Husbands, Wives and the Peculiar Economics of Household Public Goods

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Abstract

Understanding how household income is allocated among different types of expenditures is of the utmost importance when considering policy targeted at increasing household well-being. This analysis uses the collective household model to determine how household public goods and household public bads are chosen in light of the relative power balance between husband and wife. This paper shows both theoretically and empirically that the effect of additional female power on household outcomes depends on the initial level of female power. And contrary to previous findings, it need not always be positive. The policy implications of this non-monotonic relationship between female decision-making power and household well-being outcomes are important. The effectiveness of aid to households depends not only on current expenditure levels, but also on household balance of power. More specifically, enhancement of female power, while generally good for child nutrition (more controversially, and the paper shows this theoretically and empirically) there is also a class of situations where this is not so.

JEL classification numbers: D1, O1, H2

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I. Introduction

Understanding how household income is allocated among different types of expenditures is important when considering policies targeted at increasing household well-being. Knowing what determines how a dollar given to a family will be spent is necessary to focus policy on specific outcomes.

For instance, if policy makers are concerned with alleviating child malnutrition it is important to understand it may matter to whom in the household a dollar of aid is given. It is a well-documented fact that giving a household subsidy to a woman rather than a man leads to different types of expenditures and, consequently, to different child health outcomes (Senauer, Garcia & Jacinto, 1988, 1991; Handa, 1999; Thomas, 1990; Hopkins, Levin and Haddad, 1994; Hoddinott and Haddad, 1995). Among economists a consensus seems to be emerging—that giving control over money to women is more effective in increasing household well-being outcomes because women have stronger preferences for household well-being. However, this relationship may be neither linear nor monotonic, as much of the literature seems to presume. If the positive relationship between female power and the consumption of household public good (that we observe in several studies) is the result of bargaining between the man and the woman rather than a difference in preferences then it is possible that there exists a point at which giving more power to the woman is no longer beneficial to the household. Furthermore, pinpointing what determines the point at which the marginal benefit to female power reaches zero can better equip policy makers in achieving their goals.

This paper first documents previous findings by economists that show how the balance of household power affects household outcomes. It then presents a generalized model of household power balance and the choice to consume household public goods and household public bads. The theory implies that the relationship between female decision-making power and expenditures on household public goods is indeed concave, while the female power relationship with expenditures on household bads is convex. More importantly, the theory shows both these relationships could be non-monotonic. Finally, there is an empirical analysis, which provides evidence for the implications of the theory.

2. Review of Literature

How resources within a household are distributed among competing uses has long been a source of economic inquiry. Several theoretical approaches have been developed to address this problem and a satisfactory solution has not yet been reached. First, there is the unitary model, in which a household maximizes a single utility function as if all members of the household have the same preferences or allocations are determined by a benevolent dictator (Becker, 1964). This approach contradicts reality in obvious ways and now there is a body of empirical writings that document this contradiction. On the other hand, it is no more realistic to assume that a household's primary decision-making agents are completely unconcerned with each other's well-being—evoking images that decisions about how to allocate household resources are the result of standoffs in the kitchen. The collective household decision-making model recognizes that households are a place of both cooperation and conflict, and will be the starting point of the theoretical analysis that follows.

An estimation of Engel curves for household consumption in Canada confirms that households are neither fully cooperative nor completely noncooperative (Phipps & Burton, 1998). Households appear to pool income for some categories of goods but not for others (they pool income for larger purchases including durables and housing but not for smaller purchases, including nondurables). This study finds that husbands and wives are more likely to spend their own money on goods they privately consume, as well as, on household public goods that correspond with their stereotypical family roles. This result is mathematically formalized in the next section, where agents gain separate utility from certain goods yet have common preferences over others.

Regardless of theoretical approach, be it the unitary or collective household model, with very few exceptions (for instance, Basu, 2004) there seems to be a consensus that female power (whether it be measured by income share or education) has a positive effect on child outcomes. There are several empirical studies that explore implicitly the relationship between female decision-making power and child outcomes in developing countries. These studies use either female education or female income share to measure a woman's power. They can, however, be divided into two categories by the well-being outcomes examined. Some studies test physical child health outcomes including caloric

intake, height for age and weight for height, while others focus on the household expenditures on different types of goods that are then assumed to lead to favorable or disfavorable outcomes where children (and household well-being) are concerned.

There is evidence the caloric intake of children is affected positively by female wage and negatively affected by male wage (Senauer, Garcia & Jacinto, 1988). In terms of anthropometric outcomes, children's height for age increases with additional female education, while the effect of male education has been found both positive and negative in different studies (Senauer & Garcia, 1991; Handa, 1999). One of the most striking analyses of physical child health outcomes concluded that the probability of child survival in Brazil increases by almost twenty times when unearned income is accrued by the woman rather than the man (Thomas, 1990).

The analyses of household expenditure outcomes as determined by balance of household power find similar results. Expenditures on goods that are assumed to be beneficial to child outcomes increase as female income share increases. Hopkins, Levin and Haddad (1994) analyze data from Niger and determine that additional female income share has a positive effect on food expenditures when the seasonality effects of income flows are taken into account. Using a non-cooperative bargaining model of household expenditures, Hoddinott and Haddad (1995) find that as the share of wife's income rises, so does the share of the budget spent on food. They also determine that if you double the household income received by the wife there would be a decrease in the share of the budget spent on both alcohol and cigarettes. Furthermore, decreasing household income by 11% would result in no change in expenditure on food if you give all the remaining income to the woman. Their results are robust to using female education instead of income share as a measure of female power. Economists have interpreted these empirical findings to be evidence that men and women have different preferences as far as household consumption is concerned. Basu, Narayan and Ravallion (2002) study the sharing of the benefits of literacy in a collective model of the household and find in the context of Bangladesh that one member's literacy acts like a public good and this is especially true of female literacy.

Most of these studies only consider the first order effects of female power on well-being outcomes (which may be appropriate given the range of female power within

the country of analysis). And others determine explicitly that the relationship between female power and child well-being is linear or at least monotonic (Handa, 1999). Analyzing countries in contexts women are subordinate to men leads to an understanding of only half the story. The question remains: How would additional female power affect household outcomes if she were already powerful? This question is raised by Basu (2004) in his critique of the collective household decision making model. He demonstrates, in the specific context of child-labor decision, that an increase in the mother's power or say in household decisions can lead to, first, a decrease and, then, a rise in the incidence of child labor. The aim of the present paper is to generalize this result to the cases of household public goods and household public bads and to put the theoretical implications to empirical test.

3. The Decision over Household Public Goods and Household Public Bads

This paper utilizes the collective model of household decision-making (Bourguignon and Chiappori, 1994)—an approach that allows each individual to have a different utility function over goods consumed in the household. But it also incorporates the fact that there is some cooperation between agents in the decision making process. With the collective approach decisions are made by maximizing a weighted average of the decision-makers' utility functions. The weight on each individual's utility represents his or her relative power in the decision-making process. Formally, if there are two decision-making agents in the household, the woman (agent 1) with utility U_1 and the man (agent 2) with utility U_2, and there is some balance of power represented by θ, then the household maximizes $\theta U_1 + (1-\theta)U_2$. This means that the household outcome incorporates both decision-makers' utility functions and the relative power each agent has in the decision-making process. In this expression and throughout this paper θ is the index of *female* power in the household.

Let there be four goods available for *purchase* by the household: (i) x_1 is a good that brings only the woman utility, (ii) x_2 is a good that only the man enjoys, (iii) n is a household public good, on which both the man and the woman are interested in spending money, because it gives both agents positive utility and (iv) m is a household public bad,

which gives negative utility to each agent. The fact that each decision maker is only concerned with one x-good is a polar assumption made for algebraic convenience and is meant to capture the general idea that the husband and wife may have different preferences over goods the household can consume. As for m, the agents are actually willing to pay to reduce the level of the household public bad.

Each agent, the man and the woman, have the same utility function for the goods in which they are individually interested. That is,

$$\phi_i = \phi(x_i)\ , \qquad \phi' > 0\ ,\ \phi'' < 0 \tag{1}$$

represents the utility agent i gets from good x_i. Furthermore, let the benefit-function for the household public good be the same for both adults.

$$b_i = b(n), \qquad b' > 0\ ,\ b'' < 0 \tag{2}$$

That is to say, $b(n)$ is strictly concave—the returns to additional units of the household good are positive but decreasing as the level rises. An example of such a household public good is child nutrition. And with this specification the returns to additional nutrition are positive but decreasing as the child's nutrition level rises. This makes sense, as additional nutrition when the child is on the brink of starvation could save the child's life, while additional nutrition when the child is already healthy could go unobserved by other household members. Additionally, the disutility-function for the household bad is also the same for each agent. It is

$$c_i = c(m), \qquad c' > 0\ ,\ c'' > 0\ . \tag{3}$$

The cost incurred by each individual is strictly convex. Though functional forms for the costs and benefits are common to each agent, let me allow for the fact that the wife may have greater or smaller sensitivity to household public goods (and bads). I shall use γ as a scalar to indicate the worth of these public goods to the wife, where $\gamma \in (0, \infty)$. In other words, if a household consumes (x_1, x_2, n, m), the wife's and the husband's utilities are given, respectively, by

$$U_1 = \phi(x_1) + \gamma b(n) - \gamma c(m) \tag{4}$$

$$U_2 = \phi(x_2) + b(n) - c(m) \tag{5}$$

So if $\gamma > 1$, the wife has relatively greater concern for the household public goods (and bads) and if $\gamma < 1$ she has less concern for the household public goods (and bads) than her husband. Hence, according to the collective model this household's maximand is given by:

$$\Omega = \theta[\phi(x_1) + \gamma b(n) - \gamma c(m)] + (1-\theta)[\phi(x_2) + b(n) - c(m)] \qquad (6)$$

In this exercise I shall not be concerned about changes in prices, so these will be treated as fixed. Hence, the prices of the private and public goods will be assumed to be 1. There is no loss of generality in this, since they enter only as coefficients. Let y be the amount of money spent on curbing the public bad. Hence $m = m(y)$. Clearly, $m'(y) < 0$. For simplicity, I assume $m = \overline{M} - y$.

