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Adding Grossbard to Grossman: A model of demand for health with household production and marriage markets [1]

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ABSTRACT

According to the Grossman model the demand for health-related goods or services such as medical care varies with the cost of their substitutes produced in the household. This paper contributes to the literature on the demand for health-related products by simultaneously considering substitution between household-produced items and commercial health-related products and substitution between goods produced at home by oneself and by one's spouse or partner. New variables that can help explain demand for medical care and other health products are identified, including sex ratios in marriage markets and exogeneous parameters that influence sex ratios such as gender differences in mortality and incarceration. It is argued that laws about marriage or divorce may affect demand for health-related inputs and health outcomes such as good health or good nutrition. We examine how demand for health-related inputs may vary according to many traits of men and women who may marry each other and produce goods on each other's behalf. New insights are gained regarding the determinants of the price elasticity of demand for health-related goods such as medical services.

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1.Introduction

When economists analyze health outcomes such as good health, they often refer to the Grossman model of household demand for health (Michael Grossman's (1972a, 1972b), henceforth Grossman 1972). Now fifty years old, the Grossman model recognizes that meta-goods such as good nutrition or good health can be obtained with the help of purchased goods or services such as restaurant meals and doctor visits or they can be produced in the household. Even though Grossman's model was originally formulated for individuals, not multi-person households such as couples, many of the empirical applications of Grossman (1972) are studies of demand for health in couples (e.g. Thomas (1990), Ruhm (2000), and Khanam et al. (2009)). Theoretical models recognizing that individuals make decisions in couple-households have also been inspired by Grossman's model, including Jacobson (20000, Bolin et al.(2001, 2002). However, these demand for health models by individuals in couples don't integrate the following elements: individuals can enter or leave a marriage, unmarried couples can separate, people are part of marriage markets as long as they aspire to be part of a couple, one of the reasons people marry is because they want a spouse to produce healthy home-made meals for them.

By adding Grossbard to Grossman this paper contributes to the literature on the demand for health-related products such as nutritious food and medical care. It simultaneously considers (1) substitution between household produced items and commercial health-related products and (2) substitution between goods produced at home by oneself and by one's spouse. It ties the price elasticity of demand for health-related products to three kinds of substitution in production: substitution between own time and spouse's time, substitution between own time and commercial products and substitution between spouse's time in household production and commercial goods and services. New variables that can help explain demand for medical care and other health products are identified, including sex ratios in marriage markets and the exogeneous parameters that influence sex ratios such as gender differences in mortality and incarceration. It argues that laws about marriage or divorce may affect demand for health-related inputs and health outcomes such as good health or good nutrition. It examines how demand for health-related inputs may vary according to many traits of men and women who may marry each other and produce some goods on each other's behalf.

The Grossbard model first appeared in Grossbard-Shechtman (1984).[2] Both Grossman and Grossbard were students of the founders of the New Home Economics, Gary Becker and Jacob Mincer and were strongly influenced by their writings on the allocation of time, especially Becker (1965) and Mincer (1963).[3] In line with his teachers Grossman assumed that households produce meta-goods that can be produced with the help of goods or services purchased commercially or produced in the household.[4] Grossman-type models of intrahousehold allocation of resources including household production have also been applied to analyze multiple aspects of consumption (e.g. Greenwood et al. (2005)), parental investments in children's human capital, including schooling (e.g. Leibowitz 1974, Cunha and Heckman (2007), and Del Boca et al (2014)), and fertility (e.g Grossman and Joyce 2017). A major implication of these lines of research is that value of time of a household's adults influences decisions such as health, schooling, fertility, or consumption.

Early consumption models considering home production—including Mincer (1962), Becker (1965), Lancaster (1966) and Grossman (1972)--examined *household* consumption or individual consumption in a one-person household. To the extent that the decision-maker is a household, cooperation between the household members is an underlying assumption [5] and individual consumption preferences are aggregated into household preferences, often without specifying the mechanics of such aggregation.[6] These models are now called unitary. They did not investigate *individual* consumption decisions in multi-person households [7] and ignored possible conflicts of interest between members of a couple, often a battle between men and women.

[2] Grossbard-Shechtman (1984) elaborates on Grossbard (1976), which first modeled household decision-making based on the analogy between marriages and firms and included price of 'wife services' in the context of a polygamous society with very traditional gender roles. The concept of marital surplus introduced by Becker in his theory of marriage (Becker 1973), and his discussion of how this surplus is divided between spouses, is related to the concept of price of WiHo. Choo and Siow (2006) have tried to estimate how the marital surplus is divided in a model without household production.

[3] For more on the New Home Economics see Grossbard-Shechtman (2001).

[4] In turn, Mincer and Becker may have been inspired by earlier "Home Economics" analyses of consumption linking household consumption and household production (e.g. Margaret Reid (1934) and Hazel Kyrk (1953)). Becker called these meta-goods 'commodities' and many, including Grossman, followed in his footsteps.

[5] In heterosexual households that cooperation could be based on consensus regarding the roles of men and women: for instance, they may agree that women do the laundry and other cleaning and that men do all the wage-earning (see Lundberg and Pollak 1993).

[6] In the "Rotten Kid theorem" Becker (1974, 1981) adds assumptions that specify a scenario under which a household could act in its collective self-interest even if some of its members are purely selfish. These added assumptions are not found in Becker (1965) or Grossman (1972).

[7] Grossman (1972) is a consumption model to the extent that it models household demand for health care services. It can be categorized as a "unified household model" using a term introduced by Cheryl Doss (1996). Earlier *unified models of household decision-making,* such as Samuelson's (1956), did not include the possibility of

Grossbard-Shechtman (1984) is a non-cooperative model inspired by what is probably the first non-unitary model of individual in-couple consumption, namely Becker's (1973) Demand and Supply model of marriage. Grossbard expanded on Becker's theory of marriage by introducing the concepts of WiHo (Work-in-Household) and its price (Grossbard-Shechtman 2003). This non-unitary model recognizes that men and women inside a couple-household have separate utility functions and make their own decisions. Other non-unitary models of consumption include McElroy and Horney's (1981) and Manser and Brown's (1980) bargaining models and collective models such as Bourguignon and Chiappori (1992) and Chiappori (1992). Of these non-unitary models GS 1984 is the only one that assumes possible non-cooperation over production within a household.[8] In Grossbard-Shechtman (1984) the analogy between firms and households is pursued further than in Mincer (1963) and Becker (1965). It assumes non-cooperation between workers and non-workers: those who work at household production start out with interests opposed to those who employ the household production workers when it comes to how much to pay for work. Preferences regarding willingness to produce often conflict with preferences involving the willingness to compensate a spouse or partner for their work in household production. Such opposing interests are also found in labor markets: workers want a higher pay; employers would rather pay less.

The rest of this paper is organized as follows. Section 2 presents the theoretical model that motivates our analysis. Section 3 presents testable implications regarding the determinants of health-related consumption. Section 4 contains the conclusion.

2. Theoretical framework

This model is based on the work-in-household (WiHo) model first presented in Grossbard-Shechtman (1984).[9] WiHo is an activity done by one household member that potentially benefits another member who is in a position to compensate the first member in money or kind. The model is limited to individuals who are either in a heterosexual couple (married or cohabiting) or single

household production. Some unified household models with household production have been applied to farms where food production can be sold outside the household (e.g. Rosenzweig 1986, Singh, Squire and Strauss 1986, Taylor and Adelman 2003).

