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Abstract

The author investigates how maternal employment affects when during the day that employed mothers engage in enriching childcare and whether they adjust their work schedules to spend time with their children at more-desirable times of day. Using data from the American Time Use Survey and focusing on mothers of pre-school-aged children, he finds that both full- and part-time employed mothers shift enriching childcare time from workdays to non-workdays. On workdays, full-time employed mothers shift enriching care time to evenings, whereas part-time employed mothers shift care time very little. The author finds no evidence that mothers working full time adjust their work schedules to spend enriching time with their children at more preferred times of the day. In contrast, part-time employed mothers shift their work hours to later in the day in order to spend time with their children at more-desirable times of day.

THE TIMING OF MATERNAL WORK AND TIME WITH CHILDREN

JAY STEWART*

The author investigates how maternal employment affects when during the day that employed mothers engage in enriching childcare and whether they adjust their work schedules to spend time with their children at more-desirable times of day. Using data from the American Time Use Survey and focusing on mothers of pre-school-aged children, he finds that both full- and part-time employed mothers shift enriching childcare time from workdays to non-workdays. On workdays, full-time employed mothers shift enriching care time to evenings, whereas part-time employed mothers shift care time very little. The author finds no evidence that mothers working full time adjust their work schedules to spend enriching time with their children at more preferred times of day. In contrast, part-time employed mothers shift their work hours to later in the day in order to spend time with their children at more-desirable times of day.

Maternal employment potentially has both positive and negative effects on child development. It can enhance child development if it results in additional resources being available for enriching types of activities, such as sports and educational activities. At the same time, it can be detrimental if working squeezes out childcare time. Sociological studies have shown that maternal employment results in mothers spending less time with their children, but that they go to great lengths to reduce the impact on childcare time by

cutting back on other activities, such as sleep and household work.

Another avenue, largely unexplored, by which maternal employment might negatively affect child development is through its effect on timing—that is, the time of day at which childcare activities take place. Psychological research on circadian rhythms suggests that some times of day are likely to be better than others for parent-child interactions. Thus, employment constraints may result in parents spending time with their children at times of day that are potentially less valuable for development. If this is the case, mothers may wish to adjust their schedules in order to spend time with their children at times of day when the benefits from these activities are greater.

In this study, I investigate how employment affects the timing of mothers' enriching childcare activities, and how mothers adjust their schedules to reduce the impact of their employment on the timing of childcare activities. I focus on mothers of

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pre-school-aged children (ages 0–4) because they have more flexibility with respect to the timing of childcare activities than do the mothers of school-aged children.

Background

Several researchers (Baum 2003; Ruhm 2004; James-Burdumy 2005) have examined the effect of maternal employment on children's cognitive development. The results are somewhat mixed, but generally they indicate that maternal employment has a detrimental effect on child development as measured by scores on standardized tests.¹ The authors have very little to say about the mechanisms by which this occurs, although Ruhm (2004) and James-Burdumy (2005) have suggested that research on these mechanisms would be useful, with James-Burdumy specifically mentioning time-diary data. The most obvious mechanism is the amount of time spent engaged in enriching childcare, such as playing with and reading to children.

Numerous studies have examined the effect of maternal employment on childcare time; and have found that employed mothers spend less time with their children than non-employed mothers.² A study by Cawley and Liu (2007), for example, focused on the effect of maternal employment on time spent in education-related activities and found that employed mothers spend less time than non-employed mothers reading to their children and helping them with their homework, as well as less time playing with their children. There has been almost no research conducted, however, on *when* this care is provided.³

The timing of childcare matters because not all time is equally valuable or productive. Time spent in enriching childcare activities is likely to be more beneficial for the

children and to be more enjoyable for their mothers at times when the children are more receptive to learning and when their mothers are not tired. If it is the amount of *quality-adjusted* time with children that matters and if employment causes mothers to shift enriching childcare to “less-productive” times of day, then looking only at the amount of time in enriching childcare understates the full impact of employment on maternal time with children.

Circadian rhythms—how biological functions vary over the course of the day—have been studied extensively. One facet of this research focuses on individuals' preferences for certain times of day.⁴ Most of these studies are based on the Morningness–Eveningness Questionnaire (MEQ), which is designed to assess subjects' preferences and to allow researchers to classify individuals as preferring mornings or evenings.⁵ Most research on the subject has focused on teenagers and adults, and the findings indicate that teens and younger adults generally prefer afternoons and evenings and that older adults tend to prefer mornings. Other studies have shown that performance on complex tasks is better at preferred times of day whereas performance on routine tasks is invariant to the time of day.

Less research is available on the time-of-day preferences of young children. Two studies have examined the morningness/eveningness preferences of 8–16-year-olds (Kim et al. 2002) and 2–6-year-olds (Wickersham 2006). The Kim et al. study found that younger children prefer mornings whereas older children prefer afternoons and evenings. The crossover point for this change is at about age 13. The Wickersham study found that pre-school-aged children prefer mornings, with the preference being quite strong in two- and three-year-olds. If young children also perform better on complex tasks at

¹ Baum (2003) and Ruhm (2004) found that maternal employment has negative effects on test scores, whereas James-Burdumy (2005) found both negative and positive effects, depending on the age of the child when the mother worked.

² For example, see Bianchi (2000, 2006) and Bianchi, Robinson, and Milkie (2006).

³ Craig (2006) presented some evidence that employed mothers are less likely to spend time with their children in the morning and the afternoon.

⁴ This discussion is based on the work of Hasher, Goldstein, and May (2005), who have summarized the relevant research on this topic.

⁵ The MEQ asks respondents about preferred times for doing certain types of activities, as well as preferred times for waking up and going to sleep.

their preferred time of day, then we might expect enriching care to be more valuable, and thus more “productive,” in the morning than in the evening, with the afternoon falling somewhere between the two.

The key points to take away from this research are that it matters when during the day parents spend time with their children and that children generally prefer times of day that coincide with normal work hours. The times of day that parents actually choose to spend time with their children will depend on their own time-of-day preferences, their children’s preferences, and the productivity of time spent in other activities at different times of day.

A Simple Model of Timing

To see how differences in the productivity of time spent in childcare and other activities over the course of the day affect the timing of those activities, consider a simple two-stage model of timing.⁶ In the first stage, mothers maximize utility and determine the optimal amount of time to spend in each activity during a given period of time, such as a day.⁷ In the second stage, they determine how that time is distributed over sub-periods within the day.⁸ For simplicity, I assume that there are two sub-periods and two activities.

In the first stage, mothers receive utility from time spent in enriching childcare, A ,

and all other activities, X , which include leisure, household work, and working for pay.⁹ The productivity of time spent in each of these activities is given by the functions $\Gamma(\gamma)$ for activity A and $\Theta(\theta)$ for X , where the arguments γ and θ are vectors of productivities for the sub-periods and $\Gamma_i, \Theta_i > 0$ for $i = 1, 2$. Each mother solves the following first-stage optimization program:

$$\text{Max}_{A,X} U(\Gamma(\gamma)A, \Theta(\theta)X) \quad \text{s.t. } A + X = 2T,$$

where T is the total amount of time in each sub-period. The solution to this program is straightforward and the optimal values of A and X will be denoted as A^* and X^* .

