Gender Equality in Unpaid Housework

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Preface

This report presents the research results implemented during September 1, 2016 to March 31, 2017 of the Research Project on "Gender Equality in Unpaid Housework". The project is to investigate the time allocation within a household and gender equality with the appearance of home appliances.

During the seven-month period, I conducted analysis on the time division between husband and wife on unpaid housework or ordinary chores in Vietnam. The difference in household settings such as household composition (size, gender, and age), paid work, childcare and leisure activities is an obstacle for any analysis on time spent on housework. Using a household fixed effect, I was able to overcome this issue and controlled all these variations by using a dummy for each household. Besides, I divided the data into some important household settings and examined the gap. The interaction terms between home appliances and the gender shows a connection between the gender gap and home appliances. I found the gender gap is existing regardless the household settings and even among non-working couples. Especially, the gender gap tends to be larger when the home appliances are available.

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Abstract

We examined the gender gap between wives and husbands with regard to time spent on unpaid housework and the interaction terms between home appliance ownership and gender among 36,480 Vietnamese households. We found the gender gap is persistent regardless of number of co-residing children, age cohorts, household size and income, working status of the couples, and whether a wife had a higher wage rate (education) than her husband. The gender gap of time increased with the appearance of home appliances such as gas cookers. A lower probability of husbands doing housework and changes in gender values could be important explanations.

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1 Introduction

'Stoves were labor-saving devices but the labor that they saved was male.'

Cowan (1983: 61)

Our study examines whether there is a gender gap as regards time spent on unpaid housework and whether the appearance of home appliances is associated with a narrower gender gap between husbands and wives in Vietnam. We chose Vietnam because its transitioning economy contains both industrial and agricultural societies.

Thanks to trade that is more open and to rising income levels, the lifestyle of Vietnamese households is improving[1]. Approximately 99 percent of households have access to electricity[2]. In 2008, approximately 44.6 percent, 11.9 percent, and 31.1 percent of households owned a gas cooker, washing machine, and fridge, respectively[3]. However, this implies that the majority of households lived without these appliances. There has also been a shift from agricultural to nonagricultural work. For example, 55.1 percent of workers aged 15 years and over were employed in agriculture, forestry, or fishery in 2005, but this number had fallen to 52.3 percent in 2008[4]. Therefore, the allocation of time spent on paid work, unpaid housework, and leisure has changed, while an increase in earnings, according to Becker (1965), would also increase the relative cost of time. In addition, the total fertility rate fell from 2.25 to 2.08 children during 2001–2008[5]. Thus, women had an increasing amount of time for paid work, leisure time, and unpaid housework over this period.

Vietnamese women are highly involved in economic activities. The World Economic Forum's Global Gender Gap Report 2008 ranked Vietnam at 24th among 130 countries in terms of economic participation and opportunities[6]. Some 87.4 percent of married women work for income, while the figure for married men is 90.1 percent.

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[1] Vietnam joined the World Trade Organization in 2006 and experienced average annual GDP growth of over 5 percent from 1990 to 2008 (http://www.gso.gov.vn/default_en.aspx?tabid=468&idmid=3&ItemID=12979).
[2] The World Bank Indicator, http://data.worldbank.org/indicator/EG.ELC.ACCS.ZS.
[3] Authors' calculations, see Table 2.
[4] See http://www.gso.gov.vn/default_en.aspx?tabid=467&idmid=3&ItemID=12889.
[5] See http://www.gso.gov.vn/default_en.aspx?tabid=467&idmid=3&ItemID=12913.
[6] http://www3.weforum.org/docs/WEF_GenderGap_Report_2008.pdf.

Furthermore, 10.2 percent of married women and 15.9 percent of married men are "pure" wage earners (not involved in any farm or family business work)[7].

There is a rich literature on time use at the household level. Along with Mincer (1962), the works of Becker (such as Becker 1965, 1974, 1981, and 1985) are the foundation of analyses of consumption and time use[8]. Studies by Blundell *et al.* (2005), Cherchye *et al.* (2012), and Browning *et al.* (2014) are perhaps among the most important extensions of the collective model of household behavior. Meanwhile, in empirical studies, Hersch (2009) finds that men substitute less paid work for unpaid housework than do women. Gronau (1977) shows that an increase in the wife's wage rate results in more paid working hours, less housework, and less leisure. Hersch and Stratton (1994) indicate that the gender gap on unpaid housework is due to the different wage rates of husbands and wives. Wales and Woodland (1997) further estimate the response of housework hours to the ratio of the wage rates. Gough (2011) finds unemployed individuals spend three to seven hours more per week on housework than when employed; and this increase is twice as large for women as for men. However, no empirical study has investigated the case when both do not work, nor addressed the case where couples mix paid work with farm work and/or a family business.

