Session 2A: Measurement of Productive Activities by Households
Time: Monday, August 6, PM

Paper Prepared for the 32nd General Conference of
The International Association for Research in Income and Wealth

Boston, USA, August 5-11, 2012

Measuring the Relative Productivity of Sole-Tasking to Multitasking in Household Production: New Experimental Evidence

Charlene Kalenkoski and Gigi Foster

For additional information please contact:

Name: Charlene Kalenkoski
Affiliation: Ohio University

Email Address: kalenkos@ohio.edu

This paper is posted on the following website: http://www.iariw.org

Measuring the Relative Productivity of Sole-tasking to Multitasking in Household Production: New Experimental Evidence *

Gigi Foster, University of New South Wales
School of Economics
gigi.foster@unsw.edu.au

Charlene M. Kalenkoski, Ohio University
Department of Economics
kalenkos@ohio.edu

July 13, 2012

Abstract

We present a household production model that incorporates the multitasking of household production activities. We then describe and present results from a customized experiment designed to measure the key individual-specific productivity parameters from this model that determine child good and household good output in sole-tasking and multitasking contexts. In the experiment, we observe these productivity parameters under alternative incentive scenarios, designed to mimic changes in the relative utility payoffs to the two tasks. Using regression analysis and information on demographic, household, experiential, and psychological characteristics collected through an on-screen survey taken by participants, we observe the correlates

*We thank Xi Mao and Markus Schaffner for research assistance. We are also grateful to the Australian School of Business Small Projects grant fund and the ASBLab at the University of New South Wales for enabling our experiments, and to seminar participants at UNSW and the University of Queensland for helpful suggestions. This research has the approval of the UNSW Human Research Ethics Committee. All errors and viewpoints are our own.

of individuals' sole-tasking and multitasking productivities. Lastly, we provide the literature's first measures of the own- and cross-price elasticities of household task supply in a multitasking context.

1 Introduction

Child quality is one of the most important outcomes produced by households and much of it is produced using multitasked time. Both Floro & Miles (2003) and Kalenkoski & Foster (2008) use time-diary data to report on the prevalence and correlates of multitasked time. Floro & Miles (2003) examine the incidence and determinants of time spent in 'overlapped' work activity, including household work, and find that gender, household life cycle and composition, education, cultural norms, employment status, and income influence the extent to which individuals (particularly women) perform these multitasked work activities. Kalenkoski & Foster (2008), whose focus is parental child care time, regress sole-tasked and multitasked child care time on an even more exhaustive list of demographic and other explanatory variables, and find significant differences in the correlates of each. From an economic standpoint, these systematic patterns suggest that the choice to multitask may depend on individuals' ability to multitask different activities (i.e., their underlying multitasking productivity parameters in relation to different activities) and/or their relative preferences over the outcomes produced by those different activities. However, time-diary data collection efforts usually do not also involve the collection of information on the outcomes generated by various uses of time, so we cannot use typical time-diary data sets to estimate the relative productivity of multitasked versus sole-tasked time spent on household tasks. Therefore, in this paper we introduce a new experiment, guided by theory, and designed to enable us to directly observe and quantitatively compare participants' productivity in sole-tasked and multitasked household production.

To our knowledge, only one other study in economics has sought to measure multitasking productivity in an experimental setting.[1] Buser & Peter (2012) present an experiment where participants engage in two problem-solving tasks: Sudoku and word search puzzles. In different treatments the participants face sequential sole-tasking scenarios, are forced to move back and forth between tasks at pre-set intervals, or may choose whether or not to switch between tasks. These authors find that participants are significantly less productive

[1]Experimental studies of multitasking—typically analyzed as part of investigations into 'task-switching' performance and its cognitive correlates—are abundant in psychology; see, for example, Rubinstein, Meyer & Evans (2001).

when forced to switch between tasks than when forced to perform tasks sequentially. They also find, perhaps surprisingly, that when allowed to structure their own work (i.e., when allowed to decide whether to stay with a given task or switch to another at any given moment), participants are less productive than when forced to perform tasks sequentially. The average estimated decrease in task productivity across participants that the authors report when participants were forced to task-switch rather than stay with the one task is 7 to 11 percent.[2] Further, these authors directly test whether there is a difference between genders in the degree to which participants' productivity decreases in the task-switching stage compared to the single-task stage. Contrary to their priors, they find no significant gender difference.

The tasks used in the Buser & Peter (2012) study are very different from the types of tasks that are typically multitasked in the home. Their experiment also does not mimic the situation in which much multitasking in the home is performed, that is, where one of the two tasks (child care) must be attended to most if not all of the time. Yet the household setting is not only a hub of multitasking but also the main context in which non-market economic production occurs. Abraham & Mackie (2005), Folbre (2006), and others have called for better measurement of such household production. Indeed, Folbre (2006) laments the lack of good data on the multitasking of child care. For these reasons, we argue that a productivity measure specific to household production that relates sole-tasking to multitasking productivity is needed.

We present results from a new experiment that enables us to directly observe the outcomes of sole-tasked and multitasked time use and to quantitatively measure participants' productivity in stylized versions of two sole-tasked and multitasked household production activities: baby care and clothes sorting. We examine true multitasked settings, in which two tasks demand simultaneous attention, in contrast to the task-switching scenarios studied in Buser & Peter (2012). In order to determine the effect of differential preferences for the two outcomes, we manipulate the relative payoffs that participants receive for the different tasks. In addition, because our experimental participants complete a questionnaire capturing demographic, household, experiential, and psychological characteristics, we also examine the correlates of individuals' productivity parameters using standard regression analysis.

[2]This range, while not reported explicitly by the authors, is the result of our calculations based on Table 3 of their paper.

2 Model

The standard household production model pioneered by Gary Becker (Becker 1965) does not allow time to be spent simultaneously in different activities. From a conceptual perspective, this is problematic if an important activity cannot be started and ended discretely, which is true in the case of parental child care. As noted by Folbre, Yoon, Finnoff & Fuligni (2005), Folbre & Yoon (2007) and others, children cannot be 'turned off' in order for their parents to do other things. Yet, if a mother supervises her child while doing the laundry, her choice to multitask could only be mapped into the Beckerian framework if a fraction of the total minutes spent in this combined activity were allocated to child care, and the rest were allocated to doing the laundry.

In Becker's original household production model (Becker 1965), individuals choose time spent in market work and household production to maximize utility subject to production functions for household commodities, a budget constraint, and a time constraint. In this model, a unit of time may be spent in only one activity.

We present a model that is similar in spirit to Becker's model but that focuses solely on the decision to sole-task or multitask household production activities. In this model, utility is represented by

$$U = \alpha C + \beta H,$$

where individuals obtain utility from a child good, C, and a household good, H. α and β are preference parameters. Specifically, the larger is the ratio of α to β, the more that the individual benefits from production of the child good relative to production of the household good.

The child-good production function is given by

$$C = \gamma_1 lnt_{\mathrm{SC}} + \gamma_2 lnt_{\mathrm{M}},$$

where t_{SC} is sole-tasked time spent by the individual in production of the child good and t_M is multitasked time spent by the individual in both child-care and housework activities. γ_1 is the productivity factor for sole-tasked time in producing the child good, and γ_2 is the productivity factor for multitasked time in producing the child good.

The analogous household-good production function is

$$H = z_1 lnt_{\mathrm{SH}} + z_2 lnt_{\mathrm{M}},$$

where t_{SH} is sole-tasked time spent by the individual in household production, z_1 is the productivity factor for sole-tasked time in producing the household good, and z_2 is the productivity factor for multitasked time in producing the household good.

Our primary estimation targets in this paper are the baseline productivity parameters of housework and child production, γ_1, γ_2, z_1, and z_2, for each experimental participant, which are calculated as follows:

$$\gamma_1 = [\textit{quantity of C produced in sole-tasked context}]/ln(t_{\text{SC}}) \tag{1}$$

$$\gamma_2 = [\textit{quantity of C produced in multitasked context}]/ln(t_{\text{M}}) \tag{2}$$

$$z_1 = [\textit{quantity of H produced in sole-tasked context}]/ln(t_{\text{SH}}) \tag{3}$$

$$z_2 = [\textit{quantity of H produced in multitasked context}]/ln(t_{\text{M}}) \tag{4}$$

Because we observe the quantities of output produced in our experimental setting (C and H), and because as the experimenters we also control (and therefore know) the time allocated to each production context, we can directly calculate these productivity parameters for each person. We also run regressions of our measured productivity parameters on an array of individual characteristics, to examine their correlates. Our manipulation of the relative monetary payoffs to child care and housework in different experimental treatments mimics a change in the relative payoffs (α and β in our model) from producing the child good and the household good. We use our experimental manipulation of relative payoffs to estimate how the allocation of time within the multitasking setting differs when returns to the two tasks change. We interpret participants' responses to this manipulation as price elasticities of task supply in the multitasking setting.

3 Experimental design

Our experiment has several stages. The first and last stages are spent collecting various demographic, experiential, psychological, preference, and beliefs data from the participants. In the middle of the experiment, there are five income-earning stages that are presented in two different orders: one order for each of two groups of participants. These stages consist of (1) a sole-tasked baby care stage, lasting for three minutes; (2) a sole-tasked clothes-sorting stage, with a payoff regime likely to result in a lower total payoff than from the sole-tasked baby-care stage, lasting for three minutes; (3) a sole-tasked clothes-sorting stage, with a payoff regime likely to result in a higher total payoff than from the sole-tasked baby-care stage, lasting for three minutes; (4) a multitasked stage in which the clothes-sorting task is remunerated at the lower level, lasting for six minutes; (5) a multitasked stage in which the clothes-sorting task is remunerated at the higher level, lasting for six minutes.

