OSIPP Discussion Paper: DP-2012-E-002

Are daughters always the losers in the chore war? Evidence using household and twin data from Vietnam

March 15, 2012

Tien Manh Vu†

Ph.D Candidate, Osaka School of International Public Policy, Osaka University

[Key words] Housework・Division of housework・Twins・Gender equality
[JEL Codes] J16・J13・J19

[Abstract]
This paper examines the gender gap in the division of housework in Vietnam among the household heads' children who are not married and still reside in the family home. We find that in a typical day, a daughter has a higher probability of undertaking some housework and for some 9.66 to 17.94 minutes longer than would an equivalent son. Among siblings in two-child families, a daughter who has a brother has the largest gender gap. However, once we control for differences in genetic endowment, with both twins involved in at least some housework, male–female twins spend approximately the same amount of time on housework. In a mutual decision-making scenario, among siblings in two-child families, an elder daughter would shoulder housework for the other sibling while the reverse holds for younger sisters, but only where the children are 20 years of age or younger. In addition, we find that besides sharing the family total housework load, one minute spent on housework by the mother inspires a 0.0481–0.298 minute increase in the time spent on housework by her daughter.

---

†Contact: Osaka School of International Public Policy, Osaka University, 1-31 Machikaneyama, Toyonaka, Osaka 560-0043 Japan. Tel/Fax: +81-(0)6-6850-5656. E-mail: t-vu@osipp.osaka-u.ac.jp.

[Acknowledgments] The author gratefully acknowledges helpful comments and suggestions by Hisakazu Matsushige of Osaka University and participants at an Osaka University seminar chaired by Charles Yuji Horioka.

1 Introduction

Estimating and verifying any gender gap in the division of housework among children[1] in Vietnam could help explain, among other things, a number of family decisions, including gender preferences. After controlling for any difference in genetic endowments arising from marriage contracts or working for market or home production, the gender gap, if it exists, could capture the comparative advantage of gender. Moreover, the identified lexicographic preference for a son in Vietnam (Vu, 2012) poses other questions concerning the rationale and consistency of parental behavior. For instance, if daughters are more likely to be involved in housework[2] and do more housework than sons, daughters become relatively more valuable. In addition, by shedding light on the gender gap in housework, we can usefully explore the notion of altruism among siblings and their parents.

The purpose of this study is to estimate the gender gap in the division of housework among the children of household heads with single marital status who continue to reside in the family home. There is some complexity in this question in that any gender gap in housework potentially includes both the probability of undertaking housework and the time spent on housework. First, we examine the gender gap across children of household heads in one-child families. Then we compare the gender gap across two-child families and across twins in multiple-child families using twin data. We develop two scenarios—independent and mutual decision-making—to estimate the gender gap according to the order of birth, sex composition, age, altruism among siblings, and the inspiration for housework by a parent of the same gender. We use the Heckman sample selection model to deal with censored data in the independent decision-making scenario and a first-difference technique to validate the gender gap in the time spent on housework when using the twin data. Subsequently, we employ a bivariate probit model and seemingly unrelated regression (SUR) to analyze the simultaneous decision-making process among siblings in two-child families.

Our work contributes to the gender gap literature in several respects. Of these, the most

[1] Throughout our analysis, we use 'children' to denote the children of any age of household heads. Therefore, children do not necessarily mean young persons.

[2] By the nature of the data employed in this analysis, housework by the children of the household heads comprises purely 'chores' (see the description in Section 4). As explained in ILO (2002, p. 30), children engaged in domestic chores within their own household are not considered economically active. Therefore, housework by the children of the household heads, as in our study, is by definition, not a form of child labor as conventionally defined.

important is that, to the best of our knowledge, this analysis is the first to address the division of housework among siblings using twin data to deal with any difference in genetic endowment. The paper also examines mutual decision-making patterns as a complementary method. Thus, we are able to correct for any bias caused by any difference in endowment among individuals and thereby to verify the presence of altruism among siblings and their parents.

Overall, the results indicate a mixed gender gap, evidence of support from a sister to her sibling and the inspiration from mother to daughter on the time spent on housework. For females, the gender gap accounts for a 0.249–0.437 higher probability of undertaking any housework with the magnitude of the difference in housework over males of some 9.66 to 17.94 minutes a day. In two-child families, a daughter who has a brother has the largest gender gap in terms of housework. However, once we control for genetic endowment, male–female twins spend approximately the same amount of time on housework. Analysis of mutual decision-making in two-child families indicates that elder daughters would shoulder housework for the other siblings. The reverse holds for two-child families with a younger daughter, but only where the children are 20 years of age or younger. In addition, we find that besides sharing the family housework load, one minute spent on housework by the mother inspires a 0.0481–0.298 minute increase in the time spent on housework by her daughter. However, this relation is statistically insignificant where the siblings are again 20 years of age or younger.

The remainder of the paper is organized as follows. Section 2 reviews the related studies concerning the division of housework. Section 3 describes the empirical methodology, and Section 4 details the data used. Section 5 discusses the findings and Section 6 provides our conclusion.

2 Related literature

The hours spent on housework and working by individuals in families are often examined to identify the substitution between market production, home production (for low-income households), and housework (purely chores). In a collective labor supply model, the sharing rule of housework can act as an instrument to estimate the bargaining power of the husband and wife (Chiappori, 1988, 1992; Browning et al., 1998; Blundell et al., 2007). Hersch and

Stratton (2002) indicate a gender gap between males and females as housework has a negative effect on wages, regardless of marital status. More specifically, husbands do less housework than wives do when their relative earnings and workload increase (Hersch and Stratton, 1994).

There have been several arguments used to explain the gender gap in housework between husbands and their wives. Becker (1985) claims the responsibility of married women for childrearing and housework has major implications for the differences in earnings and occupation between men and women. Aguiar and Hurst (2007) suggest that the growing inequality in leisure between males and females is the mirror image of the growing inequality in male and female wages and expenditure. Further, an important component of the division of housework relies on gender effects, such as the cultural context or the historical perspective on the division of housework, rather than on any spousal differences in observable characteristics (Alvarez and Miles, 2003).

