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THE EFFECT OF PART-TIME EMPLOYMENT ON STUDENT ALLOCATION OF TIME AND ACADEMIC PERFORMANCE

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Comments on Staff Paper P-75-11 "The Effect of Part-Time Employment on Student Allocation of Time and Academic Performance" by Willis L. Peterson.
from Dr. Dale G. Smeltzer

Thanks. This is a very interesting paper. In some 20 years of counseling undergraduates we went through the process of trying to give weight to these things. This little paper formalizes the process !

Two comments -

I. The biggest question in my experience was what special weight should be given to Freshmen for the imponderable of adjustment to college life.
   a. finding out how to use study time efficiently.
   b. establishing criteria for value judgements on "Household Production," as there were so many activities competing for time.

II. In the students judgement of the value of better grades or more courses--he must consider his over-all educational objectives. It may well be that a part of the value of part-time work is that it contributes to the objectives in a large way - so, a new criterion for value of work may be needed to arrive at MPP.

Example : work on experimental plots by agronomy major, etc. Differences in regressions for lower and upper classmen are interesting.

Maybe the students who failed to adjust credit load in Lower Div. were the ones who pulled down G.P.A. for group and they are highly represented in the numbers missing at U. Div. level. Those who adjusted survived!

Would Spring Quarter present a different picture or don't students minds turn to new pleasures in Spring in Minnesota?

June 1975

The Effect of Part-Time Employment on Student Allocation of Time and Academic Performance

*Willis L. Peterson

In the United States the labor force participation of college students has more than doubled over the past 25 years. As shown in Table 1, about one-half of all students over the age of 18 now hold part-time jobs during the school year.

The main objective of this paper is to assess the impact of part-time employment on student allocation of time to academic pursuits. Do students who work part-time allocate less time to scholarly activities than comparable students who are not employed? If so, is the reduction in study time reflected in lower grades, a smaller credit load, or both?

We began by casting the student in the role of a multi-product firm. By applying the well known profit maximizing conditions to the student firm, it can be shown that part-time employment necessarily reduces the amount of time allocated to scholarly activities even though part of the hours worked is likely to be taken from leisure time. Lastly some preliminary evidence is presented to measure the effect of the reduction in study time on grades and credit hours.

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Table 1. Labor Force Participation Rates of Civilian Noninstitutional Population Enrolled in School, Selected Years. (October of respective year)

Year	Male (age)		Female (age)	
	18-19	20-24	18-19	20-24
1948	27.9	26.8	14.4	23.3
1958	34.4	49.4	31.6	38.4
1968	42.9	51.2	31.8	43.6
1972	45.4	53.2	37.0	49.9

Source: U.S. Department of Labor, Handbook of Labor Statistics, 1973, P. 51.

The Student as a Firm

The student can be viewed as a multi-product firm engaged in the production of three broad categories of output: 1. human capital, 2. intermediate goods via the labor market (for students who work part-time), and 3. final goods for current consumption. Because much of the output of the student firm is not sold in the market place we will use utility as the measure or common denominator of output rather than monetary value. Our main interest will be on the allocation of time to each of these production activities.

In the production of human capital the student combines his or her time with other purchased inputs such as faculty services, instructional facilities, books, etc. The marginal product of time in the production of human capital will of course depend on the inherent capability of the student as well as on the quantity and quality of complementary inputs such as the teacher and instructional materials. The marginal productivity of study time (for a given quantity) should be greater for more capable and highly motivated students than for those less well endowed with ability or motivation.

Similarly the marginal product of time should be higher for students having good teachers and effective instructional materials, or for those enrolled in high pay-off programs, than their less fortunate counterparts.