In the pilot and the first four experimental sessions, the income-earning stages appear in exactly the order laid out above: sole-tasked baby care, sole-tasked clothes sorting (low payoff), sole-tasked clothes sorting (high payoff), multitasking (low payoff to clothes sorting), multitasking (high payoff to clothes sorting). In the final three experimental sessions, the stages involving a high-payoff clothes-sorting task appear before the stages involving a low-payoff clothes-sorting task. Hence, the order for these sessions is: sole-tasked baby care, sole-tasked clothes sorting (high payoff), sole-tasked clothes sorting (low payoff), multitasking (high payoff to clothes sorting), multitasking (low payoff to clothes sorting). Participants earn experimental dollars in accordance with their performance in each task, and earnings in the multitasked stages are completely independent across tasks.

Extensive testing was performed on this design in advance of the main round of the experiment, including two pilot runs.[3] The goal of this testing was mainly to calibrate the relative payoffs to baby care and sorting clothes such that the money value of performance in the two tasks was roughly equivalent at a baseline level of remuneration for the clothes-sorting task. We then chose our two specific payoff regimes to bound that rough equivalence, such that in the low-payoff regime, it is generally more remunerative to increase effort on the baby care task when multitasking, while in the high-payoff regime, it is generally more remunerative to increase effort on the clothes-sorting task when multitasking.

Before all sole-tasked stages of the experiment, detailed on-screen instructions are presented regarding how to maximize one's payoff from the particular task. We also include instruction screens before every multitasked stage, reminding participants of the task objectives and the payout structure. Finally, to ensure that participants are as informed as possible about their relative performance on the different tasks throughout the experiment, on the instruction page at the start of each income-earning stage after the second, we inform participants of the relative payoffs they have earned in the prior stage or stages. On the information sheet appearing before the third stage, participants are informed of the ratio of their baby-care payoff to their first sole-tasked, clothes-sorting payoff; and on the information sheet preceding the fourth stage, they are informed of the ratio of their baby-care payoff to their second sole-tasked, clothes-sorting payoff. On the information sheet preceding the fifth and final income-earning stage, participants are told the ratio of their earnings in the baby care task to their earnings in the clothes-sorting task during the previous (multitasked) stage. Information about productivity in previous rounds is provided in order to ensure that participants are fully aware of the consequences of their

[3]Data from the second pilot are included in the analysis in this paper because neither the design nor the payoff schemes were changed between that pilot and the main rounds.

actions during the income-earning stages.

Finally, in order to minimize the potential for wealth effects to contaminate effort choices and hence our measures of productivity, each participant's actual take-home payment from the entire experiment is calculated as the sum of his earnings in two randomly-selected, sole-tasked stages, plus his earnings in one randomly-selected, multitasked stage.[4] Information about the payoff structure is clearly provided at the start of the experiment, along with a full description of the stages of the experiment, and ample time is allocated for participants' questions to be posed and answered by us.

3.1 Baby care

In the baby-care task, the participant is first shown a picture of a happy baby and presented with an icon showing a pacifier, which must be clicked when it appears—at random positions on the screen, which change at two-second intervals—in order to keep the baby in that happy mood. If the participant fails to click the pacifier button regularly enough, then the baby's mood will start to decline, following a random-walk process with a downward trend. As the baby's mood declines, pictures of successively less happy babies appear to the participant, and unpleasant sounds in the form of increasingly insistent baby cries are streamed through the headphones, which are compulsory for participants to wear.

Remuneration for this task, both in the sole-tasked and multitasked stages of the experiment, works in the following way. For each two-second interval that the baby's mood is at the highest level, the participant receives two experimental dollars. For each two-second interval that the baby's mood is at the next-highest level, the participant receives one experimental dollar. For each two-second interval that the baby's mood is at the second-to-worst level, the participant receives fifty experimental cents. Finally, the participant receives no compensation for any two-second interval during which the baby's mood is at the lowest level.

[4]Real-dollar earnings are calculated by using a fixed exchange rate relating experimental dollars to real dollars, where that rate was chosen to result in the average real-dollar payout being roughly equivalent to the ASB Lab's standard payment of $15 to $20 per hour of participant time. Earnings calculated in this way from the income-earing stage are paid in addition to a $5 show-up fee, which is paid to all participants, regardless of their performance.

3.2 Sorting clothes

In the clothes-sorting task, the participant is confronted with an overlapping set of icons representing a never-ending pile of laundry of three types: men's white shirts, men's colored shirts, and ladies' blouses. The participant's task is to drag and drop each of these distinct types of icons into the appropriate wash-basket icon: the hot-wash basket (for men's white shirts), the warm-wash basket (for men's colored shirts), or the hand-wash basket (for ladies' blouses).

For each shirt correctly (incorrectly) sorted, the participant earns (loses) two experimental dollars in the low-payoff regime or four experimental dollars in the high-payoff regime.

4 Analytical approach

Using our experimental data, we can calculate each participant's productivity parameter on each type of time input (sole-tasked baby care (γ_1), multitasked baby care (γ_2), sole-tasked clothes sorting (z_1), and multitasked clothes sorting (z_2)) using the formulas shown in Equations 1 through 4 in Section 3. Given our experimental design, t_{SC}, t_{SH}, and t_M in these formulas are respectively the total minutes spent in sole-tasked baby care (i.e., three), the total minutes spent in sole-tasked clothes-sorting (three), and the total minutes spent in the multitasked context (six). C is the weighted sum of time that the participant's actions kept the baby in the highest, next-highest, and third-highest moods, where the weights are identical to those used in the baby-care payoff function described above, i.e.,

$$\begin{aligned} &.5 * (\textit{number of two-second intervals during which baby was in second-lowest mood}) \\ &+ 1 * (\textit{number of two-second intervals during which baby was in second-highest mood}) \\ &+ 2 * (\textit{number of two-second intervals during which baby was in highest mood}) \end{aligned}$$

H is simply the number of correctly-sorted shirts minus the number of incorrectly-sorted shirts.

In addition to calculating and analyzing the raw productivity factors in isolation, we also calculate the ratios of γ_2 to γ_1 and z_2 to z_1 and interpret these ratios as measures of each participant's preservation of task productivity when s/he moves from a sole-tasking setting to a multitasking setting, for C and H respectively. This analysis—and all empirical analysis in the paper—is performed using the information from only one payoff regime per person, because we discard the data from the payoff regime in force during the participant's

first sole-tasked clothes-sorting stage and first multitasked stage due to concerns about learning effects. We expect that people's task performance will improve as they acquire experience doing the tasks, and we do not wish to compare people's productivity the first time they perform the clothes-sorting task, or the first time they multitask in our experiment, with their productivity in later stages.[5]

After a descriptive analysis of our measured productivity factors themselves, we regress these factors as well as their ratios on the set of control variables discussed in the next section in order to identify their correlates.

Finally, we aggregate the data from the non-learning stages faced by each participant to construct estimates of effort price elasticities for both types of tasks. We first construct the average per-minute output of sole-tasked and multitasked time in the baby-care task and the clothes-sorting task for each participant, under whichever of the two different payoff regimes was in place during the non-learning stages for that participant. We then calculate the means of these 'average products' across participants, and use them to construct price elasticities of task supply in a multitasked context.

4.1 Control variables

We collected data on standard demographics as well as a wide variety of other variables for each participant. A full list of the questions asked appears in the Appendix. Because we are agnostic about which variables are most or least likely to be influential in explaining our productivity parameters, we include in our simple regression models a wide variety of control variables that satisfy at least one of three criteria: they are economically meaningful; they control for experiential or preference heterogeneity across people that could plausibly be important in this application; and/or they were statistically significant in our preliminary tests.

The variables we include are described thoroughly in Tables 1a and 1b. The types of variation they capture are briefly as follows (with relevant variable nicknames following in italics): gender (*female*); culture with which the participant identifies most strongly (*oth_asian, pan_asian*); marital status (*married*); age (*age*); personal weekly after-tax income (*inc1* through *inc5*); family wealth (*famwealth2* and *famwealth3*); occupation class

[5]The sole-tasked baby care stage is extremely easy to master, as all that is involved is clicking on a button repeatedly when it appears. By contrast, the sole-tasked clothes-sorting task does require that participants learn how to drag and drop the icons, and that they accurately match clothes to the correct piles. Therefore, we only anticipate (and in practice, we only see) a sole-tasking learning effect for clothes sorting.

of the participant's mother (*mumocc1* through *mumocc5*) and father (*dadocc1* through *dadocc4*); completed schooling of the participant's mother (*mumschool1* through *mumschool3*) and father (*dadschool1* through *dadschool3*); program of study (*commerce_d*); whether the participant enjoys being busy (*enjoy*), believes himself to be good at multitasking (*goodmt*), plays computer games frequently (*game*), feels things get done better when they are done one at a time (*judge_mt*), or frequently played caretaking games with dolls or stuffed animals as a child (*doll*); number of siblings (*siblings*); whether the participant reports that he gets bored easily (*boredeasy*), frequently has time he doesn't know what to do with (*sparetime*), or frequently multitasks (*freqmult*); the degree of stress the participant reports experiencing in the sole-tasked child care (*stresscc*), sole-tasked clothes sorting (*stresshw*), and multitasked (*stressmult*) stages in the experiment; the participant's reported political leanings (*political*); the range of hours the participant reports having spent with young children (*hrswithkid2* through *hrswithkid4*) and having been solely responsible for young children (*hrsresponsible2* through *hrsresponsible4*); self-esteem (*self_esteem*); locus of control (*loc_full*); overall happiness (*happy3* through *happy5*); self-perceived level of performance at university (*perfuni1* through *perfuni3*); left-handedness (*lefthand*); whether the participant had previously participated in an experiment at the ASBLab (*experiment*); and the experimental session in which the participant participated, which is controlled using a simple set of dummies. These variables are all used in our regressions.

5 Experimental results

5.1 Individual productivity parameters

We first calculate the productivity parameters associated with sole- and multitasked time for each good for each participant using the formulas in Equations 1 through 4, performing calculations only for the non-learning stages faced by each participant. Histograms for the different productivity parameters are displayed in Figures 1 (γ_1), 2 (γ_2), 3 (z_1) and 4 (z_2), separately by payoff regime.

