

MARKET WORK AND HOUSEHOLD PRODUCTION IN BRAZIL

BY

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DISSERTATION

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Abstract

This thesis is composed of three papers in which the research questions are related to the double burden that accrues to Brazilian women. The first and second papers address this issue by looking at expenditure decisions about home production. The first paper examines whether the expenditure decisions about production goods, such as white appliances, relative to entertainment goods, such as TVs, are the outcome of a bargaining process between husbands and wives. The second paper looks at the demand for maid services and for production durable goods, examining the extent to which other household members substitute for maid services and durable goods in home production. The third paper addresses the effects of Brazilian women's double burden on their labor market participation by examining whether the occupational choice of Brazilian women is affected by their gender roles and whether entry into other occupations that are not identified as female occupations has become easier since the introduction of anti-discrimination laws in the labor market.

The first paper combines two Brazilian data sets: a Brazilian household expenditure survey, *Pesquisa de Orçamento Familiares* (POF), and a Brazilian household survey, *Pesquisa Nacional Por Amostra de Domicílios* (PNAD). The results of the first paper 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.

The same data sets as the first paper are used in the second paper. The finding of the

second paper indicates that if the marriage market is favorable to women, that is if the ratio of women to men goes from 1.07 to 0.96, the increment in the household probability of owning at least one maid's substitute durable goods is equivalent to 24% the impact of moving a household up one income quintile. Moreover, the results indicate that daughters' time substitutes for wives' time and maid services in home production. Parents may want daughters trained in home production to be able to perform their future role as wives. However, this training comes at a cost to daughters' investment in formal education, narrowing their future career options.

The data used in the third paper come from a Brazilian household survey, *Pesquisa Nacional Por Amostra de Domicílios* (PNAD). Gender roles are responsible for women to choose female-dominated occupations, married women are 1.14 times more likely to work in female-dominated occupations and having a child six years and older increases on average by 12% the probability that women work in female-dominated occupations instead of gender-integrated occupations in 2001. However, it becomes easier for all types of women to enter into male-dominated and gender-integrated occupations in 2001 compared to 1981.

To the memory of my father who supported me even when he needed my support the most.

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Chapter 1

Introduction

Brazilian women's participation in the labor market increased significantly since the second half of the last century. In 1950, about 14 percent of them participated in the labor market (Madalozzo (2009)). By 1981 the labor market participation of Brazilian women reached 31 percent (PNAD 2001). By 2001, their labor market participation rose to 52 percent (PNAD 2001). Looking at women of child bearing and child raising age (25 to 45 years), the labor market participation in 2001 is higher than that of all women. About 68 percent of all the women of child bearing and child raising age participate in the labor market (PNAD 2001). Moreover, working wives with young children are the group with higher participation in household work (Soares and Saboia (2007)).

Brazilian working women work about sixty hours a week while Brazilian work men work about fifty hours a week. In reality, working women on average work five hours less than men in the labor market (PNAD 2001). However, they undertake about fifteen hours more of household work than working men do (PNAD 2001). Moreover, gender roles still have a great influence in the intrahousehold allocation of time of Brazilian couples (Madalozzo (2009)). Given the increasing participation of Brazilian women in the labor market and their inability to engage their husbands in housework, the result is a double burden that often presents them with difficult choices between their careers and families (Oliveira (2000)). Not surprisingly, one of the concerns of Brazilian women is the unfair division of time in housework (Oliveira (2000)).

This thesis is composed of three papers in which the research question is related to this double burden that accrues to Brazilian women. The first and second papers address

this issue looking at expenditure decisions about home production. In the first paper, it is addressed whether the expenditure decisions on production goods, such as white appliances, relative to entertainment goods, such as TVs, are the outcome of a bargaining process between husbands and wives. In the second paper, it is addressed whether production goods are not the only way available for wives to reduce their time on home production, looking at other possible providers of home production than the wife: maid or teenaged daughter. The third paper addresses Brazilian women's double burden effects on their labor market participation, looking at whether the occupational choice of Brazilian women is affected by their gender role and whether entry into other occupations that are not identified as female occupations has become easier since the introduction of anti-discrimination laws in the labor market.

At first look, the research question of the third paper does not appear to be closely related to the research questions in the first and second paper. However, maid is the most common occupation among female occupations. Among the twenty most common female occupations there are other occupations that are related with women's roles as housekeeper and care givers, such as cook, laundress, nurse and teacher. In this way, the topics of the three papers relate to each other through addressing Brazilian wives' double burden and their historical role in the family.

Historically, the women's role in the family was child bearing, child raising, and house-keeping. As the population left the rural area and moved to cities, a movement that starts in the 1950's¹, there was no need to have a large number of children to work on the farm. Indeed, the fertility rate dropped from 6.15 births per woman in 1960 to 4 births per woman in 1980, and 2.39 births per woman in 2000 (World Bank 2008). Since then, the fertility rate has slowly decreased to 2.26 births per woman in 2006, approaching the replacement

¹As reported in Baer (2008), the urban population had a fast growth during this period. Indeed, the urban population increased from 31 percent in 1940 to 56 percent in 1970 and to 78 percent in 1996. In 2006, the urban population accounted for 85 percent of the country's population.

rate of 2.1².

Spending less time pregnant and with fewer children to care for and to clean up after, wives could engage in labor market activities. In fact, with the growth of the industry sector that started in the 1960's and the economic growth brought by this new developed sector (Baer (2008)), there were more employment opportunities for women, especially in the services sector. Even until 2001, among the twenty most common women's occupations the majority are in the service sector. In 2001, the twenty most common female occupations in descending order were maid, laborer or servant, street seller, teacher in primary school, tailor or seamstress, cook, nurse (without degree), receptionist, teacher in middle school, hair stylist, secretary, teacher in high school, manicure, bartender, cashier, assistant manager, clerk, embroidery-maker, teacher in kindergarten, and laundress.

Maid is a traditional and important occupation in Brazil (de Melo (1998)). The share of women in this occupation is about 99 percent, making it a female-dominated profession. Maid is the largest female-dominated occupation, as shown by the 1981 and 2001 PNAD (Brazilian Household Survey) data set. Laundress is another occupation that ranked among the 20 most common female-dominated occupations in 2001. In both occupations, workers have an average schooling of four years, which corresponds to elementary education (first to fourth grade). Maids' low educational levels results from women entering this profession at a young age and, then, having to drop out school or from women not having the education to enter another profession. The services provided by maids include cooking, doing the dishes, doing the laundry, and help with the children (de Melo (1998)).

While in developed countries the double burden was eased by the introduction of durable goods such as washing machines, dryers, and vacuum cleaners, in Brazil the double burden was eased by maid services. Brazilian households tend to lack household-production durable goods. Only half of the households living on less than two dollars a day per capita owns a refrigerator (POF 2002-2003). Even among the five percent richest households in Brazil,

²Since 1993 the population has grown at 1.5% or lower (World Development Indicators Online).

less than 20 percent of them own dish washers and dryers, 36 percent own vacuum cleaners, 60 percent own microwaves, and 78 percent own washing machines (POF 2002-2003). On the other hand, Brazilian households appear to prioritize entertainment durable goods over home-production durable goods in their purchasing decisions. Color TVs are the second most frequently observed durable goods in Brazilian households, being more frequent than refrigerators in lower income households.

Several studies have looked at the impact of home-production durable goods on freeing women's time to work in the labor market, but the results are not conclusive. Greenwood, Seshadri, and Yorukoglu (2005), using US household data, conclude that the durable goods revolution was fundamental to free women's time to work outside the household. Cavalcanti and Tavares (2008) corroborate the result of Greenwood, Seshadri, and Yorukoglu (2005), analyzing data from seventeen OECD countries. They estimate that a decline in the relative price of appliances accounts for a 10 to 15% increase in the labor force participation of women in the United Kingdom. However, Jones, Manuelli, and McGrattan (2003) argue that the factor that matters the most in explaining increases in women's labor force participation is the reduction in the gender wage gap.

The focus of the papers in this thesis is not to determine whether maid services and durable goods are a cause or consequence of Brazilian women participation in the labor market. The papers in this thesis take as given women's labor market participation and focus on maid services and durable goods as ways to ease the double burden of Brazilian women. Indeed, the gender wage gap has also decreased in Brazil. Leme and Wajnman (2000) estimates that by 1997 the gender wage gap was 25%, an 82% reduction when comparing with their baseline year, 1977. The gender wage gap for Brazilians aged 30 to 40 years old went from 30 percent in 1981 (PNAD 1981) to 13 percent in 2001 (PNAD 2001).

The first paper is motivated by the welfare improvement that home-production durable goods can bring to Brazilian wives, easing the double burden. The benefits of the time saved due to home-production durable goods are potentially large to Brazilian wives given

their inability to engage their husbands in housekeeping. The goal is to determine whether decisions about durable goods ownership are the outcomes of a bargaining process between husbands and wives, because they might have different preferences about the purchase of durable goods.

In order to investigate whether decisions about durable goods ownership are the outcome of a bargaining process between husbands and wives, the Brazilian household survey *Pesquisa Nacional Por Amostra de Domicílios* (PNAD) is used to construct the proportion of marriageable women to marriageable men by cohort in the household's state of residence. The marriage market variable is used in this paper as a proxy for female bargaining power. The assumptions behind this measure of bargaining power are that husbands and wives can leave the current marriage and remarry; the marriage market is local; and the more scarce women are, the more likely they are to find a better match and establishing a higher bargaining power. Therefore, as the proportion of marriageable women to marriageable men increases in a cohort and state, women's bargaining power within a marriage would be likely to decrease.

This information is combined with the Brazilian household expenditure survey, *Pesquisa de Orçamento Familiares* (POF). From the POF data set, the dependent variable, the relative allocation of household-production durable goods to entertainment durable goods, was constructed. This relative allocation is measured both as an expenditure ratio and as a quantity ratio. Since the idea in this paper is to test whether wives prefer production durable goods over entertainment durable goods, the dependent variable is a relative measure of household-production to entertainment. If women prefer household production durable goods over entertainment durable goods, and the marriage market variable is a good measure of bargaining power, the marriage market variable coefficient should be negative. Alternatively, other variables that capture bargaining power can be used as well, such as husbands' and wives' unearned income, indicators of households in which only the husband and households in which only the wife makes expenditure decisions, and indicators of which

spouse has more schooling. By using these variables it is possible to test whether the purchase of durable goods is the result of a household common preference or whether men and women have different preferences over expenditures on durable goods.

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. The husband's and wife's unearned income coefficients are not significant. The indicators of the husband and the wife having unearned income have the same impact on the allocation of production to entertainment durable goods. The failure to reject the common preference of husband and wife using information about unearned income may be driven by the inability of husband and wife to take from the marriage the same amount of resources they control in the marriage. Under certain circumstances, pre-nuptial agreements exist, but in most cases husbands and wives are bound by law to split their assets equally after marriage dissolution. Therefore, it is not possible to draw any conclusion from the test of the coefficient of unearned income.

The second paper of this thesis is about how wives can reduce their time in home production, alleviating the double burden, by making use of time-saving durable goods, by substituting their time for maid services or the labor of other household members, or by increasing the consumption of market goods such as carry out meals. The combination of time-saving durable goods, maid services and consumption of market goods depends on their relative prices as well as on household preferences and on the household members' cost of time.

Family composition is likely to affect home production. The presence of young children increases the demand for time in home production, increasing the demand for time-saving durable goods and maid services. However, the presence of teenagers or other relatives that can offer time in home production reduces wives' time in home production, decreasing the

demand for time-saving durable goods and maid services. The empirical specification allows for testing these hypotheses and also verifying if there are parental preferences for sons or daughters.

Even when there is no difference in parental preferences for sons and daughters, the choice of the optimal allocation of maid services and production durable goods can be affected by the gender composition of the children living in the household. This occurs because daughters and sons have different roles in home production. Parents may want their daughters to get some training to be able to perform their future role as wives.

The finding of this paper is that the expenditure on home-production inputs is an outcome of a bargaining process. The impact of the marriage market variable provides evidence of wives' preference for maid's substitute durable goods. If the marriage market is favorable to women, that is if the ratio of women to men goes from 1.07 to 0.96, the increment in the household probability of owning at least one maid's substitute durable goods is equivalent to 24 percent the impact of moving a household up one income quintile.

The presence of children that are not of school age, and therefore demand more time-intensive home production, 6 years or younger, increases the probability of having maid's substitute durable goods and maid services equally for sons and daughters. Notwithstanding, sons and daughters aged 13 to 16 years have different impacts on the probability of having expenditure on maid's substitute durable goods and maid services. Daughters decrease the relative probability of having maid services and sons increase the probability of having expenditure on maid's substitute durable goods and maid services. For older children, aged 17 to 19 years, daughters decrease the relative probability of having expenditure on maid services, while there is no difference in the impact of sons and daughters on the probability of having expenditure on maid's substitute durable goods. This indicates that daughters' time substitutes for wives' time and maid services in home production.

The result described in the previous paragraph indicates that daughters are being trained in home production to be able to perform their future role as wives. However, this training

comes at a cost to daughters' investment in formal education, narrowing their future career options. Even though, home-production training does not prohibit daughters from attending school, it does take them away from their after-school study time. With less study time and more training in home production, these girls are trapped into choosing careers that make use of their home-production training, for example, maids, corroborating the result found by Alexopoulos and de V. Cavalcanti (2006) or into getting married and being a housewife. Moreover, public policies based on cash transfers aim to keep children in school and away from market work. Nevertheless, there is no public policy designed to regulate or prevent children's home production. Because daughters are more likely than sons to work in home production and sons are more likely than daughters to perform market work, neglecting children's home-production work may lead to an increase in gender inequality in the labor market.

In the third paper of this thesis, a version of the Roy (1951)'s model in which individuals choose their occupation that best matches their gender roles considering possible discrimination and wage rates is adopted. To capture gender roles, variables are included that are related to intrahousehold division of labor, such as marital status, children's presence by age group and spouses' hourly wage. By doing that, it is possible to verify whether women are selecting themselves into female-dominated occupations due to their roles as wives and mothers.

Investigating whether gender roles influence females' occupational decisions, resulting in crowding into occupations that pay lower wages is important in terms of public policy. Take, for example, the case of childcare. Children stay in school or daycare in Brazil about five hours. Therefore, either mothers need to work fewer hours or have to find somebody to take care of their children while they work. This issue is worse for those parents that are not able to pay for childcare. An alternative to mitigate this issue is to extend hours children stay in public school.

It would be easy to know whether women would be better off in terms of wage rates in

occupations that are not female dominated, if it were possible to observe their wage rates in every occupation. However, the only observed wage rate is for the selected occupation. Therefore, selection correction terms are constructed from the occupational choice and added to the wage regression. By doing that, it is possible to estimate the difference among wage rates across occupations controlling by observed and unobserved individuals' characteristics.

Of all the working women, 70 percent of them are crowded into a few occupations that are less desired in terms of wage rates. It is possible in this model to verify whether women suffer a penalty in terms of wage by working in female-dominated occupations. That is, whether women working in female-dominated occupations have lower wage rates than women working in other occupations, independently of their schooling, age, place of residence and selection into occupations.

As shown by the results, gender roles have their share of responsibility for women being crowded into female-dominated occupations. Married women are 1,14 times more likely to work in female-dominated occupations than to work in gender-integrated occupations in both years. Having a child six years and older increases on average by 12% the probability of women working in female-dominated occupations instead of gender-integrated occupations in 2001.

Indeed, being crowded into female-dominated occupations imposes a penalty in terms of wage for women that does not depend on their schooling, age, place of residence, and selection into occupations. If women could change from female-dominated occupations to gender-integrated occupations, their log of hourly wages would increase by 0.81. However, it becomes easier for all types of women to enter into male-dominated and gender-integrated occupations in 2001 compared to 1981.

The fact that it becomes easier for all types of women to enter into gender-integrated and male-dominated occupations shows that the anti-discrimination laws have worked to improve women's well being in the labor market. However, women are still being crowded into female-dominated occupations due to their gender roles. Therefore, to increase the effectiveness of

the anti-discrimination laws, it is crucial to combine measures that can relieve the impact of gender roles on women's career choice.

However, measures to relieve the impact of women's gender roles will not be fully effective in promoting their entry into gender-integrated occupations if women continue to have lower returns to schooling than men in these occupations. For women with college degrees, female-dominated occupations give them higher returns to schooling than men with college degrees in female-dominated occupations. In male-dominated occupations, men and women have equal returns to schooling. Therefore, it is necessary to understand the reasons for women having lower returns to schooling than men in gender-integrated occupations to be able to mitigate this difference and to promote a more gender-integrated labor market.

Chapter 2

Durable Goods and Intrahousehold Allocation in Brazil

2.1 Introduction

Frequently, women do most of the household work in Brazil, even though 67.5% of women of childbearing and child rearing age (25 to 45 years old) participate in the labor force as well. When comparing working men and women, women on average work 5 hours less than men outside the household, as shown in Figure 2.1. However, they undertake about 15 hours more of household work than men. Consequently, Brazilian women tend to work 10 hours more than men. Not surprisingly, one of the concerns of Brazilian women is the unfair division of time in housework (Oliveira (2000)¹). Given their increasing participation in the job market and their inability to engage their husbands in housework, the result is a double burden that often presents them with difficult choices between their careers and families (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. Several studies have looked at the impact of home-production durable goods, but the results are not conclusive. Greenwood, Seshadri, and Yorukoglu (2005), using US household data, conclude that the durable goods revolution was fundamental to free women's time to work outside the household. Cavalcanti and Tavares (2008) corroborate the result of Greenwood, Seshadri, and Yorukoglu (2005), analyzing data from seventeen OECD countries. They estimate that a

¹Oliveira (2000) comments on the results of a study of 300 women in positions of responsibility in the public sphere done by the Center for Women's Leadership (CELIM) in Rio de Janeiro.

decline in the relative price of appliances accounts for a 10 to 15% increase in the labor force participation of women in the United Kingdom. However, Jones, Manuelli, and McGrattan (2003) argue that the factor that matters the most in explaining increases in women's labor force participation is the reduction in the gender wage gap. According to their model, a reduction in men's and women's wage differential explains most of the change since 1950 in the hours spent in market work by U.S. married women.

Whether or not the existence of home-production durable goods is crucial in freeing women's time to work outside the household, it is important to acknowledge the improvement in welfare that these goods brought to our households. The spread of home-production durable goods promoted an increase in efficiency, making it possible for clothes and houses to be cleaned more often (Jones, Manuelli, and McGrattan (2003)), reducing time spent on housework by 70% and reducing significantly the number of maids in the U.S. between 1900 and 1975 (Greenwood, Seshadri, and Yorukoglu (2005)).

This paper is motivated by the welfare improvement that these home-production durable goods bring. The benefits of the time saved due to home-production durable goods are potentially large to Brazilian wives given their inability to engage their husbands in housekeeping. Despite that, Brazilian households tend to lack household-production durable goods. Only half of the households living on less than two dollars a day per capita owns a refrigerator. Even among the five percent richest households in Brazil, less than 20% of them own dish washers and dryers, 36% own vacuum cleaners, 60% own microwaves and 78% own washing machines (Table 2.2).

Moreover, Brazilian households appear to prioritize entertainment durable goods over home-production durable goods in their purchasing decisions. Color TVs are the second most frequently observed durable goods in Brazilian households, being more frequent than refrigerators in lower income households. The goal of this paper is to determine whether decisions about durable goods ownership are the outcomes of a bargaining process between husbands and wives. Some durable goods are time-savers in household production, such as

washing machines, and their purchase reduces the burden on women and gives them time to work outside the household. Other durable goods, such as televisions and satellite dishes, are used in leisure time by both men and women. Husbands and wives might have different preferences about the purchase of durable goods. Whereas husbands might prefer to spend household income on entertainment durable goods, wives might prefer to spend household income on household production time-saving durable goods because women do most of the household production in Brazil. Therefore, investigating the factors that influence the relative allocation of durable goods is important.

Recent government policy in Brazil provides an example of the importance of households purchasing behavior as regards durable goods. In April 17th 2009, the Brazilian government lowered the taxes on the so-called “white appliances” (refrigerators, stove-ovens and washing machines) aiming to reduce their price and to stimulate their sales. The policy was intended to encourage poor households to replace old refrigerators with new, more energy-efficient models and to increase access to washing machines. The tax reduction was combined with an increase in stores’ credit lines.

As a result of this policy, the sales of “white appliances” increased, but the sales of the most desired durable goods, such as LCD TVs and personal computers, also increased. Stores have reported that advertising the price reductions on the “white appliances” brings consumers to the store, but once consumers are there they end up buying entertainment durable goods as well (Almeida and Casemiro (2009)). This unintended consequence of the tax reduction policy could be anticipated in the light of a bargaining process between husbands and wives, where wives take their husbands to the store to convince them to buy “white appliances” and couples end up compromising and taking home entertainment durable goods as well. Therefore, investigating the decision process of acquiring production versus entertainment durable goods for the household may help to determine the efficiency of the public policies to boost production durable goods ownership and to forecast its consequences.

In order to investigate whether decisions about durable goods ownership are the outcome

of a bargaining process between husbands and wives, the Brazilian household survey *Pesquisa Nacional Por Amostra de Domicílios* (PNAD) is used to construct the proportion of marriageable women to marriageable men by cohort in the household's state of residence. The marriage market variable is used in this paper as a proxy for female bargaining power. The assumptions behind this measure of bargaining power are that husbands and wives can leave the current marriage and remarry; the marriage market is local; and the more scarce women are, the more likely they are to find a better match. Therefore, as the proportion of marriageable women to marriageable men increases in a cohort and state, women's bargaining power within a marriage would be likely to decrease.

This information is combined with the Brazilian household expenditure survey, *Pesquisa de Orçamento Familiares* (POF). From the POF data set, the dependent variable, the relative allocation of household-production durable goods to entertainment durable goods, was constructed. This relative allocation is measured both as an expenditure ratio and as a quantity ratio. Since the idea in this paper is to test whether wives prefer production durable goods over entertainment durable goods, the dependent variable is a relative measure of household-production to entertainment goods. If women prefer household production durable goods over entertainment durable goods, and the marriage market variable is a good measure of bargaining power, the marriage market variable coefficient should be negative. Alternatively, other variables that capture bargaining power can be used as well, such as husbands' and wives' unearned income, indicators of households in which only the husband and households in which only the wife makes expenditure decisions, and indicators of which spouse has more schooling. By using these variables it is possible to test whether the purchase of durable goods is the result of a household common preference or whether men and women have different preferences over expenditures on durable goods.

2.2 Intrahousehold Allocation

Most of the recent studies in developing countries have refuted the unitary household model, where the household is considered as a single decision maker. The studies have influenced public policies, which are often now based on the premise that households bargain over outcomes. In the unitary model, all members of the household are assumed to jointly maximize the household welfare function, and income is allocated so that the marginal rate of substitution between any two goods equates to any other pair of goods. The assumption that the household can be treated as a single individual implies that all resources are pooled and then reallocated following a common rule.

In modeling intrahousehold decisions as a bargaining process, heterogeneity in preferences among household members is considered. In the presence of this heterogeneity and spouses' bargaining power, there is no incentive for household members to pool their incomes, but instead resources are allocated to goods that are preferable to each individual. If there are gender preferences towards durable goods, in this alternative model, then these gender preferences should be reflected in different resource allocations depending on the threat point, that is, who controls the income, and who faces better marriage market situations. This section continues by following Thomas (1990, 1997), which makes use of a Brazilian consumer expenditure survey that precedes the POF data set used here. If household members have the same preference for some goods, they would behave as a unitary household.

In the individual preference models, where there exists the bargaining within the household, households choose commodity demands, X , to maximize the product of the differences between the utility level of each member, U_m , and the threat point or reservation utility level that each member could achieve outside the household, V_0^m , which is different from the welfare function in the common preferences model. In the bargaining model, households follow a Nash equilibrium solution to the bargaining problem as described below.

$$\max \prod_m [U^m(X, Z) - V_0^m(p, I_m, A_m)] \quad (2.1)$$

where X is a vector of commodity demands including leisure, Z is a vector of home-produced goods, p is a vector of price, I_m is the unearned income of each individual, and A_m represents situations that an individual would face if this individual decides to leave the household, which are not easily monetized, such as the marriage market. If there are N goods then X has an $N \times M$ dimension, and its element, X_{im} , is the consumption of the i_{th} good by the m_{th} member. This model assumes weak separability between the utility functions. Household welfare is maximized subject to Becker (1965)'s full-time budget constraint and home-production:

$$pX = \sum_m w_m T + I_m \quad (2.2)$$

$$Z = f(X, t) \quad (2.3)$$

Where w_m is the price of time for each individual in the household, and t is a vector of time of each household member or hired time. Home-produced goods are produced with commodities, X , which includes the production and entertainment durable goods, and time, t . There are substitutes for home-produced goods such as meals away from home or, alternatively, a good can still be home-produced by substituting a household member's time for maid's services. In the last case, maid's services and household member's time are substitute factors in home production and, then, maid's services and production goods are complementary factors in home-production. On the other hand, maid's services could be a cheaper alternative to household-production durable goods and, then, maid's services and production good's services are substitute factors in home-production.

In this case, the demand for good i , X_i , is given by:

$$X_i = \sum_m X_{im} = g(p, I_1, \dots, I_M, A_1, \dots, A_M) \quad (2.4)$$

Differently from the common preference model, each household member's unearned income enters the bargaining model demand function separately. Also, the bargaining model demand function depends on the situation that each individual will face in the marriage market.

If the unearned income of household members can be carried out of the household by them without loss, then I_m is equal to the amount that household member m controls under marriage. In this case, the common preference hypothesis can be tested against the bargaining hypothesis by testing whether couples pool their unearned income. However, if the division of the unearned income between spouses is subject to pre-nuptial agreements, then the unearned income of spouses is not a good measure of their bargaining power. Therefore, the power of the test of income pooling is affected by the lack of accuracy of the measure of bargaining power. The hypothesis of common preferences can still be tested using this framework by checking the significance of the variables that capture the marriage market situation. If spouses have different preferences for time-saving household-production durable goods and entertainment durable goods and both spouses have bargaining power, then the marriage market situation will impact the demand for durable goods, and the household is not a unitary decision maker.

2.3 Data

This paper combines two Brazilian data sets: a Brazilian household survey, *Pesquisa Nacional Por Amostra de Domicílios* (PNAD), and a Brazilian household expenditure survey, *Pesquisa de Orçamento Familiares* (POF). The PNAD data set offers highly detailed information on labor force participation and some information about hours spent on household work. Furthermore, PNAD is a large survey that covers almost all counties in Brazil. For

these reasons, state- and region-level information is generated from the PNAD data set such as number of men and women in each State by cohort, as well by cohort and education, average income in a State, proportion of working women in a given cohort in a State and price of an hour of maid's services for both maids who reside in the household of employment and those who reside in their own household in a State. More importantly, the marriage market variable is constructed as the ratio of women to men by cohorts at the State using the information collected in PNAD.

On the other hand, the POF data set, similar to the US *Consumer Expenditure Survey* (CEX), contains detailed information on expenditure, income and the ownership of durable goods. This data set is collected to construct the *National Consumer Price Index* (INPC). The 2002/2003 survey is the first and only survey that contains information on the population living outside the metropolitan regions and is therefore nationally representative. The income information can be identified as belonging to the husband or wife. However, information on durable goods expenditure and ownership is not available at the individual level. Therefore, it is not possible to determine individual consumption of these goods and the services they provide. They are also inherently types of household public goods.

The sample is composed of 19,662 households in which both husband and wife are present. One of the spouses is the head of the family. Families are reported as independent consumption units² and both spouses are 20 to 50 years old. In Table 2.1, the descriptive statistics are reported. The average household per capita monthly income is *R*\$418.00³. Most of the households are composed of only one family, but there are a few households with two or three families sharing a house. The average household size is about four members. Husbands are on average 3 years older than wives. In 42% of the households, the wife has at least one more year of schooling than the husband and, in 31% of the households, the husband has at least one more year of schooling than the wife, leaving 27% of households where spouses have

²This information is relevant when there are more than one family living in the same house but these families make independent consumption decisions and do not share income.

³This value is about *U*\$138.64 using the average exchange rate for 2002 and 2003.

the same schooling. The dummies for educational level indicate that there are no strong differences between the distributions of men and women's education.

Unearned income includes income from government welfare programs; transfers from other households, such as child support, parental transfer and inheritance; savings and other financial assets; and exogenous income, such as money from gambling. About 16% of the husbands and wives in the sample report receiving some unearned income, and 12% of the wives and 6% of the husbands in the sample report receiving some transfers from other households. The husband's unearned income, *R*\$664.00, is more than twice the wife's unearned income, *R*\$289.00. Transfers from other households received by husbands are equal to about 70% of the transfers from other households received by wives, *R*\$164.00.

At the time of interview, adults living in the household are asked if they make expenditure decisions in order to determine their eligibility to participate in the personal expenditure survey. This information does not allow the researcher to identify whether the husband or the wife has the final decision over expenditures, nor whether the husband and the wife disagree about who makes the family decision. However, this information can be used to indicate who does not have any ability to decide about expenditures. For that reason, an indicator of households in which only the wife makes expenditure decisions and an indicator of households in which only the husband makes expenditure decisions are constructed. In about 82% of the households, both spouses make expenditure decisions. The households in which only the husband makes expenditure decisions are 16% of the total, and in only two percent of the households, only the wife makes expenditure decisions. These numbers indicate that it is common for both spouses to report making decisions about personal expenditure.

The household-production durable goods considered in this paper are goods that save time and help in household production. They include the following: stove-oven, refrigerator, washing machine, microwave, freezer, vacuum cleaner, dishwasher and dryer. The entertainment durable goods include the following: color TV, black and white TV, radio,

sound system, VCR, CD player, DVD, computer, and satellite dish. On average, households spend 29% more on household-production durable goods compared to entertainment durable goods. Also, they own on average 31% more household-production durable goods than entertainment durable goods.

As shown in table 2.2 the three most frequent durable goods are, in order, stove-oven, color TV and refrigerator. Almost all of the 20% richest households⁴ in the sample own these three goods. However, only 80% of the 5% poorest households in the sample own a stove-oven; the ownership increases to 83% and 88% for the 10% and 20% poorest households. Only about half of the 20% poorest households own a color TV and a refrigerator. The ownership of color TVs and refrigerators decreases to about 40% among the 5% poorest households. Among the poorest households the fourth, fifth and sixth most owned durable goods are radios, black and white TVs and satellite dishes, respectively. All of them are entertainment durable goods. A washing machine is owned by less than 10% of the 20% poorest households, and all other production goods are owned by less than 4% of them. For the richest households, the fourth most owned durable good is a washing machine, followed by VCRS, computers and microwaves.

In table 2.3, the percentage of the 20% poorest and richest households that own durable goods conditional on having a stove-oven; stove-oven and color TV; stove-oven, color TV and refrigerator is presented. This table shows the hierarchy of preference for these goods; for example, once the 20% poorest households own a color TV, a radio and a black and white TV are no longer the fourth and fifth most owned durable good, but instead the fourth most owned good is a satellite dish, the fifth is a radio followed by a washing machine in sixth. Regarding the order of preference for durable goods, there is no change for the 20% richest households when ownership is conditional on the ownership of the three most owned goods.

In table 2.4, it is shown the ratio of the average price of the new durable goods and the

⁴The 5% and 10% poorest households live with less than *U*\$1.00 daily per capita, the 20% poorest households live with less than *U*\$2.00 daily per capita, the 20%, 10% and 5% richest households live with more than *U*\$5.00, *U*\$10.00 and *U*\$15.00 daily per capita, respectively.

average monthly expenditure for each income quintile. This information is useful to compare the cost of production and entertainment durable goods. Overall, entertainment durable goods cost at least as much as production durable goods. Take, for example, a satellite dish, more frequently owned by the 20% poorest households than a washing machine, its costs is 1.26 of the average monthly expenditure of the 20% poorest households, while a washing machine costs 1.49 of the average monthly expenditure of the 20% poorest households . The most expensive goods are PCS, freezers, refrigerators, color TVs, DVD players, sounds systems, washing machines, dish washers and CD players, respectively. The cheapest goods are radios, vacuum cleaners, black and white TVs, dryers, and stove-oven.

Defining the Dependent variable

The dependent variable is constructed from the POF data set. With the aim of exploring the relative preferences of husbands and wives for production and entertainment durable goods, the dependent variable is constructed as the expenditure ratio and the quantity ratio of household production to entertainment durable goods. The problem in working with durable goods is that purchase and consumption have different meaning and timing for these goods. 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 life-time. Individuals derive utility from the services that these goods provide, and that is the consumption of durable goods.