As is well known in the literature, the utility which stems from the production of human capital is derived from both the consumption and investment components of the returns to education.[1/] It is necessary to bear in mind that the future utility which is forthcoming from the investment component (from both the nonmonetary and monetary sources) must be discounted back to the present in order to be comparable with the current utility which is produced from part-time work (income) and household activities. There is also the problem of the uncertainty connected with the magnitude of the future utility. No student knows for sure how much his or her income will be increased by education or how much education will enrich life in the future. In spite of the difficulties of assessing the utility that is forthcoming from education, each student is forced to make allocative decisions both with respect to allocating time and other inputs within the broad category of school activities, and between this category and other activities.

Students who work part-time participate in a second kind of production activity. Although the student generally does not take possession of the same goods or services produced, the income earned represents the students' claim on an equivalent amount of goods and services. These goods in turn are utilized in the production of present and/or future utility in the context of household production activities, or are used in the production of human capital. As Becker (1965) points out, these consumer goods are in effect intermediate inputs which are combined with time to produce utility in household production. For a given input of time, the higher the real wage,

the higher the marginal product of time in the production of utility through these intermediate inputs because the marginal hour of work will buy more goods and services.

The third type of activity is household production. Here the student combines time with conventional goods and services to produce "Z" goods (using Becker's terminology). These Z goods in turn yield utility. The marginal productivity of time which is utilized in household production depends on the individual's utility function. For example, a person who receives a relatively large amount of utility from pure leisure will exhibit a higher marginal product of time (for a given time input) in household production than one who receives a relatively large amount of utility from conventional goods and services. Of course, the same is true of the other two production activities. An extra dollar of income (for a given income level) that results from more education or more current employment can be expected to yield different amounts of utility to different people.

To summarize, we can view students' time as an input in three production functions. Letting U_k, U_x, and U_z represent the utility derived from human capital, intermediate inputs, and Z goods respectively; T_s, T_w, and T_h as the inputs of study, work, and household time, and E and I as vectors of other inputs, we have:[2/]

1) $U_k = f(T_s, E)$

2) $U_x = g(T_w, I)$

3) $U_z = h(T_c, X)$

Efficient Allocation of Time

We know from the theory of the firm that costs are minimized for a given level of output only if the marginal cost of producing an extra unit of output

is the same for all inputs. In other words, resources are efficiently allocated (costs minimized) when the input price/MPP ratios are equalized for all inputs. And, of course, profits are maximized when output corresponds to the point where marginal cost equals marginal revenue.

In the production of utility by the student firm the MPP of time is utility. The price of time is equal to its opportunity cost in the next best alternative use. Because the value of time for most people is likely to differ between different days and times of the day, the price of time will vary accordingly. During the normal daytime or early evening working hours, the price of time devoted to study likely will be wages foregone (net of taxes) from a full time job. Similarly the price of time devoted to employment during these hours will be the value that the student places on time devoted to study, or possibly to household activities. During normal rest or sleep hours the price of time devoted to study likely would be the implicit value placed on sleep. Conversely the price of time devoted to sleep or rest will be either the implicit value of study or of employment, whichever is higher. The price of time to employment or household activities also should vary according to the proximity of examinations. Because the implicit value of study probably is highest just before examinations, the marginal cost of producing utility by employment or household activities likely will increase during these periods. If so the student will allocate less time to these activities and more time to study.

One unique characteristic of time, as opposed to other purchased inputs, is that the individual by necessity must utilize 24 hours per day in total regardless of its price. The allocation of time to the various activities can and likely will vary as its price changes but as long as a person is

alive, time always is being utilized in one of the three production activities. (Bear in mind leisure and sleep are included in household production of utility).

Because the individual always employs a constant amount of time per day, week, or year, the objective should be to maximize the output of utility from this fixed quantity of time. As a result it is probably more useful to state the utility maximizing rule in terms of the reciprocal of marginal cost,i.e. the MPP/input price ratio. In order to maximize utility, the individual should allocate time to the various production activities such that the marginal utility (MPP) per dollar of time is equalized across all activities. Note that this does not mean that the marginal utility produced by an extra hour of time is equal across all activities. If the price of time varies for different activities or different periods, the marginal utility per hour also should vary.