The empirical ceiling clearly evident in Figure 1 indicates that our sole-tasked baby-care productivity parameter is likely to be an underestimate for many participants, as the vast majority of people performed perfectly on the baby task by keeping the baby in the happiest possible mood for the entire three minutes of sole-tasked baby-care time. Baby-care productivity fell and became far more heterogeneous across people in the multitasked stages, as seen by comparing Figure 1 with Figure 2. Comparing the top and bottom panels of Figure 2 also reveals more density in the left-hand side of the bottom panel than

Table 1a: Full Covariate Definitions: Economic and Standard Demographic Variables

Variable Nickname	Full Definition ('pt' stands for 'participant')
female	1 if pt is female; 0 otherwise
c_othasian	1 if pt identifies most strongly with culture of Hong Kong, Malaysia, or Singapore; 0 otherwise
c_panasian	1 if pt identifies most strongly with culture of Brunei, India, Indonesia, Japan, Pakistan, Korea, Taiwan, Vietnam, non-specific "Asia", or "eastern culture"; 0 otherwise
married	1 if pt is married; 0 otherwise
age	Chronological age of pt
inc1	1 if pt reports his personal weekly after-tax income to be \$100-\$199; 0 otherwise
inc2	1 if pt reports his personal weekly after-tax income to be \$200-\$299; 0 otherwise
inc3	1 if pt reports his personal weekly after-tax income to be \$300-\$399; 0 otherwise
inc4	1 if pt reports his personal weekly after-tax income to be \$400-\$499; 0 otherwise
inc5	1 if pt reports his personal weekly after-tax income to be \$500 or more; 0 otherwise
famwealth2	1 if pt reports his family to be 'the same' in terms of wealth as others; 0 otherwise
famwealth3	1 if pt reports his family to be 'poorer' than others; 0 otherwise
mumocc1	1 if pt's mother is a manager; 0 otherwise
mumocc2	1 if pt's mother is a professional; 0 otherwise
mumocc3	1 if pt's mother is an associate professional; 0 otherwise
mumocc4	1 if pt's mother is a tradesperson, transport worker or laborer; 0 otherwise
mumocc5	1 if pt's mother is some type of clerical worker; 0 otherwise
dadocc1	1 if pt's father is a manager; 0 otherwise
dadocc2	1 if pt's father is a professional or associate professional; 0 otherwise
dadocc3	1 if pt's father is a tradesperson, transport worker or laborer; 0 otherwise
dadocc4	1 if pt's father is some type of clerical worker; 0 otherwise
mumschool1	1 if pt's mother received no post-high school degree, or if pt does not know his mother's educational status; 0 otherwise
mumschool2	1 if pt's mother received a post-high school qualification from a technical institute; 0 otherwise
mumschool3	1 if pt's mother received a post-high school qualification from a university; 0 otherwise
dadschool1	1 if pt's father received no post-high school degree, or if pt does not know his father's educational status; 0 otherwise
dadschool2	1 if pt's father received a post-high school qualification from a technical institute; 0 otherwise
dadschool3	1 if pt's father received a post-high school qualification from a university; 0 otherwise

Table 1b: Full Covariate Definitions: Other Variables

Variable Nickname	Full Definition ('pt' stands for 'participant')
commerce_d	1 if pt is enrolled in a Commerce degree; 0 otherwise
enjoy	1 if pt chooses value 1 through 4 on a 1 (strongly agree) to 10 (strongly disagree) scale when prompted by 'I enjoy being busy'
goodmt	1 if pt chooses value 1 through 4 on a 1 (strongly agree) to 10 (strongly disagree) scale when prompted by 'I think I'm good at multi-tasking'
game	1 if pt reports playing computer games or video games always, often, or sometimes; 0 if pt reports rarely or never playing such games
solebetter	1 if pt chooses value 1 through 4 on a 1 (strongly agree) to 10 (strongly disagree) scale when prompted by 'Things get done better when you focus on doing only one thing at a time, without getting distracted'
dollplay	1 if pt reports playing caretaking games as a child always, often, or sometimes; 0 if pt reports rarely or never playing such games
siblings	Number of siblings with whom pt grew up: values 0 = no siblings; 1 = 1 sibling; 2 = 2 siblings; 3 = 3 siblings; 4 = 4 or more siblings
boredeasy	1 if pt chooses value 1 through 4 on a 1 (strongly agree) to 10 (strongly disagree) scale when prompted by 'I get bored easily'
sparetime	1 if pt reports having spare time he doesn't know what to do with always, often, or sometimes; 0 if pt reports rarely or never having such time
freqmult	1 if pt reports doing more than one thing at home always, often, or sometimes; 0 if pt reports rarely or never having this occur
stresscc	1 if pt reports 5 or more on a scale of 0 to 10 in response to 'How stressful did you find the sole-tasking baby care stage of the experiment?'
stresshw	1 if pt reports 5 or more on a scale of 0 to 10 in response to 'How stressful did you find the sole-tasking clothes-sorting stages of the experiment?'
stressmult	1 if pt reports 5 or more on a scale of 0 to 10 in response to 'How stressful did you find the multi-tasking stages of the experiment?'
political	Number on a scale of 0 (very left-wing) to 10 (very right-wing) that pt chooses to represent his political stance
hrswithkid2	1 if number of hours since age 14 pt spent awake in pt's home in the presence of an infant under 1 year old is 1-10; 0 otherwise
hrswithkid3	1 if number of hours since age 14 pt spent awake in pt's home in the presence of an infant under 1 year old is 10-100; 0 otherwise
hrswithkid4	1 if number of hours since age 14 pt spent awake in pt's home in the presence of an infant under 1 year old is 100 or more; 0 otherwise
hrsresponsible2	1 if number of hours pt has been completely personally responsible for the care of an infant under 1 year old is 1-10; 0 otherwise
hrsresponsible3	1 if number of hours pt has been completely personally responsible for the care of an infant under 1 year old is 10-100; 0 otherwise
hrsresponsible4	1 if number of hours pt has been completely personally responsible for the care of an infant under 1 year old is 100 or more; 0 otherwise
self_esteem	Sum of responses, reverse-coded where necessary, on 10-item Rosenberg (Rosenberg 1965) self-esteem battery
loc_full	Sum of responses, reverse-coded where necessary, on 7-item Rotter (Rotter 1966) locus of control battery
happy3	1 if pt chooses '3' on a scale of 1 (very unhappy) to 5 (very happy) to answer how happy he is usually; 0 otherwise
happy4	1 if pt chooses '4' on a scale of 1 (very unhappy) to 5 (very happy) to answer how happy he is usually; 0 otherwise
happy5	1 if pt chooses '5' on a scale of 1 (very unhappy) to 5 (very happy) to answer how happy he is usually; 0 otherwise
perfuni1	1 if pt reports his performance at university to be 'well above average'; 0 otherwise
perfuni2	1 if pt reports his performance at university to be 'a little above average'; 0 otherwise
perfuni3	1 if pt reports his performance at university to be 'average'; 0 otherwise
lefthand	1 if pt is left-handed; 0 otherwise
experiment	1 if pt had ever participated in an experiment before; 0 otherwise

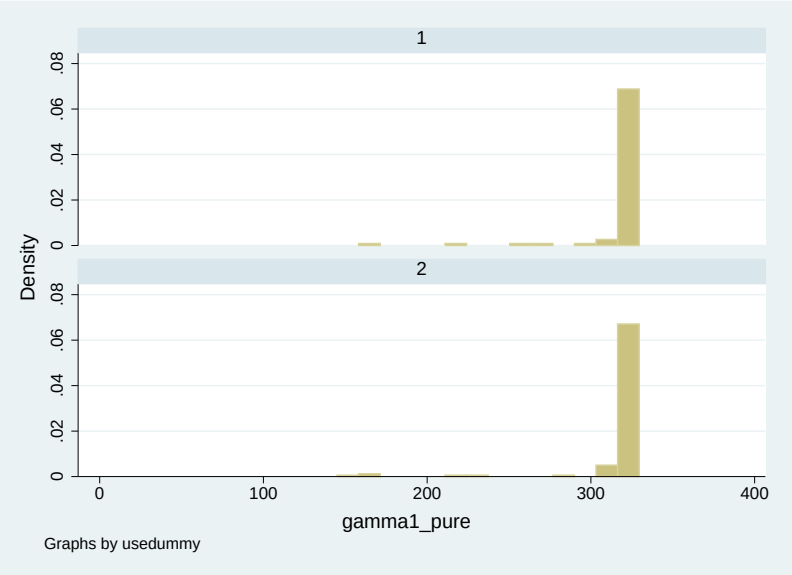

Figure 1: γ_1 (sole-tasking baby care productivity parameter): \$2/shirt scheme (top) versus \$4/shirt scheme (bottom)

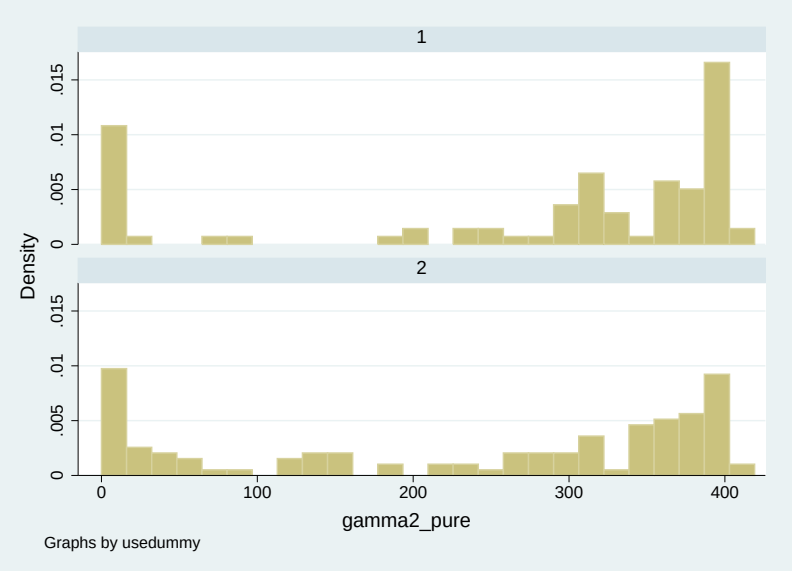

Figure 2: γ_2 (multitasking baby care productivity parameter): \$2/shirt scheme (top) versus \$4/shirt scheme (bottom)