Moreover, durable goods purchases are infrequent, and the survey follows households' purchases of durable goods for one year. To deal with these difficulties, two different measures of relative allocation are constructed: the expenditure ratio, where the numerator is the aggregated rental value of production durable goods, and the denominator is the aggregated rental value of entertainment durable goods; and the quantity ratio, where the numerator is the quantity of production durable goods owned by the household, and the denominator is the quantity of entertainment durable goods owned by the household. These measures are

described below.

Expenditure Ratio of Durable Goods, $share_{p/e}$

A common way to measure the services, i.e. the consumption, of durable goods is to calculate their rental equivalent value. This is usually done by assuming that durable goods follow a depreciation decay model. 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

$$rv = \frac{p}{2T}(r - \pi + \delta) \quad (2.5)$$

where p is the average price of each durable good, $(r - \pi)$ is the real interest rate⁵, δ is the depreciation rate, and $2T$ is the average service life of these durable goods⁶.

There are no official estimates of the depreciation rate in Brazil. Some papers working with durable goods in Brazil⁷ argue that there is no reason to believe that the depreciation rate in Brazil is different from 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)).

From the purchases of durable goods, there is information on the price households pay for each durable good. From the stock of capital, it is possible to get the average time since last purchase of each 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

⁵The 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%.

⁶Since 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 time since last purchase.

⁷For example: and Kanczuk and Faria Jr. (2000)

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%⁸, 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:

$$share_{p/e} = \begin{cases} y = 0 : & \text{no production and at least one entertainment good} \\ 0 < y < 1 : & \text{more entertainment than production goods} \\ y = 1 : & \text{same amount of production and entertainment goods} \\ 1 < y \leq PDG : & \text{more production than entertainment goods} \end{cases} \quad (2.6)$$

where PDG is the total number of 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.

Quantity Ratio of Durable Goods Indicator, $own_{p/e}$

Each household owns a certain number of production and entertainment goods. There are eight different types of production durable goods and nine types of entertainment durable goods. However, one household may have more than one unity of a specific durable good

⁸See Table 2.5 for estimates.

(e.g. two color TVs), therefore, when calculating the number of production and entertainment durable goods we count all the 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. Based on that, the quantity ratio of production to entertainment durable goods is calculated by dividing the number of all production durable goods owned by the household by the number of all entertainment durable goods. This relative allocation of production to entertainment durable good, $own_{p/e}$, is distributed as follows:

$$own_{p/e} = \begin{cases} y = 0 : & \text{no production and at least one entertainment good} \\ 0 \leq y < 1 : & \text{more entertainment than production goods} \\ y = 1 : & \text{same amount of production and entertainment goods} \\ 1 < y \leq PDG : & \text{more production than entertainment goods} \end{cases} \quad (2.7)$$

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 who owns all of the production and entertainment durable goods. Notice, as well, that the distribution of the quantity ratio is censored at zero. While this variable is a measure of quantity, the relative expenditure on production to entertainment goods, $share_{p/e}$, is an expenditure measure.

State-Level Variables

To construct the marriage market variable there are important considerations that must be done to guarantee that the variable is capturing the right information; for a complete

discussion, see Fossett and Kiecolt (1991). The first decision to be made in constructing this variable is the relevant geographic units that indicate a distinct marriage market. In the data sets used in this paper (POF and PNAD), State is the smallest region that can be identified and therefore these are the geographic units used to construct this variable. Another, relevant decision for constructing the marriage market variable is regarding the age limit and the age differences between husbands and wives. In table 2.6, the proportion of married women and men by cohort is presented. The biggest increase in the proportion of married women occurs at the 20 to 24 age range, whereas for men the same happens at the 25 to 29 age range. In table 2.7, the mean and standard deviation of the wife's age in each man's cohort is presented. For most of the men's cohorts, the wife's average age is close to the average age in that cohort, but when the wives' age is lower than the husband's cohort age, that difference is well within the standard deviation, about 5.5 years. For most cohorts, the wives' age is less. However, that difference is well within the standard deviation. Based on that information, it was assumed that husband and wife are in the same age cohort. Alternatively, a version of the marriage market variable is used where it is assumed that wives belong to a younger cohort than husbands.

In the construction of the marriage market variable the assumption that wife and husband can leave the actual marriage and remarry is made. Therefore, the marriage market variable is constructed as the ratio of women to men in a given cohort and State of residence in 2001. This variable is used in the regressions as a measure of women's bargaining power. 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.

Besides the marriage market variable, there are other State-level variables 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 described in section 2.3 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 ⁹. The average was 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 Energia Elétrica* (ANEEL). These variables are used in the regressions to capture other factors that differ across States and affect durable goods allocation such as differences in living standards, price differences and women’s labor market participation. Because the marriage market variable is a state-level variable and there exist differences among States in Brazil 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.

2.4 Econometric Model

The specification used to estimate the relative allocation of household-production to entertainment durable goods and to test the impact of bargaining power on this allocation is presented below. This specification is consistent with the previous work that has tested the common preference models using cross-sectional data, such as Lundberg, Pollak, and Wales (1997) where the expenditure ratio of two goods is used to allow for a single equation estimation. It is possible to avoid bias due to measurement errors by using the dependent variable as a ratio instead of estimating two equations. If the bargaining power variables have measurement errors, then their impact will bias the coefficient in the same direction on both equations. By doing the ratio of the dependent variable, this bias will cancel out.

⁹Because 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.

However, the specification is not a conventional demand analysis because the dependent variable is not a measure of purchase (flow) but instead it 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 the purchase because the relevant outcome is the choice between the ownership and nonownership of a durable good. The two dependent variables, Y , estimated in this paper are the expenditure ratio of production to entertainment durable goods, $share_{p/e}$, that is, a relative expenditure measure, and the quantity ratio of durable goods, $own_{p/e}$, i. e., a relative quantity measure.

$$Y = \gamma MM_{cs} + \beta_w DE_w + \beta_h DE_h + \delta_w UI_w + \delta_h UI_h + \theta_1 D + \theta_2 \bar{I}_s + \theta_3 WW_{cs} + \alpha_1 P_{maid}^s + \alpha_2 P_{prod}^s + \alpha_3 P_{ent}^s + \alpha_4 P_{elect}^s + \alpha_5 M \quad (2.8)$$

Where MM_{cs} is the ratio of women to men in a given cohort, c , and State, s , a variable that captures if the marriage market is more favorable to husband or wife. DE_w and DE_h are, respectively, an indicator of households in which only the wife and households in which only the husband reports making decisions about purchases. UI_w and UI_h are, respectively, the wife's and husband's unearned income. Because the marriage market variable is constructed for a given cohort in a given State, its variation may be correlated with cohort and State characteristics.

To guarantee the identification of the marriage market effect on the relative allocation of production to entertainment goods, a set of State- and regional-level¹⁰ variables is used as controls. These control variables are the average income in State s , $\bar{I}_s$, the proportion of working women in cohort c and State s , WW_{cs} , the prices of maid's services, P_{maid}^s , prices of production, P_{prod}^s , and entertainment, P_{ent}^s , durable goods and price of electricity, P_{elect}^s .

A set of household variables are used including the per capita income of the household,

¹⁰The prices of electricity, production and entertainment goods are not available at State level, but they are at regional level.

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 husband¹¹. However, the last two variables can also be considered measures of bargaining power.

Testing The Common Preferences Model Against The Individual Preference Model

To determine whether the decision about durable goods ownership is the outcome of a bargaining process between wife and husband, and whether wives prefer household production durable goods over entertainment durable goods, two hypothesis tests of common preferences against individual preferences and bargaining are performed. The first test is related to the significance of the marriage market variable and the second test is the difference in the impact of unearned income in the hands of husband and wife.

Testing: Marriage Market

The higher is the ratio of women in a given cohort to men in a given cohort, the lower is the probability of a wife to 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.

¹¹We 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 or more years of schooling than the wife.

$$H_0 : \gamma = 0$$

$$H_a : \gamma < 0$$

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.

Testing: Unearned Income

A post-estimation test of the equality of the coefficients of husband and wife's unearned income is performed. Under the null hypothesis, H_0 , unearned income in the hands of the wife or the husband have the same impact on the relative allocation of production to entertainment durable goods, and the household behaves as a unitary decision-maker.

$$H_0 : \delta_w = \delta_h$$

$$H_a : \delta_w \neq \delta_h$$

However, under the alternative hypothesis, H_a , the control of resources affects the relative allocation of durable goods differently for husbands and wives, then the common preferences model is rejected. Therefore, husbands and wives have different preferences over household-production and entertainment durable goods. Moreover, if the impact of wife's resources is

higher than the impact of the husband's resources on the ratio of production to entertainment durable goods, then wives prefer production to entertainment durable goods. Notice that if control over unearned income in the marriage differs from the control after divorce, the test fails to reject the null hypothesis even if the true decision is a bargaining process. This happens because the threat point is the payoff of choosing divorce and if there are imposed sharing-rules regarding the assets division upon marriage dissolution, the threat point will depend on that rule, not on the assets controlled under marriage.

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 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 this subsection, the hypothesis used and problems of identification are addressed.

Dependent Variable: Expenditure Ratio, $share_{p/e}$

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 (2.9), 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, $\alpha_1 > 0$, or complements, $\alpha_1 < 0$. 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 entertainment goods, the more elastic is the expenditure on production goods relative to the price of maids.

$$\varepsilon_{production, P_{maids}} = \alpha_1 \frac{P_{maid}}{share_{p/e}} \quad (2.9)$$

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 (2.10). 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 (2.11).

$$[\varepsilon_{production, P_{prod}} - \varepsilon_{entertainment, P_{prod}}] = \alpha_2 \frac{P_{ent} Q_{ent}}{Q_{prod}} - 1 \quad (2.10)$$

$$[\varepsilon_{production, P_{ent}} - \varepsilon_{entertainment, P_{ent}} \frac{Q_{prod}}{P_{ent} Q_{ent}}] = \alpha_3 \frac{P_{ent}}{P_{prod}} + \frac{Q_{prod}}{P_{ent} Q_{ent}} \quad (2.11)$$

Equation (2.12) is derived by differentiating the estimation equation with respect to the price of electricity. The price elasticity of production and entertainment goods with respect to 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 .

$$[\varepsilon_{production, P_{elect}} - \varepsilon_{entertainment, P_{elect}}] = \alpha_4 \frac{P_{elect}}{share_{p/e}} \quad (2.12)$$

Regarding the income elasticity of production and entertainment goods, equation (2.13), 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.

$$[\varepsilon_{production,M} - \varepsilon_{entertainment,M}] = \alpha_5 \frac{M}{share_{p/e}} \quad (2.13)$$

Dependent Variable: Quantity Ratio, $own_{p/e}$

The following set of equations is the equivalent of the set discussed above when the dependent variable is the quantity ratio of production to entertainment goods, $own_{p/e} = \frac{Q_{prod}}{Q_{ent}}$. The difference between this set of equations and the one in the previous section appears in the effect of the prices of production and entertainment goods, equations (2.15) and (2.16). 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 in the previous section hold.

$$\varepsilon_{production,P_{maids}} = \alpha_1 P_{maid} \frac{Q_{ent}}{Q_{prod}} \quad (2.14)$$

$$[\varepsilon_{production,P_{prod}} - \varepsilon_{entertainment,P_{prod}}] = \alpha_2 P_{prod} \frac{Q_{ent}}{Q_{prod}} \quad (2.15)$$

$$[\varepsilon_{production,P_{ent}} - \varepsilon_{entertainment,P_{ent}}] = \alpha_3 P_{ent} \frac{Q_{ent}}{Q_{prod}} \quad (2.16)$$

$$[\varepsilon_{production,P_{elect}} - \varepsilon_{entertainment,P_{elect}}] = \alpha_4 P_{elect} \frac{Q_{ent}}{Q_{prod}} \quad (2.17)$$

$$[\varepsilon_{production,M} - \varepsilon_{entertainment,M}] = \alpha_5 M \frac{Q_{ent}}{Q_{prod}} \quad (2.18)$$

2.5 Results

The main results are presented in table 2.8 and table 2.9, where in table 2.8 the dependent variable is the expenditure ratio of production to entertainment durable goods, $share_{p/e}$, and the dependent variable in table 2.9 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. In column three, the husband's and the wife's unearned income variables are replaced by indicators of whether the husband and the wife have unearned income, given that only 15% and 16% of the husbands and wives report some unearned income.

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 2.10. The final subsection presents a discussion of the different impacts of the bargaining power variables across income groups, presented in table 2.11 and 2.12.

Bargaining Power Variables

In both tables 2.8 and 2.9, 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%. 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 point¹². Moreover, the negative impact of the marriage market variable indi-

¹²Even 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

cates 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 indicate that these households have higher allocation of production relative to entertainment goods, in expenditure, table 2.8, and quantity, table 2.9, than households in which both spouses report making expenditure decisions. That is, the coefficients of these two indicators are positively significant in tables 2.8 and 2.9. 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 the outcome may not to be Pareto efficient, leading to a under-supply of public goods and services. However, when only one spouse makes the expenditure decision, an efficient allocation rises once households behave as an unitary decision model and in unitary household models always result in an efficient allocation by assumption.

Even though, in table 2.8, 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 2.8. 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 2.9). 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

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.

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 2.9. 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 2.8. 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 2.8, it is only significant at 10% for the relative quantity of production and entertainment goods, table 2.9. 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.

The coefficients of husband and wife's unearned income are not significant, but the coefficients of the indicators of husband and wife having unearned income are negatively significant in both tables 2.8 and 2.9. If the husband or the wife have some unearned income the expenditure on entertainment goods is eight percent higher than the expenditure on production

goods, but the quantity of entertainment goods is only four percent higher than the quantity of production goods. These results indicate that households in which the husband or the wife have some unearned income, consume more expensive entertainment goods than households where neither husband nor wife have any unearned income.

In both tables, the coefficients for the indicators of husband and wife having unearned income are close in magnitude. Furthermore, the hypothesis of equality of effects between these indicators is not rejected, as showed by the first F-statistic at the bottom of tables 2.8 and 2.9. This result is consistent with Thomas (1997) findings, using aggregate household goods expenditures in Brazil, which indicated that rearranging the distribution of unearned income within the household will not have any impact on the household goods expenditure. However, as discussed before, this test is not reliable if this income cannot be carried out of marriage by spouses if divorce occurs. Part of the unearned income, such as inheritance and financial assets is required to be divided in equal parts if divorce occurs under common pre-nuptial agreement. The other components of unearned income such as transfers and government welfare programs may increase after divorce for one spouse and decrease to another. Therefore, unearned income under marriage is not an accurate measure of unearned income under divorce and the test of income pooling is not appropriate to test the common preference model in the case studied here.

For that reason, we focus on 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. In these cases, the common preference model is rejected 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 2.8, but they affect the relative quantity of production to entertainment goods, table 2.9, 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 larger, but the rental value is the same.

Households where the wife has middle school or more have higher expenditure on entertainment relative to production durable goods compared to households where the wife has no education, table 2.8. Households where the wife has some education, i.e. primary and middle school, have more production relative to entertainment goods compared to those households where the wife has no education, table 2.9. 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. This finding may also be consistent with an income effect story, once education is a measure of permanent income. As wives permanent income increases, there is a stronger income effects for entertainment goods.

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 on table 2.8 and by the coefficient of the number of sons three years and younger on table 2.9. 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 2.9. The presence of women 61 to 70 years old decreases the relative quantity of production to entertainment goods, table 2.9. 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 2.8 and 2.9. The coefficient of the price of maids is positively significant, around 0.4. Based on equations (2.9) and (2.14), it is concluded that 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 (2.12) and (2.17) 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 on tables 2.8 and 2.9. Plugging the values presented on the descriptive statistic table on the right hand side of equation (2.10), 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 (2.15).

The effect of the price of entertainment goods is negatively significant, around 0.2 in tables 2.8 and 2.9. Plugging the values presented in the descriptive statistic table into equation (2.11), 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 (2.16). For the income effect, equations (2.13) and (2.18), together with the negatively significant monthly per capita income coefficient, around 0.09 on table 2.8 and 0.03 on table 2.9, 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 section, the robustness of the marriage market results to the assumption that both spouses belong to the same cohort and to the assumption that educational level does not matter are discussed. To avoid small sample problems, the education groups used are having less than high school (less education) and having at least some high school (more education). There are still some State and cohort cells where the number of observations is very small for those who have more education, causing a higher variation in the range of the marriage market variable. While the main specification of the marriage market varies from 0.65 to

1.35, the marriage market by education varies from 0.5 to 3.2.

The impact of the marriage market variable assuming potential wives are from a younger cohort than husbands is smaller than the impact of marriage market variable defined as husband and wife in the same cohort. The result is still negative but significant only when the dependent variable is the quantity ratio, column five on table 2.10. 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. The results flip to positive and insignificant when wife's education is used to construct the marriage market variable. When the results are significant, they indicate that the wife prefers household-production durable goods relative to entertainment durable goods.

Results By Income Groups.

Table 2.11 shows the results by income group when the dependent variable is the expenditure ratio of production to entertainment durable goods, $share_{p/e}$, while table 2.12 shows the results by income group when the dependent variable is the ratio of the quantity of production to entertainment durable goods, $owns_{p/e}$. When the dependent variable is the quantity ratio, the marriage market variable is negative and significant at 1% to all income groups, implying that independent of the income group the allocation of production to entertainment goods is a result of a bargaining process between husbands and wives, where wives prefer production durable goods over entertainment durable goods. Among all income groups, the middle income group has the highest impact of the marriage market variable, whereas the low income group has the lowest impact of the marriage market variable.

When the dependent variable is the expenditure ratio of production to entertainment durable goods, the marriage market variable is negative and significant only for the low and high income groups. While the marriage market is significant at 1% for the high income group, it is significant at 10% for the low income group. However, the result still implies

that the allocation of production to entertainment goods is a result of a bargaining process between husbands and wives and wives prefer production durable goods over entertainment durable goods, it indicates that in expenditure share this trade-off between production to entertainment goods matters only for the low and high income group.

The indicator of households in which only the husband makes expenditure decisions shows that these households have higher allocation of production relative to entertainment goods, in expenditure, table 2.11, and quantity for the lower middle and high income groups, table 2.12, than households in which both spouses report making expenditure decisions. That is, the coefficient of this indicator is positively significant in table 2.11 and for lower middle and high income groups in table 2.12. The indicator of households in which only the wife makes expenditure decisions implies that these households have higher allocation of production relative to entertainment goods only in quantity for the lower middle and middle income groups, table 2.12, than households in which both spouses report making expenditure decisions. That is, the coefficient of this indicator is positively significant for lower middle and middle income groups in table 2.12.

Even though, in table 2.11, the coefficient of the indicator of households in which only the 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 2.11. In the same way, in table 2.12, the coefficient of the indicator of households in which only the wife makes expenditure decisions, β_w , is higher than the coefficient of the indicator of households in which only the husband makes expenditure decisions, β_h , the hypothesis of equality of the coefficients of these two indicators is not rejected when the dependent variable is the quantity ratio, (table 2.12).

The coefficients of husbands' and wives' unearned income are not significant for all income groups when the dependent variable is the relative expenditure of production to entertainment good, table 2.11, and the F-statistic on the bottom of table 2.11 does not reject the

null hypothesis of equality of husbands' and wives' unearned income coefficients. When the dependent variable is the quantity ratio of production to entertainment goods, table 2.12, the only significant coefficient is the husbands' unearned income coefficient for the high income group. However, the F-statistic on the bottom of table 2.12 does not reject the null hypothesis of equality of husbands' and wives' unearned income coefficients. In the high income group, husbands' unearned income increases the quantity of entertainment to production durable goods.

For each additional year the husband is older than his wife, the expenditure on production durable goods relative to the expenditure on entertainment durable goods increases for the low income group and decreases for the higher middle and high income group, as shown by the coefficient of husbands and wives age on table 2.11. For the high income group, the coefficient of husbands and wives age on table 2.12 shows that for each year that the husband is older than his wife, the quantity of production durable goods relative to the quantity of entertainment durable goods decreases.

In upper middle income households, if the husband has more schooling than the wife or the wife has more schooling than the husband, the household spends more on production than on entertainment durable goods. However, in high income groups, households in which the wife has more schooling than the husband spend more on production durable goods than households in which the husband and the wife have the same schooling and than households in which the husband has more schooling than the wife. This conclusion is based on the F-statistic at the bottom of table 2.11, which rejects the hypothesis that households in which the husbands have more schooling than wives have the same spending behavior as households in which the wives have more schooling than the husbands.

When the dependent variable is the quantity ratio of production to entertainment durable goods, table 2.12, the test of equality of the indicators of households in which the husband has more schooling than the wife and the wife has more schooling than the husband rejects the equality of these coefficients, except for the middle income group. In low income house-

holds, if the wife has more schooling than the husband the quantity ratio of production to entertainment durable goods decreases. In lower middle income households, if the husband has more schooling than the wife the quantity ratio of production to entertainment durable goods increases. In high income households, if the husband has more schooling than the wife the quantity ratio of production to entertainment durable goods decreases.

Therefore, as the marriage market improves for wives, the relative quantity of production to entertainment goods increases, however, the expenditure share of production to entertainment goods increases only for the low and high income groups. This implies that increasing wives' bargaining power increases the quantity of cheaper production goods, except for low and high income households. Moreover, low income households in which wives have more schooling than the husband spend on production goods as much as households in which both spouses have the same schooling, but have less quantity of production goods. High income households in which wives have more schooling than the husband spend more on production goods than households in which both spouses have the same schooling but have equal quantity of production goods. This, also, implies that increasing wives schooling relative to their husbands increases the relative ownership of more expensive production goods for low and high income households.

2.6 Conclusion

This paper intends to determine whether decisions about durable goods allocation are the outcome of a bargaining process between husbands and wives. In order to do that, several measures of female bargaining power commonly used in the intrahousehold allocation literature are used. These variables are a measure of the marriage market, the sex ratio, the husband's and the wife's unearned income, indicators of households in which only the husband and households in which only the wife makes expenditure decisions, and indicators of which spouse has more schooling. The idea is that if decisions about the allocation of

durable goods are the result of a common preference of husbands and wives over durable goods allocation, then the relative allocation of household-production and entertainment durable goods will not be correlated with any of these 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. The husband's and wife's unearned income coefficients are not significant. The indicators of the husband and the wife having unearned income have the same impact on the allocation of production to entertainment durable goods. The failure to reject the common preference of husband and wife using information about unearned income may be driven by the inability of husband and wife to take from the marriage the same amount of resources they control in the marriage. Under certain circumstances, pre-nuptial agreements exist, but in most cases husbands and wives are bound by law to split their assets equally after marriage dissolution. Therefore, it is not possible to draw any conclusion from the test of the coefficient of unearned income.

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. Given the existence of a bargaining process between husbands and wives over decisions about durable goods ownership, wives' relative preferences for production durable goods, husbands' relative preferences for entertainment durable goods, and husbands' higher bargaining power, it is natural that there exist missing production durable goods in Brazilian households. Under these circumstances, a policy to stimulate the sales of "white appliances" combined with more stores' credit lines available for durable goods purchases also stimulates the purchase of entertainment goods, as was observed in 2009 in Brazil.

Increasing women's bargaining power will lead to reducing 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 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.

2.7 Figures and Tables

Table 2.1. Descriptive Statistics, Brazil, 2002-2003.

Variable	Mean	Std. Dev.
<u>Dependent Variables</u>		
Relative Ownership Indicator	1.31	(1.42)
Difference in Ownership	-0.26	(1.57)
Rental Value Share	1.29	(2.05)
<u>Bargaining Power Variables</u>		
Marriage Market, same cohort	1.07	(0.10)
Marriage Market, wife in younger cohort	1.21	(0.13)
Wife's Unearned Income (in 1000)	0.29	(4.38)
Husband's Unearned Income (in 1000)	0.66	(6.33)
Transfers wife receives from other HH (in 1000)	0.16	(3.93)
Transfers Husband receive from other HH (in 1000)	0.12	(2.93)
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)
<u>Household Variables</u>		
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)
<u>Prices</u>		
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 2.2. Durable Goods Ownership by Income, Brazil, 2002-2003.

	5 % poorest	10 % poorest	20 % poorest	20 % poorest	20 % richest	10 % richest	5 % richest
<u>Production:</u>							
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	
<u>Entertainment:</u>							
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	
<u>Housekeeper:</u>							
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 2.3. Durable Goods Ownership Conditional on The Ownership of Others, Brazil, 2002-2003.

Conditional on having:	Stove-Oven		Stove-Oven and color TV		Stove-Oven, color TV and Refrigerator	
	20% poorest	20% richest	20% poorest	20% richest	20% poorest	20% richest
<u>Production:</u>						
has refrigerator	57.13	97.85	74.04	98.27		
has freezer	3.76	36.80	5.13	37.32	3.37	36.67
has washing machine	9.94	67.54	13.72	68.11	16.92	68.35
has dish washer	0.12	8.20	0.14	8.43	0.13	8.49
has vacuum cleaner	0.20	22.37	0.34	22.83	0.45	23.08
has dryer	0.35	11.39	0.53	11.52	0.71	11.67
has microwave	0.46	37.82	0.72	38.40	0.84	38.76
<u>Entertainment</u>						
has color TV	60.20	97.29				
has black and white TV	17.04	4.14		3.94	3.50	3.93
has radio	18.20	33.81	3.36	34.09	16.85	34.24
has sound system	1.68	7.28	2.11	7.32	2.27	7.35
has computer	0.14	37.82	0.19	38.53	0.26	38.89
has VCR	3.35	62.77	5.47	64.20	6.80	64.80
has satellite dish	15.22	29.98	23.51	30.55	24.56	30.26
has CD	1.70	10.47	2.40	10.60	2.72	10.74
has DVD	0.06	9.88	0.10	10.08	0.06	10.10
<u>Housekeeper</u>						
has maid	0.55	30.29	0.58	30.68	0.65	30.85
has cleaning service	0.17	11.24	0.19	11.44	0.26	11.54
has laundry	0.29	1.92	0.29	1.94	0.26	1.92
has someone to do iron clothes	0.00	2.20	0.00	2.23	0.00	2.24
has cook	0.06	0.31	0.10	0.31	0.06	0.29

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 2.4. 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 2.5. 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** (0.0065)	-0.1007** (0.0063)	-0.1165** (0.0066)
Bought Used	-1.1667** (0.0036)	-1.1547** (0.0036)	-1.1547** (0.0037)
Unknown (Used or New)	-0.7191 (0.4124)	-0.8446* (0.3593)	-1.3161** (0.4268)
Constant	5.9182** (0.0016)	5.8989** (0.0016)	5.8989** (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 2.6. Proportion of Married People, Brazil, 2001.

cohort	Men		Women	
	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 2.7. 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.

Table 2.8. Main Results. Dependent Variable: Share of Rental Value of Production to Entertainment Durable Goods, $share_{p/e}$, Brazil, 2002-2003

	OLS	Tobit	Tobit
<u>Bargaining Power Variables</u>			
	OLS	Tobit	Tobit
Marriage Market	-0.5072 (0.1491)***	-0.505 (0.1516)***	-0.5035 (0.1516)***
Only wife makes decision over expenditures	0.1837 (0.1007)*	0.1891 (0.1024)*	0.1881 (0.1024)*
Only husband makes decision over expenditures	0.3076 (0.0408)***	0.2955 (0.0416)***	0.2861 (0.0421)***
Wife's Unearned Income (in 1000)	0.0004 (0.0034)	0.0004 (0.0035)	
Husband's Unearned Income (in 1000)	-0.0002 (0.0024)	-0.0002 (0.0025)	
Wife Has Unearned Income			-0.0852 (0.0421)**
Husband Has Unearned Income			-0.084 (0.0410)**
Wife's Age	-0.0038 (0.0026)	-0.0036 (0.0026)	-0.0037 (0.0026)
Husband's age - wife's age	-0.0026 (0.0029)	-0.0022 (0.0030)	-0.0023 (0.0030)
Wife has more schooling	0.1296 (0.0373)***	0.1315 (0.0379)***	0.133 (0.0379)***
Husband has more schooling	-0.0259 (0.0388)	-0.0032 (0.0395)	-0.0042 (0.0395)
Wife has primary education	-0.0547 (0.0612)	0.0032 (0.0626)	0.0018 (0.0627)
Wife has middle school	-0.2074 (0.0642)***	-0.1174 (0.0657)*	-0.1226 (0.0658)*
Wife has high school	-0.3313 (0.0665)***	-0.2313 (0.0680)***	-0.2356 (0.0681)***
Wife has college	-0.6116 (0.0859)***	-0.5151 (0.0876)***	-0.5138 (0.0876)***
<u>Household Variables</u>			
Number of women 0-3 years old in HH	0.0785 (0.0339)**	0.0526 (0.0346)	0.0524 (0.0346)
Number of women 4-6 years old in HH	-0.0819 (0.0367)**	-0.094 (0.0374)**	-0.0916 (0.0374)**
Number of women 7-12 years old in HH	0.0065 (0.0252)	-0.0005 (0.0257)	0.0076 (0.0259)
Number of women 13-16 years old in HH	-0.0346 (0.0341)	-0.0442 (0.0347)	-0.04 (0.0347)
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Table 2.8 – continued from previous page

	OLS	Tobit	Tobit
Number of women 17-19 years old in HH	-0.0754 (0.0494)	-0.0755 (0.0503)	-0.0761 (0.0503)
Number of women 51-60 years old in HH	-0.0239 (0.1897)	-0.0105 (0.1927)	-0.0201 (0.1927)
Number of women 61-70 years old in HH	-0.1985 (0.1677)	-0.2129 (0.1708)	-0.2192 (0.1707)
Number of women older than 70 years in HH	0.0322 (0.1412)	0.0331 (0.1436)	0.0323 (0.1436)
Number of men 0-3 years old in HH	0.1698 (0.0335)***	0.1531 (0.0341)***	0.1524 (0.0341)***
Number of men 4-6 years old in HH	0.0284 (0.0359)	0.0147 (0.0367)	0.0175 (0.0367)
Number of men 7-12 years old in HH	-0.0011 (0.0246)	-0.007 (0.0251)	0.001 (0.0253)
Number of men 13-16 years old in HH	-0.0242 (0.0326)	-0.03 (0.0332)	-0.0248 (0.0333)
Number of men 17-19 years old in HH	-0.0099 (0.0443)	-0.0094 (0.0451)	-0.0094 (0.0450)
Number of men 51-60 years old in HH	-0.1942 (0.3036)	-0.2193 (0.3098)	-0.2211 (0.3098)
Number of men 61-70 years old in HH	-0.1763 (0.2469)	-0.1536 (0.2506)	-0.1542 (0.2505)
Number of men older than 70 years in HH	-0.1129 (0.1973)	-0.1312 (0.2011)	-0.1315 (0.2011)
Number of Families in HH	-0.1607 (0.2379)	-0.2252 (0.2435)	-0.2236 (0.2435)
Per Capita Income (in 1000)	-0.0919 (0.0233)***	-0.0937 (0.0236)***	-0.0871 (0.0221)***
<u>State Level Variables</u>			
Proportion of Working Women by State and Cohort	0.1207 (0.2088)	0.0862 (0.2125)	0.098 (0.2125)
Average State Income (in 1000)	-0.1258 (0.1314)	-0.1514 (0.1336)	-0.1462 (0.1336)
Price of maids	0.3698 (0.1460)**	0.417 (0.1485)***	0.4031 (0.1486)***
<u>Region Level Variables</u>			
Price of production goods	0.5876 (0.0839)***	0.6302 (0.0852)***	0.616 (0.0854)***
Price of entertainment goods	-0.1531 (0.0405)***	-0.1707 (0.0411)***	-0.17 (0.0411)***
Price of electricity (in kwatts)	3.2103 (1.6138)**	3.8472 (1.6405)**	3.7058 (1.6426)**

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Table 2.8 – continued from previous page

	OLS	Tobit	Tobit
Constant	0.0101 (0.5339)	-0.1874 (0.5439)	-0.0789 (0.5457)
Observations	19662	19662	19662
R-squared	0.0251		
<u>Testing Income Pooling</u>			
F-statistic	0.02	0.02	0
Probability	0.8847	0.8904	0.9839
<u>Testing $\beta_w = \beta_h$</u>			
F-statistic	1.36	0.97	0.82
Probability	0.2431	0.3240	0.3655

Standard errors in parentheses.

