To Buy a Washing Machine or Television Set? Bargaining over Durable Goods in Brazil.

Ana Claudia Polato e Fava

E-mail: afava@fipe.org.br

Mary Arends-Kuenning

Department of Agricultural and Consumer Economics

University of Illinois at Urbana-Champaign

405 Mumford Hall, MC-710

1301 West Gregory Drive

Urbana, IL 61822

March 2011

1 Introduction

The introduction and widespread adoption of consumer durables has had profound impact on family life throughout the world. Durable goods used in home production such as refrigerators, stoves, and washing machines have made women's work less physically taxing and have freed up women's time. Other consumer durables such as television sets, satellite dishes, and music players provide entertainment for family members. Because women traditionally do most of the housework, they primarily benefit from the purchase of home-production durable goods. Therefore, husbands and wives may have different preferences about purchasing durable goods, with wives preferring home-production durable goods and husbands preferring entertainment durable goods. Households' decisions about consumer durable purchases might be the outcome of a bargaining process between wives and husbands.

In this study, we examine household decisions to purchase consumer durables in Brazil. Brazil provides an interesting context to study consumer durable consumption because its economy is growing rapidly, and new consumer credit institutions are developing to allow middle class and lower-middle class consumers to purchase durable goods (Jornal Estado de São Paulo (2009), UOL online (2009)). Consumer durable consumption has received attention at the highest national policy levels. In 2009, the Federal government lowered taxes on the so-called "white appliances" (refrigerators, stoves, and washing machines). The goals of the policy were to encourage consumers to replace their old models with new, energy efficient models and to increase poor households access to washing machines[1]. Understanding whether consumer durable consumption is the outcome of a bargaining process might help the private sector to sell more durable goods and government policymakers to achieve their policy goals more efficiently.

[1]Decreto N. 6.996, de 30 de outubro de 2009, Governo Federal.

In addition, increasing women's access to home-production durable goods in Brazil might increase women's wellbeing. Women aged 25 to 45 who work outside the household in Brazil spend an average of 10 hours a week more hours of working and doing housework combined than men do (Figure 1). Female labor force participation of women aged 25 to 45 is 67.5 percent (PNAD 2001). However, despite this high participation rate during women's prime childbearing and childrearing ages, ownership of consumer durables is low. Only half of the households who comprise the poorest 20 percent of the population own a refrigerator, about the same percentage that owns a color TV. Only 9 percent of households in the poorest 20 percent own a washing machine (POF 2002/2003). Increasing women's bargaining power might shift household consumption from entertainment consumer durables to household production consumer durables. To the extent that durables such as washing machines and refrigerators save time and promote a healthy home environment, women's wellbeing is increased by their purchase.

To examine whether consumer durable purchasing decisions are the outcome of a bargaining process between husbands and wives, we use two high-quality data sets from Brazil. The *Pesquisa de Orçamento Familiares* (POF) is a household expenditure survey that includes information about purchase of durable goods and about household inventories of durable goods. These data are used to construct two dependent variables - the ratio of the value of services from household-production durable goods to the value of services of entertainment durable goods and the ratio of the number of household-production durable goods to the number of entertainment durable goods. The expenditure survey data also include demographic characteristics, income measures, and indicators of which household members make purchasing decisions. These data are combined with information obtained from a national, annual household survey, the*Pesquisa Nacional Por Amostra de Domicílios* (PNAD), which is used to construct measures of how favorable local labor markets are to women. Bargaining power of women is measured by local marriage market conditions, in-

dicators of who makes household purchasing decisions, and educational and age differences between husbands and wives.

We find that bargaining power between husbands and wives affects consumer durable consumption in Brazil. As the bargaining power of women increases, households spend relatively more on household production durable goods compared to entertainment durable goods. Households in which women have higher bargaining power also own relatively more home production durable goods compared to households in which women have lower bargaining power.

2 Consumer durables and women's work load

Over the last 40 years, Brazilian women have increased their participation in the paid labor force, but men have not increased their contribution to housework by much. Women still do the greatest share of the housework, although 67.5 percent of women aged 25 to 45 participate in the labor market. Conditional on spending any time working outside the household, women work on average 5 hours per week less outside the household than men do. However, women who work outside the household spend 15 more hours per week doing housework than men do. Consequently, Brazilian women who work outside the household spend 10 hours more per week working than men do. One of the main concerns of Brazilian women is the unfair division of housework (Oliveira (2000)). Given their increasing participation in the job market and their inability to engage their husbands in housework, the result is a double burden(Oliveira (2000)).

Historically, the double burden was eased in developed countries by the introduction of durable goods such as washing machines, dryers, and vacuum cleaners. Recent studies have concluded that the widespread availability of home-production durable goods was instrumental to free women's time to work outside the household in the United States

(Greenwood, Seshadri, and Yorukoglu (2005)) and in seventeen OECD countries (Cavalcanti and Tavares (2008)). For example,Cavalcanti and Tavares (2008) estimate that a decline in the relative price of household appliances accounted for 10 to 15 percent of the increase in the labor force participation of women in the United Kingdomfrom 1975 to 1999. However, some researchers question the importance of durable goods in explaining the increase in women's labor force participation, emphasizing instead reductions in the wage differential between women and men that have occurred since 1950 (Jones, Manuelli, and McGrattan (2003)).

Regardless of whether or not the diffusion of home-production durable goods contributed to the increase in women's participation in market work, these goods improved household welfare. Owning durable goods such as washing machines promoted cleanliness by allowing women to clean clothes and houses more often (Jones, Manuelli, and McGrattan (2003)). Between 1900 and 1970, the introduction of home-production durable goods reduced the time spent doing housework by 70 percent and resulted in a large decrease in the number of maids employed by U.S. households (Greenwood, Seshadri, and Yorukoglu (2005)).

In Brazil, low ownership of consumer durables adds to women's burden, especially among the low-income households. Wealthy households rely on maids to do housework, with 30 percent of the wealthiest 20 percent of households employing maid services. Among the 20 percent poorest households, less than 1 percent employ a maid, and only 9 percent own a washing machine. Washing clothes by hand is time consuming, physically taxing work. At the same time, 47 percent of the poorest households own color television sets. Perhaps men and women both value entertainment durable goods over household-production durable goods. However, it is worthwhile to explore whether these decisions are the outcomes of a bargaining process to find out whether women would prefer to buy household-production durable goods if they had the power to decide.

3 A model of intrahousehold bargaining over consumer durables

We assume that husbands and wives bargain over whether to buy entertainment durable goods or home-production durable goods. Wives have a stronger preference for home-production durable goods relative to husbands, who have a stronger preference for entertainment durable goods. Following Thomas (1990, 1997), household bargaining follows a Nash bargaining model, with households choosing to purchase goods to maximize the product of the surplus that accrues to wives from being married and the surplus that accrues to husbands from being married:

$$N = [U^h(X, Z) - V^h(p, I_h, A_h)] * [U^w(X, Z) - V^w(p, I_w, A_w)] \quad (1)$$

The surplus is defined as a spouse's utility in the marriage (U) minus the utility that would be obtained by the spouse if the marriage broke up, also defined as the threat point utility (V). The superscript h refers to husbands, and the superscript w refers to wives. We assume that husbands and wives bargain over household consumption decisions. Other household members do not participate in the bargaining process, but provide market and domestic labor and consume goods and commodities. The vector$X$ is a vector of goods demands including leisure, Z is a vector of home-produced commodities (Becker (1965)), p is a vector of price, I represents the income available to husbands and wives after the marriage breaks up, and A represents situations that a spouse would encounter if the marriage breaks up that are not easily monetized, such as the marriage market. Husbands and wives get utility from their consumption and the consumption of other household members, such as children. If there are N goods, then X has a dimension of $N * J$, and element Xij is the consumption of the ith good by the jth member. This model assumes weak separability in X and Z.

Household welfare is maximized subject to Beckers (1965) full-income budget constraint and the home production function:

$$pX + p_z X_z = \sum_j w_j t_{mj} + \sum_j I_j \tag{2}$$

$$Z = f(X_z, t_z j) \tag{3}$$

Equation (2) represents the household's cash constraint, and Equation (3) represents the production function for home-produced commodities, Z. The price of time for each household member is represented by w_j, and t_{mj} is a vector of time spent by each household member working in the market. Households purchase goods for direct consumption, X, and goods as inputs into home-produced commodities Z, X_z. The household's expenditure on goods has to equal earned income plus members unearned income, I_j. Households produce commodities by combining household members' time, $t_z j$ with purchased goods X_z. The production function for commodities is flexible, so that they can be produced with different combinations of household members' time, purchased time such as from maids, and home-production durable goods. For example, households could produce a commodity such as clean clothes by combining 5 hours of the wife's time with water, a sink, and a clothesline, or by combining 30 minutes of the wife's time with the use of a washer and a dryer.

The demand for goods, X_z and X, are given by the following equation:

$$X + X_z = \sum_j X_j + \sum_j X_{zj} = h(p, I_h, I_w, A_h, A_w) \tag{4}$$

Note that husbands' and wives' unearned incomes enter the demand function separately. Consumption decisions are also affected by marriage market conditions.

