical model that shows how marriage market conditions can possibly affect reservation wages and therefore labor supply. This model assumes that marriage market conditions influence equilibrium compensations for household production work in marriage, the work that individuals are willing to supply to a marriage. This chapter also presents a retrospective on market analyses of household production in marriage. In particular, previous studies are reported that have found evidence for two kinds of effects of marriage market conditions on labor supply: effects taking the form of compensating differentials in marriage and sex ratio effects. This evidence possibly indicates that marriage markets affect women's labor supply via effects on market conditions in markets for women's work in marital household production.

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I. Introduction

The NHE is more than forty years old. Since its beginnings in 1962, the study of labor supply has been among its major applications. It is then that Jacob Mincer started the NHE tradition by publishing a model of married women's labor force participation (LFP) that expanded the choice between leisure and goods to include two ways by which goods are produced: commercially by firms, or in household production. A major implication of Mincer's analysis was that the effects of earnings on married women's LFP depend on whether it is the husband's earnings or the wife's earnings that are changing.

This chapter hypothesizes that the effect of husband's earnings on wife's labor supply is conditioned by marriage markets factors. This calls for attention to compensating differentials in marriage and to sex ratio effects as determinants of LFP. A major goal of this chapter is to present an original two-dimensional graphical representation of marriage market effects. Another major goal of the chapter is to review existing analyses based on market models of household production work based on Grossbard (1976).

As modeled by Lionel Robbins (1930), the decision to work weights the benefits from work with the direct and opportunity costs of work. Benefits depend on the wage paid for work, on the opportunities to translate earnings into consumption, and on the utility of goods. As pointed out by Mincer (1962), it is essential for models of married women's labor force participation to recognize that household produced goods may be substituted for commercially produced goods.

The importance of household production in models of women's labor supply derives from a frequently observed fact: women supply most household production labor. Even though this is not the case today as much as it was in 1960, when Mincer first presented his theory at a National Bureau of Economic Research conference, it is still true that most household labor in marriage is performed by women (see for instance, Duncan Ironmonger and Faye Soupourmas 2003 for Australia, Gaelle Le Guirriec 2003 for France and Joni Hersch 2003 for the U.S.). It also continues to be the case that many more women are either out of the labor force or seeking part-time employment, presumably in order to spend more time in household production.[1] Therefore, it continues to be more essential for models of women's labor supply to incorporate household production than it is for models of men's labor supply.

Mincer (1962) applied his innovative ideas on household production to derive predictions regarding the ways that male and female wages affect married women's labor supply. Consistent with his predictions, he found that male and female wages had opposite effects on married women's labor supply, a finding that has often been replicated (see Mark Killingsworth and James Heckman 1986). Mincer (1962, 1963) also led to NHE studies on the relation between female labor supply and fertility.

As a result of the success of the NHE, integration of household production into models of women's labor supply became a standard feature in the economic analyses of labor supply. Mincer's NHE ideas are usually incorporated in a leisure/goods trade-off graph based on Robbins (1930). The standard way of integrating household production is to add spouse's income as a non-wage income factor that expands an individual's budget constraint vertically, and/or to modify that budget constraint to take account of household-production-related costs of going to work (such as childcare). Standard analyses of women's labor supply typically also include household production functions

introduced by Becker (1965) and Kelvin Lancaster (1966), at a time when the NHE was prominent at Columbia University (see Grossbard-Shechtman 2001a). These NHE ideas on labor supply are standard fare, as evident from some recent labor economics textbooks (e.g. Francine Blau, Marianne Ferber, and Anne Winkler 1998, Bruce Kaufman and Julie Hotchkiss 1999).[2]

These standard models of labor supply and household production make a number of implicit assumptions about marriage and decision-making in marriage.

- *Income*. When they consider husband's income as a form of non-wage income from the wife's point of view most models implicitly assume that married women have access to all of their husband's income and can use that income in order to consume either goods or leisure time. This is reflected in the inclusion of husband's income in estimations of wife's labor supply without consideration for the amount of access that the wife has to that income.
- *Production*. Most graphs modeling married women's labor supply do not include household production functions. Also, most NHE models of labor supply assume that specialization and trade between husband and wife is beneficial. This implies that in the system of intra-household allocation the terms of trade will be such that (1) the spouse who specializes in household production (the spouse/producer) gets enough income from the spouse/consumer to make this a beneficial transaction for her, and (2) the other spouse who transfers income to the stay-home spouse is getting a satisfactory amount of household-produced goods in return for that transfer. Most analysts of the labor supply decision do not explicitly model the incentives that individuals may need in order to be motivated to perform household production. Nor do studies of married women's labor force participation typically include discussions of men's incentives to earn an income in order to make it available to a stay-home wife.
- *Consumption*. Another implicit assumption made by Mincer (1962) and most other NHE models is that all marital household production is jointly consumed in a marriage (i.e. they are public goods from the household's perspective). The possibility that people produce their own individually consumed household production is rarely discussed, nor is the possibility that they produce goods consumed only by their spouse. This tradition has continued despite the many economic models recognizing that not all goods consumed in marriage benefit husbands and wives equally. That husbands and wives may differ in their access to what a marriage produces is evident in Becker's (1973) theory of marriage, Amyra Grossbard (1976), Francois Bourguignon (1984), Frances Woolley (1988, 2003), Shelly Lundberg and Robert Pollak (1993), Pierre-Andre Chiappori (1988, 1992), and Grossbard-Shechtman (2003). It follows from these models that if husbands and wives differ in their preferences, who controls the household income becomes an important determinant of intra-household allocation of resources. This could affect both consumption and labor supply.

In contrast, the following model follows Grossbard (1976) in assuming that how much of the husband's income is accessible is one of the decision variables, and in recognizing what that implies for consumption by husband and wife. Furthermore, the following model integrates household production into the analysis of labor supply of married women. It follows Gronau's (1977) graphical model that combines Robbins'

(1930) budget frontier with a transformation curve representing possible combinations of time and goods produced in the home.[3]

II. Markets for Work in Household Production and Labor Supply

According to Grossbard (1976) it is incorrect to assume that married women have total access to "household income" (including their husband's income). Grossbard-Shechtman (1984) then derived testable hypotheses regarding the effects of marriage market conditions on married women's labor supply. The basic insight that is gained from applying a marriage market analysis to the analysis of labor supply is that household income affects a married household producer's labor supply conditional on marriage market conditions. *This is THE MARRIAGE MARKET CONDITIONED HOUSEHOLD INCOME (MMCHI) effect.*[4]

To the extent that men's labor supply is also influenced by their access to household income (including their wife's income from paid employment), this MMCHI effect and the factors associated with it belong in equations predicting the labor supply of both wives and husbands.