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

Table 2.9. Main Results. Dependent Variable: Ratio of Production to Entertainment Durable Goods, $own_{p/e}$, Brazil, 2002-2003.

	OLS	Tobit	Tobit
<u>Bargaining Power Variables</u>			
Marriage Market	-0.4152 (0.0454)***	-0.415 (0.0462)***	-0.4147 (0.0462)***
Only wife makes decision over expenditures	0.0966 (0.0307)***	0.0979 (0.0312)***	0.0969 (0.0312)***
Only husband makes decision over expenditures	0.0448 (0.0124)***	0.0419 (0.0127)***	0.0381 (0.0128)***
Wife's Unearned Income (in 1000)	-0.0002 (0.0010)	-0.0002 (0.0011)	
Husband's Unearned Income (in 1000)	-0.001 (0.0007)	-0.001 (0.0008)	
Wife Has Unearned Income (in 1000)			-0.0351 (0.0128)***
Husband Has Unearned Income (in 1000)			-0.0404 (0.0125)***
Wife's Age	-0.0035 (0.0008)***	-0.0035 (0.0008)***	-0.0036 (0.0008)***
Husband's age - wife's age	-0.002 (0.0009)**	-0.0019 (0.0009)**	-0.002 (0.0009)**
Wife has more schooling	0.0202 (0.0113)*	0.0207 (0.0116)*	0.0212 (0.0116)*
Husband has more schooling	0.0033 (0.0118)	0.0085 (0.0120)	0.0081 (0.0120)
Wife has primary education	0.0371 (0.0186)**	0.0507 (0.0191)***	0.0502 (0.0191)***
Wife has middle school	0.0768 (0.0195)***	0.0974 (0.0200)***	0.0956 (0.0200)***
Wife has high school	-0.0014 (0.0202)	0.0213 (0.0207)	0.0202 (0.0207)
Wife has college	-0.1676 (0.0261)***	-0.1457 (0.0267)***	-0.1444 (0.0267)***
<u>Household Variables</u>			
Number of women 0-3 years old in HH	0.0048 (0.0103)	-0.0011 (0.0105)	-0.0014 (0.0105)
Number of women 4-6 years old in HH	-0.0233 (0.0112)**	-0.026 (0.0114)**	-0.0252 (0.0114)**
Number of women 7-12 years old in HH	-0.0114 (0.0077)	-0.0131 (0.0078)*	-0.0097 (0.0079)
Number of women 13-16 years old in HH	-0.0201 (0.0104)*	-0.0223 (0.0106)**	-0.0208 (0.0106)**
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Table 2.9 – continued from previous page

	OLS	Tobit	Tobit
Number of women 17-19 years old in HH	-0.0114 (0.0150)	-0.0114 (0.0153)	-0.0117 (0.0153)
Number of women 51-60 years old in HH	-0.0114 (0.0577)	-0.0085 (0.0588)	-0.0125 (0.0588)
Number of women 61-70 years old in HH	-0.1188 (0.0510)**	-0.122 (0.0520)**	-0.1249 (0.0520)**
Number of women older than 70 years in HH	0.0084 (0.0430)	0.0086 (0.0438)	0.0085 (0.0438)
Number of men 0-3 years old in HH	0.0248 (0.0102)**	0.0209 (0.0104)**	0.0202 (0.0104)*
Number of men 4-6 years old in HH	-0.0097 (0.0109)	-0.013 (0.0112)	-0.012 (0.0112)
Number of men 7-12 years old in HH	-0.0149 (0.0075)**	-0.0163 (0.0077)**	-0.013 (0.0077)*
Number of men 13-16 years old in HH	-0.0157 (0.0099)	-0.017 (0.0101)*	-0.0149 (0.0101)
Number of men 17-19 years old in HH	-0.0107 (0.0135)	-0.0107 (0.0137)	-0.0107 (0.0137)
Number of men 51-60 years old in HH	-0.0664 (0.0924)	-0.0721 (0.0943)	-0.0729 (0.0943)
Number of men 61-70 years old in HH	0.0355 (0.0751)	0.0405 (0.0765)	0.0399 (0.0764)
Number of men older than 70 years in HH	-0.0234 (0.0600)	-0.0274 (0.0613)	-0.0277 (0.0612)
Number of Families in HH	0.0108 (0.0724)	-0.0023 (0.0740)	-0.0016 (0.0740)
Per Capita Income (in 1000)	-0.0389 (0.0071)***	-0.0394 (0.0072)***	-0.0394 (0.0067)***
<u>State Level Variables</u>			
Proportion of Working Women by State and Cohort	0.1204 (0.0635)*	0.1124 (0.0648)*	0.118 (0.0648)*
Average State Income (in 1000)	-0.0864 (0.0400)**	-0.0923 (0.0407)**	-0.0894 (0.0407)**
Price of maids	0.4129 (0.0444)***	0.4237 (0.0453)***	0.4169 (0.0453)***
<u>Region Level Variables</u>			
Price of production goods	0.5217 (0.0255)***	0.5313 (0.0260)***	0.5253 (0.0260)***
price of entertainment goods	-0.1996 (0.0123)***	-0.2035 (0.0125)***	-0.2031 (0.0125)***
price of electricity (in kwatts)	4.1392 (0.4910)***	4.2847 (0.5002)***	4.2284 (0.5007)***

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Table 2.9 – continued from previous page

	OLS	Tobit	Tobit
Constant	-0.1511 (0.1624)	-0.1977 (0.1657)	-0.1517 (0.1662)
Observations	19662	19662	19662
R-squared	0.0869		
<u>Testing Income Pooling</u>			
F-statistic	0.4	0.38	0.09
Probability	0.5287	0.5381	0.7671
<u>Testing $\beta_w = \beta_h$</u>			
F-statistic	2.58	2.89	3.18
Probability	0.1085	0.0889	0.0747

Standard errors in parentheses.

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

Table 2.10. Results Using Alternatives Measures of Marriage Market, Brazil, 2002-2003.

	Dependent Variable: $share_{p/e}$			Dependent Variable: $own_{p/e}$		
<u>Marriage Market Variables:</u>						
Women in younger cohort	-0.1449			-0.2655		
	(0.1249)			(0.0380)***		
<u>By education level:</u>						
Merged by wife's education		0.0842			0.0248	
		(0.0864)			(0.0263)	
Merged by husband's education			-0.1663			-0.1155
			(0.0754)**			(0.0230)***
<u>Other Bargaining Variables</u>	yes	yes	yes	yes	yes	yes
<u>Household Variables</u>	yes	yes	yes	yes	yes	yes
<u>State Level Variables</u>	yes	yes	yes	yes	yes	yes
<u>Region Level Variables</u>	yes	yes	yes	yes	yes	yes
Observations	19662	19662	19662	19662	19662	19662
R-squared	0.025	0.025	0.0252	0.086	0.0838	0.0849

Standard errors in parentheses.

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

Table 2.11. Dependent Variable: Share of Rental Value of Production to Entertainment Durable Goods by Income Group, $share_{p/e}$, Brazil, 2002-2003.

	low	lower middle	middle	upper middle	high
<u>Bargaining Power Variables</u>					
Marriage Market	-0.6622 (0.3716)*	-0.4923 (0.3893)	-0.6109 (0.3724)	-0.3695 (0.2997)	-0.3984 (0.1917)**
Only wife makes decision over expenditures	-0.0274 (0.2378)	0.2791 (0.2472)	0.1332 (0.2243)	0.2661 (0.2078)	0.1041 (0.1819)
Only husband makes decision over expenditures	0.3396 (0.0873)***	0.2499 (0.0969)***	0.3234 (0.1053)***	0.1985 (0.0939)**	0.2247 (0.0731)***
Wife's Unearned Income (in 1000)	-0.0651 (0.1636)	-0.1265 (0.1108)	-0.0478 (0.0544)	0.0269 (0.0401)	-0.0013 (0.0019)
Husband's Unearned Income (in 1000)	-0.1697 (0.1159)	0.0086 (0.0430)	0.0565 (0.0407)	-0.02 (0.0177)	-0.0009 (0.0014)
Wife's Age	0.0162 (0.0076)**	0.0093 (0.0070)	-0.0121 (0.0065)*	-0.0052 (0.0048)	-0.0083 (0.0031)***
Husband's age - wife's age	0.0132 (0.0075)*	0.0045 (0.0076)	-0.0042 (0.0074)	-0.0117 (0.0060)*	-0.0066 (0.0038)*
Wife has more schooling	-0.069 (0.1033)	0.0002 (0.1010)	0.1266 (0.0944)	0.1856 (0.0720)***	0.1568 (0.0456)***
Husband has more schooling	-0.1481 (0.1031)	-0.1211 (0.1055)	-0.0115 (0.0995)	0.1782 (0.0757)**	-0.0638 (0.0460)
Wife has primary education	0.0696 (0.1146)	-0.0839 (0.1414)	0.0526 (0.1689)	0.0129 (0.1800)	-0.4894 (0.1761)***
Wife has secondary education	0.103 (0.1406)	-0.1837 (0.1527)	-0.2169 (0.1735)	-0.1339 (0.1799)	-0.606 (0.1705)***
Wife has high school	0.2813 (0.1906)	-0.2316 (0.1724)	-0.1207 (0.1830)	-0.2431 (0.1828)	-0.7788 (0.1683)***
Wife has college	-0.1506 (0.7602)	0.1197 (0.5958)	-0.2738 (0.3071)	-0.5069 (0.2152)**	-0.9701 (0.1715)***
<u>Household Variables</u>					
Number of women 0-3 years old in HH	0.0418 (0.0690)	0.0429 (0.0852)	0.1535 (0.0958)	0.104 (0.0807)	0.0155 (0.0555)
Number of women 4-6 years old in HH	-0.1629 (0.0745)**	-0.0822 (0.0886)	-0.0869 (0.1001)	0.0014 (0.0884)	-0.0675 (0.0642)
Number of women 7-12 years old in HH	0.0054 (0.0538)	-0.0384 (0.0640)	-0.0325 (0.0672)	0.0385 (0.0590)	-0.001 (0.0408)
Number of women 13-16 years old in HH	-0.0467 (0.0788)	-0.141 (0.0849)*	0.0892 (0.0860)	-0.0915 (0.0728)	-0.117 (0.0508)**
Number of women 17-19 years old in HH	-0.1971 (0.1242)	-0.1782 (0.1284)	0.1203 (0.1262)	-0.1872 (0.0969)*	-0.0645 (0.0639)
Number of women 51-60 years old in HH	-0.398 (0.6093)	-0.2323 (0.4158)	-0.0685 (0.4613)	0.3547 (0.3594)	-0.04 (0.2701)
Number of women 61-70 years old in HH	-0.9889 (0.5436)*	0.6251 (0.4443)	-0.6221 (0.3631)*	-0.2139 (0.3148)	-0.0498 (0.2138)
Number of women older than 70 years in HH	0.2167 (0.4473)	-0.5445 (0.3616)	0.1144 (0.3233)	0.2367 (0.2549)	0.1577 (0.1846)
Number of men 0-3 years old in HH	0.1845 (0.0674)***	0.2148 (0.0841)**	0.1899 (0.0922)**	0.056 (0.0819)	0.0495 (0.0576)
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Table 2.11 – continued from previous page

	low	lower middle	middle	upper middle	high
Number of men 4-6 years old in HH	-0.1009 (0.0729)	0.1675 (0.0894)*	0.041 (0.0978)	-0.017 (0.0871)	0.0333 (0.0592)
Number of men 7-12 years old in HH	-0.0307 (0.0524)	-0.0039 (0.0619)	-0.0265 (0.0681)	-0.0385 (0.0570)	-0.0091 (0.0392)
Number of men 13-16 years old in HH	-0.0272 (0.0755)	-0.0186 (0.0813)	-0.0518 (0.0827)	-0.1157 (0.0712)	-0.0506 (0.0479)
Number of men 17-19 years old in HH	0.0546 (0.1110)	-0.053 (0.1133)	0.0609 (0.1106)	-0.1376 (0.0870)	-0.0661 (0.0595)
Number of men 51-60 years old in HH	-0.3339 (0.7455)	-0.0903 (0.7930)	-0.1307 (0.6156)	0.1456 (0.6771)	-0.8466 (0.5060)*
Number of men 61-70 years old in HH	-0.4489 (0.8409)	-0.5288 (0.6610)	0.3504 (0.5730)	-0.2696 (0.4574)	-0.0035 (0.2864)
Number of men older than 70 years in HH	-0.4324 (0.6312)	-0.0205 (0.5095)	-0.1699 (0.4382)	-0.1369 (0.3359)	0.0115 (0.2926)
Number of Families in HH	-0.5779 (0.5272)	-0.128 (0.5324)	-0.4391 (0.6552)	-0.0986 (0.4577)	1.4715 (0.4604)***
Per Capita Income (in 1000)	2.647 (1.9109)	0.7573 (1.8114)	-1.1914 (1.1282)	-0.7101 (0.4038)*	-0.0112 (0.0145)
<u>State Level Variables</u>					
Proportion of Working Women by State and Cohort	-0.1324 (0.5254)	-0.0986 (0.5350)	0.4892 (0.5441)	0.2597 (0.4242)	0.0304 (0.2747)
Average State Income (in 1000)	0.7421 (0.4617)	0.13 (0.3797)	0.031 (0.3324)	-0.4674 (0.2616)*	-0.2628 (0.1348)*
Price of maids	-0.2009 (0.4088)	0.2335 (0.3970)	0.46 (0.3736)	0.5769 (0.2822)**	0.5666 (0.1705)***
<u>Region Level Variables</u>					
Price of production goods	0.8697 (0.3163)***	0.749 (0.2271)***	0.6155 (0.2012)***	0.5997 (0.1577)***	0.1663 (0.1005)*
price of entertainment goods	-0.2595 (0.1479)*	-0.2644 (0.1102)**	-0.1653 (0.0982)*	-0.2039 (0.0742)***	-0.0168 (0.0463)
price of electricity (in kwatts)	2.3705 (5.6553)	2.7544 (4.4127)	2.6957 (3.9539)	4.5537 (3.1131)	-1.1488 (1.9372)
Constant	-0.3626 (1.4373)	0.048 (1.3548)	0.4734 (1.4064)	0.1075 (1.1225)	0.2367 (0.8108)
Observations	3933	3932	3933	3932	3932
R-squared	0.0280	0.0184	0.0215	0.0251	0.0471
<u>Testing Income Pooling</u>					
F-statistic	0.28	1.3	2.31	1.14	0.03
Probability	0.5993	0.2538	0.129	0.2857	0.8595
<u>Testing $\beta_w = \beta_h$</u>					
F-statistic	2.23	0.01	0.6	0.09	0.39
Probability	0.1352	0.91	0.4302	0.7633	0.5338
<u>Education Differences</u>					
F-statistic	0.66	1.58	2.3	0.01	22.33
Probability	0.4159	0.2083	0.1291	0.919	0.0001

Standard errors in parentheses.

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

Table 2.12. Dependent Variable: Ratio of Production to Entertainment Durable Goods by Income Group, $own_{p/e}$, Brazil, 2002-2003.

	low	lower middle	middle	upper middle	high
<u>Bargaining Power Variables</u>					
Marriage Market	-0.3083 (0.0962)***	-0.3641 (0.1034)***	-0.6024 (0.1044)***	-0.3976 (0.1089)***	-0.3357 (0.0915)***
Only wife makes decision over expenditures	0.0457 (0.0616)	0.1735 (0.0656)***	0.1054 (0.0629)*	0.0159 (0.0755)	0.0852 (0.0868)
Only husband makes decision over expenditures	0.0318 (0.0226)	0.0653 (0.0257)**	0.0366 (0.0295)	0.0255 (0.0341)	0.101 (0.0349)***
Wife's Unearned Income (in 1000)	-0.0236 (0.0423)	-0.0172 (0.0294)	-0.0107 (0.0153)	-0.0001 (0.0146)	-0.0007 (0.0009)
Husband's Unearned Income (in 1000)	-0.0319 (0.0300)	-0.001 (0.0114)	0.0039 (0.0114)	-0.0034 (0.0064)	-0.0011 (0.0007)*
Wife's Age	0.0027 (0.0020)	0.0005 (0.0019)	-0.0034 (0.0018)*	-0.0055 (0.0018)***	-0.0058 (0.0015)***
Husband's age - wife's age	0.0027 (0.0019)	-0.0016 (0.0020)	0.001 (0.0021)	-0.002 (0.0022)	-0.0061 (0.0018)***
Wife has more schooling	-0.0529 (0.0267)**	-0.0099 (0.0268)	0.0105 (0.0265)	0.026 (0.0262)	0.0334 (0.0218)
Husband has more schooling	0.0283 (0.0267)	0.0481 (0.0280)*	-0.0086 (0.0279)	-0.0333 (0.0275)	-0.0519 (0.0219)**
Wife has primary education	0.0979 (0.0297)***	0.0204 (0.0375)	0.0124 (0.0474)	-0.0162 (0.0654)	-0.0679 (0.0841)
Wife has secondary education	0.2758 (0.0364)***	0.1014 (0.0405)**	0.0073 (0.0486)	-0.0558 (0.0654)	-0.1554 (0.0814)*
Wife has high school	0.2562 (0.0494)***	0.1297 (0.0458)***	-0.0063 (0.0513)	-0.1282 (0.0664)*	-0.2754 (0.0804)***
Wife has college	0.3157 (0.1968)	0.105 (0.1582)	-0.106 (0.0861)	-0.2419 (0.0782)***	-0.3986 (0.0819)***
<u>Household Variables</u>					
Number of women 0-3 years old in HH	-0.003 (0.0179)	0.0099 (0.0226)	0.0231 (0.0268)	0.0483 (0.0293)*	-0.0202 (0.0265)
Number of women 4-6 years old in HH	0.0061 (0.0193)	0.0051 (0.0235)	-0.0569 (0.0281)**	-0.0447 (0.0321)	-0.0195 (0.0306)
Number of women 7-12 years old in HH	0.0038 (0.0139)	-0.0201 (0.0170)	-0.0288 (0.0188)	0.0172 (0.0214)	-0.0336 (0.0195)*
Number of women 13-16 years old in HH	-0.0129 (0.0204)	-0.0326 (0.0225)	0.0101 (0.0241)	-0.0454 (0.0265)*	-0.0672 (0.0242)***
Number of women 17-19 years old in HH	0.0515 (0.0322)	-0.0154 (0.0341)	0.0122 (0.0354)	-0.1178 (0.0352)***	-0.0328 (0.0305)
Number of women 51-60 years old in HH	-0.0056 (0.1578)	-0.128 (0.1104)	0.0989 (0.1293)	-0.0423 (0.1306)	-0.0734 (0.1289)
Number of women 61-70 years old in HH	-0.3344 (0.1408)**	0.03 (0.1179)	-0.2005 (0.1018)**	-0.0825 (0.1144)	-0.1005 (0.1020)
Number of women older than 70 years in HH	0.1909 (0.1158)*	-0.1635 (0.0960)*	-0.129 (0.0907)	0.0889 (0.0926)	0.1047 (0.0881)
Number of men 0-3 years old in HH	0.0068 (0.0175)	0.0463 (0.0223)**	0.0785 (0.0259)***	0.013 (0.0298)	0.0406 (0.0275)
Continued on next page					

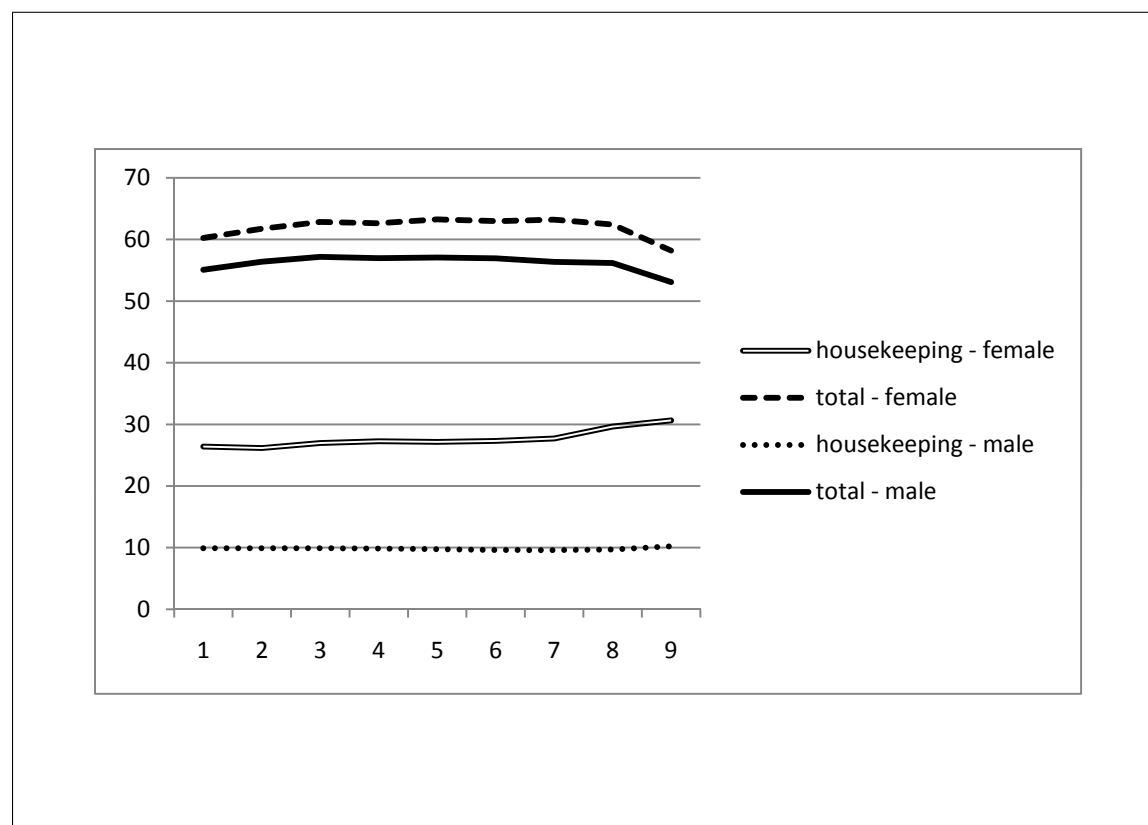
Table 2.12 – continued from previous page

	low	lower middle	middle	upper middle	high
Number of men 4-6 years old in HH	-0.0395 (0.0189)**	0.0259 (0.0237)	0.0203 (0.0274)	0.0288 (0.0317)	0.0209 (0.0283)
Number of men 7-12 years old in HH	-0.0026 (0.0136)	-0.0047 (0.0164)	0.001 (0.0191)	-0.0683 (0.0207)***	-0.0334 (0.0187)*
Number of men 13-16 years old in HH	0.0277 (0.0196)	0.0051 (0.0216)	-0.0218 (0.0232)	-0.088 (0.0259)***	-0.0659 (0.0229)***
Number of men 17-19 years old in HH	-0.0087 (0.0287)	-0.0118 (0.0301)	0.0164 (0.0310)	-0.0251 (0.0316)	-0.0523 (0.0284)*
Number of men 51-60 years old in HH	-0.2291 (0.1930)	0.1952 (0.2105)	-0.2011 (0.1726)	0.4235 (0.2461)*	-0.6289 (0.2416)***
Number of men 61-70 years old in HH	0.1737 (0.2177)	-0.1273 (0.1755)	0.2544 (0.1606)	0.1009 (0.1662)	-0.1034 (0.1367)
Number of men older than 70 years in HH	-0.1465 (0.1634)	-0.0551 (0.1353)	0.0424 (0.1229)	-0.0192 (0.1221)	-0.0598 (0.1397)
Number of Families in HH	-0.1465 (0.1365)	-0.1411 (0.1413)	-0.0946 (0.1837)	0.4179 (0.1663)**	0.3177 (0.2198)
Per Capita Income (in 1000)	1.4694 (0.4948)***	0.5516 (0.4809)	-0.35 (0.3163)	0.0203 (0.1467)	-0.0037 (0.0069)
<u>State Level Variables</u>					
Proportion of Working Women by State and Cohort	-0.2485 (0.1360)*	0.1818 (0.1420)	0.2653 (0.1525)*	0.2532 (0.1542)	0.1904 (0.1311)
Average State Income (in 1000)	0.2317 (0.1196)*	0.191 (0.1008)*	-0.0328 (0.0932)	-0.1057 (0.0951)	-0.2281 (0.0643)***
Price of maids	0.292 (0.1058)***	0.159 (0.1054)	0.4981 (0.1048)***	0.4788 (0.1025)***	0.4754 (0.0814)***
<u>Region Level Variables</u>					
Price of production goods	0.5957 (0.0819)***	0.5193 (0.0603)***	0.3891 (0.0564)***	0.5239 (0.0573)***	0.4024 (0.0480)***
price of entertainment goods	-0.2534 (0.0383)***	-0.2364 (0.0293)***	-0.1447 (0.0275)***	-0.2209 (0.0270)***	-0.136 (0.0221)***
price of electricity (in kwatts)	4.5027 (1.4643)***	2.9567 (1.1714)**	1.5059 (1.1085)	3.3998 (1.1313)***	3.4028 (0.9248)***
Constant	-0.3671 (0.3722)	0.2942 (0.3596)	0.7064 (0.3943)*	-0.1948 (0.4079)	-0.1261 (0.3871)
Observations	3933	3932	3933	3932	3932
R-squared	0.1233	0.0824	0.0774	0.1038	0.1144
<u>Testing Income Pooling</u>					
F-statistic	0.03	0.27	0.57	0.04	0.19
Probability	0.8723	0.6056	0.4487	0.8367	0.6665
<u>Testing $\beta_w = \beta_h$</u>					
F-statistic	0.05	2.49	1.03	0.01	0.03
Probability	0.8267	0.1147	0.3091	0.9066	0.8643
<u>Education Differences</u>					
F-statistic	10.42	5.13	0.56	4.98	14.64
Probability	0.0013	0.0235	0.4556	0.0258	0.0001

Standard errors in parentheses.

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

Figure 2.1. Number of Hours Worked Per Week (Only Employed Individuals).



Source: PNAD 2001.

Chapter 3

Maid Services as a Substitute Factor in Home Production.

3.1 Introduction

Maid services are a significant sector in developing countries, but few studies have looked at the importance of the availability of cheap maid services for household decisions. A trade off might exist between maid services and durable goods in home production. Even among the 5 percent richest households in Brazil, less than 20 percent own dishwashers and clothes dryers, 36 percent own vacuum cleaners, 60 percent own microwave ovens and 78 percent own washing machines, see Table 3.1. In contrast, 53 percent of these households hire maids and 20 percent hire cleaning services, see Table 3.1.

Maid is a traditional and important occupation in Brazil (de Melo (1998)). The share of women in this occupation is higher than 50 percent, making it a female-dominated profession. Maid is the largest female-dominated occupation, as shown by the 1981 and 2001 PNAD (Brazilian Household Survey) data set. Laundress is another occupation that ranked among the 20 most common female-dominated occupations in 2001. In both occupations, workers have an average schooling of four years, which corresponds to elementary education (first to fourth grade). Maids' low educational levels results from women entering this profession at a young age and, then, having to drop out school or from women not having the education to enter another profession. The services provided by maids include cooking, doing the dishes and doing the laundry (de Melo (1998)).

As usual, wives are responsible for most of the housework. In Brazil, the number of weekly hours spent on housework by working women is four times the number of working

men's hours (PNAD 2001). One of the biggest concerns of Brazilian women is the unfair division of time in housework (Oliveira (2000)¹). Given their increasing participation in the job market, the result is a double burden that many times presents them with difficult choices between their careers and families (Oliveira (2000)). To alleviate this double burden wives can reduce their time in home production by making use of time-saving durable goods, by substituting their time for maid services or the labor of other household members, or by increasing the consumption of market goods such as carry out meals.

The combination of time-saving durable goods, maid services and consumption of market goods depends on their relative prices as well as on household preferences and on the household members' cost of time. Home production can be more time-intensive (or labor-intensive) than goods-intensive (or capital-intensive) in developing countries with a large supply of unskilled workers² because the availability of cheap maid service makes not worthwhile to buy time-saving durable goods to combine with wives' time in home-production. For instance, one month of maid services costs less than a vacuum cleaner (half a month of the monthly expenditures of a household living on at most one dollar a day per capita). For a family living on more than *US*\$176.00 per capita a day (20 percent of the households with the highest income), one month of maid services costs four percent of their monthly expenditures³.

By hypothesis, wives with higher value of time are more likely to replace their time in home production with time-saving durable goods, maid services and market goods. The wives' shadow value of time in home production is measured by a proxy variable of their opportunity cost in home production, which is a set of indicators of a wife's educational level. The assumption is that the higher their educational level, the higher their skill in

¹Oliveira (2000) comments on the results of a study of 300 women in positions of responsibility in the public sphere by the Center for Women's Leadership (CELIM) in Rio de Janeiro.

²See Alexopoulos and de V. Cavalcanti (2006) for a discussion on the relationship between inequality and cheap home goods.

³However, a durable good provides a stream of services, but maid's service costs are recurring every month.

the labor force, and, therefore, the higher their wages and opportunity costs to work on home production. Therefore, wives with higher educational levels replace their time in home production with time-saving durable goods, maid services or market goods.

Family composition is likely to affect home production. The presence of young children increases the demand for time in home production, increasing the demand for time-saving durable goods and maid services. However, the presence of teenagers or other relatives that can offer time in home production reduces wives' time in home production, decreasing the demand for time-saving durable goods and maid services. The empirical specification allows for testing these hypotheses and also verifying if there are parental preferences for sons or daughters.

Even when there is no difference in parental preferences for sons and daughters, the choice of the optimal allocation of maid services and production durable goods can be affected by the gender composition of the children living in the household. This occurs because daughters and sons have different roles in home production. Parents may want their daughters to get some training to be able to perform their future role as wives. However, this comes at a cost.

A special survey conducted through PNAD in 2004 estimated that 60,167 girls aged 13 to 16 years missed at least one school day 60 days before the interview due to housekeeping responsibilities. This number accounts for 2.5 percent of the 13 to 16-year-old girls in the population. Moreover, it is estimated that 17,156 of the 13 to 16 year-old girls (0.3 percent of the 13 to 16 year-old girls in the population) are not enrolled in school due to housekeeping responsibilities. Of the girls from lower and low middle households who missed at least one school day, the most common reason given for missing school was housekeeping responsibilities, with 62 percent of these girls giving this reason. Of those girls aged 13 to 16 from lower and low middle households who are not enrolled in school, 78 percent give housekeeping responsibilities as the reason.

Although the majority of the girls do not report missing school days due to housekeeping

responsibilities, housekeeping reduces their after-school study time. With less study time and more training in housekeeping, these girls are trapped into choosing careers that make use of their housekeeping training, for example, maids. That is shown by Alexopoulos and de V. Cavalcanti (2006), where parents with lower income invest in lower quality education for their children and as a result, they end up working in low education jobs such as house work. Therefore, this paper also investigate if daughters contribute more than sons to home production.

3.2 The Home-Production Model

The theoretical model is based on Becker (1965)'s theory of time allocation in a Nash bargaining equilibrium, equation (3.1). Spouses, s , choose market goods, X , and home-produced commodities, Z , to maximize the product of the differences between the utility level of each spouse, U_s , and the threat point or reservation utility level that each spouse could achieve outside the household, V_0^s , where $s = W, H$ indicates whether s is the wife or the husband, X and Z are vectors of market goods and home-produced commodities in which some of them are “public goods” inside the households. The threat point is influenced by a vector of prices, p , which contains the price of time of each spouse, w_s , and is also influenced by spouses' unearned income that can be carried out of marriage, I_s , and situations, which are not easily monetized, that an individual would face outside the market, A_s , such as the marriage market.

Husbands' and wives' preferences for market goods and home-produced commodities may differ because husbands do not engage in home production as much as wives do. Household welfare is maximized subject to the full-time budget constraint (3.2) and the home-production function (3.3). The full income in the full-time budget constraint depends on the total time of the household members, T_m , the price of time of each household member, w_m , and the unearned income of each household member. Home-produced commodities are pro-

duced using household members' time, t_m , maid services, S , and market goods and services, X , which include production durable goods⁴. Therefore, household members other than spouses contribute to full income by bringing earnings to the household or by offering time in home production, but their consumption enters the problem through the utility function of the husband and the wife.

$$\max \prod_{s=H,W} [U^s(X, S, Z) - V_0^s(p, I_s, A_s)] \quad (3.1)$$

$$pX = \sum_m w_m T_m + I_m \quad (3.2)$$

$$Z = f(X, t_m, S) \quad (3.3)$$

Home-produced commodities can be substituted by market goods or services, such as the following: meals away from home, daycare, frozen food, and dry cleaners. Alternatively, a good can still be home produced by insourcing household members' time for maid services. In this case, maid services and household members' time are substitute inputs in home production that can be combined with production durable goods in the home-production function. The choice of insourcing time on home production will depend on the husband's and wife's preferences, the shadow price of the household members' time and the price of maid services.