The second stage maximization program can be written as:

$$\text{Max } u = \gamma_1 f(\alpha_1) + \gamma_2 f(\alpha_2) + \theta_1 g(x_1) + \theta_2 g(x_2)$$

$$\begin{aligned} \text{s.t. } \quad & \alpha_1 + \alpha_2 = A^* \\ & x_1 + x_2 = X^* \\ & \alpha_1 + x_1 = \alpha_2 + x_2 = T \end{aligned}$$

where α_i and x_i denote the time spent in childcare and in other activities in sub-period i , $f', g' > 0$, and $f'', g'' < 0$. The equilibrium condition for this program is:

$$\begin{aligned} (1) \quad & \gamma_1 f'(\alpha_1) - \theta_1 g'(T - \alpha_1) \\ & = \gamma_2 f'(\alpha_2) - \theta_2 g'(T - \alpha_2) \end{aligned}$$

Thus, parents equate the difference between the marginal utilities of the two activities across the two sub-periods, with the difference being equal to the difference between the lagrangian multipliers on the two constraints.¹⁰ This condition, along with the assumptions regarding the functional forms of $f(\cdot)$ and $g(\cdot)$, guarantee that all else equal, parents will spend more time with their children when that time is more productive. More generally, an increase in

⁶ There is relatively little research on the timing of activities. Winston (1982) presented a theoretical model of timing. Two other studies have examined the timing of work activities (Hamermesh, Myers, and Pocock 2008) and the coordination of husbands’ and wives’ time with children (Paley 2006). Hamermesh (2005) and Hamermesh and Donald (2007) examined the effect of employment on the timing of other activities. Hamermesh (2002) and van Klaveren and van den Brink (2007) examined the synchronization of husbands’ and wives’ work schedules. My theoretical model is most similar to the one in Connolly (2008), who examined the effect of weather on the timing of work and leisure activities.

⁷ I do not model the joint decision-making of mothers and fathers. The model is intended mainly to show how time-of-day preferences affect the timing of work and enriching childcare and to help guide the empirical work.

⁸ Technically, it would be more realistic to solve the utility maximization problem in one stage with the time spent in each activity at each time as an argument in the utility function. But it is easier to see the intuition in the two-stage model.

⁹ The utility from X therefore includes utility derived from goods purchased from labor market earnings as well as the utility of leisure and the utility derived from household production. A more traditional model that includes market work and leisure as separate activities includes consumption of market goods, and explicitly models household production, would be more complicated, but the important results would not change.

¹⁰ The inequality of the marginal products is an artifact of the two-stage optimization program and the adding-up constraint in the second stage.

the productivity of A in sub-period 1, γ_1 , affects α_1 , and hence α_2 , directly through changes in the relative productivities of A and X in sub-periods 1 and 2, and indirectly through changes in A^* and X^* . The former effect is akin to a substitution effect whereas the latter is akin to a scale effect.

Holding A^* and X^* constant, an increase in the productivity of activity A in sub-period 1 causes parents to shift time in activity A from sub-period 2 to sub-period 1; conversely, an increase in the productivity of activity X in sub-period 1 results in a shift in the opposite direction. Changes in the γ_i and θ_i will have an ambiguous, but small, effect on A^* and X^* .

Implications

Although I have not explicitly modeled multiple days above, the model is still useful for examining workday–non-workday comparisons. Suppose that the productivity of enriching childcare is higher in sub-period 1 (daytime) than in sub-period 2 (evening) and that productivity does not depend on whether the day is a workday— $\gamma_1^N = \gamma_1^W > \gamma_2^N = \gamma_2^W$, where the W and N superscripts denote workdays and non-workdays. Now suppose that other activities are assumed to have either (1) the same productivity in both sub-periods on non-workdays and higher productivity in sub-period 1 ($\theta_1^W > \theta_1^N = \theta_2^N = \theta_2^W$) on workdays, or (2) higher productivity in both sub-periods ($\theta_1^W = \theta_2^W > \theta_1^N = \theta_2^N$) on workdays. Higher productivity of other activities in sub-period 1 could reflect the higher productivity of work during normal work hours due to the coordination of work activities (see Hamermesh, Myers, and Pocock 2008). Equal productivities in both periods could reflect demand-side effects, which might be the case for nurses or retail workers.

In both cases, parents are predicted to shift enriching childcare time from workdays to non-workdays. On non-workdays, they would be predicted to spend time with their children mostly in sub-period 1 and shift other activities to sub-period 2. The timing of work and childcare on workdays depends on when work time is more productive. Parents would spend relatively more time working (and less time in enriching childcare) in sub-

period 1 if the productivity of other (work) activities were higher in sub-period 1, and relatively more time working in sub-period 2 if the productivity of other activities were the same in both periods.

It is important to note that I have not explicitly modeled the mother's choice of jobs. That choice will depend on her productivity (wage) in different jobs, other sources of income (especially spouse's income), and the strength of preferences for spending time with children during the day. Regarding the latter, we might expect mothers who have a preference for spending time with their children during the evening to work at jobs where sub-period-1 productivity is higher, whereas mothers who prefer to spend time with their children during the day might be more likely to work at jobs where productivity is independent of time of day.

Data

I use pooled 2003–2007 data from the American Time Use Survey (ATUS). The ATUS is a time-diary survey that asks respondents to sequentially describe their activities, which are translated into more than 400 detailed activity codes, during a 24-hour period.¹¹ For each episode, the ATUS collects the start and stop times, who else was present, and where the respondent was. The ATUS also contains demographic information for all household members and labor force information (including labor force status and usual hours worked) for the respondent and the respondent's spouse or unmarried partner.¹²

I restricted my sample to married women 18 and older and defined four sub-samples: mothers of children aged 0–4, mothers of children aged 5–9, mothers of children aged

¹¹ If respondents report doing more than one activity at a time (such as cooking while talking to a child), only the activity reported as the primary (or "main") activity is coded. However, traveling—even when done in conjunction with another activity, such as feeding a child—is always considered the primary activity. The diary day starts at 4 a.m. "yesterday" and ends at 4 a.m. "today."

¹² For additional details about the ATUS, please see Hamermesh, Frazis, and Stewart (2005); Frazis and Stewart (2007); and the ATUS section of the BLS website.

10–17, and women who are not parents.¹³ To facilitate comparisons, I excluded mothers who had children in more than one age category. Thus, the main differences among the three sub-samples of mothers are the ages of the children (and the mothers), and I interpret any differences in the timing of activities to be due to these age differences.¹⁴

I defined three broad categories of childcare—routine care (such as feeding or bathing), enriching care (such as reading to or playing with children), and other childcare (such as dropping off and picking up children)—using the twenty-six activity codes that describe care of household children. For enriching care activities, I only included time when a child was present.¹⁵ One complication that arises when comparing time spent in enriching childcare for children of different ages is that activities that might be classified as childcare when a child is young may not be classified as such when the child is older. For example, riding bikes with a 3-year-old may be coded as childcare (030105), whereas riding bikes with a 9-year-old may be coded as bike riding (130104). Since I compare time spent in enriching childcare for mothers with children of different ages, my definition of enriching childcare also includes selected leisure activities that were done while a child was present. The main leisure activity that I excluded is television watching¹⁶ (see the Appendix for detailed definitions).

