come. The coefficients of stipends are significant at 12% and 6% for the masters degrees and at less than one per cent for the Ph.D. degrees. It is interesting to note that for the students at the masters level respond more to the number rather than the size of stipends. The opposite is the case with Ph.D. students.

The lagged degrees $D_{t-\lambda+x}$ is a proxy variable for the imperfection in the market. Its coefficient is greater than one and significant at less than one per cent. It would mean that holding other things constant, the number of degrees to be conferred in the future for a given field is determined by the number conferred in some past period. Institutional rigidities and slow acceptance of new fields of specialization and other factors contributing to inertia in the decision making may explain this phenomenon. But using this as a determinant does not invalidate the hypothesis that economic variables do influence significantly the choice of fields.

When graduate enrollment, GS, is used as a dependent variable instead of those who were able to finish the response to income and stipends is stronger. The R^2's are higher and the significance of stipends increases. In the stepwise regression practically all the variance in enrollment is explained by the variance in stipends, the R^2 increased by only 2% when income is included in the regression.

The number of degrees is a good indicator of the total investment of those who complete the degrees. But the investment of students who enrolled in field i but did not complete it is not included in the proxy variable for total investment degrees. Some do not meet the academic requirement and some drop out for other reasons. The response of enrollment is expected to be stronger than the response of those who graduated because the latter do not include cases who dropped out for reasons other than economic.

There is a wide difference between the explanatory power of the various income variables, especially between on the one hand, the hiring rate, H, and income at age 40-44, Y, and on the other hand, the discounted lifetime income PV and the $\hat{PV}$. The difference between the influence of H and Y on degrees, is not as wide as between H and Y, and PV and $\hat{PV}$. In fact for the Bachelors level, the significance level of the coefficient of either H and Y is very much higher than that for PV.

It would mean that students use some estimate of the expected lifetime income based on the income of the age cohort and expected changes in income rather than on annual income for a given age or age group.

Tests of Equation (6):

Equation (6) actually tests the adjustment from one equilibrium point to another when changes in income and/or

stipends occur in one or more fields in the Group.

It was argued in Part II that when a change in labor demand occurs in one or more fields in a given Group, a new equilibrium in the capital market for education is defined. Before this new equilibrium is attained, the relative expected income is changed and the rate of return to the different investment alternatives will be positive. An adjustment toward this new equilibrium will be reflected in a corresponding change in the number of degrees from the time that the change in income is first perceived to the time a degree can be completed, plus some time lag that would allow for any delay in response by the students.

As in the first test, only the "best" results are given. The equation tested and the results of the test are given below.

$$D_{t+n} - D_t = a + d_1 (\hat{Y}_t - \hat{Y}_{t-\lambda}) + d_2 (S_t - S_{t-\lambda+s}) \qquad (6)$$

Group I - Bachelors level:

$$D_{1964} - D_{1960} = 69 + \underset{(.02)}{.018} (PV_{1962} - PV_{1960}) \qquad R^2 = 53$$

$$D_{1964} - D_{1960} = -1954 + \underset{(.01)}{1.408} (Y_{1962} - Y_{1957}) \qquad R^2 = 69$$

Group I - Masters level:

$$D_{1964} - D_{1960} = -521 + \underset{(.19)}{.465} (PV_{1962} - PV_{1957}) + \underset{(.08)}{.089} (S_{n1963} - S_{n1954}) \qquad R^2 = 67$$

$$GS_{1963}-GS_{1958} = -423 + \underset{(.43)}{1.015}\ (PV_{1960}-PV_{1957})$$

$$+ \underset{(.00)}{1.116}\ (S_{n1963}-S_{n1958}) \qquad R^2 = .953$$

Group I - Ph.D.:

$$D_{1964}-D_{1960} = -186 - .075\ (PV_{1960}-PV_{1957})$$

$$+ .026\ (S_{1963}-S_{1958}) \qquad R^2 = .17$$

$$GS_{1963}-GS_{1958} = -893 + 3.944\ (PV_{1960}-PV_{1957})$$

$$+ \underset{(.00)}{2.107}\ (S_{n1963}-S_{n1958}) \qquad R^2 = 87$$

For the bachelors level, 53% of the variance in the change in degrees from 1960 to 1964 is explained by the change in PV from 1960-62. The coefficient of PV is significant at two per cent level. A higher R^2 is obtained when average income at age 40-44 is used instead of PV.

For the masters level, the change in stipends entered first the stepwise regression explaining 57% of the variance in the change in degrees from 1960 to 1964. R^2 increased to 67% when the change in income is included. The coefficient of stipends is significant at 8%, that of income at 19%.