How husbands and wives allocate time on unpaid housework varies across countries, although husbands generally tend to do less. Ueda (2005) shows that an hour of Japanese husbands' housework does not perfectly substitute for an hour of wives' housework. Hersch and Stratton (1994) find that wives employed full time spend more time on both housework and paid work than their husbands do because women earn less. If the gender wage gap decreases, time spent on housework will be closer to equal (Hersch and Stratton, 1994). Folbre and Nelson (2000) find that if wives spend more time on paid work, husbands are less likely to increase time spent on unpaid housework to compensate.

The explanations for the reallocation of time between husbands and wives vary and are not simple among empirical studies. Stratton (2012) indicates that men dislike housework. Thus, wives have to compensate. Kroska (2003) reports that women find baby care and laundry-related activities to be "good, potent, and active" and preparation

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[7] Authors' calculations, see Table 2.
[8] Further history of the development of Becker (1965) can be found in Chiappori and Lewbel (2015).

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of meals to be "particularly powerful," but dislike washing dishes more than men do. Poortman and Lippe (2009) show that women tend to favor cleaning, cooking, and childcare more than men do. Beblo and Robledo (2008) show that husbands have more leisure time because they are Stackelberg leaders in sequential private provision games. Analyzing the French workweek reduction policy, Goux *et. al* (2014) find that husbands of policy-eligible women tend to reduce their paid work time, while the wives show little response if their husband was in the target group of the policy.

Home appliances would encourage women to participate in paid work. Cavalcanti and Tavares (2008) find that lower home appliance prices increased the labor force participation rate of women during 1975−1999 in 17 OECD countries. Similarly, Coen-Pirani *et al.* (2010) find a positive causal effect of home appliance ownership on labor force participation of women in the 1960s in the USA. However, to the best of our knowledge, the division and gender gaps of time spent on unpaid housework have not yet been examined empirically together with home appliance ownership in a developing country.

In this study, we use household fixed-effect models to estimate the time gap on unpaid housework and then the interaction terms between the appearance of home appliances and gender. We find the gender gap of time is persistent and around 40.3–58.6 minutes per day, even among dual-nonworking couples and where the wage rate (years of schooling) of the wife is higher than that of the husband. We also find a positive nexus between the appearance of home appliances (gas cooker) and an increase in the time gap, indicating less time spent on unpaid housework for men. We argue that the reduction in the probability of the husband participating in specific unpaid housework tasks and the change in male and female attitudes toward housework could be among the key explanations for this nexus.

Our study extends the previous studies in several ways. To the best of our knowledge, this is the first empirical study analyzing the interaction between home appliances and the gender gap relating to time spent on unpaid housework. By eliminating the time-invariant factors in household fixed-effect models, we can measure the real "natural" gender gap between husbands and wives. Furthermore, we first consider the

interaction terms for 32 types of household composition, including where the couples do not work and where the wife has a higher wage rate (years of schooling) than her husband.

This paper proceeds as follows. The next section describes the data. Section 3 illustrates how we estimate the gender gap relating to time spent on housework and the interaction terms using different samples. In Section 4 we present the results, and Section 5 presents the conclusions and discussion.

2 Data

We use the Vietnamese Household Living Standard Survey 2008 (VHLSS 2008). This provides cross-sectional and country-representative data from the General Statistics Office of Vietnam (GSO) using a two-stage stratified sampling method. The VHLSS 2008 design is identical to the Living Standards Measurement Studies by the World Bank. VHLSS 2008 is the latest survey containing information about housework from 45,945 households comprising 289,948 individuals. In the VHLSS, there are two questions: one about whether individuals do housework and if the answer is yes, the other concerns how many hours per day the individuals spent on housework on average during the previous 12 months. VHLSS 2008 defines housework as activities such as cleaning, shopping, cooking, washing clothes, fetching water and wood, and repairing tools. We refer to this definition as routine unpaid housework. The survey includes information about the availability of home appliances such as fridges, vacuum cleaners, washing machines and driers, gas cookers, rice cookers, and microwave ovens.

We use information on time spent on unpaid housework and the presence of home appliances as the main variables. We consider the head and the head's spouse as the husband and wife of the family in our analysis. After excluding households in which the head does not have a spouse, we have 36,480 households. The descriptive statistics of our data are presented in Tables 1 and 2.

Table 1 Descriptive statistics of husbands and wives in the selected sample

Variables	Wife				Husband			
	Mean	Std. dev.	Min.	Max.	Mean	Std. dev.	Min.	Max.
UHW (daily hours of unpaid housework)	2.354	1.238	0	8	1.149	0.994	0	8
PW (daily hours of paid work)	3.815	2.619	0	17.753	4.013	2.508	0	16.767
UHW (daily hours of unpaid housework > 0, N = 25,924)	2.380	1.096	1	8	1.560	0.808	1	8
PW (daily hours of paid work > 0, N = 30,253)	4.364	2.310	0.011	16.767	4.428	2.200	0.016	16.767
Work for income (1 = yes, 0 = no)	0.874	0.332	0	1	0.901	0.299	0	1
Wage earner	0.227	0.419	0	1	0.402	0.490	0	1
Pure wage earner (without farm work or family business)	0.102	0.303	0	1	0.159	0.366	0	1
Age	45.553	11.916	18	92	48.459	12.359	18	98
Years of schooling	6.953	4.081	0	20	7.986	4.046	0	19
Absence (Absent days from routine tasks in previous 12 months)	5.673	19.419	0	365	5.680	22.377	0	365
Ill days (Number of days of illness in previous 12 months)	1.741	11.399	0	365	2.229	16.726	0	365

Note: Total number of households = 36,480.

