Spouses as Home Health Workers and Cooks: Insights for Applied Research

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ABSTRACT

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This paper presents a model of consumption and household production that takes into account substitution between health-related goods that are produced at home and those produced commercially as well as substitution between goods produced at home by oneself and those produced by one's spouse or partner. New insights are offered that help interpret heterogeneity analysis in data for couples, when individuals differ by gender, age, weight and education. The model also identifies new variables related to marriage markets that could help explain consumption, including demand for medical care and good nutrition. These variables include sex ratios (and exogenous parameters that influence sex ratios) as well as legal changes related to marriage and divorce. A reexamination of the determinants of the price elasticity of demand includes an explanation for gender gaps in such elasticity.

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1.Introduction

Good health is based in part on good nutrition. In turn, nutritive meals can be produced in the market—in the form of restaurant meals or frozen food—or in the household. Households also offer alternatives to paid health providers to the extent that they care for the sick, prevent illness, supervise those who need monitoring or guidance, etc. These household production options have been formally integrated into analyses of the demand for health and related outcomes, at least since Grossman (1972a, 1972b). Good health and happiness are among the main meta-goods that are produced in households. Grossman's model was inspired by those of Mincer (1963) and Becker (1965) that considered all meta-goods.[1] In all these models couples make decisions about both consumption and household production as if they were one unified agent.[2] [3]

Becker (1965) has been challenged by economists questioning the assumption of unified household decision-making. Among those who, instead, have assumed individual decision-making regarding consumption in general are Manser and Brown (1980), McElroy and Horney (1981), Grossbard-Shechtman (1984), Apps and Rees (1988), Bourguignon and Chiappori (1992), and Lundberg and Pollak (1993). Jacobson (2000), Bolin et al. (2001, 2002) and Wilson (2002) contributed similar models applied to health economics.[4] However, most of these articles continued to model household production as a household decision, not taking into account that individual members of the couple are likely to have divergent interests when it comes to how to produce and who does the household production activities.[5] [6] The exception is Grossbard-Shechtman (1984). It assumes that individuals make decisions regarding both consumption and household production. This paper builds on the same approach to present a program for research on consumption, including health-related consumption such as good nutrition and caring for needy family members.

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[1] A precursor was Reid (1934). Becker and Mincer were Grossman's professors at Columbia University. Grossman's work has inspired studies of multiple aspects of health-related behavior, including parental investments in children's human capital, the schooling-health relationship, and choice between formal and informal home care (Grossman 2022).

[2] The term 'unified household model" was introduced by Cheryl Doss (Doss 1996)

[3] Related applications of the unified household production models of Becker and Mincer include the economic analyses of fertility pioneered in Mincer (1963) and Becker (1965) and studies of children's development and schooling (e.g. by another student of Becker and Mincer, Leibowitz (1974), as well as Cunha and Heckman (2007), and Del Boca et al (2014).

[4] Wilson also integrates insights generated by Becker's (1973, 1974) economic models of marriage.

[5] Jacobson (2000) includes a husband-wife family model but decision-making power is attributed to the family, not the individual. Wilson (2002), Appendix A, assumes costs of household production based on a household production function.

[6] Also recognized e.g. by Thomas (1990), Ruhm (2000), and Khanam et al. (2009).

The paper's first contribution is to offer new channels for interpreting existing findings based on data collected from couples. These include research that has examined associations between the individual behaviors of spouses which vary as a function of individual traits such as gender, relative youth, relative education, or relative weight. These new channels of interpretation link observed behavior to possible financial repercussions of how individuals in couples handle household production.

Part of these repercussions are observable and inclusion of data on behavior related to household finances could contribute to the explanatory power of economic models of consumption, risky behaviors, hospital use, etc. The observed impact of financial repercussions is expected to differ depending on whether adult household members are the main home workers—including home health workers—or they mostly use the products of household production.

The second main contribution of this paper is to identify new variables that can help explain consumption and that are often overlooked in empirical studies of consumption and investment behaviors by couples. These variables are related to the operation of marriage markets. In the rest of this paper the term 'marriage' means 'cohabiting couple' and includes non-marital cohabitation, and the term 'spouse' includes unmarried cohabiting partner. These variables include (1) the sex ratio (the ratio of men to women in marriage markets) and exogenous parameters that influence sex ratios, and (2) changes in laws about marriage and divorce such as a switch to community property.

This paper is organized as follows. Section 2 summarizes the theoretical model of consumption presented in the Appendix and based on Grossbard-Shechtman (2003).[7] This part includes a distinction between individuals who mostly produce (the workers in household production) and those who mostly consume (the users of household production), a distinction also found in labor economics (workers and firms). Solving the problem of the consumer leads to the derivation of a demand for goods, including health-related goods and services.

Section 3 offers new insights to help interpret heterogeneity analysis of health data for couples, when individuals differ by gender, age, weight and education. Section 4 presents more insights from the model: predicted effects of variation in sex ratio and changes in marriage-related laws on the demand for commercial products and services, including health-related

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[7] In turn, that model grew out of Grossbard-Shechtman (1984). A brief early version is found in Grossbard (1976).

ones. Section 5 offers some new testable insights on the price elasticity of demand, including some applicable to health-related research. Section 6 concludes.

2. The WiHo model of consumption and household production

This section summarizes selected parts of the model of consumption and household production in Grossbard-Shechtman (2003).[8] A technical summary is found in the Appendix. The model requires the introduction of three new terms. First, WiHo (Work-in-Household) is defined as an activity such as caregiving or cooking that is performed by an individual who is in couple (married or cohabiting; gay or straight) and that benefits the other member of that couple. [9] This implies that an individual who is either in a couple or plans on becoming part of a couple has three ways to produce meta-goods at home: buying products, producing at home on their own, or getting a spouse to produce the meta-good at home. This is illustrated in Figure 1. In contrast, Becker (1965) only had two options for a household: producing at home or buying goods or services.

Individuals living in a couple are subdivided into two categories: workers and users, so two additional new terms are WiHo-workers and WiHo-users, defined respectively as the individuals who do this work and their partners who benefit from it. The model presented here focuses on those who are either a worker or a user.[10]

The model assumes that individuals maximize their own utility when deciding about their consumption, their willingness to work in household production and their willingness to use the household production time of a spouse (or unmarried partner).[11] It is also assumed that the WiHo-user may be able and willing to compensate the WiHo-worker for their work in the form of a monetary or in-kind transaction. After adding the assumptions that WiHo has a price and that this price has been established in a marriage market the similarities between workers in WiHo and workers who work for firms, and between WiHo-users and firms

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[8] Grossbard-Shechtman (2003) is based on Grossbard-Shechtman (1984). Edited versions of both articles can be found in Grossbard (2015): chapters 2 to 6 on labor supply and chapter 10 on consumption.

[9] Grossbard-Shechtman's (1984) used the term 'household labor' instead of WiHo.

[10] Most insights presented here would also follow from an extended model that assumes that people are simultaneously users and workers (see Grossbard 2015).