To explain MMCHI effects one needs a theory that explains intra-marriage income transfers.[5] In this paper I simplify the analysis by focusing on the example of a couple following traditional gender roles. Competitive marriage market theories such as one of the theories in Becker (1973) and Grossbard (1976) explain such transfers in a manner very similar to another market theory dealing with people: competitive labor market theory. These theories assume that singles carry portable human capital that is marriage-general, to use an analogy with more standard applications of human capital theory (see Becker 1964), i.e. it is applicable to many possible marriages and not specific to a particular marriage.[6]

Becker's marriage market models and most bargaining models of marriage do not explicitly model the supply of work entering household production, the incentives needed to motivate such work, or the possible trade-offs and terms of trade between work in household production and labor supply providing access to consumer goods. The first theory to model choice between household production work in marriage and labor supply, Grossbard (1976), was first applied to the analysis of household production and polygamy. It followed Mincer's (1962) assumptions that (1) there is household production in marriage and that (2) women were the spouse/producers and men not. It followed Becker's (1973) market theory of marriage by assuming that (3) groups of identical men consider marriage to groups of identical women, and vice-versa,[7] and that (4) these individuals have portable marriage-general human capital and therefore interact in marriage markets. In the Nigerian city of Maiduguri in 1973, high proportions of all goods were produced by women in marriage, polygamy was common, and married women were spending several hours a day preparing a meal from scratch, so that it is very obvious that women work in household production that is similar to the supply of labor in commercial labor markets.

Grossbard (1976) pursued the analogy between marriage markets and labor markets further than other economic models of the household.[8] It assumed that wives were workers, that husbands were employers, and that the goods being produced in the home were of benefit to employers/husbands who were compensating workers/wives sufficiently to induce them to work. The material part of that compensation is the transfer

of husband's income taking the form provision of basic needs and non-pecuniary benefits.[9] These compensations are the equivalent of the intra-marriage income transfers found in subsequent literature based on game theory. In the context of the African society studied in Grossbard (1976), bridewealth payments paid by men to women's male guardians can also be viewed as part of a compensation for women's household production work (compensations that go to the women's guardians and not to the women themselves). In Nigeria and many other parts of the world, like India, bridewealth and/or dowry are the norm, and it is clear that a price mechanism operates in marriage markets (see Grossbard-Shechtman 1993).[10]

In both the cases of labor market models and Grossbard's market model of household production work, competition and a price mechanism facilitate the allocation of general human capital embodied in workers. While in the West the price mechanism functions much better in the case of labor markets than in the case of markets for household production work, this does not seem to be the case in Nigeria or India.

The applicability of labor market models to the study of household production work also depends on who makes the marriage and divorce decisions. If workers in marriage have no freedom to move in or out of a marriage or to make decisions regarding the allocation of resources in marriage, they are the equivalent of slaves and marriage markets are like slave markets, not like labor markets. The high divorce rate characterizing Maiduguri marriage markets, the degree of control that women had over divorce decisions, and current wives' involvement in the decision-making process regarding the addition of co-wives, all suggest that a household production work model viewing women as workers is more appropriate than a model viewing women as slaves.[11] What about the guardians—mostly fathers—who marry their daughters and in return receive bridewealth payments? Are they more like slaveowners cashing in on a sale of human capital, or like headhunters who receive a fee from firms eager to get more qualified workers? That is an open question, which depends on the particular cultural context. In the context of the contemporary U.S. and most industrialized nations, where women have considerable freedom of choice, it certainly makes more sense to look at household producers like workers than to look at them like slaves. [12]

Many facts reinforce the validity of a market model for household production work. It can be seen that household production workers are often compensated by their spouse as a positive function of the amount of time and effort that they devote to household production in the marriage. There are plenty of instances of individuals who spend many hours working in household production and receive nice income transfers from a spouse who engages less in household production work. Note that the compensation for work in household production in marriage can also consist of non-pecuniary benefits such as affection, autonomy, and care.

A. Previous Applications of Market Analysis of Household Production Work

David Heer and Grossbard-Shechtman (1981) first applied a market analysis of household production work to the United States and derived a MMCHI effect to explain trends in women's labor force participation. We explained why the generation of women born at the beginning of the baby-boom could be expected to have a low compensation for their household production work in marriage, given the large numbers of babies born after the war and the tendencies for grooms to be about two years older than brides. We

reported how the sex ratio (marriageable men to marriageable women) started decreasing dramatically in the mid-sixties, when the first baby-boomers entered marriage markets.[13]

MMCHI effects could explain why married women faced with low sex ratios in marriage markets would have access to smaller proportions of their household income—including husband's income--and therefore would be more likely to participate in the labor force than their older counterparts who had benefited from high sex ratios. More specifically, this effect can explain the dramatic increase in the labor force participation of young married women that was observed in the late 1960s and 1970s, precisely when the generation with the lowest sex ratio entered the labor force.[14]

Grossbard-Shechtman (1984) generalized Grossbard's simple market model of household production work by considering cases where both men and women engage in household production work. It presented formal derived demands and supplies of household production work in marriage, included a general equilibrium analysis of markets for labor and household production work, and derived a number of testable predictions--including MMCHI effects--linking marriage market conditions to labor supply.[15]

B. Modeling Labor Supply with MMCHI Effects

Even though data on compensations for household production work are generally unavailable, there are roundabout ways to test for MMCHI effects on labor supply. The first econometric model of women's labor supply taking account of possible MMCHI effects is Grossbard-Shechtman and Shoshana Neuman (1988), published in the *Journal of Political Economy*. That model contains a function

$w^* = k(X) \cdot I$, where w^* was defined as a married woman's reservation wage, I was defined as a vector of income from sources other than that individual woman's work, including spouse's income, and k was defined as the proportion of that income that the married woman had access to. It was hypothesized that a number of marriage-market related factors X influence proportion k.

