The Rug Rat Race

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Abstract

Since the early 1990s, the amount of time spent by prime age adults on childcare has risen significantly despite a decline in average family size. Moreover, the rise in childcare time has been particularly pronounced among highly educated mothers. Why would highly educated women increase the amount of time they allocate to childcare at the same time that their own market returns have skyrocketed? We argue that the increased competition for good colleges may be one important source of these trends. We document that the number of college-bound students has surged in recent years, whereas the number of slots at elite colleges has remained relatively constant. We then present a model in which highly educated parents have a comparative advantage in rivalry for scarce college slots, and hence increase their investment when the competition intensifies.

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> "It was the most selective spring in modern memory at America's elite schools, according to college admissions officers. More applications poured into top schools this admissions cycle than in any previous year on records." (*New York Times, April 4, 2007)*
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> "Attending the local public university is no longer a birthright. An explosion in applications has allowed the schools to reject students in record numbers." (*CollegeJournal from the Wall Street Journal, November 14, 2006)*

I. Introduction

One of the most surprising findings from the recent research on time use concerns trends in time spent with children. Despite shrinking families and dramatic increases in women's time spent in the workforce, the amount of time married mothers spent with children rose from 8.8 hours a week in 1975 to 12.9 hours a week in 2000 (Bianchi, Robinson, and Milkie (2006), Table 4.1). Married fathers increased the amount of time spent on childcare from 2.7 hours per week in 1975 to 6.5 hours in 2000. In contrast, the amount of time spent on other types of "home production" activities, such as cleaning house and cooking, fell significantly (e.g. Robinson and Godbey (1999), Aguiar and Hurst (2007)).

Bianchi et al (2006, p. 87) summarize several potential explanations for the increase in time parents spend with children. First, because parenthood is mostly voluntary now, individuals can choose whether and when to be parents. This sample-selection argument suggests that only those individuals who enjoy interacting with children decide to become parents now. Second, heightened concerns about safety induce parents to accompany their children in their activities and to substitute structured activities for the free, unaccompanied play on neighborhood streets that was the norm in earlier times. According to this explanation, there has been a sort of "negative technological progress" in raising children. Third, as wealth increases parents trade

"quality" for "quantity" of children (Becker's (1981)). This final explanation can explain why parents spend more time per child, but not why modern parents with fewer children spend more total time than parents 30 years ago with more children.

This paper seeks to provide another potential explanation for the upward trend in time spent with children. We show that the increase in time is more pronounced among college-educated parents, and mothers in particular. This differential trend is particularly puzzling given the dramatic increases in wages of college-educated women. We argue that the increase among the college-educated may be a response to the increased competition in college admissions. The size of college-bound cohorts increased dramatically beginning in the early 1990s, whereas the number of slots at elite colleges has remained relatively constant. Thus, competition for elite colleges has increased significantly.

Our theoretical model interprets these seemingly disparate facts by postulating that higher-educated women have a comparative advantage in investing in their children to make them more competitive for college admissions. In the model, all mothers invest in their children's college preparation, which influences the admissions decisions of colleges. When slots at elite colleges are relatively plentiful, the marginal slots are filled by children of less-educated mothers. Competition among these mothers determines the preparation required for admissions. When elite slots become relatively scarce, rivalry for the marginal slots shifts to the better-educated mothers, who are better able to compete. The "rug rat race" that emerges among these mothers drives up both admissions requirements and the time spent on childcare.

Our model also accounts for observed increases in childcare among less educated mothers. Since a rising wage premium increases the returns to a college education, non-college-educated mothers raise their preparation effort in order to secure these returns for their children.

For college-educated mothers, the opportunity costs of preparation rise along with the benefits. Nevertheless, given their overall comparative advantage in investment, rivalry for scarce slots drives their preparation efforts upward relative to those of the non-college-educated mothers. Thus, both groups invest more time in childcare, but the investments of the college-educated rise by a greater amount.

The paper proceeds as follows. Section II documents trends in childcare over the 1965-2003 period, and section III presents evidence showing increased competition for college over this period. The theoretical model is presented and analyzed in section IV, and section V concludes.

II. Trends in Time Spent in Childcare

Trends in time spent in care of children have been the subject of many studies in sociology (e.g. Bryant and Zick (1996), Robinson and Godbey (1999), and Bianchi, Robinson and Milkie (2006)). It has long been noted that college-educated mothers devote more time to child rearing than less educated mothers (e.g. USDA (1944), Leibowitz (1974)). Here, we document that there has been a widening of the gap between educated and less-educated mothers.

A. Data Description

To document trends, we use information from the American Heritage Time Use Study (AHTUS), which compiles time use information from nationally representative surveys from 1965, 1975, 1985, 1992-94, and 2003. The 1965, 1975, and 1985 surveys were funded by the National Science Foundation. The first two were conducted at the University of Michigan and

the last was conducted at the University of Maryland. The sample sizes were 2,0221, 7,088, and 2,921, respectively. The 1992-94 survey was funded by the Environmental Protection Agency and conducted at the University Maryland. Its sample size was 9,386. The 2003 survey was conducted by the Bureau of Labor Statistics, and had a sample size of 19,663. These time use studies are based on time diary information, and are considered the most reliable measure of how individuals spend their time.

A key issue concerns the extent to which the studies give consistent measures over time. The surveys in question are the 1992-94 survey and the 2003 survey. Many childcare researchers believe that the 1992-94 survey undercounts primary childcare activities (Robinson and Godbey (1999), Bianchi, Cohen, Raley and Nomaguchi (2004), Bianchi et al (2006)). Using results from other time use studies that are not part of the AHTUS, but are considered comparable to the earlier studies, Allard, Bianchi, Stewart and Wight (2007, footnote 19) argue that the 1992-94 study is not comparable. The 1992-94 survey suggests that time spent in childcare was one hour per week lower in the early 1990s (compared to 1985), whereas the 1995 survey suggest that it was one hour per week *higher*. It rose three hours between the 1995 survey and the 2000 survey and 1.5 hours between the 2000 survey and the 2003 survey. Thus, any drops in childcare time between 1985 and 1992-94 are probably due to problems with the 1992-94 survey. Another important drawback of the 1992-94 study is the lack of information on the number of children under age 5 and marital status, two potentially important control variables. Thus, we will show sets of results with and without this survey.

Concerns have also been expressed as to the comparability of the 2003 survey. For example, recently some researchers have questioned whether the significant increase in childcare recorded in the 2003 BLS survey is due to a change in the types of questions asked (e.g. Egerton

et al (2005), Aguiar and Hurst (2007)). Allard, Bianchi, Stewart and Wight (2007) compare the 2003 BLS survey to the 2000 University of Maryland survey of parents and finds very similar estimates of primary time spent in childcare (though not secondary time spent in childcare). The 2000 survey was designed to be comparable to the earlier surveys from 1965, 1975, and 1985, so it appears that the increase in time spent on childcare in the BLS surveys relative to earlier surveys is real rather than due to methodological differences in the survey.

To summarize, corroborating evidence from other time use surveys that are not available from the AHTUS suggest that the 2003 survey is comparable to those from 1965 to 1985. On the other hand, the 1992-94 survey appears to undercount time spent in childcare.

Combining the surveys available to us through the AHTUS, we use a comprehensive measure of childcare that includes care of infants, older children, medical care of children, play with children, helping with homework, reading to and talking with children, and travel related to childcare.[1] We then study changes in childcare over time by regressing individual-level time spent on childcare on various sets of controls. We use the recommended weights from the AHTUS.

B. Results

Most of our results are based on the following simple descriptive model:

$$CH_{it} = X_{it}\beta + \varepsilon_{it},$$

where CH_{it} is the number of hours per week spent on childcare for person i in year t, X_{it} is a set of controls, and ε_{it} captures omitted other factors affecting childcare time. In addition to the year of the survey, X_{it} may also include the age group of the individual (ages 18-24, 25-34, 35-

[1] Our measure of childcare time is the sum of AHTUS variables tmain33 through tmain39 and tmain96.

44, 45-54, and 55-64), whether the individual has a college degree, the interaction of the college degree dummy with year, marital status, the number of children, the number of children squared, category variables for the age of the youngest child (age <= 1, age = 2, 3-5, 6-9, 10-13, and 14-17), and the number of children under age 5.