[11] Most other decision-making models that economists have used to analyze consumption by individuals living in couples also assume selfish preferences (e.g. Becker (1973, 1981); Apps and Rees (1988), Bourguignon and Chiappori (1992)). Individual utility functions as stated in the appendix include willingness to care for others and utility from work in household production could be positive. Grossbard-Shechtman (2003) also includes models with household-public goods and the analysis could be expanded to include such goods. To recognize household-public goods is especially relevant when studying children's health. Certain kinds of in-couple spillovers not currently covered could also be added to the analysis.

(including non-profit firms) are such that the analysis can proceed with a standard labor market analysis. [12]

Demand for WiHo. The optimizing consumer is a WiHo-user with a demand for goods and for spouse's WiHo. The demand for WiHo is predicted to be a negative function of the price of WiHo. As in the case of labor demand by firms, the higher the price of WiHo the more the WiHo-user is likely to replace WiHo with substitutes, such as commercial health services or paid cleaning services (for a more formal derivation of that demand see the Appendix).

The supply of WiHo is derived based on a simple optimization problem by a representative WiHo-worker (see the Appendix). Solving this problem leads to the derivation of an individual supply of WiHo, a supply of work in the labor force, and a demand for goods. Both the supply of WiHo and the supply of regular work are expected to be upwardsloping: the higher the given price or wage, the more workers supply work.

Market equilibrium. As in labor market analysis, individual supplies are aggregated, and so are individual demands. Equilibrium price and quantity in a particular market are established at the intersection of supply and demand for WiHo.[13] Payment for WiHo may be an internal monetary transfer or can be in kind.[14]

Demand for commercial goods and services. It is shown in the Appendix (Equation A6) that under commonly used assumptions a WiHo-user's demand for commercial goods and services can be expressed as a sum of elasticities: the elasticity of demand with respect to the price of WiHo, own income elasticity of demand, price elasticity of demand (what most people mean by elasticity of demand), and wage elasticity of demand.[15]

The elasticity of demand for commercial products with respect to the price of a spouse's WiHo (A7 in the Appendix) is a function of the share of WiHo in individual *i*'s cost of producing own meta-goods, and of the elasticity of substitution in production between two inputs: commercial goods and WiHo. A higher price of spouse's WiHo implies that the WiHo-user's demand for goods (i) increases due to a substitution effect and (ii) decreases due to a negative income effect. The higher the elasticity of substitution between goods and WiHo, the more a given percentage increase in the price of WiHo will lead to an increase in the demand

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[12] This implies that there is no need for a separate economic theory of marriage, as I realized while developing an early version of this model in graduate school around the time that Gary Becker published his early theoretical models of marriage (Becker 1973, 1974).

[13] My price of WiHo was inspired by Becker's (1973) concept of marital surplus. In his *Treatise on the family* (Becker 1981) he removed the marriage models most reminiscent of labor markets.

[14] If one spouse can make a monetary transfer to the other this implies transferable utility. Transfers are expected to occur infrequently, even less frequently than workers get paid in most commercial firms.

[15] From here one could derive a demand for goods and services that would also take into account substitution in consumption.

for WiHo substitutes such as purchased meals. The elasticity of demand with respect to the price of WiHo will be positive as long as the elasticity of substitution exceeds 1.

Proposed empirical tests. I propose that future research perform empirical tests based on the following logic:

Observable "factor" *F* ➔ price of WiHo ➔ observable "outcome" *O*.

However, given that prices of WiHo are unobservable, the tests proposed would skip the middle step and just investigate whether a factor *F* helps explain an individual outcome *O*, in line with what can be predicted from WiHo model. The factors to be considered include personal characteristics of each partner, such as education, weight and beauty, and macro and institutional factors--such as sex ratio, divorce laws, and custody laws. The first are discussed in Section 3; the latter in Section 4.

Who does the work in household? A first step in applying the model is to try to identify whether an individual is a WiHo-worker or a WiHo-user. Among heterosexual couples, old cultural traditions have led women to engage in more household production than men. Even though the degree to which people adhere to these traditions varies enormously across cultures, and traditional gender roles have experienced substantial losses in popularity in recent decades, as of 2012 there was not a single society where on average men did a majority of the household production and the at-home childcare (Gimenez-Nadal et al. 2012). Recent research about the impact of COVID-19 has revealed that when families stayed home it is mostly women who took care of the kids and most other household production (e.g. Heggeness 2020 and Zamarro and Prados 2021 for the USA, Del Boca et al. 2020 for Italy, and Andrew et al. (2020) for the UK.). Who does the housework and the childcare may be related to whether an individual is a primary worker or a secondary worker: secondary workers typically work fewer hours than primary workers and may spend more time in household production. [16] Not all household production and childcare can be categorized as WiHo, but time devoted to WiHo and time devoted to childcare and household chores are expected to be positively correlated in couples with an unequal division of labor, and those couples are more likely to be heterosexual.[17]

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[16] Griffith et al. (2022) assume that the implicit cost of home-produced food is based on the value of time of secondary workers. What member of a couple is a secondary worker and who works in WiHo on behalf of the spouse are likely to be simultaneously determined.

[17] The WiHo model can also be applied to same-sex couples and to heterosexual couples who do not follow a traditional division of labor. Among same-sex couples lesbian couples tend to have a more egalitarian organization of household production than gay couples (van der Vleuten et al. 2021), which suggests that gay men are more likely to have WiHo-workers than lesbian women.

More specifically, in the area of at-home health production that potentially qualifies as WiHo, there is evidence that women are more likely to be home health workers than men. For example, (1) in Germany women are more likely to encourage their spouse to see a doctor (Neimann and Schmitz 2010); and (2) in the USA women are more likely to engage in meal preparation than men (Schaeffer 2019) and at-home cooking increases the likelihood that families eat healthy meals (Baum and Chou 2011). Thus cooking at home constitutes a form of health-related WiHo.

3. New Interpretations of Heterogeneity Analysis of Data for Couples

Behaviors such as demand for goods and services may be associated with individual traits of spouses such as their relative youth, education, or weight. A number of explanations for such associations have been proposed. The explanation most compatible with the WiHo interpretation presented in this paper is that there is a protective effect of marriage and that individual traits of spouses affecting the home production of health meta-goods may influence the extent of that protection. This interpretation is also related to arguments presented in Grossman (1985) and Wilson (2002) on investments in health capital. Spouses may contribute to their partner's individual health capital, with some traits of both spouses possibly reinforcing each spouse's effects on productivity in the production of household meta-goods. Furthermore, individual traits may affect individual bargaining power and thus control over how the couple's income is spent, e.g. Wilson (2002). In addition, it has been recognized that spouses' outcomes or behaviors could be spuriously correlated due to selection and assortative mating according to some of these traits (see e.g. Wilson 2002, Banks et al. 2021). These interpretations help understand existing findings regarding behaviors of individuals living as couples, including their willingness to get vaccinated against communicable diseases (e.g. Bouckaert et al. 2020), to undergo bowel cancer screening (Francetic et al. 2022), or to smoke and drink (e.g. Clark and Etile 2006). The same arguments have also helped interpret interspousal correlations in health outcomes (e.g. Banks et al. 2021). This section applies to couples' data collected for different purposes, with an emphasis on consumption and possibly health-related consumption.