A common test of the validity of the unitary household model contrasted to a bargaining model involves examining the effects of spouses' unearned income on household consumption decisions (Thomas (1990, 1997)). If the husband's unearned income has a different impact on consumption than the wife's unearned income does, then the results are inconsistent with the unitary model and supportive of the bargaining model. However, in Brazil, the division of unearned income between spouses is subject to pre-nuptial agreements[2], which means that spouses may not have access to all of their unearned income in the case of divorce. Unearned income is not, therefore, an accurate measure of bargaining power within the marriage. For this reason, we focus on marriage market conditions as a measure of bargaining power in the estimated equations. For example, if women prefer household-production durable goods to entertainment durable goods more than their husbands do, we expect to find that households spend relatively more money on household-production durable goods when marriage market conditions favor women.

4 Data

To test whether households make consumer durable purchasing decisions based on a bargaining model, we combine a Brazilian household survey, the *Pesquisa Nacional Por Amostra de Domicílios* (PNAD) with a Brazilian household expenditure survey, the *Pesquisa de Orçamento Familiares* (POF). The PNAD data offers detailed information about labor force participation and some information about hours spent on household work. In addition, PNAD is a large survey that covers almost all the counties in Brazil. The PNAD data is aggregated into state- and region-level variables that can be added to the house-

[2]Couples married before the 1980s face laws mandating that all assets are split. Starting in the 1980s, couples could choose at the time of the wedding whether there were going to split every asset, only non-inherited assets, or none of the assets.

hold expenditure data. These aggregated variables include average income in the state, proportion of women who work in a birth cohort in a state, and average price of an hour of maid's services in the state. The marriage market variable is constructed by taking the ratio of women to men by birth cohort within a state.

Household expenditure data are available in the POF, which is similar to the U.S. Consumer Expenditure Survey (CEX). The POF contains detailed data about expenditure, income, and ownership of durable goods. The 2002/03 survey is the first and only survey that is nationally representative. Durable goods expenditure and ownership data are available at the household level only. Therefore, it is not possible to determine individuals' consumption of these goods and the services that they provide. Indeed, such measurements would be very challenging to make because these goods are inherently types of public goods.

The sample consists of $19,662$ households in which both husband and wife are present and both are aged between 20 and 50 years old. Families are self-identified as a group of individuals who make common consumption decisions and share income. Descriptive statistics are reported in Table 1. The average household per capita monthly income is $R\$418 (US\$139)$. Most households are composed of one family, but a few households consist of 2 or 3 families sharing a house. The average household size is 4 members. Husbands are on average 3 years older than wives. Women in Brazil obtained more schooling than men did, on average. Wives had at least one more year of schooling than their husbands in 42 percent of the households; husbands had at least one more year of schooling than their wives in 31 percent of the households; and in 27 percent of the households, spouses had the same schooling. However, an examination of the proportions of husbands and wives with various levels of education indicates that the distributions of men's and women's education are similar.

At the time households were interviewed for the POF, adults were asked whether they made expenditure decisions in order to determine their eligibility to participate in the per-

sonal expenditure survey. The information is not detailed enough to determine whether the husband or the wife had the final decision over expenditures, nor whether the husband and the wife disagreed about who made the decision. However, the information can be used to construct variables indicating whether only the wife or only the husband reported making expenditure decisions. In 82 percent of the households, both spouses made expenditure decisions. Only 16 percent of households reported that only the husband made expenditure decisions, and only 2 percent of the households reported that only the wife made expenditure decisions. In Brazil, it is the norm that husbands and wives both decide about household expenditure.

The data include detailed information about consumer durable purchases during the previous 12 months, in addition to an inventory of durable goods owned by the household. Household-production durable goods are defined as goods that save time in household production and include the following: stove/oven, refrigerator, washing machine, dryer, microwave, freezer, vacuum cleaner, and dishwasher. The entertainment durable goods include the following: color TV, black-and-white TV, radio, sound system, VCR, CD player, DVD player, computer, and satellite dish. On average, households own 31 percent more, and spend 29 percent more, on household-production durable goods compared to entertainment durable goods.

The three durable goods that are most often owned by households are stove/oven, color TV, and refrigerator. Almost all of the richest 20 percent of households in the sample own these three goods. However, only 80 percent of the poorest 5 percent of households own a stove/oven. This percentage increases to 88 percent for the poorest 20 percent of households. About half of the poorest 20 percent of households own a color TV or a refrigerator, and only about 40 percent of the poorest 5 percent own a refrigerator. Among the poorest households, the fourth, fifth, and sixth most frequently owned durable goods are all entertainment durable goods-radios, black-and-white TVs, and satellite dishes. Fewer

than 10 percent of the poorest 20 percent of households own a washing machine, and all other home-production durable goods are owned by less than 4 percent of these households. The rich households show preferences for washing machines, which are the fourth most frequently owned durable goods, followed by VCRs, computers, and microwaves. Poor households appear to spend their scarce resources on entertainment durable goods rather than home-production durable goods, with implications for women's domestic work burden.

Household decisions about durable goods are certainly affected by their prices and the relationship between prices and household income. The ratios of the average prices of new durable goods to average monthly expenditure for each income quintile are presented in Table 3. The prices of home-production durable goods can also be compared to the prices of entertainment durable goods. For example, a color TV is expensive, costing about twice as much as the average expenditure of a household in the poorest quintile. A washing machine costs 1.5 times the average expenditure of these households, yet fewer households own this good. The most expensive goods are PCs, freezers, refrigerators, color TVs, DVD players, sound systems, washing machines, dishwashers, and CD players. The cheapest goods are radios, vacuum cleaners, black-and-white TVs, dryers, and stove/ovens.

Defining the Dependent variable

The dependent variables are constructed from the POF data set. With the aim of exploring the relative preferences of husbands and wives for production and entertainment durable goods, two dependent variables are constructed-the expenditure ratio and the quantity ratio of household production to entertainment durable goods. The problem in working with durable goods is that consumption occurs over a long period of time. The purchase of a durable good can be seen as an investment made at a certain point in time, for which the return is the stream of services provided by the durable good during its lifetime. Individuals derive utility from the services that these goods provide.

Moreover, durable goods purchases are infrequent, and the survey follows households' purchases of durable goods for only one year. To deal with these difficulties, two different measures of relative allocation are constructed: the expenditure ratio and the quantity ratio.

We calculate the expenditure ratio of durable goods, defined as $share_{p/e}$, by calculating the monthly rental value of each durable good owned by the household and then aggregating the rental values into totals for production durable goods and entertainment durable goods. These rental values are estimated using a depreciation decay model, as discussed in Deaton and Zaidi (2002). The share is defined as the ratio of the sum of the rental values of production durable goods divided by the sum of the rental values of the entertainment durable goods. Details about the estimation procedure may be found in Appendix A.

The expenditure ratio takes on values that range from 0 to 39.52. As the value of $share_{p/e}$ increases, the household favors production durable goods over entertainment durable goods. This measure accounts for both the quantity and quality of the durable goods that the household consumes. If the household owns no entertainment durable goods, the variable is defined as the sum of the rental values for the production durable goods. This situation is rare, however. Only four percent of the households owned production durable goods, but no entertainment durable goods. And only three percent of the households owned entertainment durable goods, but no production durable goods.

The second dependent variable is the quantity ratio of durable goods, which is defined as the total number of production durable goods owned by the household divided by the total number of entertainment durable goods owned by the household. There are eight different types of production durable goods and nine types of entertainment durable goods. However, one household may have more than one unit of a specific durable good (e.g. two color TVs). We add up all the units of production and entertainment durable goods. This way, the quantity of production durable goods can be higher than eight and the quantity

of entertainment durable goods can be higher than nine.

This relative allocation of production to entertainment durable good, $own_{p/e}$, is distributed as follows:

$$(5)\quad own_{p/e} = \begin{cases} y = 0: & \text{no production and at least one entertainment good} \\ 0 \leq y < 1: & \text{more entertainment than production goods} \\ y = 1: & \text{same amount of production and entertainment goods} \\ 1 < y \leq PDG: & \text{more production than entertainment goods} \end{cases}$$

As in the $share_{p/e}$, household is assumed to have $own_{p/e} = PDG$ if it has at least one production good and no entertainment good and $own_{p/e} = 0$ if a household owns no production good but owns at least one entertainment good. This variable orders the relative ownership of durable goods from relatively less to relatively more production goods. Notice that a household that owns a refrigerator and a TV is similar to a household that owns all of the production and entertainment durable goods. Notice, as well, that the distribution of the quantity ratio is censored at zero.

State-Level Variables

Bargaining power between husbands and wives is measured through a marriage market variable. We assume that the wife and the husband can leave the existing marriage and remarry. Therefore, the marriage market variable is constructed as the ratio of women to men in a given cohort and State of residence in 2001. Following the discussion in Fossett and Kiecolt (1991), we determined the appropriate definition of a marriage market in the Brazilian setting. The State is the smallest geographic unit that can be identified in the POF and PNAD, so marriage markets are defined at the state level. We examined marriage patterns by age (Appendix Table A.3), which indicated that men and women married within

the same age cohort. For most of the men's cohorts, the wives' average age is close to the average age in that cohort, but when the wives' age is lower than the husbands' cohort age, that difference is well within the standard deviation, about 5.5 years. Therefore, the marriage market ratios are defined within the same cohort, for example, the ratio of 20- to- 24- year-old women to 20- to- 24- year-old men. Alternatively, the marriage market variable is defined where wives are assumed to belong to a younger cohort than husbands.