This MMCHI effect was applied to analyze *compensating differentials in marriage* and their effects on married women's labor supply. In particular, it was hypothesized that personal attributes that are desirable in marriage, i.e. that add to a person's marriage-general human capital, lead to a higher k if they belong to a wife and a lower k if they belong to a husband. Positive factors in a woman's X vector included a married woman's age relative to that of her husband, whether she belonged to an ethnic group that is desirable relative to that of her husband, immigrant status, and (for immigrants) years of residence in the country of destination (the longer the residence, the more desirable immigrants become in the local marriage market.) The more a factor in vector X raised the reservation wage, the less it was likely that the woman participated in the labor force, i.e. the partial of w^* w.r.t. X was expected to be positive, and the effect of that X on hours of work and LFP was expected to be negative. Testable predictions thus included that the following groups of women *ceteris paribus* were less likely to participate in the labor force: (1) women much younger than their husband, (2) women from an ethnic group more desirable than their husband's, and (3) women with more years of residence in their destination country.

An econometric analysis based on Israeli data confirmed most of these predictions. In our estimations, we used a linear equation, where I (household income) and a number of factors associated with individual success in a marriage market were added linearly. This

specification can be derived from the equation above to the extent that the variables are transformed into logarithms, but the functional form relating labor supply and factors *X* does not need to consist of the product of *k* and *I*. A similar model, applied to Hawaiian data, showed that Caucasian women married to men from less prestigious ethnic groups are less likely to participate in the labor force than Caucasian women married to Caucasian men (Grossbard-Shechtman and Fu 2002).

A number of studies suggest that *sex ratios* can be considered as one of the *X* factors in vector *X* that has an impact on reservation wage and therefore labor supply. Age-adjusted sex ratio is a proxy for the ratio of men and women interacting in the same marriage markets. An effect of city-wide sex ratio on individual women's labor supply was found in a cross-section analysis for U.S. cities in 1990 (Grossbard-Shechtman and Matthew Neideffer 1997) and in 1988 (Chiappori, Bernard Fortin and Guy Lacroix 2002), and a comparison of city aggregates for the U.S. in 1930 and 1980 (Grossbard-Shechtman 1993). The effects all went in the direction expected from a household production work market analysis: the more men relative to women, the higher *k* and the lower married women's labor force participation.

Sex ratios also vary across cohorts, due to the fact that the difference between men and women's average age at marriage varies little over time whereas cohort size often varies dramatically. For instance, for the United State as a whole and using extrapolations based on the 1990 Census, in 2000 there were 112 men ages 27 to 31 (and born in the years 1969-1973) to 100 women ages 25-29 and born in the years 1971-1975. In contrast, using the same definition of sex ratio, the women who were 25-29 in 1975 and were born in the years 1946-1950 had faced sex ratios consisting of 87 men (born in 1944-1948) per 100 women (see Table 1). What drives these large inter-cohort differences in sex ratio is the fact that the number of children born grew rapidly right after World War II, causing a shortage of grooms for the women born at that time, whereas the number of children born fell rapidly after the legalization of abortions in the period 1970-1973. [16] Table 1 presents sex ratios for 13 five-year cohorts of women born in the United States in the years 1916-1980 and men born in the years 1914-1978.[17] It can be seen that, as defined here, sex ratios fluctuated between 87 and 112 during this period.

Grossbard-Shechtman and Granger (1998) have shown that in the United States over the period 1965 to 1990, the cohorts experiencing the fastest growth in women's labor force participation were *growing cohorts*, i.e. generations larger than the generation preceding them. The women in these growing cohorts faced decreasing sex ratios and therefore deteriorating marriage market conditions. A dummy for growing cohort was an important explanatory factor in regressions of changes in women's labor force participation, regressions that controlled for male and female wages and other variables usually included in such regressions (John Pencavel 1998 has also shown that cohort effects are major relative to other explanations of changes in women's labor force participation over time in the U.S.). The cohorts that had grown the fastest, and therefore had experienced the fastest decreases in sex ratio, were precisely the cohorts that had experienced the fastest increases in labor force participation a generation later.[18]

Recent developments strengthen explanations of cohort changes in women's LFP based on market models of household production work, as we are witnessing a trend towards slower increases in labor force participation among shrinking cohorts of women. A look at simple trends (see Table 1) suggests that indeed shrinking cohorts of women

faced with favorable markets for household production work have experienced slower than average growth in female labor force participation (FLFP) in the nineties, a sharp contrast to the faster than average growth in the FLFP of growing cohorts of women in the sixties and seventies. The simple correlation between a cohort's sex ratio and changes in women's labor force participation, including that of married women, is quite striking. The dramatic and unnoticed decrease in young married women's labor force participation that occurred from 1998 to 1999 also supports this interpretation. In 1999, the women in the ages 25-29 were born in the years 1970-1974. From 1998 to 1999, the women born in 1974 entered this age group. These are the women of the Roe generation who most benefited from the passage of Roe vs Wade. As cruel as this may look, a market analysis implies that increased abortions in 1973 benefited the women born in 1974, who tend to marry men from the relatively larger cohorts born prior to Roe vs Wade, and therefore face relatively little competition in markets for dating and marriage.

An explanation based on markets for household production work explains these fluctuations in women's labor force participation better than alternative explanations such as Easterlin's, for the sex ratio effects continue to be found even after control for changes in wages and fertility (see Grossbard-Shechtman and Granger 1998). Also, it is hard to find *ad hoc* historical factors that simultaneously account for the low *k* of growing cohorts and the high *k* of shrinking cohorts.

Young women currently ages 25-34 could also be using their higher value in markets for household production work in order to obtain more desirable work sites, even if they get paid less as a result. The higher the market value of household production work and the higher the MMCHI, the more married women are likely to engage in household production work and to look for ways to combine household production work and commercial employment. Therefore, married women receiving a higher k are more likely to be employed in at home commercial work compatible with household production work rather than in on-site commercial work that is less compatible with household production work, even if home-based commercial work pays less than on-site commercial work. This helps explain why there has been a recent increase in the tendency for employed young married women to work in home-based commercial work rather than on-site commercial work (see Field-Hendrey and Edwards 2003). The cohort experiencing this increase in home-based work includes the women born right after the state abortion reforms of the early 1970s and after Roe vs. Wade, the important decision that the Supreme Court passed in 1973. As a result, women born after the legitimization of abortion benefit from high sex ratios and beneficial conditions in markets for household production work in marriage.