The theoretical perspective presented here offers an additional explanatory channel that may underlie observed correlations between spouses' health behaviors and observed associations between health behaviors and spousal traits, namely a channel operating via possible financial repercussions related to how at-home health production is organized. The WiHo model views individuals living in-couple as independent decision-makers with their own personal disposable income. That income is a function of whether a person works in WiHo or

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uses a partner's WiHo, and of the price of WiHo. How a spouse's trait is likely to affect the price of WiHo will have repercussions for the personal income of both worker in WiHo and WiHo-user, and therefore it may affect health behaviors (such as demand for health) and health outcomes of both partners.

Any trait that raises a worker's price of WiHo is likely to be associated with more individual consumption by that worker as the higher price is likely to translate into additional individual access to income. Conversely, a trait associated with a lower price of WiHo is likely to raise the real personal income of WiHo-users and to benefit those users. These financial repercussions may affect observed association between (relative) traits of spouses and health behaviors and outcomes. The following discussion, addressing possible effects on consumption by both WiHo-worker and WiHo-user, is summarized in Table 1. Three spousal traits are considered here, as examples: education, weight, and relative age.[18]

The first column in Table 1 lists spousal traits that can help explain demand for goods and services by WiHo-users (second column) and WiHo-workers (third column). The fourth column reports related research.

The first spousal trait mentioned in Table 1 is relative youth of the WiHo-worker. Youth may increase workers' productivity in WiHo-type household production. It may also be considered attractive in marriage for other reasons, and many may think so. Therefore, relatively young WiHo-workers may be more expensive than others closer to the WiHo-user's age. The WiHo-user in couple with a relatively young spouse is thus predicted to consume less due to a real income effect and more due to a positive substitution effect. The net effect is positive as long as the substitution effect exceeds the real income effect. Youth is predicted to add to the home worker's consumption to the extent that it implies a positive income effect.

We don't have data on price of WiHo but we can infer whether a person is a WiHo-worker or a WiHo-user and we have data on behaviors related to individual disposable income of spouses: couples' financial arrangements and labor supply. Indirect, suggestive, and partial evidence supporting this prediction comes first from examining the association between a spouse's relative youth and information on who manages a couple's bank accounts or whether a couple has a joint account. Woolley (2003) found that in a sample of pre-retirement couples interviewed in Ottawa, Canada, in 1995, women married to or cohabiting with 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. To the extent that these couples were following

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[18] Applied researchers may want to measure these at the beginning of couple formation or prior to that.

traditional gender roles the women would have been the WiHo-workers in their couples and relatively young women's increased access to the couple's money may indicate that they have a higher price of WiHo.

In terms of labor supply, the less a WiHo-worker gets paid for their household production time the more they are likely to participate in the labor market and the more hours they are likely to work in the labor force (Grossbard-Shechtman 1984). Two studies found that women married to substantially older men had a lower labor supply: Grossbard-Shechtman and Neuman (1988) found that they have a lower likelihood of working in the labor force compared to women married to men closer to their own age (reported for Israeli Jewish married couples) and Grossbard-Shechtman and Fu (2002) found a similar finding for married couples in Hawaii. This may indicate that a married woman's relative youth translates into more access to husband's income (possibly due to a higher price of WiHo).[19]

The second row is a WiHo-worker's education level. Education may make people more productive in household production and this may also affect their demand for goods and services (Michael 1973). In the context of labor markets, a worker's education is viewed as a form of "general" human capital that benefits many potential employers who could use educated workers. Given widespread availability of data on wages there is plenty of evidence documenting that more educated workers tend to be paid better (Mincer 1974 being a pioneer in this line of research). By analogy, if education is also a form of general human capital that can enhance productivity at household production of WiHo-workers potentially in couple with many partners, it is expected that educated WiHo-workers will command a higher price of WiHo. [20] In turn, this implies a positive income effect on the WiHo-worker's consumption, including consumption (Column 3). Column 2 states a prediction linking WiHo-user's consumption to a WiHo-worker's education via two effects: a negative income effect (as the user now needs to pay more for employing a WiHo-worker to get personal meta-goods) and a positive substitution effect (see above).

Two findings are consistent with the price of WiHo for more educated WiHo-working

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[19] The potential higher transfer from older husband to younger wife may be a form of compensating differential if women prefer to get in couple with someone close to their own age.

[20] Becker (1964) defined a skill as 'general' if it is beneficial to many potential employers and postulated that general skills are likely to have a positive effect on workers' wages because these skills are appreciated by many potential employers. Likewise, the more general the traits associated with productivity in WiHo, the more they are likely to translate into a higher price of WiHo-work and more personal consumption by that individual. The degree to which a productivity-enhancing trait such as education leads to higher wages or higher prices for WiHo depends on the extent to which the human capital embedded in this trait is general or not, where 'general' is defined in the sense that it contributes to a worker's or WiHo-worker's 'general human capital'.

spouses exceeding that price for less educated spouses: (a) Klawitter's (2008) finding that the less a partner is educated, the more a gay or lesbian head (defined as the older partner) is likely to have their own bank account and the larger the share of the couple's income that is reported in the head's account; and (b) Amuedo-Dorantes et al.'s (2011) finding that more educated female principal household producers (most likely WiHo-workers) obtained more access to their partner's income than their less educated counterparts (in their study of complete income sharing among Danish heterosexuals).

The next row is about the education of the WiHo-user. The more educated the WiHo-user relative to the WiHo-worker, the more the WiHo worker may appreciate that and so may other potential WiHo-workers, implying that the price that educated WiHo-users need to pay for a worker will be lower than that paid by less educated users. This is a compensating differentials argument well-known to labor economists. This is expected to be associated with the WiHo-user's individual consumption level due to a positive income effect. The WiHo user may also be less inclined to substitute towards commercial goods and services if the price of WiHo is lower. As for the WiHo-workers, they will experience a negative income effect

The next trait mentioned in Table 1 is a spouse's weight. In labor markets overweight workers tend to be paid less than their slimmer counterparts (e.g. Sabia and Rees 2012),[21] possibly because they are less productive on the job. If overweight WiHo-workers are also less productive in household production and optimal weight is a form of human capital, this implies that overweight spouses who engage in WiHo may be paid less for their WiHo than their slimmer counterparts. [22] The ensuing lower personal income of the WiHo-worker may lead to their lower personal consumption, including consumption of health-enhancing products. As for the potential effect of a financial repercussion for the WiHo-user, it entails higher real income and a positive substitution effect. Overweight WiHo-users (last row) may need to pay more for WiHo due to compensating differentials in markets for WiHo-workers. This is expected to imply a positive substitution effect and negative income effect for the WiHo-user and a positive income effect for the WiHo-worker.