According to the literature on marriage markets, bargaining power is established at the time of the union, and the more scarce women are, the more likely they are to find a better match if the marriage breaks up, which gives women higher bargaining power. The marriage market variable used here is negatively associated with women's bargaining power. Therefore, if women prefer time-saving in household production durable goods over entertainment durable goods, the marriage market variable should have a negative effect on the dependent variable.

Other State-level variables are constructed using PNAD 2001, including the state average income, the proportion of working women by cohort and the average price of maid's services. The price of durable goods and electricity are not available in the PNAD or available at the State level from another source. Instead, information on the expenditure of durable goods from the POF data set is used to calculate the prices of the services of durable goods, that is, the average rental value of production and entertainment goods by regions[3]. The averages were weighted by the households' ownership of these durable goods in the region. The price of electricity is the average price for 2002 and 2003 from the *Agência Nacional de Enegia Elétrica* (ANEEL). These variables are used in the regressions to capture other factors that differ across States and affect durable goods allocation such

[3]Because of the small number of observations on the purchase of certain durable goods in some states, especially the goods that have been recently introduced, the rental value was calculated by regions of Brazil.

as differences in living standards, price differences and women's labor market participation. Because the marriage market variable is a state-level variable and States in Brazil differ regarding development stage and wealth, the regression must have these control variables to capture these differences. Otherwise, the marriage market variable would be capturing these differences as well.

5 Econometric Model

To estimate the impact of bargaining power on the household's consumption of household-production durable goods relative to entertainment durable goods, we follow the econometric approach of Lundberg, Pollak, and Wales (1997). They used the expenditure ratio of children's goods to men's goods to examine the impact of changes in women's bargaining power on household consumption. Using ratios as the dependent variables allows us to estimate a single equation and to address potential bias due to measurement error. If the bargaining power variables have measurement errors, then their impact will bias the coefficient in the same direction in both equations. By estimating the ratio of the dependent variables, this bias will cancel out.

However, the specification is not a conventional demand analysis because the dependent variable is not a measure of purchase (flow) but instead is proportional to the stock of durable goods owned by the household. As pointed out by Deaton and Muellbauer (1980), in a cross-section analysis, the stock of durable goods is a better measure than purchases of individual durable goods because the relevant outcome is the choice between the ownership and nonownership of a durable good.

The equation that we estimate is as follows:

$$
\begin{aligned}
Y = {} & \gamma MM_{cs} + \beta_w DE_w + \beta_h DE_h + \theta_1 D + \theta_2 \overline{I}_s + \theta_3 WW_{cs} \\
& + \alpha_1 P^s_{maid} + \alpha_2 P^s_{prod} + \alpha_3 P^s_{ent} + \alpha_4 P^s_{elect} + \alpha_5 M
\end{aligned} \tag{6}
$$

As discussed above, the two dependent variables are $share_{p/e}$ and $own_{p/e} = PDG$. The marriage market variable, MM_{cs}, is defined as the ratio of women to men in a given cohort c and State s. The variables DE_w and DE_h are, respectively, indicators of households in which only the wife and households in which only the husband reports making decisions about purchases.

Because the marriage market variable may be correlated with other cohort and State characteristics, we include a set of State- and regional-level[4] variables as controls. These control variables are the average income in State s, Is, the proportion of working women in cohort c and State s, WW_{cs}, the prices of maid's services, P^s_{maid}, prices of production, P^s_{prod}, and entertainment, P^s_{ent}, durable goods and price of electricity, P^s_{elect}.

A set of household variables are used including the per capita income of the household, M, and a set of demographic variables, D, such as the number of people in the household (broken down by gender and age), the number of families in the household, the wife's age and the difference between the husband's and the wife's age, a set of dummy variables for wife's primary education, middle school, high school, and at least some college, and indicators of whether the wife has more schooling, less schooling, or equal amounts of schooling compared to the husband[5]. The last two variables can also be considered measures

[4]The prices of electricity, production and entertainment goods are not available at State level, but they are at regional level.

[5]We choose to use an indicator of whether the husband has more schooling than the wife instead of a specification that allows for a linear impact of the schooling difference between husbands and wives because little variation exists between husbands' and wives' schooling. The percentage of couples with equal years of schooling is 26 percent, and in 31 percent of the couples, the husband or the wife has one or two more years of schooling than his or her partner. Only in 17 percent of the couples does the husband have three

of bargaining power.

Testing The Common Preferences Model Against The Individual Preference Model

A hypothesis test of household common preferences against individual preferences and bargaining is performed. The higher is the ratio of women in a given cohort to men in a given cohort, the lower is the probability that a wife will find a better match outside the marriage, lowering the wife's bargaining power. Therefore, if women prefer household production durable goods over entertainment durable goods and individuals in the household do not share common preferences, the coefficient of the marriage market variable is negative and significant.

$$H_0 : \gamma = 0$$

$$H_a : \gamma < 0$$

Under the null hypothesis, H_0, the marriage market variable does not affect the relative allocation of production to entertainment goods and, therefore, the household behaves as a unitary decision-maker. But under the alternative hypothesis, H_a, husbands' and wives' preferences differ, and the marriage market impacts the demand for durable goods. Moreover, if wives prefer production to entertainment goods, the impact of the marriage market variable is negative. This happens because the opportunities outside the family affect the intrahousehold distribution of resources through the threat point.

or more years of schooling than the wife.

Price and Income Effects

Because the dependent variable is a ratio, and both the numerator and denominator depend on prices and income, the effects of prices and income are not straightforward to interpret by looking only at the coefficients of these prices and income variables. To overcome this problem, the response of the dependent variable to prices and income is derived. In most cases, the coefficients of these prices and income variables are proportional to the difference of the elasticity of production and elasticity of entertainment with respect to the specific variable. In Appendix Appendix B, the derivations of the price and income elasticities are presented.

6 Results

The main results are presented in table 4 and table 5, where in table 4 the dependent variable is the expenditure ratio of production to entertainment durable goods, $share_{p/e}$, and the dependent variable in table 5 is the ratio of the quantity of production to entertainment durable goods, $owns_{p/e}$. In column one, the results are the outcome of OLS estimation and, in column two, the Tobit estimation is used to deal with censoring of the dependent variable at zero. The results are quite similar between OLS and Tobit estimation with changes in the significance of few demographic variables.

The results from both tables are grouped into bargaining variables, demographic variables such as wife and husband's characteristics, and household variables, followed by the interpretation of the income and price coefficients. The section continues with a discussion of alternative measures of the marriage market variable, presented in table 6. The final subsection presents a discussion of the different impacts of the bargaining power variables across income groups, presented in table 7 and **??**.

Bargaining Power Variables

In both tables 4 and 5, the marriage market variable indicates that the allocation of production and entertainment goods is an outcome of a bargaining process between husband and wife, that is, this variable is significant at 1%[6]. In a common preference decision process, this variable would not be significant because it does not affect preferences, but under a bargaining process this variable is significant because it affects the allocation through the threat point[7]. Moreover, the negative impact of the marriage market variable indicates that cohorts and States where an excess of women exists, lowering a wife's bargaining power, have lower expenditure on production relative to entertainment durable goods. This result confirms that wives prefer production to entertainment goods and husbands prefer entertainment to production goods.

The indicators of households in which only the wife and only the husband makes expenditure decisions imply that these households have higher allocation of production relative to entertainment goods than households in which both spouses report making expenditure decisions. This is true whether we examine shares of expenditure, or shares of the number of durable goods owned. That is, the coefficients of these two indicators are positively significant in tables 4 and 5. These results are consistent with the presence of a bargaining process between husbands and wives over production and entertainment goods in households in which husbands and wives make expenditure decisions. Under a bargaining process

[6]The level of significance is 0.001 for a two-tail test and 0.002 for a one-tail test.

[7]Even after controlling for State average income and proportion of working women in a given cohort and State, someone may still wonder if the marriage market variable is capturing the bargaining power of wives or some other state effect. In reality, the correlation of the marriage market and the state income is around -0.12 and the correlation of the marriage market and the proportion of working women was around 0.07. Moreover, the test of variance inflation was rejected for all variables in the regression. These results indicate that the marriage market variable is likely capturing females' bargaining power for a given cohort in a given State.

the outcome may not to be Pareto efficient, leading to a undersupply of public goods and services. However, when only one spouse makes the expenditure decision, the household is considered a unitary household. Household allocation is efficient because by assumption, unitary household models always result in an efficient allocation.

Although in Table 4, the coefficient of the indicator of households in which only husband makes expenditure decisions, β_h, is higher than the coefficient of the indicator of households in which only wife makes expenditure decisions, β_w, the hypothesis of equality of the coefficients of these two indicators is not rejected when the dependent variable is the relative expenditure, Table 4. However, the hypothesis of equality of β_h and β_w is rejected at 10% when the dependent variable is the ratio of quantity of production to entertainment durable goods and Tobit estimation is considered (second and third column of Table 5). In this case, households in which only the wife makes expenditure decisions have a higher number of production to entertainment goods than households in which only the husband makes expenditure decisions, indicating that the wife prefers production goods.

In summary, households in which only the husband or only the wife makes expenditure decisions have higher allocation of production to entertainment goods than households in which both spouses make expenditure decisions, as shown by the coefficients on these two indicators and the F-statistic on the bottom of Table 5. Moreover, households in which only the husbands make expenditure decisions have the same relative expenditure as households in which only the wives make expenditure decisions, as shown by the F-statistic in the bottom of Table 4. The non-rejection of the hypothesis of equality of these two coefficients in the relative expenditure, but the rejection of the same hypothesis in the relative quantity suggest that households in which only the wife makes decisions consume cheaper production goods.