Marriage market conditions and MMCHI effects on labor supply are also expected to differ across ethnic groups. In the U.S. whether a person is considered Black or White is a factor affecting marriage market conditions. Sex ratios among Blacks are lower and Americans (including Blacks) may have a preference for light skin (see Grossbard-Shechtman 1995). Therefore, even though we do not have data on *k*, it can be expected that relative to White women, Black women may obtain lower compensations for household production work in marriage, and may therefore have a lower *k* (MMCHI effect) and lower reservation wage.[19] This could help explain why Black married women are (1) more likely to be in the labor force than White married women (for instance, in 1999 46.8% of Black married women ages 25-29 were in the labor force full-time year-

round whereas 43.9% of their White counterparts were working full-time year-round; and (2) less likely to work in home-based commercial work than White married women (Field-Hendrey and Edwards 2003). Also, studies have documented that husband's income has a stronger effect on wife's labor supply among Whites than among Blacks (see e.g. Evelyn Lehrer 1992). This suggests a multiplicative function of *k* and *I*: the higher *I*, the more a high *k* makes a difference.

One also expects implications for men, even if most paid household production work is performed by women. A switch from a lower MMCHI effect (lower *k*) to a higher MMCHI effect involves more favorable market conditions in markets for women's household production work, and therefore involves differences in the behavior of both the men and the women born in growing and shrinking generations.

If MMCHI effects on labor supply indeed exist, economists need to include them in their econometric models. This leads to a number of implications.

- First, instead of simply including men's income (possibly husband's in the case of married women) in women's labor supply equation, economic models of labor supply need to separately test for the effects of spouse's income and other forms of non-wage income, a conclusion reached e.g. by McElroy (1990) and Grossbard-Shechtman and Neideffer (1997).
- Second, models of married women's labor supply should test for possible interactions between MMC factors and husband's income, and MMC factors and other forms of household income.
- Third, assuming a linear relation, models of labor supply can add MMC factors to linear equations of labor supply. These MMC factors include any factor that could possibly cause a shift in demand for household production work or supply of household production work. Should the equation behind such model be like the one in Grossbard-Shechtman and Neuman (1988), which has an individual's reservation wage on the left hand side and includes MMC factors added linearly on the right hand side? Or should compensation for household production work be on the left hand side? Even though neither the reservation wage nor the compensation for household production work are measurable, it pays off to tie analyses of the determinants of women's reservation wage *w** to analyses of markets for household production work. Market analysis of household production work makes it easier to understand why MMC (marriage market conditions) would affect reservation wage *w**.

Such analysis allows us to separate demand-shifting and supply-shifting factors in vector *X*. Market analysis of household production work is especially valuable as a means of deriving predictions regarding compensating differentials in marriage. So far other theories of marriage (e.g. those of McElroy 1990 and Chiappori 1992) have not called their readers' attention to the possible presence of compensating differentials in marriage and the effect of such differentials on labor supply. What facilitated the derivation of compensating differentials from Grossbard's market analysis of household production work was the modelization of these markets as labor markets—with a quantity and a price dimension, the only difference being that the price is not a commercial price but a compensation including a material element and psychic benefits. That analogy inspired me to borrow analytical tools that have been useful in labor market analysis, such as the concept of compensating differentials.

Next, the analogy between market established compensations for household production work and market established wages is applied to an original graphical analysis of male income effects on women's LFP that incorporates marriage market factors. This analysis is based on Gronau's well-known graphical analysis of leisure/goods trade-offs with household production.[20]

III. A Graphical Analysis of Husband's Income Effects on Wives' Labor Supply

I first discuss a simple case where women do not have the option of participating in the labor force, a case that unfortunately is representative of many poor women in the world. Then I discuss a three-way choice between labor force participation, household production work and leisure. The examples are framed in terms of a traditional division of labor, where the only spouse/producer is the wife and the husband and wife consume the goods she produces. The analysis is also applicable to the case of a husband who is the household production worker. Two forms of household income effect are examined: a pure income effect and an effect of spousal income transfer interpreted as a compensation for household production work.

A. Simple Case: Leisure and household production work. No LFP

It is assumed that the spouse/producer (let us say the wife) solely chooses between leisure and work in married household production. Other than income from a husband, it is assumed that here is no other form of income available to women. The woman considers leisure/goods trade-offs in terms of her own productivity and consumption preferences. It is assumed that her husband enjoys the exact same goods that she produces (i.e. there is joint consumption and the goods that she produces are household public goods) and is willing to pay her to produce these goods. It is assumed that an hourly compensation *y* for women's household production work has been established in a market for female household production workers. In turn, this assumes that household production workers have marriage-general human capital. Husbands can also transfer income to their wife irrespectively of hours of household production work. From the woman's point of view this is a form of non-work income and will be called *Y*.

The wife is thus maximizing a utility function is $U(x,s)$, where *x* stands for goods. The total amount of goods that the wife can consume as a result of an hour of household production is the sum of the goods that she produces x_m plus the commercial goods x_c that she purchases thanks to income that she receives from her husband, i.e. $x = x_c + x_m$. She maximizes her utility subject to

- a time constraint $T = s + m$, where *s* is leisure,
- a production function of x_m, $x_m = f(m)$, with $f' > 0$ and $f'' < 0$,
- and a budget constraint $x_c = ym + Y$, where *y* is a compensation for household production work and *Y* is an income transfer from the husband that is not tied to household production work.

It is assumed that the price of goods is 1.

Figure 1 represents the leisure/goods trade-off of this woman. There are three panels in Figure 1: (a) own consumption of household-produced goods, the equivalent of a corner solution in Gronau (1977); (b) consumption of commercial goods as a result of spouse's consumption of the same household-produced goods and a consequent payment by the spouse; and (c) combined consumption of household-produced goods and

commercial goods resulting from a given amount of hours of household production. This combination is obtained by vertical addition of the budget and transformation lines of panels a and b.

A household producer is clearly better off when her household production is also appreciated by her spouse. Whether appreciation takes the form of a high *y*, the compensation for household production work, or a high income transfer *Y*, it will increase individual opportunities for consuming goods and leisure. In both cases, there will be an income effect. However, in case of appreciation taking the form of a compensation, there will also be a substitution effect between the two kinds of goods. The difference between the effect of a non-work-related transfer *Y* and that of a household production work-related transfer *ym* is similar to the difference between a pure income effect and a wage effect in standard labor supply analysis. It is expected that appreciation conditional on household production work performance will give people more incentives to engage in in-marriage household production (see Grossbard-Shechtman and Bertrand Lemennicier 1999) than appreciation in the form of an income transfer not conditional on work effort.

The main advantage of this analysis is that it allows us to model allocation of time as a function of marriage market conditions. Both a non-work-related transfer *Y* and a household production work-related transfer *ym* are in-marriage transfers that vary with spouse's income *I*, but they will not necessarily vary in the same proportions, so that $y = k_1 . I$, and $Y = k_2 . I$. The higher each proportion *k* in a particular market for women's in-marriage household production work, the more women can expect to be compensated for producing marital public goods and the better off they are.[21] That proportion will vary as a function of *X* factors, the MMC factors.

