Article

(Un)Sustainability of the Time Devoted to Selected Housework—Evidence from Slovakia

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Abstract: Domestic appliances play a vital role in modern households. Appliances help simplify domestic work, but individuals become dependent on them. The present paper aims to contribute to the long-standing dilemma among scholars whether domestic appliances help to shorten the time devoted to household chores or not. The paper focuses on the utilization of various domestic appliances in Slovak households and on the influence of their utilization on the time of men and women in partner households and in the single-person households devoted to routine unpaid work activities. The results of the paper are based on the data from original field research conducted in Slovakia in 2015. A total of 1179 partner households, 182 single-man households and 226 single-woman households were included in the analysis. The jamovi version 1.2 statistical program was used to verify the hypothesis by chi-squared goodness of fit test and nonparametric Mann–Whitney *U*-test. In partner households and in single-man households, usage of automatic washing machines significantly influences time devoted to preparation and maintenance of the clothes. In single-woman households, usage of dishwasher significantly influences time devoted to food preparation. In partner households, men devote less time to routine unpaid work activities than women, regardless of usage or non-usage of domestic appliances.

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1. Introduction

According to the standard economic theory, households are one of the economic agents entering the process of the market mechanism, both on the supply side and on the demand side [1–3]. The specific position of households on the supply side stems from the fact that households offer their work (labor) on the labor market [4,5]. Their decisions upon the participation in the labor market are mainly based on the wage they expect for the work offered [6–8].

When we consider households on the demand side, it is necessary to include, above all, the demand for those goods and services that meet the needs of households [9,10]. In the economic analysis of the behavior of households and individuals in the market, the approach of rational behavior of economic agents prevails [11–13]. This approach is based on a cost-benefit comparison or the choice of an option that is associated with a higher profit than the effort expended or the cost of making that profit.

If we consider households and their members only as economic agents, we point only to the relations of households with the external environment (with employers on the labor market, trade unions, other employees). This means, however, that we exclude those interactions that exist directly in the households [14–16]. Specific relationships and conditions that support the internal existence and organization of households (including unpaid household work) can also significantly influence household decisions about labor supply in the labor market (it means paid work) [17–20]. As early as in the 1970 s, economist Becker emphasized the importance of including the character of families, traditions, and

other values in economic analysis (this was the beginning of the family economics) [21–24]. If considering current trends in economic thinking (outside the mainstream), one can point to a new institutional economy [25–27]. It also favors informal institutions such as family, traditions, and customs [28,29]. Interestingly, mainstream economic theory pays little attention to this aspect. It also accepts very rarely the results of other social science disciplines, such as knowledge about balancing family and work life. It is precisely this area that deserves more attention due to changes in the behavior and functioning of families (or households), as well as changes in labor market conditions [30,31].

Within the non-mainstream economic approach, one can consider households not only as consumer units but also as production units [32–36]. Inputs to the household production include work (in our case, unpaid housework) expressed by the number of hours that the household (and its members) devote to the unpaid work activities and capital equipment, represented by household appliances [37,38].

Unpaid household work (a term we use interchangeably with domestic work, or housework) is in this study defined as “unpaid work done to maintain family members and/or a home” [39] (p. 300). Although this concept can include childcare, household management, and various kinds of emotional work, most housework studies have excluded these types of work from the study [40]. The same is applied in our study. Since unpaid housework includes various types of activities, it makes sense to divide these activities into certain groups. They are usually divided into two groups, namely so-called routine tasks (housework), that include food management (food preparation and washing the dishes), household upkeep (housekeeping—cleaning), making and care of textiles (preparation and maintenance of the clothes) and non-routine housework, which includes gardening, pet care and tending domestic animals, repairs of dwelling together with house construction and renovation, shopping, and services [41–45]. Most of the latter work is not a routine activity connected to the household in the same sense as the former category.

There are significant gender differences in the amount of time devoted to different activities [39,40,46,47]. Routine tasks, such as food management, household upkeep and making and care of textiles, are done far more often by women, whereas occasional tasks, such as small repairs or outdoor projects, are done by men [48,49]. In Slovakia, food preparation belongs to the most time-consuming routine unpaid work activity [50,51], followed by the preparation and maintenance of the clothes [52].

Rapid technological progress in the 20th century affected not only market production [53,54] but also production processes in households in terms of their growing equipping with capital goods. For example, Burns points to a steady increase in the relative importance of investment in household equipment in the United States, which rose from about 33% of gross capital formation in market industries in 1900 to more than 100 percent in 1950. In 1950, Americans placed about the same amount of new equipment in their homes as in the business sector (in [55]). Another author [56] points to a significant decline in the share of household expenditure devoted to the purchase of market services in the United Kingdom for more than two decades (from 1954 to 1974). This decline was offset by rising household spending on capital equipment, such as cars, refrigerators, stoves, freezers, washing machines, vacuum cleaners, power tools, televisions, videos, and stereos. According to him, this increase in investment in the household (domestic industry) indicates a fundamental change in relations between the market and households.

There are various theoretical and research approaches to the ownership or utilization of domestic appliances in households and their influence on the environment and sustainable development. Ownership and utilization of appliances in households is commonly linked with an analysis of household electricity consumption [57–60]. In the last years, the utilization of domestic appliances has been related to climate change and protection [61–64], sustainability [65–67], and other environmental issues [68–72]. To protect the environment and to allow sustainable usage of domestic appliances, smart solutions are being considered inevitable [73–77].