Table 2 Descriptive statistics of households in the selected sample

Variables	Mean	Std. dev.	Min.	Max.
0 children[a]	0.106	0.307	0	1
1 child	0.211	0.408	0	1
2 children	0.407	0.491	0	1
3 children	0.177	0.382	0	1
4 children	0.064	0.244	0	1
More than 4 children	0.035	0.184	0	1
Tap water (being used)	0.215	0.411	0	1
Urban	0.245	0.430	0	1
Fridge	0.311	0.463	0	1
Washing machine	0.119	0.323	0	1
Gas cooker	0.446	0.497	0	1
Rice cooker	0.693	0.461	0	1
Vacuum cleaner	0.012	0.109	0	1
Microwave oven	0.024	0.152	0	1

Notes: Total number of households = 36,480. [a]Children are those of the head and are co-residing in the household.

3 Empirical methods

We use household fixed-effect models (HHFEs) to analyze the gender gap in time spent on unpaid housework. For each household, we assume the time spent on unpaid housework depends mainly on (a) the variation that covariates with the gender of the individuals, (b) individuals' characteristics that vary between the husband and the wife (X_{ik}), and (c) the preference or sharing rules or any factors that remain constant over time within the household ($Household_k$).

$$Unpaid\ housework_{ik} = \varphi_1 Sex_{ik} + \varphi_2 X_{ik} + \varphi_3 Household_k + \varphi_4 Appliances_{jk} * Sex_{ik} + \vartheta_{ik}\ (1)$$

The time-invariant factors are captured by a dummy for each family. We use the Stata command *areg* in our analysis with 34,679 dummies ($Household_k$). Thus, the coefficient φ_1 shows the "pure" gender gap in time spent on unpaid housework. Meanwhile, the interactions between the variables of interest ($Appliances_{jk}$) with Sex_{ik} show the marginal gap of time spent on housework between wife and husband if the variables of interest change by one unit, holding all other factors constant within the household.

The main characteristics of individuals are described in Tables 1 and 2. "Absence" ("ill day") indicates the total number of days in the 12 months prior to the survey that the wife/husband was absent (ill) and unable to do routine work.

We also add dummies for the appearance of home appliances in the household as well as construct the first principal component of the six appliances. We notice that pure wage earners are people who work for a salary, but who are not involved in either farm work or a family business. This is done to distinguish them from wage earners who are also involved in farm work and/or a family business.

We divide the data into eight main categories as a robustness check of the gender gap, and of the interaction between the variables of interest and gender. These categories are as follows: working status (both not working, dual-working couples[9], dual-wage earner, and pure dual-wage earner); wage rate/education of wife is higher than that of the husband given both are pure wage earners; number of co-residing children (0, 1, 2, 3, 4 and > 4); husband's age (< 26, 26–35, 36–45, 46–55, 56–65, and > 65); quartiles of income (4th quartile is the richest)[10]; household size (< 4, 4, 5, and > 5); dual-chore- undertaking couples[11]; urban (rural); and top households having highest (lowest) total time of husband and wife on unpaid housework. We also examine the case where households do not have any of the six home appliances.

In addition, we apply three measures to deal with the high correlations between gas cookers and rice cookers[12]/washing machines[13]/fridges (0.52, 0.37, and 0.43, respectively). First, we conduct principal component analysis by constructing the first principal component (PCA) from six interaction terms between gender and home appliance variables. Second, we retain gas cookers, vacuum cleaners, and microwave ovens in the analyses. Finally, we estimate separately each of the variables of interest for each of the data samples. We test their signs and statistical significance across the various data samples. We report the analyses with PCA and three appliances as the main results, and present the other results in the Appendix.

4 Results

As shown in Table 3, the gender gap relating to time spent on unpaid housework is persistent and approximately 40.3 to 58.6 minutes per day. The gap is 18 minutes lower if both the husband and wife do unpaid housework for at least a minute each day. When comparing the

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[9] Dual-working couples are those who both do some work for income. Dual-wage earners are those who both do some jobs for wages.
[10] This is because the rich have more tools (Cowan, 1983).
[11] Couples where both spent at least one minute on unpaid housework.
[12] Unfortunately, the GSO uses the same code for rice cookers, electronic cookers, and pressure cookers. Therefore, we refer to this variable as "rice cookers" and use the coded variable to construct PCA for the six variables.
[13] The variable "washing machine" represents both washing machines and driers.

gap across the data samples in Table 4, the gaps are statistically significant in 32 samples, regardless of the working status, number of co-residing children, birth cohorts, income levels, and household sizes. This is consistent with the results of Vu (2014) who finds a daily 5.25-minute gender gap between Vietnamese siblings aged less than 18 years relating to daily unpaid housework. The gender gap exists even without any appliances, as shown in column (5) of Table 3, and when the wife has a higher wage rate (years of schooling) than her husband, as shown in lines (6) and (7) of Table 4.