In order to derive predictions regarding MMCHI effects linking *X* factors to women's labor supply, it is necessary to expand the model to include labor supply.

B. The Case of Leisure, Work, and Household Production Work

Figure 2 presents an expanded transformation curve and budget constraint that includes leisure/goods tradeoff as well as trade-offs between work in household production and in the labor force. In this model, an actual or potential household production worker, let us say a woman, is still maximizing a utility function $U(x,s)$, where *x* is defined as above, and she has the same production function of x_m, but now she maximizes her utility subject to a time constraint $T = l + s + m$, where *l* is labor and a budget constraint, $x_c = ym + wl + Y$, where *w* is wage.

Maximization leads to first order conditions:

$$w = MUs / MUx = y + f'$$

The equality on the left is the first order condition in Robbins' leisure/goods tradeoff and corresponds to the point where the budget constraint with slope *w* is tangent to the indifference curve. This is the well-known result obtained by Robbins and Gronau. In addition, the equality on the right of this first order condition states that the marginal rate of substitution between leisure and goods also has to equal the sum of *y*, the compensation for household production work, and the marginal productivity of household production work (*m*) from the perspective of the household production worker. That sum is the total personal benefit that the woman derives from engaging in an hour of household production work: she enjoys that hour of household production directly at a level *f'* in terms of the home-produced goods that she produces and she also enjoys that hour according to *y*, which allows her to buy commercial goods with her husband's

income which she receives in return for these same home-produced goods. (In the extreme case of a person who engages in household production work without enjoying any of the goods that she produces, her only gain from household production work would consist of the compensation *y* that she earns and of the goods that she can buy with her ensuing earnings). The person will either work in paid employment *l* or in household production work, depending on whether *w* exceeds $y + f'$ or not.

The equality on the right is very similar to the second equality found in Gronau except that in Gronau's model a married woman does not get paid by her spouse according to what she produces in the household. Graphically, Figure 2 looks very similar to the leisure/goods trade-off graph in Gronau (1977), except that instead of the transformation curve having slope f', it now has slope $y/p + f'$ (assuming p is not 1).

Two kinds of MMCHI effects on labor supply can be derived from this model. They are defined as the following functions of husband's income:

$y = k_1 (X).\ I$ and $Y = k_2.(X).I.$

Any factor *X* that influences one of those proportions *k* can cause a MMCHI effect on labor supply (see Grossbard-Shechtman and Matthew Neideffer 1997). A positive factor in *X* that increases a woman's value in marriage markets is likely to cause an outward shift to the transformation curve in Figures 1 and 2. The kind of shift will depend on whether the compensation or *Y* are changing, i.e. it will depend on whether an in-marriage income transfer is tied to performance in marital household production or not. Comparing changes in *y* and *Y* that are identical in size, a change in MMC that increases *y* is expected to discourage household production less than a change in MMC that increases *Y*. Both effects discourage household production due to an income effect, but only a change in *y* induces a substitution effect towards more household production. Therefore, an increase in *y* is expected to discourage labor force participation more than an equivalent increase in *Y*. Two major factors included in *X* that are likely to be associated with MMCHI effects are sex ratios and the relative desirability of men and women in the same marriage markets (compensating differentials). It follows that if higher sex ratios or better individual qualities cause a higher k_1 and therefore a higher *y*, one expects the individual to choose less LFP due to an income effect and a substitution effect.

C. Related Implications of Marriage Market Conditions

This model can also help us analyze other decisions, including the decision to marry (see Becker 1973) and to have children. According to the analysis presented here the gains from marriage (or cohabitation) include the gains from an exchange of income *ym* for home-produced goods. This generates a producer surplus to the spouse/producer and a consumer surplus to the spouse/consumer. This helps explain why people want to create couples, which means either marriage or cohabitation. The more household production by both wife and husband, the more they jointly consume that household production, the larger the gains from marriage. Obviously, there are also costs of marriage, and gains from marriage or cohabitation may not be sufficiently large to make everyone want to be married or cohabit.

This analysis also leads one to question an insight on fertility and labor supply derived by Willis (1974): the insight that when a wife is employed, the value of her time and her ensuing fertility are not affected by changes in husband's wage and unearned income. According to Willis (1974), only if she is not employed in the labor force will a

woman's husband's income affect her value of time in household production. However, according to the market analysis of household production work presented here one does not expect value of time in household production $y + f'$ to vary as a result of a decision to join the labor force or not. Compensations y are determined exogeneously in markets for household production work. Causality is different: as a result of an exogeneously determined y a woman decides to participate in the labor force or not. The same factors, such as household (including husband's) income and the factors influencing MMCHI effects are likely to influence married women's value of time, fertility, and the decision to participate in the paid labor force. If markets for household production work exist and establish k and y, the value of time of married women does not vary as a result of whether they are employed or not. It is therefore not surprising that few studies confirmed the predictions that Willis (1974) derived: husband's income effects on fertility do not appear to depend on whether the wife is in the labor force or not (see William Butz and Michael Ward (1979) for the U.S. and John Ermisch (1979) for the U.K).

IV. Conclusions

Until recently, few economists have analyzed the effects of marriage market conditions on labor supply. This paper reported on econometric models that provide some evidence on at least two types of effects of marriage market conditions on married women's labor force participation and hours of work: compensating differentials in marriage and sex ratio effects. These results can be interpreted with a model whereby marriage market conditions affect reservation wage via an impact on the effect of household income on compensations for in-marriage household production work and therefore on reservation wage (MMCHI effect).

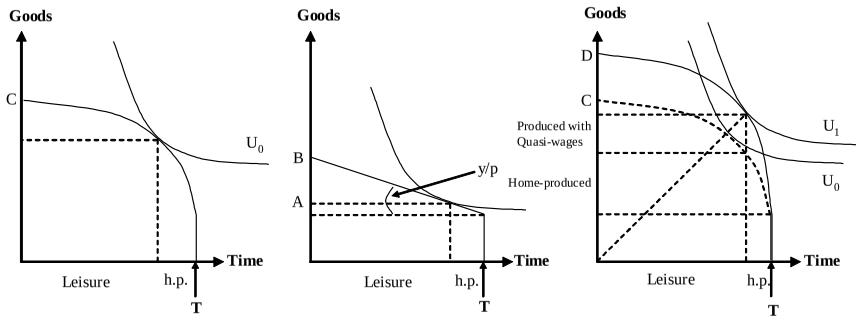
This paper also presented a graphical model that shows how marriage market conditions can possibly affect reservation wages and therefore labor supply via an effect on equilibrium wages for household production work. That model is based on the theory of allocation of time to household production, leisure, and work developed by Mincer, Becker, and Gronau. Two versions of the model were presented: a simple one without labor force participation, and a model that includes a choice of labor force participation. One of the advantage of this model is that it ties well with existing analyses of the decision to supply labor, and makes it relatively easy to add the effects of marriage market conditions to current models of labor supply. While simple, the model opens the door to many testable implications, some of which are mentioned in this paper.

