

## Chapter 2

# A Theory of Allocation of Time in Markets for Labor and Marriage: Macromodel

*This chapter and the following are adapted from “A Theory of Allocation of Time in Markets for Labor and Marriage,” Economic Journal, Vol. 94, pp. 863–882, December 1984. While writing it I benefited from helpful comments from Gary Becker, Jerry Green (from Harvard University), colleagues at Tel-Aviv University, Bar-Ilan University, and San Diego State University, and from anonymous referees.*

In this chapter, a macroanalysis of labor and marriage markets is presented assuming just two types of representative individuals: a man and a woman, both heterosexual, an assumption relaxed in Chap. 3. This macroanalysis is based on microfoundations. It is assumed that individuals can supply labor to firms or work-in-household (WiHo) to a partner.

### Work-In-Household (WiHo)

Central to this theory is the concept of WiHo—defined as an activity that benefits another household member who could potentially compensate the individual for these efforts. That other individual is usually an adult such as a spouse or partner.<sup>1</sup> In addition to what is commonly called “chores,” such as cleaning, shopping for food, meal preparation, or gardening, WiHo could also include caring psychologically or physically for the spouse.<sup>2</sup> Having sex is only WiHo for people who would enjoy doing something else instead.

Household production also plays a central role in the writings of the mentors who inspired me when I first came up with this concept. The founders of the New Home Economics, Gary Becker (1965) and Jacob Mincer (1963), were my professors in

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<sup>1</sup> I do not consider the very long run. After they grow up, children could possibly pay their parents back for the time they devoted to them when they were young and such time could possibly be defined as WiHo.

<sup>2</sup> There are some parallels with the concept of domestic labor in Himmelweit and Mohun (1977) and the concept of caring labor in Folbre (1994).

graduate school and their writings on household production had a big influence on me. However, not all time spent in household production is what I call WiHo: Becker, Mincer, and most other economists studying couples' economic decisions do not distinguish between household activities that benefit a spouse and those that do not. Most people do not make that distinction either, which is why English, French, Spanish, Dutch, or Hebrew do not have a word that captures what I mean with WiHo. Does any language have a good term for this?

The idea of WiHo came about in 1974 and was inspired by what I learned about African marriage. I had majored in economics, sociology, and social anthropology at Hebrew University and did a special field in anthropology while a doctoral student at Chicago. When I started to work on my dissertation on the economics of polygamy in Nigeria I plunged into learning more about the Kanuris as most of the respondents in my data belonged to that tribe. A specialist on the Kanuris, Ronald Cohen, conveniently taught at Northwestern University, also in Chicago, and agreed to serve on my dissertation committee (see Cohen 1967, 1971). The women in my samples were the poorest of the poor, working long hours in food preparation, and owning none of the wealth (as I now know men tend to be the only wealth owners in sub-Saharan Africa). I applied price theory using the following equivalents: households == firms; husbands == employers of WiHo; and wives == workers in WiHo. It then became easy to apply the market principle of organization: my marriage markets were markets for WiHo labor with implicit prices!<sup>3</sup> I assumed that there are markets for different types of men and women and that an equilibrium "price of WiHo" is set in each submarket, in line with Becker's second Marshallian marriage market model (Grossbard 1976). The analysis led to untestable predictions regarding the effects of various characteristics of men and women on the unmeasurable price of women's WiHo and to testable predictions on the measurable number of wives in the household.

Not only do household members not necessarily cooperate, as is assumed in cooperative models of household decision making, but they may not behave according to noncooperative models of decision making either, in the sense that such models view a need to establish equilibrium allocations for the household. My approach allows for the cohabitation of family members who are independent decision-makers. This was a natural assumption in the context of the Muslim polygamist Kanuris who lived in compounds, with each wife having her own little house. Custody rights over children naturally belonged to fathers, so children were not really public goods. I was most chocked to learn that older wives would often be divorced unilaterally by their husbands and some would die on the streets for not having where to go and lacking ways to earn a living.