It will be assumed that the adults always work and they earn a combined income of w. Thus, the household's budget constraint can be written as:

$$x_1 + x_2 + n + (\overline{M} - m) = w \qquad (7)$$

where $\overline{M}$ is the level of the household public bad that would exist if no action is taken to reduce it and m is the number of units of the bad chosen by the household. This means $(\overline{M} - m)$ are the number of units by which the household will decrease the bad, and thus the number of units the household must pay for. For example, there may be $\overline{M}$ amount of lead paint covering interior walls of the home. And by choosing level m units of lead paint the household is paying to decrease the amount of lead paint in the house by $(\overline{M} - m)$. After this reduction of the bad they still incur costs associated with the remaining m units of lead paint, the amount of lead paint they chose to let remain on the walls. This set up allows for there to be income effects from consuming the household public bad. Another example is where the bad is child labor and the natural level of child labor is zero ($\overline{M} = 0$). Then the household budget constraint can be written more intuitively as $x_1 + x_2 + n = w + km$, where k represents the wage rate for child labor. This is the specific case developed in Basu (2004).

Using this set-up, let us now explore how the balance of power within a household affects the optimal consumption levels of the household public good and the

household public bad. From (6) and (7) we can define the household's unconstrained maximization problem with respect to the choice of the woman.

$$\underset{\{x_1,n,m\}}{Max} \quad \theta\phi(x_1)+(1-\theta)\phi\left(w-x_1-n-\left(\overline{M}-m\right)\right)+\left[\theta\gamma+(1-\theta)\right]b(n)-\left[\theta\gamma+(1-\theta)\right]c(m) \tag{8}$$

In the model described above, an increase in the woman's power will have a positive effect on the consumption of the household public good (n) and a negative effect on the consumption of the household public bad (m) up to a point, defined by her *relative concern* (γ), above which additional female power will decrease the consumption of the household public good and increase the consumption of the household public bad.

Theorem 1. Both the consumption of the household public good (n) and the consumption of the household public bad (m) are non-monotonic with respect to increases in the woman's power. As θ increases, n first rises and then falls and m first falls and then rises.

Proof. The first-order conditions of this household's maximization problem are:

$$\theta\phi'(x_1)\equiv(1-\theta)\phi'\left(w-x_1-n-\left(\overline{M}-m\right)\right) \tag{9}$$

$$(1-\theta)\phi'\left(w-x_1-n-\left(\overline{M}-m\right)\right)\equiv\left[\theta\gamma+(1-\theta)\right]b'(n) \tag{10}$$

$$(1-\theta)\phi'\left(w-x_1-n-\left(\overline{M}-m\right)\right)\equiv\left[\theta\gamma+(1-\theta)\right]c'(m) \tag{11}$$

Recall that the optimal levels of each good are functions of θ—$x_i^*(\theta), \forall i\in\{1,2\}$, $n^*(\theta)$ and $m^*(\theta)$. Before we differentiate with respect to θ, in order to determine how the balance of household power affects the consumption of the household public good and the household public bad, let's simplify the above system in order to make the calculations easier. Combining (9) with (10) and (9) with (11) yields (12) and (13) respectively.

$$\theta\phi'(x_1)\equiv\left[\theta\gamma+(1-\theta)\right]b'(n) \tag{12}$$

$$\theta\phi'(x_1)\equiv\left[\theta\gamma+(1-\theta)\right]c'(m) \tag{13}$$

So differentiating (9), (12) and (13) with respect to θ yields the following system of equations (in matrix notation):

$$\begin{bmatrix} \theta\phi''(x_1)+(1-\theta)\phi''(x_2) & (1-\theta)\phi''(x_2) & -(1-\theta)\phi''(x_2) \\ \theta\phi''(x_1) & -[\theta\gamma+(1-\theta)]b''(n) & 0 \\ \theta\phi''(x_1) & 0 & -[\theta\gamma+(1-\theta)]c''(m) \end{bmatrix} \begin{bmatrix} \frac{\partial x_1^*}{\partial\theta} \\ \frac{\partial n^*}{\partial\theta} \\ \frac{\partial m^*}{\partial\theta} \end{bmatrix}$$

$$\equiv \begin{bmatrix} -\phi'(x_1)-\phi'(x_2) \\ (\gamma-1)b'(n)-\phi'(x_1) \\ (\gamma-1)c'(m)-\phi'(x_1) \end{bmatrix} \tag{14}$$

where $x_2 = w - x_1 - n - \left(\overline{M} - m\right)$ from the budget constraint.

If we apply Cramer's Rule to solve for $\frac{\partial n^*}{\partial\theta}$ and $\frac{\partial m^*}{\partial\theta}$ and simplify we get:

$$\frac{\partial n^*}{\partial\theta} \equiv \frac{c''(m)[(1-\theta)\phi'(x_1)\phi''(x_2)-\gamma\theta\phi'(x_2)\phi''(x_1)]}{|H|} \tag{15}$$

$$\frac{\partial m^*}{\partial\theta} \equiv \frac{b''(n)[(1-\theta)\phi'(x_1)\phi''(x_2)-\gamma\theta\phi'(x_2)\phi''(x_1)]}{|H|} \tag{16}$$

Since $b(\cdot)$ and $\phi(\cdot)$ are both strictly concave and $c(\cdot)$ is strictly convex, the denominator, $|H|$, is always positive. The sign of the numerators are therefore the respective signs of the comparative statics, $\frac{\partial n^*}{\partial\theta}$ and $\frac{\partial m^*}{\partial\theta}$. These depend on θ and γ.

Since $b''(\cdot)<0$, $c''(\cdot)>0$ the sign of $\frac{\partial n^*}{\partial\theta}$ is the same as the sign of X and the sign of $\frac{\partial m^*}{\partial\theta}$ has the sign opposite of X. Where X is defined as:

$$X = (1-\theta)\phi''(x_2)\phi'(x_1)-\gamma\theta\phi''(x_1)\phi'(x_2) \tag{17}$$

Now we can show that there exists a point at which $X>0$ for all θ less than some $\overline{\theta}$ and $X<0$ for all θ greater than some $\overline{\theta}$.

From (17) we know that $X = 0$ when $\gamma = \frac{(1-\bar{\theta})\phi''(\bar{x}_2)\phi'(\bar{x}_1)}{\bar{\theta}\phi''(\bar{x}_1)\phi'(\bar{x}_2)}$. And this implies for all $\theta > \bar{\theta}$, $\gamma > \frac{(1-\theta)\phi''(x_2)\phi'(x_1)}{\theta\phi''(x_1)\phi'(x_2)}$ by the fact that as θ increases so does the consumption of x_1 from (11) and $\phi' > 0$, $\phi'' < 0$, $\phi''' > 0$. Which means that $X < 0$ for all $\theta > \bar{\theta}$. And the opposite is true when $\theta < \bar{\theta}$.

This means that $\frac{\partial n^*}{\partial \theta} > 0$ and $\frac{\partial m^*}{\partial \theta} < 0$ when $\theta < \bar{\theta}$ and $\frac{\partial n^*}{\partial \theta} < 0$ and $\frac{\partial m^*}{\partial \theta} > 0$ when $\theta > \bar{\theta}$. Q.E.D.

This theorem holds as long as the woman's concern is finitely more or less than the man's. Formally, her relative concern must lie strictly between zero and infinity, $\gamma \in (0, \infty)$. Rather intuitively, if the woman were infinitely more concerned than her male counterpart with household well-being, then there would not exist a turning point for either the consumption of the household public good or the consumption of the household pubic bad and $\frac{\partial n^*}{\partial \theta} > 0$, $\frac{\partial m^*}{\partial \theta} < 0$ would hold for the full range of θ. On the other hand, if the woman's relative concern for household well-being is zero then consumption of the household public goods and bads will always be decreasing and increasing respectively, with an increase in θ. In these extreme cases, where a single individual cares about family well-being, it makes sense that increasing household well-being will only take place if power is in the hands of the agent who cares. Finally, this proof requires the common assumption that $\phi'''(\cdot) > 0$.

With this result we can now explore how the apex of the non-monotonic $n^*(\theta)$ function and the base of the non-monotonic $m^*(\theta)$ function are affected by the relative concern for household public goods and bads. The following two corollaries comment on the apex of $n^*(\theta)$ and the base of $m^*(\theta)$.