Table 3 Household fixed-effect models on time spent on unpaid housework

Variables	Six appliances[†]	Three appliances			Subsample without any appliances
		All	Both do chores	Both do not work	
	UHW	UHW	UHW	UHW	UHW
	(1)	(2)	(3)	(4)	(5)
Sex	0.952***	0.976***	0.672***	0.863***	0.886***
	(0.029)	(0.028)	(0.026)	(0.127)	(0.053)
PCA	0.078***				
	(0.007)				
Gas cooker × sex		0.281***	0.197***	0.439***	
		(0.025)	(0.023)	(0.129)	
Microwave oven × sex		0.274***	0.299***	0.108	
		(0.103)	(0.106)	(0.263)	
Vacuum cleaner × sex		0.004	0.114	–0.492	
		(0.119)	(0.121)	(0.375)	
Working hour	–0.116***	–0.115***	–0.080***		–0.121***
	(0.007)	(0.007)	(0.006)		(0.014)
Absence	–0.006***	–0.006***	–0.002***	–0.006***	–0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Ill day	–0.008***	–0.008***	–0.004**	–0.008***	–0.008***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
Wage earner	–0.345***	–0.344***	–0.288***		–0.380***
	(0.031)	(0.031)	(0.029)		(0.050)
Pure wage earner	–0.380***	–0.382***	–0.206***		–0.413**
	(0.059)	(0.060)	(0.061)		(0.172)
Age and age ^2	Yes	Yes	Yes	Yes	Yes
Head of the household	Yes	Yes	Yes	Yes	Yes
Self-employed (types 1–3)	Yes	Yes	Yes		Yes
Working (dummy)	Yes	Yes	Yes		Yes
N/2–1 dummies of households	Yes	Yes	Yes	Yes	Yes
Constant	2.001***	1.954***	2.708***	12.396***	2.113***
	(0.299)	(0.299)	(0.303)	(3.771)	(0.463)
Observations (N)	72,960	72,960	51,848	3,972	18,468
R-squared	0.704	0.704	0.735	0.721	0.708
Adjusted R-squared	0.408	0.408	0.469	0.439	0.416

Notes: Robust standard errors in parentheses (*** p < 0.01, ** p < 0.05, * p < 0.1). [†] The first principal component of the six appliances is used.

Table 4 Interaction terms by data sample

Data selections		N	Six appliances[†]				Three appliances							
			Sex	St. err.	PCA	St. err.	Sex	St. err.	Gas cooker × sex	St. err.	Microwave × sex	St. err.	Vacuum × sex	St. err.
All	(1)	72,96	0.952**	(0.029	0.078**	(0.007	0.976**	(0.028	0.281***	(0.025	0.274***	(0.103	0.004	(0.119
Dual-nonworking	(2)	3,972	0.874**	(0.136	0.101**	(0.036	0.863**	(0.127	0.439***	(0.129	0.108	(0.263	−0.492	(0.375
Dual-working	(3)	60,50	0.881**	(0.030	0.062**	(0.007	0.910**	(0.029	0.204***	(0.024	0.250**	(0.120	0.172	(0.127
Dual-wage earners	(4)	12,12	1.001**	(0.060	0.043**	(0.016	1.013**	(0.057	0.145***	(0.054	0.010	(0.234	0.347	(0.241
Pure dual-wage earners	(5)	4,642	1.149**	(0.112	0.026	(0.031	1.179**	(0.105	0.051	(0.105	−0.150	(0.251	0.498*	(0.276
Higher wage rate of wife	(6)	1,380	0.978**	(0.194	0.054	(0.056	0.993**	(0.173	0.170	(0.167	0.030	(0.301	0.143	(0.667
More years of schooling	(7)	1,228	1.157**	(0.183	−0.045	(0.060	1.122**	(0.176	−0.148	(0.187	0.025	(0.384	0.644	(0.526
Living without a child	(8)	7,708	0.803**	(0.077	0.060**	(0.021	0.848**	(0.076	0.143*	(0.074	0.526*	(0.302	−0.089	(0.245
1 child[a]	(9)	15,36	0.978**	(0.061	0.066**	(0.017	0.992**	(0.056	0.236***	(0.054	0.274	(0.233	0.042	(0.269
2 children	(10	29,73	0.918**	(0.044	0.083**	(0.011	0.939**	(0.042	0.306***	(0.037	0.195	(0.143	0.086	(0.178
3 children	(11	12,91	1.025**	(0.088	0.096**	(0.017	1.079**	(0.090	0.324***	(0.064	0.448*	(0.240	−0.096	(0.264
4 children	(12	4,664	1.094**	(0.129	0.066**	(0.030	1.105**	(0.123	0.251**	(0.102	0.501	(0.607	−0.366	(0.679
More than 4 children	(13	2,572	1.210**	(0.167	0.033	(0.039	1.140**	(0.162	0.363**	(0.163	−1.069	(0.680	−0.229	(1.230
Husband aged < 26	(14	576	1.033**	(0.368	0.081	(0.065	1.120**	(0.377	0.143	(0.365				
Husband aged 26–35	(15	9,308	0.949**	(0.087	0.040**	(0.018	0.910**	(0.084	0.273***	(0.069	−0.266	(0.341	0.191	(0.362
Husband aged 36–45	(16	23,29	0.990**	(0.054	0.062**	(0.013	1.010**	(0.053	0.236***	(0.042	0.109	(0.263	0.126	(0.249
Husband aged 46–55	(17	21,68	0.952**	(0.049	0.090**	(0.012	0.994**	(0.047	0.287***	(0.044	0.291**	(0.144	0.156	(0.170
Husband aged 56–65	(18	10,19	0.853**	(0.077	0.105**	(0.020	0.918**	(0.071	0.314***	(0.066	0.410*	(0.238	−0.350	(0.283
Husband aged > 65	(19	7,906	0.799**	(0.095	0.072**	(0.022	0.805**	(0.093	0.272***	(0.082	0.437*	(0.254	−0.017	(0.408
1st quartile income	(20	18,23	0.855**	(0.064	0.017	(0.014	0.849**	(0.063	0.194***	(0.073	−0.855	(1.149	0.237	(0.436
2nd quartile income	(21	18,23	0.967**	(0.055	0.033**	(0.014	0.949**	(0.052	0.224***	(0.047	0.118	(0.425	−0.266	(0.378
3rd quartile income	(22	18,25	1.056**	(0.062	0.055**	(0.016	1.081**	(0.057	0.169***	(0.048	0.511*	(0.265	−0.096	(0.307
4th quartile income	(23	18,23	0.970**	(0.071	0.096**	(0.019	1.041**	(0.069	0.249***	(0.065	0.198*	(0.115	−0.010	(0.141