Compared to households in which the husband and the wife have the same level of education, households in which the wife has more schooling than the husband have higher

allocation to household-production goods than to entertainment goods. While this impact is highly significant for relative expenditure, Table 4, it is only significant at 10% for the relative quantity of production and entertainment goods, Table 5. Indeed, households in which the wife has at least one more year of schooling than the husband spend 0.13 more on production goods relative to entertainment goods. On the other hand, households in which the husband has more schooling than the wife have the same allocation of production to entertainment goods compared to households in which spouses have the same education level. Furthermore, these results are also evidence that production goods are preferred by wives and, especially, by those wives that could benefit the most from their ownership, i.e., the ones with higher relative human capital.

To summarize, the results of the tests provided by the marriage market variable, the indicators of households in which only the husband or only the wife makes expenditure decisions and the differences in husbands' and wives' schooling rejects the common preference model in favor of a bargaining model. Moreover, there is evidence that wives prefer household-production durable goods and husbands prefer entertainment durable goods.

Demographic Variables

Wife's age and the difference between the husband's and the wife's age do not affect relative expenditure, table 4, but they affect the relative quantity of production to entertainment goods, table 5, lowering the quantity of production to entertainment goods. That is, as the wife gets older the number of entertainment goods relative to the number of production goods increases by 0.35%; and for each additional year in the husband's age keeping the wife's age constant, the number of entertainment goods increases 0.2% more than the number of production goods. The fact that age and age difference do not affect the relative expenditure but affect the relative quantity is evidence that this increase in quantity of entertainment goods is due to the consumption of cheaper entertainment goods or more

expensive production goods. Therefore the quantity of entertainment goods is lager, but the rental value is the same.

Households where the wife has has incomplete secondary school or more have higher expenditure on entertainment relative to production durable goods compared to households where the wife has no education (Table 4). Households where the wife has some education, i.e. primary and incomplete secondary school, have more production relative to entertainment goods compared to those households where the wife has no education (Table 5). Except for households where the wife has high school, the relative number of production to entertainment goods is not significantly different from those households where the wife has no schooling. Moreover, households where the wife has college or more have a lower ratio of production to entertainment goods than households where the wife has no schooling. These results are consistent with a story that as the opportunity cost of the wives staying at home increases, they prefer to hire someone to replace their time in home-production, lowering their needs for production durable goods. There may be more scope for consumers to increase the quality and number of entertainment durable goods than the quality and number of home-production durable goods. For example, as households become wealthier, they can purchase televisions with larger and larger screens and with finer picture definition. By contrast, consumers probably care less about the top end of quality available in a washing machine.

The presence of children three years old and younger increases the allocation of production to entertainment goods, as showed by the coefficients of number of daughter and sons three years and younger in Table 4 and by the coefficient of the number of sons three years and younger in Table 5. The presence of daughters four to six and thirteen to sixteen years old decreases the allocation of household-production to entertainment durable goods. The presence of sons seven to twelve years old decreases the relative quantity of production to entertainment goods (Table 5). The presence of women 61 to 70 years old decreases

the relative quantity of production to entertainment goods (Table 5). This result is also consistent with a story of wives replacing their time in home-production with somebody else's time instead of using production durable goods, in this case wives' time is substituted by other women living in the household such as daughters or relatives. This kind of substitution occurs when a maid's time is not feasible or not seeing as perfect substitute to a family member's time.

Prices and Income Variables

All the prices and income variables have a significant at 1% or 5% impact on the relative allocation of production to entertainment durable goods in both Tables 4 and 5. The coefficient of the price of maids is positively significant, around 0.4. Based on equations (B.1) and (B.6), production goods and maids are substitute factors in household production. For the country as a whole, the estimated cross-price elasticity of production goods and maids' services range from 0.5 to 0.64 depending on whether maids reside in the household of employment or not.

The price of electricity has a positively significant effect, around four, on the relative allocation of production to entertainment goods. Interpreting this result in the lights of equation (B.4) and (B.9) and the complementarity of the durable goods with respect to electricity, implies that entertainment goods are more sensitive to changes in the price of electricity than production goods.

The effect of the price of production goods is positively significant, around 0.55 in Tables 4 and 5. Plugging the values presented on the descriptive statistic table on the right hand side of equation (B.2), it is found that $\varepsilon_{production,P_{prod}} - \varepsilon_{entertainment,P_{prod}} = 2.9 > 0$. Assuming that production goods are neither Giffen nor Veblen goods, then own-price elasticity is negative. This implies that the cross-price elasticity of entertainment goods with respect to the price of production goods is negative, and therefore production and

entertainment goods are complements. The same conclusions hold true if the results are analyzed using equation (B.7).

The effect of the price of entertainment goods is negatively significant, around 0.2 in Tables 4 and 5. Plugging the values presented in the descriptive statistic table into equation (B.3), it is found that $\varepsilon_{production,P_{ent}} - 0.15\varepsilon_{entertainment,P_{ent}} = 0.55 > 0$. For the complementarity of the production and entertainment goods to hold, the entertainment goods must be more sensitive to changes in price of entertainment goods than production goods. The same conclusions hold true if the results are analyzed using equation (B.8). For the income effect, equations (B.5) and (B.10), together with the negatively significant monthly per capita income coefficient, around 0.09 in Table 4 and 0.03 in Table 5, and the assumption that production and entertainment goods are not inferior goods, imply that entertainment goods are more sensitive to changes in income than production goods.

Alternative Measures of Marriage Market

In this study, the marriage market variable is the key variable used to test whether consumer durable consumption is the result of bargaining process. To check the robustness of the marriage market result, we explore other ways to define the Brazilian marriage market. The results are presented in Table 6. In general, the findings support the intrahousehold bargaining hypothesis and the hypothesis that women have a stronger preference for home-production goods than men do.

In the first and fourth columns of Table 6, the marriage market variable is defined assuming that men prefer to marry women in the next younger cohort. The estimated effects are smaller than when the marriage market was defined assuming that men and women were in the same age cohort (Tables 4 and 5). When the dependent variable is the ratio of the expenditures on durable goods, the marriage market variable is no longer statistically significant.

The other specifications in Table 6 define the marriage market based on the assumption that men and women prefer to marry spouses within their educational level as well as within their age cohort. The education groups used are defined as those having less than high school and those having at least some high school. The marriage market variable has a negatively significant effect assuming that husband and wife have the same educational level, and the husband's education is used to construct the marriage market variable (Columns 3 and 6, Table 6). The results flip to positive and insignificant when wife's education is used to construct the marriage market variable (Columns 2 and 5, Table 6). When the results are significant, they indicate that the wife prefers household-production durable goods relative to entertainment durable goods.

Results By Income Groups.

The regression results that we interpret as bargaining power effects might also be affected by interactions between income and the bargaining power variables. To examine this, the estimated coefficients of the bargaining power variables by income quintiles are presented in Table 7. [The previous results included controls for per capita income, but this measure is an imperfect measure of permanent household income. Also, households may show heterogeneous consumer durable purchasing behavior depending on their income quintile.

The results in Table 7 support the conclusion that consumer durable purchases are the outcome of bargaining processes, and that women have a stronger preference for production durable goods than men do. The coefficients on the marriage market variable remain negative and statistically significant across income groups, except for the three middle quintiles when the dependent variable is $share_{p/e}$. In these cases, the marriage market variable is not statistically significant. Consistent with the results presented in Table 4, looking at the $share_{p/e}$ dependent variable, households spend relatively more on production durable goods when only the husbands make decisions about expenditures, and this is

consistent across income groups. When the dependent variable is $owns_{p/e}$, households in the lower middle and high quintile show a significant positive effect of having only the husbands make expenditure decisions on ownership of home-production durable goods relative to entertainment durable goods. Consistent with the tests presented previously in Tables 4 and 5, there is no statistically significant difference between households where only the wives and households where only the husbands make the decisions.

We found previously in Table 5 that as the husband's age minus the wife's age increased, the ratio $owns_{p/e}$ decreased, and we interpreted the result as showing that when husband's bargaining power increased, the household bought more entertainment durable goods relative to home-production durable goods. Table 7shows that this result is driven by behavior in the upper middle and high income quintiles for $share_{p/e}$ and in the high income quintile for $owns_{p/e}$. The difference between husband's and wife's age is positive and statistically significant in the low-income quintile for sharep/e.

The results for the husband's and the wife's education variables reveal interesting heterogeneity across income groups. The wife having more schooling than the husband is associated with higher relative expenditure ($share_{p/e}$) on home-production durable goods only for the two highest income quintiles (Table 7). Also for the two highest income quintiles, as wife's education increases, the relative expenditure on home-production durable goods decreases. This is consistent with our earlier result and conclusion that entertainment durable goods have more scope for quality improvements than home-production durable goods. [Or, perhaps there is an argument here that the bargaining aspect only kicks in for high income groups.] When looking at the results when the dependent variable is $owns_{p/e}$ in Table 7, households in which the wife has more education than the husband own fewer home-production durable goods relative to entertainment durable goods than households in which husbands and wives have equal educational levels. However, the result is only statistically significant for the lowest income group. This result is not consistent

with a bargaining story where wives have stronger preferences for home-production durable goods than entertainment durable goods. Also, in the lowest income quintile, higher levels of wives' education are associated with more production goods relative to entertainment durable goods. The pattern is reversed for the highest income quintile, where higher levels of schooling are associated with lower ownership of home-production durable goods relative to entertainment durable goods. One story that is consistent with these heterogeneous results is that for women in low income quintiles, increased education (and the resulting higher opportunity costs) results in greater substitution of production durable goods for wives' time. However, for high-income quintiles, wives may choose to substitute maids' time for their time, and maids might be seen as substitutes for home-production durable goods.