There is, however, a lack of literature focusing on micro-level sustainability. Sustainability, as defined by [78], means balancing the three dimensions—economy, environment, and society. In connection with micro-level sustainability, Other authors [79] sum up nine indicators that we can also apply to the analysis of time devoted to unpaid household work and usage of domestic appliances: recycling, end-of-life management, remanufacturing, resource-efficiency, disassembly, lifetime extension, waste management, reuse, multidimensional indicators. Based on the report [80], besides the GDP growth, there are also other possibilities of measuring sustainability. These possibilities restart from the conventional notion of GDP but try to systematically augment or correct it by using those elements that standard GDP does not consider and that matter for sustainability. In addition to others, they consider adding monetary estimates of activities that do contribute positively to welfare (such as leisure and work at home) as an important indicator of welfare and its sustainable measure. Time devoted to unpaid housework and utilization of appliances belongs to basic variables necessary for monetary evaluation of unpaid work (input method of assessing the monetary value of unpaid work [81,82]).

Changes in the structure and amounts of household equipment have also influenced the structure of household unpaid work and time devoted to various unpaid work activities. It is, however, necessary to deeply analyze whether there is any relationship between the two above-stated factors of unpaid domestic work, i.e. labor and capital, and if yes, what kind of relationship it is. This is in accordance with the resource-efficiency indicator of micro-level sustainability [79]. Theoretically, within the production process, there may be a partial substitution of the labor by capital (which in turn leads to an increase in domestic labor productivity). This would mean that the ownership of those capital goods that substitute particular activities of unpaid domestic work should reduce the amount of the labor entering the production process, which would, in turn, result in a decrease in the amount of time devoted to unpaid work (this assumption could be applied in *ceteris paribus* conditions, it means if the household output remains unchanged). Gershuny developed a theory of a “self-service economy”, in which households use products of the manufacturing industry, such as washing machines, to carry out domestic work themselves, which they would otherwise entrust to a paid provider [56]. This means households invest in buying domestic appliances not to decrease unpaid domestic work but to increase their overall domestic production. To verify the assumption of the increase of domestic production would, however, mean having long-term data not only about the inputs to the production process but also about all outputs from household production. As argued by authors [82], to directly value household output (household production) requires the measurement in physical quantities of household outputs, such as number and kinds of meals prepared, the number of children cared for, kilograms of laundry washed, etc. These data are not standardly gathered, so it is almost impossible to verify the assumption of the increase of household production thanks to the domestic appliances. That is why it is controversial whether the utilization of domestic appliances can reduce the time spent on unpaid work. Therefore, it is not surprising that there are mixed results in the literature examining the relationship between unpaid domestic work and usage of domestic appliances.

Starting from Vanek, many researchers have tried to prove that domestic appliances do not reduce the time spent on housework [83]. Other authors show that domestic technology rarely reduces women’s unpaid working time and even, paradoxically, produces some increases in domestic labor (so-called domestic labor paradox) [84]. The domestic division of labor by gender remains remarkably resistant to technological innovation. Their research was based on a time-use survey conducted in Australia in 1997, and they analyzed the influence of five appliances (microwave oven, deep freezer, dishwasher, clothes dryer, mower, and edge-trimmer) on time spent in unpaid work. The author Vu analyzed the association between the ownership of home appliances (namely gas cooker) and the gender gap in time spent for unpaid work [85]. He found that gas cookers help to reduce the time spent on unpaid housework for the husbands by much as 1.8 min per day. However, gas cookers increase the amount of unpaid housework of wives by 3.8 min per day. Other

authors analyzed time spent for unpaid work in Denmark in 1964–2009 [86]. They found that, despite the better availability of more highly preprocessed foods, fast food, effective cleaning agents and time-saving household appliances, the amount of time spent on unpaid work remained unchanged or even increased. According to their research, there are indications that the production simply increased—clothes are washed more frequently, families live in larger homes, people use more dishes at meals and spend more time on childcare. Even more, the do-it-yourself approach is replacing paid work at home and, to some extent, outside the home.

On the other side, there is research that proves that ownership or usage of home appliances reduces unpaid household work. Even when only using an indirect approach, researchers showed that wider availability and lower cost of home appliances facilitate the participation in the labor market by decreasing the amount of time necessary to perform household chores [87]. As an unequal share of these chores tends to fall on women's shoulders, female labor force participation should increase in response. Gershuny [88] tried to deny the domestic labor paradox (introduced by Vanek [83] and elaborated by Bittman [84]). Using the longitudinal historical data, he pointed out that the change in the total of domestic labor devoted to any sphere of domestic production depends on the ratio between the change in productivity and the change in household output over the period. If the time is saved in one sphere (such as time for laundry because of using a washing machine), it may be transferred to another (e.g., childcare) in full or partial compensation. There is no socioeconomic law according to which time for unpaid work must decrease. However, the evidence is that, across the world, in the second half of the twentieth century, unpaid housework and cooking have regularly declined. According to Gershuny, there is not any real evidence that domestic equipment decreases domestic work overtime [88].

There are even several studies focusing on the different aspects of domestic appliance utilization; there is no complex study focusing on the relationship between the time devoted to unpaid work and usage of domestic appliances in Slovakia or surrounding countries. The originality of the paper is an attempt to expand the current knowledge of the household as the production units (as part of the non-mainstream approach to analyze households), with the emphasis on the substitution of the work (time devoted to unpaid work activities) by capital equipment (domestic appliances). We examine two factors entering the household production process—unpaid work (expressed in the time devoted for various unpaid work activities) and capital (usage of various domestic appliances). Possible substitution between the human unpaid domestic work and utilization of domestic appliances raises the questions (1) whether such substitution has a significant effect on reducing the time that individuals and households devote to unpaid work, and at the same time, and (2) which impacts such substitutions have on the environment and resource sustainability. Due to the lack of official statistical data, this study is based on data from original field research conducted in Slovakia in 2015. The paper is structured in four parts—introduction, the research methodology (materials and methods), presentation of results and discussion, conclusions.