There are production durable goods that cannot be directly replaced with the household members' time or maid services, such as refrigerators, oven stoves, and freezers. These

⁴Production durable goods include oven stoves, refrigerators, washing machines, microwave ovens, freezers, vacuum cleaners, dishwashers and dryers.

three home-production durable goods are complements to maid services and from this point they are called maid service complements durable goods. There are production durable goods for which the services can be replaced with the household members' time or maid services. These home-production durable goods are substitutes for maid services and from this point they are called maid's substitute durable goods. Maid's substitute durable goods include durable goods that can be replaced with time in home production, such as washing machines, microwave ovens, vacuum cleaners, dishwashers and dryers. Indeed, 5 percent of the households⁵ in the sample do not have maid's substitute durable goods, but they have expenditures on maid services instead.

The wife's decision of how many hours to offer in home production depends on her shadow price of time. That is how much she would earn by doing market work. In that case, the higher the wife's shadow price of time, the more likely the wife will look for more time-efficient home production or will try to outsource home production, thus increasing the demand for market goods, maid's substitute durable goods, and maid services. The effect on the demand for each of them will depend on husbands' and wives' preferences and the bargaining power of both. If the households have strong preference for home-produced goods and services or perceives that market goods are of lower quality, the demand for market goods would not increase at the same rate as that for maid's substitute durable goods and maid services. The same argument holds if households perceive maid services as close substitutes for the household members' time. If services of maid's substitute durable goods are perceived to be of lower quality than maid services, an increase in the wife's shadow price will boost the demand for maid services.

⁵They are 928 out of 19,662 households.

3.3 The Empirical Specification

The choice between maid's substitute durable goods, X , and maid services, S , is represented by their first-order conditions. The first-order conditions are expressed in terms of random marginal utility as specified by equations 3.4 below. These first-order conditions are jointly estimated by a bivariate probit regression. The choice will depend on a set of spouses' bargaining power measures, BP , a set of households' demographic variables, D , a vector of prices, P , the household per capita income, M , and two measures of States' economic performances, C , i.e., the State's average income and its proportion of working women in a given cohort.

$$\begin{aligned} U_X &= \alpha_X BP + \beta_X D + \gamma_X P + \delta_X M + \theta_X C + \epsilon_X \\ U_S &= \alpha_S BP + \beta_S D + \gamma_S P + \delta_S M + \theta_S C + \epsilon_S \end{aligned} \tag{3.4}$$

The spouses' bargaining power measures are the sex ratio in a given cohort and State, which captures the marriage market, indicators of households in which only the wife and households in which only the husband makes expenditure decisions, and indicators of whether the husband and the wife have unearned income. The demographic variables are the wife's age, the difference between the husband's and the wife's age, a set of dummy variables for wife's education⁶, an indicator of whether the wife has more schooling than the husband, an indicator of whether the husband has more schooling than the wife⁷, and a set of indicators showing family composition, such as the following: the number of daughters and sons aged three years or younger, four to six years, seven to twelve years, thirteen to sixteen years,

⁶The omitted category is at least some college education.

⁷Differences between the husband's and the wife's variables, such as age and education, are also used as measures of bargaining power to identify the sharing rule, such as Browning, Bourguignon, Chiappori, and Lechene (1994). However, in cross-sections the identification of the sharing rule requires an exclusive or assigned good as discussed in Bourguignon, Browning, and Chiappori (2006). That is not the case of maid's substitute durable goods and maid services, these services are in most part a "public good" to the household. Moreover, husband's education is omitted from the empirical specification to avoid collinearity problems.

and seventeen to nineteen years, as well as the number of other relatives by gender aged 51 to 60 years, 61 to 70 years and 75 years or older⁸.

The vector of prices contains the price of maid's substitute durable goods, the price of an hour of maid services, and the prices of complement and substitute goods, such as maid service complements durable goods, entertainment durable goods⁹, and electricity. Because the marriage market variable is the sex ratio across cohorts and States, its variation may be correlated with the characteristics of cohorts and States. Therefore, the two measures of States' economic performance, i.e., the State's average income and its proportion of working women in a given cohort, are added to the regression as control variables to guarantee the identification of the marriage market effect.

The error terms, ϵ_X and ϵ_S , contain unobserved household characteristics, specifically, the wife's decision to offer time in market work. Whether the woman works in the market or not is not available in the data set that contains the expenditure on durable goods and maid services. By omitting this decision from the set of estimating equations, the coefficients of the indicators of the wife's educational level are also capturing the shadow price of her time in home production. In that case, the higher is the wife's educational level and the higher her shadow price of time, the more likely she will look to save time in household production. She will then increase demand for maid's substitute durable goods, for outsourced home production, and for maid services. Women can choose different combinations of these inputs to produce home production¹⁰.

The differences in the impact of bargaining power and the presence of sons and daughters on the probability of having expenditure on maid's substitutes durable goods and maid services are tested following Thomas (1997)'s post-estimation test. To perform this test,

⁸The omitted category is households that are composed only of husband and wife.

⁹Entertainment durable goods include the following: color TV, black and white TV, radio, sound system, VCR, CD player, DVD, computer, and satellite dish.

¹⁰In reality, the demand for maid services would also increase for goods and services that are available in the market if households have strong preference for home-produced goods and services or perceive that market goods are of lower quality. In both cases, market goods would not be perfect substitutes for home-produced goods.

the equations in 3.4 are jointly estimated, and the difference between sons' and daughters' coefficients is tested to determine whether they are statistically different across the equations. Thomas (1997) uses this test to avoid measurement errors. If the variables that capture bargaining power or the presence of sons and daughters have measurement errors, then their impact will bias the coefficients in the same direction. For that reason, the test of the equality of the relative coefficients is performed to offset measurement errors.

In the case of the impact of sons and daughters on the probability of having maid's substitute durable goods and maid services, it is possible to test whether the difference in the impact of sons and daughters is due to parental preferences for sons over daughters or if it is due to social roles assigned to teenage daughters. The test is performed by estimating the impact of sons and daughters on the expenditures, broken down by age groups. Babies and toddlers (children three years old and younger) cannot contribute to home production, but their presence increases the demand for home production goods and services.

If the presence of male babies and toddlers increases the demand for maid's substitute durable goods and maid services more than does the presence of female babies and toddlers, then mothers will have more time away from home production to spend in child care¹¹. However, if the gender of babies and toddlers does not matter in the choice of home-production inputs, then parents have no differences in preferences for sons or daughters with respect to home production. But if the presence of teenage daughters decreases the demand for maid's substitute durable goods and maid services more than the presence of teenage sons, then this is evidence that households are more willing to allocate daughters' time to housework and possibly away from school.

¹¹There is no way to tell from the data set whether maids are net complements to or net substitutes for mothers' time in child care. At the same time that maids provide childcare for children while mothers are away from home, for example, working or doing the grocery shopping, maids also do housekeeping, decreasing mothers' time in home production and making it possible to mothers to spend time with their children after market work.

3.4 Data

Data Set and Construction of Variables

The main data set, *Pesquisa de Orçamentos Familiares* (POF), provides information about household expenditure on maid services, the ownership of durable goods, the year of last purchase, the price paid if the household bought the durable good during the survey year, the household composition and state of residence, household members' income, age and educational level. The POF 2002/2003 survey is the most recent and nationally representative consumer expenditure survey available. The dependent variables are indicators of first, whether the household owns at least one maid's substitute durable goods, and second, whether the household reports any expenditure on maid services.

From the *Pesquisa Nacional por Amostra de Domicílios* (PNAD), state- and region-level information, such as the sex ratio in each State by cohort, the average income in a State, the proportion of working women in a State by cohort, and the price of an hour of maid services is generated. The PNAD data set is annual household survey that offers detailed information on labor force participation and earnings and it is representative of the population at the state level. These variables are merged into the main data set by State or region of residence. The sex ratio, i.e., the female-to-male ratio, is used to capture the marriage market conditions. In the data sets used in this paper (POF and PNAD), State is the smallest region that can be identified and therefore these are the geographic units used to construct this variable¹².

In the construction of the marriage market variable, it is assumed that a wife and a husband can leave the current marriage and remarry. Therefore, the marriage market variable is constructed as the female-to-male ratio across cohorts and States of residence¹³ in

¹²See Fossett and Kiecolt (1991) for a complete discussion of the considerations that must be taken to guarantee that the sex ratio is capturing the marriage market conditions. They recommend using the smallest relevant geographic unit for the analysis, but not so small that marrying people from another region becomes easy.

¹³See marital status statistics in Fava and Arends-Kuenning (2008) that justify this choice, which is based on a normal distribution in which about 60% of the wives' ages range 5.5 years around the husbands' ages.

2001. This variable is used in the regressions as a measure of women's bargaining power. According to the literature on marriage markets, the more scarce women are, the more likely they are to find a better match and to establish a higher bargaining power. Therefore, the definition of marriage market variable implies that the higher the marriage market variable, the lower the women's bargaining power.

The average income in a State and the proportion of working women in a given cohort in a State are used in the regressions to capture other factors that differ across States and affect expenditures on maid's substitute durable goods and maid services, as well as the wife's market working decision. Because the marriage market variable is a state-level variable and States in Brazil differ regarding their 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. Finally, the price of electricity comes from the Brazilian National Electric Power Agency, ANEEL, and it is the average price for 2002 and 2003.

Descriptive Statistics

Overall, the cost of production durable goods¹⁴ is a high share of household monthly expenditures. Take, for example, the cost of a refrigerator. To acquire a refrigerator a family must give up two and a half months of expenditures if they belong to a lower income household, one and a half months of expenditures if they belong to a low middle income household, almost one month (0.9 of a month) of expenditures if they belong to a middle income household and one fifth of a month if they belong to an upper income household. Similar forgone expenditures must be given up in order to acquire a freezer. The costs of a washing machine, a dishwasher and a microwave oven come next on forgone expenditures. Acquiring one of

¹⁴The cost of production durable goods is calculated as the mean value of purchase of the durable good by the income groups. Because the purchases of durable goods are infrequent, the POF survey follows household's purchases of durable goods for one year. Moreover, the POF survey follows households at a different starting time taking two years to finish the whole survey. Therefore, the price is deflated at the baseline time of the survey to be compared across households.

them takes up to one and a half months of expenditures. The forgone monthly expenditures needed to acquire stove/oven and dryers for households belonging to a lower income group correspond to almost a month (0.9 of a month) and acquiring a vacuum cleaner takes up to half a month of household monthly expenditures. On the other hand, maid service expenses¹⁵ are lower than the cost of a vacuum cleaner for lower, low middle and middle income households, while upper middle and upper income households spend, monthly, as much as the cost of their vacuum cleaner as percentage of their monthly expenditures.

The sample is composed of 19,662 households in which both husband and wife are present; one of the spouses is the head of the family; they report their family as an independent consumption unit¹⁶; and both spouses are 20 to 50 years old. The sample is restricted to this age group for two main reasons. The first and most important is the different life expectancies between men and women. Because men's life expectancy is lower than women, the ratio of women to men is higher than what should be if men and women have the same life expectancy, misrepresenting the wife's bargaining power. The second reason is due to the interest in the impact of children and elderly relatives on the probability of having these home-production inputs, and the 20 to 50 year-old age group is more likely to live with children and elderly relatives.

The descriptive statistics are reported in Table 3.3. Among all households in the sample, 38 percent own at least one maid's substitute durable good and 14 percent report expenditure on maid services. The average household per capita monthly income is R\$418.00¹⁷. Most of the households are composed of only one family, but there are a few households with two or three families sharing the same house. The average household size is about four members.

¹⁵The maid service expenditure is the average monthly expenditure on maid service by the income groups. The monthly expenditures decrease as percentage of income because the income increases faster than the expenditures of the higher income groups increases. The POF data set do not include the quantity of maid services purchased, only the household expenditure on maid services. Therefore, it is not possible to identify whether the expenditure on maid services increases with income because richer households are buying more hours of maid services or because they are buying more expensive maid services.

¹⁶This information is relevant when there are more than one family living in the same house, but these families make independent consumption decisions and do not share income.

¹⁷This value is about U\$138.64 using the average exchange rate for 2002 and 2003.

Husbands are on average three years older than wives. In 30 percent of the households, the wife has a higher educational level than the husband and, in 20 percent of the households, the husband has a higher educational level than the wife, so 50 percent of the households in the sample are composed of spouses who have the same educational level. The dummies for educational level indicate that there are no strong differences between the distribution of men's and women's education. The majority of wives and husbands, about 60 percent have some elementary or middle school, 25 percent of the wives and 21 percent of husbands have some high school; 7 percent of them have some college education; and 10 percent of husbands and 7 percent of wives do not have formal education.

Unearned income includes income from government welfare programs that are not related to previous work behavior¹⁸; transfers from other households, such as child support, parental transfer and inheritance; returns from savings and other financial assets; and exogenous income, such as money from gambling. About 16 percent of the husbands and wives in the sample report receiving some unearned income, and 12 percent of the wives and 6 percent of the husbands in the sample report receiving some transfers from other households. The husband's unearned income, R\$664.00, is more than twice the wife's unearned income, R\$289.00.

At the time of interview, all adults living in the household were asked if they make expenditure decisions in order to determine their eligibility for the personal expenditure survey. This information is used to construct an indicator of households in which only the wife makes expenditure decisions and an indicator of households in which only the husband does so. In about 82 percent of the households, both spouses make expenditure decisions. The households in which only the husband makes expenditure decisions account for 16 percent of the total, and in only 2 percent of the households only the wife makes expenditure decisions. These numbers indicate that it is common for both spouses to report

¹⁸The government welfare programs included in unearned income are programs such as *bolsa-escola* and *renda-mínima*.

making decisions about personal expenditure.

Table 3.4 shows the sample distribution among the covariates and the percentage of households that have some expenditure and their average expenditure on home-production and maid's substitutes durable goods, as well as on maid services. The majority of the sample, 37 percent, resides in the northeast region. The remainder of the sample is distributed about equally among the other regions. Household members that reside in the south region are more likely to have home-production durable goods, especially maid's substitutes durable goods, at 78 percent, than in any other region. Although the likelihood of having home-production durable goods is similar between the north and northeast regions (95 percent) the percentage of households in the northeast region that have maid's substitute durable goods is less than half the percentage of such households in the north region, 13 and 34 percent, respectively. The percentage of households in the southeast region that have maid's substitute durable goods is more than three times higher, 46 percent, than the percentage of households in the northeast region that own such goods. However, the percentage of households that have expenditure on maid services is similar across regions: 16 percent in the southeast, 15 percent in the north and south, 14 percent in the central west and 13 percent in the northeast.

As income increases, the percentage of households that have expenditure on home-production inputs also increases. Expenditure on maid services occurs in 45 percent of the richest 20 percent of households in the sample. Maid's substitute durable goods are more common among the upper middle and richest households in the sample. Among all households in the sample, 70 percent report no unearned income. Only in two and a half percent of households in the sample do both husbands and wives report having unearned income. The remainder of the households are evenly split among the categories only the wife reports having unearned income (13 percent) and only the husband reports having unearned income (13 percent). Expenditure on maid's substitutes durable goods occurs in 25 percent of households in which only the wife has unearned income. However, expenditure on maid's

substitutes durable goods occurs in 47 percent of households in which only the husband has unearned income. Maid services are more common among households in which husbands and wives have unearned income. Expenditures on maid's substitutes durable goods and maid services are less common in households in which only the husband makes expenditure decisions (30 percent).

For those households in which the wife has a higher shadow price of time, i.e., the wife has some college education, the expenditures on maid's substitute durable goods and maid services are more frequent, 78 and 64 percent report some spending, respectively, and higher than those households in which the wife has some high school education. As the wife's shadow price of time decreases, the households are less likely to have expenditure on maid's substitute durable goods and maid services, their expenditure is also lower. Households in which the wife has a higher educational level than the husband are slightly less likely to have maid's substitute durable goods than households in which the husband has a higher than or equal educational level to the wife. However, households in which husband and wife have the same educational level have higher and slightly more frequent expenditure on maid services than households in which spouses have different educational levels. Moreover, if the wife is older than the husband, the household is slightly less likely to have expenditures and spends slightly less on maid's substitute durable goods and maid services.

In only 18 percent of the households does the wife belong to a cohort and a state in which there are fewer women than men (i.e. the female-to-male ratio is less than one). The percentages of households that have expenditures on home-production durable goods and on maid services do not differ much comparing households with sex ratios that are greater than one with those whose sex ratios are lower than one. If the sex ratio is favorable to women, the percentage of households that have expenditure on maid's substitute durable goods is slightly bigger than the percentage of households that face a sex ratio greater than or equal to one, 42 and 37 percent, respectively.

3.5 What Determines the Choice of Home-Production Inputs?

The results in Table 3.5 identify the elements that influence whether or not households make use of maid's substitute durable goods or maid services in home production. The quintiles of household income are used instead of household income because there is not sufficient variation in the dependent variables for households belonging to the lower income quintile. The Wald test t-statistic 9323.56, which is distributed as a chi-square with the probability of not rejecting the null hypothesis of 0.01 percent, implies that the model as a whole is statistically significant. Moreover, there is a positive statistically significant covariation¹⁹ of the error terms of the probability of having maid's substitute durable goods and maid services. This positive covariation implies that the decision about expenditures on these two home-production inputs is affected by unobserved factors in the same way and, therefore, must be analyzed using a bivariate probit regression.

In summary, husbands and wives have different preferences over maid's substitute durable goods and maid services. Households in which the husband has higher educational level than the wife are more likely to have expenditures on maid's substitute durable goods and maid services. Moreover, the other household members that offer time in home production besides the couple of reference are teenaged daughters. When they are present in the household, the probability of hiring maid services is lower.

Households are more likely to have expenditures on maid's substitute durable goods if the wife belongs to a cohort and State that have fewer women than men. That is, an improvement in the marriage market for women of 10%, that is, going from a ratio of women to men of 1.07 to 0.96, increases the probability of owning at least one maid's substitute durable good by 24% the impact of moving a household up one income quintile. However,

¹⁹The statistical significance test of the covariation of the error terms, ρ , has a $\chi^2_{(1)}$ statistic equals to 65.2 and a 1% probability of not rejecting the null hypothesis.

there is no difference in the household's probability of having expenditure on maid services whether the wife belongs to a cohort and State that have more women than men or faces a higher bargaining power. That is, the marriage market has no significant effect on the household's probability of having maid services.

Households in which only the husband makes expenditure decisions have a higher probability of having at least one maid's substitute durable good than households in which both spouses make expenditure decisions. The difference is equivalent to 24% of the impact on the probability of having at least one maid's substitute durable good of moving a household up one income quintile. Nevertheless, households in which only the husband makes expenditure decisions have a lower probability of reporting some expenditure on maid services than households in which both spouses make expenditure decision. The difference is equivalent to 44% of the impact on the probability of reporting some expenditure on maid services of moving a household down one income quintile.

If the wife has unearned income the household is less likely to have at least one maid's substitute durable good than household in which wives do not have unearned income. The difference is equivalent to 41% of the impact on the probability of having at least one maid's substitute durable good of moving a household down one income quintile. If the husband has unearned income the household is more likely to have at least one maid's substitute durable good and to report expenditure on maid services than households in which husbands do not have unearned income. The difference is equivalent to 26% of the impact on the probability of having at least one maid's substitute durable good of moving a household up one income quintile and 22% of the impact on the probability of reporting expenditure on maid services of moving a household up one income quintile. The older the wife the more likely is the household to spend on these two home-production inputs. In addition, households have higher probability of having expenditures on any of these two home-production inputs for each additional year the husband is older than the wife.

The higher the wife's educational level, the higher the probability of having these two

home-production inputs. However, for households in which the wife has a higher educational level than the husband, the household's probability of having at least one maid's substitute durable good and having expenditures on maid services is lower than in households in which the wife has the same educational level as the husband. The difference is equivalent to 83% of the impact on the probability of having at least one maid's substitute durable good and 34% of the impact on the probability of reporting some expenditures on maid services of moving a household down one income quintile. Besides, the household's probability of having expenditures on maid's substitute durable goods and maid services is higher if the husband has a higher educational level than the wife. The difference is equivalent to 23% of the impact on the probability of having at least one maid's substitute durable good and 17% of the impact on the probability of reporting some expenditures on maid services of moving a household up one income quintile.

The result described above supports the common preference model rather than a bargaining model. In fact, the result is consistent with the complementarity between husband's and wives' leisure time or differences in their wage rates. In the first case, husbands' and wives' leisure time are complements, so that husbands who have higher education relative to their wives buy maid's substitute durable goods and maid services so that they can spend more time with their wives. While, in the second case, the impact is through the budget constraint. If wives' wages are lower than husbands' wages even if wives have higher educational levels than husbands, the household in which wives have higher educational levels than the husband will have less earnings to be spent on maid's substitute durable goods and maid services than households in which husbands and wives have equal education.

That result could also exist if husbands and wives do not have common preferences, but instead they behave as in Lundberg and Pollak (1993) separate spheres. In the separate spheres, husbands specialize in market work and wives specialize in home production. When this specialization occurs, husbands reward their wives by increasing expenditures on maid's substitute durable goods and maid services. Given that husbands and wives have similar

distribution across educational levels, husbands having lower educational levels than their wives also have lower educational levels than other husbands. Therefore, households in which the husband has less education than the wife are likely to have low expenditures on both home production inputs because these husbands have low earnings compared to husbands who have higher educational levels than their wives.

Family composition affects the probability of having expenditure on these two home-production inputs. If younger children are present in the household, expenditures on maid's substitute durable goods and maid services are more likely. This is true for sons and daughters 12 years older and younger, indicating that young children increase the demand for home production. Nonetheless, households that have daughters 13 to 16 years old are as likely as childless households to have expenditure on maid services, but more likely to have expenditures on maid's substitute durable goods. As daughters get older, 17 to 19 years old, households are less likely to have expenditure on maid services, but equally likely as a childless household to have expenditures on maid's substitute durable goods. The presence of sons aged 17 to 19 years increases the household's probability of having expenditure on both home-production inputs, but the presence of sons aged 17 to 19 years has no significant effect on the expenditure on maid services. These results show that daughters' time substitutes for maid services in home production, but sons' time does not.

If other female relatives, such as grandmothers, are present in the household, the household's probability of having maid services is lower as long as they are in their productive age, 51 to 60 years old, and the household's probability of having maid services is higher in case of age ranges from 61 to 70 years. However, the presence of other female relatives older than 70 years does not affect the probability of having expenditure on maid substitute durable goods. Furthermore, the presence of other male relatives does not have any effect on the household's probability of having expenditure on any of these two home-production inputs. These results indicate that other female relatives' time, such as grandmothers' time, substitutes for maid services in home production, but other male relatives' time does not.

If the wife belongs to a cohort in a State that has a higher proportion of working women, the household is less likely to have maid's substitute durable goods, but equally likely to have expenditure on maid services. This result vanishes away in regressions separated by income groups (section 3.8) where it is controlled by per capita income. Thus, it is possible that the significant impact of the proportion of working women on the probability of having maid's substitute durable goods in table 3.5 occurs because of inadequate controls for household per capita income.

Households that face higher prices for maid services are more likely to have maid's substitute durable goods and less likely to report expenditure on maid services. The higher the price of maid's substitute durable goods, the less likely it will be for the household to have maid's substitute durable goods, but the probability of reporting some expenditure on maid services is not sensitive to the price of maid's substitute durable goods. The prices of maid service complements durable goods and entertainment durable goods have no effect on the household's probability of having maid services. But, the price of maid service complements durable goods increases the household's probability of having expenditure on maid's substitute durable goods, while the price of entertainment durable goods decreases the probability of having maid's substitute durable goods. The price of electricity increases the household's probability of having maid's substitute durable goods²⁰, but does not have an impact on the household's probability of hiring maid services. Households that belong to a higher income quintile are more likely to have expenditure on both home-production inputs.

3.6 Results for the Bargaining Power Variables

This section discusses the post-estimation tests, such as Thomas (1997), which verify the difference in the impact of bargaining power variables on the probability of having expen-

²⁰This data were collected after the national blackout of 2001, which had a higher effect on the south and southeast regions, the regions with higher percentage of households that have some durable goods. After the first blackouts the price of electricity increased in regions where there was excess demand.

diture on maid's substitute durable goods and maid services. The results are reported in Table 3.6. The test of the bargaining power variables rejects the equality of the coefficients between genders, that is, it does not reject that the decision over home-production inputs is the outcome of a bargaining process. Nevertheless, they differ regarding wives' preferences for maid's substitute durable goods and maid services, contradicting one another. The test of the equality of the marriage market variable on the probability of having maid's substitute durable goods and maid services implies that wives prefer maid's substitute durable goods to maid services. Recall that the lower the female-to-male ratio, the higher women's bargaining power.

The test of the equality of the indicator of households in which only the wife and the indicator of households in which only the husband makes expenditure decisions on the probability of having maid's substitute durable goods and maid services implies that relative to their husbands, wives prefer maid services. There is no evidence of wives' preferences for maid's substitute durable goods or maid services from the indicator of households in which only the wife makes expenditure decisions. Nonetheless, the indicator of households in which only the husband makes expenditure decisions shows that husbands prefer time saving durable goods to maids. Indeed, if only the husband makes expenditure decisions, the probability of having maid services decreases. Moreover, households in which only the husband makes expenditure decisions are less likely to have maid services than households in which only the wife makes expenditure decisions. But, the probability of having maid's substitute durable goods is equal between these households.

The test of the equality of husbands' and wives' unearned income on the probability of having maid's substitute durable goods and maid services implies that wives prefer maid services. Because the estimation uses as a control the household per capita income in which unearned income is included, the interpretation of the impact of having unearned income is relative to the impact of having earnings. Since total income increases the probability of having expenditures on maid's substitute durable goods and maid services, the results imply

that wives' unearned income is more likely to be spent on maid services than on maid's substitute durable goods. But, husbands' unearned income is equally likely to be spent on maid's substitute durable goods and maid services. The test of equality of husbands' and wives' unearned income on the probability of having maid's substitute durable goods is rejected. Indeed, wives' unearned income is less likely to be spent on maid's substitute durable goods than husbands's unearned income. However, wives' and husbands' unearned income are equally likely to be spent on maid services.

In households in which the wife has better schooling than the husband, the relative probability of having maid's substitute durable goods and maid services is lower than in households in which the wife and the husband have the same educational level. However, the negative impact of wives' better education is lower on the probability of having maid services, as shown by the test of the equality of the indicator of households in which the wife has better educational level than the husband on the probability of having maid's substitute durable goods and on the probability of having maid services. The test of the equality of the coefficients of the indicator of households in which the wife has more schooling than the husband and the indicator of households in which the husband is better educated than the wife is rejected in both probabilities. Indeed, if the husband has better education than the wife, the household is more likely to have maid's substitute durable goods and maid services.

3.7 Differences Between Sons And Daughters

This section discusses the test for differences in the impact of sons and daughters on the probability of having expenditures on maid's substitute durable goods and maid services. The results are reported in Table 3.7. The test follows Thomas (1997), where the equations are jointly estimated and post-estimation tests are performed to verify the equality of the coefficients between equations, between genders, and the difference of the two previous differences. The results for the equality of parameters between equations and the results of the

equality of parameters between genders, such as in Thomas (1997), are also presented and discussed.

The only age group for which the test rejects the equality of daughters' and sons' impact on the probability of having expenditure on maid's substitute durable goods and maid services is 13 to 16 year-old one. Daughters decrease the relative probability of having maid services while sons have equal impact on the probability of having expenditure on maid's substitute durable goods and maid services. Moreover, sons have a positive impact on the probability of having expenditure on maid's substitute durable goods and maid services, and daughters have a positive impact on the probability of having expenditure on maid's substitute durable goods and a negative impact on the probability of having expenditure on maid services. This provides evidence that sons' impact on the probability of having expenditure on maid's substitute durable goods and maid services is due to the increase in the demand for home production, while daughters' impact on the probability of having expenditure on maid's substitute durable goods and maid services shows that daughters are substitutes for maid services in home production. It is also important to point out that this age group is not of legal working age, but is at the same time able to perform home-production tasks.

For the age groups that are not of schooling age and demand more time-intensive home production, 3 years old and younger and 4 to 6 years old, the test does not reject the equality of sons' and daughters' impact on the probability of having expenditure on maid's substitute durable goods and maid services. In addition, there is evidence that children of both genders aged 6 years or younger increase the probability of having maid services. The hypothesis is that any difference between genders in this age group is due to parental son or daughter preference. Because there is no significant difference between genders, it is concluded that there is no evidence of parental preferences in favor of sons or daughters in this age group in terms of demand for home production.

Sons and daughters aged 7 to 12 years have no differential impact on the probability of having expenditure on maid's substitute durable goods and maid services. Sons and

daughters increase the probability of having expenditure on maid's substitute durable goods and maid services equally. As before, there is no evidence of difference in parental preferences for sons or daughters in this age group. For older children, 17 to 19 years, the test of the equality of sons' and daughters' impact on the relative probability of having expenditure on maid's substitute durable goods and maid services is not rejected. However, daughters decrease the relative probability of having expenditure on maid services, while there is no difference in the impact of sons and daughters on the probability of having expenditure on maid's substitute durable goods. This provides evidence that daughters are substitutes for maid services in home production.

3.8 Differences in the Determinants of Home-Production Inputs Across Income Groups

The results in Table 3.8 are the estimates of the bivariate probit for each income group. The bivariate probit for the lower income group is not estimated because there is not sufficient variation in the dependent variables in this income group. For the same reason, quintiles of household income are used in the previous regressions instead of household per capita income. By excluding the lower income quintile group, it is possible to use household per capita income in the bivariate probit estimation for the other income quintile groups. For all the income groups, the likelihood ratio implies that the model as a whole is statistically significant, as compared to a model with no predictors.

Nevertheless, the covariation of the error terms of the probability of having maid's substitute durable goods and maid services, ρ , is significant only for the middle and upper income groups. Therefore, the decisions about expenditure on these two home-production inputs for the middle and upper income groups are jointly determined and must be analyzed using a bivariate probit regression, but estimating a separate probit for the low middle and upper middle income groups does not generate biased estimates. In the case of the middle and

upper income groups, the ρ is positive and significant, implying that unobserved characteristics²¹ that increase the household's probability of having maid's substitute durable goods also increase their probability of having maid services for the middle and upper income groups, but do not increase it for the low middle and upper middle income groups.

The direction of the impact of the marriage market variable is equal to the previous results. However, the effect is stronger; in terms of magnitude, for groups with the middle income group, and not significant for the group with the highest income. Recall that the marriage market is measured as the female-to-male ratio and, therefore, a reduction in the marriage market measure by one unity increases women's bargaining power a lot. An improvement in the marriage market for women by one unit increases the probability of owning at least one maid's substitute durable goods by the same amount as a *R*\$280.00 increase in monthly per capita income for the low middle income households. The probability of owning at least one maid's substitute durable goods increases by the same amount as a *R*\$1076.00 increase in monthly per capita income for the middle income households if the marriage market reduces by one unit. And the probability of owning at least one maid's substitute durable goods increases by the same amount as a *R*\$394.00 increase in monthly per capita income for the upper middle income households if there is an improvement in the marriage market for women by one unit.

The indicator of households in which only the wife makes expenditure decisions has a significant impact only on the probability of having expenditures on maid's substitute durable goods in the low middle income group. In this income group, households in which only the wife makes expenditure decisions, the probability of owning at least one maid's substitute durable goods increases by the same amount as a *R*\$75.00 increase in monthly per capita income compared to households in which both spouses make expenditure decisions. If only the husband makes expenditure decisions, households in the low middle and middle

²¹The unobserved characteristics are likely to be related to the wife's decision to offer time in the labor market since this information is not available in this sample.

income groups have a higher probability of owning at least one maid's substitute durable goods than households in which both spouses make expenditure decisions. The increment is equivalent to increasing the monthly per capita income by *R\$42.00* for the low middle income group and by *R\$286.00* for the middle income group.