Corollary 1. When the relative concern for household public goods is equal between agents ($\gamma = 1$), if $\theta < \frac{1}{2}$ then $\frac{\partial n^*}{\partial \theta} > 0$, $\frac{\partial m^*}{\partial \theta} < 0$ and if $\theta > \frac{1}{2}$ then $\frac{\partial n^*}{\partial \theta} < 0$, $\frac{\partial m^*}{\partial \theta} > 0$. As long as $\phi'''(\cdot) > 0$.

Proof. With equal concern between agents for household public goods we know the sign of $\frac{\partial n^*}{\partial \theta}$ is the same as the sign of $(1-\theta)\phi''(x_2)\phi'(x_1) - \theta\phi''(x_1)\phi'(x_2)$. When $\theta = \frac{1}{2}$ we know that $x_1 = x_2$ from (9). This means that $(1-\theta)\phi''(x_2)\phi'(x_1) - \theta\phi''(x_1)\phi'(x_2) = 0$ and so then does $\frac{\partial n^*}{\partial \theta} = 0$. For $\theta < \frac{1}{2}$, we know that $\phi'(x_1) > \phi'(x_2)$ by (9). This implies that $x_1 < x_2$, which makes sense since less female power intuitively yields less consumption of the good the female prefers. As long as $\phi''' > 0$ then $\phi''(x_1) < \phi''(x_2)$ and we know that $(1-\theta)\phi''(x_2)\phi'(x_1) - \theta\phi''(x_1)\phi'(x_2) > 0$ and $\frac{\partial n^*}{\partial \theta} > 0$. Likewise, if $\theta > \frac{1}{2}$ then $\frac{\partial n^*}{\partial \theta} < 0$ under the same condition on the third order derivative of ϕ. The same logic can be easily applied to $\frac{\partial m^*}{\partial \theta}$ to show if $\theta < \frac{1}{2}$ then $\frac{\partial m^*}{\partial \theta} < 0$ and if $\theta > \frac{1}{2}$ then $\frac{\partial m^*}{\partial \theta} > 0$. Q.E.D.

Figure 1 illustrates optimal household well-being chosen by a household with two decision-making agents. The horizontal axis measures female power—θ. And on the vertical axis measures the optimal level of the household public good, $n^*(\theta)$, and the household public bad, $m^*(\theta)$.

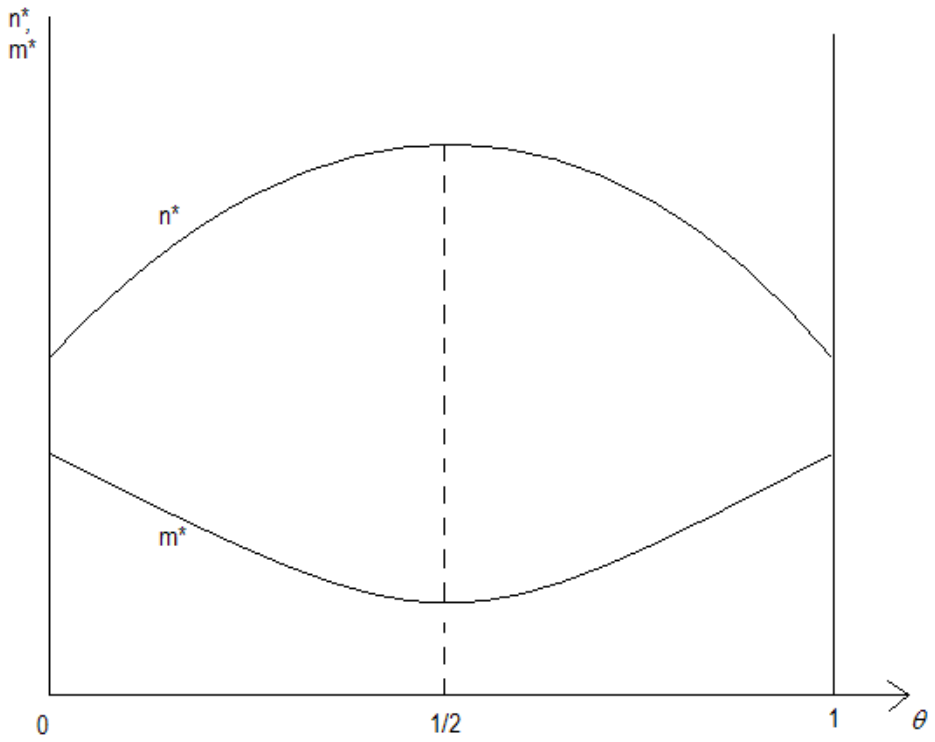

Figure 1. The Effect of Balance of Power on $n^*(\theta)$ and $m^*(\theta)$ when $\gamma = 1$

As is possible to see, when the relative concern for public and private goods is the same, the highest optimal level of consumption for the household public good is achieved when there is an equal distribution of power between agents in the household. Likewise, the lowest optimal level of consumption of the household public bad occurs when the power between decision-making agents is perfectly balanced.

It is interesting, now, to consider how this relationship changes when the relative concern for household public goods and bads between agents differs. The point at which additional female power begins having a negative effect on household public good and a positive effect on household public bad depends on her concern for these public goods and bads relative to her husband's.

Corollary 2. If the woman is more concerned with household public goods and bads ($\gamma > 1$) then the turning points in the demands for household public goods and bads occur when the female has more power ($\bar{\theta} > \frac{1}{2}$). Likewise, the turning points occur when she has less than half the decision making power ($\bar{\theta} < \frac{1}{2}$) if she is relatively less concerned with household public goods and bads ($\gamma < 1$).

Proof. Consider the sign of X at $\theta = \frac{1}{2}$. When household power is perfectly balanced $(1-\theta)\phi''(x_2)\phi'(x_1) = \theta\phi''(x_1)\phi'(x_2)$, so we can rewrite $Y = (1-\theta)\phi''(x_2)\phi'(x_1)[1-\gamma]$. Because $\phi' > 0$, $\phi'' < 0$, the sign of Y is equal to the sign of $Z = [\gamma - 1]$. The sign of Z is positive when $\gamma > 1$, so $\frac{\partial n^*}{\partial \theta} > 0$ and $\frac{\partial m^*}{\partial \theta} < 0$ at $\theta = \frac{1}{2}$ and the turning point for both functions is at $\bar{\theta} > \frac{1}{2}$ when the woman is relatively more concerned with the household public good and bad. Similarly, when $\gamma < 1$, $Z < 0$ so $\frac{\partial n^*}{\partial \theta} < 0$ and $\frac{\partial m^*}{\partial \theta} > 0$ at $\theta = \frac{1}{2}$, which makes the turning point at $\bar{\theta} < \frac{1}{2}$. Q.E.D.

These predictions are illustrated by Figures 2 and 3, for $n^*(\theta)$ and $m^*(\theta)$, respectively.