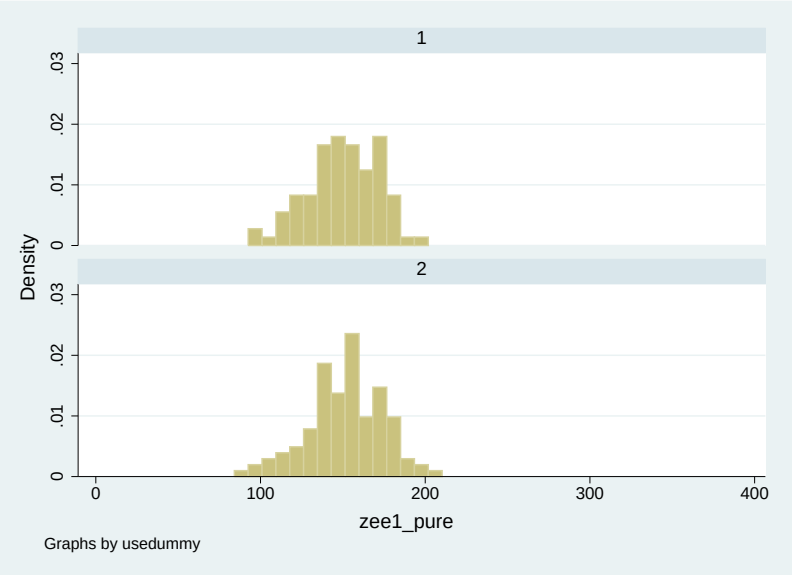

Figure 3: z_1 (sole-tasking clothes-sorting productivity parameter): \$2/shirt scheme (top) versus \$4/shirt scheme (bottom)

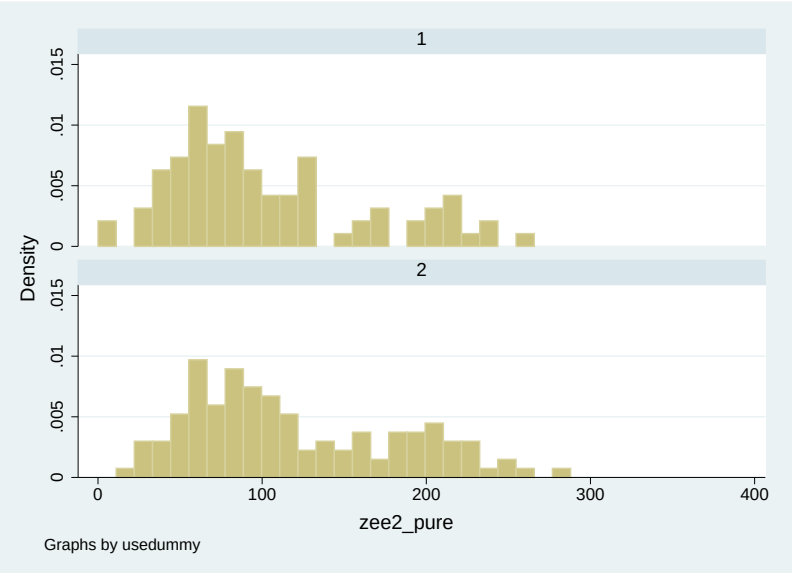

Figure 4: z_2 (multitasking clothes-sorting productivity parameter): \$2/shirt scheme (top) versus \$4/shirt scheme (bottom)

the left-hand side of the top panel, underscoring that there was, on average, an additional loss in baby care productivity when the alternative task of sorting shirts was more highly remunerated. However, some participants still returned very high baby-care productivity in the multitasked setting, even when the alternative task was more highly rewarded.

Figure 3 shows that participants' productivity in sole-tasked clothes-sorting is not strongly affected by the payoff regime. The loss in productivity when participants move to a multitasked setting is shown clearly by comparing Figure 3 to Figure 4. Comparing the top and bottom panels of Figure 4 also shows that the density of individual clothes-sorting productivity parameters is shifted slightly rightward when the multitasking is performed in a setting in which clothes-sorting is more highly remunerated, following participants' material incentives.

Taken together, these figures indicate first that participants' multitasking productivity in each task is generally lower than their sole-tasking productivity in that task, and second that multitasking productivity in each task is affected by the incentives embedded in the relative payoffs available to the two tasks.

Table 2 shows descriptive statistics for the calculated productivity parameters. Note that the productivity parameters cannot be directly compared across the two tasks, given that the scale of the baby care productivity figures reflects the fact that baby care 'output' is calculated in terms of experimental dollars, whereas clothes-sorting output is calculated in terms of numbers of shirts sorted.

Panel A presents the parameters estimated under the \$2 per shirt incentive scheme, and Panel B presents the parameters estimated under the \$4 per shirt incentive scheme. In Panel A, therefore, baby care is relatively more remunerative than clothes sorting, whereas in Panel B, sorting clothes is relatively more remunerative than baby care. Note that neither of the sole-task productivity parameters (γ_1 or z_1) changes very much across incentive schemes. This is to be expected, given that in the sole-task settings there are no competing tasks. However, the multitasking productivity parameters, γ_2 and z_2, do change as expected across incentive schemes. When sorting clothes becomes more remunerative relative to baby care, the measured multitasked productivity of child care falls 15%, from 279 to 237, whereas the multitasked productivity of sorting clothes increases by 17%, from 102 to 119. Similarly, the ratio of multitasking productivity to sole-tasking productivity for baby care falls from 0.86 to 0.75 as baby care becomes relatively less remunerative, while the analogous ratio for clothes sorting increases from 0.68 to 0.77.

Table 2: Productivity Parameters

Panel A: $2 per shirt scheme					
Variable	N	Average	Std Dev	Min	Max
γ_1 (ST baby care)	86	323.2355	23.02494	169.3045	329.5066
γ_2 (MT baby care)	86	278.919	143.5545	11.44127	402.9559
z_1 (ST clothes-sorting)	86	150.0413	21.50526	95.57512	193.881
z_2 (MT clothes-sorting)	86	102.4068	60.71167	3.348664	261.1958
γ_2/γ_1	86	.8646426	.4477164	.0347224	1.811422
z_2/z_1	86	.6759137	.3838211	.0238889	1.580191
Panel B: $4 per shirt scheme					
Variable	N	Average	Std Dev	Min	Max
γ_1 (ST baby care)	121	320.8518	29.29559	155.1958	329.5066
γ_2 (MT baby care)	121	236.5559	149.5199	11.44127	402.9559
z_1 (ST clothes-sorting)	121	151.9723	22.5721	91.93416	210.2653
z_2 (MT clothes-sorting)	121	118.7761	62.83237	18.97576	276.8229
γ_2/γ_1	121	.7505607	.4963329	.0347224	2.248755
z_2/z_1	121	.7712011	.3696928	.1248324	1.635059

Data from the participants in the final three experimental rounds is used to construct Panel A; data from participants in the pilot plus the first four experimental rounds is used to construct Panel B. Samples exclude a handful of records which demonstrated clear confusion about the task instructions (e.g., those earning zero dollars for any task). See text for full descriptions of experimental treatments.

5.2 Observable correlates of the productivity parameters

In Tables 3a and 3b, we explore the extent to which the productivity parameters discussed in the previous section are predictable using the demographic, psychological, and experiential variables that we observe. Due to the plethora of covariates, we split the presentation of these regression results into two tables. Table 3a shows coefficient estimates on the 'economic' variables (such as income, family wealth, and parental background) and standard demographic variables (such as age and gender) that we use to predict each productivity parameter. Table 3b then shows coefficient estimates on the other variables we were able to construct based on our unique survey data. Both tables show fit statistics and observation counts, but each column of Table 3b is merely a continuation of the same regression results reported in that same column from Table 3a. Columns (1) and (2) of each table provide regressions of the productivity parameter γ_1 under the \$2 per shirt and \$4 per shirt schemes, respectively. Columns (3) and (4) then present regressions for γ_2 under the two incentive schemes. Columns (5) through (8) similarly provide results for z_1 and z_2. All variable nicknames in Tables 3a and 3b are explained in Tables 1a and 1b, respectively.

The most noticeable aspect of Tables 3a and 3b is a striking change in explanatory power across columns, including even negative adjusted R-squared values in several columns despite the inclusion of a host of control variables. Of course, only a modest amount of explanatory power should be expected when the dependent variable is sole-tasking productivity in the production of the child good (i.e., Columns (1) and (2)), given that many individuals in the sample kept the baby completely happy for the entire duration of the sole-tasking stage. When we move to Column (3), predicting the multitasking baby-care productivity factor at the lower per-shirt remuneration level, the explanatory power jumps to over 50% and several types of independent variables become significant. Those participants who identify with the cultures of Hong Kong, Malaysia, or Singapore; who are married; who have mid-range personal income levels; whose families are reportedly poorer than others; whose mothers are managers; who are not enrolled in Commerce programs; who report high stress associated with the child care task or low stress associated with the clothes-sorting task; who have never been personally responsible for the care of a child; or who report themselves to be well above-average students have statistically significantly higher multitasking child care productivities at a 5% or lower p-value than other participants, at this lower level of remuneration per shirt. This increase would most logically be offset by a lower productivity in the clothes-sorting activity, and indeed in Column (7), when we predict multitasking housework productivity in the \$2 per shirt scheme, that is just what we see for many of the same covariates. This compensating effect is evident

and statistically significant for marital status, income, wealth, program of study, and stress associated with the child care task. For all other variables significant in Column (3), the compensating effect evident in Column (7) is in the correct direction but does not achieve statistical significance at the 5% level. We also note that many other variables' coefficient estimates in both columns are very large in magnitude but do not achieve statistical significance, probably due to modest sample size.