Table 4 (Conti.)

Data selections		N	Six appliances[†]				Three appliances							
			Sex	St. err.	PCA	St. err.	Sex	St. err.	Gas cooker × sex	St. err.	Microwave × sex	St. err.	Vacuum × sex	St. err.
Household size < 4	(24)	18,408	0.917***	(0.054)	0.054***	(0.015)	0.927***	(0.050)	0.197***	(0.049)	0.224	(0.222)	−0.030	(0.228)
Household size = 4	(25)	24,990	0.930***	(0.048)	0.086***	(0.011)	0.971***	(0.046)	0.267***	(0.041)	0.351**	(0.150)	0.165	(0.196)
Household size = 5	(26)	15,138	0.969***	(0.069)	0.090***	(0.015)	1.004***	(0.071)	0.333***	(0.055)	0.328	(0.241)	−0.048	(0.257)
Household size > 5	(27)	14,424	1.048***	(0.078)	0.072***	(0.016)	1.047***	(0.074)	0.343***	(0.060)	0.161	(0.244)	−0.209	(0.303)
Dual chore undertaken	(28)	51,848	0.630***	(0.027)	0.067***	(0.007)	0.672***	(0.026)	0.197***	(0.023)	0.299***	(0.106)	0.114	(0.121)
Urban	(29)	17,896	1.206***	(0.071)	0.062***	(0.019)	1.219***	(0.070)	0.206***	(0.070)	0.087	(0.124)	0.006	(0.159)
Rural	(30)	55,064	0.870***	(0.033)	0.049***	(0.007)	0.876***	(0.032)	0.203***	(0.027)	0.517***	(0.190)	−0.061	(0.161)
Top 27.72% lowest time	(31)	20,224	0.678***	(0.035)	0.020**	(0.008)	0.672***	(0.034)	0.092***	(0.032)	0.075	(0.114)	0.113	(0.153)
Top 23.29% highest time	(32)	16,990	1.101***	(0.074)	0.112***	(0.019)	1.154***	(0.071)	0.379***	(0.064)	0.202	(0.266)	0.008	(0.315)

Notes: Children are those of the head and co-residing in the household. Other control variables are the same as in Table 3. [†] The first principal component of the six appliances is used.

There might be several possible explanations for the time gap between wife and husband in which the condition whether the wife is working is important. Economic reasons such as wage rate differences are the first candidate for partially explaining the labor division in the household. This favors men who are more likely to have a higher wage rate. However, economic reasons cannot explain the gender gap when women have a higher wage rate (years of schooling) than their husbands. We propose some other explanations. First, women with higher wage rates (years of schooling) may still do more housework so as not to threaten their husbands' masculinity. Second, social norms such as womanly virtues in Confucianism maybe a contributing factor. Vietnamese men may be reluctant to participate in housework, whereas the women are willing to do the housework in order to protect the image of their husbands. Third, there may have been changes in how men and women value housework. Women may consider housework to be part of their leisure time. Besides, wives who are not full-time employees might do more housework or do it inefficiently to fill up their hours without paid work. Without paid work, women might schedule to do housework until their marginal utility of home production equals their marginal utility of leisure time.

