



APPLIANCES AND THEIR IMPACT: THE OWNERSHIP OF DOMESTIC TECHNOLOGY AND TIME SPENT ON HOUSEHOLD WORK

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Abstract

Ever since the appearance of Vanek's pioneering article in 1974, there has been a controversy about whether 'labour saving' domestic appliances actually save labour time. Vanek argued that time spent in housework had barely changed since 1924, despite the diffusion of practically every known domestic appliance over this period. Gershuny and Robinson have challenged Vanek's 'constancy of housework' thesis, arguing that, over the last three decades, domestic technology has significantly reduced the weekly hours of women's routine housework. Although there is much talking past each other, none of the protagonists in this dispute have any direct data about which households own or do not own domestic appliances. Instead, they all rely on the passage of the years as a proxy for ownership of domestic appliances, since a higher proportion of contemporary households now own domestic appliances. The Australian 1997 Time Use Survey is unique among official surveys, as it simultaneously provides detailed information on time spent in housework and an inventory of household appliances. The analysis of this data shows that domestic technology rarely reduces women's unpaid working time and even, paradoxically, produces some increases in domestic labour. The domestic division of labour by gender remains remarkably resistant to technological innovation.

1 Introduction

Thirty years ago, in a now classic article in *Scientific American*, Joann Vanek announced to the world that the time women devoted to housework in the United States had not declined over the preceding half century¹. This was a strikingly counterintuitive finding. As Vanek herself argued, there were a number of reasons to expect the obverse, that is, that during the five decades for which she had evidence, time spent in housework by non-employed American women would have diminished. Over this period, American families had typically become more urban. Whereas in the 1920s American families produced over 70 per cent of the food they consumed, they produced a mere two per cent by the late twentieth century. Moreover, the birth rate had fallen, taking-in lodgers had become a rare practice, fewer family members came home for lunch, and many more women, including married women, were in paid employment.

These changes alone might reasonably have been expected to reduce the need to spend long hours in housework. However, from Vanek's point of view, the primary reason for believing that time spent in housework had diminished between 1924 and 1966 was that American households had been electrified, acquired internal plumbing and an assortment of small machines marketed as 'labour-saving appliances'. In Ruth Schwarz Cowan's (1985) memorable phrase, over these forty years, Americans had witnessed 'an industrial revolution in the home'.

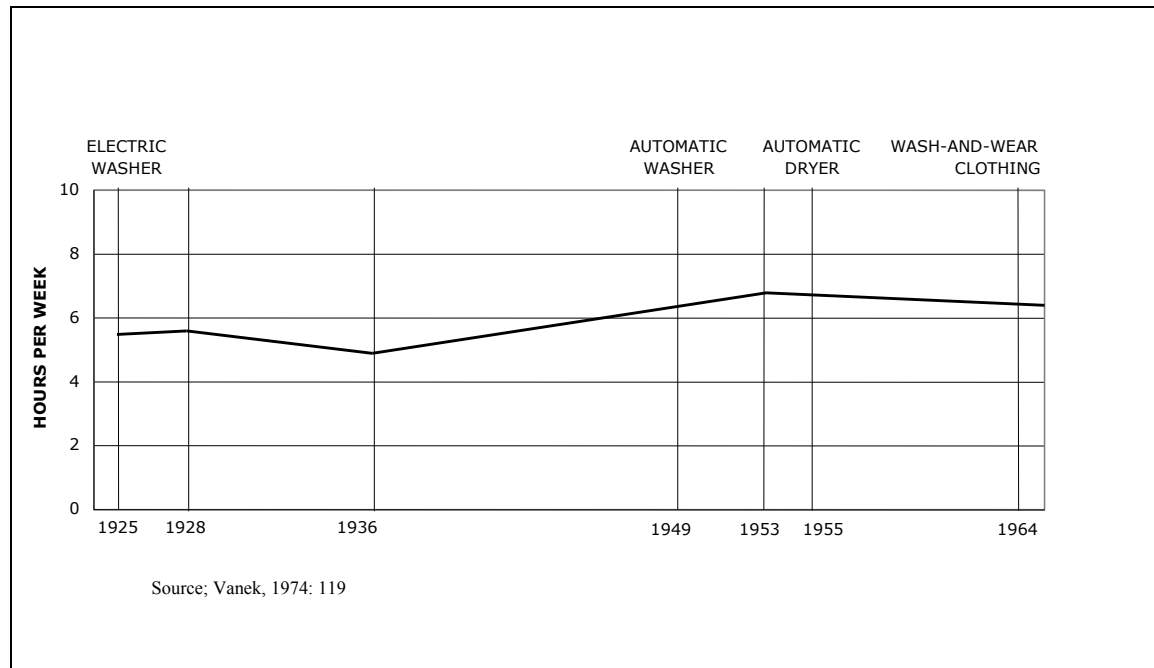
Vanek's conclusion, that housework time had remained relatively constant, rapidly passed into folklore. It was quickly followed by some elaborate attempts to explain the paradox of widely diffused 'labour-saving appliances' that didn't save time. Vanek argued that while aggregate time spent in housework had remained relatively constant, there had been significant redistribution of time among the component tasks, so that while food preparation time had declined, time spent in child care, shopping and household management had expanded substantially. Others developed these ideas, arguing that rising standards of cleanliness, greater output, fewer servants, consumption of substitutes and the addition of new tasks had all combined to neutralise any time saving delivered by the new domestic machines (Cowan, 1985; Wajcman, 1991).

Time spent doing laundry provided the clearest test because, according to Vanek, 'probably no aspect of housework has been lightened so much by technological change as laundry' (1974: 117). Over the period under investigation, American households had acquired running water, specialised soaps and detergents, automatic washing machines and large stocks of clothes made from easy care fabrics. 'Nonetheless', Vanek remarked, 'the amount of time spent doing laundry has increased' because 'people have more clothes now than they did in the past and they

1 In writing her doctoral dissertation, Vanek stumbled upon a collection of time use studies, chiefly conducted in rural localities, by the U.S. Bureau of Home Economics. Together with national data from the 1965/66 United States Time Use Survey, conducted by John P. Robinson and Philip E. Converse, these studies furnished data covering a time-span of nearly half a century.

wash them more often' (Vanek, 1974: 119), a conclusion she supported with the illustration shown in Figure 1.

