Institute of Economic Development and Research
SCHOOL OF ECONOMICS
University of the Philippines

Discussion Paper No. 76-5 5 March 1976

MEDIA FOR SKILLS FORMATION

by

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A C K N O W L E D G E M E N T

The author wishes to express her deep appreciation for the invaluable assistance of Virginia Teodosio and Celia Caringal who took the responsibility for the survey work and the processing of data, and that of Mr. Carson Ho of the College of Engineering who helped in the programming of the empirical analysis. Jean Marie Aquitania, as usual, gave her best in the typing of the drafts and the final report.

The study was supported by a grant from the Council for Asian Manpower Studies.

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The unemployment and under-employment among those with college schooling the Philippines has experienced over more than a decade is pressing for a re-direction in education policy. The large enrollment in college institutions relative to vocational schools has led to the conclusion for a re-allocation of resources to vocational technical schooling. Re-direction to this type of education has also very strong intuitive and social appeal. Yet, only tenuous data are available which would support a move towards this type of education.

The objective of this research is to provide an empirical basis for decisions on vocational technical education. Broad education and specific skills training are obtained in varying degrees in schools, on the job, and in the whole environment of the person. The higher the level of education, the greater the dependence on formal schools for learning. In general, vocational-technical training is less dependent on formal schooling than professional education. There is a large number of skills which are acquired on the job or as part of parental teaching. Development of

skills at home includes development of useful hobbies like basic electrical and electronic skills, auto mechanic and carpentry. The training may also be part of father-child or mother-child activity, or one obtained outside the home such as driving.

Most skilled workers learn their trade on the job. They usually have varied amount of general basic education: some years of elementary or high school levels. Those who have no vocational training acquire their whole training on the job. Those who have had some vocational training, whether formally acquired in training institutions or informally at home supplement this training by training on the job. While on the job, they could be expected to acquire competence in their skill faster than those who did not have any vocational training to start with. We can, therefore, expect that the acquisition of competence in a job will vary with the background of the worker. The important point to be noted here is that, unlike in the professional market, one without vocational training may enter the vocational market and acquire competence in vocational skill mainly from learning by doing. Many vocational skills are of this nature - they are acquirable through learning by doing. Exceptions to this exist, yet interestingly enough, unlike in the professions,

there is no a priori knowledge which vocational skills they are. Research itself must identify these skills that have to be acquired formally.

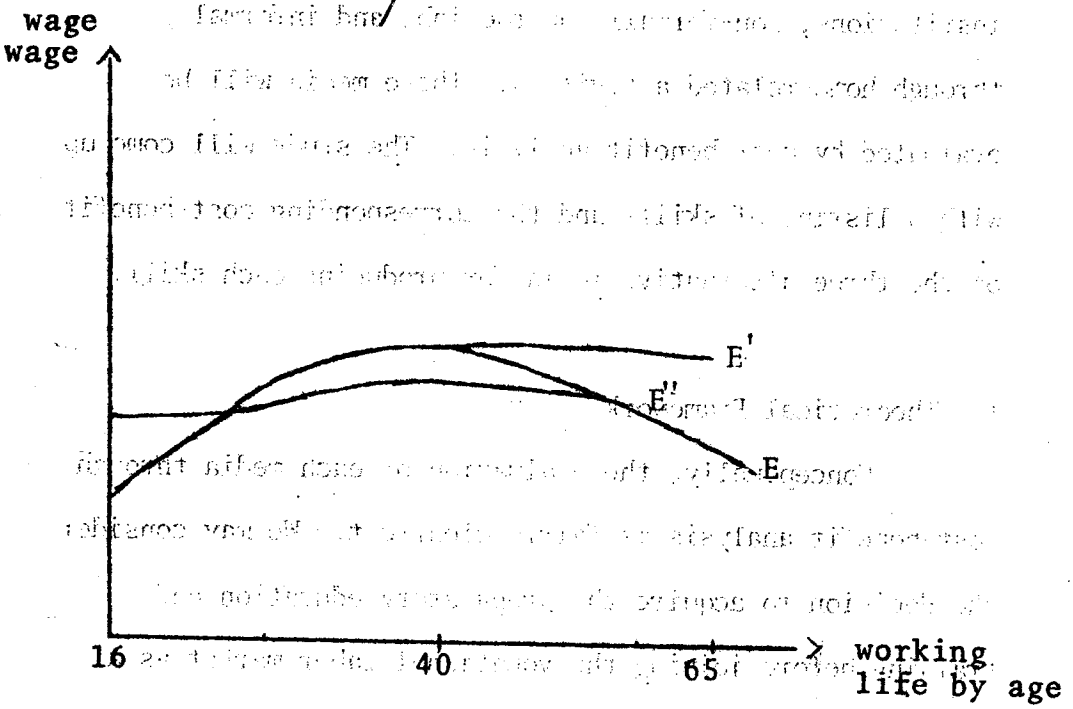
This study tries to identify common media for the acquisition of particular skills: formally in training institutions, non-formally on the job, and informally through home-related activities. These media will be evaluated by cost benefit analysis. The study will come up with a listing of skills and the corresponding cost-benefit of the three alternative media for producing each skill.

1. Theoretical Framework

Conceptually, the evaluation of each media through cost-benefit analysis is fairly clear-cut. We may consider the decision to acquire the preparatory education and training before joining the vocational labor market as a capital decision. One faces the alternatives of joining vocational markets for skills i, i=1 . . .m.

The market requires basic education of level e. The firm may provide all or a portion of training in skill i; it provides all of it if the worker has had only basic education e, and part of it if he has gone through some

training - formal or non-formal. The portion provided by the firm can be taken as $1 - t_f$, t_f being the training the worker brings to the firm. If we assume marginal productivity to be positively related to the degree of competence in a given skill, then the earning time path E would assume the following form:



The slope of the earning path depends on the rate of acquisition of training competence and depreciation through age of human capital. It is possible to have E' path instead of the observed inverted U as E. Training

competence is cumulated through time as is usually the case with most on the job training. The peak may be interpreted as returns to the maximum degree of competence in skill i.

Training on the job unlike that in formal training institutes, is usually part of the production process. Workers are assigned to jobs requiring their corresponding degree of competence. They are able to learn while doing relatively unskilled tasks through watching the next higher skill, or by assisting the more skilled workers. In cases like this, the cost of formal training is reflected mainly in productivity differential. One who brings some training to the job will tend to have higher productivity and have an earnings path above the untrained at the beginning years such as E''.

It is a different case from what Becker describes where a firm optimizes the following equation:

$$MP_0 + \sum_{t=1}^{n-1} (MP_t - W_t)R^{-t} = W_0 + k_0 \qquad (1)$$

where k_0, the training cost, is identifiable training cost. The firm's decision is what wage, W, to pay during training and thereafter, given the path of MP, the marginal product

R^{-t} is the discounting factor. Some identifiable skill training programs by firms do exist which can be costed. But other on the job training is subsumed in the production processes. In either case the relevant variables to an individual worker are the expected earnings path and the cost of training before entry into the labor market.

The evaluation follows the usual calculation of the net worth of each alternative. Assume the relevant age is 16 when decision to train is made and retirement age is 65. Then the net worth of expected earnings and cost for the various alternative skills $1, \ldots, m$ is calculated and arranged as follows. Skill training brought to the firms is defined as f.

$$
\begin{aligned}
NW_1 &= \sum_{t=A-16}^{65} (W_{1,t} - C_{1,t}) R^{-t} \\
&\vdots \\
NW_{1,f} &= \sum_{t=A-16}^{65} (W_{1,f,t} - C_{1,f,t}) R^{-t} \\
&\vdots \\
NW_m &= \sum_{t=A-16}^{65} (W_{m,t} - C_{m,t}) R^{-t} \\
&\vdots \\
NW_{m,f} &= \sum_{t=A-16}^{65} (W_{mf,t} - C_{mf,t}) R^{-t}
\end{aligned}
\qquad (1)
$$

Market equilibrium would be where there would be zero differences in the net worth of all the alternatives. Hence for the training in skill 1. . .m.

$$\sum_{t=A-16}^{65} W_{1,t} R^{-t} - \sum_{t=A-16}^{65} W_{1f,t} P^{-t}$$

$$= \sum_{t=A-16}^{65} C_{1,t} R^{-t} - \sum_{t=A-16}^{65} C_{1f,t} R^{-t} \qquad (3)$$

$$= \sum_{t=A-16}^{65} W_{m,t} R^{-t} - \sum_{t=A-16}^{65} W_{mf,t} R^{-t}$$

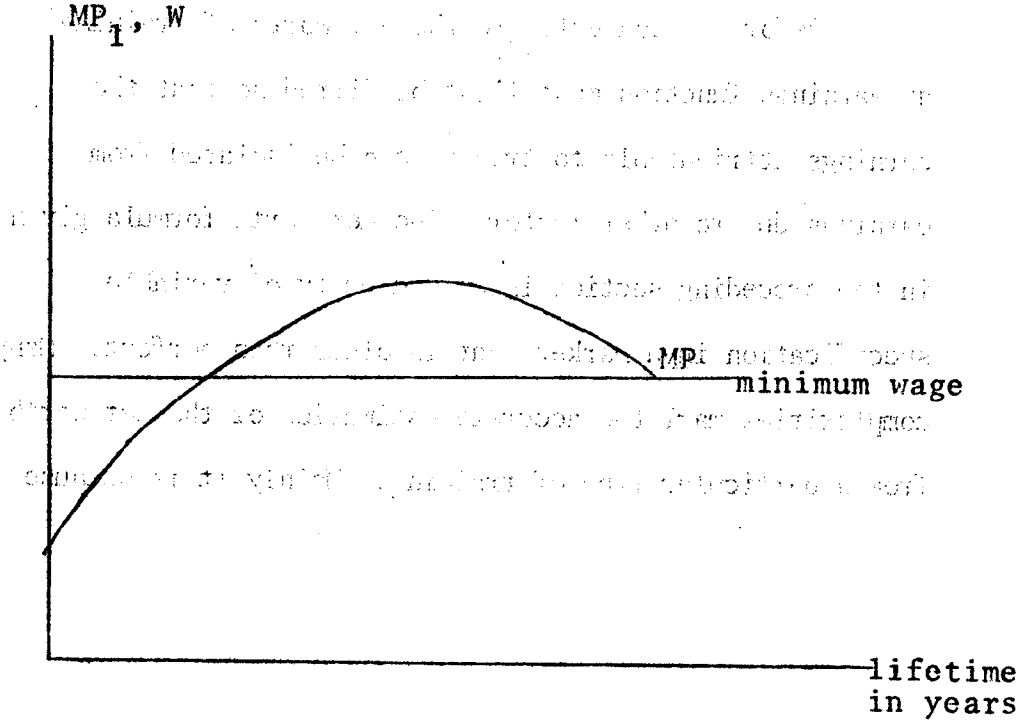
$$= \sum_{t=A-16}^{65} C_{m,t} R^{-t} - \sum_{t=A-16}^{65} C_{mf,t} R^{-t}$$

$$= 0$$

Before we can estimate the net worth of training an earnings function must first be fitted so that the earnings attributable to traning can be isolated from earnings due to other factor. The net worth formula given in the preceding section is as yet empty of variable specification in a market that is other than perfect. Many complexities mar the accurate estimation of the net worth from a particular type of training. Mainly it is because

there is no perfect labor market for skill i, such that the wage paid to this skill might very well vary as to characteristics of the firm, such as variation in personnel policy, size of firm and its capital intensity, and presence of company unions in large firms. It is also possible that the family background of a worker may have an effect on his productivity, an obvious case is the inherited attitude to work and ambition which are observed to differ between families.

The minimum wage law directly determines the earnings path. Let us take the case of the market for a skill, k, whose marginal productivity during parts of working life is below the minimum wage. The marginal productivity curve may be depicted below in relation to the minimum wage.



Let us assume the simple case where the training is specific to the firm so that it can pay its workers less than their marginal product, with $MP_K > W_{k\ firm} > W_{k\ market}$. The firm will only undertake the training if

$$\sum_{n=a+1}^{65} (MP_n - W_n)R^{-n} = \sum_{t=A=16}^{a} (W - MP_t)R^{-t} \qquad (4)$$

the discounted excess of marginal product over the wage it pays in the period after training is equal to the discounted excess of the minimum wage over the marginal product during training. The period of training is from (A=16) to a, and post training is a+1 to age 65. The wage after training is depressed below the marginal product in order to compensate for the payment of the minimum wage during the training period when the marginal productivity is below this wage. The resulting earnings path would be fairly flat and hovering around the minimum wage instead of following the marginal productivity curve. This analysis shows that firms may still hire labor whose current productivity is below the minimum wage as long as it is able to compensate itself with a marginal product-wage differential in the future. For trainable workers, therefore, the impact of the minimum wage on low-productivity workers is very much tempered.

The effect on income of all these factors - market characteristics, the minimum wage law, family background, etc., confound the effect of training on income.

2. Earnings Function

We want to obtain the net worth of each alternative skill and for each skill the net worth for workers with formal and informal training and for those with purely only the job training. But before net worth can be estimated, an earnings function must be fitted, so that the earnings attributed to training can be isolated from those due to institutional and other factors. Within each skill category the wage of a worker will depend on his productivity and some institutional factors such as firm ownership and firm size. Productivity in turn depends on the degree of competence in the particular skill and competence on the amount of his training. The amount of his training at a particular moment in time is an accumulation of training before he started work and on the job training. It is expected that the rate of accumulation of training on the job depends on the amount of training in the particular skill the worker brings with him to the job. The general level of

education is also likely to raise the rate of training accumulation. Training in other skills may help raise the training accumulation in skill i but this if for no reason than that one acquires a work-oriented discipline while training.) But the effect of such training is not expected to be strong. Thus we have the training function:

$$T_i = T_i(E, A, V_i)$$

and productivity on the job i, P_i depends on the accumulated training T_i.

$$P_i = P_i(T_i) \qquad (6)$$

and

$$P_i = P_i T_i(E, A, V_i) \qquad (7)$$

We used W as a measure of productivity. Some institutional factors such as firm characteristics, F, may be expected to influence the wage rate so that F may be included as an argument in the wage function. T is training, E is general education, A is age which is proxy for on-the-job training, V is training the worker brings to the job, P is productivity and W is wage rate.

We then fit by regression, the equation

$$W = a + B_1 A + B_2 E + B_{3j} V_j + B_{4j} F_j + u \qquad (8)$$

Equation (8) is to be fitted to a cross section of workers belonging to each skill category. From this equation can be obtained the earnings path.

An alternative way of obtaining the earning time path is from the job histories of the sample. The survey

asks the earnings per week over the past five years. Thus the sampled workers can be arranged by age so that the earnings at equivalent ages can be estimated. The earnings of the samples from ages 16 to 65 are thus listed.

16	17	18	19	20	21	22 . . .	65
W_t^{16}	W_t^{17}	W_t^{18}	W_t^{19}	W_t^{20}	W_t^{21}	W_t^{22} . . .	W_t^{65}
	W_{t-1}^{16}	W_{t-1}^{17}	W_{t-1}^{18}	W_{t-1}^{19}	W_{t-1}^{20}	W_{t-1}^{21} . . .	W_{t-1}^{64}
		W_{t-2}^{16}	W_{t-2}^{17}	W_{t-2}^{18}	W_{t-2}^{19}	W_{t-2}^{20} . . .	W_{t-2}^{63}
			W_{t-3}^{16}	W_{t-3}^{17}	W_{t-3}^{18}	W_{t-3}^{19} . . .	W_{t-3}^{62}
				W_{t-4}^{16}	W_{t-4}^{17}	W_{t-4}^{18} . . .	W_{t-4}^{61}
						W_{t-5}^{16}	

The earlier estimation takes the W_t for the different age groups as reflecting the age earning profile. From this matrix, we can see the rate of change of earnings at the equivalent ages over the past 5 years. The wage at the equivalent ages, assuming working life starts at age 16,

is the diagonal from the wage at that age; that for age 17 is the diagonal wages from the wage of those at age 17, and so on.

The earnings path over the past five years for each age group may also be computed from the path for the equivalent ages. Hence we have from the first row the current wage by single year from age 16-65. From the second, we have the path from age 17-65 based on last year's wages; from the third row, the earnings path from age 18-65 two years ago. The change in the path over the past five years reflects the shift in the earnings path which can be used for adjusting the current path to reflect expected shifts in the future. The path for each age group, on the other hand, shows relative growth in wages over the past five years of those in each age group.

Much more can be analyzed from the data: the wage structure of the market, the qualification of skilled workers, the stability or instability of employment in one occupation or in a firm, and to a limited extent social mobility as gathered from the education and occupation of fathers in relation to those of the sampled workers. Some of these will be discussed in Chapter III.

3. Data and Survey Methodology

The empirical base of this study is from a survey of employed workers in the Metro-Manila area. The information gathered is mainly about the training and job histories of the skilled workers.

The study is limited to a selected number of skills. The selection of skills for inclusion in the study was based on the largest occupational groups employed in the fastest growing among the 10 largest industries. The training history of the employed was obtained and the latter included information on the following:

1. Training history
2. Current wage
3. Wage over the past five years
4. Period of unemployment between jobs

The training history was derived partly from the employment history since learning by doing is always assumed to take place. It includes the following:

1. List of acquired skills
2. How and place where each was acquired,

formally, non-formally and informally

3. Age when formal training was acquired

4. General educational background
   a) Elementary grade
   b) High school
   c) Post high school

5. Duration of training

6. Cost of training
   a) If in school, tuition and other expenses
   b) If on the job, training cost is reflected in wage difference by duration of employment or by position held
   c) If at home, form and cost of training

Seven selected industries are included in the survey namely: textile, garment, automotive, steel, footwear, electronics and construction industries. The sample space consisting of factory and construction workers was randomly chosen among the aforementioned industries which are all listed in the NMYC (National Manpower and Youth Council) tabulation but for the construction industry. Under each industry are several large, medium-sized and small firms in which a selection was also done. Actually a three-stage sampling technique was used in the survey: the first stage being the selection of skills in each industry; the second stage being the selection of skills

in each firm and the third stage being the selection of the subsampling units, the workers themselves, in each skill.

The second stage though was done taking into consideration the number of employees for each skill so as to get significant results. Such skills with 50 or more employees were considered. Now, since the choice of the sample size for the pre-selected seven industries was set to more or less 2,000, it became imperative that the sample for each industry was chosen accordingly. The proportions used for the sample firms varied from one to the other because they have different employment sizes.

Below is the distribution of the total sampled laborers by industry:

INDUSTRY	POPULATION SIZE (N)	SAMPLE SIZE (n)
Garment	4567	303
Footwear	371	84
Electronics	569	267
Automotive	724	208
Steel	1850	247
Textile	6300	698
Construction	-	219
T O T A L		2026

A personal interview of the workers was done so as to get the maximum efficiency in the answers given for each question or point raised in the schedule. If the process would have been otherwise, i.e., letting the laborers fill in the questionnaires themselves, results would have been biased since there are particular parts which require certain amount of recall.

From the survey, we obtained samples of more than 50 observations for the following skills:

Table 1

FREQUENCY DISTRIBUTION OF SELECTED SKILLED WORKERS

		Sample Size
1.	Sewers	258
2.	Spinners	248
3.	Weavers	191
4.	Mechanics	135
5.	Fitter-Machinists	159
6.	Machine-tool Operators	156
7.	Electrical Workers	249
8.	Garment Workers	303

The questionnaire provides us with the following data:

1. Personal characteristics -- age, civil status, parents' occupation, parents' education, etc.

2. Educational background

   (1) highest educational attainment

      (a) general and

      (b) vocational or professional

3. Employment

   (1) wages, occupation and position in each occupation over the past five years

   (2) place of employment and size of firm

4. Vocational Training

Chapter II

THE MEAN EARNINGS PATH OF THE DIFFERENT OCCUPATION

The earnings path of labor in the various skills selected by medium of training and other factors were drawn using the mean earnings at each age. The earnings path for most categories of labor is shaped as discussed earlier, as an inverted - U. The acquisition of competence in a skill through learning by doing is taken to explain the upward-sloping part of this path. The fast rate of depreciation of the human capital after a certain age explains the declining part of the earnings path. While the earnings path is inverted - U, in general, the earnings level and the rate of learning by doing differed among occupations.

Our productivity and wage functions have general education, E, vocational training, V_j, and firm characteristics, F aside from age, A, the proxy for learning by doing, as arguments. The contribution to productivity of each of these variables is expected to vary by skill category so that formal training may have a stronger influence on productivity in skill i than in skill j. We would, therefore, expect variation in earnings path among skill categories,

everything else equal; and as a consequence of variation in the variables.