The analysis of markets for household production work that was presented here can benefit considerably from further empirical and theoretical work. At the empirical level, it is hoped that there will be more econometric tests of MMCHI effects on labor supply, including tests on the labor supply of men. With more and more men marrying career women, one expects that marriage market conditions increasingly influence men's labor supply and men's productivity at work (a function of hours of work and of the need to compensate women for their household production work work). Men's decisions regarding productivity and hours of work in the labor force are to some extent the mirror image of the decisions of women. For every woman who specializes in household production there tends to be a man who works harder in the labor force, and vice-versa.

At the theoretical level, we need models that analyze an individual's labor supply and marriage as simultaneous decisions or that simultaneously consider two spouses'

decisions. Every assumption that was used in the model presented here can be reevaluated. For instance, one can produce another model that does not assume that all household production is jointly consumed, as was assumed here, or that relax the assumption that equilibrium compensations are established in markets for household production work. It is hoped that others will find this line of work sufficiently promising and therefore worth exploring in future research. There is considerable untapped potential for research on labor supply that takes marriage market conditions into account.

Figure 1. Allocation of time to leisure and household production (h.p.)



a) self-consumed household production (h.p.)

b) h.p. consumed by spouse
spouse pays y per hour

c) consumed by self and spouse

Figure 2. Allocation of Time by Spouse/Producer when y/p, the Quasi-wage for Household Production (h.p.), is Given

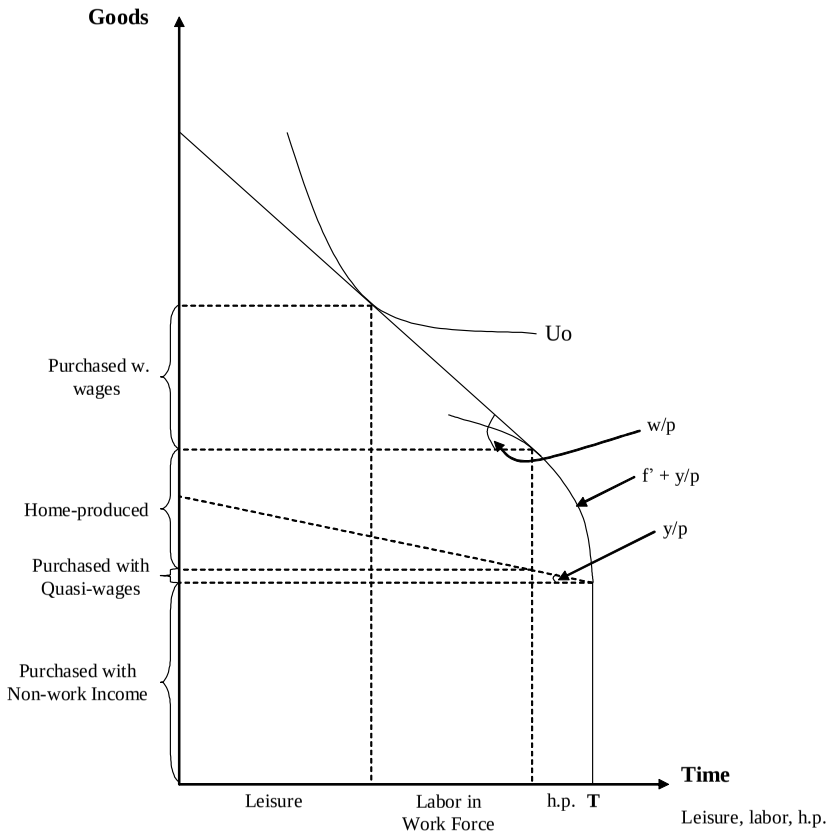


Table 1. Generations of Women, Sex Ratios, and Changes in Labor Supply (United States)

Generation	Year of Birth	Generation Name	Sex Ratio	Change in LFP[1] 25-29	Change married LFP, 25-29[1]	Change married LFP, 30-34[3]
1	1916-1920	World War I	.949	n.a.	n.a.	n.a.
2	1921-1925	Early 20	.927	n.a.	n.a.	n.a
3	1926-1930	Pre-Depression	.98	n.a.	n.a.	n.a
4	1931-1935	Depression	1.00	n.a.	n.a.	n.a.
5	1936-1940	New Deal	.943	3.3	n.a.	9.0
6	1941-1945	World War II	.907	6.3	4.5	5.7
7	1946-1950	Post WW II	.874	12.1	11.9	13.3
8	1951-1955	Korean War	.948	9.4	9.0	6.4
9	1956-1960	Sputnik	.971	4.7	6.3	4.0
10	1961-1965	Kennedy	1.027	2.4	3.9	3.0
11	1966-1970	Moon	1.06	1.1	5.0	-2.6
12	1971-1975	Roe	1.12	2.5	-.25	n.a.
13	1976-1980	First Echo	1.02	n.a.	n.a	n.a.

 Source: Census data from 1940 to 1990.

Notes: Ratio of men age 22 to 26 to women age 20 to 24 or men age 27 to 31 to women age 25 to 29 calculated based on Census data. The age group depends on the Census year. Sex ratios for last two generations were calculated based on the 1990 Census using younger age groups.

Notes

[1] For instance, in the U.S. in 1999 close to 30% of married women--including women ages 25-29--did not participate in the labor force at all (most of them described themselves as housewives); a majority of married women ages 25-29 were either not in the labor force or were working part-time (56.4%). The same is true for all married women under age 45 in 1999. However, 51.7% of women ages 45-49 were working full-time year-round. Few men were not working full-time year-round (26.3% in the same age group).This percentage was even lower for married men. Based on my own examination of the 1999 March Current Population Surveys (CPS).

[2] These standard models really are NHE models, even though most of the economists currently using them are unaware of their intellectual debt to Jacob Mincer.