Figure 1: Time Devoted To Laundry



Vanek’s ideas have continued to define the debate about the relationship between housework time and technology. However, there are serious methodological shortcomings in her approach. The most significant weakness in Vanek’s analysis is how she linked time spent in housework to domestic technology². In fact, Vanek had no direct information on the number and type of domestic appliances owned by any household. Instead, her reasoning depends upon using the passage of the years to stand as a proxy for the progressive diffusion of domestic technologies to all American households. Vanek reasons that, as domestic appliances ‘sold widely’ after a certain date, the aggregate mean time spent in household tasks after that date should reflect this (1974: 119). For example, Figure 1 shows the time devoted to laundry (on the vertical axis) and a time-line (horizontal axis) with markings representing the dates at which various domestic technologies achieved significant sales. Vanek interprets this diagram as an illustration that time spent in laundry and clothes care has not been diminished by the diffusion of automatic machinery for washing clothes, aids for drying and ironing, and the development of ‘easy care’ fabrics.

2 Vanek has been criticised for basing her conclusions on samples of rural households in different localities. Vanek responds to this criticism in a variety of ways, noting that the strict separation of ‘farm work’ from ‘housework’ means that over the years like is being compared to like, the similarity of results in the same year in different localities suggests that they conform to a national pattern, and that an urban/rural breakdown of the data she assembled for her study, including data drawn from the single national survey, show that ‘rural homemakers spent no more time in household work than urban ones’ (Vanek, 1974: 116). Vanek speculates that *if* there were some difference between rural and urban households, which she had not yet discovered, then one might expect that women in the technologically deprived rural households spent more time in domestic labour than their urban counterparts.

In making her claims about the effects of domestic technology on time spent in housework, Vanek's analytic strategy is twofold. Firstly, she screens-out a finite number of potentially confounding factors – changes in employment, household income, education and family composition – thereby controlling for compositional change in the American population. Vanek is aware of significant differences between sub-populations in time spent in household work noting, for example, that 'employed women devote about half as much time to household tasks as non-employed women' (1974: 118). Vanek acknowledges that in recent times 'proportionately fewer women are full-time homemakers' and this alone might be expected to result in a progressive decline in the time devoted to housework (1974: 118). She also recognises that there are likely to be differences in the hours of housework associated with women's family and socio-economic characteristics, women's marital status, family income, education and the number and age of children.

Secondly, the most crucial element in Vanek's strategy is her assumption that any residual change (or lack of change) over the forty-year period must be the result of the diffusion of domestic technology. However, in addition to the mass adoption of domestic appliances, other important cultural changes were taking place at the same time, for example, public awareness of hygiene increased and there was a new emphasis on parental behaviour during the early years of childhood. Economists have developed the term 'unobserved characteristics' to cover all the factors that might influence social and economic action but are not directly measured in the survey being analysed.

Logically, there is no substitute for being able to combine some direct measure of the time spent in domestic activities with direct observation of the household stocks of domestic technology. This is precisely what this paper provides. Our analysis is based on the only dataset with good information about the ownership of key appliances and accurate measures of the time spent in housework³.

Proponents' case for the contrary hypothesis – that domestic technology reduces housework time – suffers from exactly the same methodological problem. After discovering the archived Mass Observation time-diaries for the U.K. in the 1930s and 1950s, Gershuny felt he had a historical sequence of data to rival that of Vanek. Just as Vanek's conclusion was taken-for-granted for almost thirty years, it's rebuttal by Gershuny and Robinson (1988) has now achieved the aura of 'commonsense'. They argue that 'domestic work has been declining for women', even after controlling for 'structural changes' in 'women's employment and family status' (Gershuny and Robinson, 1988: 551). This reduction of routine housework is attributed to three causes - the desire to reduce unsatisfying low status activity, the women's movement generating normative support for reducing women's responsibility for housework and the 'time-saving features of new household appliances' such as the dishwasher and the microwave (Gershuny and Robinson, 1988: 539)⁴.

3 The only exception is Finland, which in some time use survey has collected some scattered information about ownership of appliances.

4 Gershuny and Robinson's endorsement of the time-saving characteristics of domestic technology is more muted than might be expected from Gershuny's publications.

Clearly, differences between women are crucial to any discussion about housework time. After analysing the data by social class, Gershuny found a steep decline in the domestic labour time of working-class housewives from 1951 onwards, a period that coincides with the mass consumption of white goods. Gershuny concludes that ‘it would seem perverse to refuse to ascribe a substantial part of the reduction [in working class women’s hours of domestic work] to the diffusion of domestic technology’ (1985: 151)⁵. The time use of middle-class housewives, however, follows a more complex pattern. The curve of average time that middle-class housewives spent in housework climbs sharply from 1937 to 1961 before declining almost as fast between 1961 and 1984. According to Gershuny, the steep rise between 1937 and 1961 is due to ‘the servant problem’, that is, declining availability and use of domestic servants. After 1961, however, middle-class housewives reduced their routine housework in direct parallel with working-class housewives because of the time-savings delivered by new domestic technologies (Gershuny, 1985: 150-153).

In disputing Vanek’s interpretation of historical trends in time spent in housework, Gershuny⁶ and Vanek often seem to be talking past each other. Crucially, Gershuny operates with a more restricted conception of the term ‘housework’. When Vanek claimed that time spent in housework had remained constant or, if anything, had increased over a forty-year period, she was making a claim about the time non-employed women devoted to all domestic tasks, including childcare and shopping. Recall, moreover, that Vanek explicitly suggested that between 1924 and 1966 there had been a re-allocation of the time devoted to the component tasks of housework. Gershuny and Robinson’s data suggest that the time women devote to both childcare and shopping has increased over the three decades they studied, while time spent in ‘routine housework’ has decreased over the same period. This finding is consistent with Vanek’s interpretation of how time spent in domestic tasks had changed over time, casting a shadow of artificiality over the adversarial nature of the dispute.