Table 1 presents the average number of hours per day spent in childcare activities by employment status. A comparison of the “all days” columns shows that, except for “other childcare,” non-employed mothers spend the most time in childcare whereas

full-time employed mothers spend the least. Nearly half of the time spent on childcare by mothers of children aged 0–4 years is routine; this type of childcare accounts for less than one-third of total childcare time by mothers of 5–9-year-olds. Mothers of older children (10–17) spend very little time on routine childcare, and time spent on enriching childcare consists mostly of leisure activities.

Childcare on Workdays and Non-Workdays

Table 1 also shows how employed mothers shift childcare from workdays to non-workdays. Workdays are those on which the mother spends any time working at a location other than her home.¹⁷ It is also important to note that, because the ATUS collects data for only one day, I do not directly observe the shifting of childcare activities. Instead, I compare employed mothers on workdays and non-workdays, noting that whether a mother is observed on any particular day is determined randomly through the procedure for assigning respondents to days of the week.

Overall, employed mothers of children aged 0–4 spend about 70 percent more time per day engaged in childcare on non-workdays than they do on workdays, but there are notable differences between full- and part-time employed mothers and by type of childcare. Part-time employed mothers spend about 50 percent more time in routine childcare on non-workdays than they do on workdays whereas full-time employed mothers spend more than twice as much. For both full- and part-time employed mothers, enriching childcare is shifted from workdays to non-workdays to a much greater degree than is routine care. This is as expected because many routine childcare activities, such as feeding and dressing, must be done every day. Childcare time is shifted in the other direction for “other childcare,” which includes transporting children. Full-time employed

¹³ Here, “children” refer to the mother’s own children (including adopted and step-children) who live in the household.

¹⁴ The differences could also be due to cohort effects.

¹⁵ I make this restriction because some activities, such as reviewing homework or preparing for a project, can be done when the child is not present.

¹⁶ One leisure activity that is potentially problematic is socializing when other adults are present, because it is possible that the children have been “dragged along” and are not part of the activity. I redid the analysis using an alternative definition of socializing and excluding it altogether, and the results were nearly identical.

¹⁷ The small number of days that mothers work exclusively at home are included with non-workdays because mothers who work at home have considerable flexibility with regard to when they spend time with their children.

Table 1. Hours Spent in Childcare by Mothers on their Diary Day, 2003–2007 ATUS Annual Averages

	Employed full-time			Employed part-time			Not employed (all days)
	Workdays (away from home)	Nonwork Days*	All Days	Workdays (away from home)	Nonwork Days*	All Days	
Mothers of 0–4-Year-Old Children							
<i>Childcare (with child < 5)</i>							
Routine childcare	2.0	3.5	2.6	2.5	4.1	3.5	4.0
Enriching childcare	0.9	1.9	1.3	1.3	1.9	1.7	1.9
Other childcare	0.7	1.4	1.0	1.0	1.9	1.5	1.9
	0.4	0.2	0.3	0.3	0.3	0.3	0.3
Observations	432	511	943	160	365	525	942
Mothers of 5–9-Year-Old Children							
<i>Childcare (with child 5–9)</i>							
Routine childcare	1.5	2.4	1.8	1.7	2.7	2.3	2.7
Enriching childcare	0.5	0.6	0.5	0.6	0.8	0.7	0.7
Other childcare	0.7	1.4	0.9	0.7	1.5	1.1	1.6
	0.4	0.3	0.4	0.4	0.5	0.5	0.4
Observations	298	299	597	99	227	326	370
Mothers of 10–17-Year-Old Children							
<i>Childcare (with child 10–17)</i>							
Routine childcare	0.7	1.2	0.9	1.0	1.5	1.3	1.6
Enriching childcare	0.1	0.1	0.1	0.2	0.2	0.2	0.3
Other childcare	0.4	0.9	0.6	0.5	0.8	0.7	1.0
	0.2	0.2	0.2	0.3	0.4	0.4	0.3
Observations	935	961	1,896	262	501	763	782

* Includes days on which the respondent worked at home and did not work away from home.

mothers spend considerably more time in other childcare activities on workdays than on non-workdays, which likely reflects time spent getting children to and from daycare or preschool. In contrast, part-time employed mothers spend equal amounts of time on work and non-workdays.

The panels for mothers of older children (5–9-year-olds and 10–17-year-olds) show that time spent in both routine and enriching childcare declines as the children get older, with the decline being much larger for routine care. Just as it is with pre-school-aged children, childcare is shifted from workdays to non-workdays. Again, enriching childcare is shifted to a much greater degree compared to routine care.

These findings are consistent with the prediction that parents will shift childcare time from workdays to non-workdays. They are also consistent with results in Hamermesh and Donald (2007), who found that the fixed costs associated with working affect the timing of non-work activities, and in Stafford and Yeung (2005), who found that children spend more time with their parents on weekend days than on weekdays.

The Timing of Childcare

The research on circadian rhythms suggests that mornings may be the best time (from the child's perspective) for enriching care. However, because it is the mother's utility that is being maximized and productivity depends on both mother's and children's time-of-day preferences, it is possible that mornings are not the most productive time of day. Although I have no direct information on these preferences, it is possible to infer when parents prefer to engage in enriching childcare by comparing non-employed mothers with employed mothers on their non-workdays, when they are not constrained by work schedules.¹⁸ Thus, I am able to determine

whether employment affects the timing of enriching care by comparing workdays to non-workdays of employed mothers and to all days of non-employed mothers. If there is no employment effect on timing, then apart from differences in the amount of time spent with children, the distributions of time spent in enriching childcare over the course of a day should be the same on both work and non-workdays.

Figure 1 shows the distribution of enriching childcare time of mothers of children aged 0–4 years old on workdays and non-workdays by employment status. The height of each bar represents the fraction of total enriching childcare time spent during that hour. For example, 22 percent of the time that full-time employed mothers spend on enriching childcare on workdays occurs between 7:00 p.m. and 8:00 p.m.