However, other studies in child labor partially examine the mechanism to divide tasks within households. Conventionally, child labor comprises children aged 5–17 years involved in economic activity but excluding children 12 years and older working only a few hours a week in permitted light work and those 15 years and older whose work is not classified as "hazardous" (ILO, 2002). Where the adult wage is high, children do not work (Basu and Van, 1998) and thus improvements in household wealth can explain about 80 percent of the decline in the incidence of child labor (Edmonds, 2005). However, when parents and children are altruistic, an increase in parental income need not always lead to a decrease in child labor (Rogers and Swinnerton, 2004). For example, Rosenzweig and Schultz (1982) argue that daughters shoulder a larger proportion of housework than do sons when the expected employment of women in the labor market is relatively high. Therefore, there is a significant interaction between adult and child labor, but they can be either substitutes or complements (Ray, 2000). In subsequent work, Edmonds (2006) suggests that in Nepal, any difference could arise because of the comparative advantage of birth order as well as gender bias toward specific types of work. Examining household data from Nicaragua and Guatemala, Dammert (2010) concludes sons are more associated with market work while the time allocation for daughters is more sensitive to domestic work.

In terms of the gender preference for children, the majority of studies show that parents

favor the rearing of sons. For instance, in rural Punjab in India, the female mortality rate is in fact higher than the corresponding rate for males aged from one to 59 months, despite a naturally higher neonatal male mortality rate (Das Gupta, 1987). Similarly, Pande (2003) evidences a gender difference that provides disadvantages to daughters in childhood nutrition and immunization. In particular, Lin and Adsera (2012) suggest that daughters could be loaded with anywhere from one to three hours more housework per week where the son has a higher perceived value.

Apart from bargaining power and the nature of the marriage contract, differences in endowment could be one of a number of possible causes for difference in the tasks loaded on family members. Using a twin sample, Behrman et al. (1994) claims that 27 percent of the variance in log earnings is because of variability in individual-specific endowments. In addition, Picard and Wolff (2010) argue that 40 percent of the total inequality in education is mainly because of differences between families, while the differences within families are smaller and rather more difficult to explain. Dammert (2010) claims that twin data, if available, would help to minimize any bias in the estimation of the gender gap.

Meanwhile, empirical research on the family division of housework has not yet fully examined simultaneous decision-making among siblings. It is likely because of data limitations that previous studies in this area neglect the influence of one sibling over another. For instance, Ray (2000) pools children aged 6–17 (10–17) in Peru (Pakistan) and therefore is unable to examine the mutual decision-making process in housework. That said, while children less than 5 years of age may not do any housework, we argue that they can nevertheless influence the housework load of their elder siblings and their parents. For example, Rapoport et al. (2011) finds the presence of very young children in the family increases both paternal market work and total work. Likewise, Evertsson (2006) shows that girls and boys in two-parent families are more likely to engage in gender atypical work the more the parent of the same sex engages in this kind of work. However, Evertsson does not construct an interaction between the gender of the child and the hours of housework by the parent (other sibling) with the same gender. In other work, Dammert (2010) documents a gender gap by birth order for market and domestic work in which elder boys spend more time in both, while elder girls experience only more domestic work. However, Dammert (2010) does not overcome the problems of sample selection and endogeneity in family decision-making.

Although the nature of housework in the data we use is not child labor, we recognize that several existing studies report the spectacular decline in child labor in Vietnam during the 1990s. For example, Rosati and Tzannatos (2006) find a sharp increase in enrolment rates in primary and lower-secondary education for both girls and boys in Vietnam between 1993 and 1998, at the same time as the gender gap in enrolment rates and working narrowed. For instance, approximately 75.1 (75.7) percent of girls (boys) attended school without work tasks, while 15.4 (17.1) percent of girls (boys) undertook both work and schooling in 1998. As one explanation, Edmonds and Turk (2004) assert a strong correlation between improvements in living standards and child labor in Vietnam, finding the decrease in child labor is most dramatic in provincial towns, minor cities, the southeast, and the rural Mekong River delta. However, new household business establishments would correlate with smaller declines in child labor though households containing home business in 1993 enjoy larger decrease in child labor than others (Edmonds and Turk, 2004). Lastly, Edmonds and Pavcnik (2005b) argue that the increase in rice prices can explain 45 percent of the decrease in child labor in rural Vietnam in the 1990s.

3 Data selection

The data we employ are from the Household Living Standard and Consumer Price Index Survey 2008, commonly known as Vietnamese Household Living Standard Survey (VHLSS) 2008. VHLSS 2008 is one wave of the Living Standards Measurement Surveys technically supported by the World Bank and undertaken nationwide by the General Statistic Office of Vietnam. The sample size is 45,945 households or 289,948 individuals. We primarily base the analysis on the responses to Questions 26 and 27 in Section 4A of VHLSS 2008. In the first question, individuals respond on whether they have to do housework, such as cleaning, shopping, cooking, washing clothes, water and wood fetching, and repairing tools. If they do, the next question is how many hours per day in the last 12 months the respondents undertook these kinds of task on average (GSO, 2008).

From the original data, we investigate individuals whose relationship to the household head are ‘children’ and divide the data by several other control criteria. To guarantee the selected child and the household head are truly blood relations, we limit the sample to parents whose children are all single in terms of marital status. In addition, if they have siblings, all siblings must have the same family name. We split our data into two sets. We select the first

set based on the number of siblings in the family without any age limit. We then set an age limit of 20 years and younger to reduce the effect of the labor market on the division of housework. The second set of data concerns twins. We construct this by selecting only those households in which one child of the household head has the same month and year of birth as a sibling. As the siblings are both children of the same household head, single in marital status, reside in the same household, and have the same month and year of birth, they are very likely twins. The twin data comprise 1,000 twins (or 500 pairs of twins).

<INSERT TABLES 1 AND 2 HERE>

We also examine the children of household heads in one- and two-child families across two age selections: all child ages and children less than 21 years of age. In one-child families, the decision of the family concerning child housework does not logically influence that for another child, because there is only one child. However, in two-child families, we can examine the interaction between the elder child and the younger child within and across families. The estimates for the two-child families are also comparable with those for the twin data.

We argue that the notion of housework as defined and obtained from VHLSS 2008 is neither home production nor market production, and obviously different from the description of child labor as defined by the ILO (2002). As shown in Tables 1 and 2, only about 47.5–52.1 percent of the children of household heads engage in housework, with a mean of roughly 1.5 hours per day and a standard deviation of approximately 0.8 hours. Consequently, approximately 95 percent of children undertake less than 3 hours of housework each day, and this is commensurately less likely to represent child labor as traditionally defined[3]. That could hold even when the responders to the questionnaire misunderstand the question and erroneously refer to economic activity as housework in the questionnaire.