We don't have data on the price of WiHo-workers as a function of their relative weight. However, research has found that heterosexual married individuals who are either obese or too skinny relative to their spouse are likely to work more hours in the labor market (Oreffice and Quintana-Domeque 2012). *Ceteris paribus*, obese individuals' higher willingness to work in

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[21] Sabia and Rees (2012) found this for women.
[22] A related finding is that obese individuals are less likely to be in couple, especially in the case of women (Mukhopadhyay 2008).

the labor force may indicate that they have less access to the couple's income and obtain lower prices for their WiHo-work relative to skinnier counterparts.

In sum, taking account of the financial side leads to the prediction that the actual effect of a productivity-enhancing individual's trait may be smaller in absolute value than the effect predicted based solely on considerations of substitution in household production of meta-goods. If the WiHo-worker's positive trait also raises the price of WiHo there will be a positive income effect on the WiHo-user's demand for goods that goes in the opposite direction from the substitution effect. This will also influence the process of spouse selection. In the Becker model, or in those of his followers, it is easier for WiHo-users to choose between educated and uneducated spouses willing to become WiHo-workers on their behalf: the educated ones are more productive. The problem is that so many others planning to become WiHo-users may feel the same way and add to the demand for educated WiHo-workers. This will raise the price of such educated workers. Consequently, being married to a more educated spouse will entail a larger internal transfer from WiHo-user to WiHo-worker than being married to a less educated spouse. After paying extra for the WiHo of an educated spouse WiHo-users may not necessarily be better off than if they were married to a less productive and cheaper spouse.

Empirical work could be designed to estimate the association between personal traits and personal assignable consumption, in conjunction with estimations of individual control over household income.

Researchers should be careful about interpreting information regarding labor force participation or spouses' relative earnings in the case of dual earners. When Mincer (1963) and Becker (1965) considered complete household specialization in a regime of traditional gender roles, with the wife doing all the household production and not participating in the labor force, they may have implicitly assumed that the housewife obtains a material compensation from the husband giving her access to his earnings.[23] However, Becker (1965, 1981), Mincer and many others have been silent about whether the spouse who does most of the household production in dual-earner households gets an internal transfer in return for this work. In fact, they ignored the need for incentives to motivate household production workers.

Many popular models of intra-household allocation don't even assume that there is household production (e.g. McElroy and Horney 1981) and/or assume that the household is a dual-earner household with both members of the couple participating in the labor force (e.g.

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[23] It was often assumed that the husband would share all his income with the wife, but studies of household finance have revealed that this is often not the case (see Amuedo-Dorantes et al. 2011).

Apps and Rees 1988; Bourguignon and Chiappori 1992).

Dual-earner couples have become the norm, and a spouse's relative earnings has increasingly been used as a measure of an individual's intrahousehold bargaining power. However, higher relative personal earnings in the labor market may not necessarily indicate an individual's higher relative bargaining power. It follows from the analysis presented here that when comparing individuals who work in both the labor market and WiHo, those who earn more in the labor market may do so precisely because they get a low price for their WiHo-work for reasons not known to the researcher. A low price of WiHo may also lead them to work more hours in the labor force (see Grossbard and Mukhopadhyay 2017 in the case of overweight women in the USA). In this case, higher earnings may not mean that a WiHo-worker is better off than counterparts with lower earnings.

There are still many cases of people in couples not participating in the labor force or not working full time. [24] Estimating their value of time is often necessary, and it may not be optimal to calculate reservation wages based on estimation methods based on Becker (1965) or Heckman (1974).

4. New variables that could help explain demand for health-related products

As mentioned in Section 2, any factor that influences the price of WiHo is also expected to influence the demand for goods and services by a WiHo-user. The more detailed modeling found in the Appendix is more precise: this influence will be found as long as the elasticity of demand with respect to price of WiHo differs from zero (i.e. the elasticity of substitution between goods and spouse's WiHo differs from 1). More specifically, it is predicted that if the goods and services are substitutes, a factor that is positively associated with the price of WiHo will be positively associated with a WiHo-user's demand for goods and services that substitute for WiHo. In addition, changes in the price of WiHo are also likely to affect the demand for goods by a WiHo-worker whose personal disposable income fluctuates with the price of WiHo.[25]

The rest of this section discusses two categories of factors that may affect the demand for goods, including health-related goods, to the extent that they may be associated with variation in the price of WiHo: sex ratios and laws governing marriage. The discussion is summarized in Table 2.

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[24] See Joni Hersch (2013) for suggestive evidence that a high price of WiHo may help explain why married women with college degrees from top universities often opt out of the labor force.
[25] See Grossbard-Shechtman (2003).

4.1. Sex Ratios.

Demographers define sex ratios as ratios of men to women in a particular time and place. Sex ratios matter when applying this model, to the extent that there are gender gaps in terms of who works in WiHo and who is a WiHo user. Sex ratios influence the price of WiHo supplied by men and women. Given that higher sex ratios mean that women are scarcer relatively to the men participating in the same marriage market, higher sex ratios imply higher prices for women's WiHo. If the elasticity of substitution between goods and WiHo exceeds one (see A7 in the Appendix) it is predicted that *an increase in sex ratio will lead to an increase in men's demand for purchased meals and other substitutes for goods that can be produced with WiHo*. This prediction is found in the first row and first column of Table 2.

Furthermore, women's income is expected to be higher when sex ratios are higher as they are likely to earn more for the WiHo they supply. This will allow them to consume more at given prices of goods and services. [26]

Existing evidence regarding sex ratio effects on consumption of goods includes a study comparing consumption in China before and after the introduction of its one-child policy (Porter 2016). That policy led many parents to have just one son (implying increased abortions of girls). After the children born during the one-child policy grew up, the country faced higher sex ratios compared to their value prior to the implementation of the one-child policy. Using Chinese data, Porter reports that where and when women are scarcer in marriage markets households consume less tobacco and alcohol, goods relatively more likely to be consumed by men. Porter also finds that higher sex ratios are associated with healthier sons and past research has associated better health results for sons with women having relatively more control over household spending (e.g. Thomas 1990).

That higher sex ratios were found to be associated with higher relative consumption by women is consistent not only with the model presented here, but also with theories of marriage and intra-household allocation of resources that focus on changes in the distribution of resources available to the household and that ignore how household production is organized, such as Becker (1973), McElroy (1990), Chiappori et al. (2002), Brown (2009) and Cherchye et al. (2009).

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[26] If the model is expanded and men also work in WiHo then higher sex ratios will cause the price of men's WiHo to decrease. This will lead women to experience a further increase in their real income and to increase their consumption of normal goods even more.