Our primary interpretation of the results in Columns (3) and (7) is that certain types of economic and cultural backgrounds predispose a person to spend more effort on the interactive baby-care task than on the menial clothes-sorting task when faced with the multitasking context and the lower payoff to clothes-sorting. Some people may simply be raised to place a particularly high value on the child good relative to the household good. Even in a setting in which the household good is almost as valuable in monetary terms as the child good, these people still follow their habits and spend more effort than others do on the baby, and less effort than others do on the household task.

The most interesting results in Tables 3a and 3b relate to how the strength and significance of the explanatory variables change as we change incentive schemes in the multitasking context. Specifically, paying more per shirt in the multitasking setting (Columns (8) and (4) compared to Columns (7) and (3), respectively) appears to wipe out both explanatory power and statistically significant relationships, almost across the board. This suggests that apparent multitasking productivity differentials—which may arise through upbringing, genes, or habit—can be overcome with a change in economic incentives.

Sole-tasking productivity in the production of the household good (Columns (5) and (6)) is fairly well-predicted, though not as well as multi-tasking productivities in the \$2 per shirt scheme. z_1 is negatively associated with mid-range parental wealth, having a mother who works in a clerical occupation, having a mother with a university degree, and frequently feeling rushed. It could be that such individuals' more-advantaged upbringing may make it less necessary for them to acquire household production skills, or may lead them to place a lower absolute value on performing menial household-production tasks.

In Tables 4a and 4b, the ratios of productivity factors, γ_2/γ_1 and z_2/z_1, are the dependent variables, and the table structure is identical to that of Tables 3a and 3b. Under the \$2 per shirt incentive scheme, statistically significantly higher relative productivity of multitasked time in the production of the child good is coupled with statistically significantly lower relative productivity of multitasked time in the production of the household good for the those who identify with the cultures of Hong Kong, Malaysia, or Singapore; who are married; who have mid-range personal income levels; whose families are reportedly poorer

Table 3a: Correlates of Productivity Parameters: Economic and Standard Demographic Covariates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	— γ_1 —		— γ_2 —		— z_1 —		— z_2 —	
Scheme	$2 per shirt	$4 per shirt	$2 per shirt	$4 per shirt	$2 per shirt	$4 per shirt	$2 per shirt	$4 per shirt
female	-0.282	-9.411	-62.947	-13.242	7.449	-2.180	15.260	-8.289
	(22.14)	(6.56)	(83.40)	(55.16)	(15.54)	(6.28)	(40.37)	(22.42)
c_othasian	39.530	3.787	390.993*	173.449*	41.437	1.301	-127.592	-49.743
	(39.45)	(8.75)	(148.59)	(73.50)	(27.68)	(8.37)	(71.92)	(29.87)
c_panasian	21.919	-2.706	244.908	31.256	-17.431	-11.696	-60.754	-29.024
	(33.11)	(9.13)	(124.71)	(76.77)	(23.23)	(8.74)	(60.36)	(31.20)
married	74.195	-50.635	926.628*	401.205	-41.781	-45.042	-374.532*	-186.789
	(80.75)	(30.89)	(304.18)	(259.60)	(56.66)	(29.56)	(147.23)	(105.50)
age	-2.324	0.894	-41.732	-1.841	2.421	3.336*	19.064	2.125
	(6.14)	(1.61)	(23.12)	(13.55)	(4.31)	(1.54)	(11.19)	(5.51)
inc1	24.572	5.647	171.837	95.740	-1.885	-4.730	-46.687	-17.474
	(24.93)	(10.23)	(93.92)	(85.98)	(17.49)	(9.79)	(45.46)	(34.94)
inc2	-12.877	-5.191	286.913*	70.338	-24.577	4.806	-126.134*	-24.868
	(25.51)	(13.10)	(96.07)	(110.14)	(17.90)	(12.54)	(46.50)	(44.76)
inc3	-65.502	12.892	224.105	259.022	17.178	4.530	-57.686	-86.639
	(61.65)	(15.79)	(232.23)	(132.69)	(43.26)	(15.11)	(112.40)	(53.92)
inc4	3.019	8.320	378.576	105.253	32.637	4.534	-135.829	-22.241
	(44.22)	(18.09)	(166.56)	(152.07)	(31.03)	(17.32)	(80.62)	(61.80)
inc5	-20.782	-6.848	-238.868	-35.520	33.993	-15.250	99.298	10.549
	(53.82)	(13.57)	(202.73)	(114.08)	(37.76)	(12.99)	(98.13)	(46.36)
famwealth2	-41.786	-5.804	107.792	105.926	-13.111	-17.532*	-30.307	-54.729
	(29.30)	(7.93)	(110.38)	(66.62)	(20.56)	(7.59)	(53.43)	(27.07)
famwealth3	-20.308	15.623	628.056*	-22.535	14.103	17.009	-296.920*	-3.485
	(60.78)	(14.78)	(228.94)	(124.20)	(42.64)	(14.14)	(110.81)	(50.48)
mumocc1	-6.223	9.705	293.923*	37.300	37.624	-2.863	-74.918	-17.933
	(33.23)	(10.01)	(125.17)	(84.14)	(23.32)	(9.58)	(60.59)	(34.19)
mumocc2	-10.150	0.191	-96.509	-13.709	-1.971	7.848	54.114	20.013
	(20.05)	(10.50)	(75.54)	(88.22)	(14.07)	(10.05)	(36.56)	(35.85)
mumocc3	-47.622	18.730	-17.632	93.773	-0.956	-5.342	11.496	-51.759
	(35.96)	(12.68)	(135.46)	(106.56)	(25.23)	(12.13)	(65.57)	(43.30)
mumocc4	-2.318	43.830*	3.544	66.575	-13.186	24.657	24.761	-12.932
	(30.94)	(17.93)	(116.56)	(150.69)	(21.71)	(17.16)	(56.42)	(61.24)
mumocc5	-32.630	10.020	-139.123	112.835	-31.176	-22.936*	54.788	-70.256*
	(30.24)	(9.67)	(113.89)	(81.27)	(21.21)	(9.25)	(55.12)	(33.03)
dadocc1	8.659	-1.547	225.625	-28.372	68.097	-9.100	-105.619	3.395
	(54.14)	(17.78)	(203.92)	(149.40)	(37.98)	(17.01)	(98.70)	(60.72)
dadocc2	-14.584	-18.363	-60.861	12.561	54.342	-17.582	6.198	-20.774
	(55.04)	(18.66)	(207.32)	(156.82)	(38.62)	(17.86)	(100.35)	(63.73)
dadocc3	41.166	-2.045	430.312	-135.350	81.581	13.913	-173.906	54.339
	(54.54)	(19.61)	(205.43)	(164.80)	(38.27)	(18.77)	(99.43)	(66.97)
dadocc4	36.873	5.460	307.908	-150.579	25.188	2.805	-135.928	48.194
	(46.88)	(21.86)	(176.60)	(183.73)	(32.89)	(20.92)	(85.48)	(74.67)
mumschool1	-6.517	-9.664	-174.365	22.162	-21.165	-6.768	77.233	-20.527
	(23.75)	(13.23)	(89.48)	(111.16)	(16.67)	(12.66)	(43.31)	(45.18)
mumschool2	2.448	9.353	70.975	0.410	-32.163	-21.587	-16.340	-20.256
	(30.14)	(11.19)	(113.54)	(94.05)	(21.15)	(10.71)	(54.96)	(38.22)
mumschool3	-21.605	-1.030	-27.896	86.766	-63.402*	-4.704	-7.963	-49.210
	(28.55)	(10.73)	(107.55)	(90.18)	(20.03)	(10.27)	(52.06)	(36.65)
dadschool1	7.200	27.144	-15.346	-26.957	26.663	4.797	30.516	29.078
	(37.06)	(13.80)	(139.58)	(115.96)	(26.00)	(13.20)	(67.56)	(47.12)
dadschool2	38.002	35.750*	-132.569	-133.100	0.749	38.627**	76.919	81.311
	(26.15)	(14.72)	(98.49)	(123.74)	(18.34)	(14.09)	(47.67)	(50.29)
dadschool3	-3.321	24.457*	-198.502	-115.717	18.252	7.833	65.054	66.691
	(31.07)	(10.61)	(117.02)	(89.21)	(21.80)	(10.16)	(56.64)	(36.25)
AdjR-sq	-0.119	0.047	0.511	-0.159	0.210	0.249	0.392	-0.114
Obs	69	98	69	98	69	98	69	98

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. See text for dependent variable definitions. Samples in odd-numbered columns include participants in the final three experimental rounds; samples in even-numbered columns include participants in the pilot and first four experimental rounds. Samples sizes differ from those of Table 2 because both samples used in these regressions exclude all records whose survey data were incomplete.