7 Conclusion

This paper explores whether decisions about durable goods allocation are the outcome of a bargaining process between husbands and wives in Brazil. The variables that measure female bargaining power include a measure of the marriage market (i.e., the sex ratio), indicators of households in which only the husband and households in which only the wife makes expenditure decisions, the age difference between husbands and wives, and indicators of which spouse has more schooling. If husbands and wives share common preferences about durable goods allocation, then the relative allocation of household-production and entertainment durable goods will not be correlated with any of these bargaining power variables.

The results indicate that the decision about durable goods ownership is the outcome of a bargaining process between husband and wife. The test on the coefficients of the marriage market variable and the indicators of households in which only the wife and households in

which only the husband makes expenditure decisions corroborate the expectations about wives' preferences for production goods. Households in which the wife has more education than the husband also spend more on home-production durable goods relative to entertainment durable goods. However, results by income quintiles reveal that this effect of educational differences is found in the upper income quintiles and not in the lower income quintiles. These results increase the understanding of consumer durable purchasing behavior in Brazil, identifying the reasons for the lack of household-production durable goods in Brazilian households and for the priority given to entertainment durable goods. Because husbands and wives bargain over decisions about durable goods ownership, wives prefer production durable goods, husbands prefer for entertainment durable goods, and husbands have higher bargaining power, ownership of production durable goods might be lower than what would be optimally chosen by women. Under these circumstances, it is not surprising that a 2009 Brazilian policy designed to stimulate the sales of "white appliances", combined with an expansion of stores' credit lines available for durable goods purchases, also stimulated the purchase of entertainment goods.

Increasing women's bargaining power will lead to a reduction in the gap between production and entertainment goods ownership in Brazilian households. Demographic trends will tend to improve women's bargaining power, but at a slow pace (Oliveira, Albuquerque, and Lins (2004)). Because men tend to marry younger women, as population growth slows, there are fewer women in the younger cohort, increasing women's bargaining power. Improvements in women's level of education will be the most important channel to increase the ownership of household-production durable goods, especially the more expensive ones. Moreover, as the Brazilian population keeps ageing, there will be the need to increase female labor force participation to financially support the growth of the dependency ratio, as well as the need to increase the time spent on elderly care. Because women do most of the household work, there will be the need to increase the ownership of household-production

durable goods to free up women's time and to improve women's well being.

References

BEA (2008): "BEA Rates of Depreciation, Service Lives, Declining-Balance Rates, and Hulten-Wykoff categories," Discussion paper, Bureau of Economic Analysis (BEA).

Becker, G. S. (1965): "A Theory of the Allocation of Time," *The Economic Journal*, 75(299), 493–517.

Cavalcanti, T. V., and J. Tavares (2008): "Assessing the "Engines of Liberation": Home Appliances and Female Labor Force Participation," *The Review of Economics and Statistics*, 90(1), 81–88.

Deaton, A., and J. Muellbauer (1980): *Economics and Consumer Behavior*. Cambridge University Press.

Deaton, A., and S. Zaidi (2002): "Guidelines for Constructing Consumption Aggreagtes for Welfare Analysis," Living Standards Measurement Study Working Paper 135, The World Bank.

Fossett, M. A., and K. J. Kiecolt (1991): "A Methodological Review of the Sex Ratio: Alternatives for Comparative Research," *Journal of Marriage and the Family*, 53(4), 941–957.

Greenwood, J., A. Seshadri, and M. Yorukoglu (2005): "Engines of Liberation," *Review of Economic Studies*, 72(1), 109–133.

Jones, L. E., R. E. Manuelli, and E. R. McGrattan (2003): "Why Are Married Women Working So Much?," Research Department Staff Report 317, Federal Reserve Bank of Minneapolis.

Jornal Estado de São Paulo (2009): "Mantega confirma reduçãO de IPI da linha branca, 17 de abril de 2009," Discussion paper, Jornal Estado de São Paulo.

Kanczuk, F., and F. Faria Jr. (2000): "Ciclos Reais para a Indústria Brasileira?," *Estudos Econômicos (IPE/USP)*, 30(3), 335–350.

Lundberg, S. J., R. A. Pollak, and T. J. Wales (1997): "Do Husbands and Wives Pool Their Resources? Evidence from the United Kingdom Child Benefit," *The Journal of Human Resources*, 32(3), 463–480.

Oliveira, J. d. C., F. R. P. d. C. e. Albuquerque, and I. B. Lins (2004): "Projeção da população do Brasil por sexo e idade para o período 1980 a 2050: revisão 2004.," Discussion paper, Instituto Brasileiro de Geografia e Estatística (IBGE).

Oliveira, R. D. (2000): "For a fair sharing of time - Brazil households," UNESCO Courier.

Thomas, D. (1990): "Intra-Household Resouce Allocation: An Inferential Approach," *The Journal of Human Resources*, 25(4), 635–664.

——— (1997): *Income, Expenditure, and Health Outcomes: Evidence on Intrahousehold Resource Allocation,*chap. Intrahousehold allocation in Developing Countries: Models, Methods, and Policy, pp. 142–164. Johns Hopkins University Press.

UOL online (2009): "Governo reduz IPI de geladeira, fogo, mquina de lavar e tanquinho, 17 de abril de 2009," Discussion paper, UOL online.

Table 1: Descriptive Statistics, Brazil, 2002-2003.

Variable	Mean	Std. Dev.
Dependent Variables		
Relative Ownership Indicator	1.31	(1.42)
Difference in Ownership	-0.26	(1.57)
Rental Value Share	1.29	(2.05)
Bargaining Power Variables		
Marriage Market, same cohort	1.07	(0.10)
Marriage Market, wife in younger cohort	1.21	(0.13)
Both make expenditure decisions	0.82	(0.39)
Only wife makes expenditure decisions	0.02	(0.14)
Only husband makes expenditure decisions	0.16	(0.37)
Wife has more education	0.42	(0.49)
Husband has more education	0.31	(0.46)
Wife's Age	33.45	(7.59)
Wife has no schooling	0.07	(0.26)
Wife has primary education	0.32	(0.47)
Wife has secondary education	0.29	(0.45)
Wife has high school	0.25	(0.43)
Wife has college or more	0.07	(0.26)
Husband's Age	36.53	(7.55)
Husband has no schooling	0.10	(0.31)
Husband has primary education	0.35	(0.48)
Husband has secondary education	0.27	(0.44)
Husband has high school	0.21	(0.41)
Husband has college or more	0.07	(0.25)
Household Variables		
Number of Families in HH	1.00	(0.06)
Number of People in Household	4.23	(1.56)
Per capita total monthly income	418.01	(781.53)
Average State Income (in 1000)	0.89	(0.28)
Prices		
Rental Value of Entertainment Durable Goods	9.31	(1.02)
Rental Value of Production Durable Goods	4.59	(0.42)
Price of a hour of maid's services	0.93	(0.25)
Price of electricity (kwatts)	0.21	(0.02)
Number of Observations	19662	

Source: POF 2002-2003 and PNAD 2001.

Table 2: Durable Goods Ownership by Income, Brazil, 2002-2003.

	5 % poorest	10 % poorest	20 % poorest	20 % richest	10 % richest	5 % richest
Production:						
has stove-oven	79.67	83.53	88.00	99.54	99.49	99.19
has refrigerator	38.41	41.69	51.55	97.71	98.02	98.37
has freezer	2.54	2.85	3.38	36.71	43.98	51.27
has washing machine	6.40	6.20	8.77	67.39	73.72	78.33
has dish washer	0.20	0.10	0.10	8.16	12.66	17.80
has vacuum cleaner	0.51	0.31	0.18	22.27	28.93	35.91
has dryer	0.20	0.20	0.31	11.34	14.69	16.89
has microwave	0.30	0.25	0.41	37.77	48.60	59.51
Entertainment:						
has color TV	41.97	47.43	54.88	97.18	98.32	98.78
has black and white TV	19.31	19.78	17.59	4.12	4.02	4.27
has radio	20.02	20.54	19.90	33.81	37.98	43.03
has sound system	1.42	1.32	1.50	7.24	9.20	10.17
has computer	0.10	0.10	0.13	37.77	51.55	61.14
has VCR	1.63	1.53	2.95	62.66	70.77	76.09
has satellite dish	11.08	11.69	13.88	29.92	29.44	29.09
has CD	1.63	1.53	1.58	10.42	12.00	13.12
has DVD	0.00	0.05	0.05	9.89	15.81	23.09
Housekeeper:						
has maid	0.41	0.31	0.53	30.22	41.84	52.29
has cleaning service	0.20	0.20	0.15	11.29	15.00	18.01
has laundress	0.41	0.31	0.25	1.91	1.37	1.02
has someone to do iron clothes	0.00	0.00	0.00	2.21	3.10	3.46
has cook	0.00	0.05	0.05	0.31	0.56	0.81

The 5% and 10% poorest live with less than $1/day/capita. The 20% poorest live with less than $2/day/capita.
The 20% richest live with more than $5/day/capita. The 10% richest live with more than $10/day/capita.
The 5% richest live with more than $15/day/capita.