We acknowledge that our data and sample selection method involve some limitations. First, the duration of housework may not be an appropriate indicator of the gender gap in housework between siblings. For example, the hours of housework do not necessarily indicate the quality of work, as a better-performing sibling may be able to complete the work

[3] Edmonds and Pavcnik (2005a) aggregate child labor data for children aged 5–14 years from 33 countries in 2000 and show that these children undertake approximately 26.1 and 15.8 hours per week on average in market and domestic work, respectively.

required in a shorter time. The types of housework for males and females may also differ, and this could result in different durations. Second, the housework information does not specify the task, so we are unable to have any insight on the type of housework in which males (females) are involved. Third, the twin data do not guarantee all individuals are identical twins, through which we can control perfectly for any difference in endowment. Finally, we may exclude some children of the household head that live away from home, and this could account for the incorrect control of family size and birth order.

Nevertheless, we argue that our use of the duration of housework and the household and twin data help in this regard. First, we assume that the variance between efficient and less-efficient housework is unlikely to be longer than one hour. This should also hold with the time gap across housework tasks. Second, the twin data and two-child family data are comparable. To start with, no children of the household heads in the selected data are married. Further, the respective mean age and standard deviation of age in two-child families are 11.225 and 5.356 and these are very close to those for the twin data, as shown in Table 2. Third, unlike market production where the training in skills is by a certified school and/or system of training, housework requires simple skills and informal training, often by parents. Therefore, selecting individuals that are siblings, of the same age, with the same father, and brought up in the same family, should sufficiently control for any difference in endowments in undertaking housework. Finally, as we consider only siblings residing in the same household, the division of housework across siblings is valid and efficient despite errors, if any, associated with an incorrect birth order.

4 Empirical models and specification

4.1 Heckman sample selection for the probability and duration of housework

We assume decisions on housework are in two steps using a Heckman sample selection model. We can apply this method to the pooled data on the children of household heads in one- and two-child families and among twins. In the selection stage, z_{ij} is the utility function of child i in family j. We cannot calculate z but are able to observe z' which is whether the individual is obliged to undertake housework or not. In the outcome stage, if the individual does undertake housework, the time duration y_{ij} will be determined.

In the selection stage,

$$z'_{ij} = select_{ij} = \begin{cases} 1, \ if \, z_{ij} = W_{ij}\alpha + X_{ij}\beta + C_j\gamma + \varepsilon \geq z^* \\ 0, \ if \ z_{ij} < z^* \end{cases}. \quad (1)$$

In the outcome stage,

$$y_{ij} = time_{ij} = W'_{ij}\alpha' + X'_{ij}\beta' + C'_j + \epsilon, \quad (2)$$

where W_{ij} is the gender gap/sex composition by birth order. Gender gap is a dummy and denoted as sex. $Sex = 1$ if the child is female. Sex composition is a family set of genders by birth order. We deploy sex composition by birth order similar to Vu (2012). For example, $eboyinBB$ means $eboyinBB = 1$ if the individual is the elder son in a two-son family; $eboyinBB = 0$ otherwise. $boyinGB$ means $boyinGB = 1$ if the individual is the son in a two-child family with the eldest a female child; otherwise $boyinGB = 0$. X_{ij} is a vector of individual characteristics, including age, education, school enrollment, and being on school vacation at the time of the survey. C_j is a vector of control variables for family background and characteristics, including the log of annual household income adjusted by the square root of household size ($lhhincomesprpc$), hours doing housework for the individuals' parents ($HhouseworkII$ for fathers, $WhouseworkII$ for mothers), interaction term between gender of the child and time spent on housework by a parent of the same gender ($BHhouseworkII$ for sons and fathers, $GWhouseworkII$ for daughters and mothers), along with dummies for a family's servant ($helper$), single parents ($singleparent$), urban region ($urban$), household appliances (freezer, washing machine, gas cooker, rice cooker, vacuum cleaner, and microwave oven) and living space per capita ($areapc$).

4.2 Mutual decision-making process

Although Heckman sample selection enables the estimates for the one- and two-child families and twin data to be comparable, it would be interesting to know the impact of mutual decision-making on housework for siblings in two-child families. A bivariate probit model is suitable for the mutual decision-making in the first step. Subsequently, SUR analysis is appropriate for the outcome step when both siblings undertake housework, as there should be a sharing rule in place. The specifications for each case are as follows.

In the bivariate probit model, we assume that the decisions on whether to undertake housework of the siblings in a two-child family are mutual. Any one child also takes the

characteristics of their sibling into consideration. The utility function y_{1j}^* consists of the gender of the individual (sex_{1j}), the characteristics of the individual (X_{1j}), the characteristics of the corresponding sibling (sex_{2j}, X_{2j}) and the other characteristics of the family (C_j). X_{1j}, X_{2j} and C_j can be specified similarly to the states in the Heckman sample selection model. The probability of undertaking housework by the first child in family j and the second child in family k can then be specified in two separate equations, as follows.

$$select_{1j} = \begin{cases} 1, if\ y_{1j}^* = sex_{1j}\alpha_1^j + sex_{2j}\alpha_2^j + X_{1j}\beta_1^j + X_{2j}\beta_2^j + C_j\gamma + u_{1j} \geq z^* \\ 0,\ if\ y_{1j}^* < z_{1j}^* \end{cases} \quad (3)$$

$$select_{2k} = \begin{cases} 1,\ if\ y_{2k}^* = sex_{1k}\alpha_1^k + sex_{2k}\alpha_2^k + X_{1k}\beta_1^k + X_{2k}\beta_2^k + C_k\gamma + u_{2k} \geq 0 \\ 0,\ if\ y_{2k}^* < z_{2k}^* \end{cases} \quad (4)$$

In a different family ($j \neq k$), these same decisions are made independently, such that $\text{corr}(u_{1j}, u_{2k}) = 0$. However, within a family ($j = k$), these decisions are made simultaneously based on an unobservable sharing rule μ_j, which can be applied to both siblings, such that $corr(u_{1j}, u_{2j}) = \rho \neq 0$.

$$u_{1j} = \omega.\mu_j + \epsilon_{1j} \quad (5)$$

$$u_{2j} = \varphi.\mu_j + \epsilon_{2j} \quad (6)$$

Removing the sharing rule implies there are no correlated elements between (5) and (6) or $corr(\epsilon_{1j}, \epsilon_{2j}) = 0$. Therefore, the residuals of (3) and (4) follow a bivariate probit distribution, such that u_{1j}, $u_{1j} \sim \emptyset_2(0,0,1,1,\rho)$.