We first compare time spent in childcare for all women between the ages of 18 to 64. Note that this sample includes women who do not have children under age 18 in the household. In this first specification, we do not condition on any choice variables that may be correlated with the woman's educational level. The only control variables used are the five age categories of the women, defined above. The omitted dummy variables are 1975, an education level less than college, and ages 18-24.[2] Column 1 of Table 1 shows the results from this estimation. The levels effects for the year indicators show that the amount of time spent in childcare decreased from 1965 to 1975, and again in 1985 and 1992-94 ("1993" for short). Recall, though, that many believe that the 1992-94 survey undercounted childcare, so we should not put too much weight on these levels effects. In 2003, however, the amount of time spent on childcare increased again, so that it was 1.25 hours more per week in 2003 than in 1975. In fact, the 2003 level was about equal to the 1965 level. This number is surprising because there were 60 percent more children per woman ages 18-64 in 1965 than in 2003.

According to the estimates, time spent in childcare was somewhat less among the college-educated in 1975, though the coefficient is not statistically significant. Of interest to this study are the coefficients on the interactions between year and college education. The only significant interaction is between college and the year 2003. The estimate implies that while less educated women increased the amount of time they spent on childcare by 1.25 hours between

[2] We use 1975 as the omitted year because we will later be comparing 2003 to 1975 with the more complete set of controls that are available for 1975 and 2003 but not for other years.

1975 and 2003, the amount of time spent by college educated women increased by almost three hours per week (1.25 + 1.67). Thus, considering the sample of all women between the ages of 18 and 64, on average women have increased the time spent in childcare recently and college-educated women have increased that time by significantly more.

These results are surprising since one might suppose that current college-educated women might be more likely to forego childbearing because of the increased opportunity cost. Column 2 shows the results from a simple probit model predicting whether a woman is a mother, where mother is defined as having a child under 18 years in the household. The only control variables are the mother's age categories. The estimates show that the likelihood of being a mother has decreased since 1975 across both educational groups, even after controlling for age. Comparing across educational groups, college-educated women were significantly less likely to be mothers than less educated women in all years, but the effect was similar in 1975 and 2003. Thus, although the opportunity cost of motherhood rose much more for college-educated women from 1975 to 2003, their relative willingness to forego motherhood did not increase.

Column 3 of Table 1 compares time spent on childcare by those women who have at least one child under 18 in the household, "mothers." The results show that the amount of time spent in childcare increased dramatically in 2003 relative to earlier years, by almost four hours per week for those without a college degree. Those mothers with a college degree increased the amount of time they spent in childcare by an additional 4.27 hours a week, for a total increase of over 8 hours per week relative to 1975. The increase for these mothers was almost 7 hours relative to 1985, and 8 hours relative to 1993 (keeping in mind the potential problems with the 1993 survey).

Column 4 of Table 1 compares childcare by mothers in 1975 and 2003 using the more complete set of controls that are available those two years. In addition to the age category of the mother, we also control for marital status, the number of children (using a quadratic), the number of children under 5 years of age, and dummy variables for whether the youngest is an infant, toddler, preschooler, younger elementary, older elementary/middle schooler, or high schooler. These additional controls have substantial explanatory power. In this specification, we are seeking to compare mothers with similar numbers and ages of children across education levels for the two years. The results show that even with the richer controls, the amount of time spent on childcare by less educated mothers rose by 3.8 hours per week from 1975 to 2003, and that time spent by college-educated mothers rose significantly more, by 7.4 hours per week. Thus, even with more complete sets of controls we find that college-educated mothers increased the amount of time spent in childcare by double the amount of less educated women.

One might worry that the increase in time among the college-educated might be due to the increase in women with graduate and professional degrees. Appendix Table A-1 shows that the results are similar if we exclude women who have spent time in graduate or professional school from the college-educated group. Thus, the fact that more college educated women have graduate degrees does not explain our results.

Figure 1 graphs the results from columns 1 and 3 of Table 1. It shows the time spent in childcare by women in the age group 25-34 by educational level. The top graph shows all women and the bottom graph shows mothers. Both show the significant rise in time spent in childcare by college-educated women relate to less-educated women starting in the early 1990s. As discussed earlier, the decline from 1985 to 1993 is probably due to problems with the 1992-

94 study. The auxiliary evidence discussed above suggests a slight rise for all mothers between 1985 and 1995, followed by a dramatic increase after 1995.

Our results are at odds with Bianchi, Cohen, Raley and Nomaguchi (2004). Using alternative time use surveys from 1995, 1998, and 2000, they find an increase in time spent in childcare since 1975, as we do, but they do not find a statistically significant increase in the differential between college-educated parents and less educated parents. It is not clear whether the difference is due to the smaller samples of their supplementary studies or the use of different controls. (For example, they control for hours of work of parents in their regressions.) On the other hand, a recent paper by Chalasani (2007) that studies married parents finds results similar to ours: a larger increase in childcare time among the college-educated between 1985 and 2003.

Table 2 shows the results for men. On average, men spend much less time on childcare. However, like the results for women, it appears that overall time spent in childcare rose in 2003 and it rose significantly more for college-educated men than for less educated men. Consider for example column 4, which compares childcare in 1975 to 2003 for men who are fathers and includes the full set of controls. According to the estimates, the amount of time spent on childcare rose by over 3 hours per week for less educated fathers and by 4.7 hours for college-educated fathers with similar family compositions.

Table 3 sheds light on the source of the extra time devoted to children. We have categorized other time expenditures into "work," "chores," and "free and personal care time." "Chores" include housekeeping, cooking, and shopping. "Free and personal care time" includes any time not included in the other categories, such as sleeping, personal care time, and leisure activities.[3] The sample is for mothers only. Column 1 reproduces the third column of Table 1

[3] Using AHTUS variable definitions, we define "work" as the sum of tmain10-tmain12, plus tmain93 (commuting). We define "chores" as tmain20-tmain32, plus tmain95 (associated travel). There is an inconsistency over time in the

for comparison. Recall that the differential increase in time spent on childcare by college educated mothers from 1975 to 2003 was 4.3 hours and the overall increase for college-educated mothers was over 8 hours from 1975 to 2003. Column 2 shows that over the same time period, college-educated mothers raised their time spent working by seven hours. On the other hand, from 1975 to 2003, college-educated mothers lowered their time spent on chores by 8 hours. This was 2.2 hours more than for less-educated mothers. As shown in column 4, free time and personal care time fell 7 hours for college-educated mothers from 1975 to 2003. This fall in free time was 3.5 hours more than for less educated mothers. Thus, all women reallocated their time from chores and free time to childcare and work, but the reallocation by college-educated mothers was greater.

Figure 2 shows graphs of the estimates. We have subtracted a constant 77 hours from personal and free care time so that magnitudes are similar.[4] The graph makes clear that most of the fall in college-educated mothers' leisure time occurred between 1993 and 2003. Time spent working also fell by a couple of hours during this period, after having risen dramatically from 1985 to 1993. All of the extra time was reallocated to childcare. On the other hand, the changes in time allocation between 1993 and 2003 were much less pronounced for the less-educated mothers.

One possible explanation for this time reallocation is that women enjoy childcare more now than they used to. In that sense, they might be reallocating time from one form of enjoyable leisure activity to another. However, measures of happiness from this activity are not consistent

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categorization of yard work and pool care in the AHTUS, since the studies from 1965-1994 categorized them as outdoor chores, but the 2003 BLS categorized them as plant care (which is not included in this measure of chores). This leads to an underestimate of chores in 2003 (see Ramey (2007)). We have not made any adjustments in these measures, in part because it is less important for women than men.

[4] 77 hours per week is the average time spent on sleeping, eating, and other personal care, so the residual is essentially leisure time.

with this explanation. Robinson and Godbey (1999) report enjoyment ratings for various activities from the 1985 survey. In this survey, which asked both men and women, basic childcare ranked below work and cooking, but above housework. Kahneman and Krueger (2006) report a measure of enjoyment of various activities based on a study of women in 2004. According to their Table 2, childcare ranked below cooking and housework, but above work. In both cases, childcare ranked well below leisure activities and eating. Thus, there is no evidence that basic childcare has become more pleasant.