Table 3b: Correlates of Productivity Parameters: Other Covariates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	— γ_1 —		— γ_2 —		— z_1 —		— z_2 —	
Scheme	\$2 per shirt	\$4 per shirt	\$2 per shirt	\$4 per shirt	\$2 per shirt	\$4 per shirt	\$2 per shirt	\$4 per shirt
commerce_d	5.018	4.144	-181.545*	43.271	12.873	4.839	79.550*	-4.152
	(18.90)	(7.66)	(71.20)	(64.37)	(13.26)	(7.33)	(34.46)	(26.16)
enjoy	5.154	4.264	81.215	55.010	-24.268	12.211	-30.852	-26.363
	(22.00)	(9.07)	(82.88)	(76.20)	(15.44)	(8.68)	(40.12)	(30.97)
goodmt	-18.566	-13.371	92.789	9.787	-11.272	-1.852	-19.793	11.067
	(24.41)	(8.71)	(91.93)	(73.23)	(17.12)	(8.34)	(44.50)	(29.76)
game	18.721	17.719*	22.541	25.001	-34.874	11.409	8.274	5.227
	(30.21)	(7.46)	(113.78)	(62.67)	(21.19)	(7.14)	(55.07)	(25.47)
solebetter	13.487	-0.851	-205.699	15.983	0.734	0.795	39.719	1.606
	(31.88)	(11.49)	(120.08)	(96.57)	(22.37)	(11.00)	(58.12)	(39.24)
dollplay	-2.398	0.022	46.589	-38.781	-22.555	1.092	-18.537	15.166
	(16.49)	(6.17)	(62.13)	(51.87)	(11.57)	(5.91)	(30.07)	(21.08)
siblings	19.373	0.875	36.189	-8.630	-5.507	2.466	-15.209	2.907
	(11.57)	(2.32)	(43.59)	(19.46)	(8.12)	(2.22)	(21.10)	(7.91)
boredeasy	-6.718	9.426	167.942	42.951	0.785	0.669	-59.731	-13.198
	(19.42)	(7.43)	(73.14)	(62.42)	(13.62)	(7.11)	(35.40)	(25.37)
sparetime	-54.125	0.170	61.484	28.860	6.661	-2.311	-29.806	-6.501
	(26.27)	(6.98)	(98.93)	(58.66)	(18.43)	(6.68)	(47.89)	(23.84)
freqmult	13.429	18.761	608.609	478.024	-66.105	-10.416	-167.230	-169.444
	(168.61)	(32.13)	(635.10)	(270.03)	(118.30)	(30.75)	(307.40)	(109.74)
feelsrushed	9.134	-32.843	79.118	237.047	-9.316	-49.161**	-25.915	-143.384*
	(38.37)	(18.20)	(144.54)	(152.95)	(26.92)	(17.42)	(69.96)	(62.16)
stresscc	8.385	-15.415*	325.085**	15.859	5.486	13.309	-108.391*	8.404
	(21.69)	(7.44)	(81.71)	(62.51)	(15.22)	(7.12)	(39.55)	(25.40)
stresshw	-18.272	8.072	-211.053*	1.254	12.033	-14.069	58.109	-5.987
	(20.47)	(7.88)	(77.12)	(66.25)	(14.36)	(7.54)	(37.33)	(26.93)
stressmult	-13.695	-1.228	156.632	-48.040	7.008	-4.382	-47.510	-1.858
	(20.98)	(9.37)	(79.03)	(78.75)	(14.72)	(8.97)	(38.25)	(32.00)
political	-0.929	0.118	-4.566	-7.310	-2.143	0.778	-2.705	-0.877
	(4.54)	(1.82)	(17.08)	(15.32)	(3.18)	(1.74)	(8.27)	(6.23)
hrswithkid2	-38.725	-20.012	18.347	50.199	-46.523*	8.176	-11.975	-15.581
	(26.22)	(11.59)	(98.76)	(97.40)	(18.40)	(11.09)	(47.80)	(39.58)
hrswithkid3	-87.110	-4.303	129.900	-56.399	22.377	7.667	-64.575	24.883
	(65.59)	(9.47)	(247.06)	(79.59)	(46.02)	(9.06)	(119.58)	(32.34)
hrswithkid4	-20.956	-0.805	45.059	-32.250	7.353	-13.885	-2.940	7.671
	(42.87)	(12.75)	(161.49)	(107.18)	(30.08)	(12.20)	(78.17)	(43.56)
hrsresponsible2	22.904	-2.850	-65.494	22.086	22.509	-29.108**	14.912	-32.242
	(32.16)	(10.26)	(121.15)	(86.24)	(22.57)	(9.82)	(58.64)	(35.05)
hrsresponsible3	-1.973	13.161	-521.966*	69.661	11.377	2.959	163.593	-14.750
	(48.80)	(10.38)	(183.81)	(87.26)	(34.24)	(9.94)	(88.97)	(35.46)
hrsresponsible4	3.390	-37.168	-43.453	221.498	51.794	-40.909	-37.703	-119.491
	(60.27)	(23.83)	(227.00)	(200.26)	(42.28)	(22.80)	(109.88)	(81.38)
self_esteem	-4.663	-1.041	-9.377	-22.586	-4.435	5.089	7.801	14.306
	(8.53)	(3.39)	(32.14)	(28.48)	(5.99)	(3.24)	(15.56)	(11.58)
loc_full	-0.401	1.014*	3.647	-1.421	0.805	-0.169	-2.094	0.057
	(1.13)	(0.44)	(4.27)	(3.69)	(0.80)	(0.42)	(2.07)	(1.50)
happy3	-69.381	40.963	687.427	136.946	-19.740	43.641	-269.002	-41.805
	(94.21)	(37.25)	(354.86)	(313.10)	(66.10)	(35.65)	(171.76)	(127.24)
happy4	-29.695	40.252	577.822	239.435	-21.788	20.979	-222.362	-97.572
	(82.83)	(37.27)	(311.98)	(313.27)	(58.11)	(35.67)	(151.01)	(127.31)
happy5	21.243	36.200	485.050	269.131	-44.329	25.224	-212.847	-96.621
	(67.83)	(39.28)	(255.50)	(330.13)	(47.59)	(37.59)	(123.67)	(134.16)
perfuni1	55.102	-0.516	868.048*	68.392	-13.315	2.803	-264.213	-13.395
	(72.59)	(17.52)	(273.44)	(147.28)	(50.93)	(16.77)	(132.35)	(59.86)
perfuni2	-24.508	-2.383	373.905	128.846	-25.183	4.158	-75.687	-34.701
	(70.93)	(15.33)	(267.18)	(128.84)	(49.77)	(14.67)	(129.32)	(52.36)
perfuni3	14.449	-6.231	430.269	35.291	-21.088	25.210	-106.817	12.364
	(63.65)	(15.96)	(239.76)	(134.12)	(44.66)	(15.27)	(116.05)	(54.51)
lefthand	-63.339	-0.747	3.208	26.634	-71.065	-17.477	32.984	-24.190
	(72.52)	(13.18)	(273.17)	(110.77)	(50.88)	(12.61)	(132.22)	(45.02)
experiment	-70.483	0.388	-144.592	33.636	31.179	-1.397	33.070	-15.524
	(43.31)	(8.34)	(163.12)	(70.13)	(30.38)	(7.99)	(78.95)	(28.50)
AdjR-sq	-0.119	0.047	0.511	-0.159	0.210	0.249	0.392	-0.114
Obs	69	98	69	98	69	98	69	98

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. See text for dependent variable definitions. Samples in odd-numbered columns include participants in the final three experimental rounds; samples in even-numbered columns include participants in the pilot and first four experimental rounds. Samples sizes differ from those of Table 2 because both samples used in these regressions exclude all records whose survey data were incomplete. This table is a continuation of Table 3a.

than others; or who report high stress associated with the child care task. These results are consistent with the results in Tables 3a and 3b, and the other variables significant in those prior tables do show the expected signs in Tables 4a and 4b, though without statistical significance at the 5% level. Also consistent with our prior results, changing the payoff to $4 per shirt removes all of these correlations and sends the explanatory power of the regressions into the negative range, suggesting that innate preferences for the child good in a multitasking context can be overcome with an increase in the relative payoff to housework.

5.3 Productivity responses to multitasking and incentives

We now proceed to estimating average task-specific productivity losses due to multitasking, together with the own- and cross- price elasticities of task performance.

5.3.1 Which is better: Sequential sole-tasking, or multitasking?

We first use our results on productivity to ask the following question, for each participant: If a window of time were available in which he could either sequentially sole-task (spending half the time in each task) or multitask for the entire time, which would be better for him to choose, purely from a productivity standpoint?

Figure 5 provides the graphical answer to this question, where the analysis is conducted separately by incentive scheme. The left-hand graph shows results for the $2-per-shirt incentive scheme, and the right-hand graph shows results for the $4-per-shirt incentive scheme. The vertical axis is a simple count of participants for whom each of the two schemes was faced during the 'non-learning' phase of the experiment.

Our results indicate that, for the vast majority of people, multitasking is preferable for at least one task in terms of the total output produced. Sequential sole-tasking is almost never preferable–except for a very small number of participants in the $2-per-shirt incentive scheme. We also see that the change to a higher relative payoff for housework induces a change in the distribution of optimal time allocations for the two tasks, in the expected direction. Specifically, by far the largest group of participants in the low-payoff regime would generate higher baby care productivity under the multitasking allocation and higher housework productivity under the sequential sole-tasking regime. Once we pay more per shirt, the gap narrows between this group of participants and the next-highest group, for whom sequential sole-tasking is preferable from a baby care productivity standpoint, but multitasking is preferable from a housework standpoint. Essentially, this group size shift illustrates the exertion of more effort to increase the multitasking productivity of

Table 4a: Correlates of Relative Productivity of Multitasking to Sole-tasking: Economic and Standard Demographic Covariates