In the SUR, we assume both siblings in the same family take the characteristics of the other sibling into account in their own decisions. Similarly, an unobservable sharing rule appears in the residuals of the equations for both the first and second child of the same family.

$$Time_{1j} = sex_{1j}\alpha_1^j + sex_{2j}\alpha_2^j + X_{1j}\beta_1^j + X_{2j}\beta_2^j + C_j\gamma + u_{1j} \quad (7)$$

$$Time_{2k} = sex_{1k}\alpha_1^k + sex_{2k}\alpha_2^k + X_{1k}\beta_1^k + X_{2k}\beta_2^k + C_k\gamma + u_{2k} \quad (8)$$

$$\text{corr}(u_{1j}, u_{2k}) = 0, if\ j \neq k\ and\ \text{corr}(u_{1j}, u_{2k}) \neq 0\ if\ j = k \quad (9)$$

The specification is the same as the bivariate probit model. Consequently, $corr(u_{1j}, u_{2j})$ should help us to gather some information from the counter equation in the SUR.

4.3 First-difference technique for analyzing the gender gap in the twin data

The twin data and the first-difference technique can help overcome any endogeneity problem that the analysis employing Heckman sample selection may contain. In the twin data, two children of the household head have the same year of birth, month of birth, and family name. Therefore, it is likely that they have almost the same endowment and family background. Therefore, we can eliminate the difference in endowment as well as consider each family separately. In addition, the first-difference technique concerning the duration of housework in the twin data can help verify the results of the previous analysis.

Apart from the difference in housework by gender ($difsex$), if any, the only other difference between a pair of twins should be school enrolment ($datscl$) and being on school vacation ($donvac$). We represent the difference in the hours of housework by:

$$dhousework_j = [time_{1j} - time_{2j}] = dastcl_j * \beta + donvac_j * \alpha + difsex_j * \gamma + C_j * \delta + \varepsilon_j, \quad (10)$$

where C_j is specified as in the preceding model to control for any differences across families.

5 Results

The results indicate a significant gender gap in the probability of doing housework regardless of the relation to the household head, birth order, number of siblings, age and endowment difference. As shown in Tables 3 and 4, the positive and statistically significant value of sex indicates that a female has a higher probability of undertaking housework across all families in all cases. In fact, the gender gap alone explains the 0.249–0.600 higher probability of undertaking housework for females. After controlling for any difference in endowment in the twin analysis, a probability of 0.437 is a more exact estimation of the gender gap, as shown in column (10) in Table 4. After considering mutual decision-making in two-child families, the housework gender gap for the eldest child is 8.61 percent higher than the younger one in two-child families, as shown in Table 7. However, for children under 21 years of age, the gender gap is 2.58 percent lower for the elder sibling in two-child families. As such, the increased probability of undertaking housework by the eldest child does not depend on the

gender of the second child as in columns (1) and (3) of Table 7. However, the youngest child has a lower probability of undertaking housework if the sibling is female. This is likely one probable cause of the large gender gap found when the first child is female.

<INSERT TABLES 3, 4, 5 AND 6 HERE>

We also find a significant gender gap in the duration of housework across birth order among children of the household head, as shown in Tables 3, 4 and 8. In Table 4, a daughter undertakes 17.94 minutes more housework a day than an equivalent son does, although the gap could be up to 36.36 minutes for any female in any family in a typical day, as shown in Table 3. Similarly, 9.66 minutes is the lowest instance we find of the housework gender gap among siblings, where all of the children are less than 21 years of age and residing in two-child families. Examining the mutual decision of the time spent on housework in Table 8, we find that the eldest female child in two-child families undertakes anywhere from 10.62 to 14.22 minutes more housework than the eldest male.

<INSERT TABLES 7 AND 8 HERE>

However, once we control for endowment in the twin data, the gender gap of the time spent on housework is negligible, as shown in column (9) in Table 4. The first-difference analysis using the twin data confirms this finding of a negligible housework gender gap. As reported in Table 9, the gender difference is not statistically significant and as such cannot possibly explain the difference in the number of hours doing housework for twins in two-child families, although the adjusted R-squared increases in value to 0.5056 or higher. Other factors, such as the difference in schooling enrollment, and/or differences in being on school vacation, could then better account for the difference in the duration of housework. If schooling enrollment were the main reason for the difference in time spent on housework for twins, it is reasonable to argue that the difference in school enrollment for twins already contains either the discrimination and/or misfortune of one of the twins. However, we are unable to arrive at a definite explanation given the available data.

<INSERT TABLE 9 HERE>

The estimations in Table 6 examine sex composition by birth order in two-child families. This result concurs with Dammert (2010) and Edmonds (2006) in the presence of a

housework gender gap by birth order, putting aside differences in method and data. All other things being equal, a sister faces the largest gender gap in housework, as she is both more likely to undertake housework up to 14.28 minutes longer in a typical day than if she were the youngest son in a BB (boy only) family. An elder daughter in a GG (daughter only) family also has a higher probability of undertaking housework and for longer than in a BB (son only) family. Dammert (2010) likewise concludes that having younger sisters does not reduce the burden of domestic work. That is also relevant to our study of GG families. The corresponding younger daughter in a GG family does housework of the same duration as the younger son in a BB (son only) family. However, she is at higher risk of being involved in housework in the first instance. Meanwhile, in a two-child family with a son and a daughter, the younger son in a GB (daughter–son) family would be the same as a younger son in a BB (son only) family. Unlike Edmonds (2006), our results indicate that an elder son in a BG (son–daughter) family has a higher probability of being involved in housework, but of the same duration as a younger son in a BB (son only) family. Lastly, unlike Dammert (2010), our estimations indicate that daughters in BG (son–daughter) and GB (daughter–son) families are the most likely participants in housework. A daughter in a GB (daughter–son) family is slightly more likely to undertake housework than one in a BG (son–daughter) family, but would do less hours of housework than her counterpart.