Part-time Employment Effects

A. The Theory.

Perhaps the easiest way to predict the effects of part-time employment is to consider an individual engaged in the production of only human capital and Z goods (a full time student). Let us assume that the student is allocating time between these two activities in an optimal manner such that the MPP/time price ratios are equalized between these two categories of activities. Now suppose an attractive job opportunity presents itself such that MPP/time price is larger in the production of intermediate goods than it is in the other two activities. The higher price of time devoted to the production of human capital also reduces the MPP/time price ratio in this activity, throwing the student out of equilibrium even further.

The price of time devoted to household production may or may not increase because of the superior job opportunity. If the job is available only during normal, daytime working hours on weekdays, the opportunity cost of time to household production may still be the wages which could be earned on less desirable jobs, or the implicit value of study time whichever is higher. If the job entails night or weekend work the opportunity cost of time devoted to household production of utility will increase initially. However it really doesn't make any difference ultimately whether the job entails day, night, or weekend work; the opportunity cost of time to household production will still increase once the student adjusts to the new situation.

Assuming that the job requires daytime work, say 20 hours per week, the initial consequence of the job (taking the adjustment in steps) is to reduce study time. If study time is subject to diminishing returns, as is reasonable, the reduction in study time will increase the implicit price of time to household activities (entertainment, sleep, etc.) This in turn reduces the MPP/time price ratio of time devoted to household production and as a consequence the student will begin to utilize some time that was originally allocated to household production for study. In reality the adjustment in study and household time is likely to take place simultaneously rather than in two distinct steps.

As the student approaches a new equilibrium the amount of time devoted to study and household production must decrease a total of 20 hours per week (in this example). How much each is reduced depends on the underlying production functions for human capital and household goods. If the MPP curve of study time is steeply sloped relative to the MPP curve of household time, the largest reduction in time would come from the latter. Obviously this depends upon the individual. The main point is that the decision to

work part-time should result in a reduction in time allocated to study and to household activities because the MPP/time price ratios are reduced in both.

We might also expect the allocation to change between different quarters or semesters. If the MPP of study time shifts to the right because of stimulating teachers or courses, for example, a greater proportion of work time would be taken away from household activities. Also the student may quit the job if the MPP of study time shifts to the right enough such that the MPP/time price ratio for study exceeds that in part-time employment.

We also would expect different students to react differently to the same job opportunity. If the MPP/time price ratios for study and household activities are relatively high because the student is highly motivated, extremely capable, is attending a high quality school, or is enrolled in a high pay-off program such as medical school, the job opportunity may well be passed up.

The production of utility from part-time work also may decline after a period of work if the student has saved enough to pay for high utility goods such as room and board for the immediate future. This can explain why students tend to be in and out of the job market.

As real wages-increase, however, the MPP/time price ratio in part-time employment also increases. As a result we may expect a greater proportion of students to find that the above ratio exceeds the corresponding ratios for study and household production. This is particularly true if the returns to education are declining as they appear to have done in recent years. The rise in real wages together with the expected decline in the monetary returns to education can explain, at least in part, the increased participation of students in the labor force, as noted in Table 1.

An increase in the proportion of students coming from low and middle income households also should result in a greater participation of college students in the labor force. A reduction in financial aid from parents in effect increases the prices of non-time inputs utilized in human capital and household production. As a result the MPP/input price ratios of these inputs fall relative to MPP/time price ratio in intermediate goods production (part-time work). Therefore it pays the student to allocate more time to part-time work and somewhat less time to the other two activities. Moreover, if the non-time inputs in these other two activities are complements to time, as is reasonable, a reduction in their use relative to time should decrease the MPP of time in these activities (especially household production). This should give rise to a further increase in the allocation of time to part-time work.