For the Ph.D. level, the test of equation (6) gave very insignificant results where $R^2 = .17$. However, when the number of graduate students, GS, instead of those who complete a gra-

duate degree is used, the test gave significant results. At the masters level, 95% of the variance of changes in degrees is explained by the variance of changes in PV and stipends. However, the changes in stipends from 1950-1963 explained practically all the variance in the change in enrollment between 1958 to 1963. A coefficient of 1.116 would mean that a unit change in the number of stipend would attract 1.116 of graduate students. The coefficient is significant at less than one per cent level.

At the Ph.D. level, graduate students respond more to the change in the number rather than to the change in amount of stipends. As at the masters level, stipends enter first in the stepwise regression, a unit change in stipends granted from 1958 to 1963 attracted 2.107 change in estimated enrollment from 1958 to 1963. A unit change in discounted lifetime income PV from 1957 to 1960 elicited a 3.944 change in enrollment. 87% of the variance in the change in enrollment at the Ph.D. level is attributed to the past changes in stipends and income.

The test of equation (6) is a test of the adjustment of the supply of graduates when a disequilibrium situation exists. It is supposed to exist when changes in income and stipends occur. At the time of the change, no long-run adjustment in supply of degrees is possible because of the required training in each profession. There could be an immediate response of enrollment (particularly with respect to stipends) but not for

degrees.

At both the bachelors and masters degree levels, the present value of income, PV, gave the best result in testing equation (4) over a cross-section of fields. The elasticity of degrees with respect to PV is higher for the bachelors level relative to the same elasticity at the masters level. We are not able to compare the impact of subsidy on undergraduate versus graduate degree. The income elasticity of Ph.D. degrees is much higher than the elasticities for the two lower degrees. The elasticity at the masters level is .266 versus 5.24 for the Ph.D. level. For the latter the fit of equation (4) on adjusted degrees is much better than the fit for total degrees. Adjusting degrees for eligibility did not improve the results of the test for the lower degrees. The response of the number of degrees conferred in a given field is partly influenced by the academic requirement in various fields. The lower the academic requirement in a given field, the greater the number of students who can qualify to complete a degree in that field. The difference in academic requirements is probably more restrictive at the doctorate relative to the lower levels of degrees. The fact that the best result of the test of equation (4) is obtained by using the raw total degrees at the bachelors and masters degree indicates that very little or no restriction to enter some fields exists because of relatively high academic requirement in these fields.

At both the masters and the doctorate levels, stipend is an important determinant of the choice of field. At the masters level, the number of stipends granted to students gives a better fit than the total amount of stipends in dollars. The elasticity of degrees with respect to stipends lagged one year at the masters level is about .5; the elasticity at the Ph.D. is about .9. When the adjustment of supply to demand in scientific manpower is slow, the adjustment can be accelerated or improved by increasing the subsidy to the fields that are experiencing a shortage in manpower. If it is a desired social goal to increase the number of graduates in some fields at the masters level, by say 50%, the number of stipends have to be increased by 100%, holding the average dollar stipends received by students constant. If it is desired to increase the Ph.D. graduates in some fields by the same percentage, the total dollar grants to these fields must increase by .50 x 1/.9 where .9 is the elasticity of Ph.D. degrees with respect to stipends. With such a high stipend elasticity, it will be very easy to increase the labor force with masters and doctorate degrees in the science and engineering fields, at least up to the limit of the proportion of the population who are qualified academically and are interested in completing a graduate degree.

Group I, Bachelors Degrees from California Institutions of Higher Education:

The same test was performed on degrees from California Institutions. However, the national data on income and sti-

pends were used to test California degrees because no separate data on these variables are available by state. It is not unreasonable to use the income data on the national level to test California degrees as the market for the professions, especially for the young members of the professions, is the nation as a whole. However, there may exist some differences in the absolute level of income in California and at the national level. There are moving costs in getting a job at a distance. The moving cost must be covered by the difference in income outside the state in order to make the net income in taking a job outside at least equal to the net income that can be earned in California. If the relative income in each profession is similar in California to that of the United States, we may expect as good a relationship between degrees and income and stipend in the test of California degrees. The presence of an extensive publicly supported University and College System may or may not improve the market adjustment of supply of degrees to changing demand. If the provision of facilities in each area is decided with the end of meeting shortages being felt in the market, the provision of facilities at a very low cost to the students will improve the adjustment toward each new equilibrium. If the State's system of public education is not very sensitive to the current demand, adjustment in the labor market will be obstructed because students will be attracted to major in the fields offered by the State University and colleges as education in these fields is relatively cheaper

than fields offered by private institutions, from the viewpoint of the students.