One caveat is that playing with and talking and reading to children has always ranked highly in terms of enjoyment. We have followed the standard practice of including these activities in our measure of childcare because they are considered to be crucial activities for investment in children's human capital. However, it might change the interpretation of the results if one believes that the increase in childcare time is simply a redirection of time from one high enjoyment activity to another.

To investigate this possibility, Table 4 reproduces columns 1, 3, and 4 of Table 1 with a measure of childcare that excludes playing with, reading to, and talking to children. As the table shows, the amount of time spent in this more narrow category also increased in 2003 for less educated mothers, but by one hour less than the broader measure. Moreover, college-educated mothers increased their time significantly more, although the differential was one hour less than for the broader measure. Thus, while the more enjoyable activities did constitute part of the increase in 2003, most of the increase was in the less enjoyable categories of childcare.

In sum, the evidence suggests that all time spent in childcare has increased since 1975, but it increased much more for higher educated parents. Moreover, with the caveats about the 1993 study in mind, it appears that almost all of the increase happened since the early 1990s.

The trends from these time use studies mirror the differences highlighted in fieldwork. Lareau's (2003) ethnographic study, *Unequal Childhoods*, documents the dramatic differences in how educated parents raise their children compared to less educated parents. The children of less-educated parents spend most of their free time playing with friends and relatives in their neighborhood, unsupervised by adults. Lareau calls this the "natural development" approach. On the other hand, more-educated parents take a "concerted cultivation" approach, which requires significant commitments of parental time:

> Children's activities create substantial work for their parents. Parents fill out enrollment forms, write checks, call to arrange car pools, wash uniforms, drive children to events, and make refreshments…. Simply getting ready for an activity – collecting the equipment, organizing the children, loading the car – can be exhausting…, in addition to the labor of preparing, there is the labor of watching. (page 47)

The key question is, why have educated parents decided to spend their time this way?

III. Increased Competition for College

We now present evidence that the increase in childcare time occurred just as competition to get into good colleges began increasing. Figure 3 shows the demand side source of this increase in competition. The top panel shows the number of high school graduates each year since 1965.[5] The initial large hump is due to the large size of the baby boom generation. The number of high school graduates fell to a low around 1990, and have since spiked up as a result of the "baby boomlet." The number of high school graduates is expected to peak in 2009 before decreasing again.

The second panel of Figure 3 shows the number of recent high school graduates who have enrolled in college. This graph shows a somewhat different pattern because of the long-run upward trend in the propensity for high school graduates to go to college. As the figure shows,

[5] These data are from the *Digest of Education Statistics*, Table 182.

after declining from 1980 to 1990, this number increased dramatically during the 1990s and, while fluctuating from year to year, has stayed high through the present. Not shown is the recent trend in foreign students applying to U.S. colleges, which serves to magnify this "demand side" effect.

On the other hand, the number of slots at "good" colleges has not risen as fast. In the last ten years, the number of undergraduate slots at the ten elite universities of "The Ivy Plus" has actually *fallen* by 1.4% (*Business Week, December 10, 2007, p. 40*). The increased competition among applicants is also perceived at other private universities as well as at public universities. For example, many public university admissions officials state that admissions have become significantly more selective as a result of the bulge in applicants and that they are rejecting record numbers of students (*CollegeJournal from the Wall Street Journal, November 14, 2006).*

This increased competition is well-known to college-bound students and parents. Whereas articles in the popular press during the 1980s talked about a "buyer's market" and highlighted colleges' efforts to woo ever shrinking pools of potential applicants, articles during the last ten years have focused on increasing competition for college admissions. Many parents have even begun worrying about getting their kids into the "right preschool" in order to gain a path into the "right college" (e.g. "The Great Admissions Race" SFGate.com, August 10, 2003).

An additional reason for the increased demand for college slots is the dramatic increase in the college wage premium over the last two decades. Figure 4 shows the college premium for males and females. We use the data and programs from Eckstein and Nagypal (2004). The college premium is the log difference between the average wages of those with a college education or more to those with less than a college degree. The figures show a continuation of the trends that were first highlighted by Katz and Murphy (1992): a rise in the relative wages of

the college-educated. Thus, the rise in the demand for college entrance can certainly be viewed as a rational response to the dramatic changes in the returns to going to college.

On the other hand, the rise in the college premium for women, shown in the bottom graph, means that the opportunity cost of time for educated women has grown during exactly the time that these women have increased the amount of time they spend on childcare. Thus, other factors must be at play to explain the rise in time spent by educated women on childcare. The next section will present a model that connects these various trends.

IV. A Theory of the Rug Rat Race

We argue that the large increase in time spent on childcare, particularly among college-educated women, might be explained by heightened rivalry for scarce college slots. To establish this point we develop a simple model in which mothers compete for slots by investing in their children's college preparation. Let *m* be the total number of mothers, each of whom has a single child. Mothers' schooling may be either college or non-college, represented by *c* and *n*, respectively. The proportion of college-educated mothers is γ.

Let college preparation be denoted by *p*. We assume that a child's preparation depends on her mother's time spent in childcare. A non-college-educated mother incurs a utility cost of $\psi_n(p)$ from choosing *p*, while a college-educated mother incurs $\pi\psi_c(p)$, where $\pi > 1$ reflects a wage premium. The cost function satisfies $\psi_s', \psi_s'' > 0$, $\psi_s(0) = \psi_s'(0) = 0$, and $\psi_s'(\infty) = \infty$ for $s = n, c$, and $\psi_c'(p) < \psi_n'(p)$. The latter inequality captures the idea that college-educated mothers incur lower utility costs in providing a given level of preparation.

A child's ultimate wealth is given by $\alpha\pi p$, where α is a factor that adjusts for the quality of the college attended by the child. Mothers choose *p* to maximize their children's wealth net of

their own time cost. Thus, the objective function for a non-college-educated mother is $\alpha\pi p - \psi_n(p)$. In the absence of constraints on college attendance, the optimal preparation level, $p_n^*(\alpha\pi)$, is determined by

$$\psi_n'(p_n^*(\alpha\pi)) = \alpha\pi .$$

For a college-educated mother, the objective function is $\alpha\pi p - \pi\psi_c(p)$, and the optimal preparation level, $p_c^*(\alpha)$, satisfies

$$\psi_c'(p_c^*(\alpha)) = \alpha .$$

The effect of mother's schooling on optimal preparation is considered in Figure 5. For non-college-educated mothers, the optimal decision occurs at point *A*, where the marginal return $\alpha\pi$ equals the marginal utility cost ψ_n'. A mother's college education shifts the utility cost locus down to ψ_c'. This captures a *productivity effect* in preparing children for college. Countering this is an *opportunity cost effect*, whereby a given quantity of time commands a higher market wage. The marginal return to preparation, adjusted for opportunity cost, drops to α, and the optimal decision occurs at point *B*. We assume that the productivity effect dominates the opportunity cost effect, so that $p_c^*(\alpha) > p_n^*(\alpha\pi)$ holds for every level of α. Thus, college-educated mothers have a comparative advantage in investing in college preparation.

College attendance is restricted by the availability of slots. Suppose there are k_1 slots available at first-tier colleges, and $k_2 m$ slots available at second-tier colleges, where $k_1 + k_2 m < m$. Thus, while college slots are scarce overall, the first-tier slots become relatively scarcer as the college-eligible population expands. Wealth obtained from attending a first-tier college is $\omega\pi p$, where $\omega > 1$, while wealth from a second-tier college is πp. The premium ω captures both pecuniary and psychic returns from first-tier colleges, e.g., mothers may value the prestige

of sending their children to elite institutions. A child is assumed to obtain p if she does not attend college.

Mothers simultaneously choose p, and colleges observe the values of p for each child. The colleges then fill their slots in descending order of p. This acceptance rule may be rationalized in a number of ways. For example, children may contribute a proportion of their wealth to their alma maters, and admissions decisions may be made in order to maximize total contributions. Since first-tier slots are most valuable, they will be filled first. In equilibrium, a threshold p_1 will exist such that children with $p \geq p_1$ are accepted to first-tier colleges, and there are exactly k_1 such children. The second-tier slots are filled next: there is a threshold p_2 such that children with $p \in [p_2, p_1)$, numbering $k_2 m$, are accepted to second-tier colleges. Finally, the remaining $m - k_1 - k_2 m$ children with $p < p_2$ do not attend college.