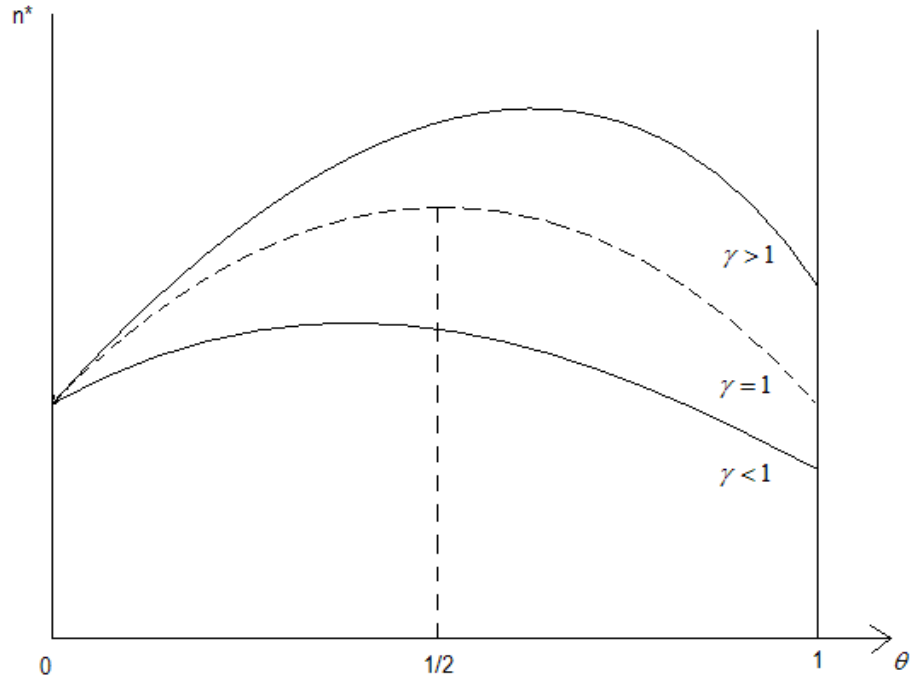

Figure 2. The Effect of Balance of Power on $n^*(\theta)$ when $\gamma \neq 1$

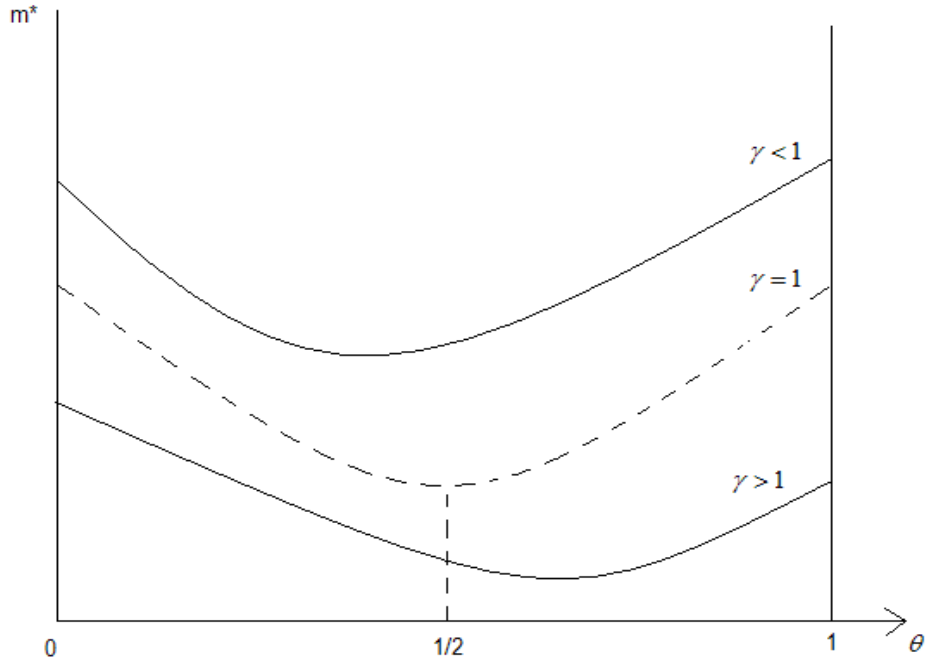

Figure 3. The Effect of Balance of Power on $m^*(\theta)$ when $\gamma \neq 1$

This result is interesting because it contradicts conventional literature, which often says more female power always leads to better household well-being outcomes (Senauer, Garcia & Jacinto, 1988, 1991; Handa, 1999; Thomas, 1990; Hopkins, Levin and Haddad, 1994; Hoddinott and Haddad, 1995). The fact that this relationship is non-monotonic for both household public goods and household public bads is important information for policy makers.

There are two other notable characteristics of this model. First, is that $\frac{\partial n^*}{\partial \gamma} > 0$ and $\frac{\partial m^*}{\partial \gamma} < 0$, which is to say that at every given θ as γ increases n^* rises and m^* falls. This makes intuitive sense—as relative concern for household public goods increases so will the optimal level of household public goods consumed by the family and vice versa for household public bads. This relationship is illustrated by the fact that the iso-γ curves in Figures 2 and 3 do not cross. Second, $\frac{\partial x_1^*}{\partial \theta} > 0$ and $\frac{\partial x_2^*}{\partial \theta} < 0$ for all θ, which means that as power shifts toward agent 1 (the woman) and θ increases the household will purchase more of the good she enjoys and less of the good she does not care about.

4. The Effects of Household Power Distribution on Expenditures

The aim of this empirical analysis is to develop a test that will support or reject the theoretical implications the model formalized in the previous section. It will examine whether or not the relationships between female power and the consumption of household public goods and bads are nonlinear and possibly even non-monotonic by considering how the budget shares for an array of commodities purchased by the household change when an operational measure of female power varies. Explicitly the analysis aims to determine whether the effect of additional female power in the household is concave and non-monotonic in household public goods and convex and non-monotonic in household public bads as Theorem 1 predicts. With respect to policy, this section endeavors to establish whether additional money given to the primary female in a household will have a positive or negative effect on the consumption of household public good and bads throughout the range of possible female power.

This section of the paper will first lay out the empirical strategy used for testing concavity, convexity and possible non-montonicity of expenditure on household public goods and bads. Then it will discuss how female power can be operationally defined in order to measure its effects on household expenditures in the available data. It also comments on how the range of female power available in the data is important to determining whether the predicted concavity and non-montonicity exist. Finally, results of the three regression analyses will be summarized and discussed—(1) expenditure regressions including a quadratic female power term for dual decision-maker households, (2) expenditure regressions allowing for higher order effects of female power and (3) separate expenditure regressions for single female and single male headed households.

4.1 Empirical Strategy

This analysis resembles the one employed by Hoddinott and Haddad (1995), which tested whether or not female income share influences household expenditures in Cote D'Ivoire. There is, however, a major difference in their analysis and the one that follows—the inclusion of a quadratic term for female power. This term is included to test whether the relationships between female power and the purchase of household public goods and household public bads are constant over the range of female power or the relationships are nonlinear and perhaps non-monotonic.

In order to test for non-linearity in the effect of female power on the expenditure associated with certain household commodities, I estimate expenditure functions of the following form:

$$Budget\_Share_i = \alpha_i + \beta_{1i}(female\_power) + \beta_{2i}(female\_power)^2 + \beta_{3i}(pcex) + \beta_{4i}(av\_educ) + \beta_{5i}(av\_age) + \beta_{6i}(urban) + \beta_{7i}(hhsize) + \sum_j \delta_{ji}(dem_j) + e_i$$

where *i* indexes the commodity, $pcex$ is the per capita monthly household expenditure, av_educ and av_age represent the average education and age of the primary decision making agents, respectively, $urban$ indicates the location of the household, $hhsize$ is the size of the household and dem_j indicates the proportion of individuals in the demographic group *j* in the household. α_i, β_{1i}, β_{2i}, β_{3i}, β_{4i}, β_{5i}, β_{6i}, β_{7i} and δ_{ji} are parameters estimated in each budget share regression.

The vector of dependent variables in this analysis, $Budget\_Share_i$, is the proportion of household budget spent on each commodity i. These variables measure the proportion of the household monthly expenditure dedicated to particular commodity groups. The budget shares considered are: food, children's education, children's clothing, housing, alcohol and tobacco.

To test the theoretical implications put forth in section 3, the commodities considered need to be classified as household public goods, household public bads or individual goods according to the framework outlined in the previous section (from the theory these are n-goods, m-goods or x-goods, respectively). Consumption of a household public good provides positive externalities to both the household decision-makers. The positive effect of consuming household public goods (n-goods) is quantified by the benefit, $b(n)$, included in the decision-makers' utility functions (recall Equations 4 and 5). Similarly, a household public bad is any commodity that presents a cost to both the decision-makers when consumed in the household. Recall, $c(m)$ represents the costs associated with m units of the household public bad being consumed within the household. All other goods yield utility to each household decision-making agent separately through the functions $\phi(x_i)$, $i \in \{1,2\}$.

Children's education and children's clothing can be classified as household public goods under the reasonable assumption that both parents are concerned with the wellbeing of their children and benefit personally from the purchase of these items. Housing (measured by all expenses related to the maintenance of the family dwelling less rent) also seems to be a natural household public good. Though food may also seem to be a household public good, it is more likely a conglomeration of n and x-goods. The budget share for food represents the total expenditure on food as a proportion of total household expenditure, and there is no way in the data to distinguish which member is consuming the food purchased. This empirical measure, therefore, includes both individual goods as well as potential household public goods. Food that ends up in the mouths of the children in the household is certainly a household public good by the definition that both decision-makers benefit from this type of consumption. However, if the woman likes apples and the man likes bananas, then part of this budget share

represents money spent on individual goods. How the budget share for food is affected by household balance of power is not predicted by the theory.

Alcohol and tobacco are certainly not household public goods, but are they household public bads (m-goods) according to the above definition? Things such as drunkenness and second hand smoke, which may result from the consumption of these commodities, will enter as costs in the utility functions of both of the household decision-makers. But it is also hard to imagine that they would be consumed at all if neither agent gained positive utility from consumption. Even if both of the primary adults partake in, and gain personal utility from, the consumption of these potential household public bads, the negative effect of their consumption on other household members will matter in terms of the cost of a household public bad. So instead of calling alcohol and tobacco household public bads, lets consider them privately consumed goods with a *public bad fallout*.[1]

The variables included to control for variation in budget shares that is not due to changes in female power are: the average age and education of the decision making adults, household composition, household size and per capita monthly expenditure. Controlling for the average age and education of the primary adults in the household accounts for any differences in expenditure that are due to dissimilar preferences between more educated and less educated families or generational differences. The dummy variable indicating whether the household is located in an urban or a rural area take into account that the cost of purchasing commodities may differ between these types of areas. Including household composition in the budget share regressions is important because who resides in the home will impact what the household purchases. For instance, if there are no children one would expect there to be no expenditures on child clothing and if there are no school aged children in the household a relatively low share of the household budget may be spent on education. On the other hand, one would expect the share of the budget on child related goods to be positive if there are children present in the household and to increase with the proportion of household members that are children. Since there

[1] If a good the man consumes has a public bad fallout then $m = \eta x_2$ as a special case of the above framework. In this case, however, the consumption of the public bad producing commodity (x_2) is not non-monotonic, but can be concave under assumptions on the functions $\phi(\cdot)$ and $c(\cdot)$.

is a possibility that any commodity may be more heavily consumed by one age group or gender the proportion of elderly men and women, as well as, the proportion of children in the household are included among the determinants of household budget shares. Including household size in the regression analysis will control for any economies of scale that may exist when purchasing goods for the family. Per capita expenditure, also among the independent variables in the analysis, controls for the level of household expenditure and essentially the purchasing power of the household. The level of expenditure for the household will systematically affect budget shares, because poorer households have less disposable income and are likely to spend a larger share of their budget on necessities like food and housing.