The following results were obtained when degrees from California were tested in equation (4). The lag and the variables used are specified in the best results obtained:

$$D_{c,1963} = -242 + \underset{(.06)}{.002}\ PV_{1960} + 1.404\ D_{c,1957} \qquad R^2 = .87$$

$$E_{PV} = .452$$

$$D_{c,1964} = -269 + \underset{(.10)}{.0024}\ PV_{1960} + 1.573\ D_{c,1957} \qquad R^2 = .80$$

$$E_{PV} = .472$$

$$D_{c,1964} - D_{c,1960} = 16 + \underset{(.02)}{.033}\ (PV_{1962} - PV_{1960}) \qquad R^2 = .51$$

The elasticity of the supply in 1963 and in 1964 with respect to PV is computed at their mean values. They are smaller than the elasticities for the nation as a whole over the same years, where the elasticities for the nation are .477 and .509. The difference is very small and a bias in the data one way or another can easily account for this difference. Assuming that there is no error in the data, a smaller income elasticity for California can be explained in terms of the public institutions. If publicly-supported institutions' facilities are not very flexible with respect to changes in demand for them, the adjustment in supply of degrees will not be as fast as in the case where students are willing to pay for the total cost of their education and would be willing to go to private institutions.

Group I, Masters Degrees from California Institutions:

The test of equation ( ) for California gave very insignificant results. They are given below:

$$D_{c,1963} = \underset{}{20} + \underset{(.25)}{.0006}\ PV_{1960} + \underset{(.85)}{.0007}\ S_{n1958} \qquad R^2 = .27$$

$$E_{PV} = .173 \qquad E_{Sn} = .026$$

$$D_{c,1964} = \underset{}{17} + \underset{(.09)}{.0011}\ PV_{1960} + \underset{(.90)}{.0007}\ S_{n1958} \qquad R^2 = .40$$

$$E_{PV} = .263 \qquad E_{Sn} = .018$$

$$D_{c,1964}-D_{c,1960} = \underset{}{6} + \underset{(.21)}{.040}\ (PV_{1960}-PV_{1957})$$
$$\underset{(.94)}{-.0008}\ (S_{n1963}-S_{n1958}) \qquad R^2 = .24$$

$$D_{c,1964}-D_{c,1960} = \underset{}{-25} + \underset{(.20)}{.032}\ (PV_{1962}-PV_{1957})$$
$$\underset{(.78)}{-.0009}\ (S_{n1963}-S_{n1958}) \qquad R^2 = .35$$

The fit of equations (4) and (6) on California degrees at the masters level is not as good as the fit on U.S. degrees. The variance of degrees in 1963 that is explained by the variance in present value and stipend is only .27 compared to .54 for the U.S., and for degrees in 1964 on the same independent variables, the explained variance in degrees is only .40 compared to .65 for the U.S.

The adjustment to a new equilibrium when changes in income and stipends occur is equally weak for California at the masters degree level.

If the income and stipend data for the United States are good proxy variables for the income and stipend data for California, we can conclude that the students who are pursuing the masters degree in California are not influenced very strongly by income and stipend in their choice of field. However, this conclusion is rather tenuous due to our inability to compare the relative income and stipend by field for the two areas--California and the United States. The University of California graduate departments cater more to Ph.D. than to masters program and its stipends probably go mostly to Ph.D. students. In such a case the national data on stipends will not apply to students pursuing the master's degree in California.

Group I, Ph.D. Degrees from California Institutions:

Ph.D. students in California are as sensitive to the amount of stipends available in their choice of field as in the rest of the United States. The regression of degrees on stipend and income to estimate the parameters of equation (4) gave the following results:

$$D_{1964} = \underset{}{7} - \underset{(.29)}{.009}\, PV_{1957} + \underset{(.00)}{.0045}\, S_{1963} \qquad R^2 = .90$$

$$E_S = 1.003$$

$$D_{1964} = \underset{}{8} - \underset{(.21)}{.009}\, PV_{1960} + \underset{(.00)}{.0045}\, S_{1963} \qquad R^2 = .91$$

$$E_S = 1.003$$

The variance of degrees explained by stipend is even larger for California than for the United States as a whole. In the stepwise regression, stipends entered first with an $R^2 = .88$. Including income raised the R^2's in each regression problem to .90 and .91 only. The coefficient of income has the wrong sign in each case. In a state where the publicly supported institution confers most of the Ph.D. degrees, the presence of other forms of stipends makes education for the Ph.D. degree almost totally subsidized with respect to out-of-pocket cost. It is interesting to note that the significance of subsidy to education in an already subsidized institution makes this additional subsidy more significant.