We have in Figures 1-11 graphs of earnings path using mean earnings in 1975 by age. The earnings paths vary by skill as seen in Fig. 1. Every point on the earnings path of electrical workers lies above the earnings path of garment workers and of the whole sampled workers.

In Figures 2 and 3 are drawn the earnings paths for each occupation by nationality of ownership of the firm and by whether or not the workers have had vocational training. The figures show that for most occupations, the earnings path of those working in American firms is higher than for those working in Filipino and Chinese firms. The charts also show the difference among skills in their requirement for vocational training. The earnings paths for those with vocational training among mechanics, electrical and electronics workers and fitter-machinists are above the paths for those without training (Please refer to Figures 3, 5 and 6 for the earnings paths). In contrast, the earning paths

Earnings Paths for the Occupations Surveyed
(Electrical, Garment and Total Workers)

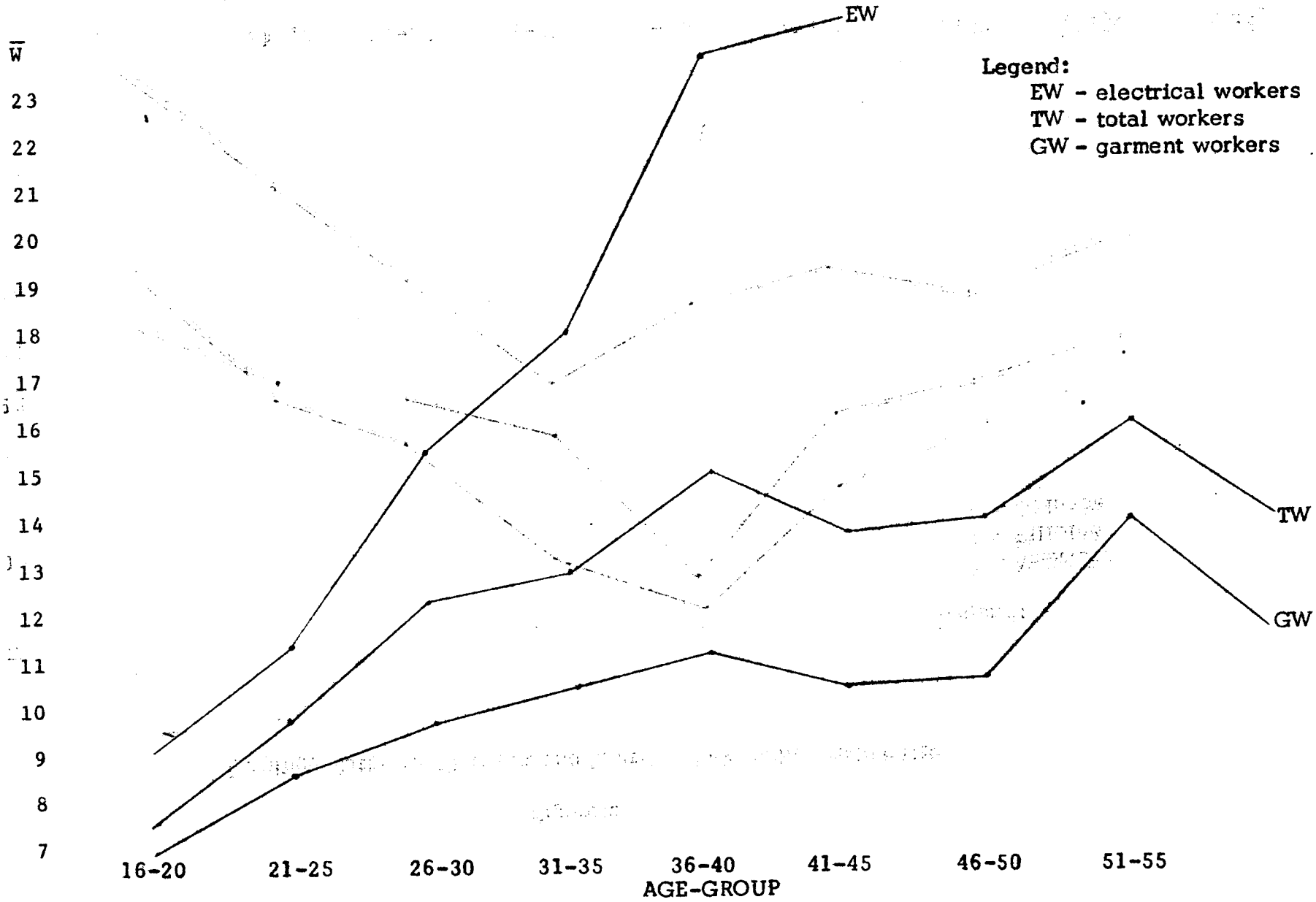


Figure 2

Earnings Paths for Garment and Textile Workers by Nationality

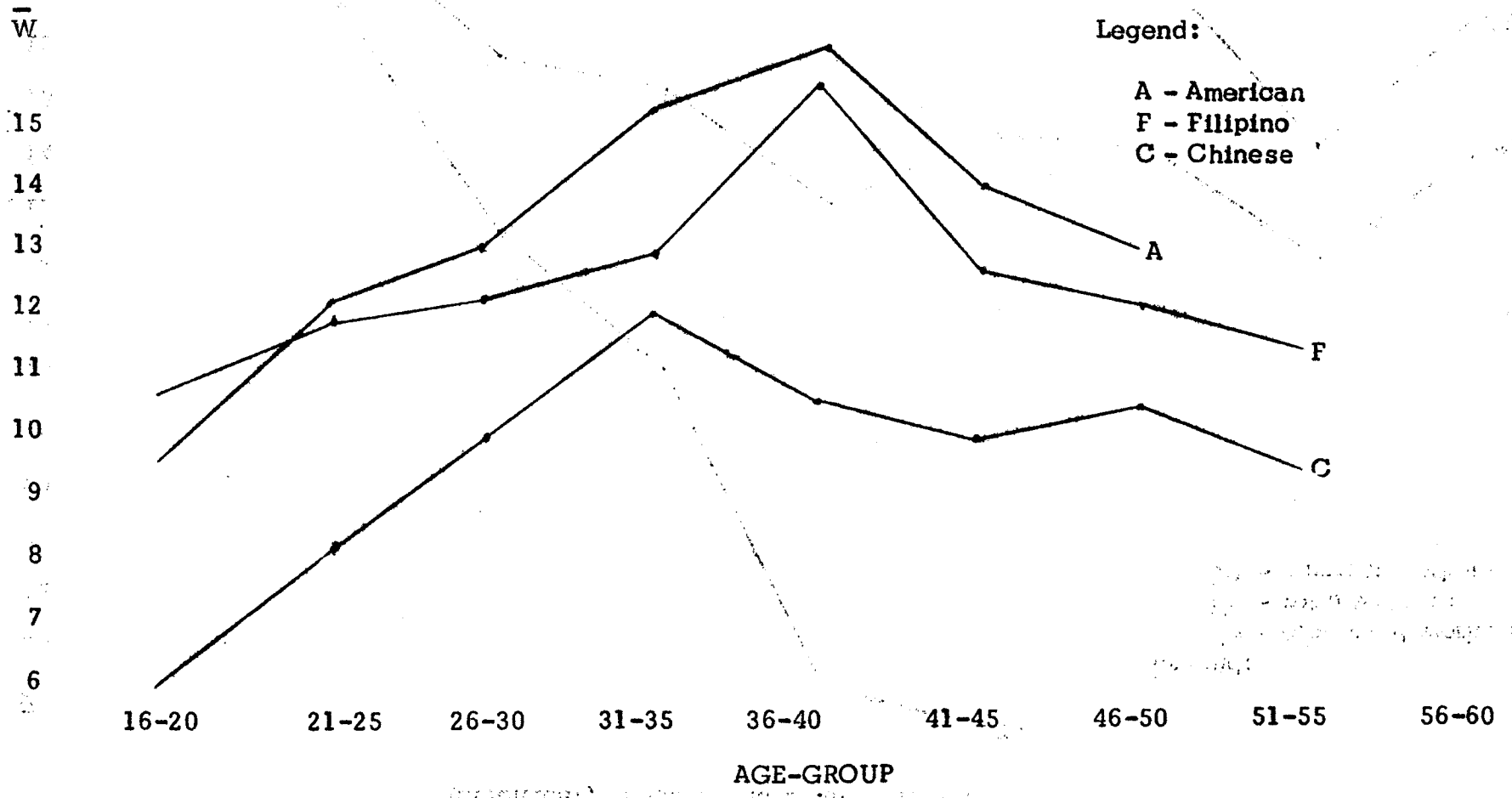


Figure 3

Earnings Paths for Electrical and Electronics Workers
by whether or not they have Vocational Training

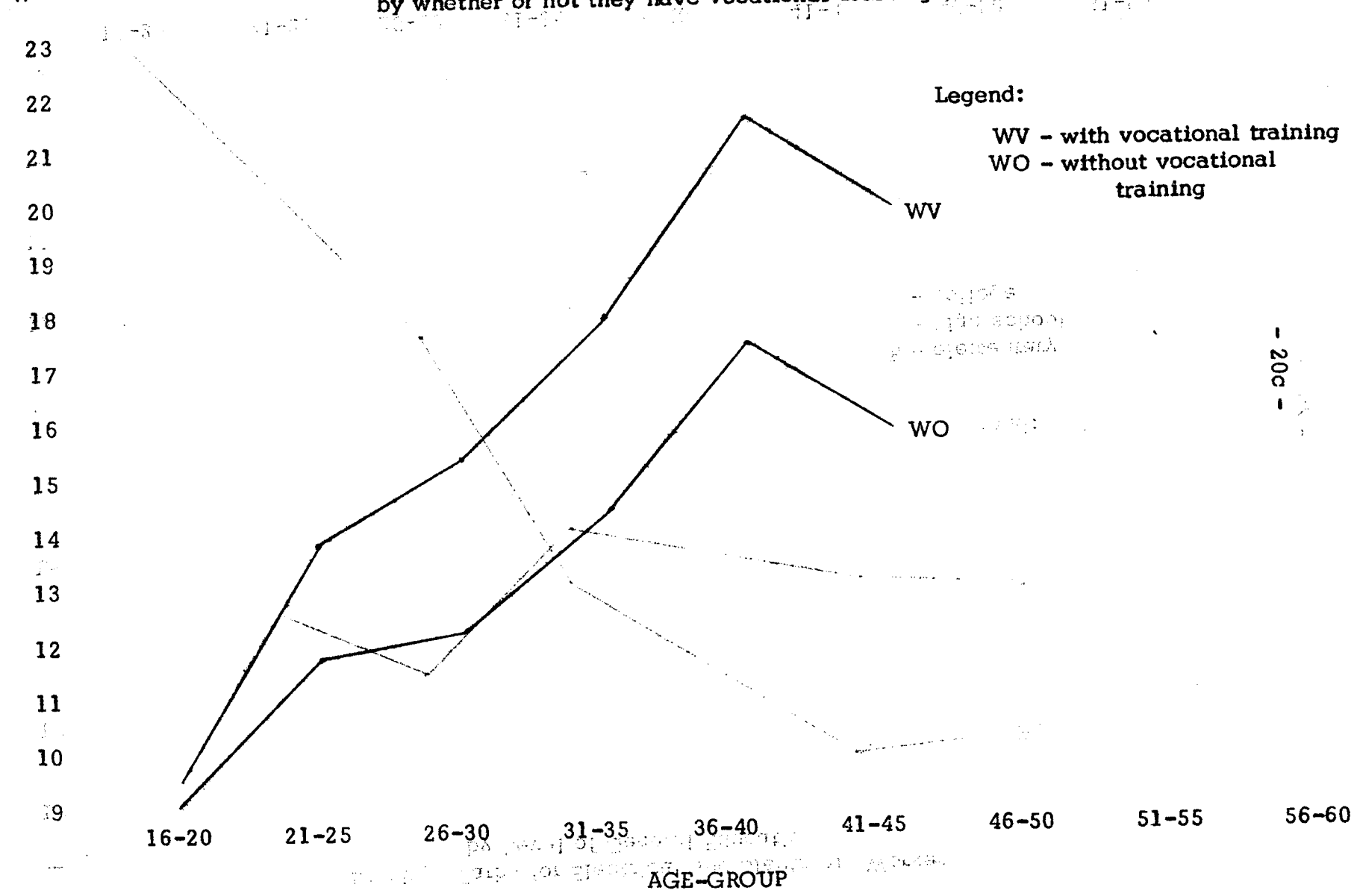
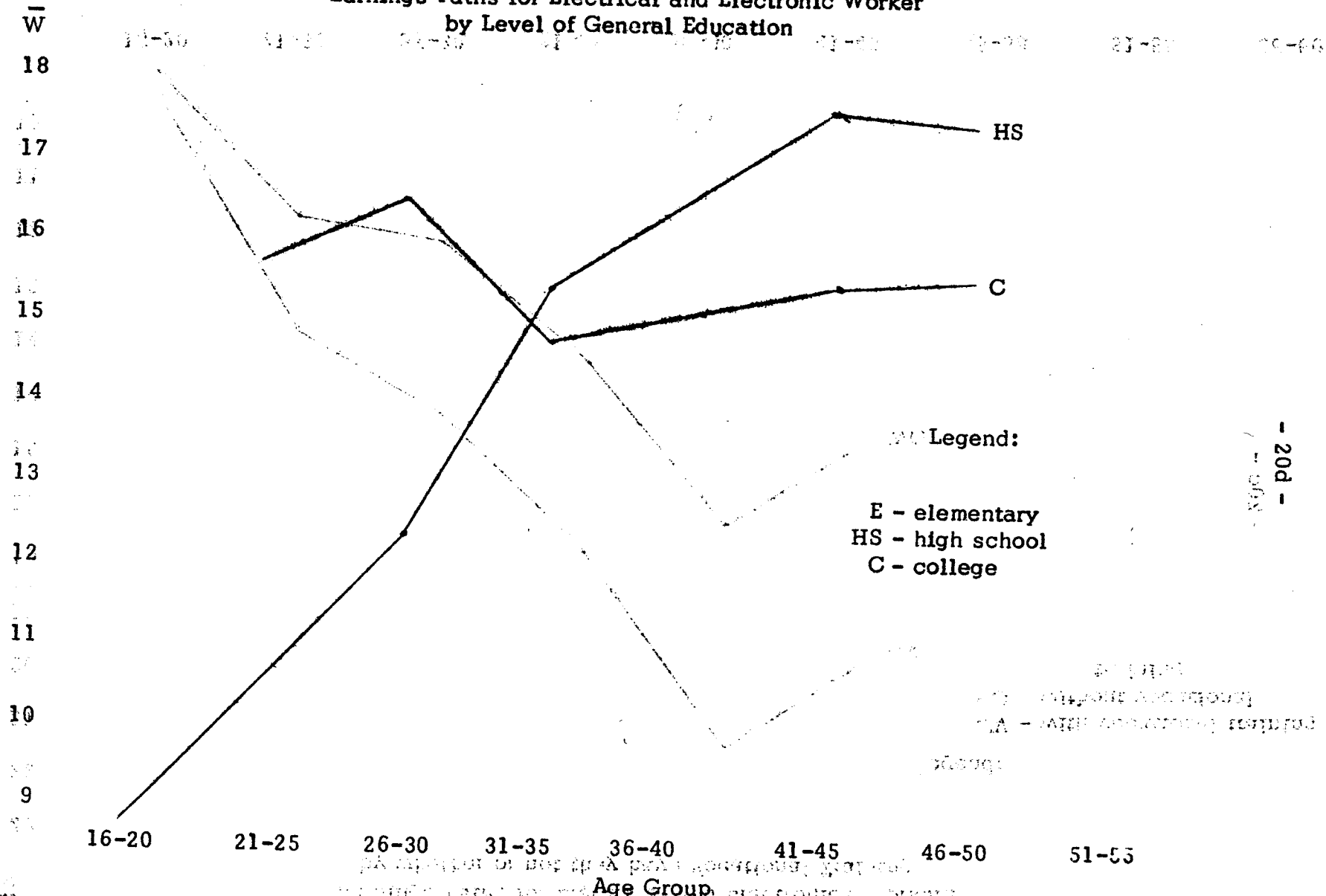


Figure 4

Earnings Paths for Electrical and Electronic Worker
by Level of General Education



Earnings Paths For Mechanics By Whether or Not They Have Vocational Training

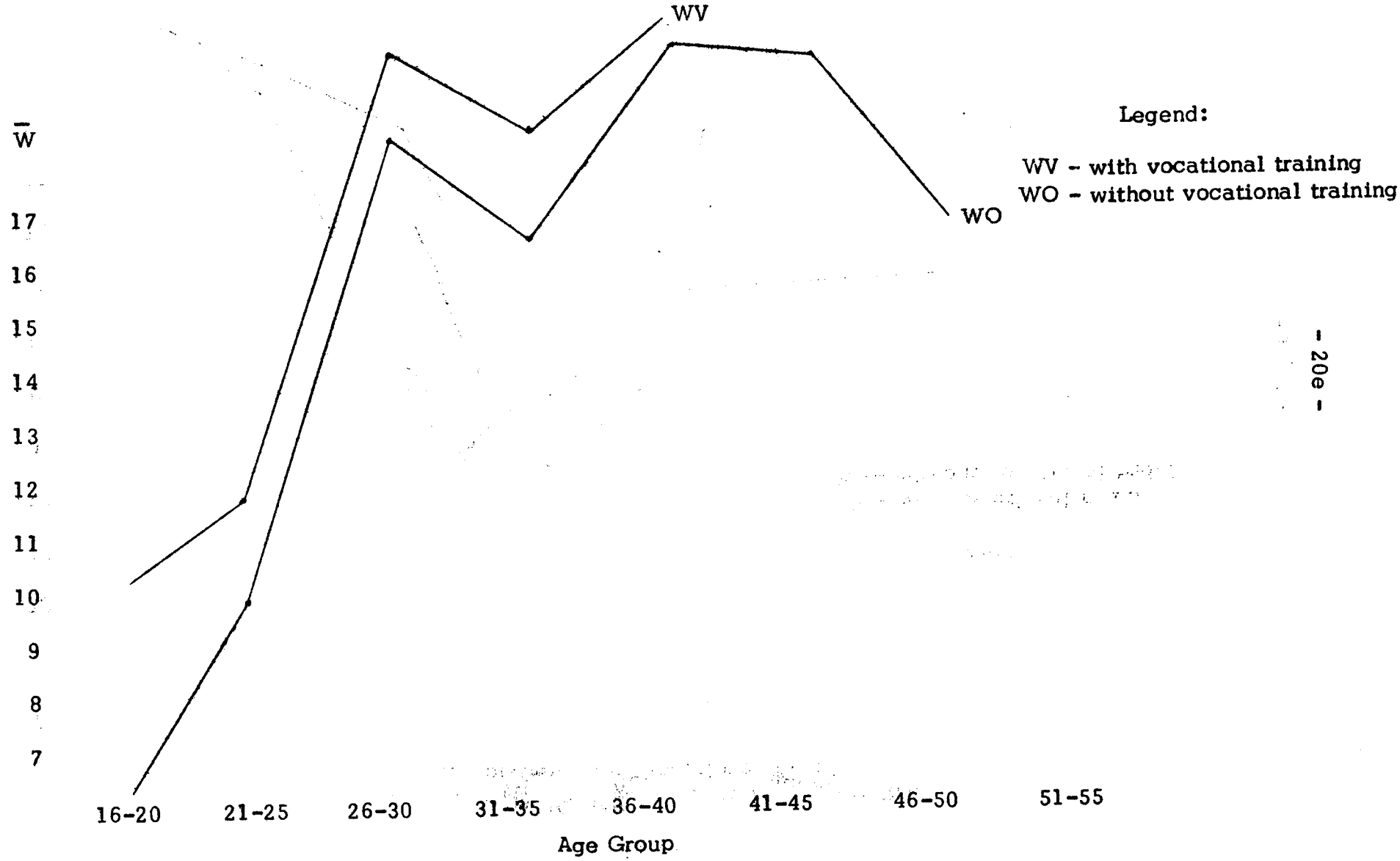


Figure 6

Earnings Paths For Fitter-Machinists by Whether or Not They Have Vocational Training