There is some evidence of altruism between siblings and this varies by the age of the sibling. When we do not control for age, there is a sharing of housework from the elder daughter to the younger, but not in the reverse, as indicated by the corresponding gender effect of one sibling to another shown in Table 7. We can infer similar outcomes from the effect of $atscl2$ (the state of being at school of the younger sibling). However, altruism in the reverse direction appears in more highly educated younger siblings, as $edu2$ in (1) in Table 7 is negative and statistically significant. The value in the same row in column (3) supports this argument. In addition, SUR analysis of the duration of housework in Table 8 again supports our argument for almost the same corresponding variables. For instance, as in the bivariate probit analysis, the sign and statistical significance of $sex1$ in (2) or (4), the statistical insignificance of $sex2$ in (1), and the statistical significance of $sex2$ in (3), confirm our earlier interpretation. In addition, as shown in Table 8, an inverse altruism arises when both siblings are less than 21 years of age, as indicated by the corresponding coefficients of $sex1$ and $sex2$ in (4) and (3).

We also find that mothers inspire their daughters in housework, unlike fathers and their sons. Table 5 suggests a positive significant interaction between the hours of housework by the mother and the gender of the child (female) when child age is not controlled. In the twin data, the influence of the mother is significantly stronger than in one- and two-child families. In all likelihood, the twin data allow us to remove the effect of birth order and the age gap between siblings which would lower the corresponding coefficients. However, this interaction is not statistically significant for siblings less than 21 years of age. In contrast, the variation between the hours of housework by the father and his son is statistically insignificant in all cases. Therefore, the results only partially agree with those in Evertsson (2006).

6 Conclusion

This paper examined the gender gap in housework among children of household heads based on the patterns of both separate and mutual decision-making. In general, the results show that females are more likely to undertake housework. However, daughters are not always the losers in the chore war. This is because the estimation using the twin data shows that if both the son and the daughter are involved in housework, the daughter spends the same amount of time on housework as if she were male. In addition, there is clear evidence of altruism in housework from an elder sister to her sibling, though the reverse is statistically significant for siblings less than 21 years of age.

Evidence of a gender gap in the probability of housework among twins implies that daughters are likely to be guided toward housework. In Vietnam, it is likely that daughters are taught to be aware of their own femininity and to fulfill social norms concerning womanly virtues. These virtues, also part of Confucianism, relate to morality, proper speech, modest manner, and diligent work. Diligent work implies good-performing house workers. Hence, our finding agrees with suggestions made by Alvarez and Miles (2003), Dammert (2010), and Lin and Adsera (2012).

However, the insignificant gender gap in the duration of housework in the twin data provides an alternative argument concerning the altruism of parents. In all likelihood, parents treat daughters and sons differently in terms of their decisions on housework. However, they would fairly assign tasks to their sons and daughters. Moreover, the negative relation between attending school and housework/hours of housework suggests that parents keep children out

of housework and require less housework if the children are in school. However, whether housework affects school enrollment remains ambiguous when using these data, although if housework hours per day are far from the sample mean, it may indeed be the case.

References

Aguiar, M., & Hurst, E. (2007). Measuring Trends in Leisure: The Allocation of Time over Five Decades. *Quarterly Journal of Economics, 122*(3), 969-1006.

Alvarez, B., & Miles, D. (2003). Gender Effect on Housework Allocation: Evidence from Spanish Two-Earner Couples. *Journal of Population Economics, 16*(2), 227-242.

Basu, K., & Van, P. H. (1998). The Economics of Child Labor. *American Economic Review, 88*(3), 412-427.

Becker, G. S. (1985). Human Capital, Effort, and the Sexual Division of Labor. *Journal of Labor Economics, 3*(1), S33-58.

Behrman, J. R., Rosenzweig, M. R., & Taubman, P. (1994). Endowments and the Allocation of Schooling in the Family and in the Marriage Market: The Twins Experiment. *Journal of Political Economy, 102*(6), 1131-1174.

Blundell, R., Chiappori, P.-A., Magnac, T., & Meghir, C. (2007). Collective Labour Supply: Heterogeneity and Non-participation. *Review of Economic Studies, 74*(2), 417-445.

Browning, M., & Chiappori, P. A. (1998). Efficient Intra-household Allocations: A General Characterization and Empirical Tests. *Econometrica, 66*(6), 1241-1278.

Chiappori, P.-A. (1988). Rational Household Labor Supply. *Econometrica, 56*(1), 63-90.

Chiappori, P.-A. (1992). Collective Labor Supply and Welfare. *Journal of Political Economy, 100*(3), 437-467.

Dammert, A. (2010). Siblings, child labor, and schooling in Nicaragua and Guatemala. *Journal of Population Economics, 23*(1), 199-224.

Das Gupta, M. (1987). Selective Discrimination against Female Children in Rural Punjab, India. *Population and Development Review, 13*(1), 77-100.

Edmonds, E. (2006). Understanding sibling differences in child labor. *Journal of Population Economics, 19*(4), 795-821.

Edmonds, E., & Turk, C. (2004). Child Labor in Transition in Vietnam. In *Economic growth, poverty, and household welfare in Vietnam.* Glewwe, Paul. Agrawal, Nisha. Dollar, David, eds., Regional and Sectoral Studies. Washington, D.C.: World Bank. (pp. 505-550).

Edmonds, E. V. (2005). Does Child Labor Decline with Improving Economic Status? *Journal of Human Resources, 40*(1), 77-99.

Edmonds, E. V., & Pavcnik, N. (2005a). Child Labor in the Global Economy. *Journal of*

Economic Perspectives, *19*(1), 199-220.

Edmonds, E. V., & Pavcnik, N. (2005b). The effect of trade liberalization on child labor. *Journal of International Economies, 65(2),* 401–419.

Evertsson, M. (2006). The reproduction of gender: Housework and attitudes towards gender equality in the home among Swedish boys and girls. *British Journal of Sociology, 57*(3), 415-436.

General Statistics Office of Vietnam (GSO). (2008). Operational handbook—Vietnamese household living standard survey 2008. GSO, Hanoi.