The analysis uses ordinary least squares to determine how a household's balance of power affects the purchase of several household commodity groups. The following empirical estimates of the effects of female power on household budget shares control for household composition, household size, average age and education of the primary adults, location and per capita expenditure. This lets us observe whether or not there exists a systematic relationship between female power in a household and the share of the household budget used to purchase several commodities, including both household public goods and household public bads.

4.2 Measuring Power

Measuring a household's balance of power is a complex task, and one essential to determining how additional female power may affect expenditures on household public goods and bads. Important to operationalizing this test is choosing the appropriate measure of a household's balance of decision making power. This sub-section addresses this crucial issue.

As noted in section 2, the existing empirical literature measures the balance of power between the household's primary adults in two ways. First, a decision-maker's power can be quantified by the share of income brought to the household by that individual. This measures directly what portion of the household resources are at least partially under each person's control, and hence, can be used to define a relative level of power for any individual in the household. By this measure female income share measures female decision-making power, and as female income share rises the amount of

money over which she has control grows, which is assumed to increase her power within the household (θ).

Another way to measure the household balance of power is by the relative education levels of the primary adults. The difference in education between the wife and the husband is meant to capture the differences in the earning potentials of each partner and consequently provide another way by which to measure bargaining power. Women who are educated at a level close to or above their husband's have better alternatives available to them outside the relationship, hence their bargaining threat point is better, giving them greater power in the making of joint expenditure decisions within the household. For example, a woman with more education has the potential to earn more money in the market and is, therefore, less dependent on her husband and more powerful in the relationship (even if she chooses not to work). Relative education is measured by education (in years) of the primary female less the education of the primary male. The greater this difference in education the greater is female power, θ.

Between these two measures of power there are tradeoffs in terms of measurement transparency (with respect to both intuition and policy implication) and possible endogeneity. Measuring power by income share is intuitive—as the amount of money a woman has control over increases it makes perfect sense that so does her say over how household money is spent. Also, this measure is transparent in terms of policy implications. Results when measuring power by income share are a direct test of how giving money to a female in the household will affect household expenditures. The mechanism by which household power measured by relative education affects household decision making is less clear. Furthermore, what the results imply in terms of policy for improving household well-being is just as unclear. In terms of transparency and policy implications one could argue that female income share is superior to relative education as a measure of female power in the household.

Before settling on a measure of power, however, it is useful to consider the possible endogeneity issues posed by each of these measures. There is a possibility of endogeneity between female income share and independent variables in this analysis.[2] It

[2] Hoddinott and Haddad contend that female income share is endogenous to the budget shares and use 2SLS rather than OLS to estimate their results. They use the household land holdings operated by the woman and proportion of business capital owned by the woman as well as relative education in their first

may be that the primary woman in the household is making her labor/leisure decision simultaneous to weighing in on the household expenditure decisions. When female power is measured by her education relative to her partner, endogeneity may also be a concern. If there exists assortative matching in the marriage market, and if education attainment is positively correlated with concerns about one's children (which seems to be the case), then well-educated women are more likely to marry well educated men (i.e. there is likely to be less of an education difference between her and her husband than there is with less well-educated woman).[3] This means that her preferences for child well-being affect both her measure of power and her preference for expenditure on certain household public goods. For this reason, it is not convincing that relative education, as a measure of female power, is superior to female income share.

This analysis will report results using female income share as the operational measure of a woman's power and comment on how the results differ if relative education is used instead. For this measure there are two ways in which the endogeneity bias may affect the results of this analysis. First, a woman preferring to provide more education to her children may increase her labor force participation in order to afford that additional cost of schooling while at the same time increasing her bargaining power to increase the probability these additional funds will be spent as she sees fit. This means the education budget share decision would be inherently linked to her income share, and not just through her decision making power. If this is the mechanism by which endogeneity will affect the results then female income share will bias the effect of female power on expenditure of public goods upward. Since there is a body of evidence (correcting for this bias) that shows this relationship is positive at low levels of female power, and this paper is primarily concerned with the possible negative effects of female power at higher levels, any negative effects will only be understated in the results. If, on the other hand, the woman is choosing not to work because focusing on household production actually

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stage regression to instrument for female power. The Bulgarian LSMS data does not include information for the two former variables. Furthermore, there is no information on the physical characteristics or stature of individuals (another possible way to instrument for power). Due to these limitations this analysis is limited to using OLS.

[3] The correlation between female years of education and male years of education in Bulgarian households where there are two decision making agents present is 0.74.

gives her more decision making power, then the results would be biased downward. There is no way to disentangle these two possible scenarios empirically.

Evidence from the data suggests that endogeneity issues when using female income share as a measure of power may be smaller in Bulgarian households than in the typical developing country setting. In order for female income share to be considered exogenous to the current month's budget share decision, the decision of how much to work (and hence what income to bring home) must be independent of this month's expenditure choices. A large proportion of women having flexible jobs, adjusting their work hours and exiting and entering jobs readily provides evidence that they are adjusting their household power to affect budget share decisions. In this case endogeneity poses a problem to the budget share regressions when female income share is used to measure power. However, if women are working consistently for long periods of time in a single job then the female income share decision may have been made long enough before the monthly expenditure decision to be considered exogenous. The latter characterizes better the female wage earners in Bulgaria in 2001, where among the working women 70% have jobs categorized as permanent, 54% and 75% have been at their current job for 10 and 5 years or longer, respectively, and among nonworking women there is even less labor status mobility.

Since there is a potential for endogeneity in both of these power measures, and female income seems better only in terms of transparency and policy implications, budget share regressions were run using both measures separately. The results for regressions using female income share as the measure of power are reported along with a discussion of how the results differ when power is measured by relative education.

The precise measure of female power in the following analysis is her wage from self-employment and work outside the home as a proportion of the household total monthly income. (Anderson and Eswaran (2005) find that income earned outside the home has the largest positive effect on female autonomy.) A measure incorporating only the incomes of the two decision-making agents (female income as a proportion male and female income) would seem a more direct mapping from the theory. But such a measure captures less power variation than the measure used. For example, consider a woman who is making 80 Levs per month with a spouse who brings home 100 Levs per month.

In a household where this is the total of household monthly income a woman would have more power than in a household where there are other sources of income. The proportion of income she would take away from the household if she left is smaller in the latter case, and it makes sense then that here bargaining power would be less.

4.3 Range of Female Power

The theoretical framework in Section 3 implies not only that the relationships between balance of power and the consumption of household public goods and bads are concave but that they are also non-monotonic. As shown, this concavity and particularly the non-monotonicity happen at relatively high levels of female power (θ). It is, therefore, important in this analysis to capture a large enough range of female power to observe possible non-monotonicity in expenditures on certain commodities. In order to test the hypothesis that the relationship between female power and the consumption of household public goods/bads is non-monotonic it is important to use data in which women can have a relatively large range of power within the household. For this reason this study relies on data from Eastern Europe.

Considering data from a conventional developing country, where women may have very little power, does not allow a large enough range of female power to determine if there is a point at which the marginal returns to female power in terms of household public good consumption becomes zero or negative. Specifically, if the analysis utilizes data in an area where women historically have little power, then the estimates will only tell part of the story: What happens when female power is increased if $\theta < \frac{1}{2}$? In Eastern Europe there is a long-standing tradition of equality between men and women. Under communism, women entered the work force well before they did in the West and Eastern European women were better educated than their Western counterparts for decades. As a result the balance of power between men and women in Bulgarian households may be more equal than in the typical developing country, where women are less educated and do not typically posses earning power near the levels of their husbands.

This analysis uses the Bulgarian Living Standards Measurement Survey data—a survey of approximately 2,500 households in Bulgaria collected by the World Bank in 2001. The data include information about family composition, income sources and

expenditures as well as individual education levels for household members. Data from this region allows for a relatively large range of female power to be observed—it includes the possibility that household power is well-balanced or the woman may even be more powerful than her partner.[4]

Notably, having a large range of female power is increasingly important when testing for a non-monotonic relationship between power and expenditures on household public goods and bads if women are indeed more concerned with household well being outcomes. Recall the effects of γ, the relative concern about household outcomes (public goods and public bads). As γ rises, and women are more concerned with consuming household public goods and avoiding household public bads, the apex of the optimal consumption household public goods shifts rightward. This means if women are relatively more concerned with the consumption of household public goods, then the point at which additional female power begins to have a negative effect on their consumption happens at a greater level of female power. So testing for non-monotonicity under these circumstances will require an even larger range of θ.

4.4 Summary and Discussion of Results

The primary purpose of the analysis is to determine how relative female power affects household demands. Therefore, the sample considered is restricted in two ways. First, it is limited to households where two decision makers, a man and a woman, are present. Approximately 70% of the surveyed Bulgarian households are two-decision-maker households. Second, the sample only includes households where the female has positive power (and this accounts for 40% of the dual agent households in the survey). Households with one decision-making agent will be considered separately at the end of this section. A summary of the balance of power variables, household composition, household size, per capita expenditures and budget shares for the 533 households in this restricted sample is described in Table 1.

[4] The share of cash accruing to the wife (Hoddinott and Haddad's measure of female power) is .506 on average with a standard deviation of .164 in Bulgaria, while the average in Cote D'Ivoire is .201 and the standard deviation is .294.