[8] Apps and Rees (1988, 1997) and Chiappori (1997) have cooperative individualized models based on consensus that include household production. Lundberg and Pollak (1993) is a non-unitary model of consumption that contains non-cooperative elements.

[9] Chapters 2 and 3 in Grossbard (2015) clarify the model.

and potentially in a heterosexual relationship.[10] Grossbard-Shechtman (2003) and Grossbard (2015, Chapter 10) adapted uses the WiHo model to analyze consumption. Here it is adapted to health-related consumption. The model leads to new insights regarding the demand for health-related goods and services that have home-produced substitutes. It throws new light on the determinants of the price elasticity of demand; (2) it leads to predictions regarding possible effects of sex ratios and marriage and divorce laws on the demand for health; and (3) it presents considerations taking account of heterogeneity by education and age.

Central to the Grossbard model of consumption is the distinction between a WiHo-user, the consumer, and a WiHo-worker who performs the work in the household. Consider an individual *i* who derives utility from consuming *Z*, a vector of privately consumed meta-goods related to health that can be produced with three inputs: a vector of commercial inputs *x*, leisure time *s*, and h_j, which stands for WiHo supplied by a (potential) spouse *j*.[11] The WiHo-user is *i* and the WiHo-worker is *j*. Commercial goods or services can be substituted for home-produced goods, such as caregiving of the sick, food preparation or cleaning. Some can be home-produced on one's own. Individuals take all prices as given, including price of spouse's WiHo y_j and own wage w_i. The individual is either in couple or single.

The demand problem that a consumer agent, *the WiHo-user*, faces is:

$$\begin{cases} Max \mathrm{U}_i(Z_i) subject\ to \\ Z_i = Z_i(x_i, s_i, h_j) \\ 1 = l_i + s_i \\ I_i + w_i l_i = y_j h_j + p_i x_i \end{cases}$$

where *l* are hours of work outside the home, *I* is individual non-work income (not household income) and *p* is the price of commercial inputs. Total time available to an individual is set to equal 1. Spouse's income is one of the aspects of the heterogeneity of (potential) spouses. The individual is selfish in the sense that (potential) spouse's private consumption does not affect own utility. The consumer solves this problem to establish a demand for leisure (and supply of labor), a demand for a spouse's WiHo, and a demand for commercial products.

[10] The model can be expanded to include same-sex couples.

[11] We do not include public goods to the couple and assume that all meta-goods are health-related. These assumptions could be relaxed.

Independently, agents of type *j*, the *WiHo-workers*, are solving their own optimization problems, A relationship (marriage or cohabitation involving spouses) occurs when an agent *i* has a positive demand for a spouse *j*'s WiHo and one agent's demand matches the other's supply at given market prices of WiHo.[12] Relationships involve exchanges of work-in-household (WiHo) to a partner for some compensation for this work by the partner. The compensation may take the form of a monetary transfers or can be in kind.[13] This internal (potential) compensation enters the problem above in the form of $y_j h_j$.

Appendix A solves the problem of the WiHo-user and derives Equation 1, an individual *i'*s demand for commercial product x_i. The solution is an individualized adaptation of a similar unitary analysis of a household's demand taught by H. Gregg-Lewis in a graduate labor course at the University of Chicago in 1973-1974.

$$\dot{x} = \frac{I}{F}\dot{I} - (\alpha_x^Z + \alpha_s^Z \sigma_{xs} + \alpha_h^Z \sigma_{xh})\dot{p} + [\frac{w}{F} + (\sigma_{xs} - 1)\alpha_s^Z]\dot{w} + (\sigma_{xh} - 1)\alpha_h^Z \dot{y}_j. \quad (1)$$

The solution depends on the assumption that production function Z_i has constant returns to scale and involves the consolidation of the time constraint and the individual income constraint into a full income constraint, using Becker's (1965) definition of full income, namely $F_i = I_i + w_i = \pi_i Z_i$, where I_i is the individual's non-work income and π is the implicit price of the composite meta-good consumed by the individual. From here on the subscript *'i'* is omitted in order to make the presentation less cumbersome. However, subscript *j* is kept, to make it clear that this regards the price of a spouse's WiHo, not own WiHo.

The demand for goods and services x is expressed in percentage changes denoted by dotted letters. Each term preceding a dotted letter on the Right-Hand-Side (RHS) of Equation 1 is an elasticity of demand. From left to right the terms in parentheses are own income elasticity of demand, price elasticity of demand (what most people mean by elasticity of demand), wage elasticity of demand and elasticity of demand with respect to the price of WiHo. The price elasticity of demand corresponds to graphical presentations of demand. The other three elasticities

[12] Marriage is monogamous. However, this model could be extended to include polygamy.
[13] This assumption implies transferable utility using the language of some other models of allocation of time in couples. For further details on optimization by WiHo-workers see Grossbard-Shechtman (2003).

correspond to the size of shifts in demand.

Each elasticity is now examined in more detail.

2.1 Income effect. The income effect in Equation 1 is the effect of the WiHo-user's income on his or her demand for goods. It is the term preceding $\dot{x} / \dot{I}$, i.e. the percentage change in quantity demanded divided by the percentage change in income. It equals $\frac{I}{F}$, i.e. individual (non-work) income divided by individual full income. The income elasticity is positive given all the assumptions stated above and in the appendix.

Here we just look at the effect of one spouse's income, holding the other spouse's income constant. Any redistribution of income within the household that causes changes in personal income will be associated with effects on relative consumption. For example, the UK government switched from paying child subsidies to fathers towards paying them to mothers. Using this formulation the policy change means that after the switch non-work personal incomes of mothers rose and non-work personal incomes of fathers declined. With each individual man or woman maximizing their personal utility women will consume more and men less than before the switch. The policy switch will thus lead to a decrease in men's relative private consumption, which is what Lundberg et al. (1997) finds. Likewise, Thomas (1990) finds that if non-work income is in the hands of mothers, children are more likely to benefit than if it is in the hands of fathers. It is expected that most income elasticities of consumption of health-related commercial goods will also be positive.

2.2 Price elasticity of demand. The price elasticity of demand for goods or services x_i is the coefficient of $\dot{p}_i$, the second term on the RHS of Equation 1:

$$\dot{x} = -(\alpha_x^Z + \alpha_s^Z \sigma_{xs} + \alpha_h^Z \sigma_{xh}) \dot{p}$$

The price elasticity is preceded by a minus sign, which is what we expect: a negative price elasticity of demand. It has three components. The first component is *a full income* effect that depends on α_x^Z, the weight of commercial goods in the cost of producing meta-health *Z*. The second terms is an effect of *substitution in production* between commercial products and the

individual's own time: it includes σ_{xs}, the elasticity of substitution in production between goods *x* and own time *s*, and α_s^Z which is the share of own time in the cost of producing *Z*. The third term shows the effect of *substitution in production* between commercial products *x* and spouse's WiHo and is equal to the product of that elasticity of substitution, σ_{xh}, and of the share of WiHo in the cost of producing *Z* (α_h^Z). It follows that

The elasticity of demand for x *will be larger* (*in absolute terms*) *the higher the elasticity of substitution in production between commercial product x and spouse's WiHo*. This implies that the more consumers can rely on a spouse to satisfy their needs for *Z*, the higher the price elasticity. The elasticity of demand is therefore a function of relationship status (married, cohabiting, or single) since in the short run people who live alone don't have the option of using WiHo as an alternative to commercial inputs. Singles need to first actively enter the couple formation markets (often called marriage markets). This is similar to the position of a firm who is potentially interested in hiring a worker and may or may not actively enter the labor market to search for workers. For individuals in couples price elasticity of demand depends on the degree to which an individual relies on a partner/spouse to produce their ultimate consumption needs *Z*.