[3] Assuming that the individual obtains the same utility from commercial goods and home-produced goods, Gronau (1977) showed that an individual produces goods at home as long as the opportunity cost of home-produced goods is lower than the real cost of purchased goods. The individual then chooses between leisure and goods based on the point at which the wage line is tangent to the leisure/goods iso-utility curve.

[4] This insight has also been derived by later theories of marriage such as Chiappori (1992).

[5] Becker's (1973) theory of marriage offered the first economic analysis of marriage market effects on intra-marriage income transfers. While he took the first step towards the derivation of a marriage market conditioned household income (MMCHI) effect, Becker did not derive a MMCHI effect on labor supply.

[6] Bargaining theories of marriage pioneered by Marilyn Manser and Murray Brown (1980) and by Marjorie McElroy and Mary Jane Horney (1981) also define marriages as institutions encouraging and regulating household production and assume marriageability in the sense of individual ownership of portable human capital that is valuable in marriage markets. In bargaining theories the focus is on married individuals who are remarriageable. Most of these theories do not consider singles preparing for marriage.

[7] Whether their parents act as their agents and broker their marriages is not very important for the analysis.

[8] Search models of marriage also go far in pursuing analogies between marriage markets and labor markets, see e.g. Michael Keeley (1977) and Dale Mortensen (1988.)

[9] Given the gender asymetry assumed in Grossbard (1976) I called household production work wife labor and the compensation was called wife wage.

[10] It is therefore not surprising that India is the country that inspired the first economics article on marriage (Martin Bronfenbrenner 1971),

[11] In this polygamous society with very rigid gender roles, all assets belonged to men, very few women participated in the labor force, and there was no labor supply for me to study. The econometric analysis in Grossbard (1976) tested how observable factors influenced number of wives in a household. It was predicted that a factor that enhances demand would cause higher wife-wages (e.g. wife's productivity in marital household production), and a factor that increases supply (e.g. more women available per man) would cause lower wife-wages.

[12] All the models that see marriage as involving the transfer of the entire human capital of a person are similar to market models of slavery. Most market models of marriage are

models of slavery, including Becker's competitive market model of marriage and Edlund (2002).

[13] There is a long tradition of sociological and demographic literature on sex ratio effects, a tradition dating back to the 1940s and that has principally studied effects of sex ratio on marriage rates (see Grossbard-Shechtman 2001b.)

[14] Heer and Grossbard-Shechtman (1981) also speculated that decreases in the market value of women's household production work may help explain changes in a number of other behaviors: more cohabitation and less marriage, more divorce, lower marital fertility, higher extra-marital fertility, increased use of contraception, and the onset of the feminist movement. Others have attributed changing women's roles to the onset of feminism, the invention of the pill, and many other factors.

[15] The model in Grossbard-Shechtman (1984) was reproduced in Grossbard-Shechtman (1993), with only minor changes. It differs from the model presented here: in Grossbard-Shechtman (1984) it was assumed that household-produced goods were private goods consumed by each spouse separately. Below, I follow previous NHE models in assuming that goods produced by households are household public goods.

[16] Links between abortion law changes and changes in fertility in the 1970s have been discussed e.g. by John Donohue and Steven Levitt (2001) and Joshua Angrist and William Evans (1999).

[17] For all generations, sex ratios were calculated according to the Census that found a generation to be either 20-24 or 25-29, as these are prime ages for dating and marriage, and most likely to influence marriage market conditions. The only cohort for which this was not feasible was the youngest cohort, for the 2000 Census is not yet available.

[18] However, Grossbard-Shechtman and Granger have not shown that there is a causal link from growing cohort to increases in women's labor force participation. Rapidly growing cohorts were coming of age soon after the invention of the pill and it is possible that the rapid growth in women's labor force participation occurred as a result of the spread of more efficient contraception or as a result of *ad hoc* factors such as the Vietnam war.

[19] See Grossbard-Shechtman (1993).

[20] Robert Cherry (1998) helped me realize that Gronau's (1977) model can be used to integrate intra-marriage transfers.

[21] Cherry's (1998) model includes a function that is the equivalent of $Y = k_2 . I$, but he does not consider the possibility that intra-marriage transfers are a compensation based on the hours that a spouse spends in household production.

References

Angrist, Joshua D. and William N. Evans. 1999. "Schooling and Labor Market Consequences of the 1970 State Abortion Reforms." *Research in Labor Economics*18: 75-113.

Becker, Gary S. 1964. *Human Capital*. New York: Columbia University Press.

_____. 1965. "A Theory of the Allocation of Time." *Economic Journal* 75: 493-515.

_____. 1973. "A Theory of Marriage: Part I." *Journal of Political Economy* 81:813-846.

_____. 1981. *A Treatise on the Family*. Cambridge: Harvard University Press.

Blau, Francine D., Marianne A. Ferber and Anne E. Winkler. 1998. *The Economics of Women, Men, and Work*. New Jersey: Prentice Hall (3d edition).

Bourguignon, Francois. 1984. "Rationalite Individuelle ou Rationalite Strategique; le Cas de l'Offre Familiale du Travail." *Revue Economique* 35: 147-62.

Brien, Michael and Michelle Seran. 2003. "The Economics of Marriage and Household Formation." Prepared for *Marriage and the Economy*, ed. Shoshana Grossbard-Shechtman. New York and Cambridge: Cambridge University Press.

Bronfenbrenner, Martin. 1971. "A Note on the Economics of the Marriage Market." *Journal of Political Economy* 79:1424-25.

Butz, William P. and Ward, Michael P. 1979. "The Emergency of Countercyclical U.S. Fertility." *American Economic Review* 69:318-28.

Cherry, Robert.1998. "Rational Choice and the Price of Marriage." *Feminist Economics* 4:27-49.

Chiappori, Pierre-Andre. 1988. "Rational Household Labor Supply." *Econometrica* 56:63-90.

_____1992. "Collective Labor Supply and Welfare", *Journal of Political Economy* 100: 437-67.

Chiappori, Pierre-Andre, Bernard Fortin and Guy Lacroix. 2002. "Marriage Market, Divorce Legislation, and Household Labor Supply." *Journal of Political Economy,* 110: 37-71.

Donohue, John J. III and Steven D. Levitt. 2001. "The Impact of Legalized Abortion on Crime." *Quarterly Journal of Economics*, 116: 379-420.

Edlund, Lena.2002. "Marriage." Working paper, Columbia University, November 8.

Ermisch, John. 1979. "The Relevance of the Easterlin Hypothesis and the New Home Economics To Fertility Movements in Great Britain." *Population Studies* 33:39-57.