The time gap between wives and husbands increases in association with the appearance of home appliances. As shown in column (1) of Table 3, the first principal component of the six home appliances increases the gap by 4.7 minutes per day for wives. The results are consistent in 26 selections of the data as shown in Table 4. However, we find the estimated PCA is statistically insignificant in six cases: pure dual-wage earners, higher wage rate (years of schooling) of wife, couples with more than four children, husbands aged less than 26, and those in the lowest income quartile.

Examining the links between specific appliances, we find the interaction term constructed from gas cookers and gender has the most statistically significant coefficient of 16.9 minutes per day as shown in column (2) of Table 3. The significance of the coefficients is independent of model specifications that include or exclude other home appliances as shown in the corresponding coefficients in both Table 4 and the Appendix. However, the coefficients become statistically insignificant for pure dual-wage earners, higher wage rate (years of schooling) of wife, and where the husband is aged less than 26 years. Among the couples living with more than four children or in the lowest income

quartile, the statistically insignificant *PCA* could be due to the opposite signs of the interaction terms.

The decision to participate in unpaid housework is one of the main reasons for a larger gender gap following the appearance of gas cookers. We find that with a gas cooker, husbands are 6 percent less likely to do unpaid housework, while the wife is only 0.6 percent less likely as shown in Table 5. This might be because men believe that cooking with a gas cooker is not difficult enough to warrant their help. Without a gas cooker, men may become involved in tasks such as collecting and chopping firewood.

Table 5 Mean comparison tests between two samples, with and without gas cooker

Data selections	Gas cooker available (A)		Without gas cooker (B)		Difference
	Obs.	Mean	Obs.	Mean	(A)–(B)
All					
Participation–H[†]	16,279	0.6958	20,201	0.7563	−0.0605***
Participation–W	16,279	0.9599	20,201	0.9659	−0.0060***
Time gap–a[††]	16,279	1.3831	20,201	1.0622	0.3209***
Time by husband–b	10,984	1.5805	14,940	1.5447	0.0358***
Time by wife–b	10,984	2.5111	14,940	2.2829	0.2282***
Time gap–b	10,984	0.9306	14,940	0.7382	0.1924***
Pure dual-wage owners					
Participation–H	1,753	0.7467	568	0.6919	0.0548
Participation–W	1,753	0.9738	568	0.9613	0.0125**
Time gap–a	1,753	1.2801	568	1.2324	0.0477
Time by husband–b	1,286	1.5303	384	1.5598	−0.0296
Time by wife–b	1,286	2.4697	384	2.4244	0.0452
Time gap–b	1,286	0.9393	384	0.8646	0.0748
Age husband < 26					
Participation–H	62	0.8065	226	0.8717	−0.0652
Participation–W	62	0.9839	226	0.9956	0.0117
Time gap–a	62	1.4839	226	0.9558	0.5281***
Time by husband–b	50	1.4800	196	1.5102	−0.0302
Time by wife–b	50	2.5800	196	2.2092	0.3708**
Time gap–b	50	1.100	196	0.6990	0.4010**

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

[†]Participation–H (W) is percentage of husbands (wives) who spent at least one minute on unpaid housework.

Meanwhile, genders might value housework differently. We observe that both husband and wife spend more time on housework if they have a gas cooker. However, the increment of time difference for the wife is 13.7 minutes, but only 2.1 minutes for the husband as shown in Table 5.

We hypothesize some additional reasons for the increased gender gap in time associated with the appearance of home appliances, particularly gas cookers. First, when home appliances are available, more added values can be created, and they may be perceived differently from different gender perspectives. With home appliances, households can increase the quality/standards (cooking, sanitation/healthiness) of home productions. For example, with a fridge, households can store a variety of food which allows them to prepare a wider range of dishes. Such improvements, however, means it takes more time to complete related housework tasks. While gas cookers reduce cooking time because of convenient heat adjustment and multiple-task heating, they allow households to cook more dishes per meal. Thus, the total time spent using gas cookers and cleaning dishes increases. Meanwhile, women might value high-quality cooked foods more than men do. Thus, there may be a connection between the wider gender gap and home appliances. Second, wives could be more involved because they might consider cooking time as leisure time and gas cookers make cooking more enjoyable. The indirect evidence is that women who are pure dual-wage earners are more likely to participate in cooking (a 1.25 percent increase) if the household owns a gas cooker (see Table 5).

Meanwhile, among pure dual-wage earners, we would argue that a high opportunity cost of time and time constraints give women less opportunity to further increase their time spent on unpaid housework, even if it is considered a leisure activity. Furthermore, by having a stable income, women can have more bargaining power. Similarly, men who have a lower wage rate (years of schooling) than their wives have less bargaining power. Thus, men cannot avoid collaborating with women and sharing tasks related to gas cookers. For example, a wife may cook while her husband cleans the dishes. These arguments could explain why the interaction terms are statistically insignificant.