When equation (6) was tested showing the adjustment in the market when changes in income and/or stipend occur, the following results were obtained:

$$D_{1964}-D_{1960} = \underset{(.26)}{-2+.015}(PV_{1960}-PV_{1957})\underset{(.02)}{+.003}(S_{63}-S_{58}) \qquad R^2 = .71$$

There is a much better adjustment in the supply of degrees to changes in income and stipends in California compared to the adjustment in the United States. One explanation for this response is because California public institutions are among the largest institutions in the nation that grant the Ph.D. degree. Therefore, if a change in demand occurs, students in California do not have to travel to other states to get a doctorate degree as there are relatively extensive facilities

at the Ph.D. level in this state. This is even more true for the science fields in which the University of California offers very good faculty and facilities.

Group II, Health Professions:

This Group consists of the four health professions in which a doctor's degree is required to qualify to practice. In order to practice in most states, one has to take the State Board examination. It takes seven years on the average to complete the medical degree, including residence requirement; six years for dentistry and veterinary medicine, and five years for optometry. The same lag on degrees for all fields is used in fitting a cross-section regression of degrees on past relative levels of income. Using the same lag for all fields gives a bias in favor of the fields that require a shorter time to complete for if the same lag is used, it allows for delay in response for the field or fields that can be completed in a shorter time. A lag of six years is first tried and then lags which are successively longer by one year each. The successively longer lags are used to show whether there is an improvement in market information about the relative income in each field.

Data on income in the early 1950's are available for the health professions. Two sets of cross-section regressions are performed on data of income for two selected time periods-

-one for income in 1953 and the other for income in 1957.

In order to minimize the loss of the number of degrees of freedom where we have four cross-section observations, the test of the theory includes one independent variable--income. Actually the results of the test of equation (4) show that it is not necessary to include other variables for income explains most of the variance in the number of degrees conferred each year in the health fields.

The best results of the test of equation (4) specifying the variables included and the lag are given below:

$$D_{1959} = -15{,}223 + \underset{(.02)}{.093}\ PV_{1953} \qquad R^2 = .95$$

$$E_{PV} = .654$$

$$D_{1960} = -15{,}537 + \underset{(.02)}{.094}\ PV_{1953} \qquad R^2 = .95$$

$$E_{PV} = .635$$

$$D_{1961} = -15{,}361 + \underset{(.02)}{.094}\ PV_{1953} \qquad R^2 = .95$$

$$E_{PV} = .640$$

$$D_{1963} = -12{,}592 + \underset{(.07)}{.067}\ PV_{1957} \qquad R^2 = .86$$

$$E_{PV} = .531$$

$$D_{1964} = -12{,}907 + \underset{(.07)}{.068}\ PV_{1957} \qquad R^2 = .87$$

$$E_{PV} = .540$$

When degrees are regressed on the four variants of income in 1953 and 1957, lagged 6, 7, 8 years, the discounted

income, PV, gave the best results in terms of the significance level of the coefficient of income and in the explained variance, R^2. In the first set of regressions, degrees in 1959, 1960 and 1961 on PV in 1953, 95 per cent of the variance in degrees is explained by the variance in PV in each regression. The coefficients of PV in every case in this set of regressions are significant at two per cent level. The coefficients and the elasticities hardly change from the regression of degrees in 1959 on income in 1953 to the regression of degrees in 1961 on the same income. It may be argued that, the parameter δ that expresses the strength of the adjustment of degrees due to the improvement in market information as the time lag is increased, is very close to one in this set of regressions. If δ is close to one, the slope of the supply curve observed from the regression of degrees with different time lag will stabilize at a certain value.

In the test of the second set of degrees, 1963 and 1964, and income in 1954, the following results are obtained; the R^2's and the coefficients of PV are both lower than in the first set. When degrees in 1963 are regressed on income in 1957; $R^2 = .86$, the regression coefficient is .067. For degrees in 1964 regressed on income in 1957, $R^2 = .87$ and the regression coefficient is .068. Both coefficients are significant at seven per cent level. The elasticities of degrees with respect to income in 1957 are .531 for the supply of

degrees in 1963 and .540 for the supply fo degrees in 1964. Compared to the results in the first set of tests on income in 1953, the explained variance increased slightly. The coefficient of income and their corresponding elasticities also increased with the length of time lag. It might be argued that in the second set, δ has not reached one which means that information about the relative income is not perfect and the supply of facilities had not adjusted in each field in the 1960's.