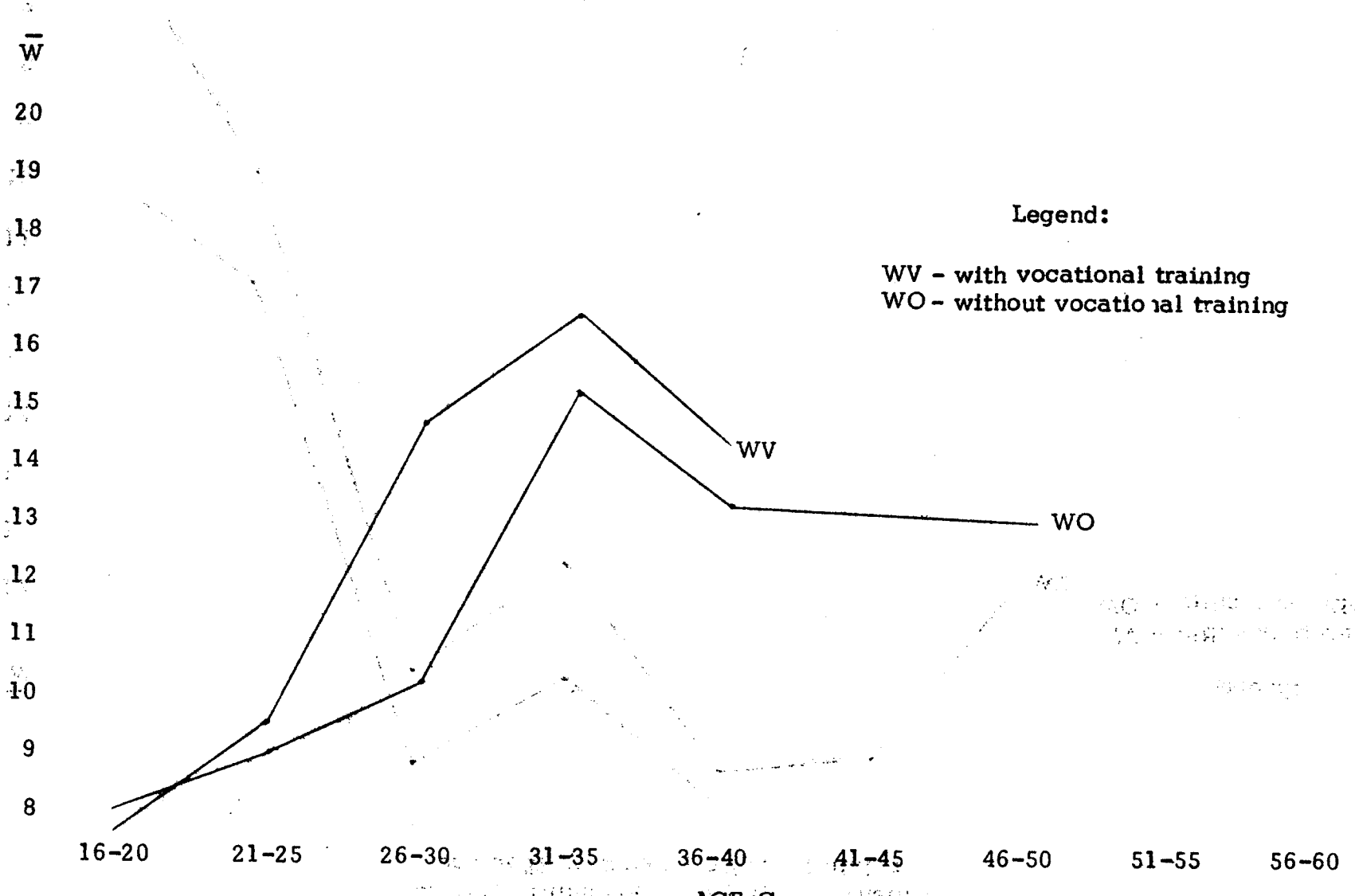


Figure 7

Earnings Paths For Machine-tool Operators By Whether or Not They Have Vocational Training

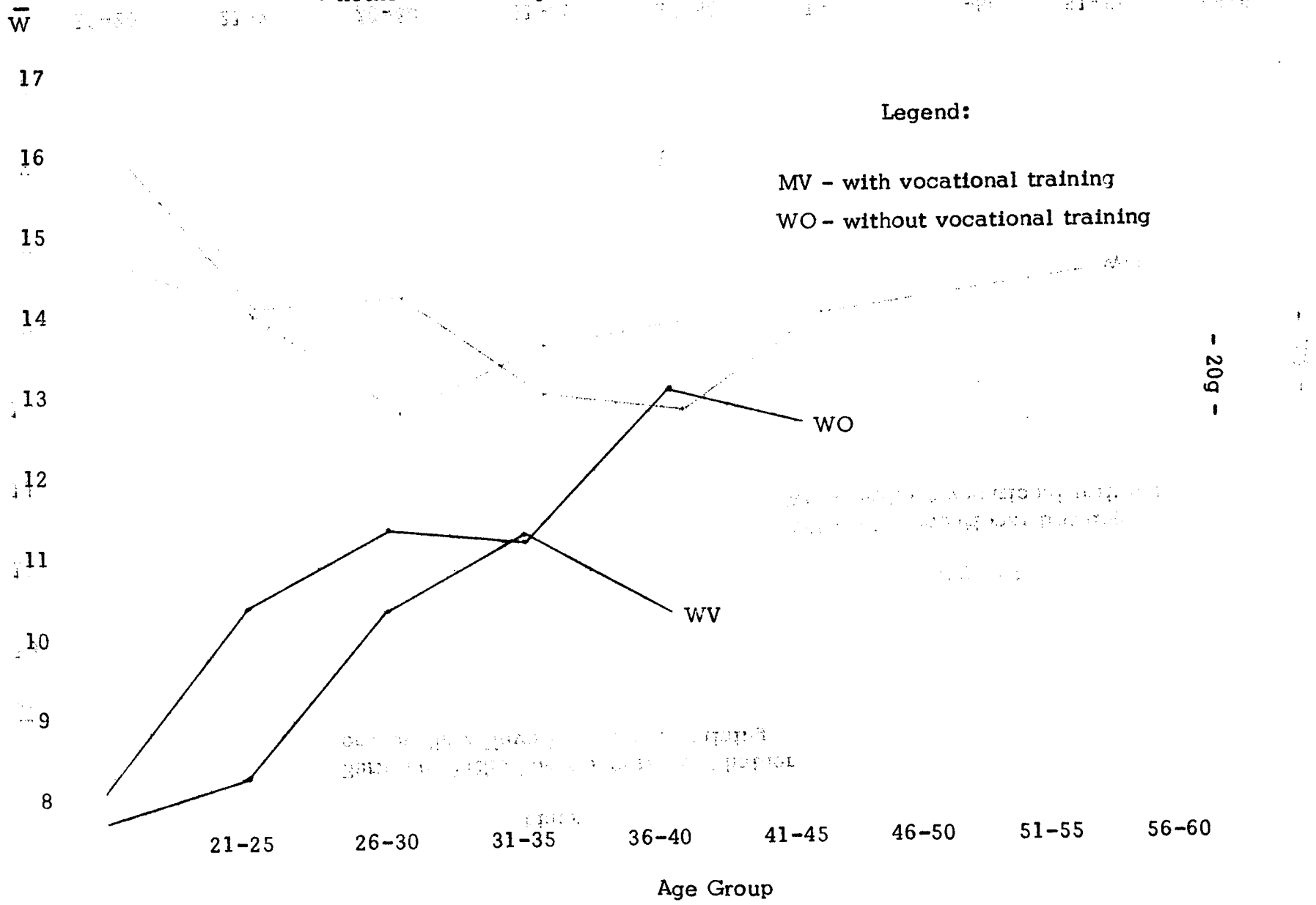


Figure 8

Earnings Paths For Weavers By Whether or Not They Have Vocational Training

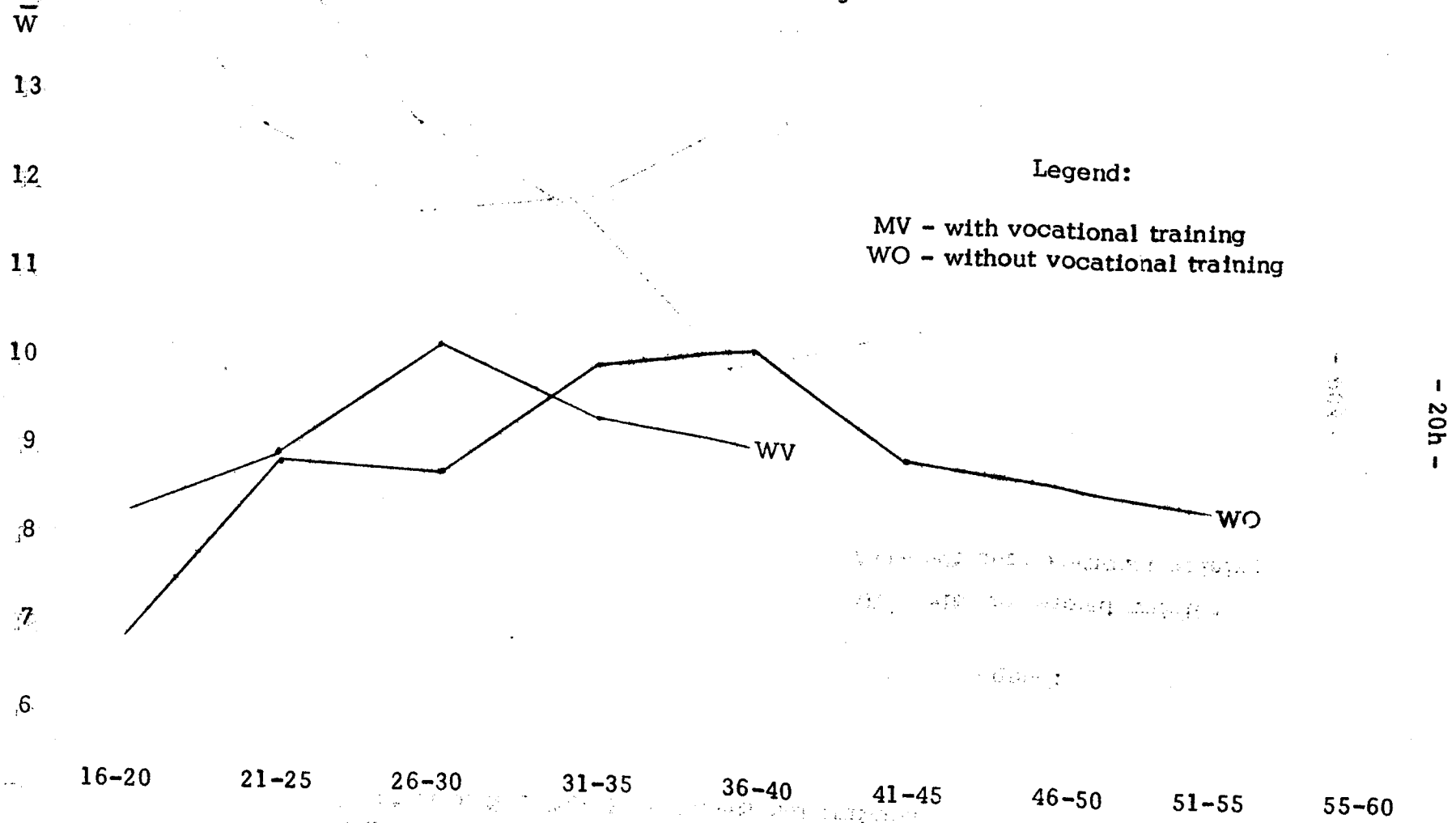


Figure 9

Earnings Paths For Spinners and Winders By Whether or Not They Have Vocational Training