Field-Hendrey, Elizabeth and Linda Edwards. 2003. " Marriage and Home-Based Work for Pay." In *Marriage and the Economy*, ed. Shoshana Grossbard-Shechtman. New York and Cambridge: Cambridge University Press.

Gronau, Reuben. 1977. "Leisure, Home Production, and Work--The Theory of the Allocation of Time Revisited." *Journal of Political Economy*. 85:1099-124.

Grossbard, Amyra. 1976. "An Economic Analysis of Polygamy: The Case of Maiduguri." *Current Anthropology* 17:701-7.

Grossbard-Shechtman, Amyra. 1984. "A Theory of Allocation of Time in Markets for Labor and Marriage." *Economic Journal* 94:863-82.

Grossbard-Shechtman, Shoshana A. 1993. *On the Economics of Marriage - A Theory of Marriage, Labor and Divorce*. Boulder, CO: Westview Press.

_____. 1995. "An Integrated Analysis of Labor and Marriage and Explanation of Black/White Differences in Marriage, Labor, and Welfare Participation," Paper presented at the Conference on Economics and Sociology in Honor of Gary Becker and in Memory of James Coleman, San Diego, July.

_____.2001a."The New Home Economics at Columbia and Chicago." *Feminist Economics* 7:103-130.

_____. 2001b. " The Economics and Sociology of Marriage: Historical Trends and Theories of In-Marriage Household Labor," in *The Expansion of Economics*, edited by Shoshana Grossbard-Shechtman. M.E. Sharpe Publishers.

_____. 2003. "A Consumer Theory with Competitive Markets for Work in Marriage." *Journal of Socio-Economics*, 31(6): 609-645.

Grossbard-Shechtman, Shoshana and Xuanning Fu. 2002. ""Women's Labor Force Participation and Status Exchange in Intermarriage: An Empirical Study in Hawaii " *Journal of Bioeconomics*, 4(3): 241-268.

Grossbard-Shechtman, Shoshana and Clive W.J. Granger. 1998."Women's Jobs and Marriage - From Baby-Boom To Baby-Bust," *Population* 53:731-52 (in French).

Grossbard-Shechtman, Shoshana and Bertrand Lemennicier. 1999. "Marriage Contracts and the Law-and-Economics of Marriage: an Austrian Perspective." *Journal of Socio-Economics* 28: 665-690.

Grossbard-Shechtman, Shoshana A. and Shoshana Neuman. 1988. "Labor Supply and Marital Choice." *Journal of Political Economy* 96:1294-1302.

Grossbard-Shechtman, Shoshana and Matthew Niedeffer. 1997. “Women’s Hours of Work and Marriage Market Imbalances,” in *Economics of the Family and Family Policies*, edited by Inga Persson and Christina Jonung, London: Routledge.

Heer, David M. and Amyra Grossbard-Shechtman. 1981. "The Impact of the Female Marriage Squeeze and the Contraceptive Revolution on Sex Roles and the Women's Liberation Movement in the United States, 1960 to 1975." *Journal of Marriage and the Family* 43:49-65.

Hersch, Joni. 2003.“ Marriage, Household Production, and Earnings”.In *Marriage and the Economy*, ed. Shoshana Grossbard-Shechtman. Cambridge and New York: Cambridge University Press.

Ironmonger, Duncan and Faye Soupourmas. 2003. “Married Households and Gross Household Product.” In *Marriage and the Economy*, ed. Shoshana Grossbard-Shechtman. Cambridge and New York: Cambridge University Press.

Kaufman, Bruce E. and Julie L. Hotchkiss. 1999. *The Economics of Labor Markets*. Fort Worth: Dryden Press, fifth edition.

Keeley, Michael C. 1977. "The Economics of Family Formation: An Investigation of the Age at First Marriage." *Economic Inquiry* :238-250.

Killingswork, Mark R., and Heckman, James J. 1986. “Female Labor Supply: A Survey,” in Ashenfelter Orly and Layard, Richard, eds. *Handbook of Labor Economics*, North Holland, pp. 103-204.

Lancaster, Kelvin J. 1966. "A New Approach to Consumer Theory." *Journal of Political Economy* 74:132-57.

Le Guirriec, Gaelle (2003). “L’Arbitrage Autarcie-Marche et la Modelisation des Decisions de Production au sein de la Famille.” Ph.D Thesis, University of Paris II.

Lehrer, Evelyn L. 1992. "The Impact of Children on Married Women’s Labor Supply. Black-White Differentials Revisited.” *Journal of Human Resources* 27: 422-444.

Lundberg, Shelly and Robert A. Pollak. 1993. “Separate Sphere Bargaining and the Marriage Market.” *Journal of Political Economy* 101:988-1010.

Manser, Marilyn and Murray Brown. 1980. "Marriage and Household Decision-Making: a Bargaining Analysis." *International Economic Review* 21:31-44.

McElroy, Marjorie B.(1990), “The Empirical Content of Nash-Bargained Household Behavior” *Journal of Human Resources* 25:559-83

McElroy, Marjorie B. and Mary Jane Horney. 1981. "Nash Bargained Household Decisions: Toward a Generalization of the Theory of Demand." *International Economic Review* 22:333-49.

Mincer, Jacob. 1962. "Labor Force Participation of Married Women: a Study of Labor Supply." In *Aspects of Labor Economics* ed. H. Gregg Lewis. Princeton, N.J.: Princeton University Press.

_____. 1963. "Market Prices, Opportunity Costs, and Income Effects." In *Measurement in Economics* ed. C. Christ. Stanford, CA: Stanford University Press.

Mortensen, Dale T. 1988. "Property Rights and Efficiency in Mating, Racing, and Related Games." *American Journal of Sociology* 94:S215-S240.

Pencavel, John. 1998. "The Market Work Behavior and Wages of Women: 1975-94." *Journal of Human Resources* 33:772-884.

Robbins, Lionel. 1930. "On The Elasticity of Demand for Income in Terms of Efforts." *Economica* 10:123-29.

Willis, Robert J. 1974. "A New Approach to the Economic Theory of Fertility Behavior." In *Economics of the Family,* edited by T. W. Schultz. Chicago: University of Chicago Press.

Woolley, Frances. 1988. "A Non-cooperative Model of Family Decision Making." Working Paper no. 125. London: London School of Economics.

_____. 2003. " Control over Money in Marriage." in *Marriage and the Economy*, ed. Shoshana Grossbard-Shechtman. New York and Cambridge: Cambridge University Press.