Like Vanek, however, Gershuny has no direct evidence about the ownership and use of domestic appliances, as he haltingly acknowledges (Gershuny, 1985: 152). As a consequence, he too allows the passage of the years to act as a proxy for the diffusion of domestic technology. In contrast, we argue that it is essential to have a close match between knowledge about the ownership of particular appliances and the time spent in the specific task for which they are designed. Only then can we examine whether appliances save labour in a particular task. Fortunately, the Australian Bureau of Statistics included questions about the ownership of household appliances in the 1997 Time Use Survey. This provides a unique opportunity to study whether the presence of domestic technology in the household affects the amount of time women devote to household tasks.

5 Gershuny expresses a changed view in his most recent book (Gershuny, 2000) which is similarly framed as a rebuttal of the standard interpretation of Vanek’s views.

6 This same comment also applies to Gershuny and Robinson (1988).

2 Data source

In 1997, the Australian Bureau of Statistics conducted the second national survey of time use patterns among the population (Australian Bureau Of Statistics, 1998a, 1998b). The 1997 Time Use Survey is based on a multi-stage area sample of private dwellings. The sample design ensured that within each State and Territory in Australia each person had an equal chance of selection. Because patterns of time use tend to vary with the time of year, the survey was conducted during four collection periods evenly timed throughout the year, one during each season. To ensure that each day of the week was sampled, an equal proportion of respondents were instructed to complete their diaries on designated days. After sample loss, 4555 households (containing 8618 persons) were selected for inclusion in the survey.

Information was collected from each selected household by interviewer-administered questionnaires and self-completed diaries. Trained interviewers collected basic information about the household and each of its members aged 15 years or more from a household representative, chosen from amongst the adult members of the household. Diaries were then left for each person aged 15 years or more who were asked to record their activities over two consecutive, specified days. Seventy-three per cent of households and 84 per cent of persons were classified as ‘fully responding’ (Australian Bureau Of Statistics, 1998a: 12-13).

As part of the 1997 Time Use Survey, household representatives were asked about stocks of selected domestic appliances, ownership of motor vehicles and the frequency of consumption of market substitutes for household work associated with food and drink preparation and cleanup, laundry, and grounds care over the previous fortnight⁷. On the basis of this data, we analyse the impact of these technologies on time use patterns through a series of distinct stages. Where possible, the appliances chosen are contemporary and in the process of being adopted by consumers. For the purposes of analysis, it is important to compare behaviour in households that do and do not own a particular appliance. For example, as almost every household possesses a washing machine or stove, no statistically valid comparison between the behaviour of owners and non-owners is possible.

Firstly, we match the technology to time spent in the specific task it is designed for. Microwave ovens, deep freezer and dishwashers are all designed as aids in food preparation and meal clean-up, clothes dryers assist with laundry and clothes care, and mowers and edge-trimmers are design to lighten the tasks of grounds care. Food and drink preparation and cleanup, laundry, grounds care, and household work are all groupings of more finely defined activity categories — the 1997 Time Use Survey distinguishes 217 of these refined activity categories. Table A. 1 in the appendix describes how the activity groupings used in this analysis are built from the more detailed activity codes. Information about men’s time spent in these tasks is included

7 Information was sought on the number of times the household had had a meal at a restaurant, had takeaway food, whether the household had used a dry cleaning, ironing, or laundry service, and whether the household had used a gardener or a lawn mowing service. In addition, household representatives were asked whether their households had used a cleaner or housework help and whether their households usually used formal and informal child care.

primarily because changes in men's share of domestic work might be expected to affect women's time.

Secondly, we investigate the impact these technologies on women's and men's time spent in household work at a more aggregate level. The value of this procedure is two-fold. Since experience has shown that in analysing time use data the narrower and more infrequent the activity the weaker the statistical reliability, this procedure provides a rather blunt, but more reliable, measure of the impact of technology. It also provides a means of detecting some indirect effects of employing domestic technology. For example, if households with a dishwasher have more dinner parties and as a result become less interested in gardening, we may find that dishwashers reduce the overall burden of housework even though they do not save time in meal preparation and cleanup.

3 Method

In this article, a mixture of tobit and ordinary least squares regression models are used to examine the relationship between domestic technology and time spent in household work. These techniques allow us to control for a variety of variables with the potential to confound the interpretation of the relationship. A substantial proportion of the daily diaries do not report any episodes of food and drink preparation and cleanup. A similar situation obtains in relation to laundry and grounds care. For a significant proportion of the daily diaries, therefore, the amount of time spent in these activities is zero, constituting an observational limit. Ordinary least squares regression, that does not take into account the qualitative difference between a limit and a nonlimit observation, is an inappropriate method for analysing this information. The tobit model, on the other hand, is specifically designed to accommodate the peculiarities of this kind of information (Greene, 2000: 905-926). Consequently, Tobit models, are used to investigate the relationship between domestic technology and time spent in food and drink preparation and cleanup, laundry, and grounds care. As only a tiny proportion of the diaries reported zero observations of broader aggregate of household work, ordinary least squares regression models are used to investigate the relationship between domestic technology and time spent in household work.

All the regression models flow the same form. The dependent variables in the tobit models are, as mentioned above, time spent in food and drink preparation and cleanup, time spent in laundry, and time spent in grounds care. The dependent variable in the regressions models is time spent in household work. Each of these time use variables is measured in minutes per day.

The regression models share the same independent variables. Those of primary interest here relate to the domestic appliances mentioned above. Household ownership of a microwave oven, a deep freezer, a dishwasher, a clothes dryer, and a lawn mower or a whipper-snipper are entered into the models as five dichotomous variables (1=own, 0= does not own).

The tobit and regression models incorporate a number of other independent variables as controls. These include day of the week, month of the year, whether it was a holiday, geographical location, age, health status, education, ethnicity, household composition, equivalent weekly household income, husband's share of family income (where applicable), type of dwelling, number of vehicles possessed by the household, consumption of cleaning services, and use of formal and informal child care. These controls are more fully described in Appendix A.

4 Domestic technology and time spent on housework

Table 1 describes the mean amount of time spent by Australian women and men in various kinds of household work. Women are predominantly responsible for ‘food, drink preparation and cleanup’ and laundry, as well as household work more generally. Grounds care, however, is mostly a male activity.