Our main findings should be robust against some endogeneity issues. We acknowledge that home appliance ownership is endogenous[14]. We also acknowledge that households who spend more time on housework might own/purchase more time-saving home appliances; however, this does not mean that their average time spent on housework after the purchase can be reduced as low as that of other households. However, for the households with the largest and smallest total amounts of time spent by the husband and wife on unpaid housework, the statistically significant coefficients of gender and interaction terms in lines (31) and (32) of Table 4 (Appendix) allow us to confirm our findings.

5 Conclusions and discussion

We examined the time spent on unpaid housework by 36,480 Vietnamese couples. The gender gap is persistent across generations despite changes in the Vietnamese economy. Despite differences in household composition in terms of age, size, income, number of co-residing children, working status, difference in wage rates (years of schooling), we found that husbands spend 40.3–58.6 fewer minutes each day on unpaid housework than their wives do. Women still do more housework when both the husband and wife are not working, and when they have a higher wage rate (years of schooling) than their husbands. In addition, the gender gap of time increases with the appearance of home appliances such as gas cookers. The reduction in the probability of men participating in housework tasks related to gas cookers and changes in men's and women's values systems could be among the important reasons for the larger gap. However, this link does not exist among pure dual-wage earners or in cases where husbands are aged less than 26 years.

We acknowledge several limitations of our data and analyses. First, the data on time spent on housework is retrospective, but not from a time use survey where each specific task of each individual is recorded with both the starting and ending times. Second, we bypassed the self-selection of men and women toward specific tasks, the

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[14] Jacobsen (2015) suggests several conditions for owning time-savings home appliances: (a) cost efficiency (opting between home production and outsourcing); (b) facility readiness for home appliances, for example, the availability of electricity and running water for washing machines; and (c) affordability and space to store/maintain the home appliances. However, we found that only 148 of the 36,480 households (0.4% of the selected sample) have home helpers. The household fixed-effect method that uses the household dummy captures whether some of the housework can be done by other workers. Furthermore, our results are robust in terms of both rural and urban area selections.

productivity of doing housework, and the collaboration between couples on the same task. Thus, the gender gap might be associated with the specific tasks included in the survey. Third, we were only able to consider gas cookers, but not other types of cookers such as electronic cookers, pressure cookers, and rice cookers. This is because the survey coded the three mentioned cookers in the same variable.

The positive relationship between gender gap of time and the appearance of home appliances has several policy implications. First, the gap exists because individuals might be self-selected to certain specific tasks of unpaid housework. Thus, policies to increase the participation of women in paid work should consider this link. Second, the positive interaction terms indicate that the policies facilitating the participation of men in housework also empower women. This can also influence the marketing strategies of the suppliers of home appliances. Similarly, policies aimed at empowering women via microcredit should consider this interaction. Finally, our study confirms the existence of gender roles in terms of unpaid housework between husbands and wives.

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Appendix Robustness checks by separating each home appliance per estimation and by data sample