	(1)	(2)	(3)	(4)
	— γ_2/γ_1 —		— z_2/z_1 —	
Scheme	$2 per shirt	$4 per shirt	$2 per shirt	$4 per shirt
female	-0.138	0.009	0.012	-0.083
	(0.25)	(0.18)	(0.25)	(0.13)
c_othasian	1.173*	0.503*	-1.034*	-0.337
	(0.45)	(0.24)	(0.44)	(0.18)
c_panasian	0.642	0.106	-0.233	-0.138
	(0.37)	(0.25)	(0.37)	(0.18)
married	2.520*	1.456	-2.103*	-1.023
	(0.91)	(0.85)	(0.90)	(0.62)
age	-0.125	-0.006	0.129	0.003
	(0.07)	(0.04)	(0.07)	(0.03)
inc1	0.411	0.275	-0.306	-0.078
	(0.28)	(0.28)	(0.28)	(0.21)
inc2	0.987**	0.214	-0.722*	-0.170
	(0.29)	(0.36)	(0.28)	(0.26)
inc3	0.935	0.685	-0.360	-0.617
	(0.70)	(0.43)	(0.69)	(0.32)
inc4	1.200*	0.273	-1.079	-0.244
	(0.50)	(0.50)	(0.49)	(0.36)
inc5	-0.646	-0.067	0.382	0.124
	(0.61)	(0.37)	(0.60)	(0.27)
famwealth2	0.455	0.348	-0.049	-0.247
	(0.33)	(0.22)	(0.33)	(0.16)
famwealth3	2.031*	-0.161	-1.937*	-0.131
	(0.69)	(0.41)	(0.68)	(0.30)
mumocc1	1.000*	0.035	-0.574	-0.105
	(0.38)	(0.27)	(0.37)	(0.20)
mumocc2	-0.235	-0.043	0.445	0.082
	(0.23)	(0.29)	(0.22)	(0.21)
mumocc3	-0.013	0.173	0.211	-0.287
	(0.41)	(0.35)	(0.40)	(0.26)
mumocc4	-0.068	-0.036	0.314	-0.155
	(0.35)	(0.49)	(0.34)	(0.36)
mumocc5	-0.388	0.252	0.629	-0.308
	(0.34)	(0.27)	(0.34)	(0.19)
dadocc1	0.809	-0.108	-1.177	0.077
	(0.61)	(0.49)	(0.60)	(0.36)
dadocc2	-0.108	0.107	-0.346	-0.061
	(0.62)	(0.51)	(0.61)	(0.38)
dadocc3	1.313	-0.402	-1.666*	0.283
	(0.62)	(0.54)	(0.61)	(0.39)
dadocc4	0.896	-0.534	-1.068	0.314
	(0.53)	(0.60)	(0.52)	(0.44)
mumschool1	-0.578	0.120	0.704*	-0.120
	(0.27)	(0.36)	(0.26)	(0.27)
mumschool2	0.120	-0.076	0.165	-0.018
	(0.34)	(0.31)	(0.34)	(0.23)
mumschool3	-0.094	0.279	0.323	-0.305
	(0.32)	(0.29)	(0.32)	(0.22)
dadschool1	-0.003	-0.215	-0.005	0.184
	(0.42)	(0.38)	(0.41)	(0.28)
dadschool2	-0.543	-0.607	0.474	0.366
	(0.30)	(0.40)	(0.29)	(0.30)
dadschool3	-0.573	-0.483	0.225	0.418
	(0.35)	(0.29)	(0.35)	(0.21)
AdjR-sq	0.550	-0.181	0.444	-0.095
Obs	69	98	69	98

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Sample selection is identical to that applied to create Tables 3a and 3b.

Table 4b: Correlates of Relative Productivity of Multitasking to Sole-tasking: Other Covariates

	(1)	(2)	(3)	(4)
	— γ_2/γ_1 —		— z_2/z_1 —	
Scheme	$2 per shirt	$4 per shirt	$2 per shirt	$4 per shirt
commerce_d	-0.572*	0.112	0.436	-0.068
	(0.21)	(0.21)	(0.21)	(0.15)
enjoy	0.130	0.124	-0.091	-0.259
	(0.25)	(0.25)	(0.24)	(0.18)
goodmt	0.360	0.127	0.011	0.061
	(0.28)	(0.24)	(0.27)	(0.18)
game	-0.134	-0.044	0.243	-0.040
	(0.34)	(0.20)	(0.34)	(0.15)
solebetter	-0.557	0.028	0.099	0.013
	(0.36)	(0.31)	(0.35)	(0.23)
dollplay	0.024	-0.119	0.062	0.076
	(0.19)	(0.17)	(0.18)	(0.12)
siblings	0.022	-0.029	-0.067	0.002
	(0.13)	(0.06)	(0.13)	(0.05)
boredeasy	0.562*	0.068	-0.321	-0.091
	(0.22)	(0.20)	(0.22)	(0.15)
sparetime	0.454	0.093	-0.199	0.003
	(0.30)	(0.19)	(0.29)	(0.14)
freqmult	1.491	1.359	-0.132	-1.041
	(1.91)	(0.88)	(1.88)	(0.65)
feelsrushed	0.260	0.857	-0.132	-0.719
	(0.43)	(0.50)	(0.43)	(0.37)
stresscc	0.962**	0.144	-0.616*	-0.018
	(0.25)	(0.20)	(0.24)	(0.15)
stresshw	-0.530	-0.046	0.281	0.080
	(0.23)	(0.22)	(0.23)	(0.16)
stressmult	0.607*	-0.154	-0.368	-0.004
	(0.24)	(0.26)	(0.23)	(0.19)
political	0.003	-0.025	-0.025	-0.008
	(0.05)	(0.05)	(0.05)	(0.04)
hrswithkid2	0.084	0.283	0.195	-0.128
	(0.30)	(0.32)	(0.29)	(0.23)
hrswithkid3	0.766	-0.157	-0.389	0.179
	(0.74)	(0.26)	(0.73)	(0.19)
hrswithkid4	0.174	-0.094	0.008	0.195
	(0.48)	(0.35)	(0.48)	(0.26)
hrsresponsible2	-0.181	0.062	-0.118	-0.072
	(0.36)	(0.28)	(0.36)	(0.21)
hrsresponsible3	-1.475*	0.152	0.804	-0.147
	(0.55)	(0.28)	(0.54)	(0.21)
hrsresponsible4	0.251	0.868	-0.622	-0.612
	(0.68)	(0.65)	(0.67)	(0.48)
self_esteem	-0.052	-0.050	0.106	0.062
	(0.10)	(0.09)	(0.09)	(0.07)
loc_full	0.018	-0.012	-0.020	0.000
	(0.01)	(0.01)	(0.01)	(0.01)
happy3	2.174	0.078	-1.184	-0.630
	(1.06)	(1.02)	(1.05)	(0.75)
happy4	1.726	0.388	-0.926	-0.845
	(0.94)	(1.02)	(0.92)	(0.75)
happy5	1.277	0.481	-0.915	-0.830
	(0.77)	(1.08)	(0.75)	(0.79)
perfuni1	2.290*	0.202	-1.405	-0.152
	(0.82)	(0.48)	(0.81)	(0.35)
perfuni2	0.933	0.437	-0.055	-0.269
	(0.80)	(0.42)	(0.79)	(0.31)
perfuni3	0.976	0.190	-0.331	-0.066
	(0.72)	(0.44)	(0.71)	(0.32)
lefthand	-0.157	0.085	0.829	-0.083
	(0.82)	(0.36)	(0.81)	(0.27)
experiment	-0.101	0.090	0.071	-0.092
	(0.49)	(0.23)	(0.48)	(0.17)
AdjR-sq	0.550	-0.181	0.444	-0.095
Obs	69	98	69	98

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Sample selection is identical to that applied to create Tables 3a and 3b. This table is a continuation of Table 4a

housework, in order to capitalize on the increased economic incentives for shirts correctly sorted, and less effort on the baby care task.

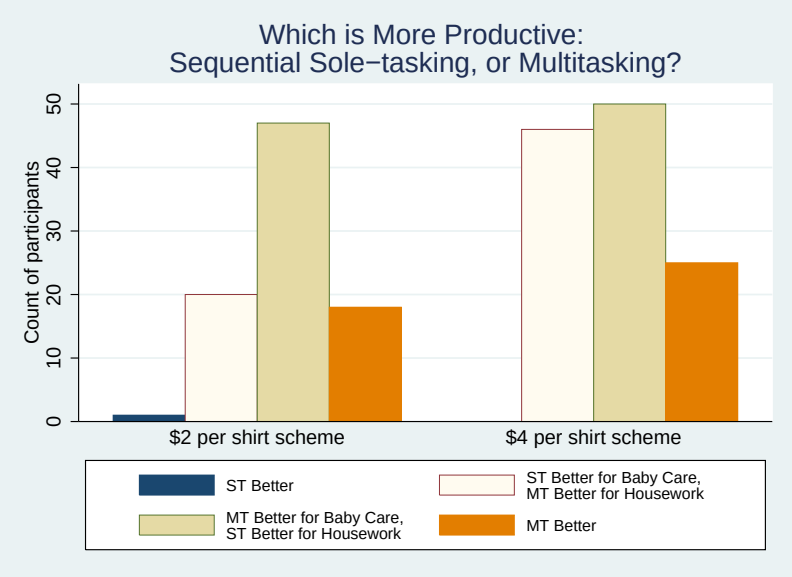

Figure 5: $2/shirt scheme (left) versus $4/shirt scheme (right)

5.3.2 Elasticities

Finally, we move to a calculation of aggregate elasticity figures. To obtain these figures, we first calculate average products for each use of time for each good under each payoff regime and stage-order structure. As before, a participant's total productivity in a baby care task is calculated as the total money payoff the participant earned in that task. To construct the participant's average product per minute, we divide this figure by the number of minutes spent in the stage in which that payoff was earned for that task (three minutes if sole-tasked, and six minutes if multitasked). Average product in the clothes-sorting task is calculated as the number of shirts sorted correctly minus the number of shirts sorted incorrectly, divided by the number of minutes spent in the stage in which that task was undertaken.

Panel A of Table 5 shows average products in the sole-tasking stages for the baby-care and clothes-sorting tasks, for each payoff regime and stage-order structure. Panel B of Table 5 shows similar figures for the multitasking stages. All figures represent means and standard deviations across the entire cell of experimental participants. Bolded figures in Table 5 represent those means that are plausibly uncontaminated by any learning effects,

as they are calculated using only the second instances of the clothes-sorting task. Only these figures are used in calculating the relative productivity measures discussed below.[6]

The figures in Table 5 imply that the loss in baby care average product due to moving from a sole-tasked to multitasked environment is between 29% and 40%, depending on the level of remuneration offered in the clothes-sorting task that competed for the participant's effort in the multitasking stage.[7] Not surprisingly, the more valuable the alternative task (sorting clothes) was to participants, the more that average per-minute product in the baby-care task fell in moving from the sole-tasked to the multitasked environment.

For sorting clothes, the figures in Table 5 imply that moving from a sole-tasking to a multitasking environment results in a loss in average product of between 36% and 46%, again depending upon the relative remuneration available in the two tasks competing for participants' effort in the multitasking context.

These average product losses are far greater than those found by Buser & Peter (2012). However, in addition to the fact that our study investigates very different tasks than theirs, our design features *bona fide* multitasking: participants face two tasks that are simultaneously competing for their attention, while the design of Buser & Peter (2012) presents tasks in sequence but with different (enforced versus optional) switching regimes.