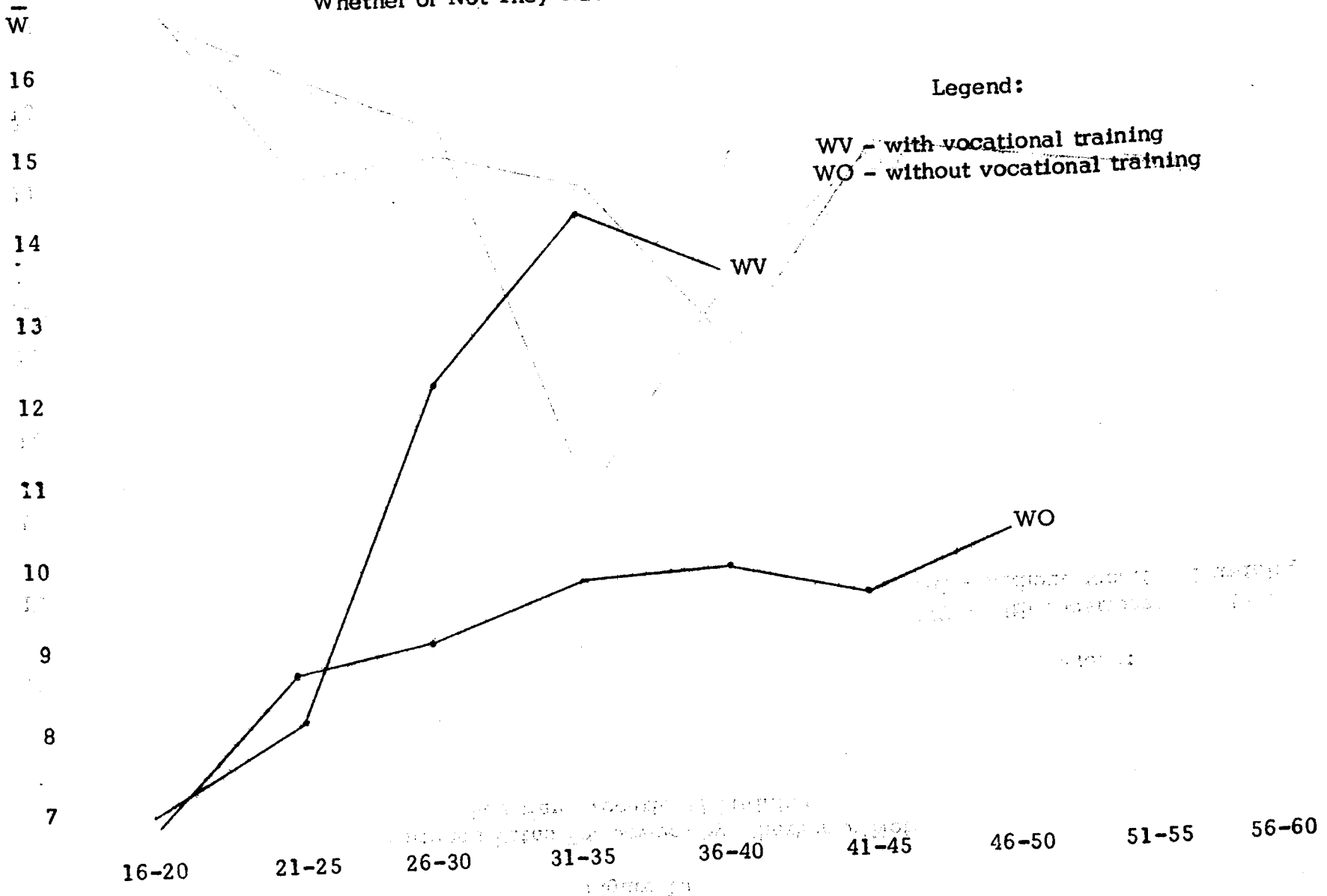


Figure 10

Earnings Paths For Sewers By Whether or Not They Have Vocational Training

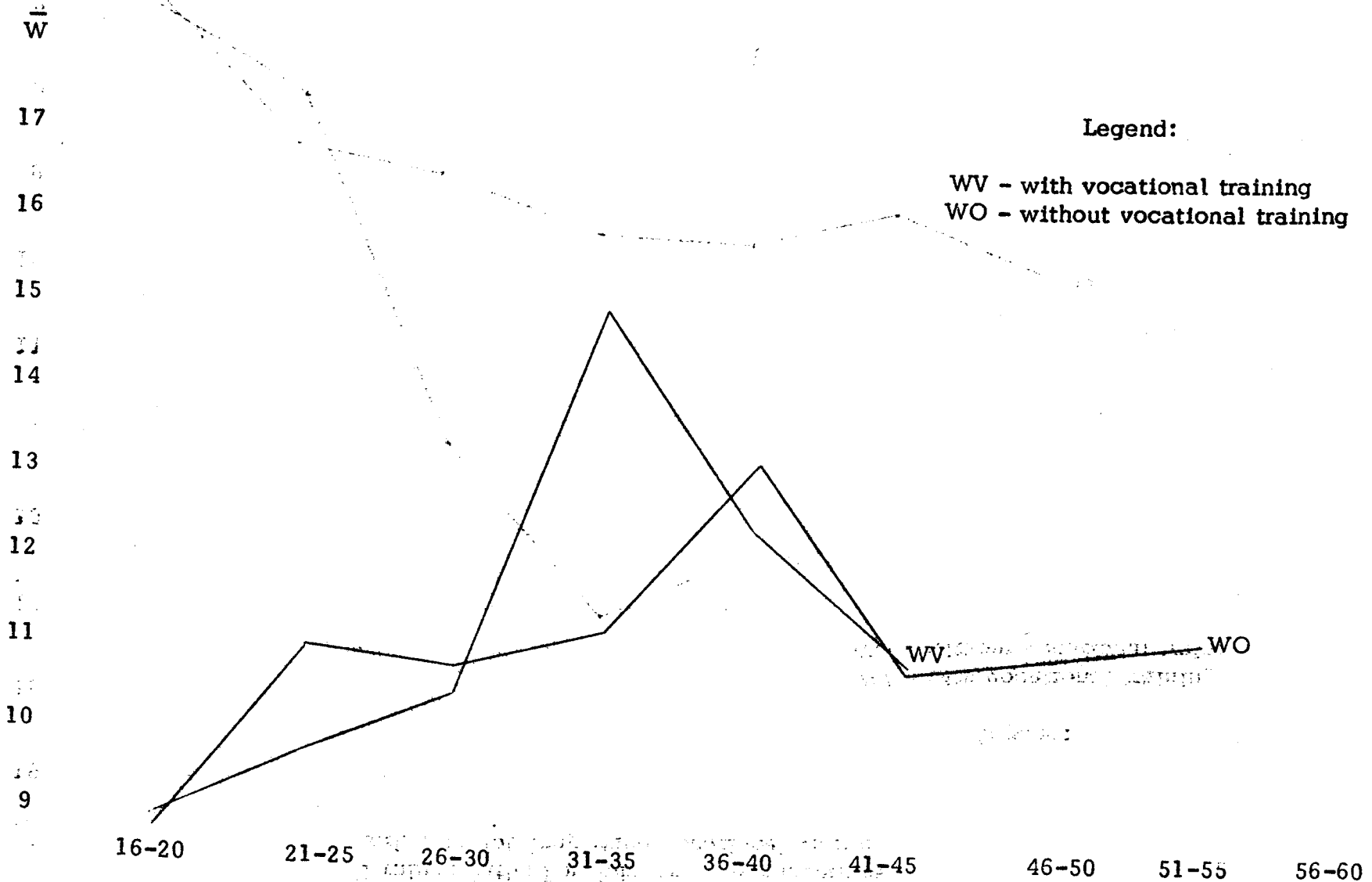
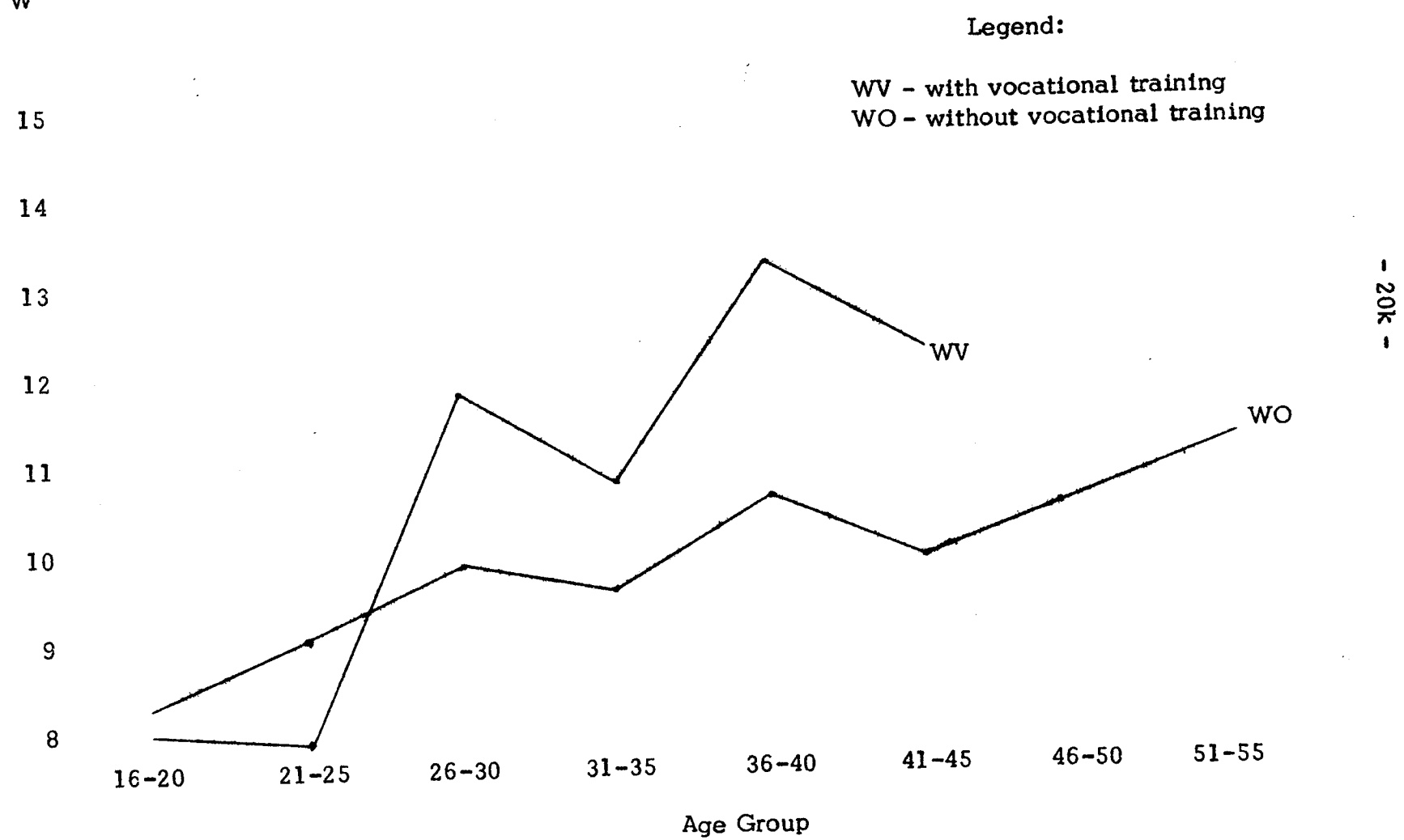
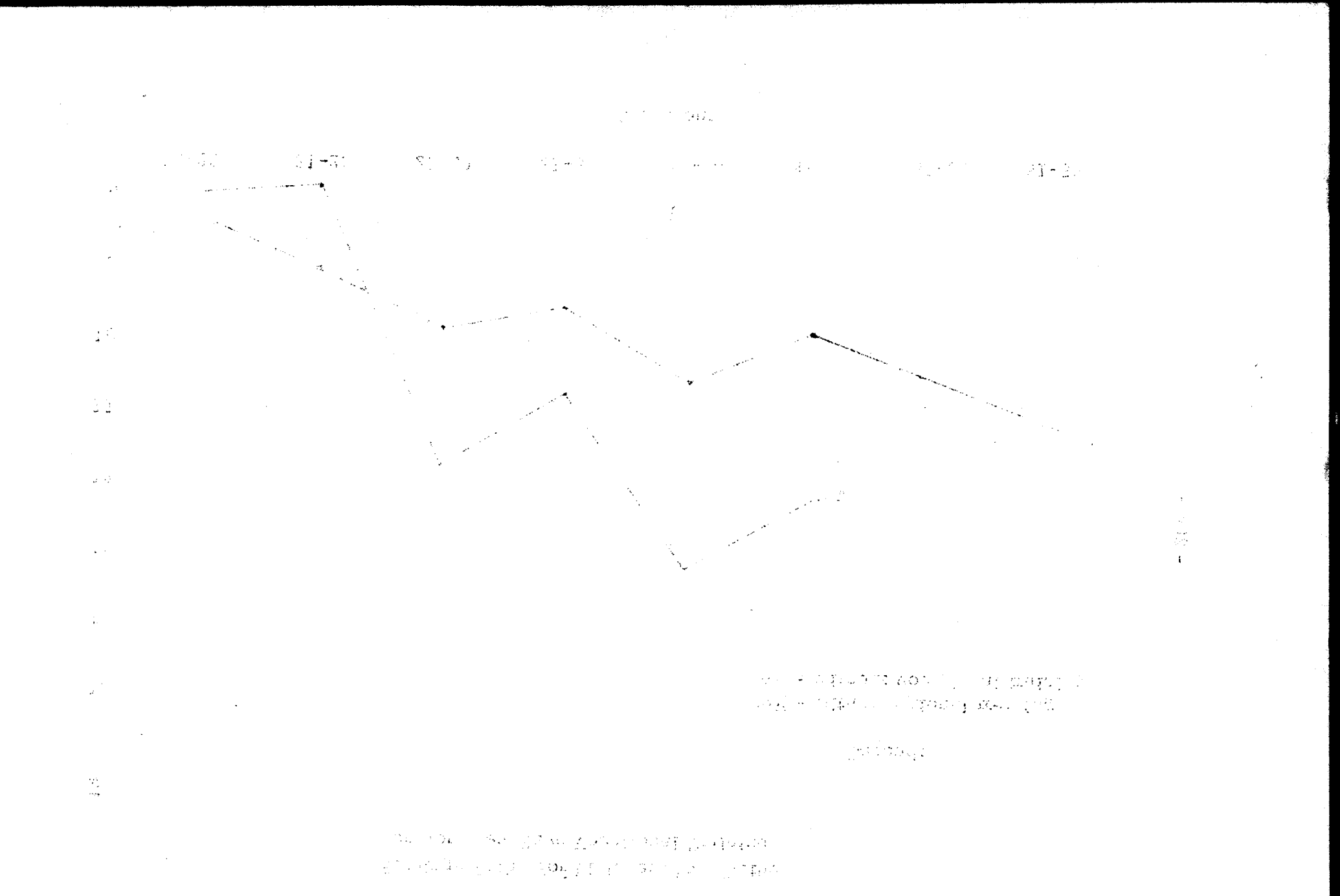


Figure 11

Earnings Paths For Finishers By Whether
or Not They Have Vocational Training





of those with and without vocational training for machine-tool operators, weavers, spinners and winders, sewers and finishers overlap almost throughout the age ranges. (Please see Figures 7-11 for the graphs). Vocational training may be considered irrelevant in the acquisitions of these skills and investment in such training is not warranted.

The earning paths of those employed in either of three types of firm - Filipino, Chinese, American varied, with the earnings path of those employed in American firms above that of those employed in Filipino firms. The earnings path of the employed in Chinese is lowest. Such variation is well known in the market and workers have responded to these. They show a strong preference for working for American companies. On the other hand, this phenomenon has not been explained. Assuming firms of all nationality are rational , why do some companies adopt a policy of paying higher than the market wage rates for seemingly the same types of labor?

Wage Policy

Marginal productivity theory assumes that the productivity of labor is constant. But one reads in personnel

management that the attitude of workers to the company, their expectations about company protection in cases of sickness, accident, and fluctuation in demand and the congeniality of management-labor relations, influence the productivity of workers. Some companies adopt policies that enhance productivity through voluntary efforts of workers who are happy on their jobs. A higher than market wage usually makes the employees of a firm loyal and well-motivated. Other companies may elicit high productivity through more intensive supervision. In small firms with relatively less costly supervisors, enhancing productivity through supervision may be the optimal personnel policy. In large firms where supervisory wages are high, self-motivated (less supervised) workers may be the less costly process. On the other hand, large firms which pay higher wage rates may be more selective. The higher than market wage rates they pay are possibly commensurate to the productivity of workers they hire even if they are classified as belonging to the same skill and age category.

Net Returns to On-the-Job and Formal Vocational Training in Various Skills

The returns to the two forms of acquiring training - purely on the job and formal vocational training - in various skills were estimated from the earnings path and the cost of training. Assuming that entry into the labor market by those going into sub-professional categories takes place at age 16, the net present values, NW, were estimated as in equation (2):

$$NW_{if} = \sum_{t=A-16}^{65} (W_{ift} - C_{ift})R^{-t}$$

$$NW_{ij} = \sum_{t=A-16}^{65} (W_{ijt} - C_{ijt})R^{-t}$$

$$\vdots \qquad \vdots$$

$$NW_{mf} = \sum_{t=A-16}^{65} (W_{mft} - C_{mft})R^{-t}$$

$$NW_{mj} = \sum_{t=A-16}^{65} (W_{mjt} - C_{mjt})R^{-t}$$

where W is wage at time t from age A-16; vocational training obtained formally in vocational schools f; or non-formally on the job, j; C is the cost of training. The cost data were obtained from the average per student-year cost of

vocational training in public and a few private schools. Please see Appendix A for the sources and estimation of cost. The expected wage rate at each age were estimated under different assumptions.

The estimated present values of the alternative media and skills are given in Table 2 below.

The computed present values of formal vocational training for mechanics, electrical workers and fitter-machinists are higher than those of on-the-job training. This supports our earlier findings about the earnings paths of the said skills, i.e., the earnings paths of those with formal training are always above the paths of those without. Now considering the other skilled workers like sewers, spinners, weavers and machine-tool operators, their respective present values of training are lower than those of on-the-job training. All but sewers exhibit the same pattern.

The distribution of skills in different types of training is given in Table 3. Most of the workers except mechanics and fitter-machinists depended on non-formal training. This may be partly explained by the net worth from formal training. The net worth of purely learning on-the-job for sewers, weavers, spinners, and machine-tool operators is higher than the net worth of formal training. Fifty nine (59) per cent of those without formal training in these skills had their training purely on the job. In contrast, 47% of fitter-

Table 2

PRESENT VALUES OF ALTERNATIVE MEDIA IN SKILLS CREATION

Skill	At 8% discount rate		At 10% discount rate		At 15% discount rate	
	Voc. training	On-the-job	Voc. training	On-the-job	Voc. training	On-the-job
Sewers	24330.45	30855.01	19496.45	25174.13	12071.70	16889.60
Spinners	16657.00	26096.74	13763.38	21101.31	9071.28	14133.03
Weavers	13662.59	23865.89	11529.83	19055.21	5195.22	12161.93
Mechanics	31667.15	30261.00	24831.64	23704.55	14507.51	13966.16
Electrical & Electronics Workers	37806.25	36926.11	30151.85	30129.87	18534.80	19886.55
Fitter-Machinists	31679.62	31105.86	25441.47	25516.49	16284.00	16665.55
Machine tool operators	16680.41	29259.64	13522.85	23091.94	8306.49	15280.70

machinists and mechanics had vocational training in the same line of work. The case for electricians does not exhibit this pattern. Those who had vocational training in own field is only 14% while 40% had purely on-the-job training.

Table 3

FREQUENCY AND PERCENTAGE DISTRIBUTION OF SKILLS IN DIFFERENT TYPES OF TRAINING

Occupation	Formal Training (Same skill)	Formal Training (Other Fields)	Purely On-the-Job	Training at Home	Tota
Electricians	36 (14.46)	58 (23.29)	99 (39.76)	56 (22.49)	249
Mechanics	80 (59.26)	5 (3.70)	22 (16.30)	28 (20.74)	135
Sewers	57 (22.09)	27 (10.47)	171 (66.28)	3 (1.16)	258
Weavers	13 (5.04)	15 (5.81)	163 (63.18)	-	191
Fitter-Machinists	56 (35.22)	5 (3.14)	39 (24.53)	59 (37.11)	159
Machine-tool Operators	16 (10.26)	16 (10.26)	40 (25.64)	84 (53.85)	156
Spinners	8 (3.23)	34 (13.71)	200 (80.64)	6 (2.42)	248

Returns to Different Levels of General Education

It has been argued not too infrequently that the more important preparation for entry into the various occupation is good general education, not formal vocational education. General education is taken to make a new entrant into the labor market easily trainable, an attribute required of most production workers. Formal vocational training tends to be directed to specific jobs. Matching of skills preparation and job requirement is assumed to take place. If this happens through time then the skills preparation is likely to pay off. However, workers with specific training will tend to suffer more from labor displacements than those without specific training who are deemed to be more flexible as far as their job placement is concerned. At the same time the more general education a laborer has, the higher is supposed to be his productivity if for no other reason than that he is capable of following more intricate instructions. We may expect also that the rate of acquisition of skill competence is faster the more general education it has. Hence the earnings path will tend to be steeper in the early ages for those with higher levels of general education relative to those with lower education.

Figure 12

Earnings Paths For Garment and Textile Workers
By Level of General Education

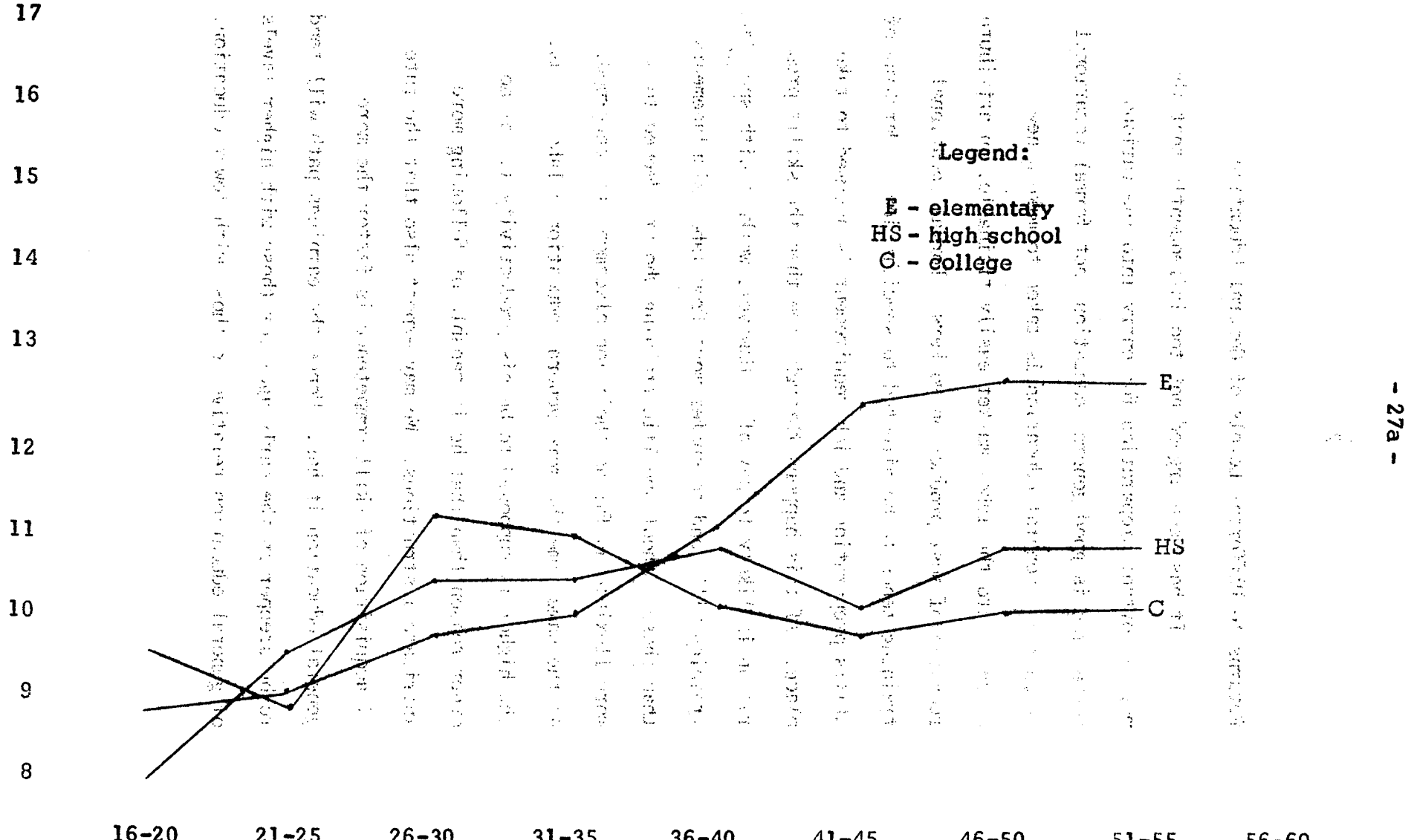


Figure 13

Earnings Paths For Weavers By
Level of General Education

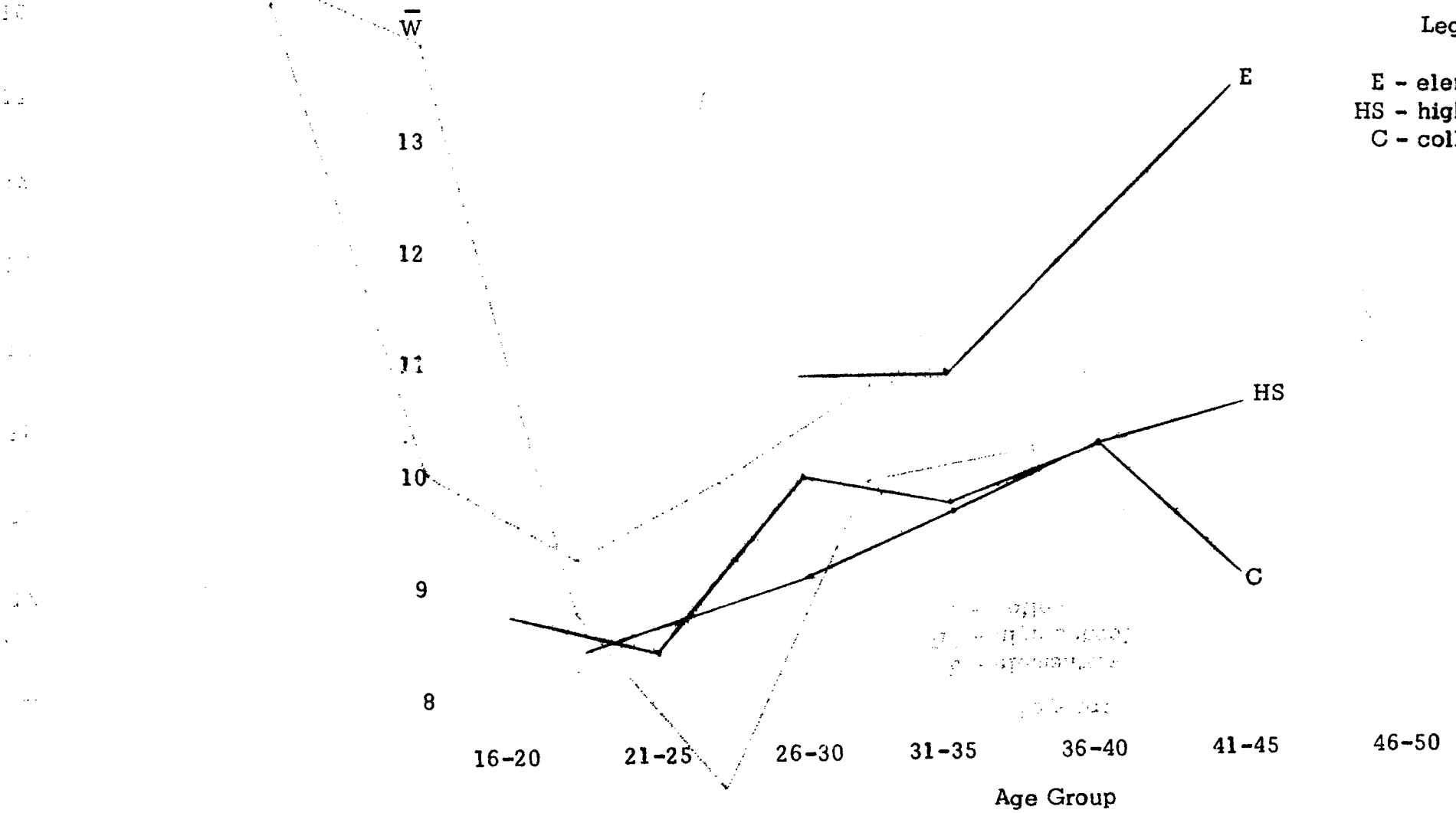
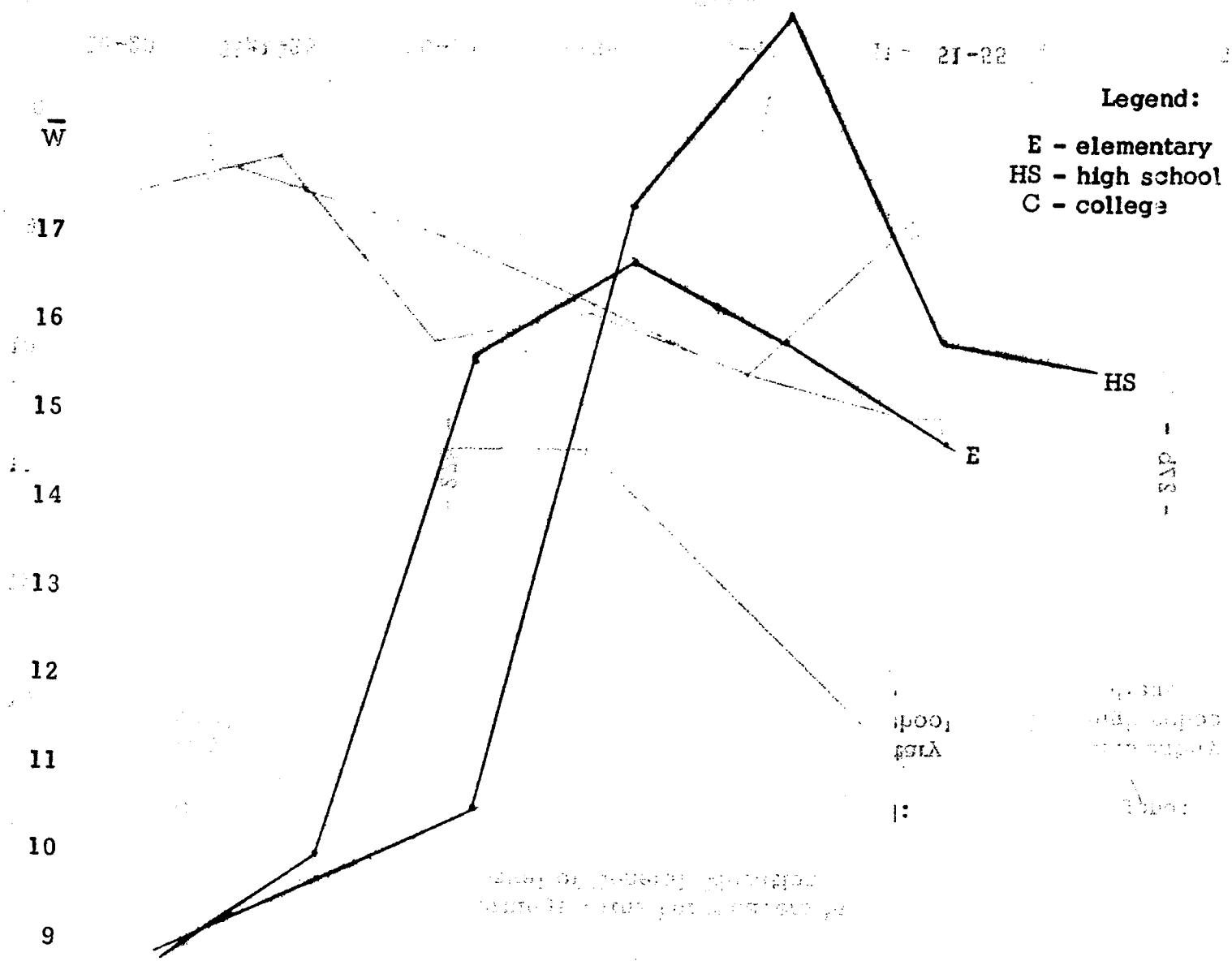