I realized that I needed a new term since my first publication (Grossbard 1976) analyzing data from Nigerian tribes who do not allow men to do any household production. In that context I used "wife services." "WiHo" has the advantage of being gender neutral. Also, including the term "work" in the expression WiHo helps emphasizing that this concept is about one spouse working for the benefit of the other, and that such work possibly entails an opportunity cost. That was not so clear from

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<sup>3</sup> At the time I called those prices "wife wages" (Grossbard 1976).

other terms I have used such as “household labor” (Grossbard-Shechtman 1984) and “spousal labor” (Grossbard-Shechtman 1993).

Spouses “hire” each other to do WiHo that benefits them. In most cases, they could also have hired a third party, and therefore WiHo is included in the definition of “household production” introduced by Margaret Reid (1934). Reid distinguished between home production and leisure according to the third-party rule. An activity is called “home production” if a third party could be hired to do it. While WiHo is included in Reid’s definition of home production, the opposite does not hold: not all work that can be done by hired hands is WiHo. The same activity can be leisure or WiHo depending on who benefits from it.

## Some Underlying Assumptions

The distinction between WiHo and other household production is related to further underlying assumptions. First is the assumption of individual decision making. Ever since the first incarnation of WiHo in the 1970s in my models *individuals*, not households, are the optimizing agents. There are two individuals involved in WiHo: one who works for the other and the other possibly paying back the first. This implies that all my models based on the concept of WiHo are “nonunitary”.<sup>4</sup> Both individuals maintain their own individual utility functions and budget constraints even if they form couples. They can also transfer utility, money, and goods to each other. They can barter to the extent that they exchange WiHo for WiHo. Alternatively, they can exchange WiHo for money or in-kind transfers.

A second assumption is that goods are *private*. Depending on who benefits from it, the same household production activity can be either WiHo (if the spouse benefits) or leisure (if the spouse does not benefit). In both cases, there may be an opportunity cost to the extent that the activity is not the individual’s preferred activity. For simplicity, in the model below, there are just two household production activities: WiHo and leisure. WiHo could possibly include activities contributing only to the well-being of the spouse (involving the production of private goods for the spouse) as well as activities of benefit to both spouses, such as caring for joint children who are usually considered to be household public goods. The model can be expanded to include such household public goods, as was done in Grossbard-Shechtman (2003) and in Chap. 10.

Third, it is assumed that there is an institutional framework facilitating exchanges of WiHo for WiHo or WiHo for money or in-kind gifts. Couples keep track of who does what and who gets what even if they have joint bank accounts or otherwise pool financial resources. Payments for WiHo need not be explicit money movements, even if they are modeled as such. For example, if the husband vacuums, a task worth \$ 50, the wife will probably not hand him \$ 50, but next time they go to the mall she may approve of him buying a \$ 50 video game. The intuition behind

<sup>4</sup> The term “unitary household” was introduced by Browning et al. 1994 (check). More on the nonunitary nature of marriage market models can be found in Grossbard (2011).

the model carries through even in settings where the couple appears to be a unitary decision-maker.<sup>5</sup>

## Macro- and Micromodels of Marriage

The theory presented in this book was developed in the period 1975–1981, while I was a graduate student at Chicago and a fellow at Stanford’s Center for Advanced Study in the behavioral sciences. Becker’s (1973) pioneering theoretical paper on marriage, my major source of inspiration, had included both a macro and a micro demand and supply (D&S) model of marriage: in the macromodel, there was only one type of man and one type of woman. In the micromodel, there were many types of men and women. Similarly, my theory of “allocation of time in markets for labor and marriage” (Grossbard-Shechtman 1984) uses D&S analysis and includes a macromodel with one type of man and one type of woman and a micromodel with many types of people.

In this book, I assume that readers are unfamiliar with D&S models of marriage and explain my theory more systematically than I did in the past. I still follow Becker’s (1973) order of presentation and start with a macrolevel model with microeconomic foundations.