2. Materials and Methods

2.1. The Aim of the Paper and Hypotheses

The aim of the paper is to find out whether usage of domestic appliances is associated with the short time devoted to household routine chores in Slovakia. The paper focuses on the utilization of various domestic appliances in Slovak households and on the influence of their utilization on the time of men and women in partner households and in the single-person households devoted to routine unpaid work activities.

According to the various theoretical approaches to the household unpaid work and usage of domestic appliances [55,56,82–84,86,88], we set up the following assumptions of household production and utilization of domestic appliances, as well as hypothesis to be verified in this paper:

- Households do not use domestic appliances;

- Households use domestic appliances, and their output (household production) remains unchanged. In this case, households (members of the households) either reduce the time devoted to unpaid work activities (in favor to more time dedicated to paid work, personal care and sleeping or leisure time), or time devoted to unpaid work is remaining unchanged, but the structure of unpaid work activities is changing (for example, thanks to the usage of a robotic mop, members of households can dedicate more time to childcare). This is also a situation when the household prefers unchanged output, but some kinds of routine unpaid work explicitly annoy members of the household (such as washing dishes). As stated by several researchers, routine tasks (such as food management, household upkeep and making and care of textiles) are usually done by women, and men are those who try to avoid such routine activities [48,49]. Based on this theoretical framework, we set two research hypotheses to verify:

Hypothesis 1 (H1). *We assume that men (male partners) dedicate less time to routine unpaid work when domestic appliances are used in the household.*

Hypothesis 2 (H2). *We assume that men living alone, who use domestic appliances dedicate less time to routine unpaid work than men living alone, who do not use domestic appliances.*

- Households use domestic appliances, and their output (household production) is increasing. In this case, usage of domestic appliances is not reducing the time devoted to unpaid work. Members of households dedicate the same time to unpaid work activities, and domestic appliances help them to increase household production. For example, a study in the Netherlands shows that about 60% of surveyed women have a positive attitude towards cooking [89]. Usage of domestic appliances (dishwasher, food processor, electric induction stove, etc.) will allow them to spend the same (or even more) time by cooking, but they will make it possible to reduce the time for activities associated with cooking (such as washing the dishes). In this case, usage of domestic appliances does not reduce the time for routine unpaid work activities but helps to increase household production. Based on this theoretical framework, we set the following research hypothesis to verify:

Hypothesis 3 (H3). *We assume that usage of domestic appliances does not influence the amount of time that women (female partners) dedicate to routine unpaid work.*

Measurement of the household production is complicated, almost impossible [82]; this is why we verify all three hypotheses with the ceteris paribus condition of unchanged household output.

2.2. Data Collection and Elaboration

Because of the lack of available official data on time dedicated to unpaid work, usage of domestic appliances and household production, we conducted original field research. The research in Slovakia was conducted in April and May 2015. The main aim of the research was to find out the structure and the extent of unpaid work, motives for performing unpaid work, the attitude of households to the existing extent of unpaid work, material equipment of households, and well-being of individuals. Households were personally visited and interviewed by volunteer students (students were trained to ask questions and to collect the data). Each student interviewed three different households and had one restriction/criterion for contacting households. The first contacted household was from Bratislava or Western Slovakia region, the second from Central Slovakia and the last from Eastern Slovakia Region.

We used a computer-assisted personal interview method (CAPI) for recording answers from respondents. All answers were recorded, and data were prepared for further pro-

ceedings. We divided all acquired data into two databases, namely database of household responses and database of individual responses.

In the research, we questioned 1854 households in Slovakia. Within households, we questioned 5089 individuals. From them, 4074 indicated information about gender. By means of the chi-squared goodness of fit test, we confirmed the representativeness of the research sample by gender (p -value = 0.053). To check representativeness, we used data from the Housing and population census in 2011 in Slovakia.

In Table 1, we present information about the structure of the Slovak population and of the research sample by gender, as well as results of the chi-squared goodness of fit test.

Table 1. Population of Slovakia and research sample by gender, chi-squared goodness of fit test.

	Descriptive Statistics				χ^2 Goodness of Fit		
	Total Population		Sample	Proportion	χ^2	df	p
Men	2,627,772	Observed	1922	0.472	3.73	1	0.053
		Expected	1984	0.487			
Women	2,769,264	Observed	2152	0.528			
		Expected	2090	0.513			

For this paper, we exported and analyzed data on two groups of households. Like the first group, we analyzed those households in which partners (man and woman) live together (either as a married couple or in any kind of informal partnership; in Slovakia, the only official coexistence of man and woman in matrimony. Any other coexistence of man and woman is considered as informal cohabitation). In total, in 1179 household's male and female partners live together. We do not consider the presence of children in households, but we excluded from the dataset households with more than 6 members (8 households) and those households in which two men or two women (as partners) live together (10 households). In the end, we included 1161 partner households in our analysis. To analyze the influence of domestic appliances on males and females living alone, we also analyzed single-person households (as the second group of households). From single-person households (407 households), 181 are single-man households, and 226 are single-woman households.

Within the research, households were asked (by means of a questionnaire) which appliances they use in the household (the usage, not the ownership, was relevant). Households could choose from the following appliances: personal computer (stationary or notebook), Internet connection, mobile phone, personal vehicle, automatic washing machine, clothes dryer, food processor, dishwasher, robotic vacuum cleaner or robotic mop, induction electric stove, television.