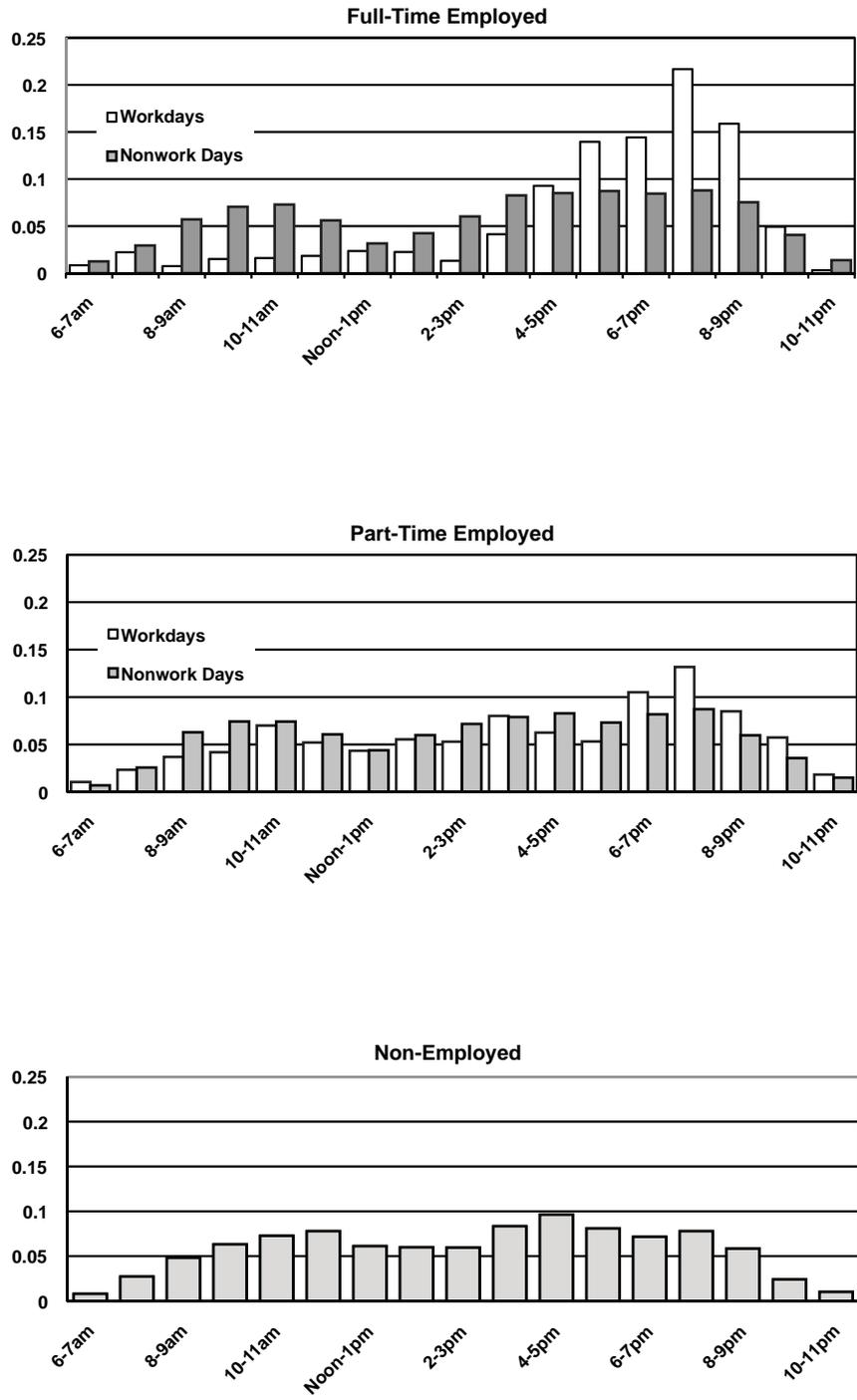
The graphs for all days of non-employed mothers and for non-workdays of employed mothers are strikingly similar, with the time spent in enriching childcare being distributed fairly uniformly throughout the day. About 40–48 percent of enriching childcare takes place between 9:00 a.m. and 4:00 p.m.; 16–20 percent occurs between 7:00 p.m. and 10:00 p.m. The fact that enriching childcare is fairly evenly distributed over the day seems to contradict the circadian-rhythm research. However, it is important to keep in mind that both the children's and their mothers' time-of-day preferences come into play here. The distributions of enriching childcare time suggest that, in terms of the theoretical model, γ_1 and γ_2 are not that different from each other. This, along with the assumption that $f(\cdot)$ exhibits diminishing marginal productivity, implies that the total value of enriching childcare is maximized when mothers spend about the same amount of enriching childcare time in each sub-period.

The distribution of enriching childcare time spent by full-time employed mothers on workdays is quite different from the distribution on non-workdays, with much of the time on workdays concentrated in the evenings. Specifically, full-time employed

¹⁸ Comparing non-employed mothers to employed mothers is potentially problematic because the employment decision may be related to unobserved differences in time-of-day preferences. For example, mothers who prefer to spend time with their children in the evenings may be more likely to be employed full-time. If this is the case, we would expect these mothers to concentrate their childcare activities in the evening

on their non-workdays as well.

Figure 1. Time-of-Day Distribution of Time Spent in Enriching Childcare by Mothers of 0-4-Year-Old Children



mothers spend more than 40 percent of their total enriching childcare time between 7:00 p.m. and 10:00 p.m.; conversely, only 15 percent of this time is spent between 9:00 a.m. and 4:00 p.m.. The distribution of enriching childcare time spent by part-time employed mothers on workdays lies between these two extremes, but it looks more like the non-workday distributions. Forty percent of enriching childcare occurs between 9:00 a.m. and 4:00 p.m. whereas only 27 percent takes place between 7:00 p.m. and 10:00 p.m.

To quantify the differences in the distributions and the amount by which workday distributions diverge from non-workday distributions, I used a weighted absolute-deviation dissimilarity index to compare average workdays and non-workdays. For each pair-wise comparison, the dissimilarity index is given by

$$T_{WAD} = \sum_{h=1}^{24} \left(\frac{|t_h^i - t_h^j|}{(t_h^i + t_h^j)} \times \frac{(t_h^i + t_h^j)}{\left(\sum_{h=1}^{24} t_h^i + \sum_{h=1}^{24} t_h^j \right)} \right) = \sum_{h=1}^{24} \left(\frac{|t_h^i - t_h^j|}{2} \right)$$

where t_h^i and t_h^j are the fractions of time spent in enriching childcare in each hour of the day on days i and j , and i and j refer to groups defined by their workday and employment status. The index ranges in value from 0 to 1, where 0 indicates that the distributions are identical and 1 indicates that there are no times of day in common.¹⁹

¹⁹ The index is designed to measure between-group differences in time spent in all activities (for example, measuring how differently men and women use their time). In my analysis, the groups are defined by employment status and whether or not the day was a workday (for example, comparing work and non-workdays for full-time employed or comparing non-workdays of full-time employed and non-employed). The activities are defined by time of day, where time spent in enriching childcare at each hour of the day is viewed as a separate activity. When the time is expressed as a percentage of total time in enriching childcare, the dissimilarity index is identical to the index proposed by Taeuber and Taeuber (1965). See Stewart (2006)

This index has a natural interpretation. It is equal to the fraction of enriching childcare time that one group must reallocate to different times of day in order to make their two distributions identical. Thus, the index values for workday–non-workday comparisons equal the fraction of enriching childcare time that mothers shift due to market work.

The index values for pair-wise comparisons of the three non-workdays (full-time employed, part-time employed, and non-employed) are all less than 0.10, which indicates a substantial similarity (see Table 2). These values strongly indicate that employed mothers have the same time-of-day preferences for enriching childcare as non-employed mothers, and that the shifting of enriching childcare time from workdays to non-workdays does not affect the timing of these activities on non-workdays. As expected, the differences between workdays and non-workdays of full-time employed mothers are large (the index values are in the 0.34–0.40 range). The index values for comparisons to the workdays of part-time employed mothers confirm the earlier observation that the workdays of part-time employed mothers are much closer to non-workdays than they are to the workdays of full-time employed mothers. The index values for comparisons to non-workdays fall into the 0.14–0.18 range. The index of 0.32 for the workday-to-workday comparison of full- and part-time employed mothers is of about the same magnitude as the index value for workday-to-non-workday comparison for the full-time employed mothers. Another way to quantify these differences is to compute the amount of time that would have to be rescheduled. Using the average day of a non-employed mother as a common reference, full-time employed mothers would need to reschedule about 16 minutes per workday (or about 71 minutes per week) of enriching childcare time whereas part-time employed mothers would need to reschedule only 11 minutes per workday

for more information and for comparisons to other indexes used to analyze time-use data.