We first consider the case in which m is small, in the sense that there are sufficiently many first-tier slots to accommodate the children of college-educated mothers. The following proposition derives the equilibrium in this case (proofs of the propositions are given in the Appendix).

Proposition 1. If $\gamma m < k_1$, then the equilibrium acceptance threshold p_1 is uniquely determined by $p_1 = p_1^A > p_n^*(\omega\pi)$ and

$$\omega\pi p_1^A - \psi_n(p_1^A) = p_n^*(1) - \psi_n(p_n^*(1)), \tag{1}$$

and the equilibrium threshold p_2 is uniquely determined by $p_2 > p_n^*(\pi)$ and

$$\pi p_2 - \psi_n(p_2) = p_n^*(1) - \psi_n(p_n^*(1)). \tag{2}$$

Moreover, $p_1^A > p_2$, and:

- College-educated mothers choose $p = \max\{p_c^*(\omega), p_1^A\}$;
- Non-college-educated mothers divide themselves between $p = p_1^A$, $p = p_2$ and $p = p_n^*(1)$, where $p_n^*(1)$ is the optimal preparation choice when a child does not attend college.

The proposition shows that college-educated mothers exploit their comparative advantage in college preparation to get their children into first-tier colleges. The children of non-college-educated mothers take up the remaining first-tier slots along with all of the second-tier slots. Equations (1) and (2) determine the acceptance thresholds that make the latter mothers just indifferent between first-tier, second-tier and no college. Note that p_1^A and p_2 are distorted upwards relative to the corresponding unconstrained optimal preparation levels $p_n^*(\omega\pi)$ and $p_n^*(\pi)$, reflecting rivalry for scarce slots. The preparation choices of college-educated mothers may also be distorted upwards relative to $p_c^*(\omega)$.

Now suppose that *m* rises to the point where there are too few first-tier slots for the children of college-educated mothers.

Proposition 2. If $k_1 < \gamma m$, then the equilibrium acceptance threshold p_1 is uniquely determined by $p_1 = p_1^B > p_c^*(\omega)$ and

$$\omega\pi p_1^B - \pi\psi_c(p_1^B) = \hat{p} - \pi\psi_c(\hat{p}), \tag{3}$$

where $\hat{p} = \max\{p_c^*(1), p_2\}$, and p_2 is determined as in Proposition 1. Moreover, $p_1^B > p_1^A$, and

- College-educated mothers divide themselves between $p = p_1^B$ and $p = \hat{p}$;

- Non-college-educated mothers divide themselves between $p = p_2$ and $p = p_n^*(1)$.

Once first-tier slots become sufficiently scarce, the focus of rivalry shifts from non-college-educated to college-educated mothers. The children of the non-college-educated are driven completely from the first tier, as the acceptance threshold jumps to a level that makes the college-educated mothers indifferent between the first and second tiers. This new level p_1^B is distorted upwards relative to unconstrained optimal preparation, $p_c^*(\omega)$.

Figure 6 illustrates the time paths of college preparation choices when *m* rises gradually, with $\gamma m = k_1$ occurring at time *T*. We interpret *T* as corresponding to a point of time in the mid 1990s. The wage premium π is also assumed to rise over time, leading to steadily increasing paths of p_1^A and p_2. Prior to *T*, the growth of *m* gradually squeezes the children of non-college-educated mothers out of the first-tier colleges, shifting their mothers' preparation choices from p_1^A to p_2. The average level nevertheless increases if the growth of π is sufficiently rapid. The preparation choices of college-educated mothers also rise if $p_1^A > p_c^*(\omega)$. At time *T* the latter mothers jump to the discretely higher level p_1^B, while the choices of the non-college-educated continue to rise with p_2.

The model shows how a combination of increasing rewards for college attendance and rivalry for ever-scarcer slots can fuel a "rug rat race" among mothers. Rivalry is manifested in higher college preparation requirements, and in order to secure slots for their children all mothers must devote increasingly large amounts of time to childcare. Once the most elite slots become sufficiently scarce, rivalry among the college-educated mothers intensifies greatly, driving up their time spent in childcare relative to that of the non-college-educated.

V. Conclusion

This paper has documented a dramatic increase in time spent in childcare by college-educated parents since the early 1990s. While time spent in childcare rose for all parents, the rise was more pronounced for college-educated parents. Since 1993, college-education mothers have reallocated more than eight hours per week from work and leisure time to childcare time. This reallocation occurred at the same time that competition to get into college intensified, as a combination of demographic forces and the increase in the college premium led to a surge in the demand for college slots.

We have explained these trends with a model in which the rise in time devoted to childcare is the optimal response to the increase in rivalry for scarce college slots. We postulate that college-educated parents have a comparative advantage in preparing their children for college, which they exploit to get their children into the most elite colleges. When slots are plentiful relative to demand, the required amount of child preparation is relatively low. However, when demand rises, rivalry among the college-educated parents drives the required preparation upwards. Less-educated parents also raise their childcare effort, but to a lesser extent.

In this paper we have focused on explaining observed trends in time use, but our results also have implications for socially efficient time allocation. To the extent that the private costs and benefits of college preparation reflect social costs and benefits, the rivalry for college slots implies wasteful overinvestment in preparation. Overinvestment may be mitigated by expanding the number of slots, or by modifying college acceptance rules to place greater emphasis on criteria that cannot be directly influenced by parents. In a broader context, however, parents may

not fully internalize the social benefits of preparing their children, which raises the possibility that the “rug rat race” provides a useful stimulus to human capital investment. These issues warrant closer investigation in future work.

Appendix

Proof of Proposition 1. Let $G_n(p \mid \pi) = \pi p - \psi_n(p)$ and $G_c(p \mid \alpha, \pi) = \alpha\pi p - \pi\psi_c(p)$ represent the objective functions of non-college- and college-educated mothers, respectively. Under our assumptions, these functions are strictly concave in p and decrease without bound as p approaches infinity. Since $G_n(p_n^*(\omega\pi) \mid \omega\pi) > G_n(p_n^*(1) \mid 1)$, there is a unique point $p_1^A > p_n^*(\omega\pi)$ satisfying $G_n(p_1^A \mid \omega\pi) = G_n(p_n^*(1) \mid 1)$. Similarly, $G_n(p_n^*(\pi) \mid \pi) > G_n(p_n^*(1) \mid 1)$ implies that there is a unique point $p_2 > p_n^*(\pi)$ satisfying $G_n(p_2 \mid \pi) = G_n(p_n^*(1) \mid 1)$. Furthermore, $G_n(p_2 \mid \omega\pi) > G_n(p_2 \mid \pi) = G_n(p_n^*(1) \mid 1)$ implies $p_2 < p_1^A$.

Consider the p choices of college-educated mothers when $p_c^*(\omega) \geq p_1^A$. Clearly, $p_c^*(\omega)$ is optimal among $p \geq p_1^A$. Moreover, for all $p \in [p_2, p_1^A)$, $G_c(p_c^*(\omega) \mid \omega, \pi) > G_c(p_c^*(1) \mid 1, \pi) \geq G_c(p \mid 1, \pi)$, and for all $p < p_2$, $G_c(p_c^*(\omega) \mid \omega, \pi) > G_c(p_c^*(1/\pi) \mid 1/\pi, \pi) \geq G_c(p \mid 1/\pi, \pi)$. Thus, $p_c^*(\omega)$ is strictly preferred to any other p.