We divided unpaid work activities into 13 activities, namely food preparation, housekeeping—cleaning, preparation and maintenance of the clothes, growing ornamental plants, pet care, preparation and maintenance of equipment, shopping and services, growing agricultural plants, breeding farm animals, building and reconstruction, children care, adults care, and voluntary activity. Because we are analyzing the influence of domestic appliances on household production, we excluded voluntary activities from our analysis. This classification of unpaid work activities is based on the Activity Coding List 2008, which is used within harmonized European time use surveys since 2008 [90].

Based on Bittman's methodology, we first linked the usage of various appliances to specific routine unpaid work activity [84]. From all appliances, we selected only those, which is possible to link with routine unpaid work (food preparation, preparation and maintenance of the clothes, housekeeping—cleaning). In Table 2, there are relations between appliances (4 selected appliances—automatic washing machine, clothes dryer, dishwasher, robotic vacuum cleaner or robotic mop) and routine unpaid work activities (3 activities).

Table 2. Relation between usage of domestic appliances and routine unpaid work activity.

Appliance	Unpaid Work Activity
Automatic washing machine	Preparation and maintenance of the clothes
Clothes dryer	Preparation and maintenance of the clothes
Dishwasher	Food preparation ¹
Robotic vacuum cleaner or robotic mop	Housekeeping—cleaning

¹ washing dishes is included in food preparation activity (it is not part of housekeeping).

To analyze data and to verify research hypotheses, we used descriptive statistics, nonparametric chi-squared test. Because the assumptions of the normal distribution of the variables (the length of the time for unpaid work activities, utilization of domestic appliances) were rejected, we used nonparametric Mann–Whitney test for testing the significance of differences in the time devoting to routine unpaid work by the gender, and differences between people using domestic appliances in the unpaid work and those not using domestic appliances.

The hypotheses were verified on the probability level $\alpha = 0.05$. To analyze data and to test hypotheses, we used statistical software jamovi, version 1.2.

3. Results and Discussion

3.1. Descriptive Statistics

We analyzed 1161 partner households, 181 single-man households and 226 single-woman households. Of all partner households, in 332 (28.6%), there are no children or any other persons living. In 343 (29.54%), three members are living together, in 340 (29.29%) there are four members living together, in 121 households (10.42%), there are five members living together, and in 25 households (2.15%), there are six members living together. As stated by Coltrane [40], among predictors of men's relative share of the housework, there are age, life-course issues, marital status, and children. Based on this, we consider the number of household members significant for considering the extent of routine unpaid work performed by man and woman partners in partner households. Not only the extent of the routine unpaid work but also the utilization of domestic appliances is influenced by the number of household members [84,91].

In the case of single-person households, we focus on the age and education of persons living alone. We divided the age of households members into four age categories—up to 19 years of age (either participating in the labor market or studying at the secondary school), 20 to 24 years (either participating in the labor market or studying at the higher education institution), 25 to 49 years (pure productive age), 50 to 64 years (late productive age) and 65 and more years (retired persons). Persons living alone (both single-man and single-woman households) are aged 20 and 64 years. In single-man households, the pure productive age (25 to 49) prevails (78.5%). In the case of single women, the ratio of women in the age category from 25 to 49 and in the age category 50 to 64 years is almost the same (43.4%, event. 43.8%).

In both groups of single-person households, higher education prevails (men 48.6% and women 40.3%), followed by secondary education (men 31.5% of full secondary education and 16.6% of partial secondary education, women 27% of full secondary education and 21.2% of partial secondary education). We consider age and education important factors influencing the decision of single living persons to use domestic appliances, which is also supported by previous research [68,84,92,93].

In Table 3, we provide the structure and basic characteristics of households included in the analysis.

Table 3. Characteristics of analyzed households.

Households	Counts	% of Total	Structure of Households						
Structure by the Number of HouseholdMembers									
Partner households	1161	62.62%	Number of households members		Counts	% of Total partner households			
			2		332	28.6%			
			3		343	29.54%			
			4		340	29.29%			
			5		121	10.42%			
			6		25	2.15%			
Structure by Education									
Single-man households	181	9.76%	Level of education		Counts	% of Total	Structure by Age		
			Primary education		2	1.1%	Age category	Counts	% of Total
			Partial secondary education		30	16.6%	20–24	26	14.4%
			Full secondary education		57	31.5%	25–49	142	78.5%
			Post-secondary education		4	2.2%	50–64	13	7.2%
			Higher education		88	48.6%			
Structure by Education									
Single-woman households	226	12.19%	Level of education		Counts	% of Total	Structure by Age		
			No formal education		1	0.4%	Age category	Counts	% of total
			Primary education		23	10.2%	20–24	29	12.8%
			Partial secondary education		48	21.2%	25–49	98	43.4%
			Full secondary education		61	27.0%	50–64	99	43.8%
			Post-secondary education		2	0.9%			
Higher education		91	40.3%						
Other households	286	15.43%							

In the research, persons living alone and older than 65 years of age are missing. It is, however, a specific group of single-person households. Most of them were living in the traditional family structures in the past (they live alone mostly because they are divorced or widowed). Because they do not participate actively in the labor market anymore, their daily time allocation is significantly different from the daily time allocation of young persons in productive age. For this contribution, the lack of single persons over 65 years and a person under 19 years is not problematic. Even more, it helps us to compare only that part of persons living alone, that are in the productive age and that are participating (or could participate) on the labor market.