One should not conclude, however, that a reduction in study time necessarily reduces the amount of time allocated to each course. When working on a part-time job the student in many cases has the option of reducing his or her credit load while maintaining the amount of time devoted to each course. Which option the student chooses to follow would seem to depend upon the value of grades (and knowledge) given up by working and maintaining a full credit load versus the cost of extending the degree program. Students who place a high value on good grades because of personal satisfaction, a belief that good grades will increase future income, or because of an intention to pursue graduate or professional school study can be expected to reduce their credit loads and extend the length of their programs if they decide to work part-time. Of course, as the hours worked per week approaches the equivalent of a full time job, we may reasonably expect both grades and credit hours to be reduced.

B. Preliminary evidence

Although our theory tells us that part-time employment should result in a reduction in time allocated to both study and household activities, it does not tell us anything about the magnitude of the effects of these reductions, particularly on academic performance. In an effort to obtain some information on the affect of part-time employment on grades and credit loads, information was gathered from a sample of 155 undergraduate students at the University of Minnesota. Data were obtained on participation in part-time work, wages received, courses taken, credits completed, grades received, and a number of other variables which might be used as proxies for academic capability and motivation. The survey was conducted during the first week of spring quarter 1974 and covered the preceding fall and winter quarters. Each student quarter was counted as an observation (N = 310). The labor force participation rate for the entire sample was 64 percent, ranging from 61 percent for freshmen and sophomores to 72 percent for juniors and seniors. Hours of work per week averaged 18.1 for the entire sample (of students who worked), 17.8 for freshmen and sophomores, and 18.5 for juniors and seniors.

Separate regressions were run to estimate the affect of part-time work on grades and on credit loads. In both regressions hours of work per week were converted to three dummy variables: 1-12, 13-25, and >25. Students who did not work part-time constituted the reference dummy. The other variables included in the regressions together with their coefficients and t-ratios are presented in the appendix. The coefficients and t-ratios obtained on the work dummies in the grade point average (GPA) regressions are presented in Table 2A. Because of apparent differences in the coefficients between freshmen and sophomores, and juniors and seniors, separate regressions were run

for each group. The coefficients in Table 2A tell us how much the GPA of each group was reduced by working the specified hours in comparison to students who did not work, holding constant the variables listed in the appendix. Similarly the credit load coefficients presented in part B of Table 2 tell us how many less credits were completed during each quarter by students who worked the specified hours in comparison to students who did not work, again holding constant the variables listed in the appendix.

It is interesting to note that all three GPA coefficients for freshmen and sophomores are highly significant (.02 level). In contrast none of the GPA coefficients are significant (at a reasonable confidence interval) for juniors and seniors. The credit coefficients exhibit an opposite tendency. Only those freshmen and sophomores working more than 25 hours per week appeared to reduce their credit load. On the other hand, juniors and seniors reduced credits significantly after the 12 hour of work per week level. These results would seem to suggest that while part-time work reduces study time for all students, at least after 12 hours per week, the affects of this reduction show up in different ways for different groups of students. Freshmen and sophomores exhibit a tendency to work, maintain credit loads, and let the "grades fall where they may", while juniors and seniors appear to reduce credit loads in order to maintain grades. Apparently the latter value grades more highly than the former.

Using the coefficients in Table 2, we can estimate the probable affect of working, say 20 hours per week, on an average student. During the first two years the student's GPA will be reduced by about .31, say from 2.75 to 2.44. During the last two years GPA is maintained at the students non-work level but credits are reduced an average of 1.4 per quarter lengthening the student's total program by about one quarter. As a result the student ends

Table 2. Reductions in Grade Point Averages and Credits Completed Resulting from Part-time Employment

A

*GPA Coefficients

Hours worked per week	Fr-Soph.	Jr.-Sr.
1-12	-.22 -(2.33)	-.24 -(1.76)
13-25	-.31 -(3.78)	-.05 -(.462)
> 25	-.39 -(3.18)	-.11 -(.677)

B

*Credit Coefficients

Hours worked per week	Fr.-Soph.	Jr.-Sr.
1-12	-.09 -(.195)	-.44 -(.622)
13-25	-.57 -(1.46)	-1.44 -(2.33)
> 25	-1.48 -(2.54)	-2.50 -(2.87)

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* Figures in parentheses are t-ratios.

up with a GPA of 2.60 instead of 2.75 and requires 13 quarters to graduate as opposed to 12. Whether this is a small or large effect of working 20 hours per week is a matter of opinion. Bear in mind, however, that the full 20 hours is not likely to be taken out of study time; part of it no doubt comes out of leisure or household activities.