The sex ratio data used by Porter (2016) and some others mentioned in Grossbard (2015) were not exogeneous. Sex ratios that vary across regions may be endogeneously determined to the extent that people migrate across regions for reasons related to the topic being investigated. So far, the only studies of the association between sex ratio and individual consumption have used such geographical variation in sex ratio. However, exogeneous variation in sex ratio is available. First, such variation could be observed for birth cohorts to the extent that the number of children born in a given year grows or declines. Then, even if the ratio of boys to girls born in a particular year remains constant, given that on average at time of marriage men tend to be older than women there will be an imbalance in sex ratio. If the population of young adults grew, this will cause low sex ratios for women about twenty years later; the opposite is true if the population of young adults shrank (see Grossbard-Shechtman and Granger 1998). This research, reported in the second row of Table 2, first made assumptions about whether a population consists of WiHo-workers or WiHo-users. It was inferred that women are more likely to be WiHo-workers and we examines the association between cohort-caused variation in sex ratios and changes in women's labor supply. Accordingly, Grossbard-Shechtman and Granger (1998) and Grossbard and Amuedo-Dorantes (2007) have shown that women's labor supply grew faster for cohorts born at times of growing number of births (implying low sex ratios) than for cohorts born at times of shrinking births (implying high sex ratios.). Likewise, Angrist (2002) used exogeneous variation in sex ratios of immigrants from various countries to help explain their labor supply in the USA.

A particular case of imbalanced immigration occurred in Taiwan after a civil war in the late 1940s. Half a million soldiers from Mainland China who had retreated to Taiwan were subjected to a marriage ban. Then, suddenly a natural experiment occurred, as reported by Chang et al. (2020): the ban was lifted in 1959, causing a great influx of soldiers into the marriage market, which led to unusually high sex ratios in the marriageable population. The researchers found that this high sex ratio at marriage has been associated with a greater likelihood of death at age 50 to 64. This could be a consequence of these men's low access to women's WiHo, even if they were married after the ban was lifted, or of the high price of women's WiHo in case they married, the high price leading to a negative real income effect for men. Also, it is possible that by the time the ban was lifted the selection of women left in the marriage market was not so good and men benefited from lower quality WiHo supplied by women.

Sex ratios could also vary due to exogeneous fluctuations in incarceration rate (e.g. Craigie et al 2018) and wars that killed large numbers of male soldiers (e.g. Abramitzky et al.

2011).

Sex ratios and the price of WiHo are expected to affect consumption by unmarried men and women as well as that of their married counterparts. Whoever plans to marry and is a potential WiHo-user or WiHo-worker may be affected by WiHo prices that in turn could be a function of sex ratios.

A further prediction that could be tested is whether changes in the price of WiHo have had more impact on WiHo-users' individual consumption of goods produced with WiHo than on their consumption of household-public-goods that are also of value to WiHo-workers, such as healthy children (see Grossbard-Shechtman 2003).

4.2 Marriage and divorce laws and consumption.

Changes in laws regulating marriage or divorce could also cause exogeneous changes in the price of WiHo and consequently shifts in the demand for goods and services Here are a few examples.

Switch from separate property to community property. Under separate property, each spouse owns the assets that 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, each gets half of the assets.[27] Switches in marital property regime from a system of separate property to one of community property is expected to affect the price of WiHo. There will be a tendency for the financial settlement to be more beneficial to the couple's lower earner under community property than under a legal regime of separate assets. If women are the WiHo-workers and the lower earners in their couple, relative to WiHo-using men, in case of marital dissolution this implies that women have relatively more to gain from a switch from separate property to community property. This may benefit women's share of consumption relative to that of men.

To the extent that the switch is associated with a higher price of women's WiHo, it is predicted that men using WiHo will be more likely to switch away from WiHo-produced goods and instead to consume more commercial goods and services (a substitution effect). However, men are predicted to consume less in general, as their real income is predicted to drop due to the higher price of women's WiHo.

Suggestive evidence for this prediction includes the following finding from a difference-in-difference analysis using English data from before and after the 'White versus

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

White' case: after equal division of marital property was introduced in England married women used more health services (Wikstrom 2017). No change in usage of health services was found for married men. As for New Zealand's switch towards community property, research has shown that after their country switched regimes, young women were more likely to first get married and then have a baby (Ekert-Jaffe and Grossbard 2008). This is consistent with a higher price for women's WiHo, making WiHo relatively more attractive and nudging more women into choosing married rather than single parenting.

Switch from divorce laws requiring mutual agreement to easier, unilateral divorce. Prior to unilateral divorce it was more difficult and costly to obtain a divorce and individuals who were unhappy in their marriage were more likely to feel stuck. To the extent that traditional gender roles prevailed and that women were more likely to be WiHo-workers than men, high costs of divorce implied that if they were supplying their WiHo at a price under its market value (or they were supplying more WiHo than they really wanted to supply at given prices for WiHo) it was difficult for women to leave and find a partner with whom they could have a more satisfactory working relationship and rewards for their work in household production. This approach helps understand why the introduction of unilateral divorce was associated with a decrease in household production on the part of women (Stevenson 2007): women may have felt forced to supply more WiHo at low prices for WiHo than they wanted to. Lower costs of divorce were also followed by a decrease in domestic violence against women (Stevenson and Wolfers 2006): after divorce costs were lowered women found it easier to leave marriages involving domestic violence perpetrated against them. Furthermore, with lower divorce costs there was a reduction in prostitution (Ciacci 2023): fewer married women felt that to survive they needed to escape the marriage, even if that meant becoming a prostitute.

What has not been tested yet (to the best of my knowledge) is the prediction that with lower divorce costs married women would obtain more access to their couple's income and would consume more of what they personally enjoy. The opposite may be case for men.

Joint custody laws. In recent decades joint custody has replaced custody automatically granted to mothers in many US states and Western countries. To the extent that under traditional gender roles custody by mothers entailed some WiHo on their part, the switch to joint custody induced a reduction in men's demand for WiHo. [28] Consequently, the price of women's WiHo dropped as there was a market-level drop in demand. WiHo-users will have

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[28] Caring for a couple's joint children is WiHo to the extent that one parent is doing more of the childcare, and especially so if the WiHo-worker teaches the children skills that matter more to the WiHo-user than to the one producing childcare.

less demand for goods as they have fewer reasons to substitute towards goods. The switch is also likely to lead to a drop in women's disposable income to the extent that women's childcare-related WiHo was compensated for in the form of internal monetary transfers from husband to wife. Research has shown that such switch led to lower labor earnings for men who have been doing more household production than they did before (Altindag et al. 2017).[29] 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 occurred principally in states without joint custody.