Figure 14
Earnings Paths For Fitter-Machinists
By Level of General Education



Earnings Paths For Machine-tool Operators
By Level of General Education

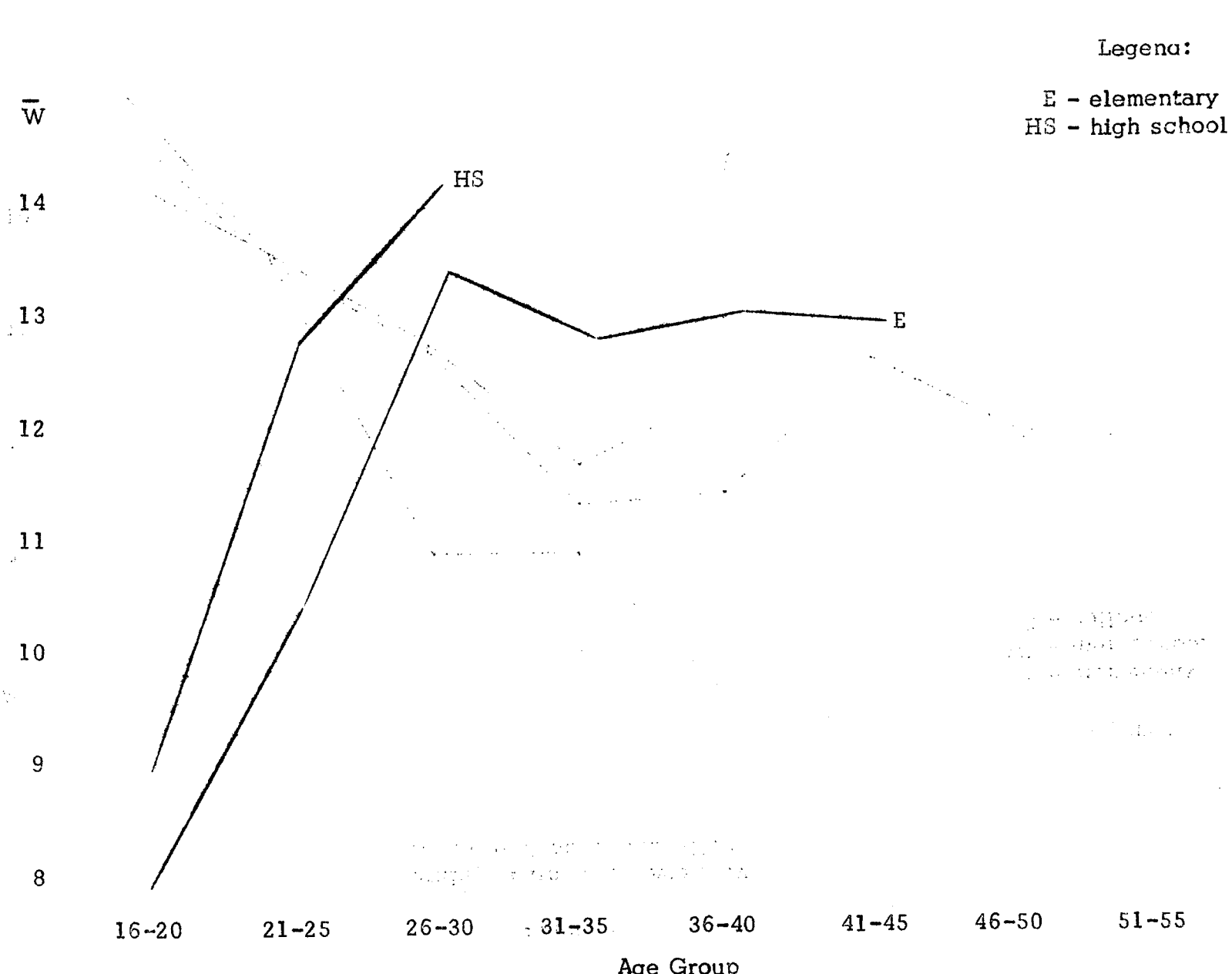
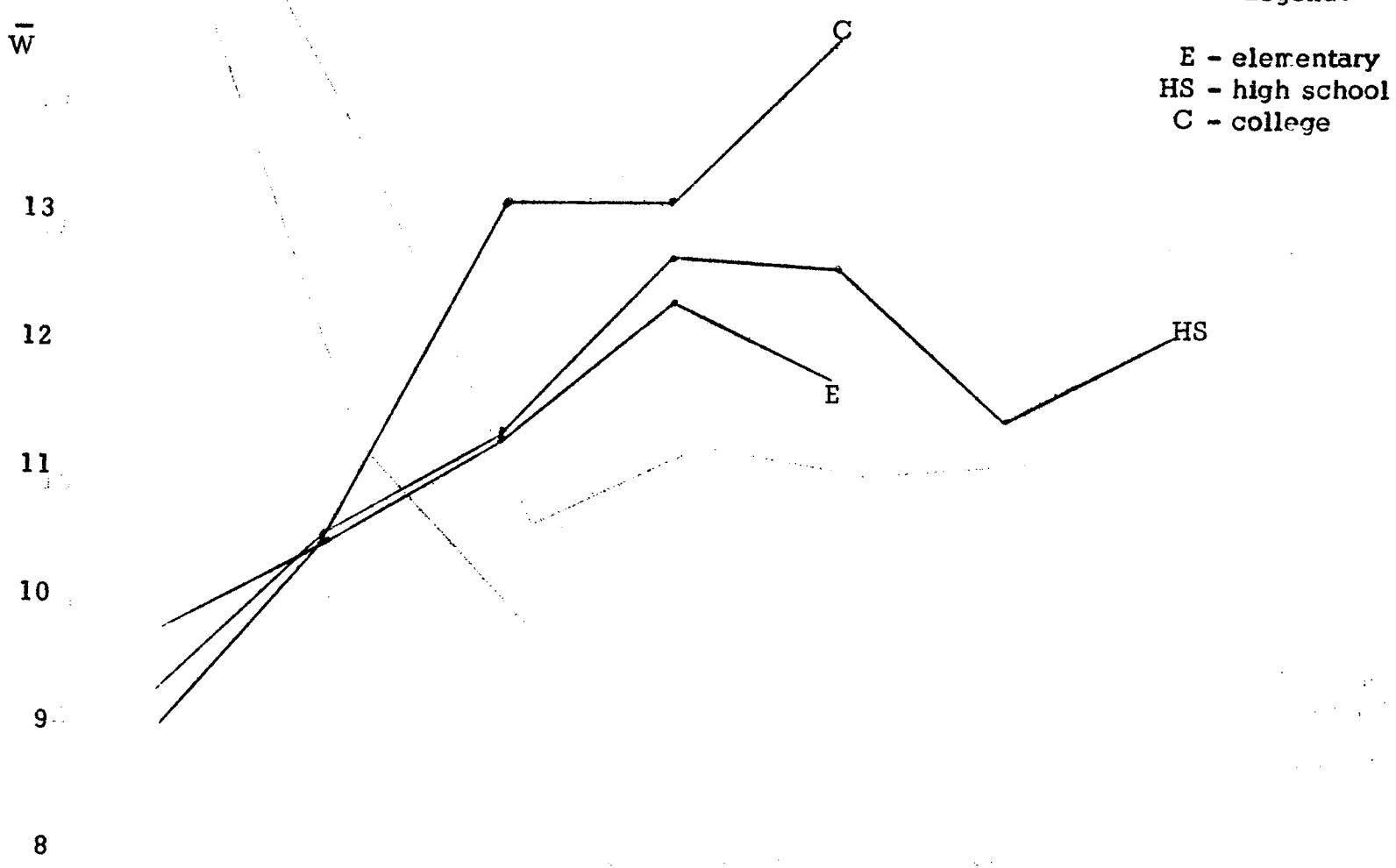


Figure 16

Earnings Paths For Sewers By Level of General Education



Earnings Paths For Spinners By
Level of General Education

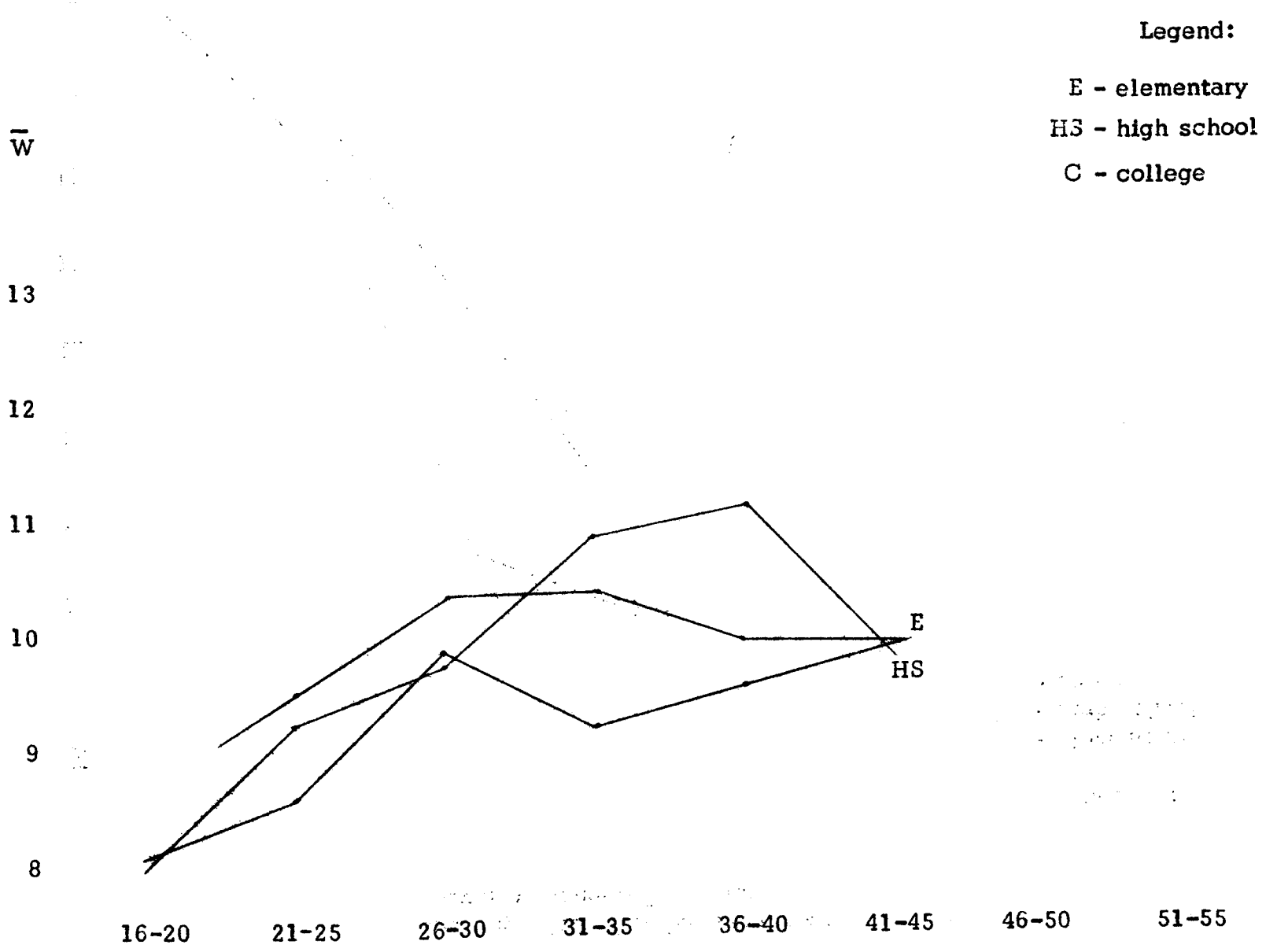
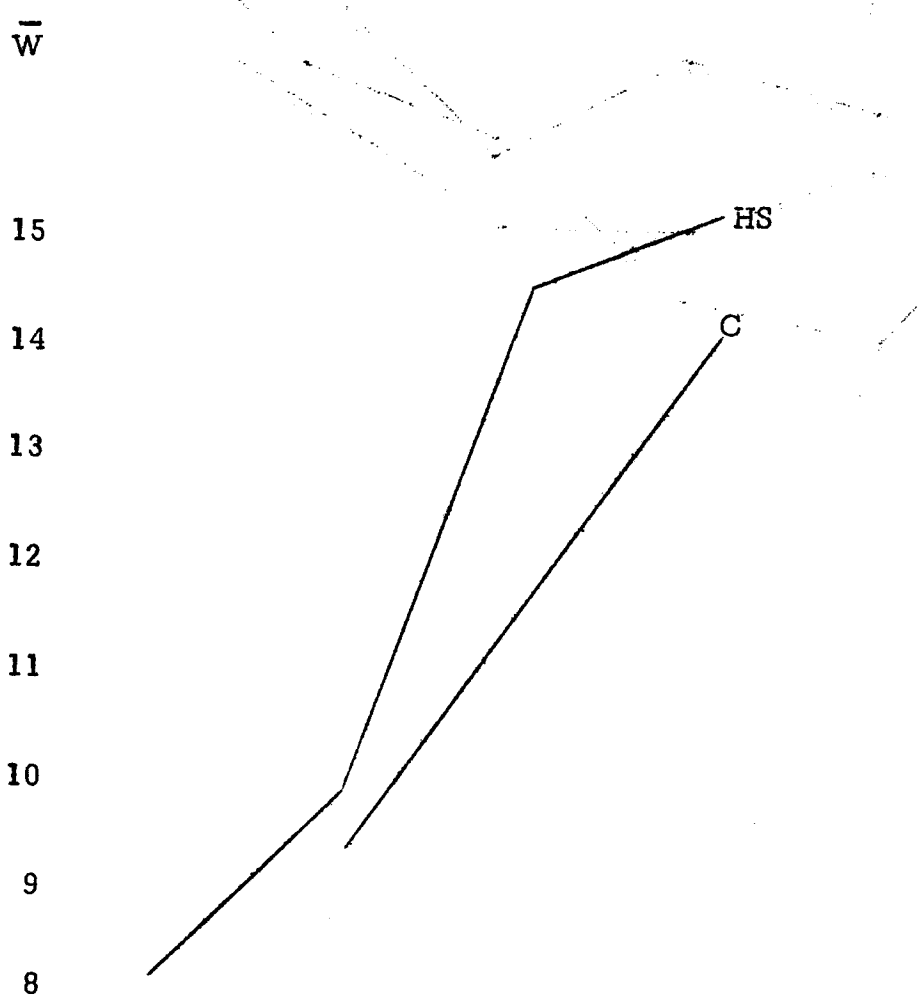


Figure 18

Earnings Paths For Machanics By
Level of General Education



Legend:

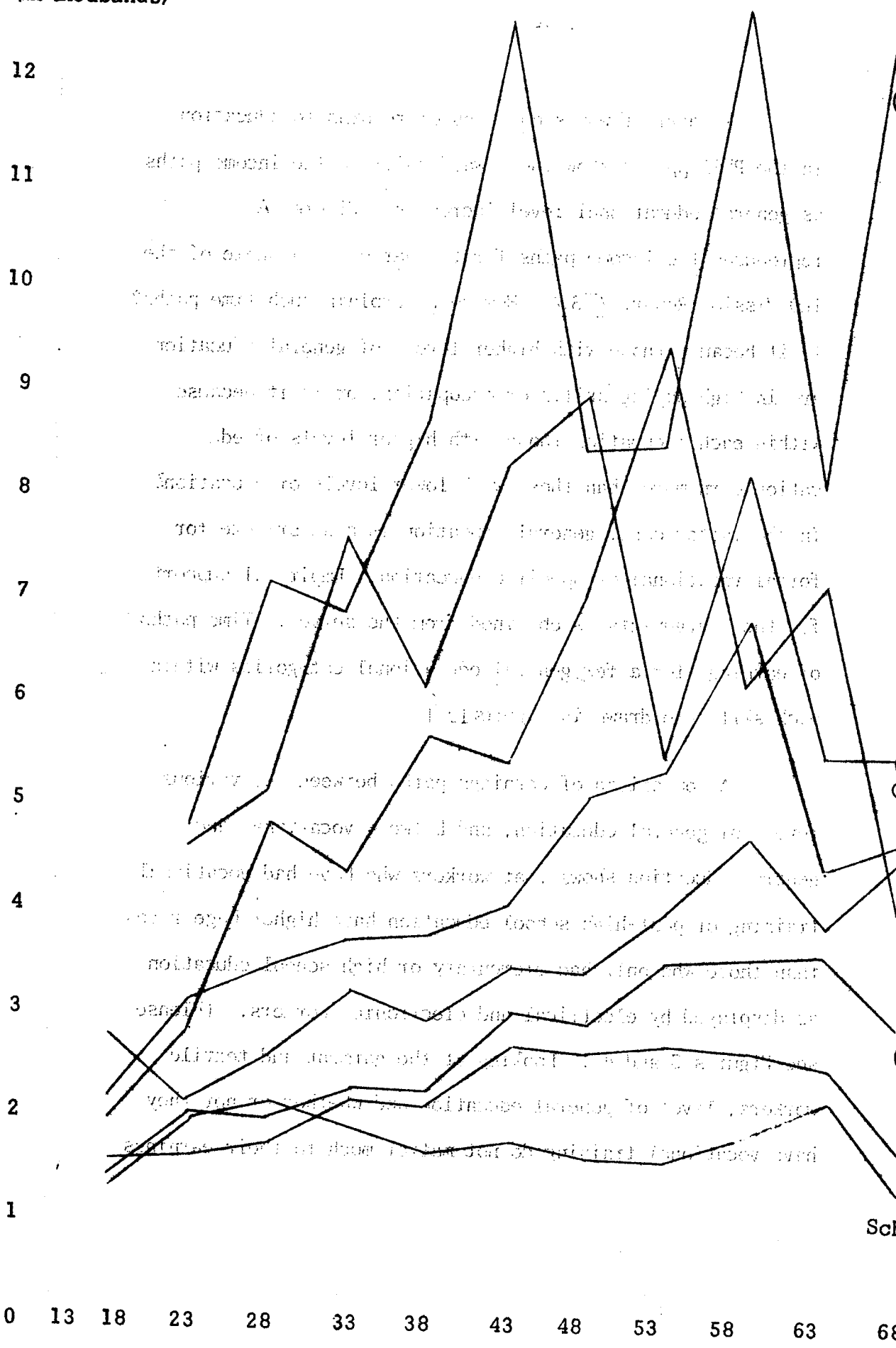
E - elementary
HS - high school
C - college

In earlier works on rates of returns to education in the Philippines show the upward shift in the income paths as general educational level increases. Figure A reproduces the income paths for the nation as a whole of the ILO-Mission Report [37]. How do we explain such time paths? Is it because those with higher levels of general education are in high paying skills or occupation, or is it because within each occupation those with higher levels of education earn more than those with lower levels of education? In the latter case, general education is a substitute for formal vocational or specific education. Empirical support for these arguments is obtained from the survey. Time paths of earnings for a few general educational categories within each skill are drawn in Figures 12-18.