Table 1: Mean time spent in various kinds of household work by Australian women and men (minutes per day)

	Wome n	Men	Two-tailed significance of the difference in means
Food and drink preparation and cleanup	72.3	26.9	0.00
Laundry	30.8	4.3	0.00
Grounds care	15.3	21.2	0.00
Household work	324.2	186.8	0.00
N	6781	6351	

Source: *Time Use Survey*, Australia, 1997

Table 2 describes the incidence of microwave ovens, deep freezers, dishwashers, clothes dryers, and lawn mowers and edge trimmers amongst the Australian population. Of the domestic technologies investigated here, microwave ovens are the most universally distributed, found in over 80 per cent of households. A similar proportion - approximately 75 per cent – of households own a lawn mower or edge trimmer. Deep freezers and clothes dryers are less common. Roughly 50 per cent of households have a deep freezer, and a similar proportion own a clothes dryer. Only about 30 per cent of households possess a dishwasher.

Table 2: Incidence amongst Australian women and men of living in a household that possesses certain kinds of domestic technology

Technology		N	%
Microwave oven	Household has	5518	83.1
	Household does not have	1122	16.9
	Total	6640	100.0
Deep freezer	Household has	3528	53.1
	Household does not have	3112	46.9
	Total	6640	100.0
Dishwasher	Household has	2231	33.6
	Household does not have	4409	66.4
	Total	6640	100.0
Clothes dryer	Household has	3798	57.2
	Household does not have	2842	42.8
	Total	6640	100.0
Lawn mower or edge trimmer	Household has	5053	76.1
	Household does not have	1587	23.9
	Total	6640	100.0

Source: *Time Use Survey*, Australia, 1997

The full results of the tobit and ordinary least squares regression models are presented in Tables A2 to A3 in the appendix. The results on the impact of domestic appliances on time spent in household work are presented in a more summarised form in

Table 3. For each of the domestic appliances investigated here, the table reports the effect that owning a particular appliance has on the amount of time spent in various kinds of household work. The cells in these tables show the net marginal effect of various technologies on time spent at household work (measured in minutes per day). In the section below, net marginal effects are only shown where the co-efficient achieves a level of statistical significance.

Turning to the impact of kitchen appliances first, the data suggests that they do not save women any time. Despite its capacity to cook food in a fraction of the time needed by conventional stoves, owning a microwave has no significant effect on the time use patterns of women, even when the number of meals out is held constant. Nor does the deep freezer's ability to harvest the economies of scale in meal production significantly reduce the average time that women devote either to meal preparation or to housework overall. While the data does not allow the process of food and drink preparation and the associated meal cleanup to be separated, it would seem reasonable to expect that a dishwasher, by reducing the time required for meal cleanup, might lower the overall time spent in the kitchen. Contrary to expectations, however, dishwashers appear to have no significant effect on either the time Australian women spend in food or drink preparation and cleanup, or in the daily hours devoted to housework.

Perversely, however, some kitchen appliances seem to diminish the time men spend in food or drink preparation and its associated clean-up, or in housework overall. Although owning a microwave has no significant effect, owning a deep freezer does significantly decrease the time men spend in food preparation and cleanup by approximately 3 minutes per day. However, these savings in meal preparation time are not passed on to any significant saving in men's overall daily housework time. In a variation on this pattern dishwashers, while not diminishing the time men spend in food or drink preparation and cleanup, reduce the time that men spend in housework overall.

Table 3: The marginal effects of appliances on the time spent in household work by Australian women and men

	Microwaves	Deep Freeze	Dishwasher	Dryer	Lawn mower or edge trimmer
Women					
Food /drink preparation and cleanup [†]	n.s.	n.s.	n.s.	-	-
Laundry [†]	-	-	-	3.21**	-
Grounds care [†]	-	-	-	-	n.s.
Household work	n.s.	-	n.s.	n.s.	n.s.
Men					
Food/drink preparation and cleanup [†]	-	-2.70**	n.s.	-	-
Laundry [†]	-	-	-	n.s.	-
Grounds care [†]	-	-	-	-	9.33**
Household work	n.s.	-	-9.16*	n.s.	14.69*

Notes: † Based Tobit estimates
 ** Significant at the 0.01 level
 * Significant at the 0.05 level
 n.s. not significant

Source: Time Use Survey, Australia, 1997

Laundry and grounds care are the most sex-segregated of domestic tasks. Women specialise in laundry (accounting for 87 per cent of all the time spent in this task) while men are the predominant contributors to grounds care (accounting for 54 per cent of the time devoted to gardening, pool or pet care). These results of this analysis shows that, net of other influences, ownership of appliances designed to save labour in laundry and grounds care tends to increase the time allocated to these tasks by those most responsible for them. Women who live in households that have clothes dryers tend to spend approximately three minutes more in laundry activities than do similar women who do not have clothes dryers. However, the extra time devoted to laundry does not translate into more time spent in household work overall. Owning a lawnmower or an edge trimmer increases men's time spent in ground care and housework generally, even when the type of dwelling (free-standing bungalow versus apartment) is held constant. Men who live in households that have a lawn mower or a whipper-snipper tend to spend approximately nine minutes longer per day in grounds care and a quarter of an hour longer in housework in general than do similar men whose households do not own these appliances.

It may well be thought that household income explains the ownership of appliances, and that in studying the alleged effects of appliances on time spent in domestic work, we are inadvertently capturing the effect of class. Previous research has shown that high-income households not only own more domestic appliances but also consume more market services that substitute for their own domestic labour (Bittman, 2000). As can be seen in Table 4, equivalent household income is significantly associated with small reductions in time spent in unpaid work.

Table 4: The marginal effects of equivalent household income (\$1000s) on the time spent in household work

	\$1000 extra household income‡
Women	
Food /drink preparation and cleanup†	-0.55**
Laundry†	n.s.
Grounds care†	n.s.
Household work (min/day)	-2.53**
Men	
Food/drink preparation and cleanup†	-0.30**
Laundry†	n.s.
Grounds care†	-0.33**
Household work	-2.23**
Notes: ‡	Adjusted for household size
†	Based Tobit estimates
**	Significant at the 0.01 level
*	Significant at the 0.05 level
n.s.	not significant

Source: Time Use Survey, Australia, 1997

However, a \$1000 increase in household income is associated with only a very modest (around two minutes per day) reduction in the time men or women devote to unpaid housework and childcare. The effect of high income reducing the time spent in separate components of housework, such as cooking, laundry or grounds care, is very small or insignificant⁸. To earn an extra \$5000 dollars a week and to save perhaps a quarter of an hour a day in housework, suggests something about the utility of domestic labour.