In any income group, households in which only the husband makes expenditure decisions are less likely to report some expenditure on maid services than households in which both spouses make expenditure decisions. The reduction in the probability of reporting some expenditure on maid services for households in which only the husband makes expenditure decisions compared to household in which both spouses make expenditure decisions is equivalent to decreasing the monthly per capita income by *R\$29.00* for the low middle income households, by *R\$137.00* for the middle, by *R\$109.00* for upper middle income, and by *R\$798.00* for the upper income households.

If wives have unearned income, the probability of owning at least one maid's substitute durable goods is lower in the middle and high income groups. If wives have unearned income, the probability of owning at least one maid's substitute durable goods decreases by the same amount as a *R\$196.00* decrease in monthly per capita income for the middle income group and a *R\$869.00* decrease in monthly per capita income for the high income group. Wives' unearned income has no statistically significant effect on the probability of reporting some expenditure on maid services.

In the results using the full sample, husbands' unearned income increases the probability of having at least one maid's substitute durable good and reporting some expenditure on maid services, but in the results by income groups and using household per capita income, the effect of husbands' unearned income is positive and significant only on the probability of having at least one maid's substitute durable good for the high income group. In fact, if husbands have unearned income, the probability of owning at least one maid's substitute durable good increases by the same amount as a *R\$415.00* increase in monthly per capita income for the high income group.

As in the full sample regression, the indicator of households in which the wife has better educational level than the husband has a negative and significant impact on the probability of having at least one maid's substitute durable good. When compared to households in which spouses have the same educational level, households in which the wife has higher educational level than the husband have a reduction in the probability of owning at least one maid's substitute durable good that is equivalent to decreasing the monthly per capita income by *R*\$1256.00 for the high income group, by *R*\$167.00 for the upper middle income group, by *R*\$242.00 for the middle income group and by *R*\$46.00 for the lower middle income group. However, its impact on the probability of reporting some expenditure on maid services is significant only for the high income group. Households in which the wife has higher educational level than the husband have a reduction in the probability of reporting some expenditure on maid services that is equivalent to decreasing the monthly per capita income by *R*\$1089.00 for the high income group.

Differently from the full sample regression, the indicator of households in which the husband is better educated than the wife does not have a statistically significant effect on the probability of reporting some expenditure on maid services. The impact on the probability of having at least one maid's substitute durable good is statistically significant only in the low middle and high income groups. The probability of owning at least one maid's substitute durable good increases by the same amount as a *R*\$542.00 increase in monthly per capita income for the high income households and a *R*\$43.00 increase in monthly per capita income for the lower middle income households.

The results of the impact of children's presence on the household decisions are similar to the results for the full sample regression, daughters aged 13 to 16 years substitute for maid services in home production. The χ^2 test of the difference in impact of sons' and daughters' presence on maid's substitute and maid services in the results by income, Table 3.9, demonstrates that this difference is characteristic of middle and upper middle income households. For the low middle and upper income households the difference in the sons' and daughters'

time is not statistically significant.

Differently from the results for the full sample regression, the presence of older relatives has no significant effect on the probability of owning at least one maid's substitute durable goods. These variables could possibly be capturing the income effect in the full-sample results. Also, in contrast with the full-sample results, the proportion of working women has no significant impact on the probability of having at least one maid's substitute durable goods. The average State's income, however, has a positive and significant effect on the probability of having at least one maid's substitute durable goods for the low middle income group.

The results for prices hold as before in terms of the direction of their effects and significance. There is some evidence that the probability of having expenditure on maid services in the high income group is less sensitive to increases in the price of maid services than in the low middle group. The high income group is more likely to replace maid services with maid's substitute durable goods when the price of maid services increases. Moreover, the higher the monthly per capita income, the higher is the probability of the household owning at least one maid's substitute durable goods and reporting some expenditure on maid services.

For all income groups, the probability of owning at least one maid's substitute durable good is higher than the probability of reporting some expenditure on maid services. The estimated marginal probability on the median values of the explanatory variables of owning at least one maid's substitute durable good is 18% for the lower middle income group, 47% the middle income group, 78% the upper middle income group, and 91% for the high income group. While, the estimated marginal probability on the median values of the explanatory variables of reporting some expenditure on maid services is 7% for the lower middle income group, 23% the middle income group, 21% the upper middle income group, and 60% for the high income group.

A ten percent increase in monthly per capita income promotes a higher increase in percent change in the probability of reporting some expenditure on maid services than on the

probability of owning at least one maid's substitute durable good for all income groups. This result indicates that home production is more time intensive than good intensive. One of the reasons for home production to be more time intensive than good intensive is that households perceive maid services as close substitutes for wives' time. Whereas, maid's substitute durable goods may not be perceived as close substitutes for wives' time.

If households do not perceive maid's substitute durable goods as close substitutes for wives' time, but teenage daughters' time is perceived as a close substitute for wives' time in home production, then the presence of teenage daughters increases the probability of owning at least one maid's substitute durable good relative to the probability of reporting some expenditure on maid services. Teenage daughters' time can be used together with maid's substitute durable goods in home production, thereby replacing wives' time in home production.

3.9 Conclusion

In studying the relationship between maid services and maid's substitute durable goods and their determinants, this paper found that the expenditure on home-production inputs is an outcome of a bargaining process. The impact of the marriage market variable provides evidence of wives' preference for maid's substitute durable goods. The test of the equality of husbands' and wives' unearned income implies that wives prefer maid services relative to husbands. If the marriage market is favorable to women, that is if the ratio of women to men goes from 1.07 to 0.96 (a ten percent decrease in the ratio of women to men), the increment in the household's probability of owning at least one maid's substitute durable good is equivalent to 24% of the impact of moving a household up one income quintile.

Wives with higher value of time are more likely to replace their time in home production with maid's substitute durable goods and maid services at all educational levels, unlike U.S. households, in which only wives with a graduate degree are more likely to have expendi-

tures on maid services (Cortes and Tessada (2007)). The results for the difference between husbands' and wives' education does not exclude the common preferences in favor of a bargaining decision process. In fact, the result is consistent with the complementarity between husbands and the wives leisure time or differences in prices (different wage rates faced by husbands and wives). In the first case, husbands' and wives' leisure time are complements, so that husbands who have higher education relative to their wives buy maid's substitute durable goods and maid services so that they can spend more time with their wives. While, in the second case, the impact is through the budget constraint. If wives' wages are lower than husbands' wages even if wives have higher educational levels than husbands, the household in which wives have higher educational levels than the husband will have less earnings to spend on maid's substitute durable goods and maid services.

The presence of children that are not of school age, and therefore demand more time-intensive home production, 6 years or younger, increases the probability of having maid's substitute durable goods and maid services equally for sons and daughters. With maid's substitute durable goods and maid services, mothers will have more time away from home production to spend in child care. This result is surprising when compared to recent findings for U.S. on the different effect of sons and daughters on mothers' and father's time allocation to market and home-production hours. Lundberg and Rose (2002) found a greater increase in men's labor supply and wage rates in response to the births of sons than to the births of daughters. They interpret this as evidence of fathers' preferences for sons. Furthermore, Lundberg (2005) found that children's genders have different impact on the labor supply of men and women and their intrahousehold division of labor, where highly educated parents devote more childcare time to young sons. However, it is still possible that maid services are used in child care or to free up time for market work.

Notwithstanding, sons and daughters aged 13 to 16 years have different impacts on the probability of having expenditure on maid's substitute durable goods and maid services. Daughters decrease the relative probability of having maid services and sons increase the

probability of having expenditure on maid's substitute durable goods and maid services. For older children, aged 17 to 19 years, daughters decrease the relative probability of having expenditure on maid services, while there is no difference in the impact of sons and daughters on the probability of having expenditure on maid's substitute durable goods. This indicates that daughters' time substitutes for wives' time and maid services in home production.

The result described in the previous paragraph indicates that daughters are being trained in home production to be able to perform their future role as wives. However, this training comes at a cost to daughters' investment in formal education, narrowing their future career options. Even though home-production training does not prohibit daughters from attending school, it does take them away from their after-school study time. With less study time and more training in home production, these girls are trapped into choosing careers that make use of their home-production training, for example, maids, corroborating the result found by Alexopoulos and de V. Cavalcanti (2006) or into getting married and being a housewife. Moreover, public policies based on cash transfers aim to keep children in school and away from market work. Nevertheless, there is no public policy designed to regulate or prevent children's home production. Because daughters are more likely than sons to work in home production, and sons are more likely than daughters to perform market work, neglecting children's home-production work may lead to an increase in gender inequality in the labor market.

3.10 Tables

Table 3.1. Durable Goods Ownership by Income Brazil, 2002-2003.

	5 % poorest	10 % poorest	20 % poorest	20 % richest	10 % richest	5 % richest
<u>Production:</u>						
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
<u>Entertainment:</u>						
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
<u>Housekeeper:</u>						
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 laundry	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 3.2. Durable Goods and Maids Costs as Proportion of Households Monthly Expenditures Brazil, 2002-2003.

	<u>lower</u>	<u>lower middle</u>	<u>middle</u>	<u>upper middle</u>	<u>higher</u>
stove-oven	96.03%	54.24%	36.5%	22.7%	7.49%
refrigerator	255.51%	138.55%	90.62%	55.45%	18.11%
freezer	281.86%	144.79%	91.06%	54.51%	17.48%
washing machine	148.59%	77.68%	50.37%	30.81%	10.04%
dish washer	146.89%	88.14%	60.88%	37.21%	12.15%
vacuum clearer	52.2%	29.36%	19.5%	11.9%	3.89%
dryer	90.67%	53.85%	36.99%	22.75%	7.53%
microwave	138.32%	75.16%	48.98%	29.99%	9.78%
maid services	45.28%	26.75%	18.52%	11.91%	4.02%

Table 3.3. Descriptive Statistics Brazil, 2002-2003.

Variable	Mean	Std. Dev.
<u>Dependent Variables</u>		
Owns at Least One Maid's Substitute Durable Goods	0.38	(0.49)
Reported Some Expenditure on Maid Services	0.14	(0.35)
<u>Bargaining Power Variables</u>		
Marriage Market, same cohort	1.07	(0.10)
Marriage Market, wife in younger cohort	1.21	(0.13)
Wife's Unearned Income (in 1000)	0.29	(4.38)
Husband's Unearned Income (in 1000)	0.66	(6.33)
Percentage of Wives with Non-zero Unearned Income	(0.162)	(0.368)
Percentage of Husbands with Non-zero Unearned Income	(0.157)	(0.364)
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 is better educated	0.42	(0.49)
Husband is better educated	0.31	(0.46)
<u>Wife's and Husband's Variables:</u>		
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 educ	0.25	(0.43)
Wife has college educ 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 educ	0.21	(0.41)
Husband has college educ or more	0.07	(0.25)
<u>Household Variables</u>		
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)
Continued on next page		

Table 3.3 – continued from previous page

Variable	Mean	Std. Dev.
Average State Income (in 1000)	0.89	(0.28)
<u>Prices</u>		
Rental Value of Entertainment Durable Goods	9.31	(1.02)
Rental Value of Production Durable Goods	4.59	(0.42)
Price of an hour of maid services	0.93	(0.25)
Price of electricity (kwatts)	0.21	(0.02)
Number of Observations	19662	

Source: POF and PNAD.

Table 3.4. Descriptive Statistics and Average Expenditures Brazil, 2002-2003.

Region	North	Northeast	Southeast	South	Central West
Percent of Sample	14.68	36.79	17.49	13.48	17.57
Production Durable Goods					
Percentage of Households	95.18	95.02	98.95	99.92	99.33
Average Expenditure	164.96	124.37	222.72	297.56	215.41
Standard Deviation	(101.94)	(89.35)	(124.68)	(140.84)	(118.31)
Maid's Substitute Durable Goods					
Percentage of Households	33.75	12.87	45.96	77.74	56.28
Average Expenditure	61.19	84.41	111.44	115.12	76.41
Standard Deviation	(31.78)	(39.06)	(56.72)	(68.05)	(48.42)
Maid Services					
Percentage of Households	14.73	13.06	16.11	14.91	13.98
Average Expenditure	1419.14	1142.22	1728.63	1764.06	1529.66
Standard Deviation	(2872.31)	(1816.69)	(1784.84)	(2855.16)	(2578.22)
Per Capita Income	20 % poorest	20 % low middle	20 % middle	20 % upper middle	20 % richest
Production Durable Goods					
Percentage of Households	89.32	97.51	99.36	99.72	99.85
Average Expenditure	86.36	133.93	177.71	222.98	307.45
Standard Deviation	(70.51)	(83.59)	(93.05)	(106.12)	(136.94)
Maid's Substitute Durable Goods					
Percentage of Households	9.15	20.73	35.11	50.08	75.38
Average Expenditure	58.72	63.63	71.99	86.91	120.25
Standard Deviation	(25.30)	(22.95)	(33.44)	(45.53)	(69.75)
Maid Services					
Percentage of Households	1.14	3.28	7.04	15.28	44.51
Average Expenditure	738.93	384.09	656.83	982.34	1840.40
Standard Deviation	(2107.32)	(560.78)	(957.70)	(2186.52)	(2492.64)
Who has unearned income	none	wife	husband	both	
Percent of Sample	70.62	13.67	13.23	2.48	
Production Durable Goods					
Percentage of Households	97.32	95.42	98.00	97.34	
Average Expenditure	188.43	150.86	218.28	217.01	
Standard Deviation	121.66	114.24	143.59	160.96	
Maid's Substitute Durable Goods					
Percentage of Households	38.90	24.60	46.83	43.44	
Average Expenditure	89.64	90.29	106.63	123.36	
Standard Deviation	52.50	56.87	70.46	74.99	
Maid Services					
Percentage of Households	13.32	11.80	19.45	26.43	
Average Expenditure	1389.84	1386.57	1632.98	1851.08	
Standard Deviation	2356.58	1607.86	2581.64	1914.83	
Who makes expenditure decisions	both	wife	husband		
Percent of Sample	81.95	2.12	15.93		
Production Durable Goods					
Percentage of Households	97.77	98.32	93.84		
Average Expenditure	195.43	181.19	149.64		
Standard Deviation	127.40	110.96	114.68		
Maid's Substitute Durable Goods					
Percentage of Households	39.79	39.09	29.31		
Average Expenditure	96.01	83.29	77.06		
Standard Deviation	58.71	48.20	46.18		

Continued on next page

Table 3.4: Descriptive Statistics and Average Expenditures Brazil, 2002-2003. – continued from previous page

Maid Services					
Percentage of Households	15.98	10.79	5.81		
Average Expenditure	1457.20	1867.43	1315.99		
Standard Deviation	2329.44	3398.54	1627.34		
Wife's Educational Level	No Schooling	Primary School	Middle School	High School	College or More
Percent of Sample	7.21	32.01	28.53	24.77	7.48
Production Durable Goods					
Percentage of Households	88.43	94.79	98.88	99.90	100.00
Average Expenditure	109.56	142.71	183.50	226.28	329.89
Standard Deviation	(84.92)	(107.31)	(110.99)	(118.65)	(150.34)
Maid's Substitute Durable Goods					
Percentage of Households	14.68	23.57	38.20	51.59	77.63
Average Expenditure	68.08	74.16	82.21	96.24	138.17
Standard Deviation	(32.13)	(36.00)	(44.57)	(55.19)	(80.54)
Maid Services					
Percentage of Households	1.91	3.34	8.56	23.47	64.04
Average Expenditure	741.37	752.08	890.81	1258.81	2156.55
Standard Deviation	(849.53)	(1643.22)	(1377.64)	(2337.82)	(2618.98)
Who has higher educational level?	wife	same	husband		
Percent of Sample	29.82	50.29	19.89		
Production Durable Goods					
Percentage of Households	97.44	96.62	98.06		
Average Expenditure	176.59	193.05	192.83		
Standard Deviation	(116.04)	(133.25)	(121.86)		
Maid's Substitute Durable Goods					
Percentage of Households	33.85	39.41	41.20		
Average Expenditure	86.66	97.56	91.72		
Standard Deviation	(49.54)	(62.64)	(52.40)		
Maid Services					
Percentage of Households	13.83	15.06	12.84		
Average Expenditure	1220.06	1657.96	1230.38		
Standard Deviation	(1693.46)	(2777.68)	(1434.50)		
Who belongs to a older cohort?	wife	same	husband		
Percent of Sample	12.67	33.92	53.41		
Production Durable Goods					
Percentage of Households	96.63	97.48	97.07		
Average Expenditure	179.79	192.27	187.37		
Standard Deviation	(120.15)	(129.86)	(125.26)		
Maid's Substitute Durable Goods					
Percentage of Households	36.29	38.95	38.01		
Average Expenditure	89.42	97.61	91.59		
Standard Deviation	(52.43)	(59.75)	(56.88)		
Maid Services					
Percentage of Households	13.69	14.78	14.05		
Average Expenditure	1375.42	1499.02	1443.24		
Standard Deviation	(2685.18)	(2032.71)	(2392.94)		
Marriage Market	sex ratio ≥ 1	sex ratio < 1			
Percent of Sample	82.13	17.87			
Production Durable Goods					
Percentage of Households	97.13	97.24			

Continued on next page

Table 3.4: Descriptive Statistics and Average Expenditures Brazil, 2002-2003. – continued from previous page

Average Expenditure	187.76	189.55
Standard Deviation	(127.15)	(122.14)
Maid's Substitute Durable Goods		
Percentage of Households	37.30	41.83
Average Expenditure	96.46	80.94
Standard Deviation	(59.20)	(47.74)
Maid Services		
Percentage of Households	14.32	13.94
Average Expenditure	1462.46	1417.59
Standard Deviation	(2242.28)	(2615.77)

Table 3.5. Bivariate Probit Estimates for Owning at Least One Maid's Substitute Durable Goods and Reporting Some Expenditure on Maid Services Brazil, 2002-2003.

	Maid's Substitute Production Goods	Maid Services
<u>Bargaining Power Variables</u>		
Marriage Market	-0.7733 (0.1128)***	0.0035 (0.1401)
Only the wife makes expenditure decisions	0.0715 (0.0759)	0.0745 (0.1001)
Only the husband makes expenditure decisions	0.0759 (0.0326)**	-0.2157 (0.0480)***
Wife Has Unearned Income	-0.1332 (0.0334)***	0.0365 (0.0388)
Husband Has Unearned Income	0.0843 (0.0303)***	0.1062 (0.0348)***
<u>Wife's and Husband's Variables:</u>		
Wife's Age	0.0223 (0.0019)***	0.0144 (0.0024)***
Husband's age - wife's age	0.0101 (0.0022)***	0.0089 (0.0028)***
Wife has no formal education	-1.4471 (0.0715)***	-1.8418 (0.1021)***
Wife has primary education	-1.2052 (0.0527)***	-1.5679 (0.0557)***
Wife has middle school	-0.8254 (0.0493)***	-1.2456 (0.0476)***
Wife has high school	-0.4938 (0.0474)***	-0.8399 (0.0427)***
Wife has higher educational level than husband	-0.2671 (0.0282)***	-0.1629 (0.0344)***
Husband has higher educational level than wife	0.0733 (0.0292)**	0.0817 (0.0362)**
<u>Household Variables</u>		
Number of daughters 0-3 years old in HH	0.1028 (0.0270)***	0.312 (0.0333)***
Number of daughters 4-6 years old in HH	0.0829 (0.0292)***	0.2109 (0.0374)***
Number of daughters 7-12 years old in HH	0.1312 (0.0201)***	0.097 (0.0264)***
Continued on next page		

Table 3.5 – continued from previous page

	Maid's Substitute Production Goods	Maid Services
Number of daughters 13-16 years old in HH	0.0875 (0.0261)***	-0.0527 (0.0354)
Number of daughters 17-19 years old in HH	0.0528 (0.0380)	-0.1486 (0.0493)***
Number of women 51-60 years old in HH	0.115 (0.1467)	-0.3511 (0.1995)*
Number of women 61-70 years old in HH	0.0308 (0.1219)	0.3073 (0.1396)**
Number of women older than 70 years in HH	0.0927 (0.1052)	0.0327 (0.1327)
Number of sons 0-3 years old in HH	0.0686 (0.0271)**	0.2737 (0.0342)***
Number of sons 4-6 years old in HH	0.1034 (0.0285)***	0.1906 (0.0364)***
Number of sons 7-12 years old in HH	0.1129 (0.0194)***	0.1374 (0.0251)***
Number of sons 13-16 years old in HH	0.0921 (0.0253)***	0.1403 (0.0319)***
Number of sons 17-19 years old in HH	0.1031 (0.0332)***	0.0222 (0.0433)
Number of men 51-60 years old in HH	-0.0792 (0.2226)	-0.1263 (0.3086)
Number of men 61-70 years old in HH	0.0341 (0.1789)	0.0077 (0.2197)
Number of men older than 70 years in HH	0.1109 (0.1465)	-0.1196 (0.1891)
Quintiles of Per Capita Income	0.3232 (0.0111)***	0.4861 (0.0155)***
<u>State Level Variables</u>		
Proportion of Working Women by State and Cohort	-0.3798 (0.1602)**	0.3069 (0.2037)
Average State Income (in 1000)	0.0706 (0.0943)	0.0758 (0.1165)
Price of an hour of maid services	0.8617 (0.1116)***	-0.8888 (0.1398)***
<u>Region Level Variables</u>		
Price of maid service complements production goods	0.286 (0.0134)***	-0.0152 (0.0165)

Continued on next page

Table 3.5 – continued from previous page

	Maid's Substitute Production Goods	Maid Services
Price of -maid's substitute durable goods	-0.0611 (0.0056)***	0.002 (0.0070)
Price of entertainment goods	-0.3631 (0.0286)***	0.057 (0.0355)
Price of electricity (per kwatts)	26.2991 (1.5033)***	-1.5343 (1.8227)
Constant	-29.6199 (1.2249)***	-0.6682 (1.4955)
Observations	19662	19662
Log likelihood	-14001.23	
rho	0.159	(0.019)***
	t-statistic	Probability
LR test (rho=0)	65.1978	0.1%
Wald $\chi^2_{(74)}$	9323.56	0.1%

Standard errors in parentheses.

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

Table 3.6. Testing Bargaining Power Brazil, 2002-2003.

	Maid's Substitute DG	Maid Services	Difference
Marriage Market	-0.7733	0.0035	-0.777 19.87 0.0010
Only the wife makes expenditure decisions	0.0715	0.0745	-0.003 0.0001 0.9808
Only the husband makes expenditure decisions	0.0759	-0.2157	0.2916 26.47 0.0001
<i>wife – husband</i>	-0.004	0.2902	-0.2945
$\chi^2(1)$	0.001	7.1	4.98
$Prob > \chi^2$	0.9569	0.0077	0.0256
Wife Has Unearned Income	-0.1332	0.0365	-0.1696 11.6 0.0006
Husband Has Unearned Income	0.0843	0.1062	-0.0219 0.24 0.6243
<i>wife – husband</i>	-0.2175	-0.0697	-0.1478
$\chi^2(1)$	23.1900	1.7200	4.79
$Prob > \chi^2$	0.0001	0.1891	0.0287
Wife has higher educational level husband	-0.2671	-0.1629	-0.1042 5.84 0.0156
Husband has higher educational level than wife	0.0733	0.0817	-0.0083 0.03 0.8531
<i>wife – husband</i>	-0.3404	-0.2446	-0.0958
$\chi^2(1)$	148.3900	49.5000	4.9
$Prob > \chi^2$	0.0001	0.0001	0.0268

Standard errors in parentheses.

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

Bellow the difference of the coefficients is the χ^2 t-statistic and its probability.

Table 3.7. Testing Differences Among Sons And Daughters Brazil, 2002-2003.

	Maid's Substitute DG	Maid Services	Difference
<u>Three years old and younger</u>			
girls	0.1028 (0.0270)***	0.312 (0.0333)***	-0.2092 25.29 0.0001
boys	0.0686 (0.0271)**	0.2737 (0.0342)***	-0.2051 23.49 0.0001
<i>girls - boys</i>	0.0342	0.0383	-0.0046
$\chi^2(1)$	0.92	0.75	0.01
$Prob > \chi^2$	0.3365	0.3856	0.9417
<u>Four to six years old</u>			
girls	0.0829 (0.0292)***	0.2109 (0.0374)***	-0.128 7.72 0.0055
boys	0.1034 (0.0285)***	0.1906 (0.0364)***	-0.0872 3.77 0.0523
<i>girls - boys</i>	-0.0205	0.0203	-0.0407
$\chi^2(1)$	0.28	0.16	0.44
$Prob > \chi^2$	0.599	0.6856	0.5086
<u>Seven to twelve years old</u>			
girls	0.1312 (0.0201)***	0.097 (0.0264)***	0.0342 1.12 0.2893
boys	0.1129 (0.0194)***	0.1374 (0.0251)***	-0.0245 0.63 0.4268
<i>girls - boys</i>	0.0182	-0.0404	0.0586
$\chi^2(1)$	0.46	1.3	1.83
$Prob > \chi^2$	0.4998	0.2546	0.1762
<u>Thirteen to sixteen years old</u>			
girls	0.0875 (0.0261)***	-0.0527 (0.0354)	0.140 10.7 0.0011
boys	0.0921 (0.0253)***	0.1403 (0.0319)***	-0.0482 1.48 0.2233
<i>girls - boys</i>	-0.005	-0.193	0.188

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Table 3.7 – continued from previous page

	Maid's Substitute DG	Maid Services	Difference
$\chi^2(1)$	0.02	17.28	11.05
$Prob > \chi^2$	0.895	0.0001	0.0009
<u>Seventeen to Nineteen years old</u>			
girls	0.0528	-0.1486	0.2014
	(0.0380)	(0.0493)***	11.09
			0.0009
boys	0.1031	0.0222	0.0808
	(0.0332)***	(0.0433)	2.33
			0.1272
<i>girls – boys</i>	-0.0503	-0.1709	0.1206
$\chi^2(1)$	1.02	7.09	2.33
$Prob > \chi^2$	0.3127	0.0078	0.1268

Standard errors in parentheses.

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

Bellow the difference of the coefficients is the χ^2 t-statistic and its probability.

Table 3.8. Bivariate Probit Estimates for Owning at Least One Maid's Substitute Durable Goods and Reporting Some Expenditure on Maid Services By Income Group Brazil, 2002-2003.

	lower middle		middle		upper middle		high	
	DG	Maid Services	DG	Maid Services	DG	Maid Services	DG	Maid Services
<u>Bargaining Power Variables</u>								
Marriage Market	-1.1471 (0.2645)***	0.0877 (0.4260) 0.3073 (0.1577)*	-0.7056 (0.2345)*** -0.043 (0.1380)	-0.11 (0.3360) 0.112 (0.2051)	-0.6663 (0.2381)*** 0.1263 (0.1692)	0.1199 (0.2768) 0.139 (0.1857)	-0.1186 (0.2550) 0.1648 (0.2666)	0.0262 (0.2383) 0.1783 (0.2169)
Only the wife makes expenditure decisions								
Only the husband makes expenditure decisions	0.1716 (0.0652)***	-0.2763 (0.1259)** -0.0391 (0.1174)	0.1876 (0.0655)*** -0.1287 (0.0717)*	-0.2297 (0.1048)** -0.0572 (0.0977)	-0.0118 (0.0738) -0.1113 (0.0750)	-0.2354 (0.0978)** -0.1288 (0.0888)	0.0789 (0.0988) -0.2177 (0.0705)***	-0.1773 (0.0929)* 0.0796 (0.0634)
Wife Has Unearned Income	-0.1 (0.0788)							
Husband Has Unearned Income	0.0896 (0.0812)	0.0645 (0.1283)	0.0741 (0.0666)	0.0188 (0.0943)	-0.0446 (0.0605)	0.0296 (0.0730)	0.1039 (0.0610)*	0.0405 (0.0528)
<u>Wife's and Husband's Variables:</u>								
Wife's Age	0.0124 (0.0048)***	0.0026 (0.0083)	0.0211 (0.0041)***	-0.0007 (0.0063)	0.0273 (0.0038)***	0.0155 (0.0048)***	0.0255 (0.0042)***	0.0182 (0.0039)***
Husband's age - wife's age	0.0077 (0.0051)	0.0091 (0.0085)	0.0044 (0.0046)	-0.0068 (0.0069)	0.0132 (0.0046)***	0.0076 (0.0057)	0.0097 (0.0050)*	0.0101 (0.0047)**
Wife has no formal education	-0.8292 (0.4025)**	-1.1313 (0.4575)**	-1.229 (0.1897)***	-1.4882 (0.2495)***	-0.9011 (0.1680)***	-1.6545 (0.2902)***	-1.0927 (0.2125)***	-1.3975 (0.2241)***
Wife has primary education	-0.6521 (0.3918)*	-0.9213 (0.4185)**	-1.0102 (0.1609)***	-1.2612 (0.1708)***	-0.9445 (0.1125)***	-1.1581 (0.1197)***	-1.1419 (0.1031)***	-1.6975 (0.1049)***
Wife has middle school	-0.3048 (0.3902)	-0.7798 (0.4159)*	-0.6848 (0.1575)***	-1.1466 (0.1634)***	-0.5484 (0.1047)***	-0.8304 (0.1050)***	-0.7356 (0.0818)***	-1.1573 (0.0721)***
Wife has high school	-0.0803 (0.3923)	-0.388 (0.4157)	-0.363 (0.1586)**	-0.8581 (0.1626)***	-0.308 (0.1014)***	-0.4609 (0.0982)***	-0.3326 (0.0685)***	-0.7704 (0.0571)***
Wife has higher educational level than husband	-0.1885 (0.0690)***	-0.0874 (0.1127)	-0.1584 (0.0581)***	-0.0926 (0.0829)	-0.2832 (0.0562)***	-0.0077 (0.0671)	-0.3148 (0.0625)***	-0.2418 (0.0569)***
Husband has higher educational level	0.1773 (0.0706)**	0.0268 (0.1220)	0.0224 (0.0615)	-0.0798 (0.0916)	-0.0586 (0.0591)	0.0917 (0.0740)	0.1358 (0.0647)**	0.0904 (0.0569)
<u>Household Variables</u>								
Number of daughters 0-3 years old in HH	0.0548 (0.0572)	0.3373 (0.0815)***	0.1589 (0.0595)***	0.2904 (0.0777)***	0.2118 (0.0632)***	0.4396 (0.0701)***	0.2315 (0.0732)***	0.3898 (0.0673)***
Number of daughters 4-6 years old in HH	0.0558 (0.0603)	0.1054 (0.0924)	0.0567 (0.0624)	0.2446 (0.0825)***	0.2228 (0.0684)***	0.3546 (0.0778)***	0.2363 (0.0886)***	0.2991 (0.0795)***
Number of daughters 7-12 years old in HH	0.0364 (0.0432)	0.0541 (0.0746)	0.157 (0.0417)***	0.135 (0.0591)**	0.2653 (0.0463)***	0.1581 (0.0542)***	0.2751 (0.0589)***	0.2222 (0.0497)***
Number of daughters 13-16 years old in HH	0.0991 (0.0565)*	-0.1478 (0.1166)	0.1265 (0.0526)**	-0.1735 (0.0939)*	0.1254 (0.0575)**	0.0891 (0.0658)	0.1669 (0.0732)**	0.0483 (0.0619)
Number of daughters 17-19 years old in HH	-0.068 (0.0924)	-0.2559 (0.1798)	0.0827 (0.0783)	-0.2048 (0.1341)	0.1231 (0.0759)	-0.1079 (0.0953)	0.2476 (0.0942)***	-0.1242 (0.0805)
Number of women 51-60 years old in HH	-0.0848 (0.3388)	-0.181 (0.5010)	0.2602 (0.3041)	-0.2384 (0.5209)	0.4269 (0.2786)	-0.2823 (0.3406)	-0.1866 (0.3452)	-0.5056 (0.3494)
Number of women 61-70 years old in HH	0.083 (0.3117)	0.0297 (0.4483)	-0.1813 (0.2198)	0.4223 (0.2802)	0.2648 (0.2531)	0.4495 (0.2674)*	-0.0209 (0.2798)	0.3462 (0.2562)
Number of women older than 70 years in HH	0.0298 (0.2601)	-5.2076 (9652.6792)	0.1074 (0.1970)	-0.0854 (0.3086)	-0.0889 (0.1958)	-0.031 (0.2607)	0.4034 (0.3054)	0.2861 (0.2319)
Number of sons 0-3 years old in HH	0.0336 (0.0574)	0.222 (0.0863)**	0.1859 (0.0568)***	0.2633 (0.0773)***	0.14 (0.0640)**	0.422 (0.0711)***	0.141 (0.0783)*	0.3783 (0.0700)***