Table 2. Dissimilarity Index Comparisons of the Distribution of Enriching Childcare on Workdays and Non-Workdays: Mothers of 0–4-Year-Old Children

	<i>Full-Time Employed</i>		<i>Full-Time Employed</i>		<i>Nonemployed</i>
	<i>Workday</i>	<i>Non-Workday</i>	<i>Workday</i>	<i>Non-Workday</i>	
Full-Time Employed					
Workday	—	0.342	0.317	0.387	0.399
Nonwork Day	—	—	0.135	0.059	0.093
Part-Time Employed					
Workday	—	—	—	0.142	0.176
Nonwork Day	—	—	—	—	0.077

(30 minutes per week).²⁰

To summarize, full-time employed mothers shift enriching childcare time from workdays to non-workdays, and from earlier to later times on workdays. This shifting reduces the value of enriching childcare time, not because the productivity parameter (γ) is lower in the evening, but because the enriching childcare production function exhibits diminishing marginal productivity and the total value of enriching childcare time is maximized when enriching childcare time is distributed evenly throughout the day. Part-time employed mothers also shift enriching childcare time from workdays to non-workdays, but on workdays there is very little shifting to later times of the day. Given mothers' preferences for spreading enriching childcare time evenly throughout the day, it would be reasonable to expect them to adjust their work schedules so that they can spend more time with their children at preferred times of day.

The Timing of Work

In order to understand how time-of-day preferences affect at what point during the day mothers of pre-school-aged children choose to work, I need to know when these mothers would work if the children were not present. Since I cannot make this comparison, I instead compare the employed

mothers of these children (0–4-year-olds) to the employed mothers of 5–9-year-olds, 10–17-year-olds, and employed women who are not mothers.

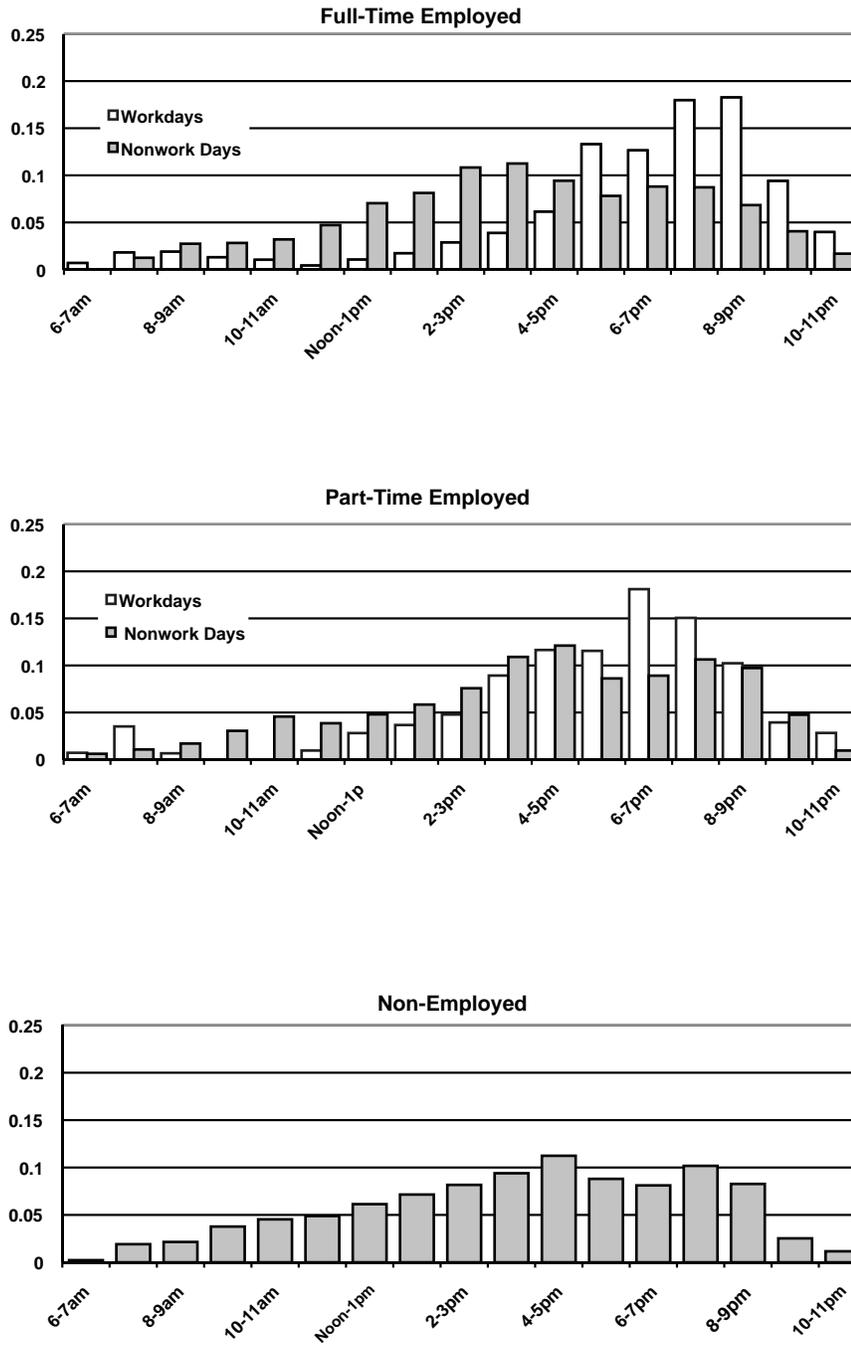
The most appropriate control group would appear to be the mothers of children aged 5–9 years old. These mothers spend almost as much time in enriching childcare activities as do mothers of pre-school-aged-children and are likely to have the same characteristics, except that their children are on average 5 years older. Perhaps more importantly, the distribution of time spent in enriching childcare activities by these mothers on non-workdays is similar to that of mothers children aged 0–4 (see Figure 2). Like the mothers of 0–4-year-olds, 41–48 percent of these mothers' enriching childcare is done between 9:00 a.m. and 4:00 p.m.

The key difference between mothers of 5–9-year-olds and the mothers 0–4-year-olds is that the mothers of the former group cannot spend time with their children when the children are in school. In the context of the theoretical model, this implies that γ_1 is close to zero on school days and that these mothers will spend very little time in enriching childcare activities at these times of day. Figure 2 shows that both part-time and full-time employed mothers of 5–9-year-olds spend very little time in enriching childcare activities on workdays, which are mostly school days.²¹ The low

²⁰ Full-time employed mothers of 0–4-year-olds work 4.5 days per week on average, whereas part-time employed mothers work 2.8 days per week.

²¹ Ideally, I would also like to distinguish between

Figure 2. Time-of-Day Distribution of Time Spent in Enriching Childcare by Mothers of 5–9-Year-Old Children



productivity of enriching childcare time during school hours implies that employed mothers will shift their work schedule so that they work more in the morning and early afternoon. Thus, comparing the mothers of 0–4-year-olds to the mothers of 5–9-year-olds will overstate the extent to which the former adjust their schedules to spend time with their children. For this reason, I also compare the mothers of pre-school-aged children to the mothers of 10–17-year-olds and to women who are not parents.²²

There is, potentially, a similar problem of overstatement in the comparison to the mothers of 10–17-year-old children. Again, the productivity of mothers' enriching childcare time is close to zero when their children are in school, which would lead to mothers shifting work to earlier in the day. In addition, these older children are more independent and it is less critical that a parent be home when these older children come home from school. Moreover, these older children prefer later times of day (although they may not want to spend that time with their parents).