Next suppose $p_1^A > p_c^*(\omega)$. Let $\hat{p} = \max\{p_c^*(1), p_2\}$. Note that $p_c^*(1) < p_c^*(\omega)$ and $p_2 < p_1^A$ imply $\hat{p} < p_1^A$. Moreover, $\hat{p} \geq p_2$ implies $G_n(\hat{p} \mid \pi) \leq G_n(p_n^*(1) \mid 1)$. Thus,

$$0 \geq G_n(\hat{p} \mid \pi) - G_n(p_n^*(1) \mid 1) = G_n(\hat{p} \mid \pi) - G_n(p_1^A \mid \omega\pi)$$

$$= \pi\hat{p} - \omega\pi p_1^A + \int_{\hat{p}}^{p_1^A} \psi_n'(p)dp > \pi\hat{p} - \omega\pi p_1^A + \int_{\hat{p}}^{p_1^A} \pi\psi_c'(p)dp$$

$$= G_c(\hat{p} \mid 1, \pi) - G_c(p_1^A \mid \omega, \pi),$$

where the strict inequality comes from the fact that $p_c^*(\alpha) > p_c^*(\alpha\pi)$ for all α implies $\pi\psi_c'(p) < \psi_n'(p)$ for all p. Thus, $G_c(p_1^A \mid \omega, \pi) > G_c(\hat{p} \mid 1, \pi)$, and it follows that $G_c(p_1^A \mid \omega, \pi)$

$> G_c(p \mid 1, \pi)$ for all $p \in [p_2, p_1^A)$ since $\hat{p}$ maximizes $G_c(p \mid 1, \pi)$ over this range of *p*. Finally, consider $p < p_2$. If $\hat{p} = p_c^*(1)$, then $G_c(\hat{p} \mid 1, \pi) > G_c(p_c^*(1/\pi) \mid 1/\pi, \pi) \geq G_c(p \mid 1/\pi, \pi)$ for all $p < p_2$, whereas $\hat{p} = p_2$ implies $\hat{p} > p_c^*(1/\pi)$ and

$$0 = G_n(p_n^*(1) \mid 1) - G_n(\hat{p} \mid \pi) > G_n(p_c^*(1/\pi) \mid 1) - G_n(\hat{p} \mid \pi)$$

$$= p_c^*(1/\pi) - \pi\hat{p} + \int_{p_c^*(1/\pi)}^{\hat{p}} \psi_n'(p)dp > p_c^*(1/\pi) - \pi\hat{p} + \int_{p_c^*(1/\pi)}^{\hat{p}} \pi\psi_c'(p)dp$$

$$= G_c(p_c^*(1/\pi) \mid 1/\pi, \pi) - G_c(\hat{p} \mid 1, \pi),$$

whence $G_c(\hat{p} \mid 1, \pi) > G_c(p \mid 1/\pi, \pi)$ for all $p < p_2$.

Now consider the *p* choices of the non-college-educated mothers. Because of strict concavity and $p_1^A > p_n^*(\omega\pi)$, $G_n(p \mid \omega\pi) < G_n(p_1^A \mid \omega\pi)$ for all $p > p_1^A$. Similarly, $G_n(p \mid \pi) < G_n(p_2 \mid \pi)$ for all $p \in [p_2, p_1^A)$. Since $p_2^*(1) < p_2$ and $p_2^*(1)$ maximizes $G(p \mid 1)$, it follows that $G_n(p \mid 1) < G_n(p_n^*(1) \mid 1)$ for all $p < p_2$, $p \neq p_n^*(1)$. Thus, the choices p_1^A, p_2 and $p_n^*(1)$ are strictly preferred to any others, and by construction these three are equally preferred.

Proof of Proposition 2. Equation (3) can be expressed as $G_c(p_1^B \mid \omega, \pi) = G_c(\hat{p} \mid 1, \pi)$. Moreover, $G_c(p_c^*(\omega) \mid \omega, \pi) > G_c(p_c^*(1) \mid 1, \pi) \geq G_c(\hat{p} \mid 1, \pi)$. Since $p_1^B > p_c^*(\omega)$, it follows that p_1^B is uniquely defined, and $G_c(\hat{p} \mid \omega, \pi) > G_c(\hat{p} \mid 1, \pi)$ implies $p_1^B > \hat{p}$.

We now verify that $p_1^B > p_1^A$.

$$0 = G_c(\hat{p} \mid 1, \pi) - G_c(p_1^B \mid \omega, \pi) = \pi\hat{p} - \omega\pi p_1^B + \int_{\hat{p}}^{p_1^B} \pi\psi_c'(p)dp$$

$$< \pi\hat{p} - \omega\pi p_1^B + \int_{\hat{p}}^{p_1^B} \psi_n'(p)dp = G_n(\hat{p} \mid \pi) - G_n(p_1^B \mid \omega\pi).$$

This implies $G_n(p_1^B \mid \omega\pi) < G_n(\hat{p} \mid \pi) \leq G_n(p_2 \mid \pi)$, and comparison with (1) and (2) shows that $p_1^B > p_1^A$.

Consider the *p* choices of college-educated mothers. Since $p_1^B > p_c^*(\omega)$, $G_c(p \mid \omega, \pi) < G_c(p_1^B \mid \omega, \pi)$ for all $p > p_1^B$. If $p_c^*(1) \geq p_2$, then $p_c^*(1)$ is strictly preferred to any other $p \in [p_2, p_1^B)$, while if $p_2 > p_c^*(1)$, then $G_c(p \mid 1, \pi) < G_c(p_2 \mid, \pi)$ for all $p \in (p_2, p_1^B)$. Thus, $G_c(\hat{p} \mid 1, \pi)$ maximizes $G_c(p \mid 1, \pi)$ over $p \in [p_2, p_1^B)$. The argument from the proof of Proposition 1 shows that $G_c(\hat{p} \mid 1, \pi) > G_c(p \mid 1/\pi, \pi)$ for all $p < p_2$. Thus, the choices p_1^B and $\hat{p}$ are strictly preferred to any others, and they are equally preferred by construction.

As for the non-college-educated mothers, $p \geq p_1^B$ implies $G_n(p \mid \omega\pi) \leq G_n(p_1^B \mid \omega\pi) < G_n(p_2 \mid \pi)$, so p_2 is strictly preferred to any such *p*. The arguments from the proof of Proposition 1 establish that p_2 and $p_n^*(1)$ are strictly preferred to any other $p < p_1^B$, and they are equally preferred by construction.

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Table 1. Trends in Weekly Hours Spent on Childcare by Women

	(1) **All women 18-64**	(2) **Probability of being a mother**	(3) **All mothers 18-64**	(4) **All mothers 18-64**
Constant	4.397 (0.254)	0.165 (0.034)	7.914 (0.422)	-6.751 (0.709)
1965	1.277 (0.378)	0.030 (0.053)	1.911 (0.572)	
1985	-0.928 (0.365)	-0.480 (0.050)	-0.396 (0.625)	
1993	-1.570 (0.280)	-0.770 (0.039)	-1.045 (0.498)	
2003	**1.245** **(0.238)**	**-0.195** **(0.033)**	**3.898** **(0.375)**	**3.829** **(0.358)**
College-Educated	**-0.949** **(0.544)**	**-0.201** **(0.074)**	**0.241** **(0.822)**	**-0.723** **(0.758)**
1965 x college	-0.428 (1.145)	-0.330 (0.158)	0.996 (1.975)	
1985 x college	0.530 (0.860)	-0.262 (0.117)	1.646 (1.530)	
1993 x college	-0.705 (0.656)	-0.174 (0.090)	1.052 (1.144)	
2003 x college	**1.669** **(0.585)**	**-0.106** **(0.080)**	**4.267** **(0.901)**	**3.560** **(0.831)**
Adult age controls	Yes	Yes	Yes	Yes
Child number, child age controls	No	No	No	Yes
Marital status	No	No	No	Yes
Observations	17309	17309	8997	6802
R-squared	0.098	0.182	0.102	0.269

Standard errors in parenthesis. The omitted year is 1975. Parent age controls are dummies for age categories 18-24, 25-34, 35-44, 45-54, 55-64, child age controls include the number of children under age 5 and the age of youngest child categories: age<=1, age=2, 3-5, 6-9, 10-13, 14-17. The number of children controls consist of the number of children and the number of children squared. "Mother" is defined as having a child under age 18 in the household.