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Table 3.8 – continued from previous page

	lower middle		middle		upper middle		high	
	DG	Maid Services	DG	Maid Services	DG	Maid Services	DG	Maid Services
Number of sons 4-6 years old in HH	0.0507 (0.0602)	0.2139 (0.0906)**	0.1764 (0.0602)***	0.2171 (0.0809)***	0.3176 (0.0678)***	0.3194 (0.0765)***	0.0651 (0.0779)	0.2436 (0.0719)***
Number of sons 7-12 years old in HH	0.0806 (0.0415)*	0.0915 (0.0669)	0.2099 (0.0417)***	0.216 (0.0581)***	0.1786 (0.0445)***	0.2432 (0.0514)***	0.1208 (0.0536)**	0.1711 (0.0475)***
Number of sons 13-16 years old in HH	0.1812 (0.0548)***	0.1048 (0.0932)	0.1288 (0.0510)**	0.1834 (0.0731)**	0.006 (0.0553)	0.2617 (0.0634)***	0.164 (0.0679)**	0.1521 (0.0685)***
Number of sons 17-19 years old in HH	0.1231 (0.0744)*	0.0912 (0.1312)	0.0978 (0.0676)	-0.2064 (0.1273)	0.1703 (0.0686)**	0.0055 (0.0835)	0.1062 (0.0819)	0.1964 (0.0734)***
Number of men 51-60 years old in HH	0.3573 (0.5213)	-5.0246 (12897.0352)	-0.0113 (0.3641)	0.0544 (0.5490)	-0.5808 (0.5012)	-6.0132 (15139.6774)	-0.1875 (0.5805)	0.4967 (0.5361)
Number of men 61-70 years old in HH	-0.1792 (0.5282)	-5.0194 (11197.3985)	0.0911 (0.3241)	0.5076 (0.4358)	0.0945 (0.3533)	-0.2086 (0.4613)	0.0422 (0.3797)	0.1142 (0.3510)
Number of men older than 70 years in HH	-0.7299 (0.4586)	0.8161 (0.4172)*	0.3289 (0.2689)	-0.2066 (0.4613)	0.1909 (0.2558)	-0.0845 (0.3333)	6.439 (25932.4329)	-0.2619 (0.3766)
Per Capita Income (in 1000)	4.0995 (1.2272)***	9.4749 (2.0883)***	0.6559 (0.7015)	1.6715 (1.0050)*	1.6927 (0.3142)***	2.1561 (0.3746)***	0.2506 (0.0344)***	0.2221 (0.0221)***
State Level Variables								
Average State Income (in 1000)	0.4579 (0.2212)**	-0.464 (0.5112)	0.0228 (0.1931)	0.4458 (0.2957)	-0.1238 (0.1983)	0.0415 (0.2493)	-0.1024 (0.1954)	-0.2035 (0.1749)
Proportion of Working Women by State and Cohort	-0.2727 (0.3661)	0.3251 (0.6190)	-0.2248 (0.3430)	0.6494 (0.5086)	-0.2918 (0.3418)	-0.0247 (0.4050)	-0.2538 (0.3685)	0.4844 (0.3457)
Price of an hour of maid services	0.2706 (0.2618)	-1.0823 (0.4603)**	0.9144 (0.2346)***	-1.333 (0.3739)***	0.9552 (0.2288)***	-0.7042 (0.2723)***	1.2137 (0.2497)***	-0.7797 (0.2238)***
Region Level Variables								
Price of maid service complements production goods	0.3212 (0.0324)***	-0.0695 (0.1013)	0.2875 (0.0271)***	-0.0033 (0.0488)	0.2959 (0.0262)***	-0.0241 (0.0331)	0.2627 (0.0308)***	-0.0225 (0.0246)
Price of maid's substitute durable goods	-0.0654 (0.0128)***	0.0302 (0.0401)	-0.0598 (0.0111)***	0.0081 (0.0190)	-0.0673 (0.0110)***	-0.001 (0.0140)	-0.0736 (0.0132)***	0.0057 (0.0108)
Price of entertainment goods	-0.3505 (0.0677)***	0.3517 (0.2201)	-0.3059 (0.0564)***	0.0324 (0.1015)	-0.4255 (0.0555)***	0.0602 (0.0701)	-0.4929 (0.0680)***	0.0279 (0.0525)
Price of electricity (in kwatts)	31.0802 (3.6926)***	1.6397 (9.3628)	24.1119 (3.1103)***	-6.5894 (5.0765)	27.5649 (3.0044)***	-4.6862 (3.6680)	23.4522 (3.2696)***	-0.5734 (2.8273)
Constant	-33.6111 (2.9707)***	0.6569 (8.4712)	-29.462 (2.5179)***	0.6937 (4.2886)	-30.0508 (2.4465)***	1.2789 (3.0119)	-24.9242 (2.7754)***	1.9628 (2.3262)
Observations	3932	3932	3933	3933	3932	3932	3932	3932
rho	0.0627	(0.0666)	0.1994	(0.0439)	0.0285	(0.0362)	0.1859	(0.0327)
LR test (rho=0)	0.8809	0.3480	19.9096	0.0001	0.6186	0.4316	31.2842	0.0001
Log likelihood	-2036.6108		-2966.9063		-3633.4155		-3887.9624	
Wald $\chi^2_{(4)}$	835.8	0.0001	985.53	0.0001	1289.16	0.0001	1525.14	0.0001

Standard errors in parentheses.

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

Table 3.9. Testing Differences Among Sons And Daughters Thirteen to Sixteen Years Old Brazil, 2002-2003.

	Maid's Substitute DG	Maid Services	Difference
<u>Lower Middle Income</u>			
girls	0.0991 (0.0565)*	-0.1478 (0.1166)	0.247 (-0.1290)*
boys	0.1812 (0.0548)***	0.1048 (0.0932)	0.076 (0.1074)
<i>girls - boys</i>	-0.082	-0.253	0.171
$\chi^2(1)$	1.20	3.10	1.12
<i>Prob</i> > χ^2	0.273	0.078	0.2892
<u>Middle Income</u>			
girls	0.1265 (0.0526)**	-0.1735 (0.0939)*	0.3 (0.1049)***
boys	0.1288 (0.0510)**	0.1834 (0.0731)**	-0.055 (0.0860)
<i>girls - boys</i>	-0.002	-0.357	0.355
$\chi^2(1)$	0.00	9.53	7.33
<i>Prob</i> > χ^2	0.984	0.002	0.0068
<u>Upper Middle Income</u>			
girls	0.1254 (0.0565)*	0.0891 (0.0658)	0.0360 (0.0868)
boys	0.0060 (0.0553)	0.2617 (0.0634)***	-0.256 (0.0836)***
<i>girls - boys</i>	0.119	-0.173	0.292
$\chi^2(1)$	2.32	3.7300	6.11
<i>Prob</i> > χ^2	0.128	0.053	0.013
<u>High Income</u>			
girls	0.1669 (0.0732)**	0.0483 (0.0619)	0.1187 (0.0918)
boys	0.164 (0.0679)**	0.1521 (0.0585)***	0.012 (0.0856)
<i>girls - boys</i>	0.003	-0.104	0.107
$\chi^2(1)$	0.00	1.5700	0.76
<i>Prob</i> > χ^2	0.976	0.209	0.3822

Standard errors in parentheses.

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

Table 3.10. Marginal Probability at the Median Price of an Hour of Maid Services and After a 10% Increase by Income Groups in Brazil, 2002-2003.

	before	after	difference	(%) change
Maid's Substitute Durable Good				
lower middle	0.18	0.18	0.01	0.03
middle	0.47	0.51	0.04	0.07
upper middle	0.78	0.81	0.03	0.03
high	0.91	0.92	0.02	0.02
Maid Services				
lower middle	0.07	0.06	-0.01	-0.17
middle	0.23	0.19	-0.04	-0.16
upper middle	0.21	0.19	-0.02	-0.09
high	0.60	0.57	-0.03	-0.05

Table 3.11. Marginal Probability at the Median Price of Maid's Substitute Durable Goods and After a 10% Increase by Income Groups in Brazil, 2002-2003.

	before	after	difference	(%) change
Maid's Substitute Durable Good				
lower middle	0,18	0,13	-0,05	-0,28
middle	0,47	0,39	-0,08	-0,17
upper middle	0,78	0,70	-0,08	-0,10
high	0,91	0,86	-0,05	-0,06
Maid Services				
lower middle	0,07	0,08	0,01	0,20
middle	0,23	0,24	0,01	0,04
upper middle	0,21	0,21	0,00	-0,01
high	0,60	0,61	0,01	0,01

Table 3.12. Marginal Probability at the Median Per Capita Income and After a 10% Increase by Income Groups in Brazil, 2002-2003.

	before	after	difference	(%) change
Maid's Substitute Durable Good				
lower middle	0,18	0,19	0,01	0,08
middle	0,47	0,48	0,01	0,01
upper middle	0,78	0,80	0,02	0,02
high	0,91	0,91	0,00	0,00
maid services				
Maid Services				
lower middle	0,07	0,09	0,02	0,25
middle	0,23	0,24	0,01	0,05
upper middle	0,21	0,23	0,02	0,11
high	0,60	0,61	0,01	0,01

Chapter 4

Gender Roles and Earnings in Brazil: Were There Any Changes between 1981 and 2001?

4.1 Introduction

Brazilian women's labor force participation increased from 31% in 1981 to 52% in 2001. However, female workers still are concentrated in few occupations. In fact, in 1981, 72% of the female workers were employed in female-dominated occupations, and this number decreased only two percentage points in 2001 (Table 4.1). Moreover, female-dominated occupations are less than one third of all occupations (Table 4.3). This degree of segregation becomes a problem because female-dominated occupations are less desirable in terms of wage rate (Table 4.4).

Comparing men and women conditional on their characteristics, gender roles still have a great influence in the intrahousehold allocation of time of Brazilian couples (Madalozzo (2009)). Wives with young children are the group of women that have higher participation in housework even if they also work in the labor market (Soares and Saboia (2007)). This paper investigates whether gender roles drive female workers to choose to enter into these female-dominated occupations.

Between 1981 and 2001, Brazil had undergone several changes. After 21 years of military dictatorship, 1964 to 1985, the country engaged in a process of democratization. At the same time, external pressure from international institutions forced Brazil to recognize human rights and comply with them. The CEDAW (Convention on the Elimination of All Forms of Discrimination Against Women) was ratified in 1984. Other relevant international treaties on the protection of human rights were ratified, as well, during the 1980's endorsing the obligation to ensure equity and to forbid discrimination.

These international pressures for improvement of human rights, combined with domestic demands from oppressed groups and the newly established democratic government led to a call for a

new constitution. The Constitution of 1988 is considered to be the legal landmark of democratic transition and institutionalization of human rights in Brazil. A significant majority of the claims made by women were incorporated into the constitutional text of 1988, such as equal rights and specifically within the family, prohibitions of discrimination in the labor market and the right to maternity-leave without the loss of job and salary (CEDAW (2002)).

In the same year that the new Constitution was finished, there was a reduction in tariff rates that was followed by the reduction or removal of nontariff barriers in 1990 during the Collor government¹. In 1992, exchange rate appreciation was used as a strategy for price stabilization that culminated in the Plano Real of 1994. This plan ended years of hyperinflation in Brazil. By 1991, the privatization of the publicly owned enterprises began. Other reforms, such as deregulation of international investment and banking, also, took place in the last part of 1990's.

There is evidence that gender discrimination in the labor market in terms of wage difference has decreased. Barros, Ramos, and Santos (1995) used household data sets from 1981 to 1989 to identify a gender wage gap of over 50%. By using the Oaxaca Decomposition, they concluded that 90% of this difference was not explained by gender differences in the variables that measure productivity such as schooling, experience, and industry and, therefore, was due to gender discrimination. Leme and Wajnman (2000) estimates that by 1997 the gender wage gap was 25%, a 50% reduction compared to Barros, Ramos, and Santos (1995) estimates; and a 82% reduction when comparing with the baseline year used in Leme and Wajnman (2000), 1977. Indeed, the gender wage gap for the 30 to 40 years old Brazilians went from 30% in 1981 to 13% in 2001². This change, however, is less due to improvements in women's wage rates and more due to a reduction in men's wage rates. Indeed, men's wage rates dropped by 29% between 1981 and 2001 (Table 4.4).

Green, Dickerson, and Arbache (2001) argue that trade liberalization was the most important factor driving wage inequality in Brazil during this period. They found that there was a rise in returns to college education due to rising demand for skilled labor. Regarding the gender wage gap, they found that trade liberalization did not accelerate or decelerate the convergence of wages. Therefore, the results to be found later in this paper are probably not driven by changes in trade.

¹These changes are well documented in Green, Dickerson, and Arbache (2001).

²These percentages are calculated as the difference of the logarithm of men's to women's wage rates (Table 4.1 and 24.2) minus ones.

Arabsheibani, Carneiro, and Henley (2003) found that the gender wage gap was reduced over this period and that, after elimination of high inflation, women's human capital has increased and the gender differential in the returns to human capital has decreased.

Soares and Oliveira (2004) analyze the earnings of male and female workers in female-dominated occupations using the PNAD 2001 data set, and relate the female wage gap to the fact that females are crowded in occupations that pay lower wages. For them, female-dominated occupations are the ones in which women's participation is over than 50%. In this paper, the female-dominated occupations are the ones in which the women's participation is well above women's participation in the labor force (section 4.4).

In this paper, a version of the Roy (1951)'s model in which individuals choose their occupation that best matches their gender roles considering possible discrimination and wage rates is adopted. To capture gender roles, variables are used that are related to intrahousehold division of labor, such as marital status, children's presence by age group and spouses' hourly wage. By doing that, it is possible to verify whether women are selecting themselves into female-dominated occupations due to their roles as wives and mothers.

Investigating whether gender roles lead women to choose occupations that pay lower wages is important in terms of public policy. Take, for example, the case of childcare. Children stay in school or daycare in Brazil about five hours. Therefore, either mothers need to work fewer hours or have to find somebody to take care of their children while they work. This issue is worse for those parents that are not able to pay for childcare. An alternative to mitigate this issue is to extend hours children stay in public school.

It would be easier to know whether women would be better off in terms of wage rates in occupations that are not female dominated, if it were possible to observe their wage rates in every occupation. However, the only observed wage rate is for the selected occupation. Therefore, selection correction terms are constructed from the occupational choice and added to the wage regression. By doing that, it is possible to estimate the difference among wage rates across occupations controlling for observed and unobserved individuals' characteristics. The institutional changes that occurred between these two years introduced wage rate variation across occupations. This wage rate variation is a key element in the Roy (1951) model, making possible the identifica-

tion of the parameters without exclusion restriction variables, as argued in Heckman and Honore (1990).

The paper follows by describing the Roy (1951) model, its assumptions and implications for gender occupational segregation. It continues by defining job classification among the gender defined occupations and analyzing its changes, followed by the discussion of the results and the conclusions.

4.2 The Econometric Model

The econometric model used is a version of the Roy (1951) model that explains occupational choice and its impacts on the distribution of earnings given that individuals differ in their occupation-specific skills. There are many different applications of the Roy (1951) model, the most famous application is the seminal insight of Heckman (1974, 1979), which modeled women's returns to labor force participation decisions considering the bias caused by neglecting the nonmarket work decision. Also, other important applications of the Roy framework are the research on the differential impact of unionism and nonunionism on wages (Lee (1978)) and the wage differential of college and high school graduates (Willis and Rosen (1979)). One of the key assumptions of the papers cited above is the joint normality of the error terms, from which the selectivity-correction term is derived. If the normal distribution is not the true generating stochastic process of the log wage data, the sample selection bias correction produces biased estimates. Heckman and Honore (1990) proved that the implications of Roy (1951) model regarding skill distribution fail if the normality assumption does not hold, unless variables exist that affect the distribution of skills among occupations to be used as exclusion restrictions or there exists enough price variation such as in repeated cross-sectional data.

Lee (1982) was the first work in this area to reject the normality assumption of log wages in U.S. data and to propose a selectivity-correction term that does not rely on the joint normality of the error terms. The rejection of the normality assumption of log wages in U.S. data was also observed by Heckman and Sedlacek (1985, 1990), which also proposed improvements in the hypothesis of

the Roy framework, such as the introduction of more than two sectors³, allowing workers to select their occupation based on utility maximization instead of income maximization, and relaxing the normality assumption of the error terms. When the selection into occupations is modeled as a utility maximization problem, selection is not based only on wage rates and occupational specific skills, but also on options that accrue to workers in that occupation, such as employment benefits and flexible hours of work. This feature is indeed important since it increases the availability of exclusion restrictions variables, and the presence of these variables guarantee model identification.

Paralleled to the evolution of the Roy framework in the wage differential literature, Durbin and McFadden (1984) developed a selection bias correction model for the estimation of the demand for electricity. In their model, selection is based on utility maximization. They recognize the importance of estimating the full set of selection choices on the identification of the estimates, which is modeled as a Multinomial Logit regression, and the selectivity-correction term is not based on the normality assumption but on a linearization of the error term in the wage and the selection distribution. The estimation of the selection regression as a Multinomial Logit has been used in research that measures the impact of female participation in the formal and informal sectors⁴ on their wage differential, such as Tiefenthaler (1992, 1994), and Hill (1989), and wage differences in public, private and public owned enterprises, Tansel (2005). Bourguignon, Fournier, and Gurgand (2004) proved that the Durbin and McFadden (1984) method is preferable to other selectivity-correction methods based on the Multinomial Logit and that the estimated parameters are unbiased even when the independence of the irrelevant alternatives (IIA) assumption is violated.

In this paper, the Durbin and McFadden (1984) selection bias correction model is used, where the exclusion restriction variables discussed in the next subsection permit the identification of the parameters of the model. However, there were changes in the country, such as reformulation of the laws, trade liberalization and privatization, that caused price skill variation, allowing for model identification even without the exclusion restriction. This section continues presenting the occupational choice model and the wage regression, discussing the effect of the selection into an occupation on the hourly wage rate, as well as the procedure used to construct the selectivity-

³Heckman and Sedlacek (1990) found that accounting for nonmarket participation improves the fit of the model.

⁴In which nonmarket participation is one of the females' choices.

correction term. The first step is estimated using a Multinomial Logit, and then the selectivity-correction terms are calculated for each occupation. The second step is an OLS estimation where the selectivity-correction terms are added to the set of covariates in the wage regression. The section is finalized with a comment on the model testable implications and the expected results.

The Occupational Choice

In the gender segregation occupation model, individuals choose among four different states: to work in an integrated occupation, to work in a male-dominated occupation, to work in a female-dominated occupation, or not to work. The chosen or observed state, $O_i = j$, is assumed to be the one that offers the individual the highest utility given his or her characteristics, and $O_i = 0$ for all occupations other than j . Therefore, the choice can be expressed as a random utility model such as (4.1) below, where U_{ij} is the utility of the individual i facing the choice j , and z_{ij} are the observed characteristics of individual i who chooses occupation j . These observed characteristics include geographic location, age, education, number of children by age group, marital status, unearned income and spouse's income (split into earned and unearned income).

$$U_{ij} = z_{ij}\beta + \epsilon_{ij} \quad (4.1)$$

The errors are assumed to follow an independent and identically distributed type I extreme value distribution, thus the probability that individual i will choose an occupation j follows a Multinomial Logit Model. There are four possible outcomes in the case studied in this paper, therefore, the Multinomial Logit estimates four equations that provide a set of probabilities. Given that the probabilities must sum to one, the model is normalized so that the coefficients for the probability equation of the gender-integrated occupation are all equal to zero. Consequently, there are three probability equations estimated by (4.2) below, for j equal to working in a male dominated occupation, working in a female dominated occupation, or non-workers.

$$Prob(O_i = j) = \frac{e^{z'_{ij}\beta_j}}{1 + \sum_{j=1}^J e^{z'_{ij}\beta_j}} \quad (4.2)$$

After estimating the Multinomial Logit, a selectivity correction term can be estimated and incorporated in the wage regression to correct for the fact that wages are only observed for the occupation in which the individual is actually working. The approach followed is given by Durbin and McFadden (1984), which is a traditional approach that has flexible specification and performs well in Monte-Carlo experiments when the sample size is similar to the household survey used in this paper⁵. There are three selectivity-correction terms added to the wage regression, one for each type of occupation: gender-integrated occupations, male-dominated occupations, and female-dominated occupations. The selectivity correction term for working in occupation j depends on the logarithm of the probability of working in j , and on the weighted sum of the logarithm of the probability of the other choices. Each term is calculated by (4.3).

$$\lambda_j = \sum_{k \neq j} \frac{\sqrt{6\sigma^2}}{\pi} \rho_k \left(\frac{P_k \ln P_k}{1 - P_j} + \ln P_j \right) \quad (4.3)$$

The exclusion restrictions are the variables that capture the intrahousehold division of labor, as well as the role that is culturally assigned to each gender. They are marital status, number of children by age group (younger than 3 years old, 3 to 5 years old, 6 to 10 years old, 11 to 15 years old, and 16 years and older), interaction of marital status and spouse's hourly wage, and variables that capture financial constraints, such as unearned income and interaction of marital status and spouse's unearned income. Married women are assumed to be less likely to work or more likely to work in occupations that have more flexible working hours compared to occupations that are inflexible. Married men, on the other hand, are more likely to work in occupations that have higher working hours or to spend less time looking for a job⁶. The higher the earnings ability of the husband, the more likely is the wife to specialize in household production (to not work or to work fewer hours), and her husband to specialize in the job market (to work more hours and/or to work in a higher earning occupation)⁷. On the other hand, the higher the earnings ability of the

⁵See Bourguignon, Fournier, and Gurgand (2004) for the Monte-Carlo experiments and discussion of the alternatives methods of selectivity correction term based on the Multinomial Logit Model.

⁶Becker (1991) makes a good case why specialization in market work and household work takes place between husbands and wives. Even with equal comparative advantages, an efficient outcome rises when husbands specialize in market work and wives specialize in household production or divide her time in market work and household production.

⁷This is the case where differences in husbands' and wives' comparative advantages increase specialization

wife, the less likely is the wife to specialize in household production and her husband to specialize in the job market⁸.

The presence of children can have the same impact as marital status and husband's earnings on women's choice. However, it can differ by children's age group. Whereas younger children demand mother's time, older children can help in the household work and in taking care of the younger ones. On the one hand, the decomposition of number of children into age groups helps to understand the different impacts of each group; on the other hand, an additional complication in interpreting the role of children in women's occupational decision is introduced. Provided that the sample is restricted to individuals 30 to 40 years old, the presence of young children may signal career-driven women, at the same time the presence of older children may signal lower investments in job-specific human capital. It is, therefore, difficult to determine a priori the estimated impact of the number of children on the probability of choosing an occupation.

The higher the unearned income and the spouse's unearned income, the higher is the ability of the individual to wait for a better job. Additionally, part of the unearned income is related to the individual's access to financial markets and parental resources. Therefore, the unearned income also captures ability to invest in human capital, and so, it will reflect the ability to enter in a higher earning occupation.

The Wage Regression

The occupational choice and the wage regressions are estimated for women and men, and for both years separately. Later the wage regression is estimated in a pooled sample with year and gender dummies and the interactions of year and gender. The coefficients and standard errors are bootstrapped to correct for efficiency loss due to the two-step estimation. The wage regression is given by (4.4), where the dependent variable, y_i , is the log of hourly wage. The covariates are geographic location (dummy for country regions, and urban and metropolitan areas), human capital (age, age squared, and four educational level dummies⁹), dummy for female- and male- of wives in household production.

⁸This is the case where differences in husbands' and wives' comparative advantages decrease specialization of wives in household production.

⁹The omitted category is primary education, first to fourth grade.

dominated occupations, and the three selectivity correction terms, one for each type of occupation. The omitted category in the first step (Multinomial Logit) is the gender-integrated occupation. Moreover, the omitted occupational dummy is the gender-integrated occupation and, therefore, the results of the dummies for male and female occupations are in comparison to the integrated occupations.

$$y_i = \beta_0 + \sum_{g=1}^6 \beta_g d_g + \beta_7 a_7 + \beta_8 a_8^2 + \sum_{s=1}^4 \beta_{8+s} d_s + \beta_{11} d_{male-occupation} + \beta_{12} d_{female-occupation} + \beta_{13} \lambda_{male} + \beta_{14} \lambda_{female} + \beta_{15} \lambda_{integrated} + \epsilon_i \quad (4.4)$$

In the above specification, the constant captures the part of the wage rate that does not depend on the observed characteristics and the selection into occupations for gender-integrated occupations, and β_{11} (β_{12}) captures the premium or penalty for male-dominated occupations (female-dominated occupations). That is, β_{11} (β_{12}) captures the difference in wage rates between male-dominated occupations (female-dominated occupations) and gender-integrated occupations that does not depend on the observed characteristics and the selection into occupations. Therefore, the focus of this paper is the test of significance of β_{11} and β_{12} . A positive and significant β_{11} in a wage regression of only female workers is showing that females, on average, independently of their observed characteristics and their selection into occupations, have a higher wage rate in male-dominated occupations than in gender-integrated occupations. It is also possible to test whether there exists a premium or penalty between male- and female-dominated occupations with a post-estimation test.

If female workers select themselves in female-dominated (male-dominated) occupations, then the coefficient of the selectivity-correction terms, β_{14} (β_{13}) will be significant. Moreover, if individuals pursue their comparative advantage, then selection of females in female-dominated occupations and selection of males in male-dominated occupation will be positive. However, the model is also consistent to the hierarchical interpretation of ability; in this case, higher ability individuals select themselves into higher earning jobs, and selection into occupations that demand higher skill are positive, while selection into other occupations is negative.

The indicators of geographic location capture differences across these locations in the part of the

wage rate that does not depend on the observed characteristics and the selection into occupations for gender-integrated occupations. The indicators of school level, age and age squared capture the returns to human capital. The model assumes that geographic location and human capital variables influence the occupational choice through wage. The model also assumes that the other variables present in the occupational choice regression but not in the wage regression, the exclusion restriction variables discussed in the previous subsection, affect only the occupational choice. If the last assumption holds, the parameters of the model are identifiable and it is possible to test the model implications described above by estimating only the above estimating equation for one type of occupation, gender and one year¹⁰.

However, the model identification could fail if the exclusion restriction variables influence wage rates, that is, if marital status, children, unearned income individuals, and spouse's income affect individuals' productivity. These variables are commonly used as exclusion restrictions in previous research. Marital status and children are exclusion restrictions in Heckman (1974, 1979), unearned income and spouse's income are exclusion restrictions in Willis and Rosen (1979). Yet, the above regression is also estimated including both gender and years. In addition, Heckman and Honore (1990) show that if price variation exists, usually provided by the use of repeated cross-sections, the Roy (1951) model is still identified even without exclusion restriction variables or independent variables in the wage regression.

If the human capital variables influence occupational choice through other channels than the wage, then their parameters capture more than returns to human capital. For example, if the classification into gender dominance is confounded with education differences, there is an unobserved ability not captured by the selectivity-correction terms that select individuals into occupations, schooling levels, and higher wage rates. Then, the coefficient of schooling captures returns to schooling and ability. In this case, it is still possible to compare returns to schooling between gender in a given occupation, since the bias of omitted unobserved ability will affect the returns to schooling for males and females in the same direction.

¹⁰See Heckman and Honore (1990); Heckman and Sedlacek (1990, 1985).

4.3 Data Set

The data used in this analysis come from a Brazilian household survey, *Pesquisa Nacional Por Amostra de Domicílios* (PNAD). This survey is conducted almost every year, but is not a longitudinal survey. As claimed before, the choice to compare these two years, 1981 and 2001, is justified by economic, legal, and social changes that took place in Brazil during these two decades. The sample was narrowed to individuals 30 to 40 years old, who were not self-employed, employers, or military. The age range was chosen to avoid individuals - in 2001 - who made their occupational choice before the changes occurred in 1980's, as well as to avoid individuals who were still in school and may have not made their occupational choice. Moreover, the comparison is restricted to individuals in the same stage of the income life cycle and for which their choice regarding family can already be observed, allowing the determination of their role in occupational choice. Non-participants in the labor force in the same age range were used to correct for selection into the labor force. Table 4.1 in the appendix shows the descriptive characteristics of the women's sample for both years and Table 4.2 shows the descriptive statistics of the men's sample for both years.

There are 28,074 women in the 1981 sample, where 9,322 are working, 21,773 are married or cohabitating, and 10.5% of the women in the sample are single household heads. Therefore, 12% of the women in the sample live with their parents or other relatives, or are housekeepers. In 2001 these numbers are, respectively, 25,431 for sample size, 13,366 for working women, and 17,839 for married or cohabitating. While there is not much change in the percentage of women that live with their parents or other relatives, or are housekeepers, there is an increase of 8.5 percentage points of single women heads of households. From 1981 to 2001, the percentage of working women in the sample increased from 31% to 52%; the percentage of women working in an integrated occupations increased by about 3 percentage points; and the percentages of women working in male and female occupations slightly decreased. The definition of gender integrated, male- and female-dominated occupations is presented in the next section.

There are 20,943 men in the 1981 sample, where 19,225 are working, 17,484 are married or cohabitating, and 5% of the men in the sample are single household heads. Therefore, 12% of the men in the sample live with their parents or other relatives, or are housekeepers. In 2001 these

numbers are, respectively, 19,731 for sample size, 16,735 for working men, and 14,785 for married or cohabitating. The percentage of men that live with their parents or other relatives, or are housekeepers increased by 6.5 percentage points, and there is an increase of 7.8 percentage points of single men head of households. From 1981 to 2001, the percentage of working men decreased from 92% to 85%. Among male workers the percentage working in an integrated occupations has increased by about 4 percentage points, the percentages working in male occupations decreased by 6 percentage points, and the percentages working in female occupations increased by 1.6 percentage points.

Most of the sample lives in urban areas, where Metropolitan regions are a special case of urban areas. About 15% of the females left the rural area to urban areas from 1981 to 2001 as shown by the percentages of the women residing in rural and urban areas, but the percentages in Metropolitan areas remained the same between these two years. Males, however, left the rural areas and the Metropolitan regions. About half of the sample resides in the Southeast States, and about 20% resides in the Northeast States. There was an increase in schooling for both genders, but females' schooling increased more than males', and females went from having a little less schooling to have a little more schooling than males. Especially interesting is the drop of the proportion of females with no formal education; the rates went from 22% to 8%, whereas the percentage of males with no formal education went from 19% to 11%. Moreover, there were no changes in the percentage of males with some college education, about 10%, but female participation in college education doubled, from 7% to 14%. The number of children has decreased by one, so the average number of children in a household is two in 2001. Individuals 30 to 40 years old are more likely to have children that are 6 to 10 years old than other age groups.

In 1981, the gender wage gap was 30% and decreased to 13%¹¹ in 2001. This change, however, is less due to improvements in women's wage rates and more due to a reduction in men's wage rates. Indeed, men's wage rates dropped by 29% between 1981 and 2001. In terms of unearned income, there was an inversion of the values between genders, while women's unearned income increased from 23 to 31 thousand 2001 Reais, the men's unearned income decreased from 33 to 19.

¹¹These percentages are calculated as the difference of the logarithm of men's to women's wage rates minus one.

On average men work more hours per week than women; however, the number of women's weekly hours worked and the percentage of married women indicates that a good proportion of wives are, indeed, working full-time. Husband's wage rate in 2001 is above the overall men's wage rates, while the wages rates of married and all men are very close in 1981. This is evidence that single men accrued most of the losses in men's wage rates between these two years. Husbands' average unearned income is higher than the overall men's average unearned income, while wives' average unearned income is lower than the overall women's unearned income.

4.4 Classifying Occupations by Gendered Participation.

This paper follows Beller (1982) method of classifying occupations among male-dominated, gender-integrated and female-dominated occupations, where a gender-integrated occupation is defined to be the one where males' participation is in an interval around their share in the labor force. The classification cutoffs change to accommodate the changes in female participation in the labor force between these years. While this definition may seem arbitrary, so is any other candidate definition. Moreover, the definition used allows for accounting for the changes in female labor force participation. This section continues by explaining further the classification and presenting facts based on the data.

It is common to assume that the ideal share of females in the labor force or in a particular occupation should be close to 50%. Under this assumption, gender equality in labor markets would be achieved only when all women of working age participate in the labor force. Therefore, women's reasons and choices to not participate are not considered. However, Beller (1982) asserts that under the assumption that males' and females' preferences are equal and there is no barrier to the females to enter into any occupation, all occupations should have a female participation rate that reflects the female participation rate in the labor force. Following this idea, a gender-integrated occupation is defined to be the one where males' participation is in an interval of sixteen points around their share of the labor force. Consequently, a male-dominated (female-dominated)

occupation is defined as one in which males' (females') participation is higher (lower) than the gender-integrated occupations.