My final comparison is to women who are not parents. These women are the most appropriate control group because their time-of-day preferences for work are not influenced by school considerations but instead are likely determined by their desire to spend time with their husbands. Studies by Hamermesh (2002) and van Klaveren and van den Brink (2007) support this supposition. Both studies found that married couples synchronize their work schedules so that they can spend more time together, but they synchronize to a lesser extent when there are children present.

For each of the above comparisons, I estimated a series of linear probability

models. I restricted my sample to workdays and estimated a separate linear probability model for each time of day between 6:00 a.m. and 11:00 p.m. at 5-minute intervals (204 equations total). The dependent variable equals one if the woman was working away from home at that moment, and the independent variable of interest is an indicator variable that equals one if the woman was the mother of a child aged 0–4. I controlled for the mother's age and education; her husband's employment status and education; whether the diary day was in the summer, a school day, or a weekend; and the amount of time spent working away from home on the diary day.²³

Figures 3 and 4 graph the coefficients on the indicator variables for the presence of children aged 0–4 (and no older children) by time of day. Comparisons to each control group are shown in separate panels. I constructed 95-percent confidence intervals (not shown) using robust standard errors clustered by geographic identifiers and found that most of the individual coefficients are not statistically significant. The significance of individual coefficients, however, is less important than whether the difference is statistically significant for blocks of time. To perform these tests, I estimated three regressions for every possible 30-minute block of time between 6:00 a.m. and 11:00 p.m.. The first block of regressions was estimated for 6:00 a.m., 6:15 a.m., and 6:30 a.m.; the second block for 6:05 a.m., 6:20 a.m., and 6:35 a.m.; and so on. The three equations for each block were estimated jointly to account for the cross-equation correlation of residuals and to facilitate hypothesis testing. For each block, I tested whether the sum of the three coefficients was significantly greater than or less than zero (depending on time of day) using a one-tailed test that accounts for clustering as above. Times for which the

school and non-school days, but the sample is not large enough to do so. In the regression analysis, I control for whether the diary day is a school day.

²² Another factor that facilitates mothers' labor force participation is the availability of before- and after-school day care (also known as extended day) that allow parents to drop children off at school before the school day begins or to stay at school after the official school day has ended. In 2007, nearly half of all elementary schools offered these programs (Snyder, Dillow, and Hoffman 2008, Table 97).

²³ School days are defined as non-holiday weekdays between September 15 and December 15 or between January 15 and May 15. A day is considered a school day only if school-aged children live in the household. Summer is the period from June 1 through August 31. The school-day variable was not included in the equation comparing mothers of 0–4 year-olds to non-parents.

sums of the three coefficients are statistically significant are indicated by the bold portions of the graph.

Figure 3 shows the coefficients for full-time employed mothers of pre-school-aged children. The smallest coefficients are for the comparison to mothers of 5–9-year-olds, with the difference being larger than 0.05 in absolute value at only a few times during the day. The differences are larger in the middle panel's comparison to mothers of 10–17-year-old children, with the largest occurring in the early morning and late afternoon. Even so, the coefficient never exceeds 0.1 in absolute value. The largest differences occur in the bottom-panel comparison to non-parents. Mothers of pre-school-aged children are between 5 and 10 percentage points more likely to work at early-afternoon times and between 5 and 10 percentage points less likely to work in the early evening. This likely reflects these mothers' desire to be home at dinnertime. Even though the differences are statistically significant for several blocks of time in the mornings and evenings, they are small given that, between 8:00 a.m. and 4:00 p.m., an average of 73 percent of full-time employed women are working at any given time. Thus, it is clear that even though full-time employed mothers have the same time-of-day preferences as part-time employed and non-employed mothers regarding when they engage in enriching childcare, it is too costly for them to make large adjustments to their work schedules so that they can spend more time with their children earlier in the day. The lack of variability of work schedules by presence and age of children among full-time employed mothers is consistent with the result in Hamermesh (2005) that the presence of children has no effect on "temporal variety"—variability in the timing of activities.

Figure 4 illustrates the same comparisons for part-time employed women. The differences are much larger than those in Figure 3. The top graph reveals that, compared to the mothers of 5–9-year-old children, the mothers of pre-school-aged children are less likely to be working during school hours and more likely to be working outside of school hours. This is consistent

with the prediction from the theoretical model that mothers of school-aged children will shift work to times when their children are in school. The differences are quite large in the mid-morning, with mothers of children aged 0–4 being 10–30 percentage points less likely to be working. They are also about 15 percentage points less likely to be working during the early afternoon. These differences are statistically significant for about three hours in mid-morning and for just under an hour in the afternoon. These mothers are 10–15 percentage points more likely to be working in the early morning and 15–20 percentage points more likely to be working in the early evening. The morning and evening differences are statistically significant for blocks of time that are approximately one and three hours long. As noted above, these estimates overstate the true effect because of the shifting of work to school hours by the mothers of 5–9-year-olds.

When comparing the mothers of pre-school-aged children to the mothers of 10–17-year-olds, the differences are smaller—but they are still large. These differences are in the 10-percentage-point range in the morning, the 10–15-percentage-point range in the early afternoon, and in the 10-percentage-point range in the evening, with a smaller fraction of mothers of pre-school-aged children working in the morning and afternoon. The period over which the differences are statistically significant covers about two hours in the morning and afternoon and about one hour in the evening.

The bottom panel of Figure 4 presents the comparison to women who are not parents, which, as noted above, is the most appropriate control group. Here, the differences are somewhat smaller than in the other two panels, falling into the 10-percent range for large portions of the day. The differences, though large, are statistically significant only for two blocks of time that cover a little more than two hours in the evening. In interpreting these results, it is important to keep in mind that the positive difference in the evening necessarily implies a negative difference at other times of the day. Thus, the lack

Figure 3. Difference in Percent of Full-Time Employed Mothers Working by Time of Day (Regression Coefficients on Indicators for Presence of 0–4-Year-Old Children)