In addition, exchange or bargaining theory suggests that the relative share of resources within households has an important influence of how time will be allocated among household members. These theories predict that the person contributing more financial resources will do less domestic labour.

8 A \$1000 rise in household income is significantly associated with a less than 1 minute per day fall in the time women spent in cooking. This is the only statistically significant association between income and the components of domestic labour.

Table 5: The marginal effects of husbands and wives' share of household income on the time spent in household work*

	0%	25%	59%	75%	100%
Women					
Food /drink preparation and cleanup [†]	0.00	-2.40	-4.32	-5.74	-6.68
Laundry [†]	n.s.	n.s.	n.s.	n.s.	n.s.
Grounds care [†]	0.00	-0.56	-0.78	-0.65	-0.18
Household work	0.00	-10.78	-19.43	-25.95	-30.34
Men					
Food/drink preparation and cleanup [†]	0.00	-1.16	-2.32	-3.48	-4.64
Laundry [†]	n.s.	n.s.	n.s.	n.s.	n.s.
Grounds care [†]	n.s.	n.s.	n.s.	n.s.	n.s.
Household work	0.00	-4.86	-9.72	-14.57	-19.43

Notes:

† Based Tobit estimates

* Fitted values are shown only where coefficients are significant at the 0.05 level or better

n.s. not significant

Source: Time Use Survey, Australia, 1997

The measure of the respondent's relative power within the household is the respondent's weekly personal income expressed as a proportion of the mean weekly personal income of all adults in the household. Where the wife in a couple provides no income, her relative share of household income will be zero, and where she provides the all income, her share will be one hundred per cent. Following the methods used by Sørensen and McLanahan, a quadratic term is introduced to capture any curvilinear effects.

Table 5 shows that the relative share of income has a much more powerful effect on time spent in domestic labour than even large increases in total household income. Compared to women who are wholly financially dependent on men, women who earn all of their household's income reduce their time spent in housework by half an hour a day, even when hours of paid employment are held constant. However, little of this overall reduction comes from reducing the time spent cooking, laundry or grounds care. Moreover the relationship between income share and the above mentioned domestic activities are curvilinear, so that, proportionally, the greatest reductions in women's domestic labour comes from contributing smaller portions of household income and the effect weakens as women become the dominant earner in the household. This is seen most clearly in effect of relative income share on women's time spent in grounds care, but is also observable in women's time spent in cooking and the broad category of housework.

The impact of relative income on men's domestic labour is also much greater with sharp rises in household income. Among the men who are dominant earners, time spent housework is predicted to diminish by almost 20 minutes a day, when hours of employment are held constant. In contrast to women, the impact of men's income

share is linear, so that every incremental increase in their income produces the same rate of reduction in domestic labour.

5 Discussion

In this article we have provided unique data that matches the ownership of a particular appliance and the time spent in the specific task for which it was designed. Thus we can, for the first time, directly examine whether the domestic appliance actually saves labour-time in a particular task. Our overall conclusion is that owning domestic technology rarely reduces unpaid household work. Indeed, in some cases owning appliances marginally increases the time spent on the relevant task. Nor did we find evidence that the diffusion of these appliances leads to any significant alteration in the traditional gender division of housework tasks. In cases where these contemporary domestic technologies do encourage less household work, it tends to be men who are the beneficiaries.

How do we begin to explain these paradoxical effects? Why do devices allegedly designed to save women domestic labour time either fail to save time or increase the time needed in some tasks? Why do these particular appliances appear to serve men rather than women?

Turning to the issue of the failure to save time first, previous commentators have suggested that this could be connected with rising standards in domestic production. The concept of rising standards implies a greater quantity or quality of domestic production – for example, more or better meals, cleaner clothes and more attractive gardens. In other words, the appliances are used to increase output and not to save labour time. Unfortunately, currently there are no good measures of the output of domestic labour. However, we have presented some indirect evidence to suggest that households behave in this way. We have shown that large differences in income produce only very small changes in the time devoted to housework, childcare and shopping. This finding is consistent with the idea that higher income households do use their appliances (and paid auxiliary workers) to produce a higher output of goods and services – maintaining larger, more refined and more pleasant homes. Indeed, Gershuny's response to Vanek has produced the explicit suggestion that the middle-classes dealt with the historical decline in domestic service by substituting their own labour to produce the domestic goods and services at the culturally required standard.

The most unexpected aspect of our findings is the differences between men and women that emerge in terms of the impact of domestic technologies. None of the appliances we researched reduce women's housework time. Clothes dryers increase the time women spend doing laundry, while microwaves, dish washers and deep freezers have no significant effect on women's daily hours devoted to housework. Paradoxically, some kitchen appliances, such as dishwashers and deep freezers, lead to a reduction in men's housework time. Only a lawn mower or an edge trimmer increase the time men devote to the traditionally male task of grounds care.

An intriguing aspect of household income is the effect of relative shares on the time women and men spend doing domestic work. According to either exchange or bargaining theory, the housewife's financial dependence upon the male provider, and not her gender *per se*, is responsible for the traditional sexual division of domestic labour (Bergman, 1986). One would therefore expect that those providing the larger share of household income would spend less time on housework and childcare. But, as we have shown, this is only strictly true for men. In contrast, the effect of women's

share of income on their time spent in domestic labour follows a complex curvilinear pattern. The bargaining effect of women's income share diminishes as their relative contribution to household income increases. It is as though women who provide two-thirds or more of their household's income need to reassure their husbands by neutralising the appearance of gender deviance (Bittman, et al 2003).

Clearly, much more is at stake in marital negotiations than money. The social and cultural construction of gender identity is still heavily implicated in the everyday practices of housework (Butler 1990; Jackson and Scott 2002). To be feminine is to perform femininity, and the daily doing of housework continues to be pivotal to being a wife and mother. Domestic appliances thus enter a domain heavily signified in terms of traditional sex roles. Moreover, these technologies are themselves inscribed with gendered meanings that shape their design and use. Feminist writing on the social studies of technology suggests that machines arrive in the household already imprinted with gendered agendas defining their appropriate operators (Cockburn and Ormrod 1993; Wajcman 2004). Indeed, individuals demonstrate their gender identity in part through their daily use of technologies.