Hersch, J., & Stratton, L. S. (1994). Housework, Wages, and the Division of Housework Time for Employed Spouses. *American Economic Review, 84*(2), 120-125.

Hersch, J., & Stratton, L. S. (2002). Housework and Wages. *Journal of Human Resources, 37*(1), 217-229.

International Labor Organization (ILO). (2002). Every child counts: new global estimates on child labor. ILO, Geneva.

Lin T, Adsera, A (2012) Parental son preference and children's housework: the Indian case. https://www.princeton.edu/~adsera/TinChiLin&Adsera_SonPreference_Nov2011.pdf. Accessed 17 February 2012.

Pande, R. P. (2003). Selective Gender Differences in Childhood Nutrition and Immunization in Rural India: The Role of Siblings. *Demography, 40*(3), 395-418.

Picard, N., & Wolff, F.-C. (2010). Measuring educational inequalities: a method and an application to Albania. *Journal of Population Economics, 23*(3), 989-1023.

Rapoport, B., Sofer, C., & Solaz, A. (2011). Household production in a collective model: some new results. *Journal of Population Economics, 24*(1), 23-45.

Ray, R. (2000). Child Labor, Child Schooling, and Their Interaction with Adult Labor: Empirical Evidence for Peru and Pakistan. *World Bank Economic Review, 14*(2), 347-367.

Rogers, C. A., & Swinnerton, K. A. (2004). Does Child Labor Decrease When Parental Incomes Rise? *Journal of Political Economy, 112*(4), 939-946.

Rosati, F. C., & Tzannatos, Z. (2006). Child labour in Vietnam. *Pacific Economic Review, 11*(1), 1-31.

Rosenzweig, M. R., & Schultz, T. P. (1982). Market opportunities, genetic endowments, and intrafamily resource distribution: child survival in rural India. *American Economic Review, 72*(4), 803-815.

Vu, T. M. (2012). The lexicographic preference for a son: evidence from household data in Vietnam. Osaka School of International Public Policy, Osaka University.

Table 1 Descriptive statistics for children of household heads in one-child families

Variables	Descriptions	Obs.	Mean	SD
select	1 if do housework, 0 otherwise	4,164	0.521	0.500
time	hours spent on housework in a day	2,168	1.534	0.806
age	in years	6,167	11.779	6.150
sex	1 if female, 0 if male	6,167	0.417	0.493
edu	years of schooling	5,271	6.166	4.539
atscl	1 if attending any school, 0 otherwise	5,271	0.646	0.478
onvac	1 if on school vacation at time of survey, 0 otherwise	6,167	0.294	0.456
WhouseworkII	hours spent on housework by the mother	5,033	2.473	1.128
HhouseworkII	hours spent on housework by the father	3,519	1.592	0.837
lhhincomesqrpc	logarithm of annual household income adjusted by squared number of household size	5,269	9.793	0.720
helper	1 if hire a housemaid, 0 otherwise	6,167	0.018	0.132
singleparent	1 if one-parent family, 0 otherwise	6,167	0.148	0.355
urban	1 if resides in urban region, 0 otherwise	6,167	0.277	0.448
underseven	1 if the child is less than 7 years old, 0 otherwise	6,167	0.252	0.434
freezer	1 if have freezer, 0 otherwise	6,130	0.293	0.455
washing	1 if have washing machine, 0 otherwise	6,130	0.116	0.320
gascooker	1 if have gas cooker, 0 otherwise	6,130	0.454	0.498
ricecooker	1 if have rice cooker, 0 otherwise	6,130	0.706	0.456
vacuum	1 if have vacuum cleaner, 0 otherwise	6,130	0.011	0.106
microwave	1 if have microwave oven, 0 otherwise	6,130	0.025	0.156
areapc	living space per capita in square meters	5,254	20.431	11.986

Children of household heads are less than 21 years of age with single marital status.

Table 2 Descriptive statistics for children of household heads in two-child families and for twins

	Two-child families			Twins		
Variables	Obs.	Mean	SD.	Obs.	Mean	SD.
select	19,612	0.475	0.499	604	0.505	0.500
time	9,319	1.465	0.796	305	1.489	0.835
age	33,053	11.225	5.356	1,000	12.958	6.424
sex	33,053	0.446	0.497	1,000	0.500	0.500
edu	23,409	6.009	4.203	696	6.644	4.308
atscl	23,409	0.751	0.432	696	0.685	0.465
onvac	33,053	0.302	0.459	1,000	0.240	0.427
WhouseworkII	22,458	2.480	1.176	668	2.434	1.087
HhouseworkII	16,760	1.565	0.842	458	1.563	0.838
lhhincomesqrpc	23,409	9.826	0.698	696	9.854	0.660
helper	33,053	0.015	0.121	1,000	0.016	0.126
singleparent	33,053	0.066	0.248	1,000	0.096	0.295
urban	33,053	0.254	0.435	1,000	0.264	0.441
underseven	33,053	0.223	0.416	1,000	0.170	0.376
freezer	32,859	0.329	0.470	996	0.309	0.462
washing	32,859	0.137	0.344	996	0.153	0.360
gascooker	32,859	0.460	0.498	996	0.456	0.498
vacuum	32,859	0.719	0.449	996	0.703	0.457
microwave	32,859	0.014	0.117	996	0.010	0.100
areapc	32,859	0.023	0.151	996	0.022	0.147

Descriptions of variables as in Table 1. In two-child families, children of household heads are less than 21 years of age, of single marital status, and with the same family name as the only sibling. In the twin data, children of household heads have single marital status and the same family name and year and month of birth as the only other sibling residing in the household.

Table 3 Probability and duration of being involved in housework by relationship with household head

	All family members		Children of household heads	
	(1)	(2)	(3)	(4)
Variables	Time	Select	Time	Select
sex	0.606***	0.600***	0.293***	0.411***
	(0.00760)	(0.00948)	(0.0208)	(0.0144)
Head's spouse		0.468***		
		(0.0169)		
Head's children		–0.897***		
		(0.0158)		
Head's parents		–2.005***		
		(0.0331)		
Head's grandparents		–2.668***		
		(0.133)		
Head's grandchildren		–1.753***		
		(0.0305)		
Other relations to the head		–0.324***		
		(0.0242)		
Observations	160,616	160,616	54,937	54,937

Robust standard errors in parentheses (*** p < 0.01, ** p < 0.05, * p < 0.1). All selected children in (3) and (4) have single marital status. Results for other variables not reported but always included in estimations, including age in both select stage and outcome stage, edu, $lhhincomesqrpc$, $helper$, and $urban$ in select stage, and workhour (working hours) in outcome stage.