## Two Steps to the Analysis

There are two steps to the analysis, as in Marshallian economic theory. Step 1 analyzes individual decision making assuming that market equilibrium prices prevail in all relevant markets, including implicit prices for WiHo. Individual supplies and demands are derived. Step 2 derives market equilibria in the relevant markets: familiar labor markets and markets for WiHo. This chapter presents a general equilibrium, macrolevel model in which there is only one type of woman and one type of man. The model is expanded to the case of many different types of men and women in Chap. 3.

### *Step 1: Individual Maximization*

There are two categories of people:  $i$  and  $j$ , but no other types of people. A representative individual  $i$  makes decisions regarding (1) supply of WiHo to a spouse (or partner)  $j$  and (2) demand for the WiHo supplied by a representative person  $j$ . Parallely, a representative individual  $j$  makes decisions regarding (1) supply of WiHo to a spouse  $i$  and (2) demand for the WiHo supplied by a representative person  $i$ . In addition, the following individual maximization leads to the derivation of

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<sup>5</sup> I thank Oana Tocoian for pointing this out.

a conventional labor supply and demand for consumption goods. The decision to form a couple can also be derived from this maximization: at zero (or very low) levels of WiHo it is optimal not to form a couple. To the extent that each representative individual has a nonzero supply of own WiHo and nonzero demand for a spouse's WiHo these demands and supplies have to match as a person can only marry one person at a time:  $i$  and  $j$  have to be spouses to each other.

Three categories of time-use enter a representative individual  $i$ 's utility function: labor, WiHo, and leisure. Furthermore, individual  $i$  derives utility from WiHo performed by a spouse or partner  $j$  and from goods and commercial services  $x$ . Individual utility functions, thus, include five elements:

$$U_i = U_i(l_i, h_i, s_i, h_j, x_i), \quad (2.1)$$

$i, j = f, m$  where  $f$  stands for woman and  $m$  stands for man;  $l$  denotes time allocated to labor,  $h$  is WiHo,  $s$  is leisure (self-oriented time), and  $x$  denotes commercial goods that are private and separable within the household: the goods consumed by individual  $i$  do not include those consumed by spouse  $j$ . If couples are heterosexual  $i \neq j$ . Monogamy implies that only a single  $h_j$  appears in the utility function).<sup>6</sup> Labor and WiHo may affect individual utility positively or negatively, depending on whether the individual enjoys working. Given diminishing marginal utility, negative marginal utility is more likely after a person is already engaged in a substantial amount of labor. A person supplying either kind of labor in the range of negative or zero wages is performing volunteer work.

The planning horizon consists of one period. The individual is constrained by limited time and disposable income defined as personal income *plus* or *minus* any income transfers to or from the spouse. This is in contrast to most economic models of labor supply where it is assumed that a household income constraint affects all members of a household.<sup>7</sup> Decisions are made *ex ante* assuming given equilibrium market prices known to all participants. This includes prices of WiHo.

Formally, the individual maximizes the utility function 2.1 subject to a time constraint

$$T = l_i + h_i + s_i, \quad (2.2)$$

and a monetary disposable income constraint

$$w_i l_i + y_i h_i + V_i = p_i x_i + y_j h_j, \quad (2.3)$$

<sup>6</sup> However, the model could be expanded to include same-sex marriages, cohabitation, and polygamy.

<sup>7</sup> This was certainly the case when I first published this model in 1984.

where  $T$  is the maximum time available (e.g., 24 h/day),  $w$  is market wage for labor,  $y$  is the price of WiHo,<sup>8</sup>  $V$  is nonwage income, and  $p$  is a vector of prices of commercial goods and services. The left-hand side of the budget constraint indicates the sources of individual income: labor, WiHo, and income sources unrelated to work. The right-hand side consists of the individual's expenditures on commercial goods  $x$  and WiHo supplied by the spouse.<sup>9</sup> Both income and expenditures are a function of the price of WiHo  $y$ . Disposable income includes quasi-earnings  $y_i h_i$  and expenditures include what is paid to the spouse working in WiHo, namely,  $y_j h_j$ . It is also possible to move the term  $y_j h_j$  to the left-hand-side. In that case, disposable personal income includes a deduction for what is paid to the spouse.