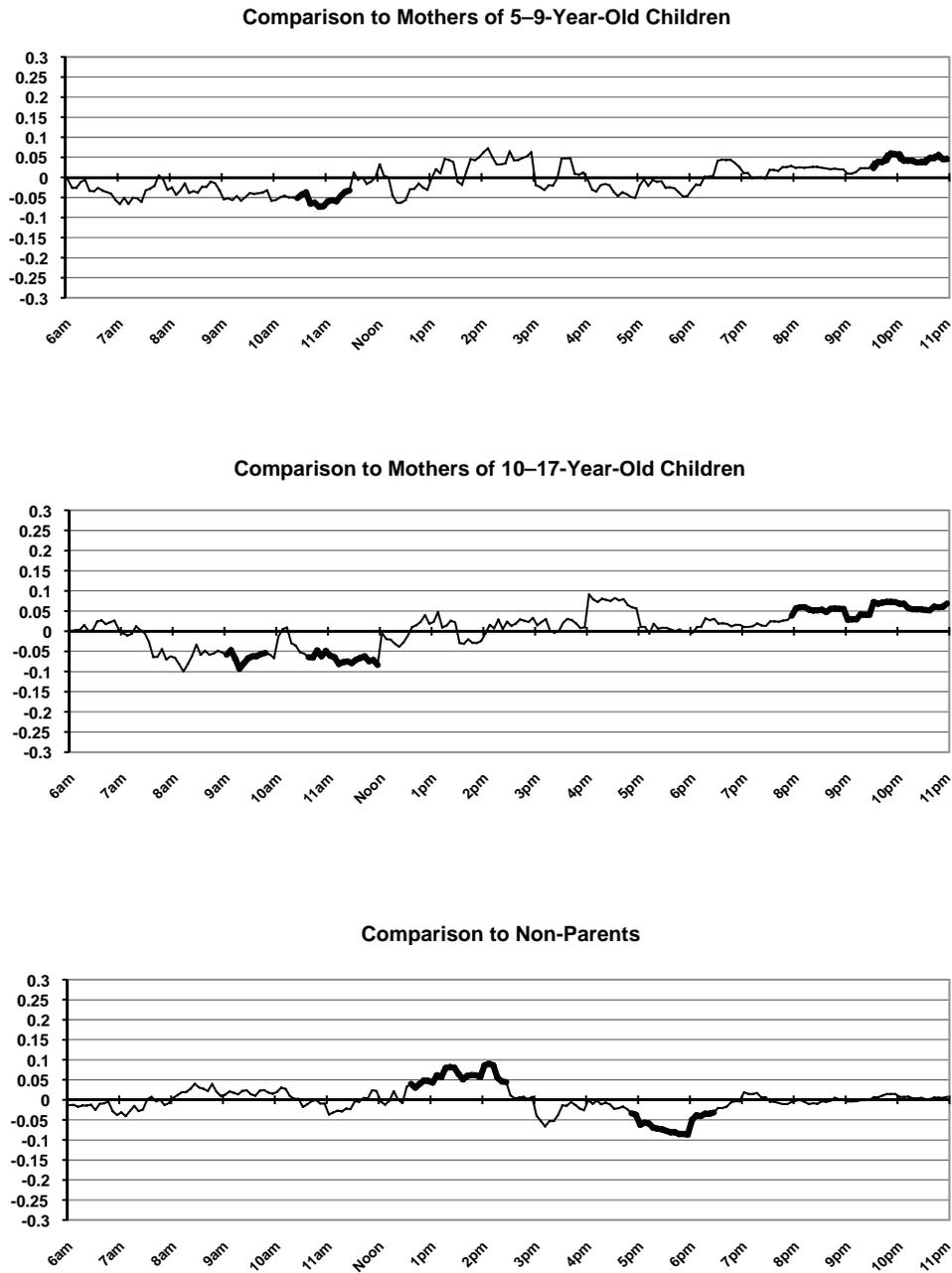
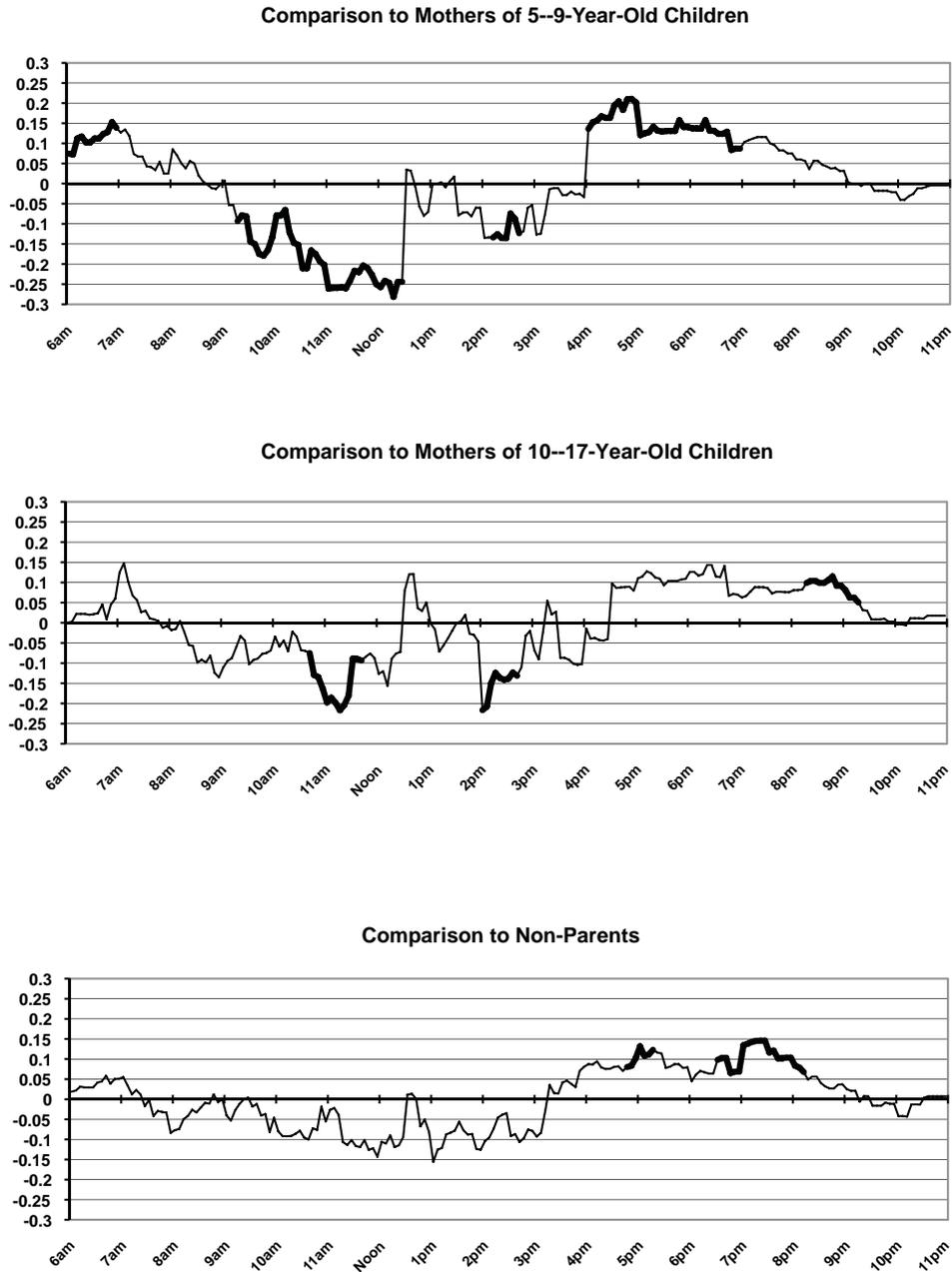


Figure 4. Difference in Percent of Part-Time Employed Mothers Working by Time of Day (Regression Coefficients on Indicators for Presence of 0–4-Year-Old Children)



of statistical significance in the morning and afternoon does not mean that there is no effect. Rather, it arises because the effect is spread out over a larger portion of the day. These results indicate that part-time employed mothers of pre-school-aged children adjust their work schedule so that they work less during the day and more in the evening. This allows them to spend more time with their children throughout the day so that their enriching childcare time is not concentrated in the evening.