Differences in elasticity of demand due to differences in relationship status are potentially important. The lower consumers' elasticity of demand the more firms can take advantage of the consumers by charging them higher prices for the product they sell. For example, if consumers really need a drug such as insulin, their demand will be inelastic and drug firms with some monopoly power are likely to charge them more than they charge for a product with a more elastic demand.

It follows from this model that in places with *higher proportions of singles (such as Manhattan) certain medical services that have WiHo-produced substitutes will be more expensive than in places where a higher proportion of the population is in couple.*

Equation 1 also implies that *commercial products that can more easily be produced with WiHo will have a more elastic demand than products that cannot be easily produced with WiHo*. For instance, it is easier to get a spouse to produce a well-balanced meal at home than it is to get a spouse to recreate the atmosphere of a bar. It follows that the demand for family-style restaurant

meals will be more elastic than the demand for bar services.[14]

According to Equation 1 the effect of σ_{xh}, the elasticity of substitution in production between commercial products *x* and WiHo, on the price elasticity of demand depends on α_h^Z, the share of WiHo in total costs of producing Z. This means that the more an individual *i* relies on WiHo in the production of *Z* the more elastic his demand for *x.* For instance, if *Z* is clean garments, an element entering the production of good health, this can be produced by a spouse doing the laundry (WiHo) or the individual buys commercial laundry services. The more the individual has access to WiHo, the more her demand for commercial laundry services will be elastic. Also, the higher the share of a (potential) spouse's WiHo in fulfilling one's needs for good nutrition, the more elastic the person's demand for frozen dinners and other commercial products that substitute for spouse's WiHo. Generally, it is predicted that the more people can rely on spouses to perform WiHo benefiting them, the less they will be willing to pay for commercial WiHo-substitutes.

One application of this insight is to gender differences in consumption. So far gender was not specified in this discussion. Now we add the assumption of traditional gender roles. In every country for which we have time use data, it has been documented that women engage in considerably more domestic chores than men (e.g. by Hersch 2003, 2009; Gimenez-Nadal and Sevilla-Sanz 2012). This implies that men can rely on women's WiHo more than women can rely on men's WiHo. Therefore, it is generally the case that the share of WiHo costs α_h^Z will be lower for women than for men. It follows that:

Relative to men, women will have lower price elasticities of demand for commercial goods that substitute for a spouse's WiHo.

Predicted gender differences in elasticity of demand for various products are interesting in and of themselves. In addition, they may lead to gender differences in product prices charged by the firms selling the products. The more we observe that men can rely on a spouse's WiHo more than women, the more related industries could discriminate against women as consumers of commercial goods and services. One application of this idea is to gender differences in food-related consumption.

[14] Oana Tocoian points out that restaurants may also price discriminate in terms of spousal WiHo availability when they issue coupons that can't be used by single customers, such as "free entree with purchase of another" or "dinner for two for X dollars." (personal communication).

Women spend more time than men in food preparation, often as a form of WiHo. This will affect food-related industries that supply products specifically aimed at men or women. Women's demand for these products may be less elastic than men's. It follows that women can be expected to be charged higher prices for female-oriented food products relative to what men pay for male-oriented products. Take the example of food-away-from home (FAFH). It is predicted that outlets selling FAFH that is more popular among men (fast food hamburgers for instance) face a more elastic demand than outlets selling FAFH that is more popular among women (vegan grill for instance). It follows that women may be charged more than men for their favorite type of FAFH, if firms have some monopoly power.[15] USDA data shows that over the last 30 years FAFH expenditures have increased at a steady rate, relative to food-a-home (FAH) expenditures.[16] These statistics on FAFH are not broken down by kinds of food (such as hamburgers versus vegan food, for example). We also know that the overall price index for FAFH reached its peak in about 1978 and then declined slowly until about 1998 and had remained about the same until about 2007 (Christian and Rashad 2009).[17] [18] These ideas are fertile ground for further research.

Furthermore, the model helps us understand why women's demand for cigarettes is less elastic than men's: Hersch (2000) finds that when calculating elasticities of consumption of cigarettes for a sample of workers, and thus including personal earnings (rather than household income) in the regressions, women's price elasticity of demand (-.38) is lower than men's (-.46 ; also see Chaloupka and Pacula, 1998). When the price of cigarettes increases smoking habits become more costly and people may be more motivated to detoxify from smoking. DeCicca et al. (2008) follow young adults over a period of 8 years and find that some evidence that higher taxes are associated with increased smoking cessation. Successful cessation may benefit from commercial services such as patches or clinics or from the intervention of a spouse who either nags or encourages you. If men are less supportive of their wives than women are of their husbands when it comes to helping a spouse kick the smoking habit, and more generally men in couple are less likely to provide this type of WiHo than women in couple, women will have more of a demand for products helping them stop the habit. They may also find it costlier and more difficult to free

[15] Again, this assumes that sellers can take advantage of buyers' less elastic demand.
[16] See Davis (2014) for a review of FAH versus FAFH and the implications for nutrition and Health.
[17] Prices may be stable if supply side outpaced the demand side, assuming nothing else on the demand side changed.
[18] The demand for frozen dinners aimed at children is expected to be very price-elastic as both mothers and fathers may possibly substitute for their children's cooking activities

themselves from smoking after the price of cigarettes rises. Therefore, price increases are expected to cause less change in women's consumption of cigarettes than in men's. It is also expected that women's demand for commercial anti-smoking products and services will be less elastic than men's.[19] Some of these insights may also apply to singles expecting to become part of a couple. The expectation that in the future there will be WiHo available to quick the habit will influence current consumption.

An additional prediction related to demand for health-related services is about gender differences in long term care, or more generally caregiving in organized facilities. To the extent that men are less likely to be caregivers of their sick spouses/partners one expects women's demand for long term care and long-term care insurance to be higher than men's, controlling for all relevant variables such as income and age. Evidence consistent with this prediction can be found in Van Houtven et al. (2015). They found that men are less likely to purchase LTCI (Long-Term Care Insurance) than women. Furthermore, women's demand for own formal care will be less elastic than men's.[20] Consequently, they may get charged more for similar services.

A further example is about laundry, another factor related to health, especially during pandemic times. Men do their wives' laundry much less frequently than women do their husbands' laundry. According to the American Time Use Survey, in 2012 men age 20-55 spent an average of 5.58 minutes a day on doing laundry, in contrast with 19.37 minutes for women (this gender gap has decreased a bit since 2003, when the numbers stood at 4.39 minutes for men and 20.74 minutes for women).[21] It has also been observed that dry cleaners and commercial laundries often charge different prices to men and women for similar items (shirts and blouses, for example).[22] These two facts are related according to this theory: dry cleaners often charge more for women's blouses than for men's shirts, even if costs of production are the same, because they act as discriminating local monopolies taking advantage of the fact that women's demand is less elastic than that of men. It also follows that if women typically engage in more home cleaning than men, men's demand for commercial maid services will be more elastic than women's and women may

[19] A spouse's time is likely to be a better substitute for the time of professional services than is the case with own time.
[20] One of the reasons why women are less likely to be able to count on husbands as caretakers in old age is that men are often older than women at the time of marriage and that men tend to have lower life expectancy.
[21] Thanks to Victoria Vernon for calculating these numbers.
[22] Barbara Bergmann, personal communication. Her observation is based on data she collected with the help of students in the Washington, DC area. Some states, including California, have banned gender-based price differentials in dry-cleaning services (see also Cohen 1999).

need to pay more than men for a given quantity of commercial maid services (this may be very difficult to test for lack of data).