A comparison of earnings paths between the various levels of general education, and between vocational and general education shows that workers who have had vocational training or post-high school education have higher wage rates than those who only had elementary or high school education as displayed by electrical and electronics workers. (Please see Figures 3 and 4). Looking at the garment and textile workers, level of general education and whether or not they have vocational training do not matter much to their earnings.

Figure A

ANNUAL FAMILY INCOME BY AGE AND EDUCATION, 1971



paths. There is no clear-cut pattern as to which earnings path is higher.

It is to be noted that those with vocational training have had also more general education. The reader is referred to the multiple regression analysis in the next chapter to see the effect of each variable on earnings. This cannot be meaningfully shown in the chart where mean earnings for so many small groupings have to be computed.

Chapter III

EMPIRICAL ANALYSIS

Equation 8 of Chapter I is fitted to data grouped by skills. To recall equation (8) is as follows:

$$W = a + B_1A + B_2E + B_{3j}V_j + B_{4j}F_j + u \quad (8)$$

The observations were for eight (8) selected skills (the list is given on page 17 Chapter I): A is age; E is general educational attainment which is given in number of years of schooling; W is daily wage rate. Dummy values for types of training and for firm ownership were used. These variables are coded as follows:

Training, V_j

1 formal training within the occupational skill

2 formal training outside the occupational skill

3 informal training

4 zero training (brought to the job)

Firm ownership, F_j

1 for Filipino

2 for American

3 for Chinese

Using these dummy variables, the regression equation fitted takes the following form:

$$W = a + b_1A + b_2E + b_{31}V_1 + b_{32}V_2 + b_{33}V_3 + b_{42}F_2 + b_{43}F_3 + u \quad (9)$$

with V_4 and F_1 taking the values of zero.

The regression results are given below in Tables 4, 5, and 6. Some variables have zero observations such as for firm ownership and skill training outside the samples occupation. These variables were omitted in the regression. Also we wanted to enter some of the variables step-wise in order to see their contribution to the $\bar{R}^2$. Thus we have several regression sets, the first of these usesonly some of the independent variables, instead of a set using all the variables as in equation (9).

The objective of this study is to see to what extent formal vocational training influences worker productivity, hence, his wage rate. Moreover, we want to see to what extent the influence of formal vocational training varies between skills. We hypothesized that the influence of vocational training would vary between skill categories; it would be strongest in skills which are more efficiently

provided in formal than on the job training or informally through the family. Since there are no a priori knowledge of which skills are best provided in which medium of training, such information has to be deduced from fact. The study hopes to provide this. Once we are able to identify the medium of training for each skill, we might try to see a pattern and make some tentative generalizations as to how the nature of the skill, the production process it is used and the size of market determine the pattern of skill formation.

Regression Results

The regression results are given in Tables 4, 5 and 6. In general, the coefficients of our variables are significant at 5% level. In Table 4 where we used the three main independent variables on which all skills have observations, the values of the b's can be compared.

Table 4 includes two regression equations:

$$W = a + b_1 A + b_{31} V_1 + u \qquad (9.1)$$

$$*W = a + b_1 A + b_{31} V_1 + b_{32} V_2 + u \qquad (9.2)$$

---

* Equation (2) cannot be fitted for all skills as the samples for some skills do not have observations for variable V_2.

Table 4

Regression Coefficients of Variables A, V_1 and V_2 For Eight Skills

Variables	Weavers	Electricians	Machine-Tool Operators	Fitter-Machinists	Construction Workers	Mechanics	Sewers	Garment Workers*
A	0.113	0.483	0.210	0.348	0.162	0.377	0.087	0.114
V_1	0.326	4.052	-0.028	2.006	6.169	1.522	-0.072	0.086
V_2	0.986	2.094	---	---	---	---	---	---
K	2.627	0.788	5.311	2.562	7.359	1.430	8.236	6.820
F	41.739	14.946	14.422	28.822	17.211	108.284	10.892	111.461
R^2	0.0652	0.145	0.164	0.281	0.137	0.319	0.077	0.116

*Please Note Garment Workers include sewers.

Table 5

Regression Coefficients of Variables A, V_1, V_2 and E For Eight Skills

Variables	Weavers	Electricians	Machine-Tool Operators	Fitter-Machinists	Construction Workers	Mechanics	Sewers	Garment Workers*
A	0.103	0.455	0.207	0.347	0.162	0.363	0.087	0.105
V_1	0.077	-2.938	0.216	2.385	6.186	1.244	-0.125	0.298
V_2	-0.262	-0.305	---	---	---	---	---	0.874
E	0.098	-0.906	0.124	0.205	0.007	-0.103	-0.022	-0.024
K	3.207	4.035	4.976	1.878	7.331	2.306	8.317	7.103
F	36.246	12.452	9.680	19.376	11.421	77.573	6.912	27.472
R^2	0.145	0.174	0.165	0.284	0.137	0.335	0.077	0.116

*Please Note Garment Workers include sewers.

Table 6

Regression Coefficients of Variables A_1, V_1, V_2, E, F_2 and F_3 For Three Skills

Variables	Weavers	Fitter-Machinists	Garment Workers
A	0.116	0.342	0.109
V_1	0.490	2.356	0.407
V_2	0.640	---	0.473
E	---	0.199	-0.053
F_2	0.236	1.972	0.189
F_3	-1.378	-0.059	-1.406
K	6.940	2.060	7.417
F	39.986	11.575	30.917
R^2	0.191	0.286	0.182

Looking at the regression coefficients of V_1 obtained the b_3's of construction workers, electrical workers, fitter-machinists and mechanics exhibit the highest values; 6.17, 4.05, 2.01 and 1.52 respectively. These results are in accordance with our previous findings about the estimated present values of vocational training for the abovementioned skills. For the rest of the skills like weavers, sewers, fitter-machinists and machine-tool operators, insignificant b_{31}'s were obtained. Since a higher value of b_{31} would mean a higher income considering the other independent variables constant, we can conclude that our two findings agree with each other. Now, if we consider the age factor, the same pattern of coefficients is shown, i.e., electrical workers, mechanics and fitter-machinists show higher coefficients than the second group.

If we take the regression in different skills into account, say for electrical workers, we could observe that the coefficient of V_1 is higher than that of V_2. This behavior is as expected where formal training in the same skill for electricians exhibits a greater contribution to their daily income than vocational training outside their field. Table 1 shows the coefficients of V_1 and V_2: 4.052 and 2.09475 respectively. The contribution of V_1 to

the dependent variable (income) is almost 100% higher than V_2. For weavers, the computed regression coefficients for V_1 and V_2 are 0.326 and 0.986 respectively. There is a relatively higher contribution to the regression of the variable V_2 than of V_1. In our earlier findings, it seems that formal training for weavers is not warranted since the rate of return is higher for on-the-job training. Using regression analysis, the same observation is deduced since only a very small contribution of the coefficients to income is exhibited. Generalizing, the less important is formal training, the less specific it is and therefore the higher the coefficient for unrelated training. This is well exemplified by b_{31} and b_{32} of weavers. We may also say that the skill is easily substituted by other skills to fill the given job.

An entry of a fourth variable E or number of years of general education in the regression (please see Table 5) does not contribute much to income, in fact in most skills like mechanics, sewers and other garment workers, a negative effect is demonstrated, hence we could deduce that variable E is not an

important variable in determining the estimated income of a respondent in a particular skill. If the factor of ownership is introduced in the regression, opposite effects are charaterized by Chinese-owned and American-owned firms. While the former has a negative effect on the regression, the latter has a positive effect. (Please refer to Table 6). This implies that workers of American-owned firms tend to have a higher income than those working in Chinese-owned establishments, everything else given. Again, comparing our results in the regression with the previous ones using charts, they certainly complement each other.

Mechanics show the highest coefficient of determination (R^2) in all the regression done. For the model $W = a + b_1A + b_{31}V_1 + u$ 31.9% of the variability of the dependent variable (daily wage rate) can be explained by the independent variables (age and vocational training within the same skill), while for $W = a + b_1A + b_{31}V_1 + b_2E + u$ 33.5% is explained by A, V_1 and E (number of years in school). The computed F-values of all the regressions done in Tables 4, 5 and 6 are highly significant

at0.01 level. This means that the regression coefficients in each regression significantly deviate from zero.

3. The Present Value of Formal Training in Same Skill.

From the regression equation

$$W = a + b_1 A + b_{31} V_1 + b_{32} V_2 + u$$

we estimated the earnings path of those with zero and without formal training for six skills categories. The net worth of the estimated earnings over the working life net of cost of training were calculated using three alternative discount rates: 8 per cent, 10 per cent and 15 per cent. At 15 per cent discount rate, the net worths of formal training are very much higher than on the job training for electricians, mechanicsand fitter machinists; and they are less than those on the job training for machine tool operators and sewers. For weavers there was minimal difference of P261 in the net-worth of the two alternative training media.

These figures as well as the values of the coefficients of V bring in bold relief the effectiveness of alternative forms of training.

4. Where training was obtained

The preceding sections estimated the contribution to productivity of alternative sources of training in each of our skill categories. As expected significant variation in the coefficients of formal vocational training is observed implying variation in returns to training. Now we want to see whether workers' choice of training media is determined by their relative returns.

Table 3 provides the distribution of workers by source of training. If workers were making rational decision of where to obtain training, and assuming that there were no financial and information constraints on their choice, they would tend to choose the training medium that gives the highest returns. We would therefore expect that relatively more workers would have had formal training in skills where the b_{31} (the coefficient of formal training) to be highest. From Table 3 fitter machinists and mechanics behaved as expected. Electricians and construction workers did not rely on formal training though its returns were high. The other skills behaved also as expected where they trained on the job as formal training

gave them poor returns.)

The table is interesting by itself for showing that majority obtain their training non-formally. Outside fitter-machinists and mechanics, formal training in the related occupation was obtained by 11 per cent or less of skilled workers. Majority learned on the job or at home.

5. Non-Linear Regression Equation

A common observation is that the age aarnings path is non-linear. We tested equation 9.1 and 9.2 in non-linear form, and an equation which include V_3, training obtained at home: $W = a + b_1 \log A + b_2E + b_{31}V_1 + b_{32}V_2 + b_{33}V_3 + b_{42}F_2 + b_{43}F_3 + u$.

In almost all skills where regressions using log of A are done, no distinct change in the coefficients of V_1 and V_2 is observable when compared to the betas using the actual values of A. However, the coefficient of determination (R^2) in most skills are larger than the R^2s obtained in linear form. As t and F variables are added. R^2 increased but the regression coefficients of the first variables entered, A and V_1, changed only slightly.

The earlier sets of regression did not include V_3, skills learned at home. A substantial number of workers in four skills: machine-tool operators, electricians, mechanics and fitter-machinists, were trained informally at home. The results are given in Table 8. The inclusion of V_3 increased the value of R^2. The coefficient of V_3 is significant at 5% and 20% levels for electricians and mechanics respectively. The b_{31} and b_{33} of machine-tool operators are both insignificant though b_{33} is higher than b_{31}. For mechanics, however, the total contribution to income of V_1 is higher than that of V_3.

When variables F_2 and F_3 were introduced in the regression, the R^2s increased significantly for electricians and mechanics and slightly for fitter-machinists and machine-tool operators. For the first two skills R^2s were 54% and 35% respectively. On the part of machine-tool operators and fitter-machinists, there is an insignificant increase in b_{31} and b_{33} while among electricians, a marked increase in the coefficients is observed especially in b_{31}. Mechanics, on the other hand, exhibit opposite results.

The foregoing results show the very uneven effectiveness of the alternative training media on the formation of the selected skills.

Table 7

Regression Coefficients of Variables Log A, V_1, and V_2 For Eight Skills

Variables	Weavers	Sewers	Machine-tool Operators	Electrical Workers	Mechanics	Fitter-Machinists	Construction Workers	Garment Workers
log A (log of age)	3.435	6.589	10.875	31.491	17.211	15.295	15.025	10.191
V_1	0.262	-0.236	-0.219	4.162	3.210	2.594	5.965	0.193
V_2	0.077	0.142	---	1.575	---	---	---	3.336
K	4.534	1.230	-4.338	-31.450	-14.021	-9.017	-9.630	3.246
F	4.355	8.242	5.988	14.444	8.997	9.896	21.040	35.597
R^2	0.067	0.091	0.101	0.155	0.183	0.172	0.163	0.311

Table 8

Regression Coefficients of Variables Log A, V_1, V_2, V_3 and E For Four Skills

Variables	Machine-tool Operators	Electrician	Mechanics	Fitter-Machinists
Log A	10.758	30.073	17.316	15.394
V_1	0.002	2.831	4.23	3.063
V_2	---	-0.282	---	---
V_3	0.150	2.554	1.636	-0.048
E	0.103	-0.882	0.423	0.194
K	-4.235	-30.922	-13.001	-10.022
F	4.297	11.024	6.864	7.231
R^2	0.106	0.190	0.192	0.433

Table 9

Regression Coefficients of Variables Log A, V_1, V_2, V_3, F_2, F_3 and E For Four Skills

Variables	Machine-tool Operators	Mechanics	Fitter-Machinists	Electricians
log A	10.931	17.562	15.548	25.328
V_1	0.022	3.680	2.979	4.896
V_2	---	---	---	0.804
V_3	0.237	0.581	-0.268	2.802
F_2	---	6.569	2.200	10.846
F_3	0.942	-0.310	-1.185	2.994
E	0.097	0.615	0.198	-0.386
K	-4.900	-16.557	-9.526	-25.342
F	3.581	10.283	5.242	38.576
R^2	0.110	0.353	0.203	0.537

Table 10

NET PRESENT VALUES OF TRAINING IN DIFFERENT MEDIA AND SKILLS USING REGRESSION RESULTS

Skills	at 8% discount rate		at 10% discount rate		at 15% discount rate	
	With Vocational Training (same skill)	On-the-job Training	With Vocational Training (same skill)	On-the-job Training	With Vocational Training (same skill)	On-the-j Trainin
Electrical Workers	61,756.81	48,975.83	48,169.67	37,902.88	30,526.09	22,946.04
Mechanics	44,733.25	41,032.64	34,855.85	31,769.14	21,813.89	20,136.17
Fitter-Machinists	47,033.11	42,208.26	37,373.36	32,997.84	23,765.54	21,098.33
Weavers	34,076.02	34,337.58	27,909.18	28,074.39	17,742.58	18,465.30
Machine-tool Operators	37,705.11	38,594.59	29,145.11	30,759.68	18,960.37	20,345.21
Sewers	35,394.18	37,045.32	28,514.72	30,147.95	19,083.07	20,633.72
Construction Workers	61,474.64	41,157.01	49,477.79	33,115.60	33,365.41	22,290.93

Source: Table 4.

Chapter IV

SUMMARY, FINDINGS AND CONCLUSIONS

The study tried to identify the media for vocational skill formation in selected occupations and applied the cost-benefit analysis to the alternative media. The alternative media considered are V_1 formal training in a field related to current occupation, V_2 formal training in a field not related to current occupation, V_3 vocational training obtained in home-related activities, and V_4 no training brought to the job. The main hypothesis tested is that the alternative media of training are not equally effective for all skills. Formal training is a more efficient medium for some skills while on the job training is more effective for some other skills. But as stated earlier, there is no a priori basis for knowing which training medium is effective for which skills.

The basis for judging the relative effectiveness of the alternative media in acquiring each skill was the contribution to productivity, proxied in each skill by wage, of each medium of training. Earnings (wage) functions were tested on observations of employed workers grouped by skill category to obtain the productivity effect of training. The wage equation included age, training, general educational

attainment and firm characteristics as independent variables. The coefficients of the training alternatives: V_1, V_2, V_3 are interpreted as the contribution to the wage of each of these training medium.

As expected, the coefficients varied among skills. Formal training in own field is most important for construction workers, electricians, fitter-machinists and mechanics, and not important for machine-tool operators, weavers and sewers. The latter skills were best acquired on the job.

We also found that skills were to some extent substitutable. For weavers, machine-tool operators and spinners the contributions to productivity of skills in the same occupational field and those unrelated to the job were equal, or were equally unimportant. For these skills, formal training could be considered unnecessary. Their net worth was found negative.

The survey showed that except for mechanics and fitter-machinists most of the training was acquired either out of the occupation line or outside the formal system. Fifty four (54) and 37 per cent respectively of machine-tool operators and fitter-machinists acquired their skills informally through home activities.

The study covered a very small number of skills relative to the skills used in the economy. It also studied the employed workers in these skills so that the estimates of returns are based on their full-time employment through the working life. (The author decided not to use the reported unemployment in the survey since this was mainly based on recall.) The paper could very well be criticized for these weaknesses. Its value, however, lies with offering an empirical approach to understanding skill formation at the sub-professional level. We found that the survey was not difficult to undertake. It could easily be done as part of the planning exercise by agencies like the National Manpower and Youth council (NMYC). Such a study provides a basis for selecting the skills to be provided in training centers and those skills which could be assisted through informal channels such as the radio and other mass media. Such assistance is to complement training on the job and at home.

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Appendix A

SOURCE AND ESTIMATION OF COSTS

We used one cost figure for the formal training for different skills given in the 1973 ILO Report and inflated this to approximately ₱1,400 for 1975. This rise in cost of training was based on a rough estimate by comparing the 1975 tuition fees with that of 1973. We assumed training cost to be incurred at time zero at age just before entry into the labor force. We also assumed that foregone income is zero given that the training period takes place during the young age, when opportunity for wage employment is almost nil. If there is employment b low age 16, it would be mainly self-employment in home related activities which could be done simultaneously with training. Wage employment normally takes place at age 16 or older.

Appendix B

3. Earnings Paths Estimated from the Regression Results

The estimated earnings paths for different skills are plotted in Figures 1-12. Figures 1 and 2 show the income paths of fitter-machinists: the former includes age, A and vocational training in own field, V_1 as independent variable while the latter includes the same variables plus the addition of general education, E. In both graphs the earnings paths of workers with formal training within the same skill are above the paths of those without vocational training. The vertical differences of the two paths in the two figures are simply the regression coefficients of V_1 such that for Figure 1, 2.00643 units separate the two lines while for Figure 2, 2.38586 is the increment. There is an observable increase in the values of the b_{31} coefficients which can be explained by the addition of the third variable E. General education alone may

not significantly contribute to income but its entry to the regression effected the value of the coefficient of V_1.

Figure 3 characterizes the behavior of the earnings paths of electrical workers. The independent variables in the regression are A, V_1 and V_2. As expected, V_1 contributes more to income than V_2 does. There is an almost equal gradation of earnings paths of electrician without vocational training, with vocational training in the same field and with vocational training in other fields. As with fitter-machinists, the differences between WO and WVO and WO and WVS are the coefficients of V_1 and V_2 respectively.

The introduction of the variable F, firm ownership into the regression of garment workers and weavers (please see Figures 4 and 11) shows that income paths of workers in American-owned firms are way above those workers in Chinese-owned establishments. If we consider the income path of workers without vocational training as our base line, all income paths for Chinese-ownership are

below the others.(The difference between the base line and any income path for weavers and garment workers are the betas in Table 6`. Both skills display the same trend of earnings paths although weavers reveal slightly higher regression coefficients than garment workers do. The addition of variable E in the regression of garment workers seems to decrease the betas, although E is not in the least significant among the variables entered in the regression.