3.2. Hypotheses Verification

3.2.1. Utilization of Domestic Appliances in Partner Households

Partner households accounted for the largest part of the research sample (62.62%). In the partner households (where man and woman live together as partners, regardless of the formal status of their relationship), partners share their contribution to the household income, as well as their participation in unpaid work activities. As confirmed by several studies, men in partner households dedicate more time to non-routine unpaid work, while women in partner households dedicate more time to routine unpaid work [39,40,46–49]. Using the domestic appliances (those, which are used to simplify routine unpaid work) could possibly reduce the time women dedicated to routine unpaid work or increase the household production (or the quality of household production). At the same time, domestic appliances could also reduce the time of men dedicated to routine unpaid work (even if they are standardly spending less time on routine unpaid work than women). This is linked with such situations when men (who do not prefer routine unpaid work) try to avoid them even more by buying and using domestic appliances [48,49]. In this case, domestic appliances should decrease the time of men dedicated to routine unpaid work.

To find out the situation in partner households, we compared those households in which domestic appliances are used with households in which domestic appliances are not used. By means of Mann–Whitney *U* test we verified, whether there is a significant difference in the time devoted to various routine unpaid work activities (preparation and maintenance of the clothes, food preparation, housekeeping—cleaning) if households use or do not use selected domestic appliances (automatic washing machine, clothes dryer, dishwasher, robotic vacuum cleaner, and robotic mop). In Table 4, there are data on the number of partner households that use/do not use various domestic appliances, the average time of men and women dedicated to various routine unpaid work, and results of Mann–Whitney *U* test (we verified statistically significant differences separately for men and separately for women).

Table 4. Time of men and women in partner households dedicated to routine unpaid work, results of Mann–Whitney *U* test.

		Men—Time for Preparation and Maintenance of Clothes (hours/week)					
		No.	%	Mean	SD		
Automatic washing machine	Using	1138	98.01%	0.283	0.811	Mann–Whitney <i>U</i> test	
	Not using	23	1.99%	0.478	1.88	<i>p</i> -value	0.522
	Women—Time for Preparation and Maintenance of Clothes (hours/week)						
				Mean	SD		
				3.19	3.45	Mann–Whitney <i>U</i> test	
				4.35	2.71	<i>p</i> -value	0.05
		Men—Time for Preparation and Maintenance of Clothes (hours/week)					
		No.	%	Mean	SD		
Clothes dryer	Using	179	15.42%	0.23	0.622	Mann–Whitney <i>U</i> test	
	Not using	982	84.58%	0.297	0.879	<i>p</i> -value	0.454
	Women—Time for Preparation and Maintenance of Clothes (hours/week)						
				Mean	SD		
				3.1	2.14	Mann–Whitney <i>U</i> test	
				3.24	2.83	<i>p</i> -value	0.6
		Men—Time for Food Preparation (hours/week)					
		No.	%	Mean	SD		
Dishwasher	Using	520	44.79%	2.46	2.9	Mann–Whitney <i>U</i> test	
	Not using	641	55.21%	2.45	2.93	<i>p</i> -value	0.447
	Women—Time for Food Preparation (hours/week)						
				Mean	SD		
				8.82	6.3	Mann–Whitney <i>U</i> test	
				9.23	5.67	<i>p</i> -value	0.247
		Men—Time for Housekeeping—Cleaning (hours/week)					
		No.	%	Mean	SD		
Robotic vacuum cleaner or robotic mop	Using	294	25.32%	1.91	2.45	Mann–Whitney <i>U</i> test	
	Not using	867	74.68%	1.99	2.9	<i>p</i> -value	0.469
	Women—Time for Housekeeping—Cleaning (hours/week)						
				Mean	SD		
				5.63	3.69	Mann–Whitney <i>U</i> test	
				5.8	4.28	<i>p</i> -value	0.881

Most of the partner households are using automatic washing machines (98.01%). It is quite surprising that only 44.79% of partner households are using a dishwasher, 25.32% of partner households are using a robotic vacuum cleaner or robotic mop, and 15.42% of partner households are using the clothes dryer. In the case of all routine unpaid work

activities (regardless of using or not using domestic appliances), men dedicate themselves to these activities much less time than women. This is in accordance with the previous research [39,40,46–49].

By means of Mann–Whitney *U* test, we found that there are no statistically significant differences in the time that men dedicate to various unpaid work activities if there are domestic appliances used or not used in the household. Men spent on average 0.283 h per week by preparation and maintenance of the clothes (if households use automatic washing machine) and on average 0.478 h per week if households do not use automatic washing machine (*p*-value 0.522). Men spend even less time on preparation and maintenance of clothes if considering the usage of the clothes dryer (0.23 h per week if using clothes dryer and 0.297 h per week if not using it). Men dedicate 1.91 h per week (in the case of using a robotic vacuum cleaner or robotic mop) and 1.99 h per week (if not using a robotic vacuum cleaner or robotic mop) to housekeeping. The most time per week men dedicate to food preparation (2.46 h per week if using dishwasher and 2.45 h per week if not using a dishwasher). It seems that the time of men in partner households dedicated to routine unpaid work is almost the same if using or if not using domestic appliances. Our hypothesis H1 (that men (male partners) dedicate less time to routine unpaid work in the case domestic appliances are used in the household) was not confirmed.