Data selections		N	Interaction between sex and											
			Gas cooker	Std. err.	Microwave oven	Std. err.	Vacuum cleaner	Std. err.	Fridge	Std. err.	Washing machine	Std. err.	Rice cooker	Std. err.
All	(1)	72,96	0.295***	(0.025)	0.399***	(0.097)	0.224**	(0.113)	0.244**	(0.028)	0.326**	(0.044)	0.138**	(0.025)
Dual-nonworking	(2)	3,972	0.434***	(0.127)	0.142	(0.249)	−0.348	(0.353)	0.358**	(0.127)	0.328**	(0.152)	0.289*	(0.151)
Dual-working	(3)	60,50	0.218***	(0.024)	0.383***	(0.113)	0.349**	(0.121)	0.181**	(0.027)	0.291**	(0.046)	0.107**	(0.024)
Dual-wage earners	(4)	12,12	0.158***	(0.054)	0.169	(0.205)	0.408**	(0.201)	0.149**	(0.062)	0.161*	(0.084)	0.063	(0.056)
Pure dual-wage earners	(5)	4,642	0.058	(0.104)	0.001	(0.222)	0.421*	(0.230)	0.091	(0.099)	0.024	(0.106)	0.051	(0.123)
Higher wage rate wife	(6)	1,380	0.179	(0.166)	0.086	(0.310)	0.189	(0.665)	0.091	(0.158)	0.148	(0.163)	0.223	(0.231)
More years of schooling	(7)	1,228	−0.116	(0.184)	0.143	(0.380)	0.614	(0.499)	−0.162	(0.182)	−0.379*	(0.208)	0.050	(0.237)
Living without a child	(8)	7,708	0.165**	(0.073)	0.579**	(0.286)	0.125	(0.240)	0.203**	(0.084)	0.357**	(0.175)	−0.003	(0.077)
1 child[a]	(9)	15,36	0.254***	(0.054)	0.383*	(0.219)	0.242	(0.259)	0.197**	(0.060)	0.263**	(0.094)	0.094*	(0.056)
2 children	(10)	29,73	0.318***	(0.037)	0.335**	(0.135)	0.273	(0.170)	0.237**	(0.040)	0.306**	(0.057)	0.158**	(0.039)
3 children	(11)	12,91	0.341***	(0.064)	0.567**	(0.223)	0.213	(0.234)	0.358**	(0.072)	0.431**	(0.121)	0.173**	(0.061)
4 children	(12)	4,664	0.264**	(0.103)	0.539	(0.545)	0.039	(0.541)	0.100	(0.130)	0.442*	(0.245)	0.192**	(0.093)
More than 4 children	(13)	2,572	0.326**	(0.162)	−0.933	(0.580)	−1.073	(1.107)	0.221	(0.188)	−0.027	(0.362)	0.376**	(0.133)
Husband age < 26	(14)	576	0.143	(0.365)					0.474	(0.441)	0.482	(0.833)	0.411	(0.260)
Husband age 26–35	(15)	9,308	0.268***	(0.068)	−0.065	(0.356)	0.220	(0.369)	0.155*	(0.083)	0.044	(0.126)	0.153**	(0.065)
Husband age 36–45	(16)	23,29	0.243***	(0.042)	0.241	(0.233)	0.256	(0.212)	0.199**	(0.048)	0.227**	(0.078)	0.156**	(0.042)
Husband age 46–55	(17)	21,68	0.308***	(0.044)	0.445***	(0.135)	0.377**	(0.160)	0.237**	(0.047)	0.385**	(0.073)	0.135**	(0.047)
Husband age 56–65	(18)	10,19	0.333***	(0.065)	0.477**	(0.228)	−0.075	(0.267)	0.349**	(0.073)	0.544**	(0.108)	0.116*	(0.070)
Husband age > 65	(19)	7,906	0.302***	(0.081)	0.556**	(0.250)	0.274	(0.410)	0.252**	(0.091)	0.252*	(0.146)	0.056	(0.083)
1st quartile income	(20)	18,23	0.190***	(0.073)	−0.711	(1.147)	0.217	(0.400)	0.023	(0.112)	−0.166	(0.278)	0.051	(0.043)
2nd quartile income	(21)	18,23	0.224***	(0.047)	0.182	(0.418)	−0.227	(0.389)	0.008	(0.062)	0.061	(0.190)	0.024	(0.045)
3rd quartile income	(22)	18,25	0.174***	(0.048)	0.556**	(0.270)	0.008	(0.300)	0.091*	(0.051)	0.203**	(0.089)	0.040	(0.061)
4th quartile income	(23)	18,23	0.267***	(0.064)	0.233**	(0.107)	0.112	(0.132)	0.269**	(0.055)	0.224**	(0.058)	0.050	(0.084)

Appendix (Conti.)

Data selections		N	Interaction between sex and												
			Gas cooker	Std. err.	Microwave oven	Std. err.	Vacuum cleaner	Std. err.	Fridge	Std. err.	Washing machine	Std. err.	Rice cooker	Std. err.
Household size <4	(24)	18,408	0.208***	(0.049)	0.304	(0.209)	0.124	(0.216)	0.183***	(0.056)	0.240**	(0.096)	0.033	(0.050)
Household size = 4	(25)	24,990	0.288***	(0.040)	0.494***	(0.141)	0.393**	(0.188)	0.242***	(0.044)	0.323***	(0.063)	0.154***	(0.044)
Household size = 5	(26)	15,138	0.345***	(0.054)	0.457**	(0.228)	0.206	(0.246)	0.291***	(0.060)	0.391***	(0.099)	0.167***	(0.052)
Household size > 5	(27)	14,424	0.347***	(0.060)	0.272	(0.224)	0.034	(0.275)	0.251***	(0.068)	0.340***	(0.112)	0.205***	(0.056)
Dual chore undertaken	(28)	51,848	0.214***	(0.023)	0.413***	(0.100)	0.306***	(0.116)	0.205***	(0.027)	0.299***	(0.044)	0.142***	(0.022)
Urban	(29)	17,896	0.214***	(0.069)	0.126	(0.115)	0.083	(0.147)	0.188***	(0.060)	0.126**	(0.062)	0.084	(0.091)
Rural	(30)	55,064	0.212***	(0.027)	0.619***	(0.186)	0.112	(0.162)	0.103***	(0.032)	0.247***	(0.068)	0.074***	(0.025)
Top 27.72% lowest time	(31)	20,224	0.098***	(0.032)	0.144	(0.108)	0.178	(0.147)	0.034	(0.035)	0.089*	(0.053)	0.020	(0.033)
Top 23.29% highest time	(32)	16,990	0.392***	(0.064)	0.357	(0.247)	0.214	(0.292)	0.398***	(0.071)	0.457***	(0.110)	0.251***	(0.064)

Notes: [a]Children are those of the head and are co-residing in the household. Other control variables are the same as in Table 3.