Consider the traditional case of a housewife (not in the labor force (LF)) married to a husband employed in the LF who compensates her for her WiHo. Then,  $y_i h_i$  is positive in the wife's budget constraint and zero in that of the husband, whereas  $y_j h_j$  will be zero in the wife's budget constraint and positive in that of the husband. More generally, whenever one spouse engages in more WiHo than the other—and this is also likely to occur in dual-earner couples—exchanges of WiHo for money and internal monetary transfers are likely to occur inside the household.<sup>10</sup> Quasi-earnings from WiHo can be used to purchase private goods and services that the WiHo worker enjoys, allowing individuals with low earnings in the labor market to enjoy a nice lifestyle. If both husband and wife supply WiHo to each other in equivalent amounts, barter may occur and net income transfers may possibly cancel out.

From the first-order conditions, and assuming  $p=1$ , we obtain:

$$w_i = \frac{MU_{si}}{MU_{xi}} + \frac{-MU_{li}}{MU_{xi}}, \quad (2.4)$$

which indicates that in equilibrium the real wage per hour of work in the LF is equal to the sum of the monetary equivalent of the value of that hour in leisure (self-oriented activities) and of the absolute (monetary) value of the disutility of this kind of work, and

$$y_i = \frac{MU_{si}}{MU_{xi}} + \frac{-MU_{hi}}{MU_{xi}}, \quad (2.5)$$

<sup>8</sup> In the past, I have called this price “*quasi-wage*.” In the original article and in the 1993 edition of this book, the symbol for price of WiHo was “ $w^*$ .” Since that symbol is often used by labor economists to denote “shadow wage” (the value of time of individuals out of the labor force) I have switched to “ $y$ .”

<sup>9</sup> The maximization problem could also be expressed using an adaptation of Becker's (1965) concept of full income to incorporate earnings from supplying WiHo, as I did in the original article (Grossbard-Shechtman 1984) that is the basis of this chapter.

<sup>10</sup> More on this can be found in Chap. 10 and Amuedo-Dorantes et al. (2011).

which is the equivalent of Eq. 2.4 but for WiHo supplied to a spouse instead of labor supplied to a firm; wage is replaced by price of WiHo. Combining 2.4 and 2.5 yields Eqs. 2.6 and 2.7 that express trade-offs between the two types of work:

$$y_i = w_i + \frac{MU_{li}}{MU_{xi}} - \frac{MU_{hi}}{MU_{xi}}, \quad (2.6)$$

which can also be written as

$$y_i + \frac{MU_{hi}}{MU_{xi}} = w_i + \frac{MU_{li}}{MU_{xi}}. \quad (2.7)$$

Equation 2.7 implies that when in equilibrium a rational individual spends time in the LF and doing WiHo for a spouse to the point where the total marginal benefit from work in the LF (the right-hand side of the equation) equals the total marginal benefit from working for a spouse (the left-hand side of the equation). The total marginal benefit from each type of work includes a monetary component and non-pecuniary benefits (or costs) that economists often call “psychic” benefits. Given that there are two forms of labor, the demand for leisure does not simply lead to the supply of labor, as is the case in standard analyses of labor supply. The approach taken here is that of an analysis of occupational choice in which two occupations—labor and WiHo—differs in the disutility they generate.

The individual sets the following minimum asking wage before deciding whether to enter into the LF:

$$w_i^* = y_i + \frac{MU_{hi}}{MU_{xi}} - \frac{MU_{li}}{MU_{xi}}. \quad (2.8)$$

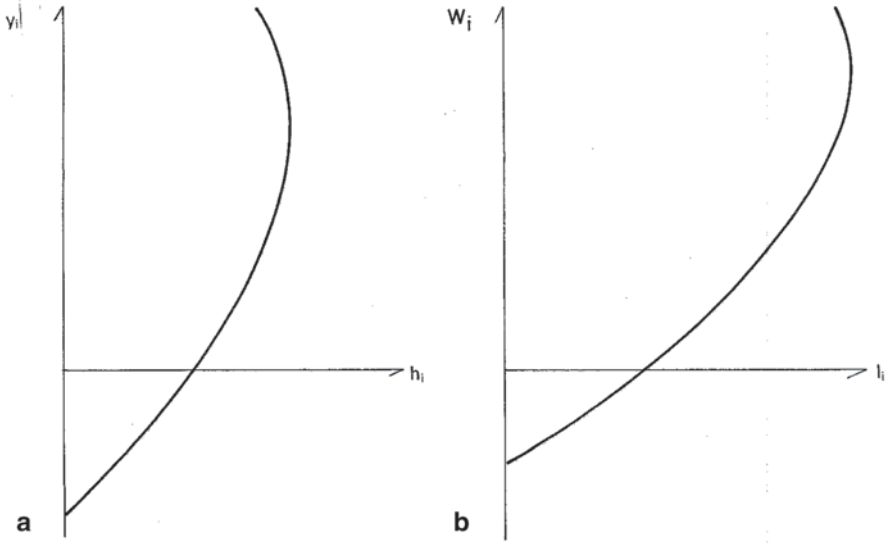
The more the individual enjoys WiHo relative to work in the LF the higher the asking wage. This individual’s supply of WiHo (2.9), supply of labor (2.10), and demand for a spouse’s WiHo (2.11) can be summarized as:

$$h_i^s = h_i(w_i, y_i, y_j, V_i) \quad (2.9)$$

$$l_i^s = l_i(w_i, y_i, y_j, V_i) \quad (2.10)$$

$$h_j^d = h_j(w_i, y_i, y_j, V_i). \quad (2.11)$$

These are reduced forms: the individual’s choice of hours of work supplied ( $h_i^s$  and  $l_i^s$ ) and hours of WiHo demanded from the spouse ( $h_j^d$ ) are solely dependent on exogenously determined parameters, including prices for WiHo  $y_i$  and  $y_j$  and wages  $w_i$  and  $w_j$ . These are choices that individual  $i$  makes independently from other household members. What actual or potential partners are willing to do is taken into



**Fig. 2.1** Individual supplies of WiHo labor (a) and labor (b).

account via prices  $y$  for their WiHo in analogy with labor market analysis in which employers' calculations are integrated into equilibrium wages.

A graphic representation of supply functions 2.9 and 2.10 is found in Fig. 2.1. Panels *a* and *b* in Fig. 2.1 describe individual supplies of each kind of labor: WiHo (Panel *a*) and work in the LF (Panel *b*). It is assumed that initial hours of work produce positive marginal utility, causing the supply curves to start at negative wage levels. The individual depicted in Fig. 2.1 enjoys supplying the first hours of WiHo more than the first hours of labor.

The supply functions are upward sloping to the extent that the substitution effect caused by an increase in the real wage ( $y_i$  in panel *a* and  $w_i$  in panel *b*) initially dominates the income effect. The supplies could eventually become backward bending if the income effect comes to dominate the substitution effect.

The equivalent of nonleisure in conventional models is here the sum of labor and WiHo. Individual well-being is likely to be tied to total labor more than to total time at work and in household production, as is often calculated since time use surveys are widely available. The household production time benefiting the self only is likely to contribute more to happiness and well-being than household production time of the WiHo type.

Given that labor and WiHo are alternative occupations, it follows that the supply of WiHo  $h$  is inversely related to wage in the labor market  $w_p$ , and that the supply of labor  $l$  is inversely related to price of WiHo  $y_i$ . A substitution effect is likely to be reinforced by an income effect. Nonwage income  $V$  is expected to discourage both kinds of labor supply.



The demand for spouse's WiHo  $h_j$  is expected to be a downward-sloping function of price of WiHo  $y_j$  for the usual reasons determining the slope of derived demands.

Assuming heterosexuality, individual women demand male WiHo whereas individual men demand female WiHo. Next, markets accomplish their function and establish equilibrium wages and prices of WiHo. To the extent that each representative individual has a nonzero supply of own WiHo and demand for the other's WiHo these demands and supplies have to match.