For the estimated earnings paths of machine-tool operators in Figures 5 and 6, there is a somewhat opposite behavior of the two lines - that of workers without vocational training and that of those with vocational training in the same field. In Figure 5, V_1's effect is negative such that income path of V_1 is lower than that of our base line. However, in Figure 6, the opposite phenomenon is presented. As E variable is entered in the regression for fitter-machinists, b_{31} increased although very slightly such that the effect of E could be ignored. Testing the effect of E separately would give us a non-significant t-value.

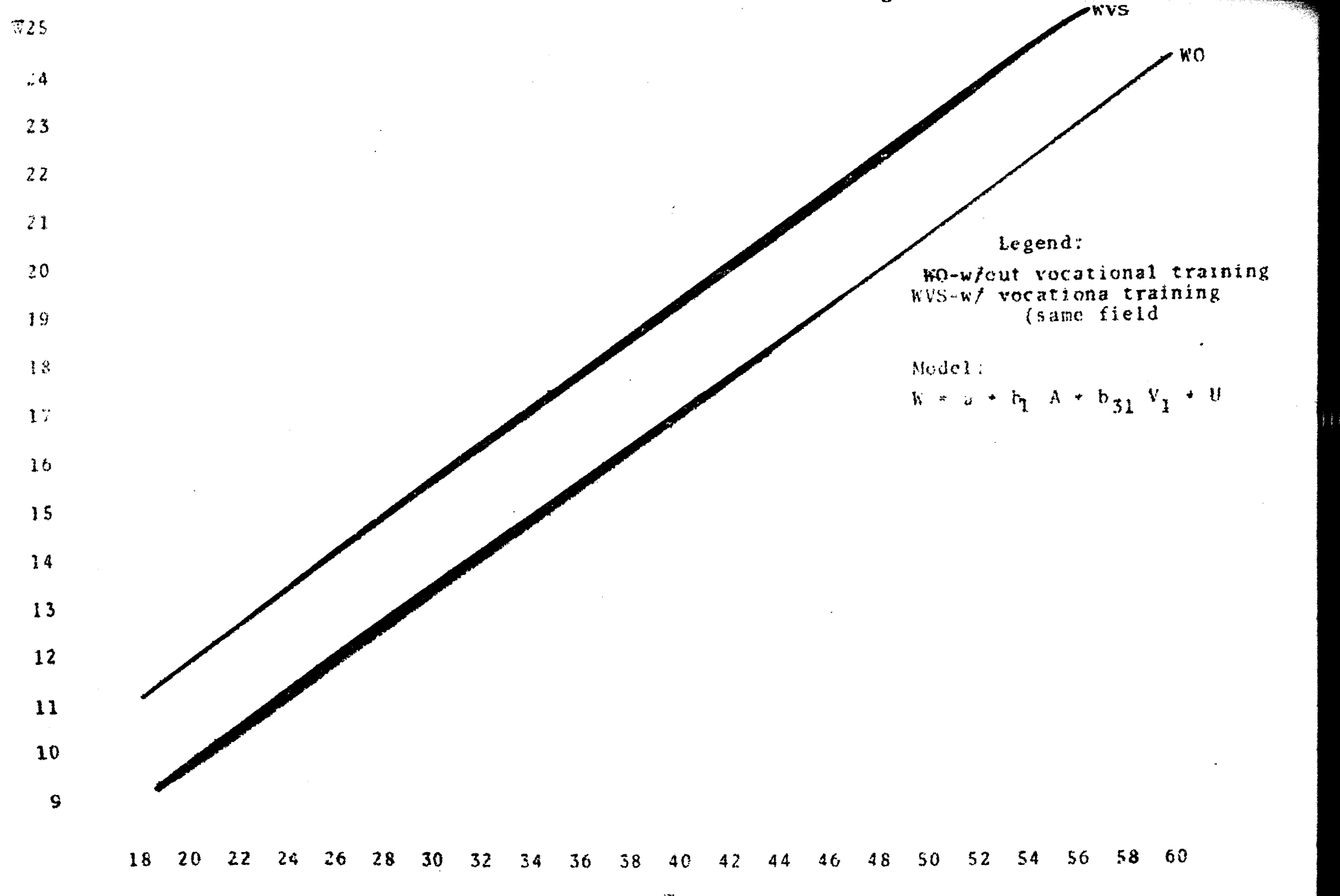
Appendix B-4

Figures 7 and 8 display the estimated earnings paths of mechanics with the former having A, V_1 and E as independent variables and the latter having A and V_1 only. In the two graphs, the income paths of those with vocational training in the same skill (V_1) are above those who had no vocational training. If we are to consider the entry of E in the regression in Figure 7, it could explain the b_{31}. There is a somewhat opposite effect of E for mechanics than either fitter-machinists or garment workers. While E increased b_3 in the latter, it decreased b_3 in mechanics. But this would not be enough basis to conclude that E has differing effects on different skills since by itself it is insignificant.

Sewers in Figures 9 and 10 show the same characteristics since their b_1's and b_{31}'s do not differ much. As displayed by mechanics, the addition of E (number of years of schooling) tended to decrease b_{31} in Figure 9. The vertical difference in W_0 and W_S in Figure 9 is -0.12521 while that in Figure 10 is -0.07234.

Appendix B-5

Figure 12 reveals that for weavers who have vocational training in other fields, a higher income path than for those who have formal training in the same field is to be expected. Both, however, must lie above the base line (income path of those who have no vocational training). The vertical differences between WO and WS (WS-WO) and between WO and WO (WO - WO) are b_{31}'s and b_{32}'s the regression coefficients of V_1 and V_2 respectively, i.e., 0.32608 and 0.98648.


25
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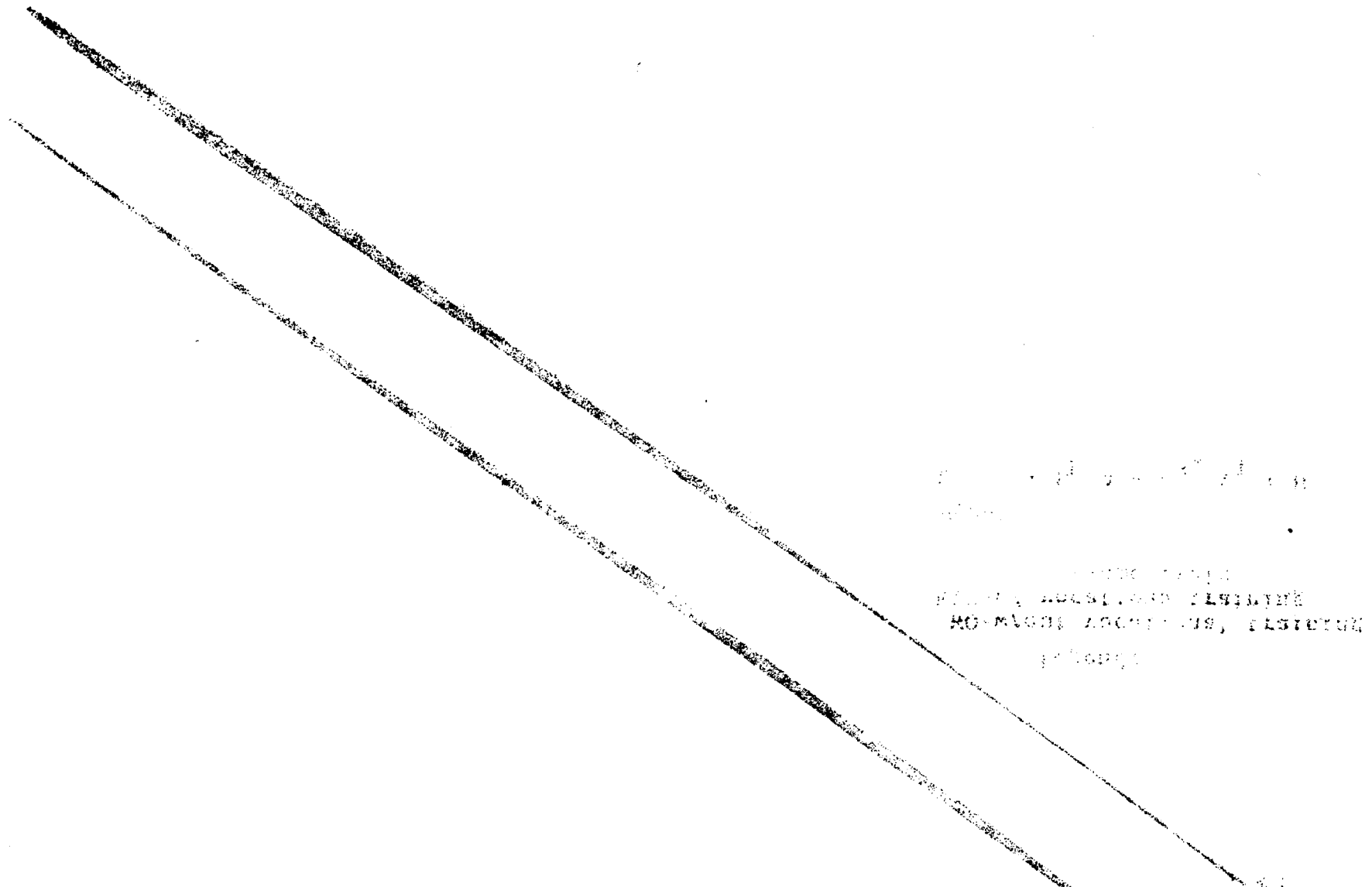
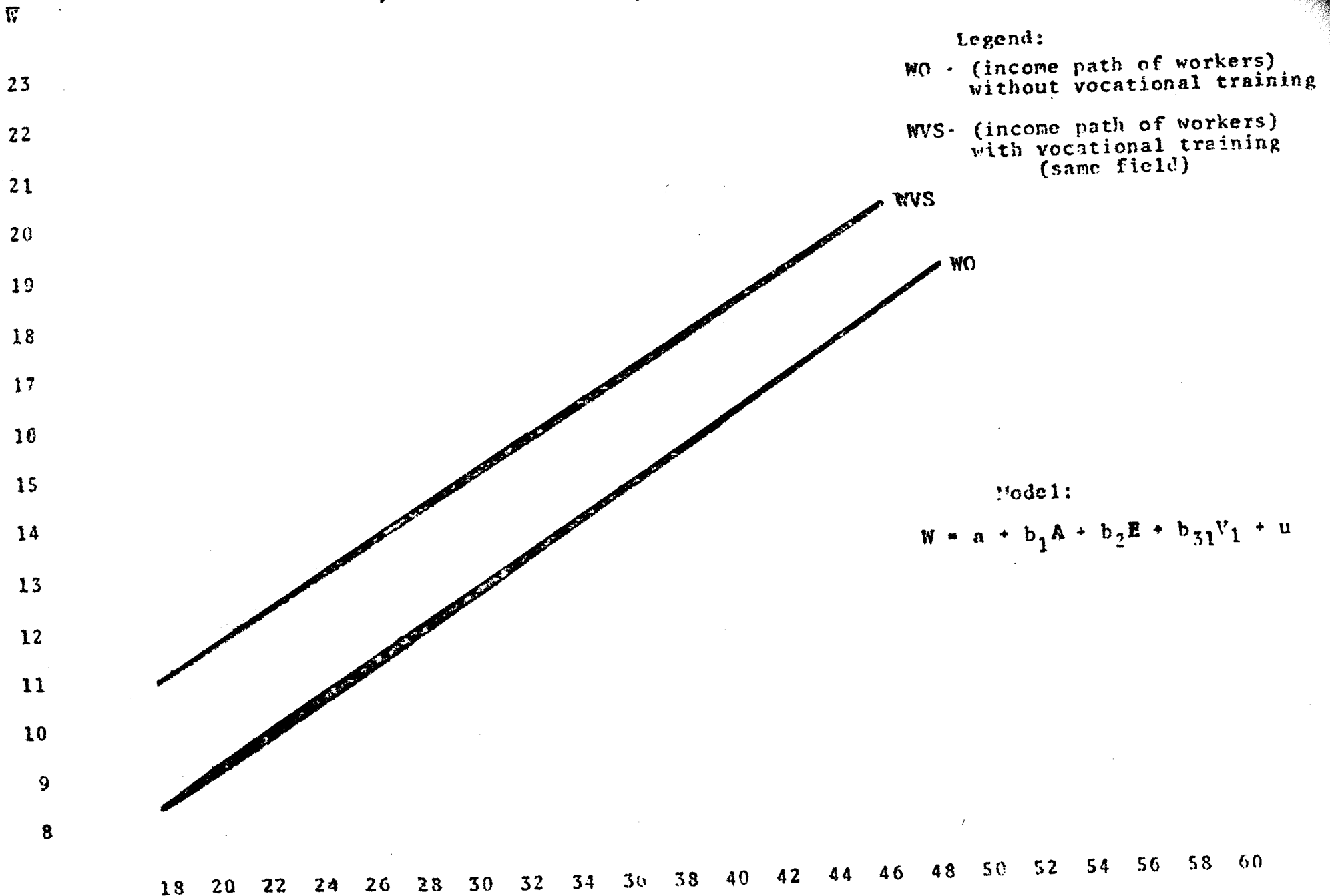
WVS
WO
Legend:
WO-w/out vocational training
WVS-w/ vocationa training
(same field
Model:
W = a + b1 A + b31 V1 + U
18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60



Estimated Income Paths of Persons Who Are
By Whether or Not They Have Vocational Training



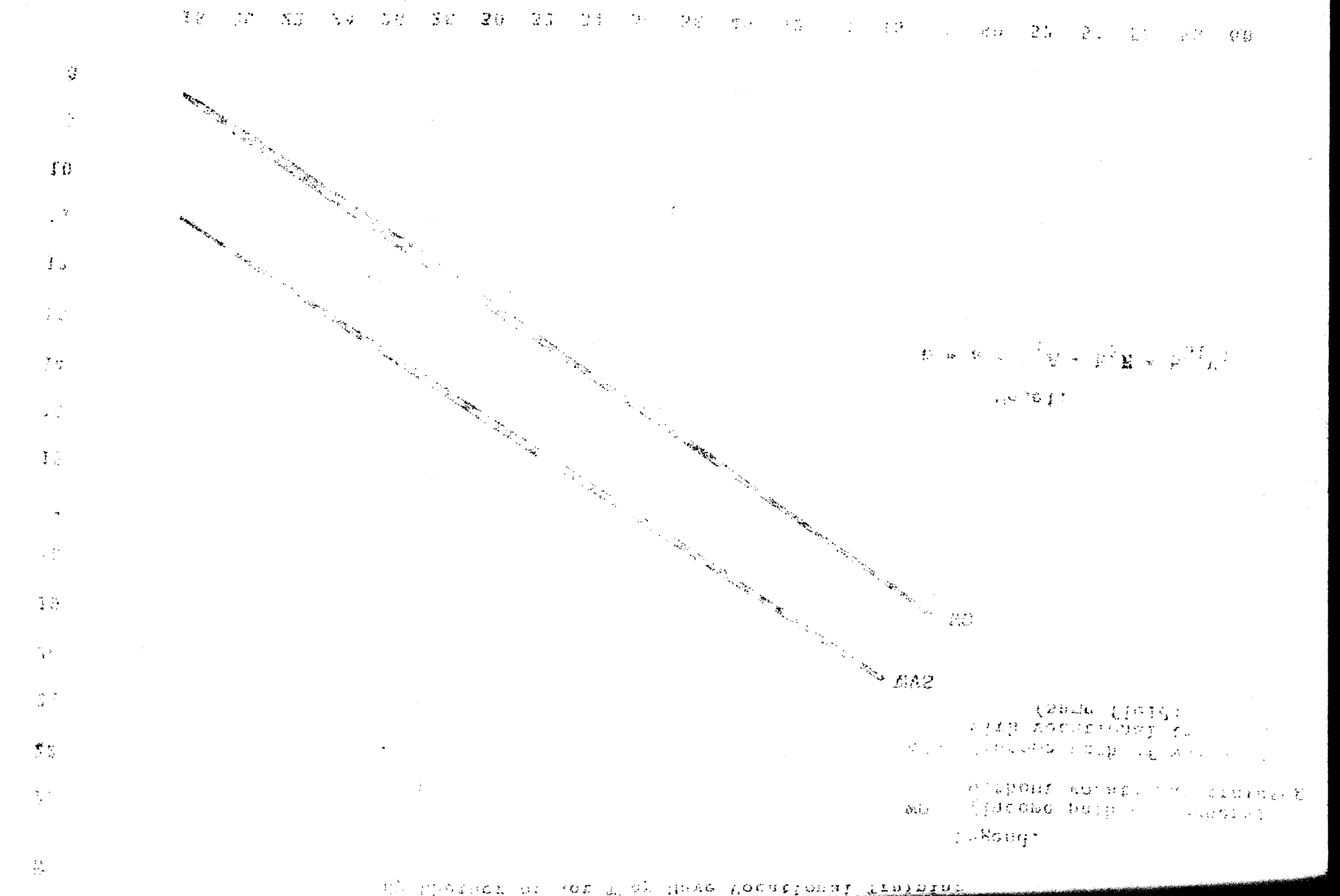
Legend:

WO - (income path of workers) without vocational training

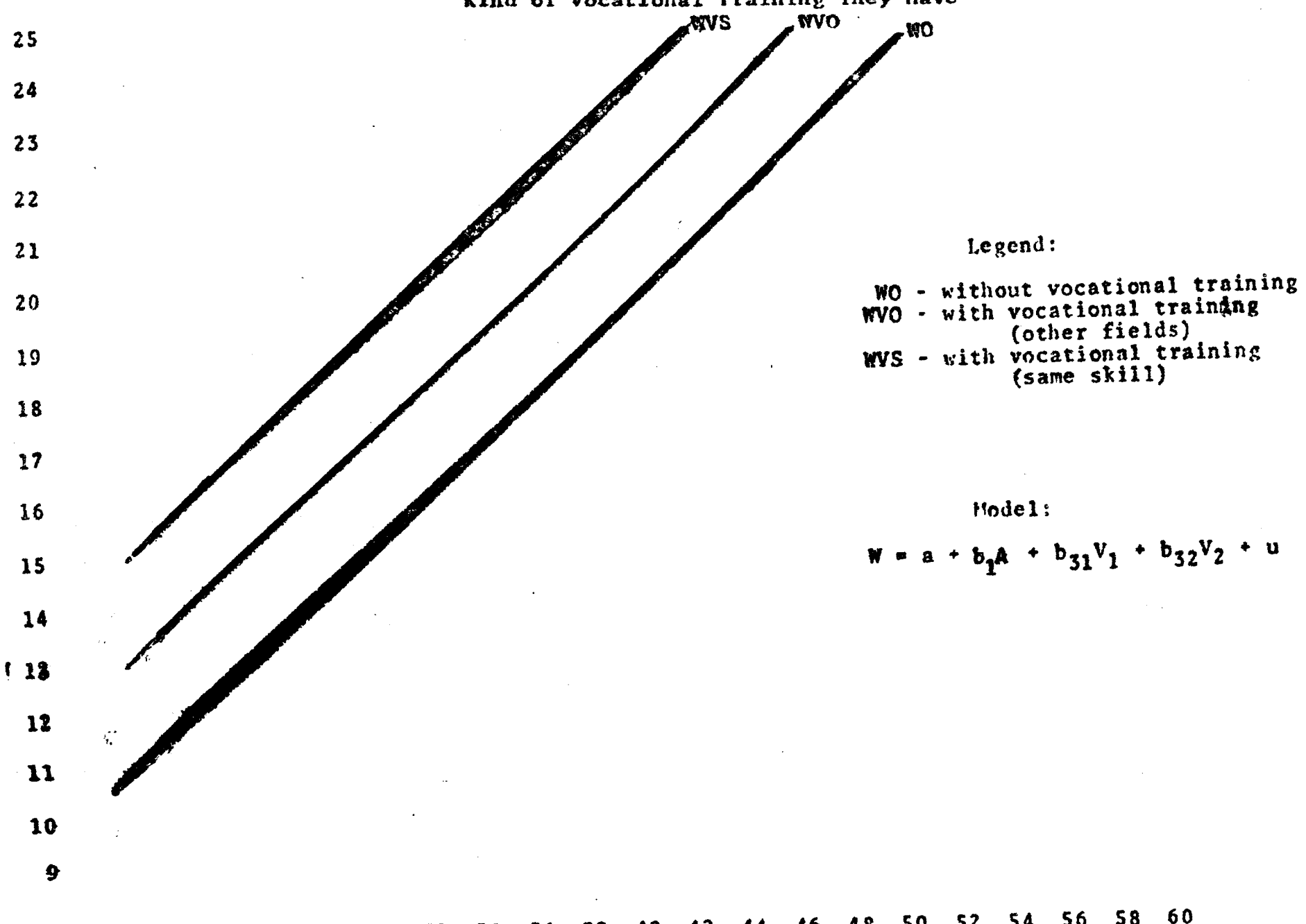
WVS- (income path of workers) with vocational training (same field)