Table 2. Trends in Weekly Hours Spent on Childcare by Men

	(1) **All men 18-64**	(2) **Probability of being a father**	(3) **All fathers 18-64**	(4) **All fathers 18-64**
Constant	0.192 (0.178)	0.090 (0.039)	0.034 (0.336)	-3.586 (0.609)
1965	0.229 (0.265)	0.102 (0.060)	0.275 (0.437)	
1985	-0.145 (0.258)	-0.357 (0.057)	-0.076 (0.481)	
1993	-0.378 (0.200)	-0.915 (0.046)	0.075 (0.424)	
2003	**0.899** **(0.165)**	**-0.475** **(0.037)**	**3.192** **(0.295)**	**3.255** **(0.326)**
College-Educated	**0.285** **(0.287)**	**-0.129** **(0.063)**	**0.750** **(0.489)**	**0.581** **(0.528)**
1965 x college	0.089 (0.632)	0.097 (0.143)	0.168 (1.028)	
1985 x college	-0.521 (0.504)	-0.183 (0.111)	-0.220 (0.954)	
1993 x college	-0.565 (0.381)	-0.050 (0.087)	-0.288 (0.809)	
2003 x college	**0.744** **(0.320)**	**0.092** **(0.071)**	**1.971** **(0.564)**	**1.387** **(0.610)**
Adult age controls	Yes	Yes	Yes	Yes
Child number, child age controls	No	No	No	Yes
Marital status	No	No	No	Yes
Observations	13865	13865	6546	4838
R-squared	0.054	0.120	0.100	0.137

Standard errors in parenthesis. The omitted year is 1975. Parent age controls are dummies for age categories 18-24, 25-34, 35-44, 45-54, 55-64; child age controls include the number of children under age 5 and the age of youngest child categories: age<=1, age=2, 3-5, 6-9, 10-13, 14-17. The number of children controls consist of the number of children and the number of children squared. "Father" is defined as having a child under age 18 in the household.

Table 3. Trends in Time Allocation by Mothers

	(1) **Childcare**	(2) **Work**	(3) **Chores**	(4) **Free and personal time**
Constant	7.914 (0.422)	13.025 (0.966)	22.261 (0.635)	124.801 (0.884)
1965	1.911 (0.572)	-2.858 (1.309)	8.638 (0.861)	-7.691 (1.199)
1985	-0.396 (0.625)	3.234 (1.431)	-1.772 (0.942)	-1.066 (1.311)
1993	-1.045 (0.498)	5.914 (1.140)	-4.501 (0.750)	-0.368 (1.044)
2003	**3.898** **(0.375)**	**5.865** **(0.858)**	**-6.212** **(0.564)**	**-3.551** **(0.786)**
College-Educated	**0.241** **(0.822)**	**0.458** **(1.881)**	**0.884** **(1.237)**	**-1.583** **(1.723)**
1965 x college	0.996 (1.975)	4.747 (4.521)	-5.062 (2.974)	-0.681 (4.141)
1985 x college	1.646 (1.530)	-2.055 (3.503)	1.512 (2.304)	-1.103 (3.208)
1993 x college	1.052 (1.144)	3.669 (2.619)	-4.711 (1.723)	-0.010 (2.399)
2003 x college	**4.267** **(0.901)**	**1.469** **(2.062)**	**-2.208** **(1.356)**	**-3.529** **(1.888)**
Observations	8997	8997	8997	8997
R-squared	0.102	0.023	0.077	0.049

Standard errors in parentheses. Parent age controls are included. These are dummies for age categories 18-24, 25-34, 35-44, 45-54, 55-64.

Table 4. Trends in Weekly Hours Spent on Basic Childcare by Women
Excludes time playing with, reading to, or talking to children

	(1) **All women 18-64**	(2) **All mothers 18-64**	(3) **All mothers 18-64**
Constant	3.695 (0.218)	6.511 (0.366)	-6.174 (0.624)
1965	1.369 (0.325)	2.192 (0.496)	
1985	-0.795 (0.314)	-0.191 (0.543)	
1993	-1.239 (0.240)	-0.749 (0.432)	
2003	**0.693** **(0.204)**	**2.709** **(0.325)**	**2.936** **(0.315)**
College-Educated	**-0.775** **(0.467)**	**0.15** **(0.713)**	**-0.522** **(0.667)**
1965 x college	-0.587 (0.984)	0.816 (1.714)	
1985 x college	0.468 (0.739)	1.338 (1.328)	
1993 x college	-0.807 (0.564)	0.424 (0.993)	
2003 x college	**1.312** **(0.503)**	**3.346** **(0.782)**	**2.823** **(0.732)**
Adult age controls	Yes	Yes	Yes
Child number, child age controls	No	No	Yes
Marital status	No	No	Yes
Observations	17309	8997	6802
R-squared	0.08	0.08	0.22

Standard errors in parentheses

Table A-1. Trends in Weekly Hours Spent on Childcare by Women
Results excluding women with graduate school experience

	(1) **All women 18-64**	(2) **Probability of being a mother**	(3) **All mothers 18-64**	(4) **All mothers 18-64**
Constant	4.402 (0.254)	0.167 (0.034)	7.904 (0.421)	-6.477 (0.723)
1965	1.288 (0.377)	0.031 (0.053)	1.920 (0.569)	
1985	-0.936 (0.363)	-0.489 (0.050)	-0.382 (0.622)	
1993	-1.562 (0.278)	-0.778 (0.039)	-1.015 (0.496)	
2003	1.254 (0.237)	-0.195 (0.033)	3.910 (0.373)	3.825 (0.359)
College-Educated	-1.004 (0.610)	-0.268 (0.084)	0.395 (0.923)	-1.102 (0.855)
1965 x college	0.028 (1.261)	-0.262 (0.175)	1.744 (2.186)	
1985 x college	1.065 (0.977)	-0.219 (0.134)	1.687 (1.763)	
1993 x college	-0.926 (0.757)	-0.061 (0.104)	0.358 (1.322)	
2003 x college	1.580 (0.654)	-0.043 (0.089)	3.630 (1.006)	3.720 (0.930)
Adult age controls	Yes	Yes	Yes	Yes
Marital status	No	No	No	Yes
Child number, child age controls	No	No	No	Yes
Observations	15786	15786	8334	6270
R-squared	0.096	0.186	0.093	0.257

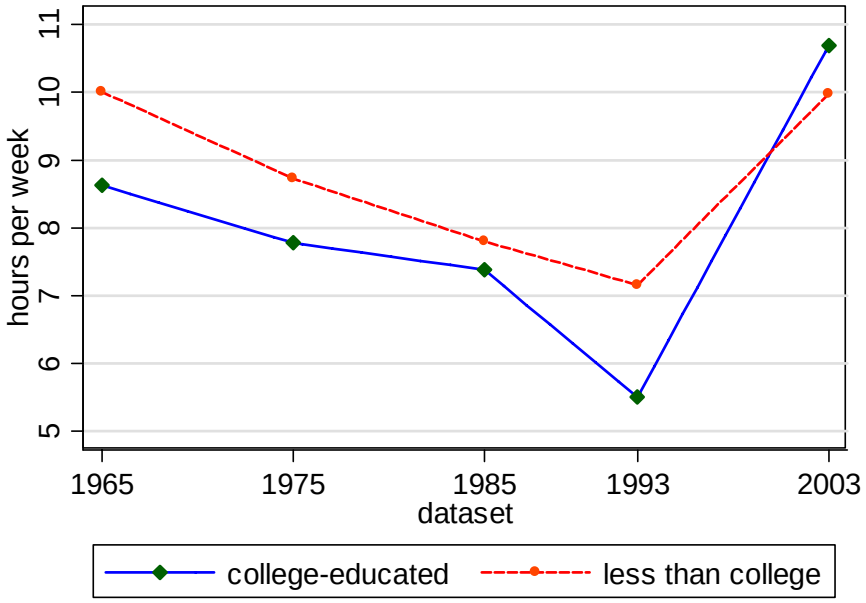
Table A-2. Trends in Weekly Hours Spent on Basic Childcare by Women
Excludes time playing with, reading to, or talking to children