There are two challenges when working with these definitions. The first one is the choice of the length of the interval that defines the occupations. The sixteen percentage points were chosen because they are half of the standard deviation from the mean proportion of females in the labor force. In that way, if the distribution were normal, then the sample would be divided in three parts of about equal size. The second challenge is whether the cutoff points of occupation classifications should change to accommodate increases in female participation in the labor force. Table 4.3 presents the number of occupations in each classification. For 2001, these numbers are presented keeping fixed the cutoffs of 1981 and also correcting for changes in female participation in the labor force.

In 1981, males made up 68.4% of the Brazilian labor force, with the same percentage of males actually employed. By 2001, males lost about eleven percentage points in their share of the labor force, falling to 57.5%, and ten percentage points in their share of actual employment, 58.6%. Therefore, a male occupation, in 1981, is defined as one in which males hold more than 84.33% of the jobs. In an integrated occupation, males' share of jobs are in an interval from 52.48% to 84.33%, and as a result, a female occupation is defined as the ones in which the share of males' jobs is lower than 52.48%. When changes in female participation in the labor force from 1981 to 2001 are accounted for, these cutoff points change to 73.47% and 41.62%.

Independently of the classification procedure used in 2001, most of the occupations have a low participation of females, and female-dominated occupations are less than one third of the occupations, see table 4.3. However, the number of integrated occupations increased from 1981 to 2001. The net changes were an increase of 19 occupations in the integrated category, 12 coming from former male-dominated and 7 from former female-dominated, and three new occupations have been created. When the 2001 occupations are classified using the 1981 cutoffs, most of the changes were from male occupations to integrated occupations. As would be expected, as women's participation in the labor force increases, it gets easier for them to enter in any occupation. For that reason, the 2001 cutoffs are used to classify the occupations in 2001 in the following sections of this paper.

Table 4.4 shows the total mean hourly wage by gender label occupations and the mean male's and female's hourly wage by gender label occupations. In 1981, female-dominated occupations paid 40% less than the gender-integrated occupations; and by 2001 this percentage differential was reduced to 3%. However, for male workers the relationship is somewhat unexpected; they don't lose as much by working in female-dominated occupations comparing to if they were employed in a male-dominated occupation, and, in 2001, they are even better off. Women, on the other hand, receive a premium for working in male-dominated occupations compared to other working women, as well as, compared to men working in male-dominated occupations. As shown in Table 4.1 in the Appendix, in 1981, 72% of the female workers were employed in a female occupation, and this number decreased only by two percentage points, in 2001. This degree of occupational segregation becomes a problem because, as discussed above, female occupations are less desirable for women in terms of wage rate compared to the other two categories.

Tables 4.5 to 4.10 show the number of workers and their mean education for the top 20 by number of workers in male-dominated, gender-integrated, female-dominated occupations in 1981 and 2001. Most of the occupations are low-skill occupations, especially among the male-dominated occupations. Gender-integrated occupations have a higher share of college-degree occupations, such as physicians, lawyers, college/university professors, dentists and economists, than the other two types of occupations. The occupations that changed categories from male-dominated to gender-integrated are mostly higher paid and higher human capital required occupations, such as manager, accountant, and business person. Occupations that went from gender-integrated to male-dominated are low skill, such as doorman. Occupations that changed from gender-integrated to female-dominated are mainly in the services sector.

4.5 The Determinants of Women's Participation into Gender Labeled Occupations

Women in 1981 (Table 4.11)

In short, the results discussed in this subsection indicates that not working is preferred by married women in 1981, especially if they have children. That is, traditional women's role as wife and mother affect women's participation in the labor market, more than the choice of the occupation. However, if their husbands' earnings fall short they are "pushed" into female-dominated occupations.

Married women are more likely to work in female occupations than in integrated occupations when they work at all. Relative to working in an integrated occupation, married women are 4.73¹² times more likely to not work than to work in integrated occupations and 1.14 times more likely to work in female occupations than to work in integrated occupations. However, the odds ratio of male occupations to integrated occupations for married women is 0.725, implying that married women are 27.5% less likely to work in male occupations than to work in integrated occupations.

Having a child increases the probability that women will not work and the younger the child the higher is the women's probability of not working. Having a child younger than three years old, three to five years old, six to ten years old and older than 16 years old increases the probability of not working by 1.45, 1.28, 1.17 and 1.10, respectively. However, having a child 11 to 15 years old decreases women's probability of not working by 5.9%, the odds ratio is 0.941.

As their husbands' earnings increase, married women are less likely to work in female occupations and equally likely to work in integrated or male occupations if women decide to work. For an increase in \$ 1,000 Reais in husband's earned income, married women are 1.05 times more likely to not work relative to work in integrated occupations. The odds ratio of female and integrated occupations is 0.98, implying that an increase of \$ 1,000 Reais in husband's earned income decreases in 1.2% the probability of working in female occupations. Therefore, to not work is the preferred option of married women whose husbands have higher earnings.

¹²The impact of the variables discussed are significant at either the 1%, 5% or 10% levels, unless the contrary is noted.

Women with higher unearned income are more likely to not work, but when they work they are less likely to work in gender specific-occupations than in integrated occupations. As unearned income increases by \$ 1,000 Reais, and the probability of not working is 4.25 times higher than the probability of working in integrated occupations. The odds ratio of working in male occupations and integrated occupations is 0.18 and the odds ratio of working in female occupations and integrated occupations is 0.47. The husband's unearned income does not influence the choice of occupation. Women are equally likely to work in any occupation and to not work independently of their husband's unearned income.

As women's education increases, the odds ratio of not working and work in integrated occupations decreases. Indeed, women with college degrees are 98% less likely to not work compared to the likelihood of women with primary education working in gender-integrated occupations. The odds ratio of working in female occupations and integrated occupations are similar across women's educational levels. Women of all degree levels are less likely to work in female-dominated occupations than in gender-integrated occupations. As education increases, the odds ratio of working in male-dominated occupations and integrated occupations increases. Still, women with college degrees are 32% less likely to work in a male-dominated occupation compared to the likelihood that women with primary education are working in gender-integrated occupations.

Women in 2001 (Table 4.12)

The results discussed in this subsection shows that the effects of the traditional women's role in women's labor force participation haven't changed. However, differently from 1981, married women choose to participate in the labor market even when their husbands' earnings is high, and the choice of work sector is not very sensitive to husband's earnings. In summary, women have established their role as co-providers in their families. Therefore, the anticipation of this new role makes them to prepare themselves to enter into other occupations than female occupations.

Relative to working in integrated occupations, married women are 2.48 times more likely to not work. That is, the choice of not working becomes less likely in 2001 than in 1981. However, the odds ratio of working in female and integrated occupations is still 1.14 for married women,

i.e., married women are as likely as before to choose to work in female occupations over integrated occupations. Relative to the probability of working in integrated occupations, married women are more likely to work in male occupations in 2001 than in 1981. In fact, the odds ratio of working in male and integrated occupations is statistically equal to one, i.e., married women are equally likely to choose between integrated and male occupations.

Having a child ten years old and younger increases the probability that women do not work, but having a child 11 years old and older increases the women's probability of working in female occupations. Having a child younger than three years old, three to five years old and six to ten years old increases the probability of not working by 1.56, 1.22, and 1.21 times compared to the probability of working in integrated occupations, respectively. However, having a child six to ten years old, 11 to 15 years old and 16 years old and older increases women's probability of choosing to work in female occupations over integrated occupations by 1.09, 1.15 and 1.12, respectively.

The choice of work sector is not very sensitive to husband's earnings. Married women whose husbands have higher earnings are equally likely to choose working in male and integrated occupations, given that the odds ratio of male and integrated occupations is statistically equal to one. The odds ratio of married women whose husbands have higher earnings to choose to work in female occupations over integrated occupations is 0.97. In other words, an increase in \$ 1,000 Reais in their husbands' earned income makes married women 3% less likely to work in female occupations. Even though the odds ratio of married women whose husbands have higher earnings to choose do not work over to work in integrated occupations is not statistically equal to one, an increase in \$ 1,000 Reais in their husbands' earned income makes married women only 0.75% more likely to not work relative to work in integrated occupations.

In 1981, husbands' unearned income does not have any impact on married women's choice to not work, or to work in female, male, or integrated occupations. However, in 2001, husbands' unearned income makes the odds ratio of married women to choose female over integrated occupations equal to 0.72. In this case, an increase in \$ 1,000 Reais in their husbands' unearned income makes married women 28% less likely to choose to work in female occupations compared to working in integrated occupations.

As women's unearned income increases by \$ 1,000 Reais the probability of choosing not to work

over to work in integrated occupations increases by 3.83. The odds ratio of choosing to work in female occupations over working in integrated occupations is 0.45, that is, an increase in unearned income by \$ 1,000 Reais makes women 55 percent less likely to choose female over integrated occupations. However, the odds ratio of choosing to work in male over integrated occupations is statistically equal to one, meaning that to work in male and integrated occupations are equally likely. Therefore, an increase in unearned income makes the option to not work the preferred one.

As women's education increases, women are less likely to not work. However, for women with no schooling the odds ratio to choose to not work over working in integrated occupations is 1.39, meaning that to not work is preferable over to work in integrated occupations if women have no schooling. For the other educational levels women are more likely to choose work in integrated occupations than to not work. Likewise, women with more than primary education are more likely to choose work in integrated occupations than work in female occupations. There is not much difference in the probability of women working in male-dominated and gender-integrated occupations across educational groups, except for women with college degrees, whose odds ratio to choose work in male over integrated occupations is 0.65, meaning that women with college degrees are more likely to work in integrated occupations. In fact, to work in an integrated occupation is the preferred option for women with college degree.

4.6 The Determinants of Men's Participation into Gender Labeled Occupations

Men in 1981 (Table 4.13)

Married men are more likely to work in male occupations. Relative to working in integrated occupations, married men are 1.31 times more likely to work in male occupations. While, the odds ratios of choosing work in female over integrated occupations and choosing not working over integrated occupations are 0.73 and 0.56, respectively. That is, to work in integrated occupations is preferable to married men compared to working in female occupations or not working. However,

to work in male occupations is preferable to married men compared to working in integrated occupations.

As for women, increasing educational levels decreases men's probability of not working. Men with college degrees have a odds ratio of choosing not to work over work in integrated occupations of 0.03. That is, men with college degrees are 97% less likely to not work than to work in integrated occupations. The odds ratio for men with college degree of choosing to work in male over integrated occupations is 0.41, meaning that they are 59% more likely to choose to work in integrated occupations than male occupations. The odds ratio of choosing female over integrated occupations for men with college degree is statistically equal to one. Therefore, work in female and integrated occupations is preferred by college educated men.

Men with higher unearned income are less likely to work in a gender specific-occupation than in an integrated occupation. The odds ratio of working in male over integrated occupations is 0.61 and the odds ratio of working in female over integrated occupations is 0.56. As unearned income increases by \$ 1,000 Reais, the probability of not working is 8.6 times higher than the probability of working in integrated occupations. Therefore, not working is the preferred option when unearned income increases by \$ 1,000 Reais.

Having a child younger than three years old does not impact men's decisions about work and occupations. But, having a child three to five years old decreases men's probability of not working by 15%; the odds ratio of choosing not working over working in integrated occupations is 0.85. Having a child six to ten years old increases men's probability of working in male occupations relative to working in integrated occupations by 1.06 times.

As their wives' earnings increase, married men are less likely to work in male occupations. For a \$ 1,000 Reais increase in wife's earned income, the odds ratio of choosing work in male occupations over integrated occupations is 0.98, that is, they are 2% less likely to work in a male occupation than integrated occupations. The wife's unearned income does not influence the choice of occupation. Men are equally likely to work in any occupation and to not work independently of their wives' unearned income.

Men in 2001 (Table 4.14)

Married men are still more likely to work in male occupations. Relative to working in integrated occupations, married men are 1.24 times more likely to work in male occupations. The odds ratio of married men choosing to work in female over integrated occupations is statistically equal to one. Relative to work in integrated occupations, married men are 37% less likely to not work; the odds ratio is 0.63. Therefore, work in male occupations is the preferable option for married men.

Having a child makes men less likely to not work and more likely to work in male occupations. Having a child 3 years and younger increases men's probability of working in male occupations relative to working in integrated occupations by 1.09 times. The odds ratio of choosing to work in male occupations over integrated occupations is 1.13 for men with children eleven to fifteen years old and 1.14 for men with children sixteen years and older. The odds ratio of choosing work in female occupations over integrated occupations is 1.11 for men with children eleven to fifteen years old.

While in 1981 married men whose wives have higher earned income were more likely to work in male occupations, in 2001 they are equally likely to work in the three types of gendered-labeled occupations. The odds ratios of married men whose wives have higher earnings choosing to work in male over integrated occupations and female over integrated occupations are statistically equal to one. However, the odds ratio of married men whose wives have higher earnings choosing not working over integrated occupations is 0.94, that is they are 5.6% less likely to not work.

Men with higher unearned income are equally likely to work in gender specific-occupations as in integrated occupations. The odds ratios of men with unearned income choosing to work in male over integrated occupations and female over integrated occupations are statistically equal to one. However, the probability of not working is 39 times higher than the probability of working in integrated occupations as unearned income increases by \$ 1,000 Reais.

4.7 The Impact of Participation into Gender Labeled Occupations on Wages

In this section, the impact of working in a gendered occupation on wages is investigated. First, the wage difference among occupations within a gender in a particular year is compared. The results are presented in Table 4.15, column one to four for women in 1981, women in 2001, men in 1981 and men in 2001, respectively. In general, female occupations pay men and women lower earnings than male and integrated occupations, that is, working in female-dominated occupations has a penalty in terms of wage. Also, the results are consistent with the hierarchical interpretation of ability. Higher ability women select themselves in male-dominated occupations in 1981 and in gender-integrated occupations in 2001¹³.

The comparison between men's and women's wages and its evolution is based on the estimates reported in Table 4.16, where all four groups are pooled. The interaction of the dummy for female with the dummy for male-dominated, gender-integrated and female-dominated occupations capture the difference between women's and men's wages for those working in one of these occupations in 1981. The selection of women into gender-integrated and male-dominated occupations has less impact on hourly earnings in 2001 than in 1981, implying that women working in male-dominated occupations increasingly came from the lower end of the ability distribution over time. In 1981, only very high ability women worked in these professions. Now, they have opened up to lower ability women.

Comparing Women's Wage Among Occupations

There exists a negative difference (penalty) between the mean log of hourly wage of female-dominated and gender-integrated occupations in both years after controlling for geographic location, individuals' characteristics and selection into gender-labeled occupations. In other words,

¹³Regressing the residuals of the wage regression on the exclusion restrictions was used as a test of the validity of the exclusion restrictions. If the exclusion restrictions are valid, they should not enter into the wage regression and therefore not be significant in explaining the wage. Indeed, their significance levels vary between men and women and both years. However, there is always at least one exclusion restriction that can be considered valid.

β_{12} is negative and significant on Table 4.15, column 1 and 2. Regarding the mean log of hourly wage of male-dominated occupations after controlling for geographic location, individuals' characteristics and selection into gender-labeled occupations, in 1981 (Table 4.15, column 1), it was higher than the mean log of hourly wage of gender-integrated occupations (premium). However, in 2001 (Table 4.15, column 2), the difference was not statistically significant, indicating that there is no premium for female workers in male occupations in comparison with female workers in gender-integrated occupations. Post-estimation tests confirm a positive difference in the mean log of hourly wage between male- and female-dominated occupations¹⁴, where male-dominated occupations pay a premium to females that is not explained by geographic location, individuals' characteristics and selection into gender-labeled occupations.

In 1981 (Table 4.15, column 1), women who worked in male-dominated occupations had unobserved characteristics that increased their earnings ability, that is, the coefficient of the selectivity-correction term of male-dominated occupations is positive and significant. On the other hand, women who worked in female-dominated occupations had unobserved characteristics that reduced their earnings ability, that is, the coefficient of the selectivity-correction term of female-dominated occupations is negative and significant. However, selection into gender-integrated occupations is not significant, indicating that the distribution of unobserved characteristics in gender-integrated occupations, in 1981, reflects the distribution of unobserved characteristics in the female sample. The story reported by the 1981 data is that there is not a selection of females into gender-integrated occupations, but there is a selection of females into male- and female-dominated occupations, where females selected to male-dominated occupations have above average unobserved characteristics and female with below average unobserved characteristics are crowded in female-dominated occupations.

In 2001 (Table 4.15, column 2), women who worked in female occupations still had unobserved characteristics that reduced their earnings ability. However, there were changes in the distribution of skills in the female population or across the female workers in gender-integrated and male-integrated occupations. As is shown by the coefficient of the selectivity-correction term of male-dominated occupations, there is no significant selection of females workers into male-dominated

¹⁴The test of equality of the coefficients, $\chi^2_{(1)} = 125.06$ $\chi^2_{(1)} = 6.13$ for 1981 and 2001 respectively, is rejected in both years.

occupations. However, the unobserved characteristics of females who enter into integrated occupations increases their earnings ability, as shown by the coefficient of the selectivity-correction term of gender-integrated.

Comparing Men's Wage Among Occupations

In 1981 (Table 4.15, column 3), there exists a penalty in terms of the mean log of hourly wage for male workers in female-dominated occupations relative to males workers in gender-integrated occupations after controlling for geographic location, individuals' characteristics and selection into gender-labeled occupations. The coefficient of the indicator of female-dominated occupations is negative and significant. That is, men who worked in female-dominated occupations received less than men who worked in integrated occupations. However, there is no significant difference between male-dominated and gender-integrated occupations in terms of the mean log of hourly wage. The coefficient of the indicator of male-dominated occupations is not significant. The post-estimation test rejects, at 10% significance level, the equality of the mean log of hourly wage between female- and male-dominated occupations, $\chi^2_{(1)} = 3.55$. Therefore, men who work in female-dominated occupations have a penalty in terms of wage compared to those who work in male-dominated and integrated occupations.

Similar to men who worked in female-dominated occupations, men who worked in male-dominated occupations have a distribution of ability that differed from the rest of the male population. In particular, they have a negative selection, i.e., the coefficients for the selectivity-correction term of female- and male-dominated occupations are negative and significant. In reality, the impacts of unobserved earnings abilities of men working in male- and female-dominated occupations were not significantly different¹⁵. However, men who worked in integrated occupations have a similar skill distribution to the male population; that is, the selectivity-correction term is positive, but not significant.

Differently from 1981, in 2001 (Table 4.15, column 4), men who worked in male-dominated occupations have higher mean log wages than men who worked in gender-integrated occupations, i.e.,

¹⁵The estimated difference in the log of hourly wage is -0.037 and the standard errors are 0.042 .

the coefficient of the indicator of male-dominated occupation is positive and significant. However, as in 1981, the difference in the mean log wage between gender-integrated and female-dominated occupations is negative, i.e., the coefficient of the indicator of female-dominated occupations is negative and significant. The post-estimation test of equality of parameters for the indicators of male- and female-dominated occupations is rejected at 1% significance level, $\chi^2_{(1)} = 42.31$.

Men who work in male-dominated occupations have unobserved characteristics that are positively correlated with earnings ability. That is, the coefficient of the selectivity-correction term of male-dominated occupations is positive and significant. However, men who worked in gender-integrated and female-dominated occupations have negative selection, i.e. the coefficients of the selectivity-correction terms of these two occupations are negative.

Comparing Women's and Men's Wages

The results reported here are based on the pooled regression, for which estimates are presented in Table 4.16. In 1981, male-dominated occupations have a premium in terms of wage compared to gender-integrated occupation. This premium is equal for male and female workers in male-dominated occupations, as shown by the coefficients of male-dominated occupations and the indicator of women in male-dominated occupations, respectively. In 2001, this premium for male-dominated occupations decreased for men and women. In fact, it become a penalty in terms of wage, -0.226 for men¹⁶ and -0.876 for women¹⁷, and the penalty for women in male occupations in 2001 is 0.65 higher than the penalty for men in male occupations.

Compared to male workers in gender-integrated occupations, male workers face no premium or penalty in terms of wage working in female occupations in 1981, as shown by the coefficient on female occupations. Moreover, there is no premium or penalty in terms of wage for female workers working in female-dominated occupations compared to male workers working in female-dominated occupations, as shown by the coefficient of the interaction of indicators of female occupation and

¹⁶The impact of male occupation in 2001 on men's wage is the sum of the coefficient of male occupations and the coefficient of the interaction of male occupation and the dummy for 2001.

¹⁷The impact of male occupation in 2001 on women's wage is the sum of the impact of male occupation in 2001 on men's wage, the coefficient of the interaction of dummy for women and male occupations and the coefficient of the interaction of male occupation and dummy for women and the dummy for 2001.

female. However, in 2001, there is a penalty in terms of wage for men and women working in female-dominated occupations compared to workers in gender-integrated occupations. This penalty is 0.44 higher for female workers than for male workers in female-dominated occupations.

In 1981, there is no premium or penalty in terms of wage for female workers working in integrated occupations compared to male workers in gender-integrated occupations, as shown by the coefficient on the interaction of dummy for women and integrated occupation. But, in 2001, there is a penalty in terms of wage for men and women working in integrated occupations. Indeed, this penalty for women working in integrated occupations is 0.66 higher than the penalty for men working in integrated occupations, as shown by the coefficients on the interaction of integrated occupation and the dummy for 2001 and the interaction of integrated occupation, the dummy for women, and the dummy for 2001, respectively.

In 1981, men who work in male-dominated occupations have unobserved characteristics that reduce their wages, as shown by the coefficient of the selection into male-dominated occupation, while women working in male-dominated occupations have unobserved characteristics that increase their earnings ability, as shown the coefficient of selection into male-dominated occupation for women. However, this selection of men and women into male-dominated occupations has changed in 2001. It becomes easier for all skill type women to enter into male occupations, that is, the distribution of women's skill in male-dominated occupations is similar to the distribution of the female population, as shown by the non-significance of the selectivity-correction term of women into male-dominated occupation in 2001¹⁸. Moreover, it becomes more difficult for men with lower unobserved earnings ability to enter into male-dominated occupations, i.e., the distribution of men's skill in male-dominated occupations is more concentrated on higher skills than in 1981, as shown by the interaction of year and the selectivity-correction term of men into male-dominated occupations.

The selection of men and women into female-dominated occupations is negative in 1981, as shown by the coefficients of the selection into female-dominated occupations and the interaction of selection into female-dominated occupations and dummy for women. There is no significant change between 1981 and 2001, as shown by the non-significance of the coefficients of the interactions of

¹⁸The sum of the coefficients of selection of women into male occupations and the interaction of women into male occupations and dummy for 2001 is -0.051 and the standard error is 0.048.

dummy for 2001 and the selection of men into female occupations and the interactions of dummy for 2001 and the selection of women into female occupations. Therefore, in both years, the distribution of skill in female-dominated occupations is more concentrated on low skill, and the distribution of female workers in female-dominated occupations is more concentrated on low skill than the distribution of male workers.

Whereas, in 1981, selection of men into gender-integrated occupations is negative, as shown by the coefficient of selection into gender-integrated occupations, the selection of women into integrated occupations was not significant¹⁹. The impact of women's selection into gender-integrated occupations is estimated by summing the coefficients of selection into integrated occupations and the interaction of selection into gender-integrated occupations and dummy for women. However, in 2001, men with higher unobserved earnings ability relative to those who worked in integrated occupations in 1981 have entered into integrated occupations as shown by the coefficient on the interaction of selection into gender-integrated occupations and the dummy for 2001. On the other hand, women with lower unobserved earnings ability than the women who worked in gender-integrated occupations in 1981 have entered into integrated occupations in 2001, as shown by the coefficient on the interaction of selection into integrated occupations, dummy for women and dummy for 2001. That is, the distribution of skill in gender-integrated occupations becomes less concentrated on high skill women.

Gender Differences in Returns to Schooling

Here, the gender difference in returns to schooling in a given occupational group is discussed. The estimates are shown in table 4.17, they are the outcome of running separate regressions for each type of occupation. Only the estimates of the returns to schooling are displayed since the other parameters are roughly the same as before. The first column shows the males' returns to schooling and the second column shows the difference between males' and females' returns to schooling, which is the coefficient of the interaction of female with the dummies for educational level.

Looking at the difference between male and female workers' returns to schooling avoids the bias

¹⁹The estimated impact of selection into integrated occupations on women's wage is 0.002 with a 0.02 standard error.

in estimating returns to schooling due to omitted variables. Because omitted variables bias returns to schooling of males and females in the same direction and magnitude, the difference is free from this bias. For that reason, this section focuses on the difference of returns to schooling of female and male workers.

In 1981, there is no difference in returns to schooling of male and female workers in female-dominated occupations, except for high school. However, female workers with high school degree have higher returns to schooling than male workers in male-dominated occupations. Except for women with college degrees, women working in gender-integrated occupations have lower returns to schooling than men working in gender-integrated occupations.

In 2001, women with no schooling or with high school degrees have lower returns to schooling than men working in female-dominated occupations. However, women with college degrees working in female-dominated occupations have a 0.27 higher return to schooling than men with college degrees working in female-dominated occupations. In male-dominated occupations, there is no statistically significant difference in returns to schooling of female and male workers. Except for women with no schooling, women working in gender-integrated occupations have lower returns to schooling than men working in gender-integrated occupations.

4.8 Conclusions

Even after the institutional changes that Brazil underwent from 1981 to 2001 that favored women in the labor market, 70% of the working women are still crowded into few occupations that are less desired in terms of wage rates. To understand their reasons for crowding themselves into these occupations, this paper uses a version of the Roy's model to test whether gender roles contribute to their career choice. It is also possible in this model to verify whether women suffer a penalty in terms of wage by working in female-dominated occupations. That is, whether women working in female-dominated occupations have lower wage rates than women working in other occupations, independently of their schooling, age, place of residence and selection into occupations.

As shown by the results, gender roles have their share of responsibility for women being crowded into female-dominated occupations. Married women are 1.14 times more likely to work in female-

dominated occupations than to work in gender-integrated occupations in both years. Having a child six years and older increases on average by 12% the probability of women working in female-dominated occupations instead of gender-integrated occupations in 2001.

Indeed, being crowded into female-dominated occupations imposes a penalty in terms of wages for women that does not depend on their schooling, age, place of residence, and selection into occupations. If women could change from female-dominated occupations to gender-integrated occupations, their log of hourly wages would increase by 0.81. However, it becomes easier for all types of women to enter into male-dominated and gender-integrated occupations in 2001 compared to 1981.

It becomes easier for all types of women to enter into gender-integrated and male-dominated occupations. However, women are still being crowded into female-dominated occupations due to their gender roles. Therefore, to increase the effectiveness of the anti-discrimination laws, it is crucial to combine measures that can lessen the impact of gender roles on women's career choice. Measures such as increasing children's school time could help to freer women's time enabling them to choose occupations that are less flexible in hours and higher paying.

However, measures to relieve the impact of women's gender roles will not be fully effective in promoting their entry into gender-integrated occupations if women continue to have lower returns to schooling than men in these occupations. For women with college degrees, female-dominated occupations give them higher returns to schooling compared to men with college degrees in female-dominated occupations. In male-dominated occupations men and women have equal returns to schooling. Therefore, it is necessary to understand the reasons why women have lower returns to schooling than men in gender-integrated occupations to be able to mitigate this difference and to promote a more gender-integrated labor market.

4.9 Tables

Table 4.1. Descriptive statistics, Employees (Non-Military) and Non-Workers Women, Aged 30-40, Brazil 1981 and 2001.

Variables	1981		2001	
	Mean	Std. Dev.	Mean	Std. Dev.
Percentage of workers	0.3076	(0.4615)	0.5213	(0.4995)
Percentage of Urban Residents	0.4189	(0.4934)	0.5661	(0.4956)
Percentage of Metropolitan Residents	0.3667	(0.4819)	0.3600	(0.4800)
Percentage of Residents in the North Region	0.0235	(0.1515)	0.0534	(0.2249)
Percentage of Residents in the Northeast Region	0.2608	(0.4391)	0.2412	(0.4278)
Percentage of Residents in the Southeast Region	0.4965	(0.5000)	0.4780	(0.4995)
Percentage of Residents in the South Region	0.1536	(0.3605)	0.1495	(0.3566)
Percentage of Residents in the Centralwest Region	0.0656	(0.2476)	0.0778	(0.2679)
<u>Characteristics of Individual</u>				
Age	34.5887	(3.1790)	34.8373	(3.1458)
Percentage of Individuals by educational Level:	0.0000	0.0000	0.0000	0.0000
None	0.2190	(0.4136)	0.0822	(0.2747)
First to Fourth Grade	0.4416	(0.4966)	0.2413	(0.4279)
Fifth to Eighth Grade	0.1619	(0.3684)	0.2835	(0.4507)
High School	0.1058	(0.3076)	0.2570	(0.4370)
College	0.0716	(0.2579)	0.1361	(0.3429)
Unearned Income	22.8521	(169.1570)	31.1560	(230.9455)
Percentage Married	0.8496	(0.3574)	0.7616	(0.4261)
Number of Observations:	N = 28074		N = 25431	
<u>Conditional on Work:</u>				
Hourly Earnings (in Reais of 2001)	3.6152	(4.6371)	3.2405	(5.3696)
Hours Working	40.4461	(13.2222)	38.9519	(12.2049)
<u>Percentage of Workers in:</u>				
Male Occupations	0.0502	(0.2183)	0.0473	(0.2122)
Integrated Occupations	0.2292	(0.4203)	0.2529	(0.4347)
Female Occupations	0.7206	(0.4487)	0.6998	(0.4583)
Number of Observations:	N = 9322		N = 13366	
<u>Characteristics of Household</u>				
Number of Children	3.2560	(2.1858)	2.0328	(1.3359)
Number of Children younger than 3 years old	0.4442	(0.6393)	0.1922	(0.4314)
Number of Children 3 to 5 years old	0.5332	(0.6872)	0.2709	(0.5029)
Number of Children 6 to 10 years old	1.0134	(0.9919)	0.6197	(0.7454)
Number of Children 11 to 15 years old	0.8695	(1.0274)	0.6376	(0.7812)
Number of Children older than 16	0.3957	(0.8069)	0.3124	(0.6492)
Number of Observations:	N = 24699		N = 22446	
<u>Conditional on Being Married:</u>				
Spouse's Hourly Earnings (in Reais of 2001)	4.8435	(7.7417)	4.0233	(10.6180)
Spouse's Unearned Income (in 1,000 of Reais of 2001)	59.4700	(286.0027)	42.4290	(433.1935)
Number of Observations:	N = 21773		N = 17839	
Source: PNAD 1981 and 2001.				

Table 4.2. Descriptive statistics, Employees (Non-Military) and Non-Workers Men, Aged 30-40, Brazil 1981 and 2001.