Not surprisingly, then, our results suggest that the domestic appliances we have investigated tend to reinforce rather than undermine the obdurate sex-segregation of domestic tasks. As women are responsible for over eighty per cent of the time expended in laundry, ironing and clothes, the purchase of clothes dryers merely increases women's time in laundry. Similarly, work outside the house is heavily masculine, with men typically contributing the majority of time spent in these activities, so ownership of lawn care implements increases men's activity in traditional masculine outdoor activity.

Our evidence, then, suggests that domestic appliances are not the solution to saving women time. While it was recently reported (*The Age*, 25 April 2003) that two sportsmen had broken a world record by ironing a Union Jack on Mount Everest, we can only wonder if conquering the mountain of laundry at home would achieve the same acclaim.

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Appendix A

Table A. 1: Classification of activities

Activity group	Activity code	Activity	Activity code	Activity
Food and drink	410	Food/drink preparation/cleanup nfd	Other household work (continued)	
preparation and cleanup	411	Food preparation	work	Sell/dispose household asset
	412	Preserving/freezing	464	Recycling
	413	Wine/beer-making	465	Mail organisation
	414	Set and clear table	466	Pack for journey/moving
	415	Clean up	467	Packing away goods
	419	Food/drink preparation/cleanup nec	468	Disposing of rubbish
Laundry	421	Washing, loading/unload washing machine	469	Household management nec
	422	Hanging out/bringing in washing	471	Communication associated with domestic activities
	423	Ironing	481	Travel associated with domestic activities
	424	Sorting, folding clothes	499	Domestic activities nec
Grounds care	441	Gardening	500	Child care activities nfd
	442	Lawn care	510	Care of children nfd
	444	Cleaning grounds, garage etc	511	Physical care of children
Other household work	131	Personal hygiene	512	Emotional care of children
	171	Communication associated with personal care	521	Teaching/helping/reprimanding child
	251	Job search	541	Minding child
	371	Communication associated with educational activities	551	Visit child care establishment/school
	400	Domestic activities nfd	571	Communication associated with child care
	420	Laundry/clothes care nfd	581	Travel associated with child care
	425	Clothes upkeep and care	599	Child care activities nec
	426	Clothes making	600	Purchase goods and services nfd
	427	Sorting clothes for disposal	610	Purchasing goods nfd
	429	Laundry/clothes care nec	611	Purchasing consumer goods
	430	Other housework nfd	612	Purchasing durable goods
	431	Dry housework	619	Purchasing goods nec
	432	Wet housework	620	Purchasing services nfd
	433	Dry occasional housework	621	Purchasing repair service
	434	Wet occasional housework	622	Purchase administrative services
	439	Other housework nec	623	Purchase personal care service
	440	Grounds/animal care nfd	625	Purchase child care service
	443	Harvesting home produce	626	Purchase domestic/garden service
	445	Pool care	629	Purchasing service nec
	446	Pet care	671	Communication associated with purchasing goods and services
	449	Grounds/animal care nec	681	Travel associated with purchasing goods and services

Table A.1: Continued

Activity group	Activity code	Activity	Activity code	Activity
	450	Home maintenance nfd	699	Purchasing goods and services nec
	451	Home/equipment repairs	861	Negative social activity
	452	Design new home/interior design		
	453	Home improvements		
	454	Making furniture/household goods		
	455	Making furnishings		
	456	Heat/water/power upkeep		
	457	Car/boat/bike care		
	459	Home maintenance nec		
	460	Household management nfd		
	461	Paperwork, bills		
	462	Budget, organise roster, make list		

Notes: nfd not further defined
 nec not elsewhere classified

Table A. 2: Specification used multiple regression analyses

Control variables	
Day of the week	Monday (Yes=1, No=0), Tuesday (Yes=1, No=0), Thursday (Yes=1, No=0), Friday (Yes=1, No=0), Saturday (Yes=1, No=0), Sunday (Yes=1, No=0); Reference category =Wednesday
A holiday	(1=yes, 0=no)
Season	Autumn (Yes=1, No=0), Winter (Yes=1, No=0), Spring (Yes=1, No=0); Reference category =Summer
Ethnicity	First language spoken English, born in Europe (Yes=1, No=0); First language spoken English, born in Asia (Yes=1, No=0); First language spoken English, born elsewhere (Yes=1, No=0); First language spoken language other than English, born in Australia (Yes=1, No=0); First language spoken language other than English, born in Europe (Yes=1, No=0); First language spoken language other than English, born in Asia (Yes=1, No=0); First language spoken language other than English, born elsewhere (Yes=1, No=0); Reference category = First language spoken English, born in Australia
Region	Rural (Yes=1, No=0); Other urban (Yes=1, No=0); Reference category = Major urban
Age	In ten-year bands
Age ²	The square of the respondent's age after the mean age of all respondents (4.2) has been subtracted
Disability	Respondent has a disability but has no moderate to profound limitation in personal activity (Yes=1, No=0); Respondent has a moderate limitation in personal activity (Yes=1, No=0); Respondent has a moderate limitation in personal activity (Yes=1, No=0); Other adult in household is less disabled than respondent ((Yes=1, No=0); Other adult in household is less disabled than respondent ((Yes=1, No=0); Reference category = No reported disability
Education	Basic vocational post-school qualification (Yes=1, No=0); Skilled vocational post-school qualification (Yes=1, No=0); Associate diploma (Yes=1, No=0); Undergraduate diploma (Yes=1, No=0); Bachelor degree (Yes=1, No=0); Postgraduate degree (Yes=1, No=0); Higher degree (Yes=1, No=0); Other post-school qualification (Yes=1, No=0); Reference category = Did not complete year 12
Income	Equivalent1 weekly household income in units of \$1,000
Income share	Respondent's weekly personal income expressed as a proportion of the mean weekly personal income of all adults in the household2.
Marital status	De facto (Yes=1, No=0); Separated (Yes=1, No=0); Divorced (Yes=1, No=0); Widowed (Yes=1, No=0): and Never married (Yes=1, No=0) Reference category = Married
Household composition	One adult, no children present (Yes= 1, No= 0); Two adults, no children present (Yes= 1, No= 0); Four or more adults, no children present (Yes= 1, No= 0), One adult, children present (Yes= 1, No= 0); Two adults, children present (Yes= 1, No= 0); Three adults, children present (Yes= 1, No= 0); and Four or more adults, children present (Yes= 1, No= 0); Reference category = Three adults, no children present