Table 1. Summary Statistics for Two-Decision-Maker Bulgarian Households

Variable	Mean	Std. Dev.	Min	Max
Education (Years):				
Primary Female	12.434	3.203	0	22
Primary Male	12.048	3.273	0	22
Average of Primary Adults	12.079	3.032	0	21
Difference	0.386	2.783	-11	20
Age (Years):				
Primary Female	41.403	8.951	19	69
Primary Male	44.667	9.123	22	71
Average of Primary Adults	33.318	10.639	12.2	68.5
Monthly Income (Levs):				
Total Household	604.074	1367.325	0	19113.33
Primary Female	176.346	156.950	0	2500
Primary Male	188.878	203.019	0	2500
Female Monthly Income Share	0.474	0.758	0.005	16.5
Household Located in an Urban Area	0.831	0.375	0	1
Household Size (persons)	3.388	0.850	2	6
Household Composition (Proportions in Household):				
Children of the Head <6	0.041	0.108	0	0.6
Children not of the Head <6	0.002	0.025	0	0.333
Children of the Head 6-15	0.139	0.182	0	0.6
Children not of the Head 6-15	0.003	0.028	0	0.333
Females 60-69	0.007	0.056	0	0.5
Males60-69	0.019	0.089	0	0.5
Females 70 and older	0.000	0.000	0	0
Males 70 and older	0.002	0.028	0	0.333
Total Monthly Household Expenditures (Levs):	161.121	88.234	22.14	656.572
Monthly Budget Shares (Levs):				
Food	0.494	0.142	0.099	0.883
Children's Clothing	0.011	0.019	0	0.108
Children's Education	0.031	0.047	0	0.304
Housing	0.198	0.101	0	0.770
Transportation	0.035	0.049	0	0.569
Entertainment	0.029	0.039	0	0.349
Jewelry	0.047	0.105	-0.004	1.074
Alcohol	0.024	0.026	0	0.170
Tobacco	0.032	0.037	0	0.196

The typical two-decision-maker Bulgarian household consists of between 3 and 4 individuals and has a monthly income of 600 Levs per month (approximately 1200 USD).[5] On average, the woman brings in slightly less than half of the household monthly

[5] In 2001, the year when the data were collected, the Bulgarian Lev (BGN) fluctuated in worth between .5 and .43 United States Dollars (USD) (tokyoahead.com, 2005).

income. Not surprisingly, food and housing represent by far the largest budget shares among the commodities measured in this analysis. The average husband and wife have the same amount of education and only three years apart in age. The minimum and maximum education differences are striking, but there are extreme cases where either the man or the woman has approximately twenty more years of schooling than their spouse.[6] This is equivalent to one spouse having a graduate degree and the other having no formal schooling. This is an extreme case and 97% of the couples in the sample have a difference in schooling of six years or less.

Notice that the variable for female decision-making power, female monthly income share, does not range from zero to one, rather it takes on values as high as 16.5. This indicates that a woman's income can be larger than total household monthly income, which may seem counterintuitive but is possible given how these two variables are measured. Female income is the sum of any wage she makes from employment outside the home or self-employment. Household total monthly income is the sum of net agricultural income, wage income and self-employment income, social benefit income, net remittances, other revenue and rents from real estate assets. Since it is possible for net agricultural income and net remittances to be negative, total household income can be less than any of its individual components. The fact that a woman's income can be large relative to or larger than household total monthly income in some Bulgarian households is useful to this analysis, since a large range of female power is desirable. As noted in the previous subsection this will allow the analysis to determine the relationship between female decision making power and household expenditures for a range beyond that which is usually considered. In the theoretical framework $\theta \in (0,1)$, but the results hold for θ outside that range by simply allowing observable female power ($\hat{\theta}$) to be a positive and monotonic transformation of actual female power, $\hat{\theta} = h(\theta)$.

Table 2 summarizes the findings for each of the OLS estimations of household composition, size, total expenditure, average age, average education, location and power

[6] In order to check that these huge differences were not mere reporting errors, years of schooling was compared to another variable indicating the highest level of education attained. When the highest level of education attained was associated with a positive number of years but years of schooling was reported as zero, years of schooling was imputed from the previous question. From the imputation dummy we can see this happened in about 0.5% of the cases.

effects on the household budget shares for each commodity, where female power is measured by her income share.

Table 2. Budget Share Regressions for Two-Decision-Maker Bulgarian Households

	Food	Children's Education	Children's Clothing	Housing	Alcohol	Tobacco
Female Income Share	-5.51315***	1.17407*	-0.4504*	2.05968	-0.75735*	-0.02082
	(2.0)	(0.6)	(0.3)	(1.6)	(0.4)	(0.6)
Female Income Share-squared	0.32574**	-0.06722*	0.02183	-0.14898	0.05701**	0.01633
	(0.131)	(0.039)	(0.017)	(0.104)	(0.026)	(0.038)
Per Capita Monthly Expenditure	-0.04771***	-0.00517**	0.00126	-0.02008***	0.00118	-0.00283
(Levs)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
Household Location (Urban)	-4.85499***	0.831*	-0.19445	3.63355***	-0.69687**	0.88559*
	(1.555)	(0.5)	(0.2)	(1.236)	(0.3)	(0.5)
Average Age of Primary Agents	-0.01091	-0.01309	-0.01153	0.11499*	0.00731	-0.04461*
	(0.087)	(0.0)	(0.0)	(0.069)	(0.0)	(0.0)
Average Education of Primary Agents	-1.02577***	0.07999	0.02176	0.31929*	0.01462	-0.24745***
	(0.217)	(0.064)	(0.028)	(0.172)	(0.043)	(0.063)
Household Size	-0.84515	0.37816*	0.12437	-1.66642***	-0.10989	0.03675
	(0.764)	(0.227)	(0.098)	(0.607)	(0.152)	(0.223)
Proportion of Household members:						
Child of Head, <6	1.48431	1.03033	4.98129***	3.29585	-2.8873**	-2.02433
	(6.173)	(1.834)	(0.791)	(4.905)	(1.226)	(1.804)
Child not of Head, <6	46.00549**	0.70629	2.19096	-8.66485	-9.08412**	-9.47986
	(21.367)	(6.349)	(2.737)	(16.979)	(4.243)	(6.245)
Child of Head, 6-15	-0.48448	15.14219***	4.33226***	-4.60684	-1.03182	-1.64032
	(3.882)	(1.154)	(0.497)	(3.085)	(0.771)	(1.135)
Child not of Head, 6-15	16.22453	16.40317**	2.65937	-21.4674	-1.11306	-2.19484
	(22.436)	(6.667)	(2.874)	(17.829)	(4.455)	(6.558)
Males, 60-69	16.09553**	1.44792	0.58438	-7.5197	0.4551	-4.73403**
	(7.588)	(2.255)	(0.972)	(6.03)	(1.507)	(2.218)
Females, 60-69	-11.74753	-2.43051	-0.50026	12.56688	-2.7474	4.37662
	(12.721)	(3.78)	(1.63)	(10.109)	(2.526)	(3.718)
Males, 70 and older	-13.20332	-0.04185	0.84341	-0.79458	-5.84426	-8.26945
	(18.601)	(5.528)	(2.383)	(14.782)	(3.694)	(5.437)
Intercept	78.81432***	-1.08461	0.21257	16.67837***	3.24021***	8.19065***
	(5.36)	(1.593)	(0.687)	(4.259)	(1.064)	(1.567)
R-squared	0.2438	0.4213	0.3049	0.0998	0.0608	0.0722
Adjusted R-squared	0.2234	0.4057	0.2861	0.0754	0.0354	0.0471
Observations	533	533	533	533	533	533

Notes: Standard errors in parentheses; *, ** and *** indicate significance at the 90%, 95% and 99% level of confidence, respectively; All coefficients are scaled up by 100.

The results of the budget share regression for dual-agent Bulgarian households where women have positive power support the theoretical prediction that the effect of

female power on the consumption of household public goods and bads is non-monotonic. The budget share for housing and children's education are concave and non-monotonic with respect to female power, demonstrating empirically the predicted properties of household public goods. The effects of female power on these budget shares are insignificant for housing but significant at the 90% confidence for children's education. The first order female power term has a positive effect on children's education expenditures and the effect of the quadratic term is negative. This means that the positive effect of female power is decreasing as this power rises. Furthermore, the total effect of female power on children's education budget share is negative for female power above 8.7. This turning point is at a relatively high level of female power (as predicted in the theoretical framework) but still within the range present in the data. Tobacco and alcohol demonstrate the predicted properties of household public bads in terms of their budget shares and the relationships to female decision making power. In both cases the consumption of this household public bad is negatively affected by the linear female power term but positively affected by female power squared. The first and second order power coefficients in alcohol budget share regression are significant at the 90% and 95% level of confidence, respectively. The turning point for alcohol budget share, the point at which the total effect of female power is positive, is at female income share greater than 6.6.

The results for the food and children's clothing budget share regressions are a bit perplexing. They both seem to be household public bads according to the framework in section 3. The effect of female power on the budget share for children's clothing is relative small in magnitude and not significant in the quadratic term. The effects of female power on the budget share for food, however, are both significant and large relative to the effects of female power on the other commodity groups. It is initially puzzling that given the budget share regression results for food and the predictions from Theorem 1, food could be classified empirically as a household public bad. But perhaps this result stems from the fact that the food commodity group is a compilation of several individually consumed commodities rather than a true household public good. It seems reasonable that not every commodity in this category provides benefit to both decision

making agents, so it can theoretically be classified as neither a household public good nor a household public bad.