## Step 2: Market Equilibrium

All individuals  $i$  and  $j$  interested in supplying WiHo to a spouse will be included in an aggregate supply. All individuals interested in using WiHo by a spouse will be included in an aggregate demand in one of the two markets for WiHo. It is assumed that markets for WiHo suppliers are competitive. The first condition of competition—large numbers of participants—applies to the case of marriage: in most societies, large numbers of men and women could possibly compete for marriage partners. Competition is more likely when there are larger numbers of market participants, information is more easily accessible, and more protection is given to the rights of individual market participants (i.e., because marriage contracts are more binding). Since there is only one type of man and one type of woman WiHo is homogeneous. Individual  $i$ 's are perfectly substitutable and so are individual  $j$ 's. These assumptions follow Becker's (1973, 1981) first *D&S model of marriage* and are typical of macrolevel models.

Equilibrium wages and prices are established in the respective markets once all individual demands and supplies are aggregated and aggregate demands and supplies are juxtaposed in the appropriate markets. Aggregate D&S functions for women are presented in Eqs. 2.12–2.14, and for men in Eqs. 2.15–2.17. Superscripts  $d$  and  $s$  denote whether a function is a supply or a demand. Capital letters are used to denote aggregate hours of work.

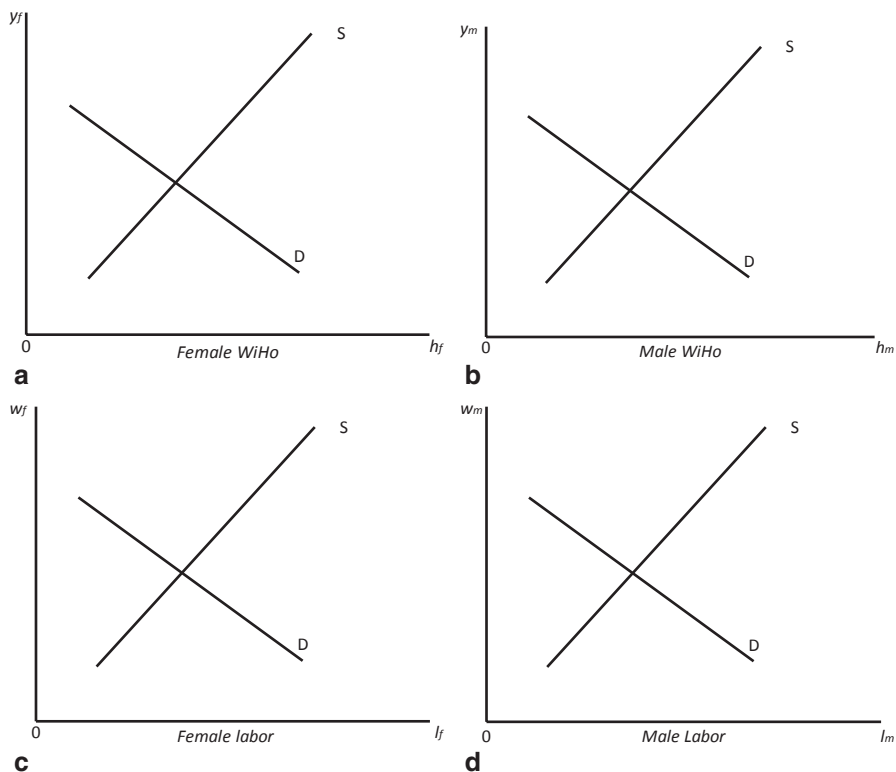
$$H_f^s = H_f^s(y_f, w_f, y_m, p_f, V_f, \beta_f, N_f) \quad (2.12)$$

$$L_f^s = L_f^s(w_f, y_f, y_m, p_f, V_f, \beta_f, N_f) \quad (2.13)$$

$$H_m^d = H_m^d(y_m, w_f, y_f, p_f, V_f, \beta_f, N_f), \quad (2.14)$$

where  $\beta$  is a factor describing tastes or productivity, and  $N_f$  is the number of women married or eligible for marriage. The equations for men are analogous, subscripts  $f$  now being replaced by  $m$  and subscripts  $m$  by  $f$ :