When we compare the time of men and women in partner households dedicated to unpaid work activities, it is evident that women in Slovak partner households spent much more time by routine unpaid work than men. This may be due to the country's predominant family model with a classic division of housework into male and female. It is, however, interesting that the time of women dedicated to unpaid work is not reducing even by using domestic appliances. Women in partner households spent 3.1 h per week (when using clothes dryer) and 3.24 h per week (when not using clothes dryer) by preparation and maintenance of the clothes. For housekeeping (cleaning), they dedicate on average 5.63 h per week (if using a robotic vacuum cleaner or robotic mop) and 5.8 h per week (if not using a robotic vacuum cleaner or robotic mop). The most time women dedicate to food preparation (on average 8.82 h per week if using dishwasher and 9.23 h per week if not using it). The only routine unpaid work activity that is influenced by the usage of domestic appliances (automatic washing machine) is the preparation and maintenance of the clothes (*p*-value 0.05). Automatic washing machines significantly reduce the time of women dedicated to the preparation and maintenance of the clothes (3.19 h per week if households use automatic washing machines and 4.35 h per week if households do not use them). It is evident that usage of domestic appliances does not have any specific influence on the time that women in partner households dedicate to unpaid work activities (except automatic washing machine). We can conclude that our hypothesis H3 (that usage of domestic appliances does not influence the amount of time of women (female partners) dedicated to routine unpaid work) was confirmed.

Because we are not able to measure domestic output (neither amount nor quality), we could not conclude whether usage of domestic appliances helps to increase it. It is only evident that usage of domestic appliances does not have a significant influence on the time that both men and women in partner households dedicate to routine unpaid work (except for automatic washing machine that reduces the time of women for the preparation and maintenance of the clothes).

3.2.2. Utilization of Domestic Appliances in Single-Person Households

In addition to partner households, we also analyzed persons living alone. These persons live out of a standard family, without children (it does not mean that they do not have children). Because they live alone in their own households, they must perform all unpaid work activities by themselves, and they also independently decide upon the utilization of domestic appliances. Single-person households represent a continually growing group of households not only in Slovakia but also in the whole western world. According to the last census (from 2011), single-person households represent 25.7% of all

households in Slovakia (when considering census households, it is 29.5% of all households). In our research, single-person households represent 21.95% of all households.

To find out if there is a statistically significant difference in the average time dedicated to routine unpaid work in the case of using domestic appliances and not using domestic appliances, we used a nonparametric Mann–Whitney *U*-test (significance level 0.5). To verify hypothesis H2 (We assume that men who are living alone who use domestic appliances dedicate less time to routine unpaid work than men living alone who do not use domestic appliances), we compared the situation in single-man households, in which domestic appliances (automatic washing machine, clothes dryer, dishwasher, robotic vacuum cleaner and robotic mop) are used with single-man households where men do not use these appliances. To get a complete overview of the situation in Slovakia, we also analyzed the situation in single-woman households. In Table 5, there are data on the number of single-man households and single-woman households that use/do not use various domestic appliances, the average time of men living alone and women living alone dedicated to various routine unpaid work, and results of Mann–Whitney *U* test.

Women living alone spend more time by unpaid work than men living alone (regardless of using or not using the domestic appliances). However, the differences are not so significant as in the case of men and women living in partner households. Most of the men living alone are using automatic washing machines (91.7% of single-man households). Almost 89.5% of women living alone are also using an automatic washing machine. It is interesting that more men living alone use other domestic appliances than women living alone. Clothes dryers are used by 8.3% of men and only by 3.5% of women. Dishwashers are used by 28.7% of men but only by 15.9% of women. Robotic vacuum cleaner or robotic mop is used by 28.7% of men and only by 19.9% of women. This finding is not only interesting but also confirms the theory that men try to avoid routine unpaid work [48,49]. However, when we compare single-man households using domestic appliances with those not using domestic appliances, it is evident that there is no significant reduction in the time dedicated to routine unpaid work thanks to the domestic appliances. In the single-man households, only the usage of automatic washing machines significantly influences time spent by particular routine unpaid work—preparation and maintenance of the clothes (p -value < 0.001). Men who use automatic washing machines spend significantly more time (on average 1.51 h per week) on the preparation and maintenance of the clothes than men who do not use automatic washing machines (on average 0.533 h per week). It seems that usage of an automatic washing machine is supporting the self-service activities of men living alone. Because of the lack of data, we can only assume that men who do not use automatic washing machine either use market services (laundries) or have their laundry washed by their parents (in the case of, for example, younger men, who have just become independent from their parents).

By the results from our research, we were not able to confirm hypothesis H2 (that men living alone, who use domestic appliances, dedicate less time to routine unpaid work than men living alone, who do not use domestic appliances). The only domestic appliance (automatic washing machine) that significantly influences time dedicated to routine unpaid work (preparation and maintenance of the clothes) even increase the time that single living men dedicate to this activity.

In the case of women living alone, only the usage of a dishwasher has a statistically significant influence on the time devoted to the food preparation (when using a dishwasher, single-woman spend on average 5.85 h per week on food preparation. Single living women, who do not use a dishwasher, spend on average 7.71 h per week on food preparation. In this case, it is evident that dishwasher helps to decrease the time for food preparation. It is, however, interesting that most of the single living women do not use a dishwasher (84.1%). When we compare it with partner households (from which 44.79% are using a dishwasher), it is evident that this domestic appliance serves mostly for reducing time in households with more members.

Table 5. Time of men and women in single-person households dedicated to routine unpaid work, results of Mann–Whitney U test.