Table 3: Durable Goods Costs as Forgone Households Monthly Expenditures, Brazil 2002-2003.

	lower	lower-Middle	middle	upper-middle	higher
Microwave	1.38	0.75	0.49	0.30	0.10
Dryer	0.91	0.54	0.37	0.23	0.08
Washing Machine	1.49	0.78	0.50	0.31	0.10
Vacuum Cleaner	0.52	0.29	0.20	0.12	0.04
Dish Washer	1.47	0.88	0.61	0.37	0.12
Refrigerator	2.56	1.39	0.91	0.55	0.18
Freezer	2.82	1.45	0.91	0.55	0.17
Stoven/Oven	0.96	0.54	0.37	0.23	0.07
TV	2.05	1.13	0.74	0.46	0.15
Black-White TV	0.54	0.29	0.18	0.12	0.04
Sound System	1.64	0.89	0.58	0.35	0.11
Radio	0.23	0.14	0.10	0.06	0.02
PC	7.09	3.76	2.41	1.46	0.47
VCR	1.30	0.70	0.46	0.28	0.09
Satellite	1.26	0.68	0.44	0.27	0.09
CD player	1.44	0.77	0.49	0.30	0.10
DVD player	1.84	1.00	0.65	0.40	0.13

Source: POF 2002-2003

Table 4: Main Results. Dependent Variable: Share of Rental Value of Production to Entertainment Durable Goods, $share_{p/e}$, Brazil, 2002-2003

	OLS	Tobit
Bargaining Power Variables		
Marriage Market	-0.5088	-0.5066
	(0.1495)***	(0.1520)***
Only wife makes decision over expenditures	0.1839	0.1893
	(0.1010)*	(0.1027)*
Only husband makes decision over expenditures	0.3081	0.2959
	(0.0410)***	(0.0417)***
Wife's Age	-0.0038	-0.0036
	(0.0026)	(0.0026)
Husband's age - wife's age	-0.0026	-0.0022
	(0.0030)	(0.0030)
Wife has more schooling	0.1302	0.1321
	(0.0374)***	(0.0380)***
Husband has more schooling	-0.0262	-0.0034
	(0.0389)	(0.0396)
Wife has primary education	-0.0547	0.0035
	(0.0614)	(0.0628)
Wife has middle school	-0.2086	-0.1183
	(0.0644)***	(0.0659)*
Wife has high school	-0.3326	-0.2324
	(0.0667)***	(0.0681)***
Wife has college	-0.6134	-0.5166
	(0.0862)***	(0.0878)***
Household Variables		
Number of women 0-3 years old in HH	0.0785	0.0525
	(0.0340)**	(0.0347)
Number of women 4-6 years old in HH	-0.0823	-0.0945
	(0.0368)**	(0.0375)**
Number of women 7-12 years old in HH	0.0065	-0.0005
	(0.0253)	(0.0258)
Number of women 13-16 years old in HH	-0.0345	-0.0442
	(0.0341)	(0.0348)
Number of women 17-19 years old in HH	-0.0757	-0.0758
	(0.0496)	(0.0505)
Number of women 51-60 years old in HH	-0.0234	-0.0100
	(0.1903)	(0.1933)
Number of women 61-70 years old in HH	-0.1990	-0.2135
	(0.1682)	(0.1713)
Number of women older than 70 years in HH	0.0310	0.0320
	(0.1416)	(0.1441)
Number of men 0-3 years old in HH	0.1703	0.1536

Continued on next page

Table 4 – continued from previous page

	OLS	Tobit
	(0.0335)***	(0.0342)***
Number of men 4-6 years old in HH	0.0284	0.0146
	(0.0360)	(0.0368)
Number of men 7-12 years old in HH	-0.0011	-0.0071
	(0.0247)	(0.0252)
Number of men 13-16 years old in HH	-0.0241	-0.0299
	(0.0327)	(0.0333)
Number of men 17-19 years old in HH	-0.0101	-0.0097
	(0.0444)	(0.0452)
Number of men 51-60 years old in HH	-0.1939	-0.2190
	(0.3045)	(0.3107)
Number of men 61-70 years old in HH	-0.1770	-0.1542
	(0.2477)	(0.2513)
Number of men older than 70 years in HH	-0.1133	-0.1317
	(0.1979)	(0.2017)
Number of Families in HH	-0.1618	-0.2265
	(0.2386)	(0.2443)
Per Capita Income (in 1000)	-0.0921	-0.0940
	(0.0217)***	(0.0220)***
State Level Variables		
Proportion of Working Women by State and Cohort	0.1200	0.0854
	(0.2094)	(0.2132)
Average State Income (in 1000)	-0.1255	-0.1511
	(0.1318)	(0.1340)
Price of maids	0.3701	0.4174
	(0.1464)**	(0.1489)***
Region Level Variables		
Price of production goods	0.5869	0.6296
	(0.0842)***	(0.0856)***
Price of entertainment goods	-0.1535	-0.1712
	(0.0407)***	(0.0413)***
Price of electricity (in kwatts)	31.705	38.095
	(1.6187)*	(1.6455)**
Constant	0.0308	-0.1672
	(0.5353)	(0.5454)
Observations	19662	19662
R-squared	0.0251	
Testing $\beta_w = \beta_h$		
F-statistic	1.36	0.97
Probability	0.2434	0.3244

Standard errors in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: Main Results. Dependent Variable: Ratio of Production to Entertainment Durable Goods, $own_{p/e}$, Brazil, 2002-2003.

	OLS	Tobit
Bargaining Power Variables		
Marriage Market	-0.4158	-0.4156
	(0.0454)***	(0.0462)***
Only wife makes decision over expenditures	0.0964	0.0976
	(0.0307)***	(0.0312)***
Only husband makes decision over expenditures	0.0446	0.0417
	(0.0124)***	(0.0127)***
Wife's Age	-0.0035	-0.0035
	(0.0008)***	(0.0008)***
Husband's age - wife's age	-0.0021	-0.0020
	(0.0009)**	(0.0009)**
Wife has more schooling	0.0202	0.0207
	(0.0113)*	(0.0116)*
Husband has more schooling	0.0033	0.0085
	(0.0118)	(0.0120)
Wife has primary education	0.0371	0.0507
	(0.0186)**	(0.0191)***
Wife has middle school	0.0769	0.0976
	(0.0195)***	(0.0200)***
Wife has high school	-0.0010	0.0217
	(0.0202)	(0.0207)
Wife has college	-0.1674	-0.1454
	(0.0261)***	(0.0267)***
Household Variables		
Number of women 0-3 years old in HH	0.0046	-0.0013
	(0.0103)	(0.0105)
Number of women 4-6 years old in HH	-0.0236	-0.0263
	(0.0111)**	(0.0114)**
Number of women 7-12 years old in HH	-0.0116	-0.0133
	(0.0077)	(0.0078)*
Number of women 13-16 years old in HH	-0.0205	-0.0227
	(0.0104)**	(0.0106)**
Number of women 17-19 years old in HH	-0.0113	-0.0114
	(0.0150)	(0.0153)
Number of women 51-60 years old in HH	-0.0110	-0.0081
	(0.0577)	(0.0588)
Number of women 61-70 years old in HH	-0.1189	-0.1221
	(0.0510)**	(0.0520)**
Number of women older than 70 years in HH	0.0086	0.0088
	(0.0430)	(0.0438)

Continued on next page

Table 5 – continued from previous page

	OLS	Tobit
Number of men 0-3 years old in HH	0.0244	0.0205
	(0.0102)**	(0.0104)**
Number of men 4-6 years old in HH	-0.0101	-0.0133
	(0.0109)	(0.0112)
Number of men 7-12 years old in HH	-0.0150	-0.0164
	(0.0075)**	(0.0076)**
Number of men 13-16 years old in HH	-0.0158	-0.0171
	(0.0099)	(0.0101)*
Number of men 17-19 years old in HH	-0.0107	-0.0106
	(0.0135)	(0.0137)
Number of men 51-60 years old in HH	-0.0661	-0.0718
	(0.0924)	(0.0943)
Number of men 61-70 years old in HH	0.0349	0.0399
	(0.0751)	(0.0765)
Number of men older than 70 years in HH	-0.0236	-0.0276
	(0.0600)	(0.0613)
Number of Families in HH	0.0107	-0.0024
	(0.0724)	(0.0740)
Per Capita Income (in 1000)	-0.0421	-0.0425
	(0.0066)***	(0.0067)***
State Level Variables		
Proportion of Working Women by State and Cohort	0.1209	0.1129
	(0.0635)*	(0.0648)*
Average State Income (in 1000)	-0.0856	-0.0916
	(0.0400)**	(0.0407)**
Price of maids	0.4120	0.4227
	(0.0444)***	(0.0453)***
Region Level Variables		
Price of production goods	0.5224	0.5320
	(0.0256)***	(0.0260)***
price of entertainment goods	-0.1997	-0.2036
	(0.0123)***	(0.0126)***
price of electricity (in kwatts)	41.397	42.852
	(0.4910)***	(0.5003)***
Constant	-0.1506	-0.1973
	(0.1624)	(0.1657)
Observations	19662	19662
R-squared	0.0868	
Testing $\beta_w = \beta_h$		
F-statistic	2.57	2.88
Probability	0.1092	0.0895

Standard errors in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: Results Using Alternatives Measures of Marriage Market, Brazil, 2002-2003.