Using the numbers in Table 5, we can compute rough estimates of the relevant own- and cross-price elasticities of task supply for baby care and sorting clothes. When we double the opportunity cost of baby care, by moving from the low-payoff regime to the high-payoff regime, baby care average product in the multitasked setting decreases by 16.84%, whereas average product in the clothes-sorting task increases by 19.71%. The first of these figures translates into an own-price output elasticity of -0.1685 for the baby care task within the multitasking setting, while the second translates into a cross-price output elasticity of 0.1971.

In the opposite direction, moving from the $4 per shirt scheme to the $2 per shirt scheme

[6]The magnitude of the learning effect, calculated by comparing mean average product in the first sole-tasked clothes-sorting task that participants faced to the second one (roughly 47 and 55 respectively, as shown in Table 5), is roughly 8 shirts per minute. Again, it is evident that there are no learning effects for baby care.

[7]As mentioned above when discussing the histogram of baby care productivity parameters, it should be noted that approximately 64% of participants earned the maximum amount possible in the sole-tasked baby care stage. This may mean that the average product losses estimated in this section are underestimates. However, re-calculating the figures above using only those participants who did not earn the maximum in the sole-tasked baby care stage yields slightly *smaller*, but still fairly similar, estimated losses for the baby care task: 23% and 32% in the low-payoff and high-payoff regimes respectively.

Table 5: Mean Average Products

Panel A

Task:	Sole-tasked baby care	Sole-tasked clothes sorting: Low-payoff regime	Sole-tasked clothes sorting: High-payoff regime
Structure 1 (N=124) (low-payoff stages presented first)	**117.44** (10.67)	47.17 (10.10)	**55.75** (8.47)
Structure 2 (N=88) (high-payoff stages presented first)	**118.42** (8.34)	**55.08** (7.85)	47.85 (8.81)

Panel B

Task:	Multitasked baby care: Low-payoff regime	Multitasked baby care: High-payoff regime	Multitasked clothes sorting: Low-payoff regime	Multitasked clothes sorting: High-payoff regime
Structure 1 (N=124) (low-payoff stages presented first)	96.85 (32.72)	**69.96** (45.15)	23.82 (13.95)	**35.78** (19.52)
Structure 2 (N=88) (high-payoff stages presented first)	**84.13** (42.74)	80.24 (40.90)	**29.89** (18.50)	30.80 (16.24)

Average product is calculated for baby care as experimental dollars earned per minute, given the remuneration scheme for this task; see text for details. Average product for sorting clothes is the number of correctly-sorted shirts minus the number of incorrectly-sorted shirts, per minute. Standard deviations are in parentheses. Bolded figures are those from which learning effects are credibly excluded. Participants earned two experimental dollars per shirt in the 'low-payoff regime' and four experimental dollars per shirt in the 'high-payoff regime'. See text for full descriptions of experimental treatments.

doubles the opportunity cost of sorting clothes. This change then brings about a decrease in the clothes-sorting average product of 16.46%, with a concomitant increase in baby care average product of 20.25%. Hence, the own-price supply elasticity for clothes-sorting is roughly -.1646, very similar to that of baby care. The estimate of the cross-price supply elasticity of baby care is .2025, also very similar to that of clothes sorting.

Perhaps the most important conclusion from this simple analysis, which echoes our regression results, is that economic incentives are clearly at work with respect to multitasking. Participants are willing to perform less baby care in a multitasked setting if they are compensated for it, which is accomplished in our experiment through increased pay for the alternative task of sorting clothes.

6 Conclusion

Our paper provides the first economic estimates of the relative productivity of multitasked time to sole-tasked time in individuals' production of child and household goods, using a novel experimental approach. Our results show raw output reductions associated with multitasking that are far greater than those estimated in prior experimental work, which we believe are due to the different tasks we analyze and the different approach we take in our experimental design compared to that taken in prior work. We also find a significant impact of economic incentives on measured productivity parameters, while at the same time showing important observable correlates of people's performance in a multitasking setting where the more interactive of the two tasks (baby care, in our case) is slightly more remunerative in relative terms. We finally calculate the literature's first relative price elasticities of task supply in a multitasking setting.

In our theoretical model, the analog to a change in the relative payoffs of each task is a change in the relative utility payoffs of each task (i.e., a change to the ratio of α to β). Our experimental results suggest, at a minimum, the order of magnitude of change in multitasking performance for which differences across people in these utility parameters may be responsible. They also suggest that the influence of these in-built preferences or habits may be able to be meaningfully moderated through the application of targeted economic incentives.

7 Questionnaire Appendix

The following questions/statements were posed to participants before the income-earning stages of the experiment. The statements were followed by scaled answer alternatives, ranging from Strongly Agree to Strongly Disagree, or Always to Never. Double-asterisked items form part of the modified Rosenberg (1965) self-esteem battery; single-asterisked items form part of the modified Rotter (1966) locus of control battery:

- I get bored easily.
- I think I'm good at multitasking.
- I enjoy being busy.
- Things get done better when you focus on doing only one thing at a time, without getting distracted.
- On the whole, I am satisfied with myself.**
- At times I think I am no good at all.**
- I feel that I have a number of good qualities.**
- I am able to do things as well as most people.**
- I feel I do not have much to be proud of.**
- I certainly feel useless at times.**
- I feel that I am a person of worth, or at least on an equal plane with others.**
- I wish I could have more respect for myself.**
- All in all, I am inclined to feel that I am a failure.**
- I take a positive attitude toward myself.**
- How often do you feel rushed or pressed for time?
- How often do you have spare time that you don't know what to do with?
- How often do you play computer games or video games?

- When you are at home, how often do you find yourself doing more than one thing at once?
- When you were a child, how often did you play caretaking games with dolls and/or stuffed animals?
- I have little control over the things that happen to me.*
- There is really no way I can solve some of the problems I have.*
- There is little I can do to change many of the important things in my life.*
- I often feel helpless in dealing with the problems of life.*
- Sometimes I feel that I'm being pushed around in life.*
- What happens to me in the future mostly depends on me.*
- I can do just about anything I really set my mind to.*

The following questions were posed to participants after the income-earning stages of the experiment:

- How stressful did you find the multitasking stages of the experiment?
- How stressful did you find the sole-tasking clothes-sorting stages of the experiment?
- How stressful did you find the sole-tasking baby-care stage of the experiment?
- What is your year of birth?
- What is your month and day of birth?
- Please indicate your gender.
- Please type in your nationality/citizenship.
- Please type in the country in which you were born.
- Please type in the country whose culture you identify with most strongly.
- Please type in the postcode of the area you live in.
- Please type in the name of the UNSW degree program in which you are enrolled, if any (Bachelor of Economics; Bachelor of Commerce; Masters of Commerce; etc.).

- When do you expect to graduate (month and year)?
- Are you a UNSW student?
- Are you an international student?
- Have you ever participated in an experiment before?
- What is your personal weekly after-tax income from all sources?
- Do you speak English at home?
- What is your current living situation?
- Are you currently...(married, in a partnership, or single).
- Are you a parent?
- How many siblings did you grow up with (in the same household?
- How many hours in your adult life (over 14 yrs old) have you spent awake in your home in the presence of an infant under 1 year old?
- How many hours in your life have you been completely personally responsible for the care of an infant under 1 year old?
- How many people under age 15 are you currently living with (in the same household?
- How many women aged 15 or older are living in your household (including yourself, if applicable)? [Only asked of participants who are living with children.]
- How many parents of children under age 15 who are living in your household also live in your household (including yourself, if applicable)? [Only asked of participants who are living with children.]
- How many people aged 15 or older are living in your household and are NOT parents of children under 15 living in your household (including yourself, if applicable)? [Only asked of participants who are living with children.]
- Please type in the age of the youngest child in your household. [Only asked of participants who are living with children.]
- What is the highest year of school you have completed?

- How much schooling did your mother complete?
- How much schooling did your father complete?
- Did your mother complete an educational qualification after leaving school? Please include any trade certificates, apprenticeships, diplomas, degrees or other educational qualifications.
- If yes, from where was her highest level qualification obtained?
- Did your father complete an educational qualification after leaving school? Please include any trade certificates, apprenticeships, diplomas, degrees or other educational qualifications.
- If yes, from where was his highest level qualification obtained?
- Please select the category of class of professions your mother's occupation falls into.
- Please select the category of class of professions your father's occupation falls into.
- Which hand do you write with?
- In political matters, people talk of "the left" and "the right". How would you place your views on this scale, generally speaking?
- All things considered in your life, how happy would you say you are usually?
- Would you say that your family is ... (wealthier, the same, or poorer than others)?
- Overall, how would you rate your performance at university?

References

Abraham, K. & Mackie, C., eds (2005), *Beyond the Market: Designing Nonmarket Accounts for the United States*, The National Academies Press, Washington, D.C.

Becker, G. (1965), 'A theory of the allocation of time', *The Economic Journal* **75**, 493–517.

Buser, T. & Peter, N. (2012), 'Multitasking', *Experimental Economics* .

Floro, M. S. & Miles, M. (2003), 'Time use, work and overlapping activities: Evidence from Australia', *Cambridge Journal of Economics* **27**, 881–904.

Folbre, N. (2006), 'Measuring care: Gender, empowerment, and the care economy', *Journal of Human Development* **7**(2), 183–199.

Folbre, N. & Yoon, J. (2007), 'What is child care? Lessons from time use surveys of major English-Speaking countries', *Review of Economics of the Household* **5**(3).

Folbre, N., Yoon, J., Finnoff, K. & Fuligni, A. S. (2005), 'By what measure?: Family time devoted to children in the United States', *Demography* **42**(2), 373–390.

Kalenkoski, C. M. & Foster, G. (2008), 'The quality of time spent with children in Australian households', *Review of Economics of the Household* **6**, 243–266.

Rosenberg, M. (1965), *Society and The Adolescent Self-Image*, Princeton University Press.

Rotter, J. (1966), 'Generalized expectancies for internal versus external control of reinforcement', *Psychological Monographs* **80**.

Rubinstein, J., Meyer, D. E. & Evans, J. E. (2001), 'Executive control of cognitive proceese in task switching', *Journal of Experimental Psychology: Human Perception and Performance* **27**(4), 763–797.