	(1) **All women 18-64**	(2) **All mothers 18-64**	(3) **All mothers 18-64**
Constant	3.695 (0.218)	6.511 (0.366)	-6.174 (0.624)
1965	1.369 (0.325)	2.192 (0.496)	
1985	-0.795 (0.314)	-0.191 (0.543)	
1992-94	-1.239 (0.240)	-0.749 (0.432)	
2003	**0.693** **(0.204)**	**2.709** **(0.325)**	**2.936** **(0.315)**
College-Educated	**-0.775** **(0.467)**	**0.15** **(0.713)**	**-0.522** **(0.667)**
1965 x college	-0.587 (0.984)	0.816 (1.714)	
1985 x college	0.468 (0.739)	1.338 (1.328)	
1993 x college	-0.807 (0.564)	0.424 (0.993)	
2003 x college	**1.312** **(0.503)**	**3.346** **(0.782)**	**2.823** **(0.732)**
Adult age controls	Yes	Yes	Yes
Child number, child age controls	No	No	Yes
Marital status	No	No	Yes
Observations	17309	8997	6802
R-squared	0.08	0.08	0.22

Standard errors in parentheses

Figure 1. Weekly Hours Spent in Childcare
(Based on estimates from Table 1, columns (1) and (3))

A. All Women, Ages 25-34



B. Mothers, Ages 25-34

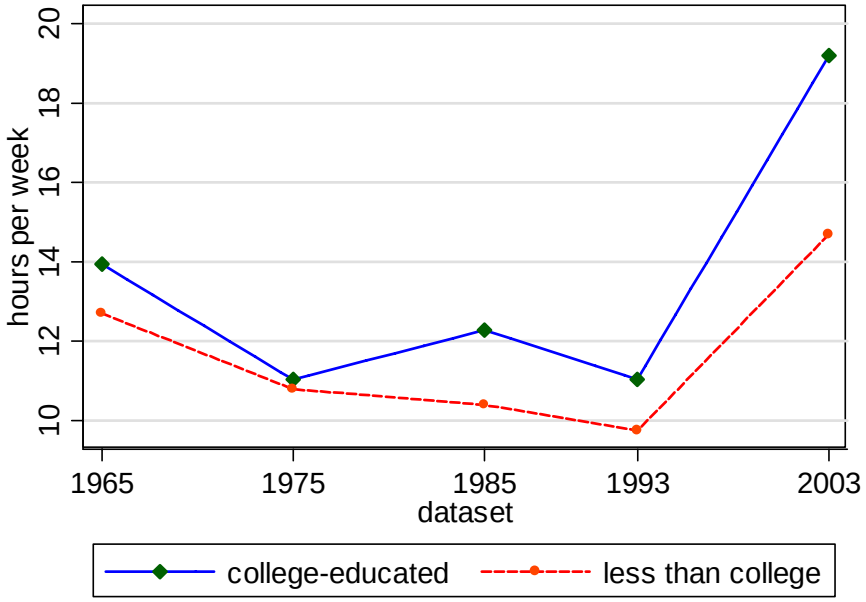
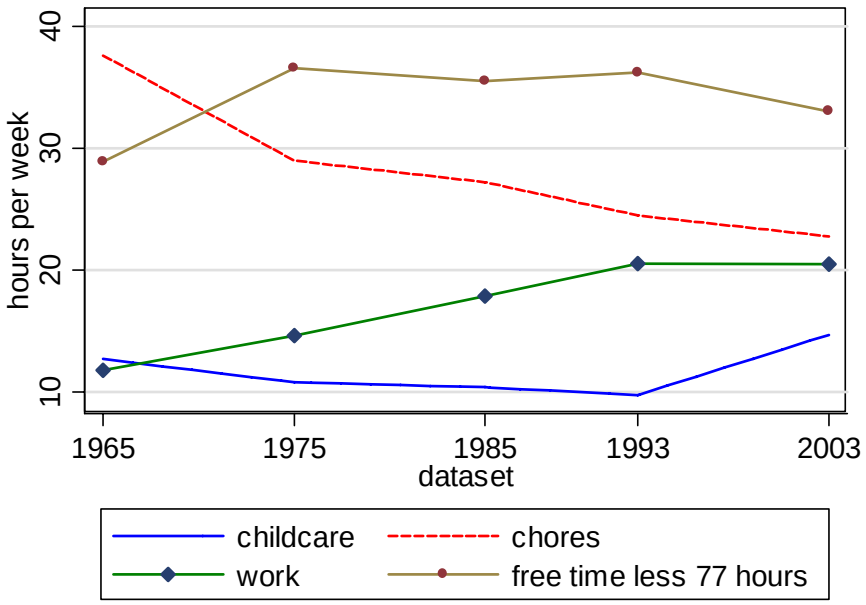


Figure 2. Time Use of Mothers ages 25-34
(Based on estimates from Table 3)

A. Less than College



B. College-Educated

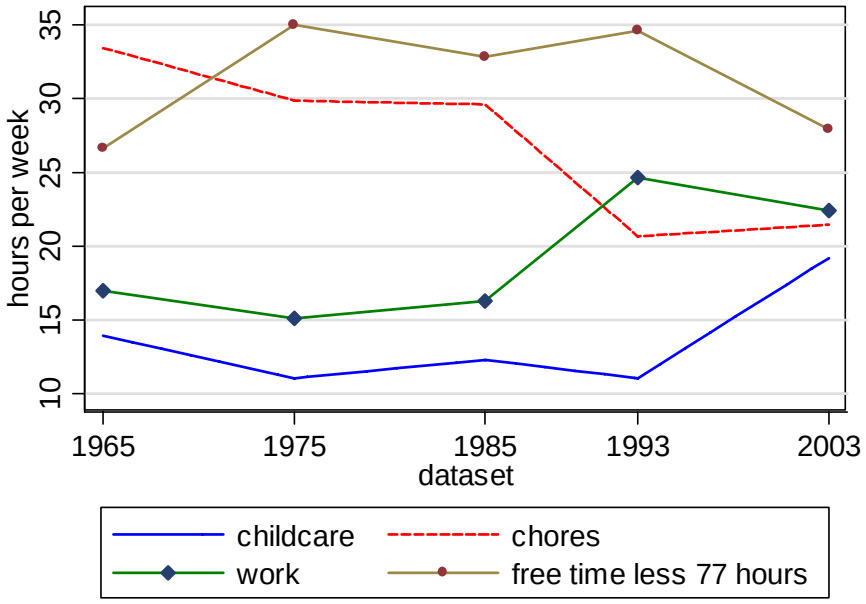
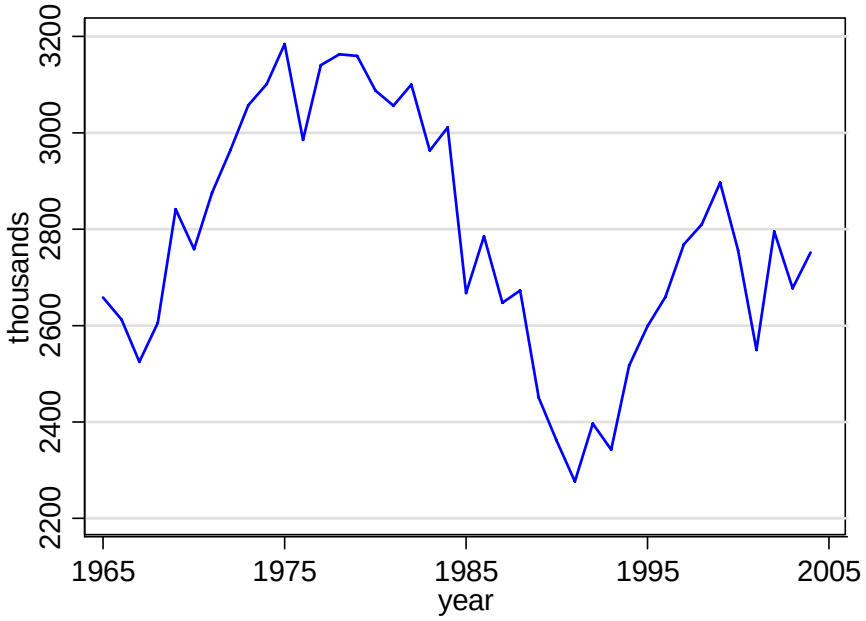