Table A.2 Continued

Control variables	
Age of youngest child	0 to 1 year (Yes= 1, No= 0); 2 to 4 years (Yes= 1, No= 0); 5 to 9 years (Yes= 1, No= 0); 10 to 12 years (Yes= 1, No= 0); and 13 to 14 years(Yes= 1, No= 0); Reference category = No child present ⁷
Child, disability status	Household contains a child with a disability who does not have a severe or profound limitation in personal activity (Yes= 1, N= 0), Household contains a child with a disability who has a severe or profound limitation in personal activity (Yes= 1, N= 0), Reference category = Household does not contain a child with a disability
Sex composition of Household	Respondent has no female, adult housemates (Yes= 1, No= 0), Respondent has no male, adult housemates (Yes= 1, No= 0),
Type of dwelling	Attached dwelling, including semi-detached, row, terrace, and town houses, as well as flats attached to houses and houses and flats attached to shops and offices (Yes= 1, No= 0), Other dwelling, including flats, units, apartments, caravans, tents, and cabins (Yes= 1, No= 0).
Domestic services outsourced	Number of times in the previous fortnight the household purchased a meal at a restaurant or consumed takeaway food. Whether, over the previous fortnight, the household used a dry cleaning, ironing, or laundry service (Yes 1, No= 0) a gardener or lawn mowing service (Yes 1, No= 0), a cleaner or housework help (Yes 1, No= 0), formal child care (Yes 1, No= 0) or informal child care (Yes 1, No= 0). The number of private vehicles possessed by the household.

- Notes: 1 The equivalence scale used here is the OECD equivalence scale (OECD, 1982: 36-37). In the analyses that follow, the OECD equivalence scale has been divided by 2.4 in order to give a household with three adults and no children an equivalised household income equal to its unequivalised household income.
- 2 A quadratic term is also included, which equals the square of the respondent's relative income after the mean relative income of all respondents (1.0) has been subtracted (Sørensen and McLanahan, 1987: 663-664).

Table A. 3: Multivariate models of Australian's women's and men's time spent in domestic activities

Variable	Women			Men				
	Tobit model			OLS Regression	Tobit model			OLS Regression
	Food and drink preparation and cleanup	Laundry	Grounds care	Unpaid work	Food and drink preparation and cleanup	Laundry	Grounds care	Unpaid work
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Constant	34.20***	-24.16*	-199.37***	243.09***	-7.41	-85.33***	-211.67***	91.65***
Monday	3.16	9.23*	9.73	7.54	-1.65	1.83	-0.17	0.03
Tuesday	-0.46	3.34	5.23	-8.15	-1.21	4.43	8.17	-6.82
Thursday	-2.64	-4.98	-8.59	8.42	-6.34*	-1.76	-25.33**	-2.80
Friday	-5.59	1.48	1.76	0.60	-5.28	-4.24	-18.36	-17.06*
Saturday	-4.19	5.18	29.65***	26.44***	2.45	8.85	18.95	49.61***
Sunday	2.03	5.76	26.82***	-8.19	4.84	10.23	46.69***	44.89***
Holiday	5.00	4.58	23.98***	30.84***	15.10***	-0.26	57.06***	76.42***
April or May	2.52	-1.98	-7.59	-5.66	-1.24	-2.31	-28.56***	-14.83**
June or July	3.61	-4.10	-49.57***	-7.85	2.64	2.09	-67.26***	-15.35**
October or November	-0.37	-3.74	-1.26	-0.18	0.57	3.54	-12.88	-8.87
First language spoken English, born in Europe	-1.80	-1.58	-4.57	5.38	2.48	-8.72	7.34	7.49
First language spoken English, born in Asia	7.35	-13.67	-21.27	-4.50	0.81	3.56	-10.60	-7.99
First language spoken English, born elsewhere	-2.79	-11.04	-7.91	-21.82	0.34	-2.26	17.89	16.93
First language spoken not English, born in Australia	6.18	-12.65	-5.29	8.86	-13.86**	-3.20	25.04	5.30
First language spoken not English, born in Europe	16.12***	-12.59**	-0.67	-7.61	-15.36***	-22.29***	30.81***	-10.40
First language spoken not English, born in Asia	12.76***	-24.72***	2.58	-1.25	-7.54	-14.60	-5.52	19.39
First language spoken not English, born elsewhere	20.80***	-18.81*	-38.33*	16.41	-21.11***	-16.85	-3.36	11.70
Other urban	4.34*	9.37**8	13.41**	4.06	2.04	2.86	6.63	-7.35
Rural	6.00*	0.16	26.35***	24.47***	-1.68	1.12	1.74	2.87