Table 3 shows how women's work time is distributed across weekdays and weekends. Full-time employed women do most of their work on weekdays; there is very little variation by presence and age of children. About 33 of the 35 hours they work per week are worked on weekdays. There is more variation among part-time employed women in both the number of hours worked per week and in the percent of that time that is worked on weekdays. The mothers of children aged 0–4 work the fewest hours per week, but they work the most hours on weekends. Of the 16.5 hours that they work per week, 2.4 (14 percent) of those hours are worked on weekends. The mothers of 5–9 year-olds work the most hours per week (20.0 hours), but they work the fewest hours on weekends (1.0 hours or 5 percent of all hours). The mothers of 10–17-year-olds fall in between the other two groups, working about 7 percent of their hours on weekends. Thus, the mothers of school-aged children appear to be concentrating their work time on weekdays (school days) whereas the mothers of pre-school-aged children appear to work more on days when their husbands are likely to be available for childcare.²⁴

²⁴ I examined whether part-time employed mothers of school-aged children also shift their work hours to coincide with school hours. Restricting the sample to days when school is in session (September 15–December 15 and January 15–May 15), I calculated the fraction of total hours worked during school hours (9 a.m. – 3 p.m. on weekdays). As a point of reference, full-time employed women (regardless of presence and age of children) and part-time employed non-mothers worked about 55 percent of their total weekly hours during school hours. Part-time employed mothers of school-aged children worked a little more than 60 percent of their weekly hours during school hours, compared to 43 percent for part-time employed

All of these results strongly suggest that one of the reasons that mothers of pre-school-aged children work part-time is to have the flexibility to schedule work in order to spend time with their children throughout the day. For the mothers of school-aged children, part-time employment allows them to work when their children are in school. The results also suggest that the greater ability to choose when they work is one of the attributes that makes part-time work desirable to working mothers. This explanation is consistent with the results of Ichino and Sanz de Galdeano (2005), who found that the availability of part-time jobs and flexible employment arrangements is a more important determinant of maternal employment rates than the availability of formal childcare facilities. Their research suggests that many of these part-time employed mothers would choose not to work, rather than work full-time, if part-time jobs were not available.

Summary and Conclusions

The time that parents spend in enriching childcare activities is crucial to child development, and an extensive literature has examined the effect of maternal employment on childcare time. Most of this literature has focused on the amount of time parents spend with their children, but it has largely ignored when that time is spent. The theoretical model predicts that mothers will want to spend more time in enriching childcare activities at times of day when those activities are the most productive. Psychological research on circadian rhythms suggests that early in the day is the best time for enriching childcare, but the productivity of enriching childcare time also depends on the mother's time-of-day preferences. Evidence indicates that for mothers of pre-school-aged children (ages 0–4), the total value of enriching childcare time is maximized when that time is evenly distributed throughout the day.

On workdays, full-time employed mothers of children aged 0–4 shift a large fraction of enriching childcare time toward the evenings, whereas part-time employed

mothers of children aged 0–4.

Table 3. Distribution of Work Between Weekdays and Weekends by Age of Children and Full-/Part-Time Status

	Average Time Spent Working on Diary Day			Percentage Working on Diary Day			Average Time Spent Working on Diary Day Conditional on Working		
	Weekdays	Weekend		Weekdays	Weekend		Weekdays	Weekend	
		Days	All Days		Days	All Days		Days	All Days
Full-Time Employed									
with 0-4-Year-Old Children	6.5	1.0	5.0	83.6	16.9	64.6	7.8	5.9	7.3
with 5-9-Year-Old Children	6.7	1.1	5.1	85.3	18.6	66.2	7.8	6.0	7.3
with 10-17-Year-Old Children	6.6	1.1	5.0	82.5	18.5	64.2	8.0	6.0	7.4
Non-Parents	6.7	1.2	5.1	83.8	18.2	65.0	8.0	6.5	7.6
Part-Time Employed									
with 0-4-Year-Old Children	2.8	1.2	2.4	50.2	17.1	40.7	5.6	6.9	6.0
with 5-9-Year-Old Children	3.8	0.5	2.9	62.0	7.1	46.3	6.2	6.8	6.3
with 10-17-Year-Old Children	3.4	0.7	2.6	58.6	14.8	46.0	5.8	4.6	5.5
Non-Parents	3.5	0.9	2.8	62.6	17.3	49.7	5.7	5.2	5.5

mothers shift enriching childcare time to a much lesser extent. Full-time employed mothers of pre-school aged children would have to reschedule about 40 percent of enriching childcare time on workdays, compared to only 18 percent for part-time employed mothers, to make the workday distribution the same as the distribution for non-employed mothers. This translates to 71 minutes per week for full-time employed mothers, compared to 30 minutes for part-timers. Thus, it appears that, though part-time employment affects the amount of time that mothers devote to enriching childcare, it does not have a large effect on when that care takes place.

Part-time employed mothers adjust their schedule so that they can spend time with their children throughout the day. Compared to employed women who are not parents—the preferred control group—the mothers of pre-school-aged children are 18 percent (10 percentage points) less likely to be working in the morning and early afternoon. In contrast, there is no evidence that full-time employed mothers of pre-school-aged children adjust their schedules

to spend more time with their children during the day.

These results suggest that mothers who work part time do so not only to spend more time with their children but also to increase the value of that time. Further, the results imply that looking only at the amount of time spent in enriching childcare activities understates the full impact of maternal employment on enriching childcare for full-time employed mothers, but not for part-timers. These findings do not necessarily imply that the children of full-time employed mothers are worse off because of this shifting of enriching childcare time. These children are presumably in daycare or preschool, where they can participate in enriching activities with their teachers and other children throughout the day. As is the case when analyzing the effect of maternal employment on the amount of time mothers spend with their children, the level at which children are affected positively or negatively by these conditions depends on the extent to which this time can function as a substitute for maternal time.

APPENDIX

Classification of Activities among Routine Care, Quality Care, and Unclassified Care

Routine childcare	
030101	Physical care of household children
030109	Looking after children as a primary activity
030301	Providing medical care to household children
Enriching childcare (children of all ages)	
030102	Reading to/with household children
030103	Playing with household children, not sports
030104	Arts and crafts with household children
030105	Playing sports with household children
030106	Talking with/listening to household children
030107	Helping/teaching household children (not related to education)
030201	Homework (household children)
030203	Homeschooling of household children
Enriching childcare (children ages 2+)	
1201	Socializing and communicating
120307	Playing games
120309	Arts and crafts as a hobby
120310	Collecting as a hobby
120311	Hobbies, except arts & crafts and collecting
120401	Attending performances
120402	Attending museums
120403	Attending movies/films
1301	Participating in sports
1302	Attending sporting event
Other childcare	
030108	Organization and planning for household children
030110	Attending household children's events
030111	Waiting for/with household children
030112	Picking up/dropping off household children
030199	Caring for and helping household children, not elsewhere classified
030202	Meetings and school conferences (household children)
030204	Waiting associated with household children's education
030299	Activities related to household children's education, not elsewhere classified
030302	Obtaining medical care for household children
030303	Waiting associated with household children's health
030399	Activities related to household children's health, not elsewhere classified
170301	Travel related to caring for and helping household children
180301	Travel related to caring for and helping household children
180302	Travel related to household children's education
180303	Travel related to household children's health

Note. A child must be present during enriching care activities. For children ages 2+, enriching childcare includes leisure activities during which the child was present (see text for further details).

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