	Dependent Variable: $share_{p/e}$			Dependent Variable: $own_{p/e}$		
Marriage Market Variables:						
Women in younger cohort	-0.1461			-0.2658		
	(0.1253)			(0.0380)***		
By education level:						
Merged by wife's education		0.0876			0.0261	
		(0.0866)			(0.0263)	
Merged by husband's education			-0.1650			-0.1147
			(0.0756)**			(0.0230)***
Other Bargaining Variables	yes	yes	yes	yes	yes	yes
Household Variables	yes	yes	yes	yes	yes	yes
State Level Variables	yes	yes	yes	yes	yes	yes
Region Level Variables	yes	yes	yes	yes	yes	yes
Observations	19662	19662	19662	19662	19662	19662
R-squared	0.0246	0.0245	0.0247	0.0852	0.0829	0.0841

Standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

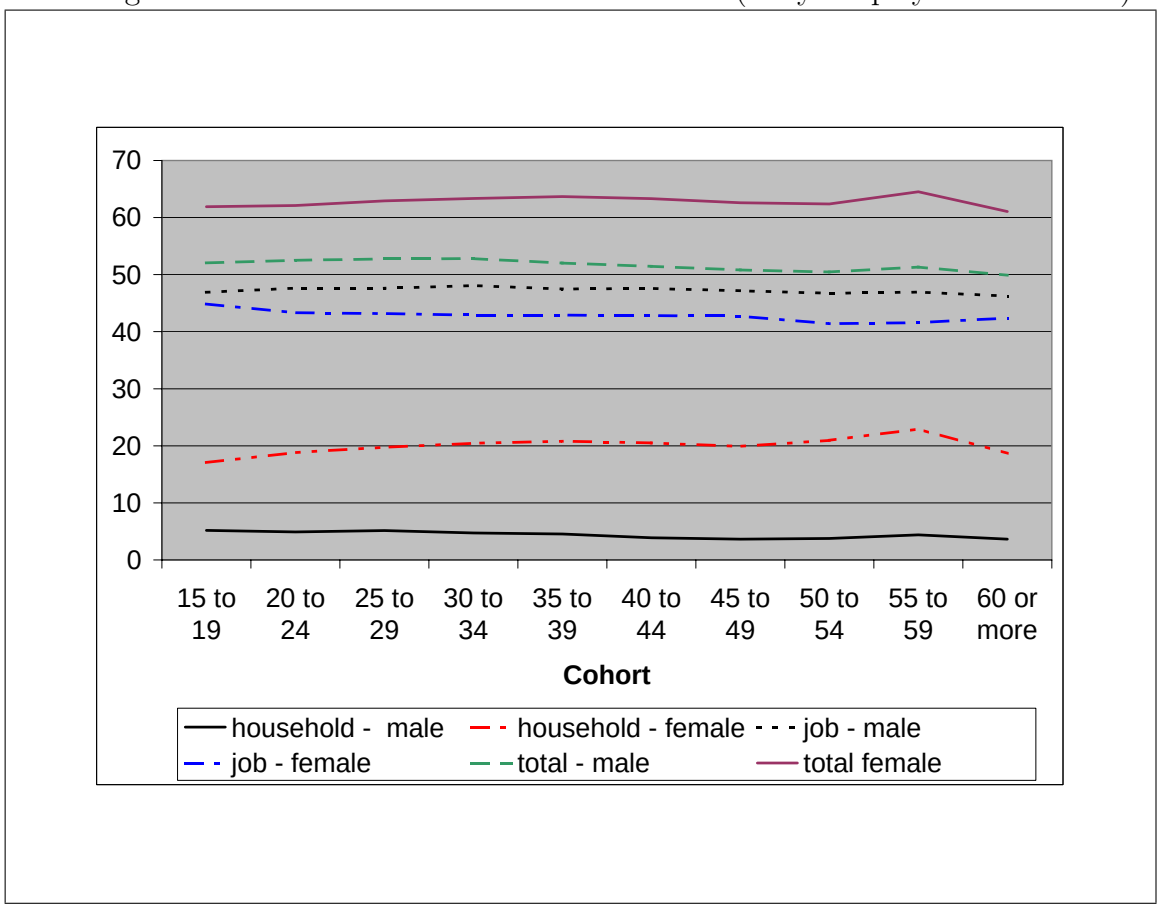
Table 7: Results by Income Group, Brazil, 2002-2003.

	$own_{p/e}$					$share_{p/e}$			
	low	lower middle	middle	upper middle	high	low	lower middle	middle	upper middle
Bargaining Power Variables									
Marriage Market	-0.3093	-0.3646	-0.6019	-0.3981	-0.3372	-0.6683	-0.4930	-0.6014	-0.3705
	(0.0962)***	(0.1033)***	(0.1044)***	(0.1089)***	(0.0915)***	(0.3716)*	(0.3892)	(0.3723)	(0.2997)
Only wife makes decision over expenditures	0.0452	0.1736	0.1055	0.0162	0.0824	-0.0273	0.2791	0.1310	0.2714
	(0.0615)	(0.0656)***	(0.0629)*	(0.0755)	(0.0868)	(0.2377)	(0.2472)	(0.2243)	(0.2078)
Only husband makes decision over expenditures	0.0326	0.0665	0.0377	0.0251	0.1013	0.3382	0.2587	0.3296	0.1933
	(0.0222)	(0.0256)***	(0.0295)	(0.0341)	(0.0349)***	(0.0857)***	(0.0966)***	(0.1051)***	(0.0938)**
Wife's Age	0.0027	0.0005	-0.0034	-0.0055	-0.0059	0.0162	0.0090	-0.0122	-0.0052
	(0.0020)	(0.0019)	(0.0018)*	(0.0018)***	(0.0015)***	(0.0075)**	(0.0070)	(0.0065)*	(0.0048)
Husband's age - wife's age	0.0026	-0.0015	0.0010	-0.0020	-0.0062	0.0131	0.0050	-0.0042	-0.0120
	(0.0019)	(0.0020)	(0.0021)	(0.0022)	(0.0018)***	(0.0075)*	(0.0076)	(0.0074)	(0.0060)**
Wife has more schooling	-0.0531	-0.0101	0.0101	0.0257	0.0341	-0.0704	-0.0013	0.1232	0.1841
	(0.0267)**	(0.0268)	(0.0264)	(0.0262)	(0.0218)	(0.1033)	(0.1010)	(0.0944)	(0.0720)**
Husband has more schooling	0.0286	0.0480	-0.0082	-0.0337	-0.0518	-0.1473	-0.1211	-0.0098	0.1761
	(0.0267)	(0.0280)*	(0.0279)	(0.0275)	(0.0220)**	(0.1031)	(0.1054)	(0.0995)	(0.0757)**
Wife has primary education	0.0981	0.0208	0.0137	-0.0160	-0.0679	0.0715	-0.0805	0.0613	0.0135
	(0.0297)***	(0.0375)	(0.0473)	(0.0654)	(0.0841)	(0.1146)	(0.1414)	(0.1688)	(0.1800)
Wife has secondary education	0.2763	0.1020	0.0086	-0.0553	-0.1543	0.1063	-0.1786	-0.2063	-0.1317
	(0.0364)***	(0.0405)**	(0.0486)	(0.0654)	(0.0814)*	(0.1405)	(0.1526)	(0.1734)	(0.1799)
Wife has high school	0.2532	0.1299	-0.0052	-0.1273	-0.2747	0.2665	-0.2267	-0.1111	-0.2384
	(0.0493)***	(0.0457)***	(0.0513)	(0.0664)*	(0.0804)***	(0.1904)	(0.1722)	(0.1829)	(0.1827)
Wife has college	0.3062	0.1037	-0.1103	-0.2415	-0.3983	-0.2023	0.1114	-0.2906	-0.5028
	(0.1966)	(0.1581)	(0.0858)	(0.0782)***	(0.0819)***	(0.7594)	(0.5957)	(0.3062)	(0.2152)**
Observations	3933	3932	3933	3932	3932	3933	3932	3933	3932
R-squared	0.1230	0.0823	0.0773	0.1037	0.1136	0.0274	0.0181	0.0208	0.0247
Testing $\beta_w = \beta_h$									
F-statistic	0.04	2.45	1.01	0.01	0.04	2.24	0.01	0.68	0.12
Probability	0.8426	0.1179	0.3156	0.9129	0.8386	0.1348	0.9370	0.4101	0.7275
Education Differences									
F-statistic	10.56	5.16	0.52	4.99	14.86	0.63	1.55	2.14	0.01
Probability	0.0012	0.0232	0.4710	0.0255	0.0001	0.4292	0.2139	0.1434	0.9132

Standard errors in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Figure 1: Number of Hours Worked Per Week (Only Employed Individuals).



Source: PNAD 2001.

Appendix A Calculation of the expenditure ratio of durable goods

A common way to measure the consumption of durable goods is to calculate their rental equivalent value. Here this rental equivalent measure is calculated using this model as well as using the empirical guides provided by Deaton and Zaidi (2002) to aggregate the values of production and entertainment categories. In the depreciation decay model, the rental equivalent value, rv, is estimated as

$$rv = \frac{p}{2T}(r - \pi + \delta) \tag{A.1}$$

where p is the average price of each durable good, $(r - \pi)$ is the real interest rate[8], δ is the depreciation rate, and $2T$ is the average service life of these durable goods[9].