Furthermore, good health is related to paid domestic help, often a substitute for caregiving WiHo and other household production (see Stancanelli and Stratton 2013). Early in the twentieth century rising incomes in the U.S. were associated with rapid increases in employment of servants, implying a high income elasticity of servants' services (Stigler, 1946). As servants became increasingly expensive and new technologies sprung up there has been rapid growth in many other substitutes for household production, such as frozen meals and appliances, including microwave ovens (see Greenwood et al. 2005). There is potential for much more research on how this theory helps understand the demand for domestic help.

2.3 Wage effects. Equation 1 also includes an elasticity of demand for *x* with respect to own wage, i.e., the coefficient of $\dot{w}$: $\frac{w}{F}+(\sigma_{xs}-1)\alpha_s^Z$. This elasticity contains a real income effect $\frac{w}{F}$ and a substitution effect $(\sigma_{xs}-1)\alpha_s^Z$ based on substitution between own household production time (leisure) and goods and the share of such leisure in the cost of production of private consumption meta-good *Z*. The higher the wage, the more expensive own time at home production and the more inclined the individual will be to rely on commercial goods instead. The wage effect will definitely be positive if σ_{xs}>1. *If* elasticity of substitution σ_{xs} is less than 1, then the wage elasticity has a positive component (the real income effect) and a negative component (the substitution effect). That substitution effect depends on α_s^Z, the share of own time in the cost of producing *Z*. The wage effect will be positive as long as $\frac{w}{F}>|(\sigma_{xs}-1)\alpha_s^Z|$.

2.4 Effects of the Price of a Spouse's WiHo. It also follows from Equation 1 that the demand for commercial products is a function of price y_j that the individual has to pay for a spouse's WiHo. The coefficient of $\dot{y}_j$ is the elasticity of demand with respect to spouse *j*'s WiHo price y_j and it equals $(\sigma_{xh}-1)\alpha_h^Z$, where α_h^Z is the share of WiHo in the individual's cost of producing own *Z* and σ_{xh} is the elasticity of substitution in production between commercial goods and WiHo. This term will be positive as long as σ_{xh} exceeds 1. A positive elasticity of demand with respect

to the price of WiHo implies that the demand for a commercial good or service increases when the price of WiHo rises. The more the individual uses a spouse's WiHo and the higher the elasticity of substitution in production between WiHo and goods or services the more his demand for commercial goods is likely to respond to changes in WiHo price. The elasticity of demand for health products with respect to the price of WiHo also includes a negative real income effect.

There are no data on WiHo prices. However, we can use the model to make predictions regarding how possible shifts in factors expected to influence the WiHo price could affect the demand for health-related goods such as frozen meals or services such as visits to the doctor. In the next section we identify a number of factors that could be associated with variation in the price of WiHo, and therefore with variation in health-related consumption.

3. Demand for health-related goods and factors affecting equilibrium in marriage markets.

In this section we examine the following factors related to the market price of WiHo: sex ratios, laws related to marriage and divorce, and variation in WiHo price due to differentials associated with personal traits such as education and weight.

3.1 Sex Ratio Effects.

Sex ratios affect aggregate demand and supply in markets for WiHo and therefore the presumed equilibrium price of WiHo (more on that in Grossbard 2015, Chapter 4). To the extent that gender roles are traditional, higher sex ratios (when women are scarcer relatively to the men in the same marriage market) imply higher prices for women's WiHo, *y*. In turn, under traditional gender roles such higher price *y* implies (a) higher disposable income for women and lower disposable income for men, and (b) a higher demand for goods and services *x* to the extent that goods and WiHo are strong substitutes.

a/ It follows from this expected gender differential in income effects that a rise in the price of WiHo is more likely to contribute to increases in women's income than to increases in that of men. From this standpoint it is predicted that

The higher the sex ratio the more women will consume relative to men. This is expected to affect both individuals in couple (married or not) and singles preparing themselves for couple formation.

b/ gender differentials in the effects of sex ratio on consumption may also occur as a result of gender differences in the elasticity of substitution in production between WiHo and commercial

goods and services. If men find it easier to substitute between *x* and WiHo their demand for fast food, for example, will shift more with a given percent change in sex ratio than it will in the case of women who may have fewer options to substitute between home production by a spouse and production by commercial firms. This substitution effect of changes in price of sex ratio may thus differ for men and women, but it is likely that for all individuals the substitution effect of price of WiHo is positive.

Adding the income and substitution effects possibly following changes in sex ratio it is likely that women become relatively scarcer and the price of women's WiHo increases they will consume more health-related products. Price of men's WiHo may possibly decrease which implies a positive net income effect for women but a substitution effect towards fewer goods and more men's WiHo. Predictions linking sex ratios to individual consumption also follow from a number of other theories of marriage, including Becker (1973), McElroy (1990), and Chiappori et al. (2002). However, these theories do not distinguish income from substitution in production effects.

Evidence regarding sex ratio effects have to be based on exogeneous changes in sex ratio. One source of exogeneous change originates from changes in selective abortions of female embryos.[23] This occurred in China after the introduction of the one-child policy, and many parents preferred just to have one son. Many years later, when the children grew up, it appears that women's relative consumption benefited from higher sex ratios: Maria Porter (2014) reports that as women are scarcer in marriage markets men consume less tobacco and alcohol. Since most tobacco and alcohol is consumed by men it was easy to determine that such consumption benefits men. Studies of personal consumption in couples have also examined spending on children, even though goods bought for children or children outcomes benefit both husband and wife. However, prior research has shown that increases in female income or greater female control of household assets leads to greater investment in children (e.g., Thomas 1990, Brown 2009). Porter also establishes that in China higher sex ratios are associated with healthier sons and she shows that this not fully explained by the characteristics of the parents. She then infers that higher sex ratios

[23] Sex ratios can also change across cohorts. This could be due to growth or drops in number of children born in a given year, even if the ratio of boys to girls born in a given year does not change, given that on average at marriage men tend to be older than women (see Grossbard-Shechtman and Granger 1998). Other possible sources of exogeneous changes in sex ratio include fluctuations in the number of male and female immigrants (see e.g. Angrist 2002), fluctuations in incarceration rate (see e.g. Craigie et al 2018) and in the mortality rate of young men and women, as was the case when HIV/AIDS hit men (including bisexual men) considerably more than women (see e.g. Hakak and Pereda 2021).

give women more access to the couple's resources, which they apparently prefer to spend on their sons' health. This is also indirect evidence that sex ratios are positively associated with married women benefiting more from the household's consumption relative to their husbands.

In addition, Grossbard-Shechtman (1984) also implies that sex ratios will affect the consumption of unmarried men and women. Whoever plans to marry—whether it is a first marriage or a later marriage—may be aware of current WiHo prices, whether they consider supplying or consuming WiHo (or both). Consequently, spending habits of singles will be influenced by expected future earnings from WiHo (if WiHo-suppliers) or expected future expenses (if WiHo-users). For instance, given a traditional division of labor in the home, young single women expecting high prices for WiHo (due to a high ratio of males to females) will spend a higher portion of their current income on private consumption (e.g., expensive clothing, and travels abroad) than comparable women expecting lower WiHo prices. In contrast, unmarried men expecting to pay high WiHo prices to their future wife will spend less on themselves and save more if they intend to marry. Grossbard and Pereira (in Grossbard 2015, Chapter 11).