When significant, the effect of total per capita monthly expenditures is negative. This means that households that consume more have a smaller budget share dedicated to the commodity groups considered here. As expected, a larger proportion of children in the household has a positive effect on the budget share dedicated to both children's clothing and children's education. These effects are significant for the proportion of school age children in the education regression and for children of the head in the clothing regression. Also, with more young children present there is less money spent on alcohol. These results are robust to the inclusion of a quadratic term for per capita monthly expenditures.[7]

The following figure represents graphically the relationship between female power and expenditures on children's education predicted by the above regression analysis.

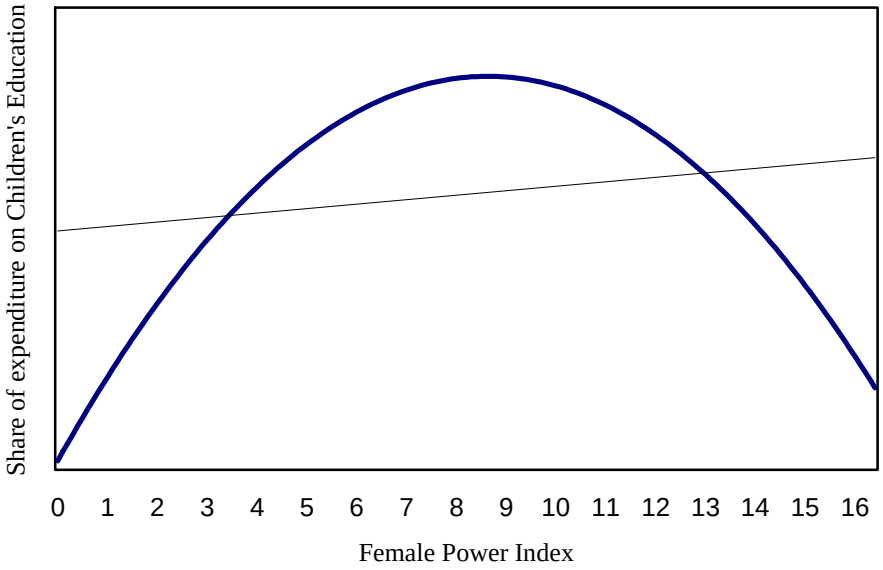

Figure 4. The Predicted Relationship between Female Power and Expenditures on Children's Education

[7] The results for the female power effects are the same in sign, magnitude and significance with one exception. The first order effect of female power on the budget share for children's clothing is insignificant when per capita monthly expenditures-squared is included in the specification.

Notice, the trend line included in Figure 4 is positive and represents the relationship that would be calculated if linearity between power and expenditures were assumed. It is also interesting to note that if linearity were imposed on this regression analysis, not only would the negative effects of additional female at high levels be unobserved, but also the estimation of the positive effects of additional female power at low levels would be understated.

When female power is measured in terms of relative education, instead of female income share, the coefficients on female power are not statistically systematic. In the regressions using relative education the first order power coefficients are insignificant for each of the six budget share regressions. The second order power term is only significant for expenditures on food and education. In both cases the squared power term has the opposite sign and is an order of magnitude smaller than it is in the regression results reported in Table 2.

Because a main point of this analysis is that we should not assume the relationship between female decision making power is linear, likewise, we should also not assume that it is quadratic either. The theoretical framework above has no conclusions as far as higher order effects are concerned, so looking at the possibility there are higher order effects of female power on household budget shares may be instructive. Table 3 summarizes the budget share regression with the addition of a quadratic term for per capita monthly expenditures and a cubed term for female income share.[8]

[8] Higher order terms for female power were included in regressions not reported here. The effects of female power were insignificant in all regressions where terms of order higher than female income share-cubed were included.

Table 3. Budget Share Regressions for Two-Decision-Maker Bulgarian Households with Female Power-cubed

	Food	Children's Education	Children's Clothing	Housing	Alcohol	Tobacco
Female Income Share	-8.208 *	3.169 **	-0.578	5.251	-1.641 *	0.322
	(4.4)	(1.3)	(0.6)	(3.5)	(0.9)	(1.3)
Female Income Share-squared	1.809	-1.189 *	0.102	-2.076	0.593	-0.238
	(2.148)	(0.637)	(0.275)	(1.702)	(0.425)	(0.626)
Female Income Share-cubed	-0.080	0.061 *	-0.004	0.105	-0.029	0.014
	(0.116)	(0.0)	(0.0)	(0.092)	(0.0)	(0.0)
Per Capita Monthly Expenditure	-0.054 **	-0.004	0.003	-0.039 **	0.007 *	-0.012 **
(Levs)	(0.02)	(0.0)	(0.0)	(0.016)	(0.0)	(0.0)
Per Capita Monthly Expenditure	0.000	0.000	0.000	0.000	0.000	0.000 *
-squared (Levs)	(0.)	(0.0)	(0.0)	(0.)	(0.0)	(0.0)
Average Age (Years)	-0.014	-0.011	-0.012	0.119 *	0.006	-0.044 *
	(0.088)	(0.026)	(0.011)	(0.069)	(0.017)	(0.026)
Average Education (Years)	-1.016 ***	0.081	0.019	0.367 **	0.001	-0.226 **
	(0.221)	(0.066)	(0.028)	(0.175)	(0.044)	(0.064)
Household Location (Urban)	-4.890 **	0.861 *	-0.198	3.706 **	-0.717 **	0.902 **
	(1.559)	(0.462)	(0.2)	(1.235)	(0.308)	(0.454)
Household Size	-0.946	0.438 *	0.126	-1.658 **	-0.110	0.006
	(0.779)	(0.231)	(0.1)	(0.617)	(0.154)	(0.227)
Proportion of Household members:						
Child of Head, <6	1.010	1.360	4.968 ***	3.703	-2.998 **	-2.024
	(6.217)	(1.843)	(0.797)	(4.925)	(1.229)	(1.812)
Child not of Head, <6	45.334 **	1.154	2.181	-8.231	-9.199 **	-9.534
	(21.418)	(6.348)	(2.744)	(16.968)	(4.235)	(6.242)
Child of Head, 6-15	-0.230	14.986 ***	4.330 ***	-4.670	-1.018	-1.581
	(3.905)	(1.157)	(0.5)	(3.094)	(0.772)	(1.138)
Child not of Head, 6-15	16.244	16.513 **	2.606	-20.584	-1.372	-1.847
	(22.478)	(6.662)	(2.88)	(17.807)	(4.444)	(6.55)
Males, 60-69	16.474 **	1.173	0.600	-7.928	0.567	-4.767 **
	(7.618)	(2.258)	(0.976)	(6.035)	(1.506)	(2.22)
Females, 60-69	-12.142	-2.125	-0.525	13.135	-2.906	4.466
	(12.752)	(3.78)	(1.634)	(10.103)	(2.521)	(3.716)
Males, 70 and older	-13.491	0.106	0.858	-0.930	-5.799	-8.417
	(18.634)	(5.523)	(2.387)	(14.762)	(3.684)	(5.43)
Intercept	80.644 ***	-2.138	0.168	16.720 **	3.195 **	8.811 ***
	(6.027)	(1.786)	(0.772)	(4.775)	(1.192)	(1.756)
R-squared	0.2446	0.4248	0.3055	0.1061	0.0697	0.0785
Adjusted R-squared	0.2212	0.407	0.2839	0.0784	0.0408	0.05
Observations	533	533	533	533	533	533

Notes: Standard errors in parentheses; *, ** and *** indicate significance at the 90%, 95% and 99% level of confidence, respectively; All coefficients are scaled up by 100.

The effects of the female power variables in this specification are generally insignificant. But the non-monotonic relationship between children's education and female power remains significant. Notably, in this regression the point at which the overall effect of female power becomes negative is when female income share reaches 1.3, and approximately 5% of the households in the sample have female income share at or above this level.

So far, this analysis has shown that the balance of household power between the man and the woman matters to the budget shares dedicated to different types of commodities. And with the non-monotonic relationship between female power and the consumption of household public goods provides evidence that the mechanism underlying this effect is due to bargaining rather than attributable to differing preferences for household public goods and household public bads between men and women. To provide additional evidence that the differences in household expenditures may not be due to dissimilar preferences between men and women, I consider the behavior of single decision-maker households. This strips away the balance of power effects found to be important in the previous regression analyses and focuses on what differences exist between men and women in terms of preferences over the purchase of household commodities. The following two tables summarize budget share regressions for households headed by a single male or a single female separately. Tables 4 and 5 summarize the effects of household and decision-maker characteristics on the budget share devoted to six of the different commodity categories previously considered. The power terms are omitted from these regressions because there is no other primary agent present, by which to measure relative decision-making control.