Variables	1981		2001	
	Mean	Std. Dev.	Mean	Std. Dev.
Percentage of workers	0.9207	(0.2702)	0.8522	(0.3549)
Percentage of Urban Residents	0.4075	(0.4914)	0.5478	(0.4977)
Percentage of Metropolitan Residents	0.4045	(0.4908)	0.3488	(0.4766)
Percentage of Residents in the North Region	0.0228	(0.1493)	0.0538	(0.2256)
Percentage of Residents in the Northeast Region	0.2248	(0.4174)	0.2371	(0.4253)
Percentage of Residents in the Southeast Region	0.5384	(0.4985)	0.4811	(0.4996)
Percentage of Residents in the South Region	0.1503	(0.3574)	0.1504	(0.3574)
Percentage of Residents in the Centralwest Region	0.0636	(0.2441)	0.0777	(0.2677)
<u>Characteristics of Individual</u>				
Age	34.5261	(3.1747)	34.8164	(3.1608)
Percentage of Individuals by educational Level:	0.0000	0.0000	0.0000	0.0000
None	0.1895	(0.3919)	0.1113	(0.3145)
First to Fourth Grade	0.4269	(0.4946)	0.2499	(0.4330)
Fifth to Eighth Grade	0.1825	(0.3863)	0.2967	(0.4568)
High School	0.1019	(0.3025)	0.2401	(0.4271)
College	0.0992	(0.2990)	0.1020	(0.3026)
Unearned Income (in Reais of 2001)	32.9820	(202.6310)	18.8201	(162.7255)
Percentage Married	0.8977	(0.3031)	0.8386	(0.3679)
Number of Observations:	N=20943		N = 19731	
<u>Conditional on Work:</u>				
Hourly Earnings	4.9347	(7.0014)	3.6902	(5.6700)
Hours Working	48.2802	(11.1780)	46.3107	(10.6549)
<u>Percentage of Workers in:</u>				
Male Occupations	0.6150	(0.4866)	0.5515	(0.4973)
Integrated Occupations	0.3122	(0.4634)	0.3595	(0.4798)
Female Occupations	0.0728	(0.2598)	0.0890	(0.2848)
Number of Observations:	N = 19225		N = 16735	
<u>Characteristics of Household</u>				
Number of Children	2.6246	(1.8692)	1.7735	(1.2928)
Number of Children younger than 3 years old	0.5590	(0.6758)	0.2641	(0.4949)
Number of Children 3 to 5 years old	0.6046	(0.7050)	0.3283	(0.5448)
Number of Children 6 to 10 years old	0.8825	(0.9685)	0.6169	(0.7551)
Number of Children 11 to 15 years old	0.4643	(0.8358)	0.4283	(0.6989)
Number of Children older than 16	0.1141	(0.4279)	0.1360	(0.4262)
Number of Observations:	N = 18478		N = 16128	
<u>Conditional on Being Married:</u>				
Spouse's Hourly Earnings (in Reais of 2001)	1.0558	(3.4497)	1.4326	(3.4306)
Spouse's Unearned Income (in 1,000 of Reais of 2001)	5.7056	(64.4132)	13.1040	(98.0228)
Number of Observations:	N = 17484		N = 14785	
Source: PNAD 1981 and 2001.				

Table 4.3. Occupations by Gender Labels, Brazil 1981 - 2001.

Occupations	1981		2001		2001 (1981 classification)	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Male	203	57.83	191	53.95	154	43.5
Integrated	61	17.38	83	23.45	102	28.81
Female	87	24.79	80	22.6	98	27.68
Total	351	100	354	100	354	100

Source: PNAD 1981 and 2001.

Table 4.4. Mean Hourly Wages by Gender Labels, Brazil 1981 - 2001.

Occupations	Total	1981		Total	2001	
		Men	Women		Men	Women
Male	5.4265	5.4150	5.8289	3.4638	3.4457	3.7153
Integrated	5.9350	6.1486	5.2769	3.1036	3.3245	2.7962
Female	3.8529	5.2049	3.5398	2.9278	4.1729	2.7216
Total		5.6249	4.0067		3.4649	2.7921

Source: PNAD 1981 and 2001.

The wages are presented in value of 2001 Reais.

Table 4.5. Top 20 Male-Dominated Occupations in 1981 Brazil, in descending order.

Code	<u>Occupation</u>	Number of Workers	<u>Education</u>	
	Name		Mean	Std. Dev.
301	Meat farmer/producer	922581	1.66	2.02
751	Driver	478433	4.47	2.46
512	Stonemason /Building Contractor	373207	2.80	2.32
924	Manual Worker	248980	2.00	2.34
40	Foreman/person in charge in an office	138803	9.66	3.88
10	Small Store Owner (employer)	133199	7.21	4.10
513	Laborer Stonemason /Assistant Building Contractors	131401	2.59	2.30
482	Carpenter	107087	2.94	2.43
424	Automobile Mechanic	98090	4.76	2.74
425	Mechanic	94346	5.55	3.14
852	Soldier/Officers' Mess	93088	7.52	3.04
843	Night Watchman/ Security Guard	79510	2.75	2.60
1	Retail Business/Store Owner	76035	3.23	3.31
8	Transformation Industry (Employer)	75244	7.48	4.36
514	Painter	69023	3.82	2.28
481	Cabinet-maker	62439	4.18	2.53
631	Travel Sellers	58957	8.54	3.40
33	Manager in transformation industry	55256	11.00	4.27
426	Welder	53475	4.33	2.40
182	Accountant	52400	12.65	2.57
Total number of workers working in male occupations		5092133		
Share of workers in all male occupations in top 20 male occupations		66.80%		

Table 4.6. Top 20 Gender-Integrated Occupations in 1981 Brazil, in descending order.

Code	<u>Occupation</u>	Number of Workers	<u>Education</u>	
	Name		Mean	Std. Dev.
601	store owner (self-employed)	311908	4.08	3.42
65	office assistant	247299	9.16	3.04
602	sellers	213065	6.06	3.08
35	retail manager	65964	8.57	3.64
151	physician/doctor	49719	16.73	0.83
611	market trader, stallholder	48474	3.24	2.83
53	clerk	39598	10.74	2.57
64	assistant managers	39409	10.06	3.33
233	lawyer	33815	15.61	0.74
920	garbage man	31429	2.00	2.12
212	college/university professor	28264	15.77	1.27
841	doorman	25476	4.32	2.83
152	dentist	21671	14.00	3.40
447	weaver	21395	4.22	2.06
58	typist / data analyst	20864	10.49	2.27
191	accountantstechnician	18568	11.33	1.81
613	sweet-seller	16048	2.47	2.20
752	conductor	15898	4.44	2.13
50	tax inspector/ customs officer	15009	9.50	4.62
181	economist	14300	14.40	1.65
Total number of workers working in gender-integrated occupations		2891689		
Share of workers in all integrated occupations in top 20 integrated occupations		44.20%		

Table 4.7. Top 20 Female-Dominated Occupations in 1981 Brazil, in descending order.

Code	Occupation	Number of Workers	Education	
	Name		Mean	Std. Dev.
805	Housekeeper	429823	3.02	2.36
470	Tailor/ Seamstress	268720	4.20	2.69
844	Laborer/ Servant	242930	3.03	2.45
215	Teacher in Primary School	147963	10.26	3.24
824	Manicure	132234	5.61	2.66
617	Street Seller	112326	4.43	3.35
162	Nurse (without degree)	99387	7.31	3.04
216	Teacher Primary and Middle School	97687	10.15	3.60
813	Cook	88596	3.28	2.45
59	Secretary	82036	10.49	2.76
21	Manager in Public Service	62392	11.90	3.84
815	Bartender	53425	4.50	2.62
214	Teacher in Middle School	51396	13.35	2.05
52	Assistant Manager	51327	10.77	3.15
336	Worker in Vegetable Extraction	50427	0.57	1.22
213	Teacher in High School	47850	14.18	1.67
474	Embroidery-maker	38581	4.08	2.94
584	Packing Worker	36239	4.31	2.46
821	Hair Stylist	34935	5.80	2.73
478	Worker in Shoe Factory	34061	4.38	2.33
Total number of workers working in female occupations		2573620		
Share of workers in all female occupation in top 20 female occupations		84.02%		

Table 4.8. Top 20 Male-Dominated Occupations in 2001 Brazil, in descending order.

Code	<u>Occupation</u>		<u>Education</u>			<u>Education in 81</u>		
	Name	Number of Workers	Mean Years of Schooling	Std. Dev.	Status in 81	Mean Years of Schooling	Std. Dev.	
301	Meat Farmer/Producer Driver Stonemason /Building Contractor Manual Worker Laborer Stonemason /Assistant Building Contractor Night Watchman/ Security Guard Soldier / Fireman Automobile Mechanic Guard Worker in transformation industry Painter Cabinet-maker, Joiner Mechanic Doorman Manager in transformation industry Build Electrician Travel Sellers Tractor Driver Machine Electrician Welder	845492	2.44	2.78	male	1.66	2.02	
751		810292	6.44	3.23	male	4.47	2.46	
512		781642	4.20	2.90	male	2.80	2.32	
924		295089	4.59	3.28	male	2.00	2.34	
513		272750	4.72	3.10	male	2.59	2.30	
843		208113	5.25	3.77	male	2.75	2.60	
862		201639	10.27	2.27	male	7.63	2.90	
424		196751	6.58	3.11	male	4.76	2.74	
869		137795	7.63	3.20	male	6.51	3.88	
589		130887	7.60	3.33	integrated	5.00	3.15	
514		120470	5.57	2.96	male	3.82	2.28	
481		116828	6.39	3.32	male	4.18	2.53	
425		113301	7.59	3.49	male	5.55	3.14	
841		106665	6.70	3.68	integrated	4.32	2.83	
33		98069	11.37	3.85	male	11.00	4.27	
506	95876	7.13	3.10	male	5.37	3.01		
631	94007	10.38	3.05	male	8.54	3.40		
303	93791	4.33	2.93	male	3.28	2.49		
503	87582	8.30	3.43	male	9.92	3.04		
426	76644	6.24	3.09	male	4.33	2.40		
Total number of workers working in male occupations		7357918						
Share of workers in all male occupation in top 20 male occupations		66.37%						

Table 4.9. Top 20 Gender-Integrated Occupations in 2001 Brazil, in descending order.

Code	Occupation	Name	Education			Education in 81		
			Number of Workers	Mean Years of Schooling	Std. Dev.	Status in 81	Mean Years of Schooling	Std. Dev.
304	meat worker seller		1874325	3.11	2.86	integrated	1.87	2.09
602			790050	8.37	3.30	integrated	6.06	3.08
601	store owner (self-employed)		734396	6.41	4.09	integrated	4.08	3.42
64	Assistant Manager		498042	10.68	2.79	integrated	10.06	3.33
10	Small Store Owner (employer)		373244	9.83	3.90	male	7.21	4.10
40	Foreman / Person in charge in an office		209863	10.18	3.68	male	9.66	3.88
35	Retail Manager		181804	10.81	3.09	integrated	8.57	3.64
15	Services Business Owner		155886	11.33	3.99	integrated	4.08	3.42
21	Manager in Public Service		149240	12.37	3.42	female	11.90	3.84
8	Transformation Industry (employer)		131927	9.76	4.26	male	7.48	4.36
151	physician/doctor		102974	16.49	1.28	integrated	16.73	0.83
233	Lawyer		90607	15.70	1.12	integrated	15.61	0.74
478	Worker in shoe factory		88029	6.47	2.91	female	4.38	2.33
814	Waitress/Waiter		79272	7.21	2.98	male	4.83	2.72
39	Other Manager		73675	12.51	3.37	integrated	11.47	4.25
537	Baker		72071	6.14	3.35	male	3.25	2.32
584	Packing Worker		70307	7.28	3.14	female	4.31	2.46
182	Accountant		65031	14.00	2.16	male	12.65	2.57
586	Worker in latex/plastic industry		61220	7.59	3.14	integrated	4.09	2.25
611	Market Trader, Stallholder		49072	4.76	3.54	integrated	3.24	2.83
Total number of workers working in gender-integrated occupations			7355000					
Share of workers in all gender-integrated occupations in top 20 integrated occupations			79.55%					

Table 4.10. Top 20 Female-Dominated Occupations in 2001 Brazil, in descending order.

Code	Occupation Name	Number of Workers	Education		Status in 81	Education in 81	
			Mean Years of Schooling	Std. Dev.		Mean Years of Schooling	Std. Dev.
807	Housekeeper	1238968	4.87	3.14	female	3.02	2.36
844	Laborer/ Servant	469053	5.00	3.28	female	3.03	2.45
617	Street Seller	377742	5.93	3.74	female	4.43	3.35
215	Teacher in Primary School	337573	12.07	2.40	female	10.26	3.24
470	Tailor/ Seamstress	327098	6.40	3.32	female	4.20	2.69
813	Cook	292489	5.59	3.25	female	3.28	2.45
162	Nurse (without degree)	232849	10.17	2.55	female	7.31	3.04
63	Receptionist	214449	10.29	2.53	female	8.22	3.22
214	Teacher in Middle School	199719	13.27	2.47	female	13.35	2.05
821	Hair Stylist	151674	7.83	3.26	female	5.80	2.73
59	Secretary	136273	11.23	2.43	female	10.49	2.76
213	Teacher in High School	125510	14.52	1.78	female	14.18	1.67
824	Manicure	117963	7.18	3.22	female	5.61	2.66
815	Bartender	115713	6.88	3.15	female	4.50	2.62
603	Cashier	104552	9.53	2.55	female	7.59	2.89
52	Assistant Manager	101204	11.99	2.56	female	10.77	3.15
53	Clerk	84588	11.86	2.94	integrated	10.74	2.57
474	Embroidery-maker	71272	5.54	3.63	female	4.08	2.94
217	Teacher in Kindergarten	70004	11.76	2.16	female	10.46	3.03
825	Laundress	68699	3.59	3.21	female	1.73	2.07
	Total number of workers working in female occupations	6130092					
	Share of workers in all female occupation in top 20 female occupations	78.91%					

Table 4.11. Multinomial Logit, Brazilian Women Aged 30 to 40 in 1981.

	Male odds-ratio/se	Female odds-ratio/se	Non-workers odds-ratio/se
<u>Geographic Location:</u>			
Urban Residents	1.3835 (0.3280)	3.1178*** (0.3090)	1.2100* (0.1026)
Metropolitan Residents	2.3727*** (0.5350)	3.7591*** (0.3651)	1.1249 (0.0933)
North Region	0.8205 (0.1747)	0.8229 (0.0842)	0.9219 (0.0926)
Northeast Region	0.6749** (0.0978)	0.9105 (0.0608)	0.9571 (0.0619)
South	1.1392 (0.1614)	1.0222 (0.0761)	0.8285** (0.0604)
Central West Region	0.6910	1.4104***	1.3255***
<u>Characteristics of Individual:</u>			
	(0.1374)	(0.1218)	(0.1129)
Age	1.2904 (0.5503)	1.2319 (0.2516)	0.9777 (0.1941)
Age Squared	0.9963 (0.0061)	0.9974 (0.0029)	1.0006 (0.0029)
No Education	0.4728*** (0.0980)	0.5151*** (0.0450)	0.7064*** (0.0562)
Fifth to Eighth Grade	0.6264** (0.1033)	0.5645*** (0.0464)	0.4895*** (0.0380)
High School	0.6469** (0.1037)	0.5382*** (0.0433)	0.1128*** (0.0091)
College	0.6766* (0.1152)	0.5453*** (0.0474)	0.0237*** (0.0024)
Number of Children younger than 3 years old	1.0356 (0.1155)	0.9540 (0.0504)	1.4541*** (0.0716)
Number of Children 3 to 5 years old	0.9842 (0.1042)	1.0189 (0.0493)	1.2753*** (0.0577)
Number of Children 6 to 10 years old	0.8993 (0.0680)	1.0543 (0.0350)	1.1711*** (0.0365)
Number of Children 11 to 15 years old	0.9786 (0.0714)	0.9785 (0.0321)	0.9411* (0.0291)
Number of Children older than 16	0.9242 (0.0969)	1.0164 (0.0454)	1.0985* (0.0462)
Unearned Income (in 1000)	0.1852** (0.1064)	0.4734*** (0.0836)	4.2500*** (0.6986)
Married or Partnered	0.7247* (0.0946)	1.1428* (0.0731)	4.7271*** (0.3092)
Husband's Unearned Income (in 1000)	0.8495 (0.1993)	0.9291 (0.0838)	1.1295 (0.0947)
Husband's Earnings	1.0068 (0.0083)	0.9814*** (0.0043)	1.0499*** (0.0044)
Constant	0.0034 (0.0247)	0.0272 (0.0959)	3.3840 (11.5897)
Pseudo R-squared	0.1730		
Model chi-square	8439.3372		
Number of Observations:	28074		
Hausman-MacFadden IIA Test ($\chi^2(20)$)	12.98		
prob.	0.8782		

Standard errors in parentheses.

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

Omitted Categories: Rural Residents, Southeast Region, First to Fourth Grade, Childless and Single.

Table 4.12. Multinomial Logit, Brazilian Women Aged 30 to 40 in 2001.

	Male odds-ratio/se	Female odds-ratio/se	Non-workers odds-ratio/se
<u>Geographic Location:</u>			
Urban Residents	1.3648 (0.3158)	1.6288*** (0.1539)	1.5737*** (0.1445)
Metropolitan Residents	1.9282** (0.4460)	1.6651*** (0.1593)	1.6346*** (0.1521)
North Region	1.1668 (0.1773)	1.0434 (0.0787)	1.2314** (0.0927)
Northeast Region	0.7972 (0.0969)	1.1003 (0.0602)	1.3157*** (0.0720)
South	0.9627 (0.1170)	0.8255** (0.0482)	0.6457*** (0.0389)
Central West Region	1.2801 (0.1795)	1.2474** (0.0867)	0.9726 (0.0695)
<u>Characteristics of Individual:</u>			
Age	0.9126 (0.3150)	0.9862 (0.1616)	0.7812 (0.1295)
Age Squared	1.0013 (0.0050)	1.0005 (0.0024)	1.0038 (0.0024)
No Education	1.1665 (0.2949)	0.8730 (0.1045)	1.3925** (0.1603)
Fifth to Eighth Grade	0.9838 (0.1560)	0.7194*** (0.0531)	0.6616*** (0.0477)
High School	0.8666 (0.1286)	0.3623*** (0.0252)	0.2271*** (0.0155)
College	0.6513* (0.1088)	0.3872*** (0.0295)	0.0605*** (0.0051)
Number of Children younger than 3 years old	0.8770 (0.1130)	0.9254 (0.0538)	1.5614*** (0.0866)
Number of Children 3 to 5 years old	1.0455 (0.1060)	1.0100 (0.0488)	1.2233*** (0.0576)
Number of Children 6 to 10 years old	1.0115 (0.0706)	1.0853* (0.0353)	1.2050*** (0.0386)
Number of Children 11 to 15 years old	1.0430 (0.0699)	1.1508*** (0.0363)	1.0429 (0.0328)
Number of Children older than 16	1.1121 (0.0934)	1.1180** (0.0464)	1.0665 (0.0441)
Unearned Income (in 1000)	1.2018 (0.3624)	0.4542*** (0.0825)	3.8249*** (0.5871)
Married or Partnered	0.9224 (0.0939)	1.1362** (0.0561)	2.4844*** (0.1274)
Husband's Unearned Income (in 1000)	0.5503 (0.1870)	0.7153*** (0.0699)	1.0275 (0.0782)
Husband's Earnings	0.9986 (0.0063)	0.9661*** (0.0037)	1.0074** (0.0028)
Constant	0.7352 (4.3958)	2.6859 (7.6253)	111.0646 (318.8440)
Pseudo R-squared	0.0843		
Model chi-square	4633.3664		
Number of Observations:	2.54e+04		
Hausman-MacFadden IIA Test($\chi^2(20)$)	8.56		
prob.	0.9874		

Standard errors in parentheses.

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

Omitted Categories: Rural Residents, Southeast Region, First to Fourth Grade, Childless and Single.

Table 4.13. Multinomial Logit, Brazilian Men Aged 30 to 40 in 1981.

	Male odds-ratio/se	Female odds-ratio/se	Non-workers odds-ratio/se
<u>Geographic Location:</u>			
Urban Residents	4.9118*** (0.2790)	6.2264*** (0.8857)	9.3652*** (1.4203)
Metropolitan Residents	6.5680*** (0.3708)	9.9106*** (1.3842)	14.7897*** (2.2010)
North Region	1.0826 (0.0873)	1.6960*** (0.2137)	0.8095 (0.1415)
Northeast Region	1.0834 (0.0528)	1.4221*** (0.1226)	1.5243*** (0.1371)
South	1.2029*** (0.0658)	1.3584** (0.1283)	0.9597 (0.1065)
Central West Region	0.8064*** (0.0452)	1.6040*** (0.1444)	0.9638 (0.1060)
<u>Characteristics of Individual:</u>			
Age	1.1243 (0.1631)	0.8204 (0.2022)	1.7077 (0.4852)
Age Squared	0.9984 (0.0021)	1.0031 (0.0035)	0.9930 (0.0040)
No Education	0.5827*** (0.0314)	0.5462*** (0.0602)	0.8008* (0.0779)
Fifth to Eighth Grade	0.8393** (0.0456)	0.8439 (0.0772)	0.6440*** (0.0617)
High School	0.4554*** (0.0278)	0.6751*** (0.0685)	0.2117*** (0.0294)
College	0.4056*** (0.0266)	0.9342 (0.0920)	0.0316*** (0.0082)
Number of Children younger than 3 years old	1.0293 (0.0286)	0.9217 (0.0460)	0.9905 (0.0548)
Number of Children 3 to 5 years old	1.0205 (0.0273)	0.9593 (0.0458)	0.8520** (0.0465)
Number of Children 6 to 10 years old	1.0572** (0.0215)	0.9855 (0.0359)	1.0244 (0.0395)
Number of Children 11 to 15 years old	1.0013 (0.0255)	0.9994 (0.0449)	0.9923 (0.0453)
Number of Children older than 16	0.9582 (0.0445)	0.9042 (0.0766)	1.0773 (0.0802)
Unearned Income (in 1000)	0.6085*** (0.0796)	0.5626** (0.1207)	8.6365*** (1.3298)
Married or Partnered	1.3053** (0.1120)	0.7271* (0.0915)	0.5639*** (0.0768)
Wife's Unearned Income (in 1000)	0.9998 (0.0003)	0.9996 (0.0005)	1.0010* (0.0004)
Wife's Earnings	0.9765*** (0.0052)	0.9988 (0.0067)	0.9743 (0.0161)
Constant	0.0648 (0.1627)	1.4726 (6.2851)	0.0000* (0.0000)
Pseudo R-squared	0.0818		
Model chi-square	3094.1039		
Number of Observations:	1.85e+04		
Hausman-MacFadden IIA Test ($\chi^2(21)$) prob.	18.76 0.6006		

Standard errors in parentheses.

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

Omitted Categories: Rural Residents, Southeast Region, First to Fourth Grade, Childless and Single.

Table 4.14. Multinomial Logit, Brazilian Men Aged 30 to 40 in 2001.

	Male odds-ratio/se	Female odds-ratio/se	Non-workers odds-ratio/se
<u>Geographic Location:</u>			
Urban Residents	4.0512*** (0.2558)	2.5660*** (0.3169)	4.7234*** (0.4500)
Metropolitan Residents	5.0063*** (0.3296)	3.7099*** (0.4657)	7.3661*** (0.7186)
North Region	0.9113 (0.0567)	1.3287** (0.1315)	1.1428 (0.0953)
Northeast Region	1.0232 (0.0468)	1.4305*** (0.1057)	1.3220*** (0.0791)
South	1.0655 (0.0554)	0.7543** (0.0722)	0.6952*** (0.0552)
Central West Region	0.9303 (0.0536)	1.1109 (0.1065)	0.8119* (0.0683)
<u>Characteristics of Individual:</u>			
Age	0.9620 (0.1326)	1.2364 (0.2847)	1.0666 (0.2008)
Age Squared	1.0006 (0.0020)	0.9969 (0.0033)	0.9992 (0.0027)
No Education	0.5745*** (0.0371)	0.5988*** (0.0747)	1.1042 (0.0839)
Fifth to Eighth Grade	1.1531** (0.0572)	1.0797 (0.0975)	0.8677* (0.0564)
High School	0.7708*** (0.0393)	1.0974 (0.0977)	0.4137*** (0.0294)
College	0.3167*** (0.0217)	1.6467*** (0.1605)	0.1007*** (0.0127)
Number of Children younger than 3 years old	1.0868* (0.0419)	0.9474 (0.0641)	0.7517*** (0.0454)
Number of Children 3 to 5 years old	1.0498 (0.0364)	0.9332 (0.0566)	0.7997*** (0.0424)
Number of Children 6 to 10 years old	1.0327 (0.0257)	0.9494 (0.0415)	0.7597*** (0.0287)
Number of Children 11 to 15 years old	1.1288*** (0.0326)	1.1124* (0.0547)	0.8822** (0.0374)
Number of Children older than 16	1.1389** (0.0531)	0.9285 (0.0804)	0.8366* (0.0582)
Unearned Income (in 1000)	0.7395 (0.2165)	1.3376 (0.5228)	39.2992*** (10.6468)
Married or Partnered	1.2360*** (0.0676)	0.9954 (0.0851)	0.6330*** (0.0411)
Wife's Unearned Income (in 1000)	0.9999 (0.0002)	0.9990 (0.0005)	1.0008** (0.0003)
Wife's Earnings	0.9900 (0.0055)	0.9888 (0.0077)	0.9448*** (0.0132)
Constant	0.7069 (1.6888)	0.0023 (0.0091)	0.0760 (0.2480)
Pseudo R-squared	0.065		
Model chi-square	3122.99		
Number of Observations:	19933		
Hausman-MacFadden IIA Test ($\chi^2(20)$)	4.69		
prob.	0.9998		

Standard errors in parentheses.

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

Omitted Categories: Rural Residents, Southeast Region, First to Fourth Grade, Childless and Single.

Table 4.15. Wage Regression Brazilian Men and Women Aged 30 to 40, Dependent Variable: Log of Hourly Wages in Reais of 2001.

	Female 1981 b/se	Female 2001 b/se	Male 1981 b/se	Male 2001 b/se
<u>Dummies for Occupations</u>				
Male Occupations	0.1966* (0.0898)	-0.0189 (0.2448)	-0.0577 (0.0963)	0.4728*** (0.0859)
Female Occupations	-0.2117* (0.0825)	-0.8067*** (0.0798)	-0.5247*** (0.1475)	-0.4252** (0.1307)
<u>Geographic Location</u>				
Urban Residents	0.6860*** (0.0423)	0.1396*** (0.0252)	0.4490*** (0.0302)	0.1880*** (0.0255)
Metropolitan Residents	0.8503*** (0.0375)	0.3331*** (0.0253)	0.6004*** (0.0313)	0.3285*** (0.0273)
North Region	-0.2483*** (0.0257)	-0.1429*** (0.0198)	-0.2181*** (0.0211)	-0.2890*** (0.0134)
Northeast Region	-0.2770*** (0.0192)	-0.3711*** (0.0128)	-0.2642*** (0.0116)	0.0564*** (0.0125)
South Region	0.0692*** (0.0176)	0.0537*** (0.0134)	-0.0597 (0.1029)	-0.0481 (0.0281)
Central West Region	0.2558*** (0.0260)	0.0622*** (0.0175)	-0.0643*** (0.0147)	0.0883*** (0.0176)
<u>Individual's Characteristics</u>				
Age	0.0909 (0.0508)	0.0329 (0.0418)	0.1064** (0.0363)	0.0871* (0.0387)
Age Squared	-0.0009 (0.0007)	-0.0002 (0.0006)	-0.0014** (0.0005)	-0.0009 (0.0006)
No Education	-0.3259*** (0.0230)	-0.2288*** (0.0270)	-0.3417*** (0.0143)	-0.1864*** (0.0185)
Fifth to Eighth Grade	0.3763*** (0.0204)	0.1746*** (0.0145)	0.3580*** (0.0131)	0.2681*** (0.0132)
High School	1.1543*** (0.0206)	0.6243*** (0.0162)	1.0370*** (0.0203)	0.7666*** (0.0148)
College	1.8525*** (0.0234)	1.5722*** (0.0202)	1.8233*** (0.0220)	1.8157*** (0.0271)
<u>Selection Correction Terms</u>				
Selection into Integrated Occupations	-0.0035 (0.0222)	0.0590** (0.0218)	0.0303 (0.0230)	-0.0755** (0.0238)
Selection into Male Occupations	0.2546*** (0.0225)	0.0133 (0.0467)	-0.1253*** (0.0345)	0.0944*** (0.0236)
Selection into Female Occupations	-0.4023*** (0.0279)	-0.2575*** (0.0294)	-0.0882* (0.0350)	-0.1378*** (0.0311)
Constant	-1.9241* (0.8922)	-0.6061 (0.7282)	-1.6717** (0.6279)	-1.9322** (0.6720)
Adjusted R-squared	0.6490	0.5207	0.6182	.5021
Model chi-square	18820.22	13763.89	30097.42	14432.4
N	9322	13364	17381	16774

Standard errors in parentheses.

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

Omitted Categories: Integrated Occupations, Rural Residents, Southeast Region and First to Fourth Grade.

Table 4.16. Pooled Wage Regression Brazilian Men and Women Aged 30 to 40 in 1981 and 2001, Dependent Variable: Log of Hourly Wages in Reais of 2001.

	Coefficient	(S.E.)
<u>Dummies for Occupations</u>		
Female * Integrated Occupations	0.1178	(0.0810)
Year=2001 * Integrated Occupations	-0.1105*	(0.0449)
Female * Year=2001 * Integrated Occupations	-0.6627***	(0.1004)
Male Occupations	0.1970***	(0.0474)
Female * Male Occupations	0.1071	(0.0614)
Year=2001 * Male Occupations	-0.4228***	(0.0391)
Female * Year=2001 * Male Occupations	-0.7568**	(0.2337)
Female Occupations	-0.2281	(0.1264)
Female * Female Occupations	0.1158	(0.1306)
Year=2001 * Female Occupations	-0.5212***	(0.1583)
Female * Year=2001 * Female Occupations	-0.5546**	(0.1699)
<u>Geographic Location</u>		
Urban Residents	0.3374***	(0.0130)
Metropolitan Residents	0.5041***	(0.0131)
North Region	-0.1658***	(0.0099)
Northeast Region	-0.3201***	(0.0066)
South Region	0.0812***	(0.0089)
Centralwest Region	0.0344***	(0.0084)
<u>Individual's Characteristics</u>		
Age	0.0757***	(0.0208)
Age Squared	-0.0008**	(0.0003)
No Education	-0.2919***	(0.0100)
Fifth to Eighth Grade	0.3139***	(0.0076)
High School	0.8593***	(0.0082)
College	1.7552***	(0.0100)
<u>Selection Correction Terms</u>		
Integrated Occupations	-0.0471***	(0.0140)
Female * Integrated Occupations	0.0490*	(0.0237)
Year=2001 * Integrated Occupations	0.1196***	(0.0193)
Female * Year=2001 * Integrated Occupations	-0.1451***	(0.0318)
Male Occupations	-0.0807***	(0.0196)
Female * Male Occupations	0.2163***	(0.0239)
Year=2001 * Male Occupations	0.0527*	(0.0251)
Female * Year=2001 * Male Occupations	-0.2672***	(0.0524)
Female Occupations	-0.0646*	(0.0313)
Female * Female Occupations	-0.1109**	(0.0348)
Year=2001 * Female Occupations	-0.0354	(0.0408)
Female * Year=2001 * Female Occupations	-0.0559	(0.0468)
Constant	-1.3083***	(0.3614)
R-squared Adjusted	0.577	
N	56841	

Standard errors in parentheses.

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

Table 4.17. Returns to Schooling Among Occupations for Brazilian Men and Women Aged 30 to 40 in 1981 and 2001.

	1981		2001	
	<u>Male-Dominated Occupations</u>			
	male	female - male	male	female - male
No Education	-0.4143 (0.0203)***	0.0475 (0.1214)	-0.1196 (0.0291)***	-0.0052 (0.1448)
Fifth to Eighth Grade	0.3093 (0.0153)***	0.162 (0.0910)*	0.2195 (0.0174)***	0.0144 (0.0971)
High School	0.9773 (0.0222)***	0.2137 (0.0926)**	0.6761 (0.0184)***	0.1171 (0.1122)
College	1.7508 (0.0254)***	0.1879 (0.1051)*	1.764 (0.0360)***	-0.064 (0.1295)
	<u>Gender-Integrated Occupations</u>			
	male	female - male	male	female - male
No Education	-0.287 (0.0293)***	-0.1567 (0.0685)**	-0.2626 (0.0319)***	0.2054 (0.0805)**
Fifth to Eighth Grade	0.4588 (0.0290)***	-0.1568 (0.0600)***	0.3779 (0.0265)***	-0.2119 (0.0558)***
High School	1.027 (0.0403)***	-0.1479 (0.0672)**	0.8097 (0.0279)***	-0.4359 (0.0684)***
College	1.797 (0.0445)***	-0.116 (0.0748)	1.6757 (0.0444)***	-0.4277 (0.0851)***
	<u>Female-Dominated Occupations</u>			
	male	female - male	male	female - male
No Education	-0.3334 (0.0600)***	-0.0043 (0.0653)	-0.0813 (0.0708)	-0.1803 (0.0765)**
Fifth to Eighth Grade	0.4275 (0.0454)***	-0.0608 (0.0505)	0.2025 (0.0470)***	-0.0551 (0.0502)
High School	1.0775 (0.0528)***	0.0995 (0.0574)*	0.7463 (0.0525)***	-0.1349 (0.0556)**
College	1.8604 (0.0590)***	-0.0401 (0.0644)	1.2949 (0.1011)***	0.2729 (0.1033)***

Standard errors in parentheses.

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

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