SINGLE-MAN HOUSEHOLDS							
				Time for Preparation and Maintenance of Clothes (hours/week)			
		No.	%	Mean	SD		
Automatic washing machine	Using	166	91.7%	1.51	1.33	Mann–Whitney <i>U</i> test <i>p</i> -value	<0.001
	Not using	15	8.3%	0.533	1.06		
		No.	%	Mean	SD		
Clothes dryer	Using	15	8.3%	0.822	0.644	Mann–Whitney <i>U</i> test <i>p</i> -value	0.051
	Not using	166	91.7%	1.48	1.37		
		No.	%	Mean	SD		
Dishwasher	Using	52	28.7%	4.5	2.98	Mann–Whitney <i>U</i> test <i>p</i> -value	0.219
	Not using	129	71.3%	5.34	3.58		
		No.	%	Mean	SD		
Robotic vacuum cleaner or robotic mop	Using	52	28.7%	2.75	1.98	Mann–Whitney <i>U</i> test <i>p</i> -value	0.958
	Not using	129	71.3%	2.81	2.19		
SINGLE-WOMAN HOUSEHOLDS							
				Time for Preparation and Maintenance of Clothes (hours/week)			
		No.	%	Mean	SD		
Automatic washing machine	Using	202	89.4%	2.14	1.9	Mann–Whitney <i>U</i> test <i>p</i> -value	0.977
	Not using	24	10.6%	2.0	1.44		
		No.	%	Mean	SD		
Clothes dryer	Using	8	3.5%	2.0	1.75	Mann–Whitney <i>U</i> test <i>p</i> -value	0.877
	Not using	218	96.5%	2.13	1.87		
		No.	%	Mean	SD		
Dishwasher	Using	36	15.9%	5.85	3.99	Mann–Whitney <i>U</i> test <i>p</i> -value	0.018
	Not using	190	84.1%	7.71	5.3		
		No.	%	Mean	SD		
Robotic vacuum cleaner or robotic mop	Using	45	19.9%	3.79	2.64	Mann–Whitney <i>U</i> test <i>p</i> -value	0.133
	Not using	181	80.1%	4.51	3.22		

3.3. Domestic Appliances, Time Devoted to Unpaid Work and Sustainability

Within the European Union, dishwashers, washing machines, and clothes dryers contributed to almost 3% of the household energy consumption, and household energy

consumption represented about 26% of the whole EU energy consumption in 2018 [94]. A standard four-member household in Slovakia consumes about 8% of energy for washing laundry and about 7% of total energy consumption for washing dishes [95]. The share of individual appliances on the total household electricity consumption depends not only on the number of household members but also on the age of the household's members and their usage habits.

In the Slovak household, the washing machine is one of the most common domestic appliances and, at the same time, one of the biggest energy hogs [95]. There is, however, an increasing trend of buying energy saving (A+) washing machines [96]. The washing machine is one of those appliances that positively influence the reduction of the time dedicated to unpaid work (hand-washing). However, the total savings in the amount of unpaid work do not necessarily reflect the absolute reduction in the time dedicated to unpaid work. Households spend the saved time not only on paid work, free time, and sleep but also on other types of unpaid work (while the laundry is being washed in the washing machine, household members have time to clean up, vacuum, cook, etc.). It is obvious that households are aware of the importance of washing machines for saving washing time, which is confirmed by the fact that of all the appliances we have examined, the automatic washing machine is the most widespread.

Historically, there was no culture in Slovakia to carry clothes to the laundry services—in the past, there were laundries, but they were used only for such linen that could not be washed at home. Such a trend persists to this day. Slovak households use dry cleaners mainly for washing oversized bedding (duvets, blankets), coats, suits, formal wear [97]. There is also an exceptionally low proportion of public laundries in Slovakia. It is common that even in single-person households, the washing machine is among the first appliances that the household buys.

When using appliances in multi-member households, economies of scale are realized, which is also transferred into energy savings. Based on our research, 98% of partner households use a washing machine, while only about 90% of one-person households (91.7% of single-man households and 89.4% of single-woman households) use a washing machine. Because there is not a tradition in Slovakia to carry clothes to the laundry services, nor are the laundry facilities widespread as such, we can link this situation with the intergenerational help (parents wash clothes for their children, who live alone, or adult children do laundry to an elderly parent).

Other domestic appliances (clothes dryer, dishwasher, robotic vacuum cleaner) are not as popular as a washing machine in Slovakia. According to the research in 2004, only 2.3% of Slovak households owned a dishwasher [96]. The reason is the imagination of high electricity consumption, even though this appliance usually leads to energy savings when comparing to hand-washing [98]. It is also an interesting domestic appliance in terms of saving the time dedicated to unpaid work. However, a different amount of time is being saved if the dishwasher is used in a four-member family (for example, after a Sunday lunch cooked at home) or in a single-person household whose member ate a fast-food meal. Based on our research, almost 45% of partner households use the dishwasher, while only 28.7% of single-man households and 15.9% of single-woman households use it. In this respect, Slovaks behave ecologically in the sense that they use energy-intensive household appliances when they really need them (to save time as another scarce resource in the case of multi-member households).

Clothes dryers are not quite common in Slovak households yet. It is mostly due to the energy intensiveness and therefore expensiveness of automatic hot air drying (while one does not pay for drying in the fresh air) [95]. This means that the usefulness of cloth dryer is decreasing in relation to its purchase price and operating costs. The most common reason for buying and using cloth dryers in Slovakia is to avoid ironing or an afraid of increased humidity when drying clothes in the rooms. Based on our research, the clothes dryer is the less used domestic appliance in all kinds of households (15.42% of partner

households, 8.3% of single-man households and 3.5% of single-woman households are using clothes dryers).

Robotic vacuum cleaners are usually not considered energy hogs. However, as shown by [99], robotic vacuum cleaners save energy only if they completely substitute the traditional vacuum cleaner. Most of the households, other than a single person living in a small, rented apartment, usually use a robotic vacuum cleaner as a supplement, not a substitute for the traditional vacuum cleaner. Based on our research, mostly men living alone use robotic vacuum cleaners (28.7%). Only 25.32% of partner households and 19.9% of women living alone use it. Usage of a robotic vacuum cleaner can reduce the time for vacuum cleaning (which is relevant regarding resource-efficiency sustainability of households), but we did not prove that it reduces the overall time dedicated to unpaid work. It was also not proved, as stated by [99], that it is reducing household energy consumption (which is relevant for macro-level sustainability).