Table 4. Budget Share Regressions for Households Headed by a Single Male

	Food	Education	Children's Clothing	Housing	Alcohol	Tobacco
Per Capita Monthly Expenditure	-0.00037***	-1.4E-06	1.06E-06	0.000103*	-1.6E-05	-3.5E-05
(Levs)	(.0001)	(0.00)	(0.00)	(.0001)	(0.00)	(0.00)
Decision Maker's Education	-0.00787***	-0.00018	-0.00011	0.005463**	-0.00032	-0.00065
(Years)	(.0027)	(.0009)	(.0001)	(.0025)	(.0009)	(.001)
Household Location (Urban)	-0.0533**	0.013521**	-0.00013	-0.00205	-0.003	-0.00536
	(.021)	(.0069)	(.0007)	(.0193)	(.0072)	(.0079)
Household Size (People)	-0.01884*	0.002397	-0.00019	0.012018	-0.00089	-0.00259
	(.0109)	(.0036)	(.0004)	(.01)	(.0037)	(.0041)
Proportion of Household members:						
Children <6	0.459977*	-0.04808	0.026808***	-0.30711	-0.08679	0.101557
	(.2544)	(.0831)	(.0089)	(.2336)	(.0874)	(.0952)
Children 6-15	0.135838	0.088796***	0.028687***	-0.09816	-0.04304	-0.03323
	(.1046)	(.0342)	(.0037)	(.0961)	(.036)	(.0392)
Males, 60-69	0.010863	-0.0185*	-0.00058	0.069746**	0.000612	-0.03183***
	(.0311)	(.0102)	(.0011)	(.0286)	(.0107)	(.0116)
Females, 60-69	0.075231	-0.05622	-0.00033	0.084646	-0.03856	0.054137
	(.1071)	(.035)	(.0037)	(.0983)	(.0368)	(.0401)
Males, 70 and older	-0.00157	-0.02014**	-0.00071	0.117268***	-0.02977***	-0.03207***
	(.0274)	(.0089)	(.001)	(.0251)	(.0094)	(.0102)
Females, 70 and older	-0.02921	-0.04945*	-7.6E-05	0.154541**	-0.00269	-0.02031
	(.0844)	(.0276)	(.003)	(.0776)	(.029)	(.0316)
Intercept	0.758267***	0.012996	0.001822	0.08557**	0.057172***	0.070402***
	(.0402)	(.0131)	(.0014)	(.0369)	(.0138)	(.015)
R-squared	0.2886	0.139	0.3209	0.1326	0.0586	0.081
Adjusted R-squared	0.2574	0.1012	0.2911	0.0945	0.0174	0.0407
Observations	239	239	239	239	239	239

Notes: standard errors in parentheses

*, ** and *** indicate significance at the 90%, 95% and 99% level of confidence, respectively

Table 5. Budget Share Regressions for Households Headed by a Single Female

	Food	Education	Children's Clothing	Housing	Alcohol	Tobacco
Per Capita Monthly Expenditure	-0.00027***	2.58E-05	1.44E-05**	-0.00016*	4.16E-05***	-2.7E-05
(Levs)	(.0001)	(0.00)	(0.00)	(.0001)	(0.00)	(0.00)
Decision Maker's Education	-0.01057***	0.000349	0.000128	0.002625	0.000117	0.000631
(Years)	(.0019)	(.0005)	(.0001)	(.0019)	(.0003)	(.0004)
Household Location (Urban)	-0.0898***	0.007878**	-0.00123	0.064008***	-0.00477**	-0.00072
	(.0154)	(.0036)	(.0012)	(.0149)	(.002)	(.0036)
Household Size (People)	-0.00237	0.00261*	0.000196	-0.01996***	0.004577***	0.005388***
	(.0063)	(.0015)	(.0005)	(.0061)	(.0008)	(.0015)
Proportion of Household members:						
Children <6	0.067196	-0.02014	0.057801***	-0.05142	-0.03661***	-0.00278
	(.0949)	(.0223)	(.0072)	(.0916)	(.0126)	(.022)
Children 6-15	0.006396	0.101976***	0.047643***	-0.03186	-0.01666***	-0.0198*
	(.0455)	(.0107)	(.0035)	(.0439)	(.006)	(.0105)
Males, 60-69	-0.04597	-0.007	0.002509	0.074897	0.033242	-0.0053
	(.1664)	(.039)	(.0127)	(.1606)	(.0221)	(.0385)
Females, 60-69	0.002784	-0.01357***	4.35E-06	0.038502*	-0.00247	-0.02348***
	(.0217)	(.0051)	(.0017)	(.021)	(.0029)	(.005)
Males, 70 and older	-0.42244	-0.01069	0.020583	0.203956	-0.01452	-0.05387
	(.2577)	(.0604)	(.0196)	(.2487)	(.0342)	(.0596)
Females, 70 and older	-0.01231	-0.01269***	0.000666	0.074394***	-0.00212	-0.02322***
	(.0199)	(.0047)	(.0015)	(.0192)	(.0026)	(.0046)
Intercept	0.743227***	-0.0004	-0.00266	0.224806***	-0.00197	0.017558***
	(.0293)	(.0069)	(.0022)	(.0282)	(.0039)	(.0068)
R-squared	0.2535	0.3045	0.3885	0.1494	0.1035	0.1828
Adjusted R-squared	0.2395	0.2915	0.377	0.1335	0.0867	0.1675
Observations	545	545	543	545	545	545

Notes: standard errors in parentheses
*, ** and *** indicate significance at the 90%, 95% and 99% level of confidence, respectively

There seem to be no significant and systematic differences between the preferences of men and women in Bulgaria as far as household expenditures are concerned.[9] Most of the significant coefficients on the determinants of budget shares have the same sign for single female household as the do for single male households. The one exception is the effect of per capita monthly expenditure on housing, which is positive for male headed households and negative for female headed households. This effect, however, is small—a one Lev increase in per capita monthly expenditure

[9] A Chow Test indicates that only for alcohol and tobacco are the sub-samples of men and women statistically different in their expenditures. There is no statistically significant difference in expenditures on the household public goods.

represents a .01% increase in the budget share dedicate to housing for men and a .02% decrease in that budget share for women. Not only do the coefficients have the same sign but they are comparable in magnitude in most cases. For both men and women an additional year of education decreases the budget share spent on food by close to 1%. These findings are evidence that the variation in spending on household public goods is the result of variation in household power distribution rather than dissimilar preferences between men and women.

Empirically this study has provided evidence of concavity and non-monotonicity in the relationship between female decision making power and the consumption of household public goods. And finally, these relationships seem to be a result of household bargaining power rather than preference differences between men and women.

5. Policy Implications

This paper has shown both theoretically and empirically that the effect of additional female power on household outcomes depends on the initial level of female power. Contrary to previous findings, it need not always be positive. Theoretically, there must exist a turning point, beyond which additional female power actually has a negative effect on household outcomes. Evidence from Bulgarian households supports this theoretical finding. The coefficient on the second order education difference term indicates the relationship between female power and household well-being is concave and the regressions considering women with more or less power suggest the relationship may be non-monotonic. There is a point at which additional female decision-making power has a negative effect on expenditures on household public goods. Both the evidence that the relationship between female power and household well-being is concave and the evidence it is non-monotonic are important considerations when developing effective household policy.

The fact that additional female decision-making power has a concave relationship with positive household outcomes is important. It indicates that additional female power has a diminishing positive marginal effect on expenditures on household public goods. In terms of household aid targeted at increasing well-being this means that a dollar given to a woman with little power has a larger incremental positive effect than if the woman had

been more powerful. The importance of this is twofold. First, if there are any additional administrative costs associated with giving aid to the woman rather than the man, there may be a point at which the benefits of designating the recipient of additional household funds is no longer worth the cost of the designation. As the marginal benefit of additional female power falls, it becomes less and less important to ensure subsidies fall into her hands.

Second, there are interesting social welfare implications associated with the concavity of the relationship between female power and household well-being. With decreasing marginal benefits to additional female power, policy targeted at changing household expenditures gets more bang for its buck when female power is lower. This is to say, in terms of increasing expenditures on household public goods, it is more effective to give aid to households in which the power balance between the woman and the man is relatively unequal (and in favor of the husband). Interestingly, these may not necessarily be the poorest households. The effectiveness of aid on household well-being (rather than simply the expenditures on household public goods) depends on both the inequality of power within the household and the household's level of expenditures on household public goods. This is because the benefit in terms of household well-being is concave in additional expenditures on household public goods. So aid should be targeted not only at households where the current level of expenditure is the lowest, but also at households where inequality between the husband and the wife is the greatest.

The non-monotonicity between female power and household well-being has even more striking consequences for household policy: it may not always be best to give the wife control over the money given to the family. Both the theory and empirics in this paper attest to the fact that there may exist a point at which the marginal effect of additional female power is no longer positive when it comes to expenditures on household public goods. For higher levels of female decision-making power it will be better if aid is in the control of the man.

When deciding who should receive welfare benefits, that aim to increase household well-being, it is necessary to understand the characteristics of current power distribution within the households at which the aid is directed. Both time and place are important to the distribution of household power and, consequentially, the relative

effectiveness of aid given to either the husband or the wife. As noted in several prior studies, in countries where woman have relatively little decision making power, giving aid to the primary female in the household will have a greater positive effect on household well-being than giving the man control over monetary benefits. However, these findings do not carry over from countries where women have little power to those where household power is relatively more balanced. Additionally, as female power in an area increases, policy aimed at increasing household well-being needs to be constantly reassessed. Giving women aid today may not have the same effect in terms of household outcomes as giving them aid tomorrow if the balance of household power is changing in favor of the woman.

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