Figure 3. High School Graduates and College Enrollment

A. High School Graduates



B. Recent High School Graduates Enrolled in College

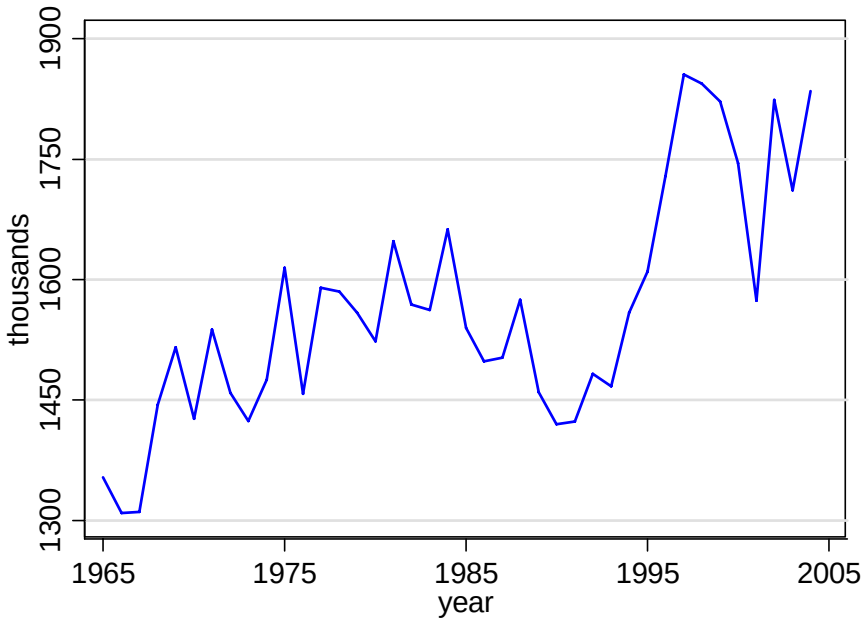
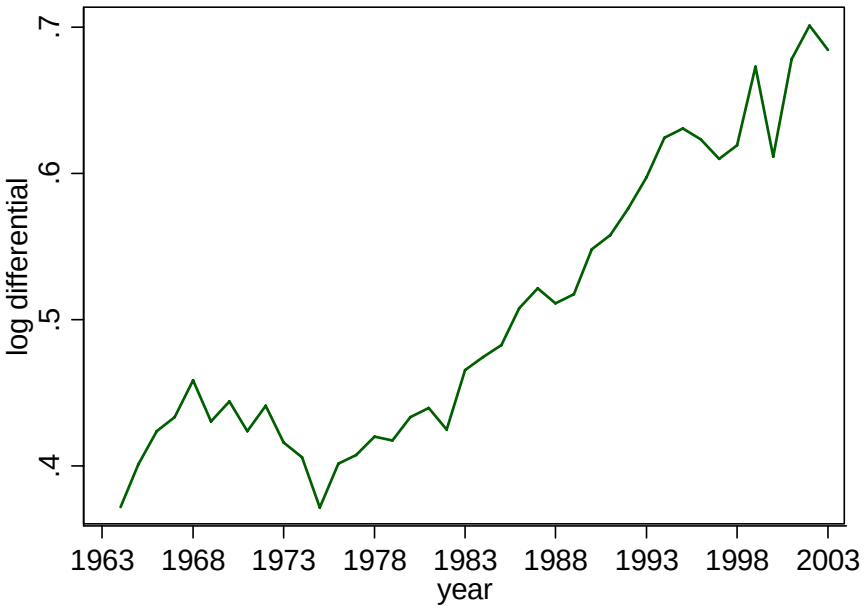


Figure 4: College Premium in Wages
Full-Time, Full-Year Workers, Ages 22-64

A. Men



B. Women

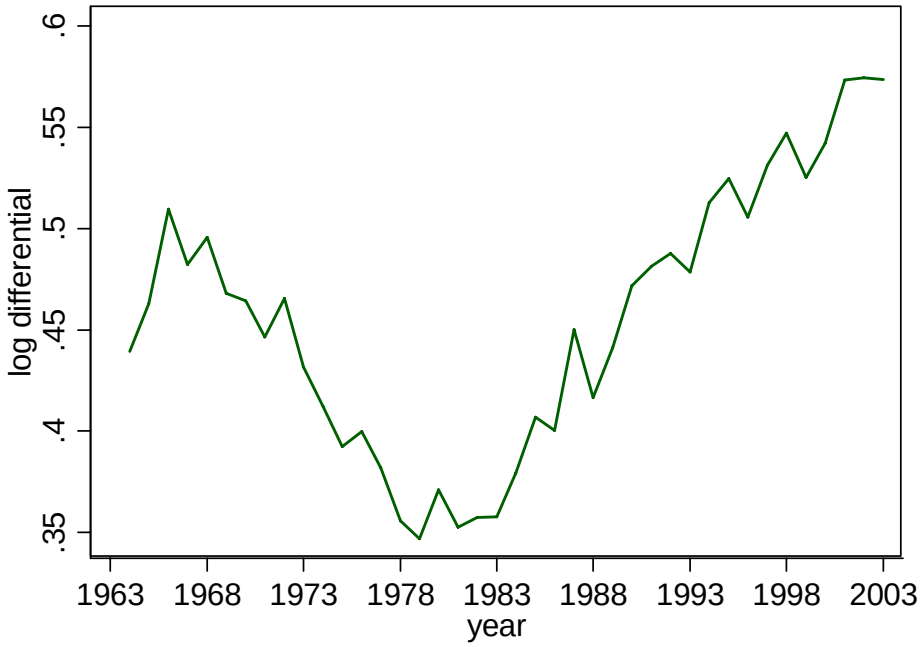


Figure 5: Choice of College Preparation

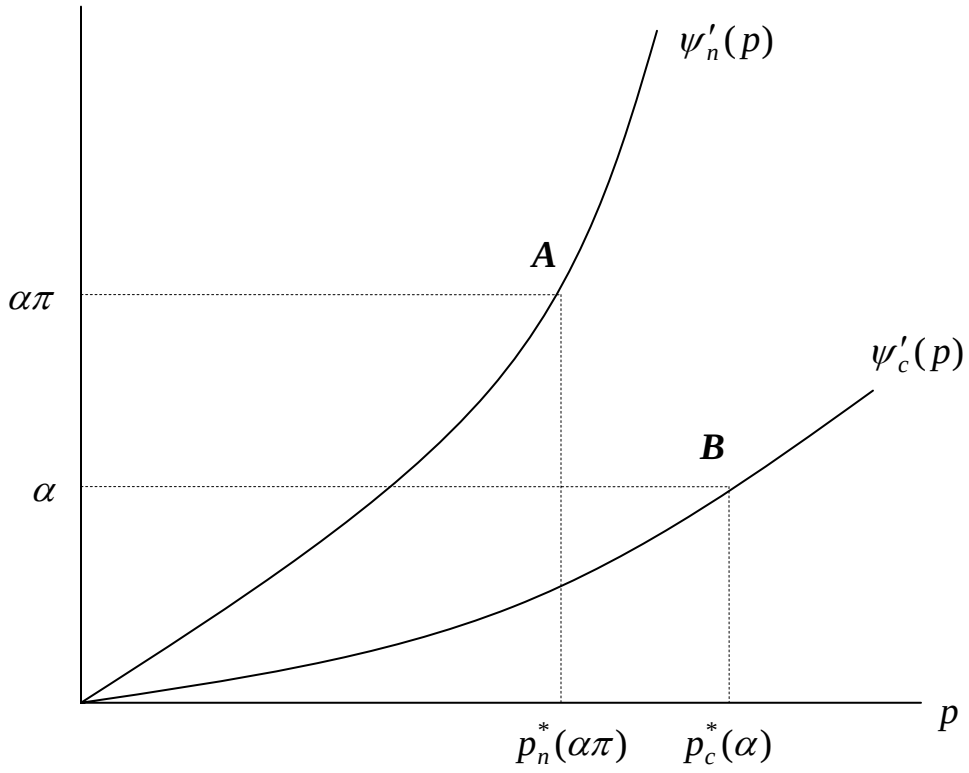


Figure 6: Time Paths of College Preparation