5. Price elasticity of demand.

The price elasticity of demand is the most commonly examined demand elasticity. The price elasticity of demand for goods or services x_i is the coefficient of the second term in Equation A6 in the appendix. The price elasticity is preceded by a minus sign, indicating that the higher a product's price, the less quantity is demanded. This elasticity has three components: (1) *a full income* effect that depends on the weight of commercial goods in the cost of producing meta-health, (2) an effect of *substitution in production* between commercial products and the individual's own time that includes the elasticity of substitution in production between goods and own time, and the share of own time in the cost of producing the meta-good, and (3) the effect of *substitution in production* between commercial products and spouse's WiHo. *The elasticity of demand for goods 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 produce their ultimate meta-good, the higher the price elasticity. It is likely that the elasticity will be higher for married and cohabiting people than for singles, since in the short run people who live alone don't have the option of using WiHo as an alternative to commercial inputs. It is predicted that price elasticity of demand for health-related goods and services with home-produced substitutes will be lower in places with *higher proportions of singles (such as Manhattan) than in small towns where a higher proportion of the population is in couple.*

It also follows from Equation A6 in the Appendix that *commercial products that can more easily be substituted for WiHo-produced ones will have a more elastic demand than*

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[29] Joint custody's effects on allocation of resources and individual wellbeing are likely to vary cross-country. 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 the non-custodial parent to the parent who cares more for children.

products that cannot be easily produced with WiHo. For instance, it could be easier to get a spouse to produce a well-balanced meal at home than to recreate the atmosphere of a bar. If that is the case the demand for family-style restaurant meals will be more elastic than the demand for bar services. It can also be seen that the effect of the elasticity of substitution in production between commercial products x and WiHo, on the price elasticity of demand depends on 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 meta-goods the more elastic their demand for goods x. It also follows that the higher the share of a (potential) spouse's WiHo in fulfilling one's needs for good nutrition, the higher that person's elasticity of demand for frozen dinners and other commercial products that substitute for those produced with a spouse's WiHo.

The degree to which individuals can rely on paid domestic help will also affect the price elasticity of demand via its effect on the share of spouse's WiHo in the costs of meta-goods. The cheaper paid domestic help, the less individuals will rely on WiHo. People tend to rely more on domestic help in poor countries with a poor majority and pockets of well-to-do households such as Brazil or South Africa than in rich countries with a relatively large middle class such as the USA.[30]

These insights carry implications for gender differences in demand for goods, especially where traditional gender roles lead to gender differences in the degree to which individual consumers can rely on a spouse's WiHo as an input into the production of what they ultimately want to consume (which includes good health).[31] It is therefore predicted that *if traditional gender roles prevail, ceteris paribus women will have relatively lower price elasticities of demand for commercial goods and services related to health*. This includes elasticity of demand for caregiving in organized facilities.

A further example is clean garments, which also contribute to good health. Men do their wives' laundry much less frequently than women do their husbands' laundry.[32] 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). Could these price differences be related to gender differences in elasticity of demand, women's demand being less elastic because they don't have as much access to laundry-related WiHo performed by a partner?

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[30] I thank Lorena Hakak for pointing this out.
[31] This implies that the share of WiHo costs in total costs of the meta-good is expected to be lower for women than for men.
[32] For example, in 2012 men aged 20-55 spent an average of 5.58 minutes a day on doing laundry, in contrast with 19.37 minutes for women. Thanks to Victoria Vernon for calculating these numbers based on the American Time Use Survey.

This analysis could also help us understand gender differences in elasticity of demand for cigarettes due to gender gaps in demand for smoking-cessation programs and products.[33] A substitute for commercial smoking-cessation products is having a spouse or partner who nags you into quitting the habit. Such nagging is a form of WiHo. If men are more likely to obtain such WiHo from a female partner than women from a male partner it follows that women's demand for commercial habit-stoppers will be less elastic than men's. It appears that smokers become more motivated to kick a smoking habit after the price of cigarettes rises.[34] This helps explain a gender gap in the elasticity of cigarette smoking: according to Hersch (2000) and Chaloupka and Pacula (1999) women's price elasticity of demand for cigarettes is lower than men's.[35]

Women's responsibilities as WiHo-workers may also help explain why Van Houtven et al. (2015) found that women are more likely to purchase Long-Term Care Insurance than men. This could be a consequence of women doing more WiHo than men during many years of marriage. This insurance may be interpreted as a form by which men pay for their wives who act as health workers on their behalf during the marriage. Other reasons for this finding include men being less likely to do WiHo benefiting women if they need assistance, men often being older than women at the time of marriage and men's lower life expectancy.

6. Conclusions and Caveat

This paper builds on Grossbard-Shechtman (2003), a model of demand for goods and services that assumes that individuals--not households--make decisions regarding consumption, including consumption of health-related goods and services. This stands in contrast to other economic models of consumption that account for household production, such as Becker (1965) and Grossman (1972a), that assumed that unified "households" make choices about both consumption and household production, and bargaining, collective models, and Becker (1981) that assumed that unified households make decisions on household production. The model starts by assuming that some individuals living in-couple chose whether they want to work in household production on behalf of a partner (i.e. to become a WiHo-worker) or

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[33] Empirical studies of smoking by members of the same couple need to take into account that there tends to be positive assortative matching over smoking (see Clark and Etile 2006).

[34] DeCicca et al. (2008) follow young adults over a period of 8 years and find that higher taxes tend to be associated with increased smoking cessation.

[35] For a discussion of the last two terms in equation 2, the income elasticity of demand for goods and the elasticity with respect to own wage, see Grossbard-Shechtman (2003).

whether they want a partner to work in household production on their behalf (i.e. to become a WiHo-user). Others living in-couple may prefer an equal division of household labor, with nobody working on the other's behalf.

Furthermore, it was assumed that if they decide to become home health workers caring for their spouse at home or to work in any other household production benefiting their spouse, WiHo-workers are likely to be compensated financially for this work in the form of intra-household financial transfers. This is relevant to marriages and non-marital cohabitation; heterosexual and same-sex cohabitation, married or not; the old faced with complex health care challenges and parents caring not only for each other's health, but often also for the health of young children.

Replacing households by individuals making decisions about household production leads to an analysis of the demand for goods and services that considers two forms of substitution: (1) substitution between household-produced items and commercial health-related products (also found in Grossman and Becker) and (2) substitution between goods produced at home by oneself and those produced by one's spouse. Considering this second dimension of substitution in household production leads to the introduction of new marriage-related variables that can help explain demand for medical care and other health-related goods and services as well as other health behaviors and health outcomes. These are variables that so far have played a limited role in research on health economics. They include (a) sex ratios in marriage markets and the exogenous parameters that influence these sex ratios such as cohort size, gender differences in mortality and incarceration, and (b) legal changes related to marriage or divorce such as the introduction of community property or a switch to joint custody of children in case of divorce. These variables have demonstrated their usefulness in other studies of household decisions by individuals living in couples or aspiring to do so.

The model presented here also adds to currently available explanations used to interpret heterogeneity analysis of health-related behaviors of individuals living in couples. Substitution and income effects are explored in new ways by taking account of possible financial repercussions of the organization of household production. It is argued that relative traits of spouses—such as relative age or relative weight—can also help explain health behaviors such as demand for health-related goods and services due to the value of such traits in marriage markets and their possible impact on the price of WiHo, work in household. Some of these financial repercussions are observable and could contribute to the explanatory power of economic models of health behaviors.

In addition, this paper has offered insights on the determinants of the price elasticity of demand for goods, including health-related goods and services, and highlighted why there could be gender gaps in this elasticity in the case of products for which traditional gender roles affect the availability of home-produced substitutes.