It is also to be noted that the coefficients of PV and their corresponding elasticities decreased tremendously from the first set of regressions on income in 1953 to the later set of regressions on income in 1957. A change in the relative income occurred between 1953 and 1957 and students had not responded fully to the change. However, there is still a very high proportion of explained variance, R^2 which means that income is still a significant determinant of the choice of field in the health professions in the second set of tests. Medicine has been the highest income health profession for decades; Dentistry the second; and the relative position of Optometry and Veterinary Medicine shifted during the past decade. If the relative income position of each field persists over a long period of time, information about this position becomes perfect after a while. We will observe fairly constant regression coefficient of income and high R^2's.

Group III - Professions Dominated by Women:

Data on degrees are available from 1952 to 1964 for the fields that graduate mostly women--Education, Dietetics and Nutrition, Library Science, Medical and Dental Technology, Nursing and Social Welfare. Income by age, and by field at the Bachelors level is available only for 1959 from the Census of the Population in 1960. There is no information on stipends for this Group.

A test of equation (4) using different variants of income shows that the best result is obtained when discounted net lifetime income, PV, is used. A lag of four and five years is used.

$$D_{1963} = -18{,}967 + \underset{(.00)}{1.995} D_{1955} + \underset{(.11)}{.183}\ PV_{1960} \qquad R^2 = .99$$

$$E_{PV} = 1.222$$

$$D_{1964} = -19{,}898 + \underset{(.00)}{2.051} D_{1955} + \underset{(.13)}{.193}\ PV_{1960} \qquad R^2 = .999$$

$$E_{PV} = 1.239$$

Compared to the results of the test in other groups, the supply of degrees respond more to relative income. The elasticity of the supply of degrees with respect to income is higher than for other groups with the exception of Group I, Ph.D. degrees. The relative size of the degrees granted at time t depends on the size of the profession. For instance, the degrees granted in Education are even larger than the total for all the

other fields in this group. The American society's goal of providing public education up to the high school level created this big demand for teachers. In order to realize this goal, all states have provided college for the training of teachers. The Federal Government has aided the state financing of these colleges by land grant and other subsidies.

The existence of extensive subsidized colleges for the training of teachers, plus the high income of teachers relative to that paid to the other women's professions, has attracted practically all the women into this field.

There has been a shortage in the nursing profession but the low income of nurses has discouraged growth in this profession. At the same time, subsidized education is not as extensive for nursing as in the case of teacher training.

Even women whose career is secondary to their role in the home, respond quite strongly to the relative return to their investment in education. If society wants to increase the services of any profession in the Group, it has to make the salary schedule comparable to other professions that women may enter. It may also provide more subsidies to this field.

The main employer of women in these professional groups is the government at the Federal and state level. There is no keen competition between the government agencies that hire women in these professions and the private sector. The

salary schedule is more institutionalized and does not respond to market demand as much as in the other groups. Therefore, if society wants the services of more social workers, librarians, etc., it has to make their income competitive to the salaries of teachers and possibly women who are outside Group III.

No test can be performed on equation (6) as the only data on income from which the discounted lifetime income is derived is for 1959. It is expected that with such a high income elasticity observed for this group, the adjustment of the market from disequilibrium toward equilibrium will be strong also once a disequilibrium is perceived. However, nothing can be said about the market information for this group and it is not known whether the time lag before women respond to changes in income will be longer or shorter than in other groups.

Part V - Conclusions:

The theory presented in this paper has been confirmed by the data for both the United States and for California, with the exception of the Master's degree for California. It is argued that when differences in personal interest and in specific attitudes are controlled, the choice of a major field is an investment choice, once the student has, before hand, decided to complete a given degree. By grouping fields such that personal interests and specific attitudes are homogeneous for the group, students do behave as though they try to maximize the present value of their income when they choose a field in which to specialize. In testing equation (4), which asserts that there is a functional relationship between total investment in each field and the relative return to investment and stipends for a given level of degree, it has been found that relative return is a significant determinant of total investment in a given field. Because of imperfections in the capital market and the high risk students attach to investment in their education, stipends, which cover only a small portion of the total cost of education, are found to be the most important variable in determining the number of students and graduates at the masters and Ph.D. levels. Where there are big fluctuations in the demand for labor with professional skills, as in the case of professions belonging to Group I, at all levels, the variant of income that gives the best results is $\widehat{PV}$, the present value expected lifetime income. This estimate takes into