3.2 Effects of marriage and divorce laws.

Changes in laws regulating marriage or divorce could cause shifts in the demand for health-related products and affect the price of WiHo. Consider the case of a country or state that switches its marital property regime from a system of separate property to one of community property. Under separate property, each spouse owns what he or she paid for; under community property all property acquired during the marriage is jointly owned by the spouses/partners and if the couple separates or divorces they each get half of the assets.[24] This is likely to increase the financial settlement of the lower earner in a couple that dissolves due to death or divorce/separation, and due to the popularity of traditional gender roles, the lower earner is more likely to be the WiHo-worker and a woman. Consequently, relative to men who use women's WiHo, women working in WiHo are more likely to gain from a switch from separate property to community property. This has the following predicted implications for demand for health-related goods or services that possibly substitute for WiHo.

First, the *switch from separate property to community property* causes income effects

[24] In a few countries community property also includes what was acquired prior to the marriage (see Ekert-Jaffe and Grossbard 2008)

affecting both the demand for goods and the supply of WiHo. It increases the price of women's WiHo and makes such WiHo used by men more expensive. As a result, men are likely to switch from WiHo-produced goods to commercial goods and services (a substitution effect) and they will likely experience a drop in their real income if they have less access to marital property. The net effect on men's health is likely to be negative. Second, women are likely to experience a positive income effect. This may a/increase their demand for commercial health products and b/ reduce the time women spend exercising or otherwise producing their own health as their value of time rises.

Partial and preliminary evidence for these predictions can be found in a MA thesis by J. Wikstrom (2017) who performed a difference-in-difference analysis using English data from before and after the White versus White case, which introduced equal division of marital property in England. He finds that after the reform married women use more health services than before the reform. However, they devote less of their time to physical training.[25] No changes in usage of health services and time at physical training is found for married men.

Next, consider a country or state introducing *unilateral divorce*, the initial regime being one that required mutual agreement between the spouses. This legal change tends to discourage individuals from supplying WiHo of benefit to a spouse because supply implies a cost of foregone earnings to WiHo-workers and prior to unilateral divorce WiHo-workers may have considered themselves more protected about their long-term sources of income and in-kind provision of goods and services for their private consumption. Under traditional gender roles, this is expected to reduce supply of WiHo by women more than by men. Indeed, Stevenson (2007) finds that unilateral divorce is associated with a decrease in household production on the part of women; Roff (2017) finds that both men and women reduced the amount of their time devoted to household work after this legal change. This is expected to be accompanied with higher demand for commercial goods and services that replace household production. A switch from divorce by agreement to unilateral divorce is expected to influence the price of WiHo of men and women. To the extent that it leads to shifts in supply of WiHo by both men and women it is likely to raise the price of WiHo. Given traditional gender roles this increase in price of WiHo will affect men negatively more than women, since they start out with a higher share of costs of production of Z in the form of WiHo expenses. We end up with less reliance on WiHo, especially for men.

[25] Training is a binary variable that equals 1 if the respondent practices at least once a week, and zero otherwise. Usage of health services is a binary variable that equals 1 if the person used health services in the past year.

Researchers have also looked at the impact of passage of joint custody laws (typically replacing laws that automatically granted custody to mothers). Consider a country that switches to joint custody. This legal change may reduce the demand for WiHo by the WiHo-user while the WiHo-worker obtains more leisure hours but experiences a decrease in her disposable income. This may lead to a drop in her demand for commercial goods and an increase in the time she spends exercising or otherwise producing her own health. When interacting the effect of unilateral divorce with that of joint custody, Roff (2017) finds that the increase in fathers' share of household work in response to unilateral divorce is driven by the growth in the share of household work among fathers in states without joint custody. Apparently, if fathers face a higher cost of divorce due to possible loss of contact with their children, they make more efforts to accommodate their spouses and perhaps avoid divorce. Bolin et al. (2001) find that after the passage of joint custody in Sweden in 1998 there was an increase in child support paid by one parent to the other, who cares more for children. This can be could be interpreted as a change in the price of WiHo.

3.3 Heterogeneity: differences by gender, age, education etc.

There is extensive heterogeneity among participants in marriage markets. WiHo-workers and WiHo users differ along a number of traits (see Chapter 6 in Grossbard 2015). Any personal characteristic that influences the price that WiHo users are expected to pay to WiHo-workers will be associated with differences in demand for commercial products that substitute for health-related WiHo. This includes factors associated with higher productivity in home production and with compensating differentials established in markets for WiHo.

Characteristics known to be associated with labor productivity in general, such as education, knowledge, and non-cognitive skills, are also expected to influence productivity in WiHo. Physical attractiveness may be an element of productivity if people form couples in part to have children together and future children's looks are a function of the genetic attributes of both members of a couple. The combination of traits of self and partner may contribute to productivity in WiHo.

To the extent that skills leading to higher productivity are appreciated by many, these skills are part of a person's 'general human capital' (see Becker 1964). Consequently, more productive individuals are likely to be paid more for their WiHo. They are also expected to have a higher

income and part of that higher income will allow them to spend more on their own health. This is one reason why individuals who are more productive at WiHo are expected to be healthier.

Furthermore, just like in labor markets, we may observe *compensating differentials* in markets for WiHo. WiHo price can vary due to variation in the willingness of WiHo workers to supply their labor to various types of WiHo-users. Such variation in willingness to supply can be expressed mathematically via a supply of WiHo function (see Grossbard-Shechtman 1984, 2003). The intuition is as follows: less attractive WiHo-users are expected to pay WiHo-workers of given quality more, as they compete with more attractive WiHo-users in the same markets for WiHo.

For instance, if most people consider good looks as an attractive trait, then WiHo users lacking these traits will have to pay WiHo prices that exceed the prices paid by good-looking WiHo-users. In a market for women of given quality, for example, the supply of WiHo to more attractive men will lie to the right of their supply of WiHo to less attractive men.

If demand is the same then the price paid by less attractive men exceeds that paid by more attractive men. Such differentials in price of WiHo are likely to help explain differences in individual consumption, including consumption of health-related products: the more a WiHo worker gets paid, the more she or he will spend on goods and services that promote her health.

Attractiveness is not easy to measure. A number of empirical studies have measured attractiveness in terms of optimal weight and used this measure to study labor supply. For example, Oreffice and Quintana-Domeque (2012) investigates the relationship between individual levels of physical attractiveness and hours worked in the labor market by married men and women. They find that the less attractive the person, the more hours he (she) works relative to his (her) spouse. Grossbard and Mukhopadhyay (2017) find that an increase in BMI (body mass index) increases the hours worked by white married women, but do not find the same results for men.

One could possibly estimate the association between attractiveness (measured in terms of optimal weight or otherwise) and individual health of members of a couple. It is possible that the less attractive member of a couple obtains fewer of the couple's resources to spend on improving their health (or attempting to reverse the negative impact of aging). This could affect singles as well as members of a couple. Attractiveness influences the price of WiHo and raises current or future real income of WiHo-workers. This may raise WiHo-workers' consumption of goods and services. Furthermore, having to work more in the labor market, less attractive people may have less time to exercise (if working in sedentary jobs) and eat, possibly increasing their consumption

of fast food. These are also factors that injure individual health status. As for less attractive WiHo users who are paying more for WiHo due to compensating differentials, their consumption of health-related products may be affected in at least two ways: due to a real income effect they are likely to be less able to afford goods and services that make them healthier and due to a substitution effect they may switch from using WiHo to relying on commercial substitutes.