Table 4 Probability and duration of being involved in housework by children of household heads in one- and two-child families and twin data

Head's children	One-child families				Two-child families				Twins	
	No age limit		Age < 21 years		No age limit		Age < 21 years		No age limit	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variables	Time	Select	Time	Select	Time	Select	Time	Select	Time	Select
sex	0.299***	0.419***	0.240***	0.298***	0.191***	0.295***	0.161***	0.249***	0.116	0.437***
	(0.0353)	(0.0428)	(0.0439)	(0.0536)	(0.0188)	(0.0210)	(0.0206)	(0.0231)	(0.116)	(0.134)
edu	–0.00979	0.0606***	–0.000229	0.108***	–0.00846**	0.0814***	–0.0308***	0.107***	–0.0241	0.0463**
	(0.00600)	(0.00575)	(0.0108)	(0.00802)	(0.00402)	(0.00307)	(0.00754)	(0.00362)	(0.0197)	(0.0192)
atscl		–0.512***		–0.442***		–0.264***		–0.241***		–0.480**
		(0.0497)		(0.0690)		(0.0290)		(0.0362)		(0.197)
onvac		0.300***		0.250***		0.127***		0.102***		0.448***
		(0.0567)		(0.0633)		(0.0247)		(0.0260)		(0.156)
lhhincomesqrpc		–0.138***		–0.120**		–0.112***		–0.100***		0.290*
		(0.0394)		(0.0526)		(0.0204)		(0.0226)		(0.150)
underseven		–1.314***		–0.983***		–0.767***		–0.623***		–6.270***
		(0.253)		(0.256)		(0.110)		(0.109)		(0.306)
age	0.0101***		0.0160*		0.0161***		0.0465***		0.0220*	
	(0.00266)		(0.00908)		(0.00251)		(0.00693)		(0.0117)	
WhouseworkII	0.113***		0.123***		0.0952***		0.104***		0.0961	
	(0.0205)		(0.0268)		(0.0106)		(0.0119)		(0.0614)	
HhouseworkII	0.235***		0.221***		0.209***		0.198***		0.227***	
	(0.0304)		(0.0377)		(0.0166)		(0.0177)		(0.0735)	
Observations	5,346	5,346	3,295	3,295	19,985	19,985	16,627	16,627	485	485

Robust standard errors in parentheses (*** p < 0.01, ** p < 0.05, * p < 0.1). Results for other variables not reported but always included in estimations, including $helper$, $singleparent$, $urban$ in the select stage, household appliances (freezer, washing machine, gas cooker, rice cooker, vacuum cleaner and microwave oven, and living space per capita) in both select and outcome stages.

Table 5 Interaction between child gender and housework load by parent of the same gender

Head's children	One-child families				Two-child families				Twins	
	No age limit		Age < 21 years		No age limit		Age < 21 years		No age limit	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variables	Time	Select	Time	Select	Time	Select	Time	Select	Time	Select
sex	0.0916	0.419***	0.0771	0.298***	0.0717	0.295***	0.0915	0.249***	–0.525	0.437***
	(0.109)	(0.0428)	(0.139)	(0.0536)	(0.0592)	(0.0210)	(0.0662)	(0.0231)	(0.399)	(0.134)
WhouseworkII	0.0805***		0.0853**		0.0742***		0.0919***		–0.110	
	(0.0255)		(0.0340)		(0.0134)		(0.0159)		(0.123)	
HhouseworkII	0.240***		0.204***		0.210***		0.200***		0.141*	
	(0.0432)		(0.0484)		(0.0243)		(0.0253)		(0.0794)	
BHhouseworkII	–0.00886		0.0331		–0.00254		–0.00379		0.105	
	(0.0594)		(0.0739)		(0.0332)		(0.0353)		(0.0739)	
GWhouseworkII	0.0797*		0.0885		0.0481**		0.0270		0.298**	
	(0.0412)		(0.0548)		(0.0209)		(0.0234)		(0.150)	
Observations	5,346	5,346	3,295	3,295	19,985	19,985	16,627	16,627	485	485

Robust standard errors in parentheses (*** p < 0.01, ** p < 0.05, * p < 0.1). Results for other variables not reported but always included in estimations, including age in outcome stage, $atscl$, $onvac$, $lhhincomesqrpc$, $helper$, $singleparent$, $urban$ and $underseven$ in select stage, household appliances (freezer, washing machine, gas cooker, rice cooker, vacuum cleaner and microwave oven), education and living space per capita in both select and outcome stages.

Table 6 Probability and duration of being involved in housework by sex composition and birth order of children of household heads in two-child families

Head's children	No age limit		Age < 21 years	
	(1)	(2)	(3)	(4)
Variables	Time	Select	Time	Select
egirlinGG	0.207***	0.352***	0.185***	0.301***
	(0.0394)	(0.0446)	(0.0400)	(0.0488)
ygirlinGG	0.0580	0.209***	0.0513	0.202***
	(0.0379)	(0.0494)	(0.0394)	(0.0521)
girlinGB	0.214***	0.400***	0.195***	0.375***
	(0.0331)	(0.0386)	(0.0359)	(0.0425)
girlinBG	0.238***	0.396***	0.220***	0.365***
	(0.0370)	(0.0408)	(0.0389)	(0.0435)
boyinBG	0.0269	0.129***	0.0318	0.164***
	(0.0313)	(0.0383)	(0.0329)	(0.0427)
boyinGB	0.0272	0.0322	0.0390	0.00374
	(0.0356)	(0.0407)	(0.0379)	(0.0435)
eboyinBB	–0.00983	0.0860**	0.0123	0.147***
	(0.0337)	(0.0376)	(0.0384)	(0.0420)
Observations	19,985	19,985	16,627	16,627

Robust standard errors in parentheses (*** p < 0.01, ** p < 0.05, * p < 0.1). Results for other control variables not reported but always included in estimations, including *age*, $WhouseworkII$, and $HhouseworkII$ in outcome stage, $atscl$, $onvac$, $lhhincomesqrpc$, $helper$, $singleparent$, $urban$ and $underseven$ in select stage, household appliances (freezer, washing machine, gas cooker, rice cooker, vacuum cleaner and microwave oven), education and living space per capita in both select and outcome stages.