This paper has focused on demand for goods and services, including those that are health-related. Many of the insights it presents are also applicable to studies of caregiving within the household, including time in household production benefiting a partner (see Grossbard and Hakak 2023). It is hoped that future research will offer more evidence testing the predictions presented here and implementing the many suggestions relevant to health-related empirical work.

Reading this paper could benefit from the reader learning about WiHo and its price, even though few like to think that a price mechanism may operate in marriage markets and dating scenes. It is a perspective that is foreign to the prevailing ways of thinking. Not much has changed since Bertrand Lemennicier and I wrote about how prices for WiHo could facilitate the coordination needed to organize more and better household production and thereby contributing more to people's health and happiness (Grossbard-Shechtman and Lemennicier 1999).

Thinking more in terms of work in household production and prices for such work paid by those who use and benefit from the work could help individuals reach higher levels of health and happiness. It could help people fight antiquated laws and institutions that prevent the workers in household production from getting compensated for that work by those who are willing and able to pay for it. It is still the case that in the U.S.A courts condemn providers of household production who expect and are sometimes promised financial rewards for their efforts, a situation that has been deplored by e.g. by Viviana Zelizer (2007), a sociologist and legal scholar. A future with more caregiving by spouses and cohabiting partners requires more recognition of the economic realities surrounding the work involved in caring for those we love (and sometimes don't love, but we still care for them!).

Appendix: Optimization by WiHo-users, WiHo-workers and Markets for WiHo.

The WiHo-user as consumer.
As in Grossbard-Shechtman (2003) consider a WiHo-using individual i who derives utility from consuming Z, a vector of privately consumed meta-goods such as wellness, physical wellbeing, and mental wellbeing. The individual can organize the production of these meta-goods with three inputs: commercial inputs x, the individual's own leisure time s, and WiHo supplied by a spouse j: h_j.

It is assumed that WiHo has a price denoted by y_j. Due to the existence of WiHo prices individual optimization by an individual user i is tied to decision-making by many other agents, including their partner. The price of a spouse's WiHo is given to individual agent i. Also given to the agent are own wage w_i and p, prices of commercial goods and services that can be substituted for home-produced goods. Total time available to an individual is set to equal 1.[36] The individual is selfish in the sense that (potential) spouse's private consumption does not affect own utility and all consumption is private.

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

$$\text{Max } U_i(Z_{ij})$$
$$\text{subject to } Z_{ij} = Z_{ij}\,(x_{ij}, s_{ij}, h_{ji}),$$
$$1 = l_{ij} + s_{ij},$$
$$\text{and } I_{ij} + w_{ij}l_{ij} = y_{ji}h_{ji} + p_i x_i \quad ,$$

where Z is a vector of privately consumed health-related 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, which in regular English is not considered leisure but the convention among economists is to call 'leisure' time not spent in the labor force.

The following section of the Appendix is adapted from the problem that H. Gregg Lewis was solving in his labor economics lectures at the University of Chicago in the years 1973-74, but in the case of Lewis the problem was that of a household maximizing its utility, not an individual. He also assumed that the household had access to three inputs: commercial goods and services, mother's time and father's time. Lewis assumed that the household was constrained by each individual's total time available, implicitly assuming that as decision-maker "the household" controlled each member's allocation of time. Lewis also assumed that non-work income I was that of the household, whereas here it is personal income. Lewis' household also controlled all labor earnings and Lewis had no intra-household transfers.

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. Then the problem looks like: [37]

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[36] It is assumed that WiHo users can spend time either in the labor market or in leisure (time for self). A fuller model could also include own time in household production (see Grossbard-Shechtman 1984).

[37] 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.

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

Solving this problem leads to the derivation of a demand for goods and a demand for WiHo, assuming the production function has Constant Returns to Scale. I follow the same five steps that Lewis followed in his class.

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

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

$$\dot{F} = \dot{Z} + \dot{\Pi}.\tag{A.1}$$

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. If total time=1 we obtain $F = I + w$. We differentiate: $dF = dI + dw$ and divide both sides by *F*, which gives:

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

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

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

$$\dot{\Pi} = \alpha_s \dot{w} + \alpha_x \dot{p} + \alpha_h \dot{y}_j ,\tag{A.3}$$

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:

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

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

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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 CRS (Constant Returns to Scale) the following is the case:

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

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 A6:

$$\dot{x} = \frac{I}{F}\dot{I} - (\alpha_x^Z + \alpha_s^Z \sigma_{xs} + \alpha_h^Z \sigma_{xh})\dot{p} + [\frac{w}{F} + (\sigma_{xs} - 1)\alpha_s^Z]\dot{w} + (\sigma_{xh} - 1)\alpha_h^Z \dot{y}_j. \qquad (A6)$$

The demand for goods and services x is expressed in percentage changes denoted by dotted letters. On the Right-Hand-Side of Equation A6 each term preceding a dotted letter is an elasticity of demand. From left to right, these terms are the elasticity of demand with respect to the price of WiHo, own income elasticity of demand, price elasticity of demand (what most people mean by elasticity of demand), and wage elasticity of demand.

The elasticity of demand for health-related commercial products with respect to the price of a spouse's WiHo, y_j, is one of the terms in equation A6, namely:

$$(\sigma_{xh} - 1)\alpha_h^Z ,$$

It includes α_h^Z, the share of WiHo in individual i's cost of producing own Z, and σ_{xh}, the elasticity of substitution in production between two inputs: commercial goods and WiHo. A higher price y implies that the WiHo-user experiences (i) an increase in quantity demanded of goods and services x to the extent that goods and WiHo are substitutes (the substitution effect) and (ii) a negative income effect (- 1). The higher the elasticity of substitution between x and WiHo, σ_{xh}, the more a given percentage increase in the price of WiHo will lead to an increase in the demand for WiHo substitutes such as purchased meals. The elasticity will be positive as long as σ_{xh} exceeds 1.

The rest of this Appendix is solely based on Grossbard-Shechtman (1984, 2003)

The demand for WiHo by a WiHo-user is derived from the same optimization process. It is predicted to be a negative function of the price of WiHo, as in the case of labor demand by firms. The higher the price of WiHo, the more the WiHo-user will be motivated to replace WiHo with substitutes, such as commercial health services or paid cleaning services.

The Problem of the WiHo-worker.

The problem of j is:

$$\begin{cases} Max \ U_j(Z_j) \ subject \ to \\ Z_j = Z_j(x_j, s_j) \\ 1 = l_j + s_j \\ I_j + w_j l_j + y_j h_j = p_j x_j \end{cases}$$

The WiHo-worker derives utility from consuming Z_j, meta-goods related to health that can be produced in the market or by herself.[38] The problem has been simplified to make it more similar to the problem of a worker in the commercial sector: in contrast to the WiHo-user, it is assumed that the WiHo-worker cannot rely on the partner's time to produce WiHo. Only two inputs thus enter in the production of meta-goods consumed by the WiHo-worker: goods x and own time s. The budget constraint contains three sources of income: non-work income, earnings from the labor market and earnings from WiHo.