Table A.3 continued

Variable	Women				Men			
	Tobit model			OLS	Tobit model			OLS
	Food and drink preparation and cleanup	Laundry	Grounds care	Unpaid work	Food and drink preparation and cleanup	Laundry	Grounds care	Unpaid work
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Sick or injured	-29.07***	-21.96***	2.66	-58.00***	6.90	-20.02	-61.03***	3.60
Has a disability, no moderate or profound limitation	8.26***	-0.86	3.84	19.20**	4.58	2.92	3.39	12.74
Has a disability, moderate limitation	11.86*	-5.85	6.20	23.98	13.31	4.98	9.38	39.64***
Has a disability, severe or profound limitation	-6.27	-4.98	-26.25*	-27.15	-1.61	11.80	-25.15	4.29
Adult housemate who is less disabled than the respondent	-11.54*	5.44	1.51	-17.21	-2.84	-7.84	-18.13	-6.67
Adult housemate who is more disabled than the respondent	1.47	-0.35	10.24*	6.51	9.30***	12.16**	-14.35	19.04***
Left school year 12	3.54	-1.25	12.13*	13.67	7.22**	14.23***	-0.37	12.19
Basic vocational	5.66	4.64	-13.74	19.39*	8.78	19.10*	-8.21	9.90
Skilled vocational	-1.65	-1.61	-12.70	3.67	7.15***	6.12	-4.98	18.42***
Associate diploma	0.89	-4.75	0.62	-2.30	9.61**	11.65	-0.35	13.89
Undergraduate degree	-5.86	-10.38	3.05	-10.30	4.84	23.26**	-22.63	23.71
Bachelor degree	-0.41	-5.14	-5.05	2.20	14.99***	34.34***	-5.20	26.22***
Postgraduate degree	-9.62	-12.85	15.90	-21.70	16.55**	24.50*	-13.58	30.89*
Higher degree	9.61	6.33	9.27	33.38	11.97*	13.34	-12.52	26.32
Other post-school qualification	16.97***	1.85	-14.62	19.54	5.93	19.12	-29.35	25.66
Equivalent weekly household income (in \$1,000s)	-0.65***	-0.33	0.00	-2.53***	-0.49***	0.37	-1.41**	-2.23***
Relative economic power	-12.31***	-2.72	-12.30***	-47.39***	-7.68	-4.82	-0.76	-19.43***
Relative economic power ²	4.54*	1.32	11.54***	17.05***	-1.51	-4.30	-9.43	0.85
De facto	-6.12	-8.68	5.98	-26.53**	0.09	5.06	9.79	18.25*
Separated	-22.34***	-19.30**	-10.17	-45.05***	2.22	14.54	-71.04**	-4.99
Divorced	-30.13***	-27.05***	-10.27	-65.68***	-13.52**	11.57	-66.36***	-22.83
Widowed	-27.57***	-19.50***	2.19	-24.04*	-5.27	32.86***	-39.76*	-10.69

Table A.3 Continued

Variable	Women				Men			
	Tobit model			OLS	Tobit model			OLS
	Food and drink preparation and cleanup	Laundry	Grounds care	Unpaid work	Food and drink preparation and cleanup	Laundry	Grounds care	Unpaid work
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Never married	-23.74***	-32.26***	-22.01*	-63.79***	-11.80	1.12	-39.78***	-14.88
One adult, no children	-15.23	-27.71**	51.80**	-13.56	-12.83	-0.29	13.36	9.78
Two adults, no children	0.24	-15.34***	20.59*	-11.17	-3.31	-5.40	0.47	12.38
Four or more adults, no children	3.63	-6.20	11.68	6.01	6.29	10.30	-31.47*	2.24
One adult, children	29.46*	7.25	56.74*	297.98***	-6.39	-45.36	-21.84	63.62
Two adults, children	20.49***	3.95	4.29	252.33***	13.55*	14.77	7.94	76.71***
Three adults, children	15.53*	4.68	16.40	223.89***	10.66	14.65	3.96	54.34***
Four or more adults, children	19.88*	6.07	-6.53	213.96***	4.64	15.16	-39.49	41.14*
Youngest child aged 0 to 1 year	16.69*	9.03	15.13	-61.72***	-3.16	-2.40	8.03	-11.80
Youngest child aged 2 to 4 years	12.78*	5.24	19.13	-103.74***	-7.55	-9.98	-15.35	-40.30***
Youngest child aged 5 to 9 years	1.62	2.61	3.43	-157.16***	-4.02	0.84	-9.75	-38.16***
Youngest child aged 10 to 12 years	-7.47	-5.47	0.08	-212.72***	-2.28	9.43	-5.53	-48.93***
Youngest child aged 13 to 14 years	-7.67	7.24	0.83	-207.78***	-11.66	-17.73	-4.17	-49.56***
Child with a disability, no severe or profound limitation	6.75	6.03	7.67	28.66**	-9.49*	-21.85	3.02	-24.50*
Child with a disability, severe or profound limitation	8.90	-5.28	-13.91	33.26	-5.55	5.41	-1.34	24.96
No female, adult housemates	8.60*	11.18	7.79	15.58	35.34***	30.36	24.53	41.00***
No male, adult housemates	2.58	16.77	20.50	26.97*	7.96*	-2.77	-0.61	-1.57
Attached dwelling	-5.06	-4.57	-21.31	-20.41**	0.81	-6.10	-17.49	-14.84
Other dwelling	-4.09	-0.95	-60.04	-18.76*	1.65	-4.03	-93.94***	-26.56***
Microwave	-1.82	2.09	-9.95	-10.75	-3.05	4.06	2.81	-8.93
Deep freezer	-2.81	-3.83	0.89	-0.42	-4.47**	-13.28***	-9.52	-0.47
Dishwasher	-0.07	-1.18	8.52	4.84	-1.86	-6.25	-5.39	-9.16*

Table A.3 Continued

Variable	Women				Men			
	Tobit model			OLS	Tobit model			OLS
	Food and drink preparation and cleanup	Laundry	Grounds care	Unpaid work	Food and drink preparation and cleanup	Laundry	Grounds care	Unpaid work
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Number of times had a meal at a restaurant	-0.54	0.09	-0.10	-0.71	0.18	-0.23	-4.07***	0.08
Number of times had takeaway food	-1.10	-0.07	-1.07	-1.17	-0.36	0.07	-0.81	-0.31
Clothes dryer	-0.77	6.11**	-1.80	2.47	-1.33	-1.13	-3.40	-2.22
Dry cleaning, ironing, or laundry service	-6.08	2.12	-8.04	2.46	-2.41	2.34	10.29	3.91
Lawn mower or edge trimmer	-3.61	-0.22	6.06	3.10	-1.92	-0.63	40.48***	14.69*
Gardener or lawn mowing service	-1.67	1.34	-5.61	0.71	-3.91	-7.88	-25.55**	-18.48**
Number of vehicles	-4.65	0.62	1.96	1.09	-3.20**	-8.64	0.53	-6.74*
Cleaner or housework help	-6.01	-9.89*	0.15	-18.45*	1.05	7.85	-11.65	4.71
Formal child care	-5.88	0.48	4.62	-13.32	-1.36	10.80	-3.38	-8.56
Informal child care	-6.12	-4.54	-12.89	-30.39***	2.09	-3.17	-16.15	7.21
Log likelihood/Adjusted R ²	-28347.68	-18951.39	-9832.96	0.32	-19036.10	-4998.31	-9218.08	0.18
N	5772	5772	5772	5811	5370	5370	5370	5413

*** P<.005, **P<.01, P<.05,
Source: *Time Use Survey*, Australia, 1997.