Another trait that is associated with productivity, preferences, and compensating differentials is older age compared to the spouse's age. One expects the *personal consumption of women in couple with substantially older men to be higher than the personal consumption of comparable women married to men closer to their own age*. There is evidence supporting this expectation in Browning et al. (1994) in terms of assignable consumption such as clothing. Also consistent with the prediction is Woolley's (2003) finding that in Ottawa, Canada, women married to substantially older men were more likely to be in charge of withdrawing cash from bank accounts than women married to men closer to their own age,[26] and findings on compensating differentials by age and labor supply reported in Grossbard-Shechtman and Neuman (1988).[27] Van Houtven et al. (2021) find that wealth and the husband being substantially older than the wife add to the probability that both spouses purchase a Long-Term Care Insurance (LTCI). That the wife is more likely to purchase such insurance makes sense since the age differential makes it less likely to still have a husband when she needs care at an older age; that the husband is more likely to purchase such insurance may be related to the wife's high price of WiHo due to compensating differentials and her ensuing lower willingness to care for a needy husband.

It is also possible that having a substantially older wife/partner is associated with men's personal consumption. There is less research on that topic for this age difference is less common.

[26] Presumably, whoever is more likely to withdraw cash is also more likely to consume their favorite items relatively to what their spouse prefers.

[27] The prediction of compensating differentials in marriage does not follow from matching models of marriage that assume a continuum of individual men and women varying in their characteristics, such as Becker's matching model (1974) and Roth and Oliveira Sotomayor (1990), nor does it follow from household production models where individual producers of household production do not own portable general human capital and therefore cannot move from one marriage to the next.

4. Conclusion

The Grossman model recognizes that the demand for health-related goods or services such as restaurant meals and medical care varies with the cost of their substitutes produced in the household. By adding Grossbard to Grossman this paper contributes to the literature on the demand for health-related products such as nutritious food and medical care by simultaneously considering (1) substitution between household produced items and commercial health-related products and (2) substitution between goods produced at home by oneself and by one's spouse or partner. New variables that can help explain demand for medical care and other health products are identified, including sex ratios in marriage markets and the exogeneous parameters that influence sex ratios such as gender differences in mortality and incarceration. It is argued that laws about marriage or divorce may affect demand for health-related inputs and health outcomes such as good health or good nutrition. We examine how demand for health-related inputs may vary according to many traits of men and women who may marry each other and produce some goods on each other's behalf. New insights are gained regarding the determinants of the price elasticity of demand for health-related goods such as medical services.

This paper suggests numerous avenues for further research. Such research needs to address challenges such as measurement problems and possible endogeneity between many of the variables that are considered. Measurement problems include difficulties in measuring health outcomes, home-produced health inputs such as good nutrition, Work-In-Household, and the price for such work. However, the good news is that many previous studies have addressed at least some of these problems. Endogeneity is a rampant problem in household economics, including applications to health economics. For example, it makes it difficult to disentangle causality in studies of association between marital status and health (see Averett et al 2013). Consider health indicator normal weight (as opposed to obese). Healthier people are more likely to be in a couple (being healthy may be attractive). It is also true that people are more likely to gain weight after a couple is formed, as the cost of a healthy meal may be lower if the spouse provides WiHo and returns to scale kick in. Furthermore, if you are married and care for others, you may not be healthier (Cheng et al. (2021), Zamarro and Prados (2021), Umberson and Williams (2005), Schmitz and Stroka (2013)).

Caregiving is a major form of WiHo. Possible beneficiaries of the caregiving discussed here span a wide range of ages. Caregiving benefiting the very young and the very old can be a

form of in-couple WiHo to the extent that one person takes care of dependents their spouse or partner loves. Growing proportions of elderly need care and parents of young children find it very challenging to combine work and family. There is a tendency in modern societies to expect that the state will resolve all needs for caregiving.

To the extent that our societies decide to encourage more in-family caregiving it may be necessary to revamp our legal system. There is a tendency for the legal system in modern societies to condemn those who provide WiHo in return for financial incentives, as documented e.g. by Viviana Zelizer (2007). WiHo-workers may need to be compensated better by other household members who benefit from their work directly or indirectly, because they love the care recipients. Our legal systems can do much more to encourage caregiving in families.

Appendix A

DERIVING AN INDIVIDUAL DEMAND FOR GOODS (source: Grossbard-Shechtman 2003; adapted from class lectures by H. Gregg-Lewis at the University of Chicago, 1973-74)

The demand for input *x* is derived from the consumer optimization problem presented in Section 3.[28] The subscript used for the WiHo-user is *i* and for the WiHo-worker *j*.

$$\begin{cases} Max \mathrm{U}_i(Z_i) subject\ to \\ Z_i = Z_i(x_i, s_i, h_j) \\ 1 = l_i + s_i \\ I_i + w_i l_i = y_j h_j + p_i x_i \end{cases}$$

where *Z* is a vector of privately consumed goods that individual *i* can produce with three inputs: a vector of commercial inputs *x*, leisure time *s*, and h_j, which stands for WiHo supplied by a (potential) spouse *j*. Leisure is own time in household production. It is assumed that the production function has Constant Returns to Scale.

In the context of a micro model with many types of WiHo-users *i* and many types of WiHo-workers *j* the problem becomes:

$$\text{Max } U_i(Z_{ij})$$

$$\text{subject to } Z_{ij} = Z_{ij}(x_{ij}, s_{ij}, h_{ji}),$$

$$1 = l_{ij} + s_{ij},$$

$$\text{and } I_{ij} + w_{ij} l_{ij} = y_{ji} h_{ji} + p_i x_i$$

[28] The model also leads to a demand for WiHo contributed by a spouse, *hj*, and a supply of labor *li*. The model could be extended to include the derivation of a supply of own WiHo, *hj*.

Using the definition of full income found in Becker (1965), the time and income constraints can be restated as full income constraint $F_{ij} = I_{ij} + w_{ij} = \Pi_{ij} Z_{ij}$, where Π is the implicit price of the composite good consumed by the individual. From here on I omit the subscript *'i'* or *'ij'* in order to make the presentation less cumbersome. The following are all personal functions of an individual *i*. I still use subscript *j* for the spouse.

Step 1: the real full income effect on the demand for the product. Assume $F(\Pi) = \Pi Z$. We take the differential, which gives
$dF = \Pi dZ + Zd\Pi$.

We now divide each side by F, which gives $\frac{dF}{F} = \frac{\Pi dZ}{\Pi Z} + \frac{Zd\Pi}{\Pi Z}$. Denoting percentage changes with dots above the letters, we obtain

$$\dot{F} = \dot{Z} + \dot{\Pi}. \qquad \text{(A.1)}$$

Step 2: separating the full income effect into an effect of income and wage. There are two sources of income: non-work income *I* and earnings from wages. Given that this is full income and total time=1 we obtain $F = I + w$. We differentiate: $dF = dI + dw$ and divide both sides by *F*, which gives:

$$\frac{dF}{F} = \frac{IdI}{FI} + \frac{wdw}{Fw} \quad \text{or} \quad \dot{F} = \dot{I}\frac{I}{F} + \dot{w}\frac{w}{F}. \qquad \text{(A.2)}$$

Step 3: decomposing the implicit price effect. We assume that the price of household production, Π , is the average cost, an assumption that is fitting when the production function exhibits constant returns to scale and the marginal cost equals the average cost. Then

$AC = \Pi = \frac{TC}{Z} = \frac{ws + px + yh_j}{Z}$. We take the differential: $d\Pi = \frac{s.dw}{Z} + \frac{x.dp}{Z} + \frac{h.dy_j}{Z}$, and then divide by Π , which gives $\frac{d\Pi}{\Pi} = \frac{s.dw}{\Pi Z} + \frac{x.dp}{\Pi Z} + \frac{h.dy_j}{\Pi Z}$.