Solving this problem leads to the derivation of individual j's supply of WiHo and their demand for goods. To the extent that WiHo-workers have limited income from other sources they have to earn sufficiently from working in the labor force or in WiHo to afford buying goods and services x_j at price p_j. In most cases WiHo-workers will expect a positive price in return for their work in household production and the supply of WiHo is expected to be upward-sloping, as in the analogous case of a worker in the labor market: the higher the price, the more workers supply work. Supply of work in WiHo and supply of work in the labor force are determined in the same optimization process. Individual willingness to supply each type of labor is a function of the difference in the value of marginal (dis)utility of these types of labor (see Grossbard 2015).

Equilibrium in the market for WiHo and determination of the price of WiHo

According to the model marriage occurs when particular WiHo-user i has a positive demand for a spouse j's WiHo and that demand matches that person's supply at a given market price of WiHo. Monogamy is assumed. When a price is paid this causes an internal transfer. It may be a monetary transfer or can be in kind.[39] The total internal (potential) compensation is $y_j h_j$. Marriage relations are thus a special case of labor relations. The parallels with labor relations make it possible to apply standard labor market analysis. Individual supplies are aggregated, and so are individual demands. There could be one single market or many separate markets defined by individual traits of participants, depending on the goal of the analysis. Equilibrium price and quantity in a particular market are established at the intersection of supply and demand for WiHo.

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[38] This section summarizes the parallel section in Grossbard-Shechtman 2003.
[39] If one spouse can make a monetary transfer to the other this implies transferable utility. Transfers are expected to occur infrequently, even less frequently than workers get paid in most commercial firms.

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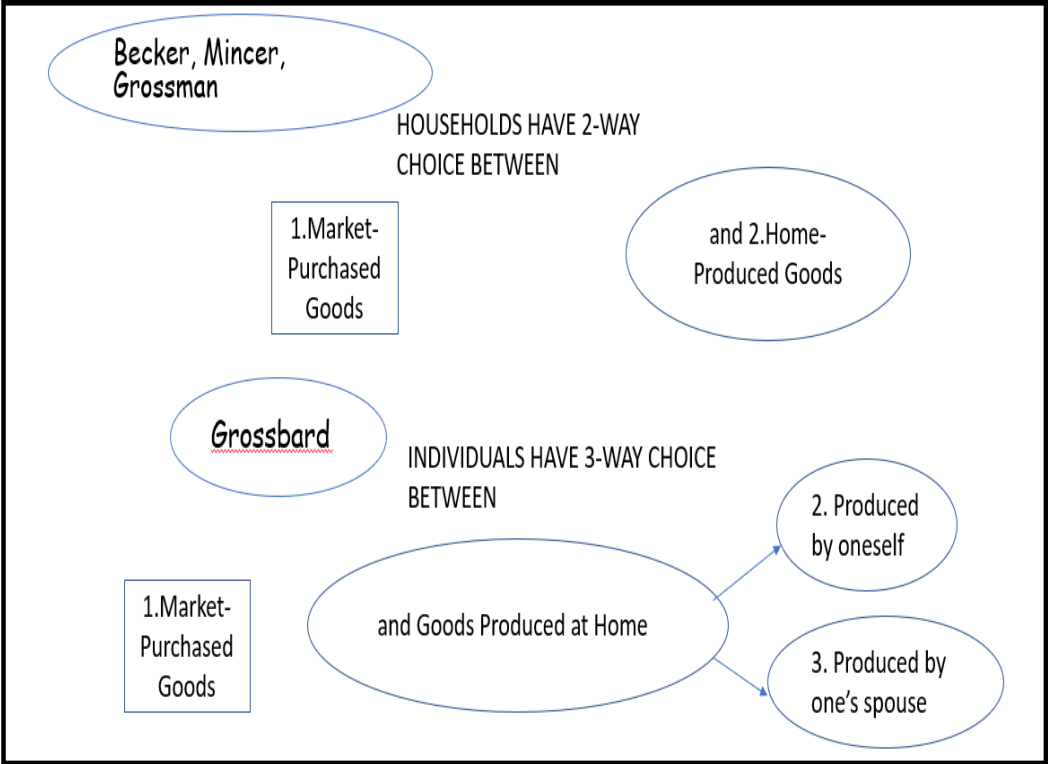
Figure 1: Ways to produce meta-goods according to Becker (1965), Mincer (1963), Grossman (1972) and Grossbard-Shechman (1984) (adapted from Grossbard and Hakak 2023)

Table 1. Predicted effects of individual traits on consumption by WiHo-users and WiHo-workers

Explanatory variable	Predicted effect on consumption by WiHo-user	Predicted effect on consumption by WiHo-worker	Research on related outcomes and country
Relative youth of WiHo-worker	Pos. substitution effect Neg. Income effect	Pos. income effect	• Woolley (2003); Canada; whose bank account? • Grossbard-Shechtman & Neuman (1988) on women's labor supply; Israel • Grossbard-Shechtman & Fu (2002) on women's labor supply; Hawaii
Education level of WiHo-worker	Pos. substitution effect Neg. Income effect	Pos. income effect	• Klawitter (2008); USA; on relative size of individual bank accounts; • Amuedo-Dorantes et al. (2011) on individual access to household income; Denmark
Education level of WiHo-user	Pos. income effect	Neg. Income effect	-
WiHo-worker overweight	Neg. Substitution effect Pos. income effect	Neg. Income effect	Oreffice and Quintana-Domeque (2012) hours of work; USA
WiHo-user overweight	+ substitution effect - Income effect	+ income effect	

Table 2. Variables expected to influence a WiHo-user's consumption of goods and services that can substitute for WiHo, potential data, related existing research on consumption, and related research on other outcomes

Explanatory variable	Consumption by WiHo-user	Consumption by WiHo-worker	Potential source of data	Existing Research on consumption; and country	Research on related outcomes; and country
Increase in sex ratio	Pos. substitution Neg. Income	Positive income effect	N of men & women in various regions at given time	Porter (2016); China	
	-		Cohort size fluctuations		Grossbard-Shechtman & Granger (1998) and Grossbard & Amuedo-Dorantes (2007) on labor supply; USA
	-		N of male & female immigrants		Angrist (2002); labor supply and marriage; USA Chang et al. mortality; Taiwan
	-		Incarceration rate by region and race		Craigie et al (2018); female family headship; USA
	-		Mortality from war		Abramizky et al (2011); assortative mating ; France
Switch to community property	Pos. substitution Neg. income	Pos. Income effect	Change in legal regime	Wikstrom (2017); UK	Ekert-Jaffe and Grossbard (2008) New Zealand; births out-of-couple
Reduction in cost of divorce		Pos. effect on divorce *	Change in divorce laws		Stevenson (2007) on household production; Stevenson & Wolfers (2006) on domestic violence; Ciacci (2023) + prostitution; USA
Introduction of joint custody	Neg. substitution	Neg. income effect	Legal change		Altindag et al (2017) + household production and – labor supply for men; - household production and + labor supply for women;. USA

Notes

* Assuming that prior to legal change the high costs of divorce kept women married against their will.