$$H_m^s = H_m^s(y_m, w_m, y_f, p_m, V_m, \beta_m, N_m) \quad (2.15)$$



**Fig. 2.2** Markets for **a** female WiHo, **b** male WiHo, **c** female labor, and **d** male labor

$$L_m^s = L_m^s(w_m, y_m, y_f, p_m, V_m, \beta_m, N_m) \quad (2.16)$$

$$H_f^d = H_f^d(y_f, w_m, y_m, p_m, V_m, \beta_m, N_m). \quad (2.17)$$

Given that there is only one kind of woman and one kind of man the only mechanism that leads to upward-sloping supplies and downward-sloping demands is hourly variation in marginal individual (dis)utility (in the case of supply) and marginal utility and productivity (in the case of demand). In equilibrium, all marriages between identical men and identical women will be identical.

Four markets are interrelated in a general equilibrium: two markets for the WiHo supplied by men and women, and two markets for work in the LF supplied by men and women. Figure 2.2 presents the four markets that are, thus, obtained based on eight equations: the six Eqs. 2.12–2.17 and two equations of aggregate labor demand by employers. It is assumed that employers have separate demands for male and female workers.

Equilibrium wages, prices for WiHo, and employment levels are established in each of the four markets. Given demands  $D$  and supplies  $S$ , the equilibrium wages for women and men are, respectively,  $\bar{w}_f$  and  $\bar{w}_m$  (panels *c* and *d* in Fig. 2.2), and the equilibrium prices of WiHo for women and men are, respectively,  $\bar{y}_f$  and  $\bar{y}_m$  (panels *a* and *b*.) Equilibrium conditions in all four markets are interdependent. Wages in labor markets affect marital behavior and conditions in markets for WiHo influence labor supply.

Higher WiHo prices  $y$  mean that suppliers of WiHo obtain more “exit power,” “threat power,” or “bargaining power.” In turn, higher bargaining power translates into more access to private consumption within a couple, more influence on decisions, etc. (see Chap. 10). Any behavioral outcome that is related to such price for WiHo can become a testing ground for this theory. Chapters 4–6 examine testable implications for labor supply. Chapter 10 presents testable implications related to consumption, and Chap. 11 examines savings.

Some of the testable implications that follow from this analysis also follow from other models analyzing determinants of bargaining power such as McElroy and Horney (1981) and Lundberg and Pollak (1993). One difference is that bargaining theories limit their analyses to two agents dealing with each other. In contrast, according to the market analysis presented here higher threat power does not necessarily result from bargaining between two agents. Hypothetical willingness to supply or to demand WiHo while one is single or married to someone else also has an impact on the price of WiHo and therefore on outcomes of interest such as access to consumption goods. Limitations that apply to labor market analyses also apply to markets for WiHo. For instance, in macromodels wage rigidity is a problem that has featured in many economic models. Likewise, there could be “wage” rigidity in markets for WiHo. Rigidity may even be worse in the case of prices of WiHo than in the case of regular wages, as the institutions regulating marriage and family life tend to change very slowly. An additional complication peculiar to markets for WiHo is the limitation to one-to-one matches when polygamy is prohibited. In a monogamous society, marriage will occur when at the equilibrium  $\bar{y}_f$  and  $\bar{y}_m$  the representative man has a demand for the amount of WiHo that the representative woman wants to supply and that woman demands the amount of WiHo that the man supplies. In this macromodel, one has to assume that representative individuals’ hours of WiHo are given in order to obtain predictions regarding the number of individuals who are married in a society.

In equilibrium, the representative married couple experiences no excess demand for or excess supply of WiHo at the relevant  $y$ ’s. This couple could be defined as egalitarian if the market value of her services  $y_f h_f$  is identical to  $y_m h_m$ . Alternatively “egalitarian” could be defined in terms of equal amount of hours that each spouse works in WiHo. To the extent that  $y_f h_f > y_m h_m$ , a representative husband makes financial transfers (or purchases goods) to the representative wife. Net transfers from the wife to the husband will occur if  $y_f h_f < y_m h_m$ .

The next chapter expands the model to include many types of men and women.

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