There are no official estimates of the depreciation rate in Brazil. Some papers working with durable goods in Brazil[10] argue that the depreciation rate in Brazil is equal to the US estimates. Usually, these papers use the US depreciation rate to deal with Brazilian aggregated durable goods data. The Bureau of Economic Analysis (BEA) estimates that the US depreciation rate for household appliances is 16.5% (BEA (2008)). Information on the price of new and used durable goods is available in the POF for households who made apurchase during the survey period. Each household in the POF is asked about its stock of durable goods, allowing us to calculate the average time since last purchase of each

[8]The real interest rate used is the average of the 'selic' interest rate over 1979 to 2003 discounted by the average inflation rate during the same period. Both data come from IPEA, www.ipeadata.com. The average real interest rate is 5.6%.

[9]Since the average service life is not observed in the sample, it is assumed that the life-time of durable goods is normally distributed. Therefore, the average service life is calculated as two times the average time since last purchase.

[10]For example: and Kanczuk and Faria Jr. (2000)

durable good. By combining the information on purchase and stock of durable goods, the nominal depreciation rate is estimated by regressing the log of the average purchase price of each durable good in each State on the average time since last purchase in each State and a constant. The estimated nominal depreciation rate is about 10%[11], resulting in a real depreciation rate of approximately 15.6%, similar to the BEA estimates for the US. This is the number used to calculate the rental equivalent value of the durable goods.

Finally, the rental value is summed over all of the household-production durable goods owned by the household, as well as for the entertainment durable goods owned by the household. Then a ratio of aggregated household-production expenditure to aggregated entertainment expenditure is generated. The relative expenditure on production to entertainment goods, $share_{p/e}$, is distributed as follows:

$$\text{(A.2)} \quad share_{p/e} = \begin{cases} y = 0: & \text{no production and at least one entertainment good} \\ 0 < y < 1: & \text{more entertainment than production goods} \\ y = 1: & \text{same amount of production and entertainment goods} \\ 1 < y \leq PDG: & \text{more production than entertainment goods} \end{cases}$$

where PDG is the tota expenditure onf production durable goods owned by the household. A household is assumed to have $share_{p/e} = PDG$ if has at least one production good and no entertainment good. This ratio is equal to zero if a household has no production good but has at least one entertainment good. The distribution of the expenditure ratio is censored at zero.

[11] See Table A.1 for estimates.

Table A.1: Estimation of the Depreciation Rate for Consumer Durables, Brazil, 2002-2003 (Dependent Variable: Log of Average Price Per State).

	(1)	(2)	(3)
Average Age	-0.1087**	-0.1007**	-0.1165**
	(0.0065)	(0.0063)	(0.0066)
Bought Used	-1.1667**	-1.1547**	-1.1547**
	(0.0036)	(0.0036)	(0.0037)
Unknown (Used or New)	-0.7191	-0.8446*	-1.3161**
	(0.4124)	(0.3593)	(0.4268)
Constant	5.9182**	5.8989**	5.8989**
	(0.0016)	(0.0016)	(0.0017)
Observations	1508	1519	1506
R-squared	0.3192	0.315	0.2997

Standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.
Specification (1) includes the following: refrigerator, freezer, oven, washing machine, dryer, microwave, dishwasher, vacuum cleaner, TV, radio,sound system, VCR, CD player, DVD player, computer and satellite dish.
Specification (2) includes the durable goods in (1) plus new goods such as '*taquinho elétrico*'.
Specification (3) includes the durable goods in (2) and more detailed categories of entertainment goods, such as: type of radio, sound system, DVD recorder.

Table A.2: Proportion of Married People, Brazil, 2001.

	Men		Women	
cohort	Mean	Std. Dev.	Mean	Std. Dev.
15 to 19	0.03	(0.16)	0.14	(0.34)
20 to 24	0.26	(0.44)	0.42	(0.49)
25 to 29	0.56	(0.50)	0.63	(0.48)
30 to 34	0.73	(0.45)	0.72	(0.45)
35 to 39	0.79	(0.41)	0.74	(0.44)
40 to 44	0.82	(0.38)	0.72	(0.45)
45 to 49	0.84	(0.37)	0.69	(0.46)
50 to 54	0.85	(0.36)	0.66	(0.47)
55 to 59	0.84	(0.37)	0.61	(0.49)
60 or more	0.78	(0.42)	0.40	(0.49)

Source: PNAD 2001.

Table A.3: Wife's Average Age by Husband's Cohort, Brazil, 2001.

Husband's Cohort	Wife's Age	
	Mean	Std. Dev.
15 to 19	19.41	(5.41)
20 to 24	22.14	(4.96)
25 to 29	25.77	(5.50)
30 to 34	29.72	(5.62)
35 to 39	33.86	(5.91)
40 to 44	38.08	(6.06)
45 to 49	42.68	(6.50)

Source: PNAD 2001.

Appendix B Deriving Price and Income elasticities when the Dependent Variable ia a Ratio

In this section, we derive expressions for the price and income elasticities of demand for the dependent variables. The first dependent variable is the ratio of expenditures on home-production durable goods to entertainment durable goods, $share_{p/e}$. The effect of the price of maids is easier to interpret if it is assumed that maids and entertainment goods are independent, i.e., the price of maids affects the expenditure on production goods but does not affect the expenditure on entertainment goods. The price elasticity of production goods with respect to price of maids is presented in equation B.1, and depends on the coefficient of the price of maids, α_1, the price of maids, P_{maid}, and the relative expenditure of production to entertainment goods, $share_{p/e}$. The coefficient of the price of maids indicates whether maids and production goods are substitutes, α_1 ¿ 0, or complements, α_1 ¡ 0. Notice also that the higher is α_1 and P_{maid}, the more elastic is the expenditure on production goods relative to the price of maids. As well, the lower is the expenditure on production goods relative to expenditure on entertainment goods, the more elastic is the expenditure on production goods relative to the price of maids.

$$\varepsilon_{production,P_{maids}} = \alpha_1 \frac{P_{maid}}{share_{p/e}} \tag{B.1}$$

The own-price elasticity of production goods, $\varepsilon_{production,P_{prod}}$, and the price elasticity of entertainment goods with respect to price of production goods, $\varepsilon_{entertainment,P_{prod}}$, are not identified in equation (B.2). The same problem occurs with own-price elasticity of entertainment goods, $\varepsilon_{entertainment,P_{ent}}$, and the price elasticity of production goods with respect to price of entertainment goods, $\varepsilon_{production,P_{ent}}$, as shown in equation (B.3).

(B.2) $$[\varepsilon_{production,P_{prod}} - \varepsilon_{entertainment,P_{prod}}] = \alpha_2 \frac{P_{ent}Q_{ent}}{Q_{prod}} - 1$$

(B.3) $$[\varepsilon_{production,P_{ent}} - \varepsilon_{entertainment,P_{ent}} \frac{Q_{prod}}{P_{ent}Q_{ent}}] = \alpha_3 \frac{P_{ent}}{P_{prod}} + \frac{Q_{prod}}{P_{ent}Q_{ent}}$$

Equation (B.4) is derived by differentiating the estimation equation with respect to the price of electricity. The price elasticity of production and entertainment goods with respect the price of electricity is not identified either. However, assuming that both goods are complements to electricity, since their services are only provided if electricity is available, it is possible to determine which good is more elastic depending on the coefficient of price of electricity, α_4.

(B.4) $$[\varepsilon_{production,P_{elect}} - \varepsilon_{entertainment,P_{elect}}] = \alpha_4 \frac{P_{elect}}{share_{p/e}}$$

Regarding the income elasticity of production and entertainment goods, equation (B.5), the identification of which good is more income elastic depends on the coefficient of per capita monthly income, α_5, as well as, on assumptions on the inferiority and normality of these goods.

(B.5) $$[\varepsilon_{production,M} - \varepsilon_{entertainment,M}] = \alpha_5 \frac{M}{share_{p/e}}$$

The expression for price and income elasticities when the dependent variable is the quantity ratio of production to entertainment goods, $own_{p/e}$ are very similar to the set of equations discussed above for the dependent variable $share_{p/e}$. The difference appears in equations (B.7) and (B.8), which measure the effects of the prices of production and

entertainment goods. These differences are the results of the absence of prices of these goods in the quantity ratio. For the other equations, everything else is the same except for the $share_{p/e}$ being replaced by $own_{p/e}$, and all the identification problems discussed above hold.

$$\varepsilon_{production,P_{maids}} = \alpha_1 P_{maid} \frac{Q_{ent}}{Q_{prod}} \tag{B.6}$$

$$[\varepsilon_{production,P_{prod}} - \varepsilon_{entertainment,P_{prod}}] = \alpha_2 P_{prod} \frac{Q_{ent}}{Q_{prod}} \tag{B.7}$$

$$[\varepsilon_{production,P_{ent}} - \varepsilon_{entertainment,P_{ent}}] = \alpha_3 P_{ent} \frac{Q_{ent}}{Q_{prod}} \tag{B.8}$$

$$[\varepsilon_{production,P_{elect}} - \varepsilon_{entertainment,P_{elect}}] = \alpha_4 P_{elect} \frac{Q_{ent}}{Q_{prod}} \tag{B.9}$$

$$[\varepsilon_{production,M} - \varepsilon_{entertainment,M}] = \alpha_5 M \frac{Q_{ent}}{Q_{prod}} \tag{B.10}$$