Table 7 Bivariate probit estimation for probability of undertaking housework by birth order among children of household heads in two-child families

Head's children	No age limit		Age < 21 years	
	(1)	(2)	(3)	(4)
Variables	Select1	Select2	Select1	Select2
sex1	0.416***	–0.0518*	0.302***	–0.0697**
	(0.0277)	(0.0284)	(0.0329)	(0.0346)
age1	–0.0120**	–0.0184***	–0.0177	0.00572
	(0.00537)	(0.00563)	(0.0122)	(0.0133)
edu1	0.0303***	0.00970	0.0561***	–0.000221
	(0.00587)	(0.00613)	(0.0110)	(0.0115)
atscl1	–0.426***	0.0163	–0.427***	–0.00250
	(0.0404)	(0.0404)	(0.0546)	(0.0546)
onvac1	0.278***	–0.207***	0.294***	–0.0521
	(0.0477)	(0.0489)	(0.0576)	(0.0601)
underseven1	–5.828***	–4.743***	–6.456***	–4.809***
	(0.149)	(0.194)	(0.143)	(0.210)
sex2	–0.00453	0.383***	–0.0217	0.310***
	(0.0274)	(0.0281)	(0.0328)	(0.0347)
age2	0.0180**	0.0313***	0.0122	0.107***
	(0.00720)	(0.00725)	(0.0172)	(0.0180)
edu2	–0.0211***	0.0777***	–0.00799	0.0609***
	(0.00717)	(0.00719)	(0.0165)	(0.0167)
atscl2	0.299***	–0.287***	0.407***	0.0147
	(0.0464)	(0.0474)	(0.0707)	(0.0748)
onvac2	–0.101**	0.226***	–0.165***	0.0803
	(0.0414)	(0.0415)	(0.0529)	(0.0536)
underseven2	–0.428***	–0.638***	–0.378***	–0.232*
	(0.0696)	(0.136)	(0.0725)	(0.141)
Observations	10,691	10,691	7,493	7,493

Robust standard errors in parentheses (*** p < 0.01, ** p < 0.05, * p < 0.1). Results for other control variables not reported but always included in estimations, including $lhhincomesqrpc$, $helper$, $single\ parent$, $urban$, living space per capita and household appliances (freezer, washing machine, gas cooker, rice cooker, vacuum cleaner and microwave oven).

Table 8 SUR for time spent on housework by birth order among children of household heads in two-child families

Head's children	No age limit		Age < 21 years	
	(1)	(2)	(3)	(4)
Variables	Time1	Time2	Time1	Time2
sex1	0.237***	–0.0712***	0.177***	–0.0537*
	(0.0330)	(0.0268)	(0.0398)	(0.0301)
age1	0.00469	0.000185	0.0164	0.00495
	(0.00712)	(0.00578)	(0.0150)	(0.0114)
edu1	–0.00532	–0.00455	0.000593	–0.00568
	(0.00751)	(0.00610)	(0.0130)	(0.00984)
atscl1	–0.178***	–0.124***	–0.232***	–0.0949*
	(0.0486)	(0.0395)	(0.0652)	(0.0492)
onvac1	–0.0183	0.104**	0.0388	0.0974*
	(0.0597)	(0.0484)	(0.0718)	(0.0543)
sex2	–0.0389	0.153***	–0.0870**	0.0740**
	(0.0325)	(0.0264)	(0.0395)	(0.0299)
age2	–0.0161*	0.00230	–0.0137	0.0142
	(0.00969)	(0.00787)	(0.0194)	(0.0147)
edu2	0.00312	0.0177**	–0.00529	0.0139
	(0.00976)	(0.00793)	(0.0182)	(0.0138)
atscl2	–0.111**	–0.130***	–0.110	–0.130**
	(0.0566)	(0.0459)	(0.0852)	(0.0644)
onvac2	0.0866*	–0.0226	0.0530	–0.0107
	(0.0504)	(0.0409)	(0.0636)	(0.0481)
Observations	2,487	2,487	1,745	1,745
R-squared	0.119	0.127	0.125	0.124

Robust standard errors in parentheses (*** p < 0.01, ** p < 0.05, * p < 0.1). Results for other variables not reported but always included in estimations, including $WhouseworkII$, $HhouseworkII$, $helper$, $urban$, living space per capita and household appliances (freezer, washing machine, gas cooker, rice cooker, vacuum cleaner and microwave oven).

Table 9 First-difference analysis for time spent on housework for twins

Head's children	Twins (pooled)	Twins in two-child families	Twins (pooled)	Twins in two-child families
	(1)	(2)	(3)	(4)
Variables	dhousework	dhousework	dhousework	dhousework
samesex	0.238*	0.0556	0.218	0.0894
	(0.124)	(0.179)	(0.158)	(0.130)
datscl	–0.430	2***	–0.754	2.276***
	(0.643)	(0.0222)	(0.613)	(0.288)
donvac	0.158	–2.389***	0.428	–2.727***
	(0.665)	(0.307)	(0.611)	(0.311)
lhhincomesqrpc			0.0859	0.0925
			(0.0885)	(0.0716)
helper			–1.352	0.0955
			(1.127)	(0.134)
singleparent			–0.264**	–0.103
			(0.133)	(0.188)
urban			0.0954	–0.0576
			(0.0760)	(0.0680)
freezer			–0.0825	0.114
			(0.105)	(0.103)
washing			0.302	–0.167
			(0.191)	(0.114)
gascooker			–0.0402	0.102
			(0.0927)	(0.0961)
ricecooker			–0.303**	–0.266**
			(0.137)	(0.110)
microwave			–0.467*	–0.0416
			(0.262)	(0.198)
areapc			0.0120	–0.000684
			(0.00796)	(0.00645)
Constant	–0.227**	–0.0556	–0.973	–0.816
	(0.114)	(0.179)	(0.845)	(0.655)
Observations	133	63	132	62
R-squared	0.079	0.530	0.271	0.633
Adj R-squared	0.0571	0.5056	0.1905	0.5341

Robust standard errors in parentheses (*** p < 0.01, ** p < 0.05, * p < 0.1).