Summary and Conclusions

The college student can be viewed as a multi-product firm engaged in the production of 1. human capital, 2. intermediate goods via the labor market, and 3. final or "Z" goods via household production. All goods yield present and/or future utility. Each production activity is governed by a production function which includes the student's own time among the inputs.

In keeping with the theory of the firm, the marginal cost of producing a given amount of output is minimized only if the input price/MPP ratios are equalized across all inputs. Because time must always be employed in the same amount per period regardless of its price, the total utility resulting from the use of time is maximized when the MPP/time price ratios (the reciprocal of marginal cost) are equal across all activities. The MPP of time is utility, and the price of time is its opportunity cost in the next best alternative use.

Part-time employment necessarily reduces the amount of time allocated to study and household activities because the MPP/time price ratios must be lower in these activities than in part-time employment in order for the student to take a part-time job. As the student approaches a new equilibrium after taking a part-time job, the MPP/time price ratios must increase both for study and household activities. In order for this to occur less time must be allocated to each.

Preliminary evidence from a sample of students at the University of Minnesota suggests that part-time employment has its main effect in reducing grades for freshmen and sophomores and reducing credit loads for juniors and seniors. An average student working 20 hours per week should end up with a GPA that is about .15 lower than if he or she had not worked, and requiring 13 quarters as opposed to 12 quarters to complete a 4-year degree.

Appendix

Additional Variables in The Regressions

A

GPA regressions

		Fr - Soph		Jr - Sr	
	Extra - Curricular Time (hours)	.01	-(2.94)	-.01	-(1.49)
a/	Classes cut/week	-.05	-(2.62)	-.08	-(2.26)
	Female dummy	-.15	-(2.18)	-.14	-(1.40)
b/	≥90 high school rank dummy	.15	(1.33)	.29	(2.17)
b/	75-89 high school rank dummy	-.10	-(.97)	.19	(1.44)
c/	Grades important dummy	.34	(4.80)	.38	(3.48)
d/	Chemistry-Biology-Math dummy	-.35	-(5.06)	-.46	-(4.41)
	R^2		.36		.39
	N		206		104

B

Credit regressions

	Extra - Curricular Time (hours)	.01	(.39)	-.08	-(1.82)
a/	Classes cut/week	-.01	-(.13)	-.09	-(.55)
	Female dummy	-.87	-(2.61)	-.41	-(.78)
b/	≥90 high school rank dummy	1.18	(2.27)	1.05	(1.47)
b/	75-89 High school rank dummy	.79	(1.62)	.62	(.90)
c/	Grades important dummy	-.47	-(1.41)	.08	(.14)
d/	Chemistry-Biology-Math dummy	-.40	-(1.24)	-.36	-(.67)
	R^2		.11		.18
	N		206		104

a/ Classes cut per week is intended to serve as a proxy for student motivation.

b/ Students below the 75th percentile were the reference dummy.

c/ Students were asked if they considered good grades as quite important. This variable also is intended to serve as a proxy for student motivation.

d/ These courses tend to be the most difficult for students and as such may affect credit load or grades. The dummy was given the value of one for students who had one or more of these courses.

Footnotes

1/ See for example Becker, 1964, Hansen, 1963, Houthokker, 1959, Schultz, 1960, 1963, 1968, and Weisbrod, 1962.

2/ Study time includes class time as well as time spent on study outside the classroom.

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