Now $\Pi Z = C$. We also divide and multiply *dw* by *w*, *dp* by *p, and* dy_j by y_j. Consequently, $\frac{d\Pi}{\Pi} = \frac{sw}{C}\frac{dw}{w} + \frac{px}{C}\frac{dp}{p} + \frac{hy_j}{C}\frac{dy_j}{y_j}$, which can be denoted as

$$\dot{\Pi} = \alpha_s \dot{w} + \alpha_x \dot{p} + \alpha_h \dot{y}_j, \qquad \text{(A.3)}$$

where α_k is the share of input *k* in the costs of production. We now replace Π in equation A.1 with A.3 and replace *F* with equation A.2. This gives:

$$\dot{Z} = \frac{I}{F}\dot{I} + \frac{w}{F}\dot{w} - \alpha_s \dot{w} - \alpha_x \dot{p} - \alpha_h \dot{y}_j. \qquad \text{(A.4)}$$

Step 4: derived demand for input x. Given that the production function has constant returns to scale the scale effect is separable from an effect of substitution in production. An elasticity of

substitution is defined for every two factors of production: for substitution between *x* and h_j we define elasticity of substitution σ_{xh}, and for substitution between *x* and *s* we define σ_{xs}. These elasticities are based on technical substitution in production.
It can be shown that when the production function has constant returns to scale the following is the case:

$$\dot{x} = \dot{Z} - (\alpha_s \sigma_{xs} + \alpha_h \sigma_{xh})\dot{p} + \alpha_s \sigma_{xs} \dot{w} + \alpha_h \sigma_{xh} \dot{y}_j. \qquad \text{(A.5)}$$

Step 5: combining steps 3 and 4. We now replace the percentage change in production, $\dot{Z}$, with equation A.4, and combine terms. This gives equation 1, reproduced below:

$$\dot{x} = \frac{I}{F}\dot{I} - (\alpha_x^Z + \alpha_s^Z \sigma_{xs} + \alpha_h^Z \sigma_{xh})\dot{p} + [\frac{w}{F} + (\sigma_{xs} - 1)\alpha_s^Z]\dot{w} + (\sigma_{xh} - 1)\alpha_h^Z \dot{y}_j.$$

This is equation 1 in Section 3.

References

Angrist, J. (2002). How do sex ratios affect marriage and labor markets? Evidence from America's second generation. *The Quarterly Journal of Economics*, *117*(3), 997-1038.

Apps, P. F., & Rees, R. (1988). Taxation and the Household. *Journal of Public Economics*, *35*(3), 355-369.

_____. (1997). Collective labor supply and household production. *Journal of political Economy*, *105*(1), 178-190.

Averett, S. L., Argys, L. M., & Sorkin, J. (2013). In sickness and in health: An examination of relationship status and health using data from the Canadian National Public Health Survey. *Review of Economics of the Household*, *11*(4), 599-633.

Becker, Gary S. (1964). "Human capital: a theoretical and empirical analysis with special reference to education". *New York*. The University of Chicago Press.

_____. (1965). "A Theory of the Allocation of Time." *Economic Journal* 75(299): 493-517.

_____. (1973). A theory of marriage: Part I. *Journal of Political economy*, *81*(4), 813-846.

_____. (1974). A theory of social interactions. *Journal of political economy*, *82*(6), 1063-1093.

_____. (1981). Altruism in the Family and Selfishness in the Market Place. *Economica*, *48*(189), 1-15.

Bolin, K., Jacobson, L., & Lindgren, B. (2001). The family as the health producer—when spouses are Nash-bargainers. *Journal of health economics*, *20*(3), 349-362.

_____. (2002). The family as the health producer—when spouses act strategically. *Journal of health economics*, *21*(3), 475-495.

Bourguignon F., Chiappori P.A. (1992), Collective models of household behaviour, *European Economic Review* 36, pp 355 – 364.

Brown, P. H. (2009), "Dowry and Intrahousehold Bargaining: Evidence from China." *Journal of Human Resources* 44(1): 25-46.

Browning, M., Bourguignon, F., Chiappori, P. A., & Lechene, V. (1994). Income and outcomes: A structural model of intrahousehold allocation. *Journal of political Economy*, *102*(6), 1067-1096.

Cheng, Z., Mendolia, S., Paloyo, A. R., Savage, D. A., & Tani, M. (2021). Working parents, financial insecurity, and childcare: mental health in the time of COVID-19 in the UK. *Review of Economics of the Household*, *19*(1), 123-144.

Chiappori, P. A. (1988). Rational Household Labor Supply. *Econometrica*, *56*(1), 63-90.

_____. (1992). Collective labor supply and welfare. *Journal of political Economy*, *100*(3), 437-467.

_____. (1997). Introducing household production in collective models of labor supply. *Journal of Political Economy*, *105*(1), 191-209.

Chiappori, P. A., & Bourguignon, F. (1992). Collective models of household behavior: an introduction. *European Economic Review*, *36*(2-3), 355-364.

Chiappori, P. A., Fortin, B. & Lacroix, G. (2002). Marriage market, divorce legislation, and household labor supply. *Journal of Political Economy*, 110, 37-71.

Choo, E., & Siow, A. (2006). Who marries whom and why. *Journal of political Economy*, *114*(1), 175-201.

Christian, T., & Rashad, I. (2009), "Trends in US Food Prices, 1950–2007." *Economics & Human Biology*, *7*(1): 113-120.

Cohen, R. (1999), "Cut-Rate Rationale", The Ethicist Column, New York Times Magazine, July 18, p. 20.

Craigie, T. A., Myers, S. L., & Darity, W. A. (2018). Racial differences in the effect of marriageable males on female family headship. *Journal of demographic economics*, *84*(3), 231-256.

Cunha, F., & Heckman, J. (2007). The technology of skill formation. *American Economic Review*, *97*(2), 31-47.

Davis, George C. (2014). Food at home production and consumption: implications for nutrition quality and policy. *Review of Economics of the Household*. 12:565–588

DeCicca, P., Kenkel, D., & Mathios, A. (2008). Cigarette taxes and the transition from youth to adult smoking: smoking initiation, cessation, and participation. *Journal of health economics*, *27*(4), 904-917.

Del Boca, D., Flinn, C., & Wiswall, M. (2014). Household choices and child development. *Review of Economic Studies*, *81*(1), 137-185.

Doss, C. R. (1996). Testing among models of intrahousehold resource allocation. *World development*, *24*(10), 1597-1609.

Ekert-Jaffe, O., & Grossbard, S. (2008). Does community property discourage unpartnered births?. *European Journal of Political Economy*, *24*(1), 25-40.