According to the preferences of Slovak households to use different domestic appliances, one can conclude that Slovak households behave in accordance with the approach of rational behavior [11–13]. They prefer those household appliances whose added value (in the form of time savings) outweighs the costs (purchase price, operating costs, energy consumption).

4. Conclusions

The study implies that domestic appliances in Slovak households play an important role. However, they influence time dedicated to routine unpaid work only slightly. There are no reasonable studies focusing on the utilization of domestic appliances in Slovak households and on their influence on the time devoted to routine unpaid work. In the study, we examined utilization of four domestic appliances (automatic washing machine, clothes dryer, dishwasher, robotic vacuum cleaner or robotic mop) and their influence on the time that men and women spent by three routine unpaid work activities (preparation and maintenance of the clothes, food preparation, housekeeping—cleaning activities). Paper focused on the influence of the utilization of domestic appliances on the time that men and women dedicate to routine unpaid work, both in partner households and in single-person households. Domestic appliances are energy hogs that, on the one side, save time and human work, but on the other side contribute to the ever-increasing energy consumption and other negative effects on the environment and overall sustainability. Results of this study are of original value because they are based on the unique research conducted in Slovakia in 2015.

We found that most of the households are using various types of domestic appliances, which support previous theories [55,56]. The results of our research support those previous research, according to which users of domestic appliances do not reduce the time dedicated to routine unpaid work [83,84,86]. We found that in partner households, utilization of domestic appliances does not have a significant influence on the time that men dedicate to routine unpaid work. In addition, the time of women dedicated to routine unpaid work is not significantly changed because of the utilization of domestic appliances. Only utilization of automatic washing machine is significantly reducing their time for preparation and maintenance of the clothes. The automatic washing machine is also the only domestic appliance that is significantly influencing the time dedicated to the preparation and maintenance of the clothes by men living alone. It is, however, interesting that an automatic washing machine reduces the time for preparation and maintenance of the clothes for women in partner households, and at the same time, increases for men living alone. On the other side, the dishwasher is the only domestic appliance that is significantly reducing the time of women living alone for food preparation.

There are, however, several limitations of the research and findings. There are no official data on the time allocation (paid work, unpaid work, free time, other nonproductive activities), neither on the interconnection between the usage of domestic appliances and time for various activities in Slovakia. In addition, data interconnected usage of domestic

appliances and energy consumption are missing. Data from our research represent a unique source of information. However, data were collected only once, and we do not have a continuous dataset. Moreover, our research was dedicated to unpaid work, and with the gathered data, we cannot focus deeper on the impact of the usage of domestic appliances on free time and other unproductive activities of individuals and households.

Gender plays an important role in the division of the household unpaid work, both when using domestic appliances and when domestic appliances are not used. We did not include other variables in the analysis, such as the income of households [84], time spent in paid work [17,55], traditions in households [51], or substitution of unpaid work by market substitutes.

We consider it necessary to continue with the research and to extend research for more countries. It will be interesting and even necessary to apply similar research in other V4 countries (Czech Republic, Poland, and Hungary). Because of the common past (part of the socialistic block, the participation of large proportion of women on the labor market, growing number of single-person households, aging of the population, similar age of persons entering the labor market, traditional roles of man and woman in the household, etc.), there could be interesting similarities in the utilization of domestic appliances and in the time dedicated to routine unpaid work. Because there is a lack of official data on the energy consumption of households caused by the usage of domestic appliances, as well as on the real household equipment with domestic appliances, further research should focus more on the interconnection between the time savings, energy savings and usage of domestic appliances.

We confirmed that a high ratio of households in Slovakia is using domestic appliances (because of the lack of similar research and no official data on the ownership and utilization of domestic appliances, we are not able to discuss trends in utilization of various domestic appliances). However, usage of domestic appliances influence time dedicated to routine unpaid work only slightly. Due to a complicated/impossible objective finding of household production, research focusing on subjective evaluation of household production directly by households could help to gather necessary data for completing an overview on the impact of domestic appliances on routine unpaid work. In the paper, we give priority to the resource-efficiency, in our case, human work (including unpaid one) and capital (domestic appliances). Because of the lack of flow indicators and availability of results from only one unique research, we are not able to analyze an increase/decrease of resource-efficiency over time. We analyze only static data collected in 2015. Even though we consider the uniqueness of data analyzed for Slovakia (the only research in Slovakia devoted to the time consumption and domestic appliances utilization) to be the main originality and novelty of the paper, this paper addresses a part of micro-level sustainability (in connection to scarce source—time that individuals devote to unpaid domestic work and utilization of domestic appliances), which, however, has a significant influence on the overall sustainability. Paper aimed to point out a non-mainstream approach to analyze households in Slovakia as the production units that transfer their work (unpaid domestic work) into products and services, which they consume. This “hidden” part of the production that does not enter the market is important for the overall well-being of individuals and household sustainability.

Results of the research included in this paper can serve as a source of information and fundament not only for households but also for public policy actions. It will be interesting to find out whether utilization of domestic appliances increase the quality of household production (because, as we found out, they do not significantly reduce the time spent on routine unpaid work). It is also necessary to consider the impact of domestic appliances on the quality of life of households, on the protection of the environment, as well as on possibilities of local enterprises to substitute routine unpaid work. Nowadays, energy efficiency policies are one of the key measures to reduce the impact of human activities on the environment and the climate. In this context, it is necessary to also perceive the usage of household appliances in Slovak households. A rational approach, and the use of only

those appliances that really lead to resource savings (whether energy or time), should be the key moments in the implementation of economic policies towards a sustainable society.

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