Gimenez-Nadal, J. I. & Sevilla-Sanz, A. (2012), Trends in Time Allocation: A Cross-Country Analysis. *European Economic Review* 56(6): 1338-1359

Greenwood, J., Seshadri, A., & Yorukoglu, M. (2005). Engines of liberation. *The Review of Economic Studies*, *72*(1), 109-133.

Grossbard, A. (1976). An Economic Analysis of Polygamy: The Case of Maiduguri, *Current Anthropology*, 17(4): 701-707.

Grossbard, S. (2015) *The Marriage Motive: A Price Theory of Marriage. How Marriage Markets Affect Employment, Consumption and Savings.* Springer.

Grossbard, S., & Pereira, A. M. (2015). Savings, Marriage, and Work-in-Household. In *The Marriage Motive: A Price Theory of Marriage* (pp. 191-209). Springer, New York, NY.

Grossbard, S. A., Gimenez-Nadal, J. I., & Molina, J. A. (2014). Racial intermarriage and household production. *Review of Behavioral Economics*, *1*(4), 295-347.

Grossbard, S., & Mukhopadhyay, S. (2017). Marriage markets as explanation for why heavier people work more hours. *IZA Journal of Labor Economics*, *6*(1), 1-30.

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

Grossbard-Shechtman, S. (2001). The new home economics at Colombia and Chicago. *Feminist Economics*, *7*(3), 103-130.

_____. (2003). A consumer theory with competitive markets for work in marriage. *The Journal of Socio-Economics*, *31*(6), 609-645.

Grossbard-Shechtman, S., & Granger, C. W. J. (1998). Travail des femmes et mariage: du" baby-boom" au" baby-bust"/Women's jobs and marriage: baby-boom versus baby-bust. *Population*, *53*(4), 731.

Grossbard-Shechtman, S. A., & Neuman, S. (1988). Women's labor supply and marital choice. *Journal of Political Economy*, *96*(6), 1294-1302.

Grossman, M. (1972a). On the Concept of Health Capital and the Demand for Health. *Journal of Political Economy*, *80*(2), 223-55.

_____. (1972b). *The demand for health: a theoretical and empirical investigation.* New York: Columbia University Press.

Grossman, M., & Joyce, T. J. (2017). *10. Unobservables, Pregnancy Resolutions, and Birth Weight Production Functions in New York City* (pp. 377-401). Columbia University Press.

Hakak, L., & Pereda, P. (2021). Marriage in the time of the HIV/AIDS epidemic. Unpublished Manuscript. Available at SSRN: https://ssrn.com/abstract=3799554.

Hersch, J. (2000). Gender, income levels, and the demand for cigarettes. *Journal of Risk and Uncertainty*, *21*(2), 263-282.

_____. (2003). "Marriage and Household Production." In *Marriage and the Economy*, ed. Shoshana Grossbard-Shechtman. Cambridge and New York: Cambridge University Press.

_____. (2009), "Home Production and Wages: Evidence from the American Time Use Survey." *Review of Economics of the Household* 7: 159-178

Jacobson, L. (2000). The family as producer of health—an extended Grossman model. *Journal of health economics*, *19*(5), 611-637.

Khanam, R., Nghiem, H. S., & Connelly, L. B. (2009). Child health and the income gradient: evidence from Australia. *Journal of health economics*, *28*(4), 805-817.

Kyrk, H. (1953). *The Family in the American Economy.* University of Chicago Press.

Lancaster, K. J. (1966). A new approach to consumer theory. *Journal of political economy*, *74*(2), 132-157.

Leibowitz, A. S. (1974). Home investments in children. *Journal of Political Economy* 82 (2, Part 2): S111-S131.

Lundberg, S., & Pollak, R. A. (1993). Separate spheres bargaining and the marriage market. *Journal of political Economy*, *101*(6), 988-1010.

Lundberg, S. J., Pollak, R. A., & Wales, T. J. (1997). Do husbands and wives pool their resources? Evidence from the United Kingdom child benefit. *Journal of Human resources*, 463-480.

Manser, M., & Brown, M. (1980). Marriage and household decision-making: A bargaining analysis. *International economic review*, 31-44.

McElroy, M. B., & Horney, M. J. (1981). Nash-bargained household decisions: Toward a generalization of the theory of demand. *International economic review*, 333-349.

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

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

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

Oreffice, S., & Quintana-Domeque, C. (2012). Fat spouses and hours of work: are body and Pareto weights correlated?. *IZA Journal of Labor Economics*, *1*(1), 1-21.

Porter, M. (2016). How do sex ratios in China influence marriage decisions and intra-household resource allocation?. *Review of Economics of the Household*, *14*(2), 337-371.

Reid, M. (1934). *Economics of Household Production*. New *York*: John Wiley and sons.

Roff, J. (2017). Cleaning in the Shadow of the Law? Bargaining, Marital Investment, and the Impact of Divorce Law on Husbands' Intrahousehold Work. *The Journal of Law and Economics*, *60*(1), 115-134.

Rosenzweig, M. R. (1986). Program interventions, intrahousehold distribution and the welfare of individuals: Modelling household behavior. *World Development*, *14*(2), 233-243.

Roth, A. E., & Sotomayor, M. O. (1990). Two-Sided Matching: A Study in Game-Theoretic Modeling and Analysis. In *Econometric Society Monograph Series*.

Ruhm, C. J. (2000). Parental leave and child health. *Journal of health economics*, *19*(6), 931-960.

Samuelson, P. A. (1956). Social indifference curves. *The Quarterly Journal of Economics*, *70*(1), 1-22.

Schmitz, H., & Stroka, M. A. (2013). Health and the double burden of full-time work and informal care provision—Evidence from administrative data. *Labour Economics*, *24*, 305-322.

Singh, I., Squire, L., & Strauss, J. (1986). Agricultural household models: Extensions, applications, and policy.

Stancanelli, E. G., & Stratton, L. S. (2014). Maids, appliances and couples' housework: the demand for inputs to domestic production. *Economica*, *81*(323), 445-467.

Stevenson, B. (2007). The impact of divorce laws on marriage-specific capital. *Journal of Labor Economics*, *25*(1), 75-94.

Stigler, G. (1946), "Domestic Servants in the United States, 1900-1940." Occasional Paper No. 24, National Bureau of Economic Research.

Taylor, J. E., & Adelman, I. (2003). Agricultural household models: genesis, evolution, and extensions. *Review of Economics of the Household*, *1*(1), 33-58.

Thomas, D. (1990). Intra-household resource allocation: An inferential approach. *Journal of human resources*, 635-664.

Umberson, D., & Williams, K. (2005). Marital quality, health, and aging: Gender equity?. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 60*(Special_Issue_2), S109-S113.

Van Houtven, C. H., Coe, N. B., & Konetzka, R. T. (2015). Family Structure and Long-Term Care Insurance Purchase. *Health economics, 24*, 58-73.

_____. (2021). Long-term care insurance within married couples: Can't insure one without the other?. Unpublished manuscript. Duke University Medical Center

Wikström, J. (2017). The effect of equal division of property regime on subjective health, psychological well-being and investments in health capital. Master Thesis Dissertation.

Woolley, Frances (2003), "Marriage and Control over Money." In *Marriage and the Economy*, ed. Shoshana Grossbard-Shechtman. Cambridge and New York: Cambridge University Press.

Zamarro, G., & Prados, M. J. (2021). Gender differences in couples' division of childcare, work and mental health during COVID-19. *Review of Economics of the Household*, *19*(1), 11-40.

Zelizer, V. A. (2007). *The purchase of intimacy*. Princeton University Press.