Model:

$$W = a + b_1 A + b_2 E + b_{31} V_1 + u$$



kind of vocational training they have



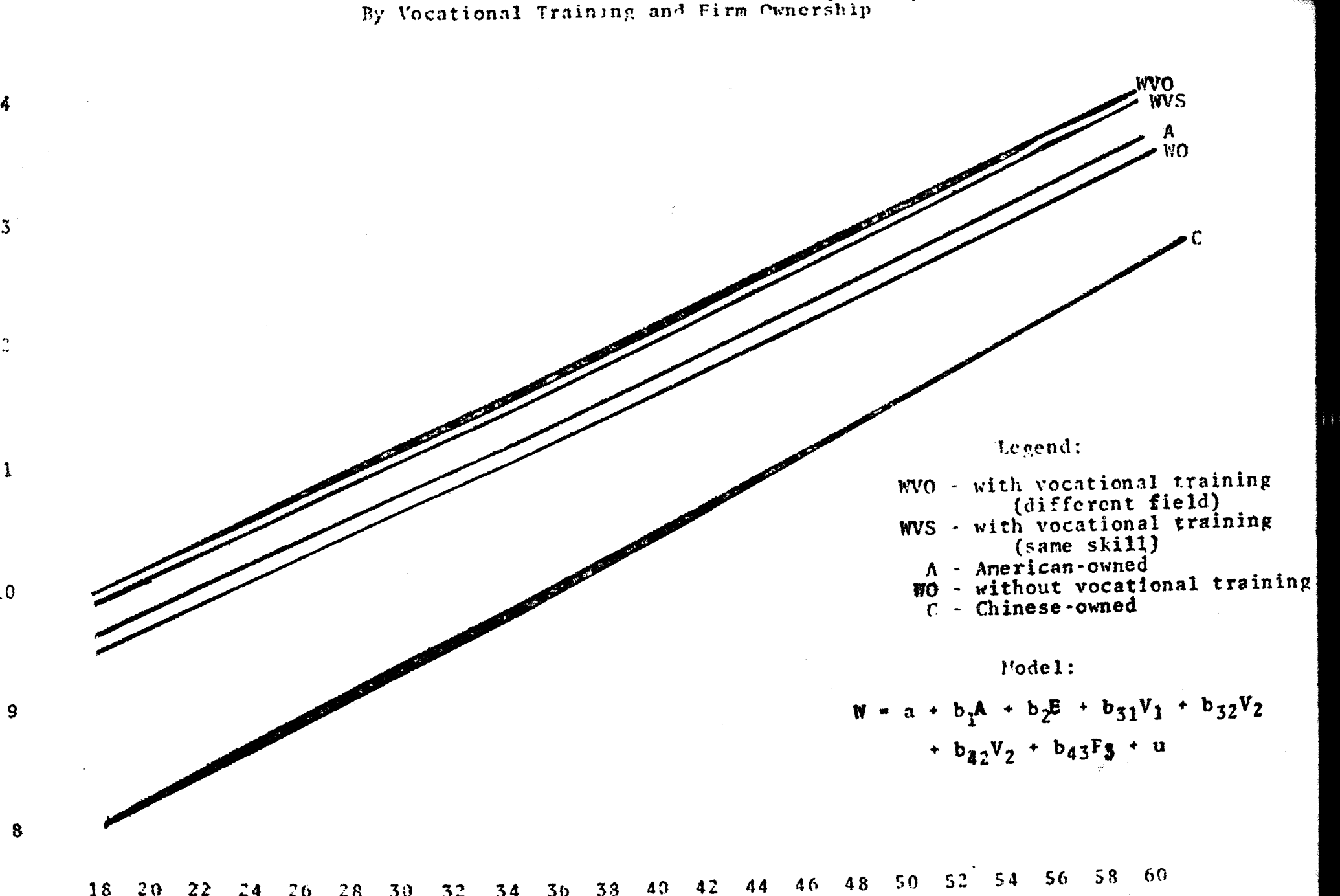
Legend:

WO - without vocational training
WVO - with vocational training (other fields)
WVS - with vocational training (same skill)

Model:

$$W = a + b_1 A + b_{31} V_1 + b_{32} V_2 + u$$

By Vocational Training and Firm Ownership



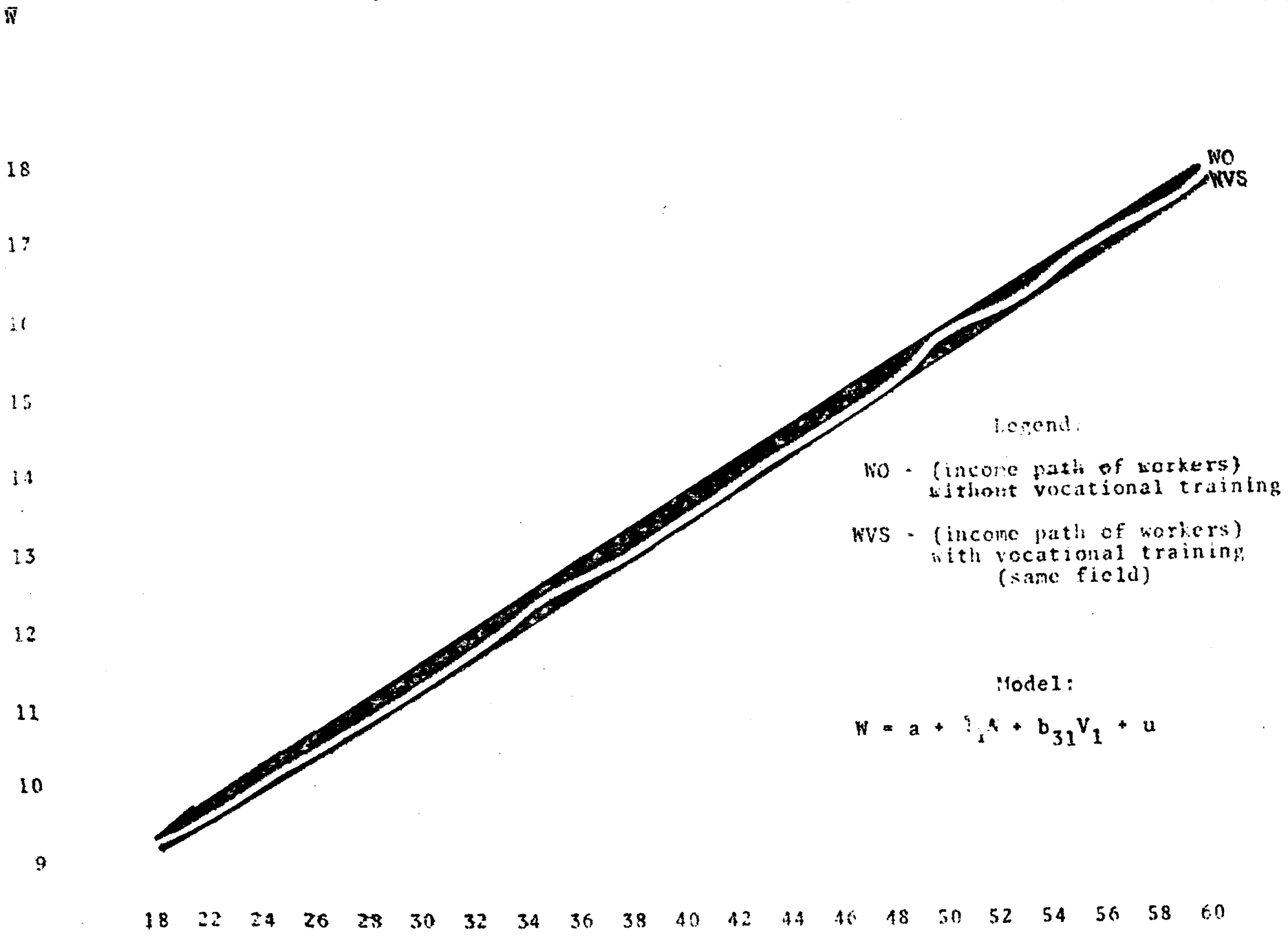
Legend:

WVO - with vocational training (different field)
WVS - with vocational training (same skill)
A - American-owned
WO - without vocational training
C - Chinese-owned

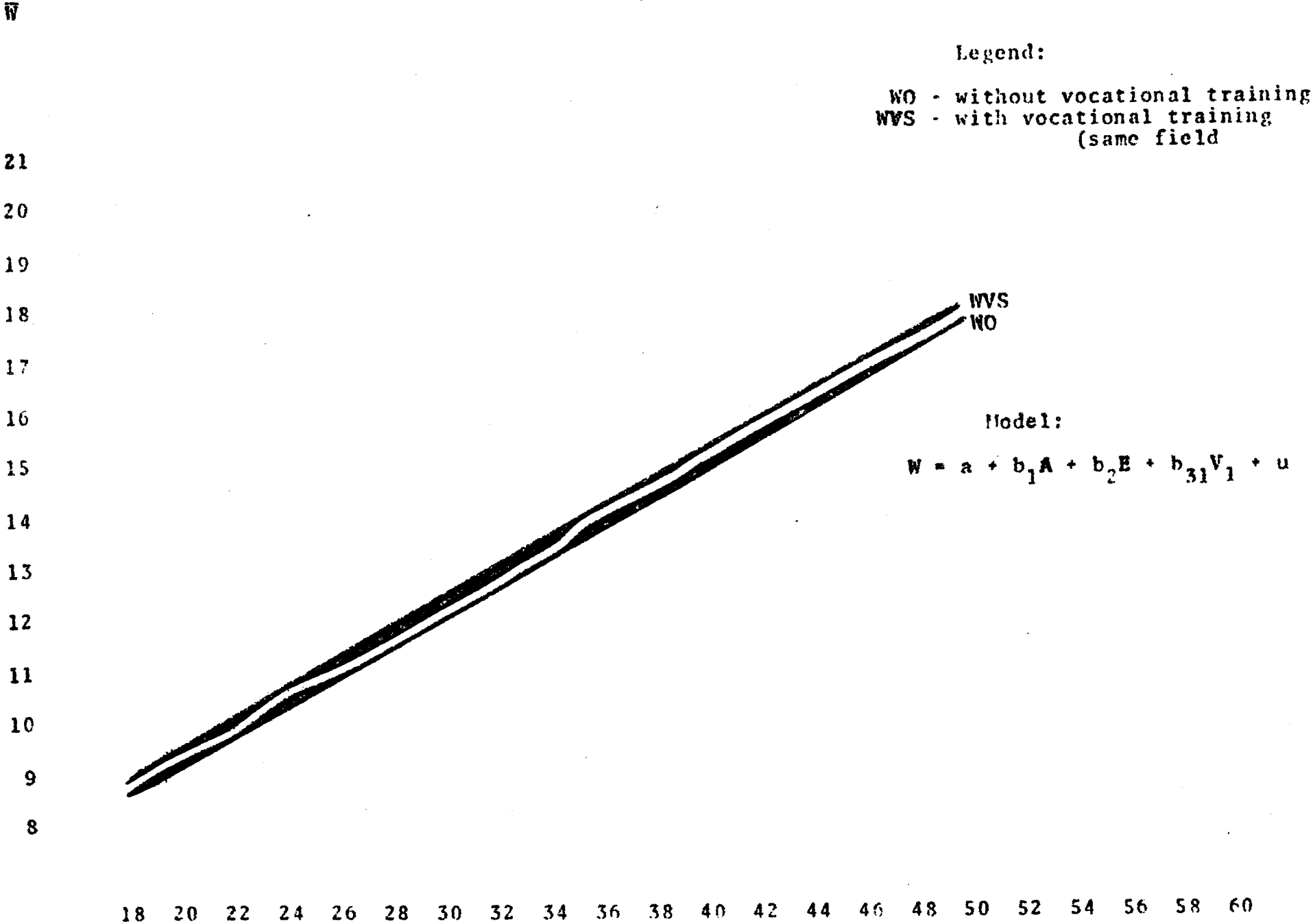
Model:

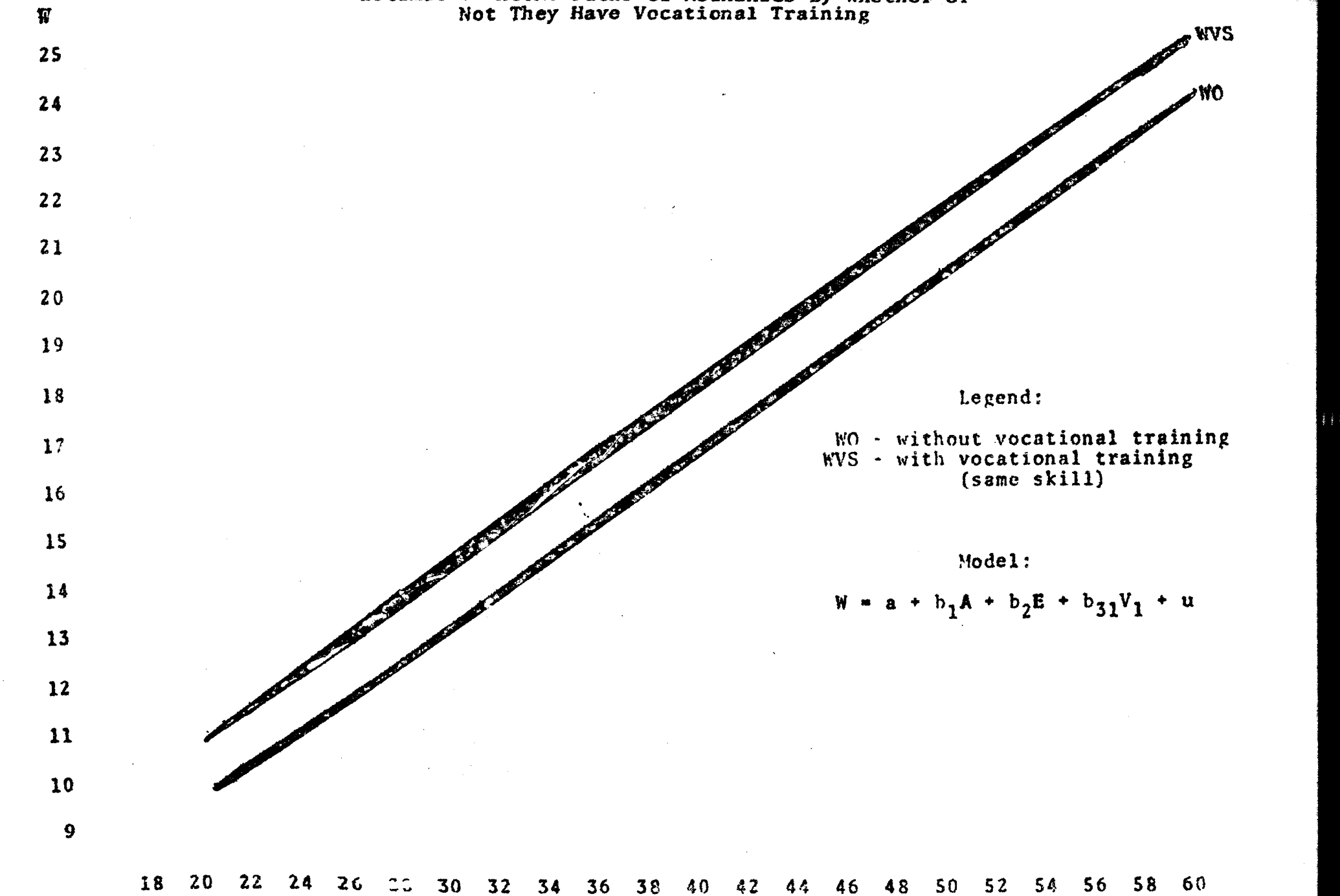
$$W = a + b_1A + b_2E + b_{31}V_1 + b_{32}V_2 + b_{42}V_2 + b_{43}F_3 + u$$

by whether or not they have vocational



By whether or not they have vocational training




W
Not They Have Vocational Training
WVS
WO
Legend:
WO - without vocational training
WVS - with vocational training
(same skill)
Model:
W = a + b1A + b2E + b31V1 + u
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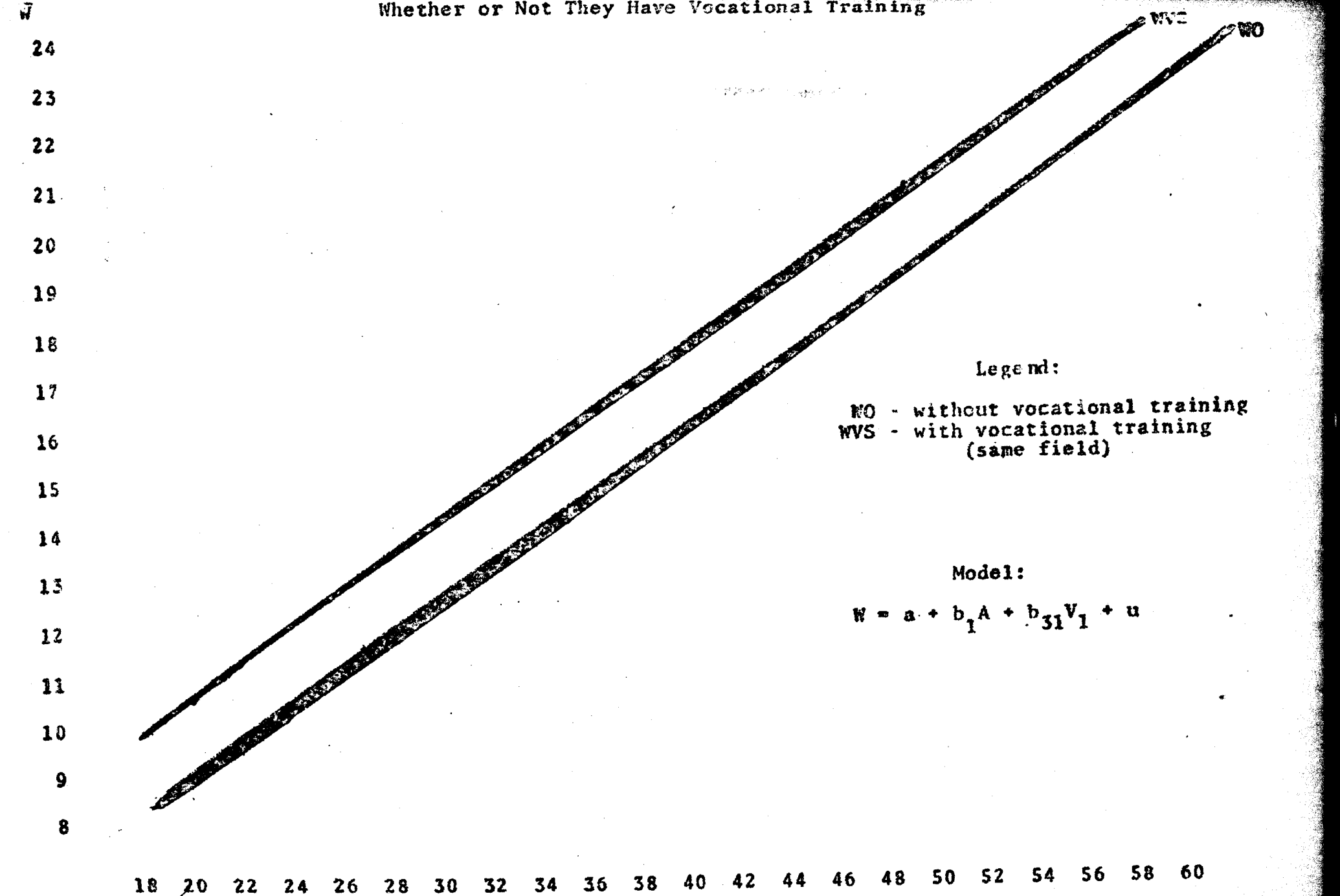
18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60


W
Whether or Not They Have Vocational Training
WVS
WO
24
23
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10
9
8
Legend:
WO - without vocational training
WVS - with vocational training
(same field)
Model:
$W = a + b_1 A + b_{31} V_1 + u$
18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60

Estimated Income Paths of Sewers By Whether or
Not They Have Vocational Training

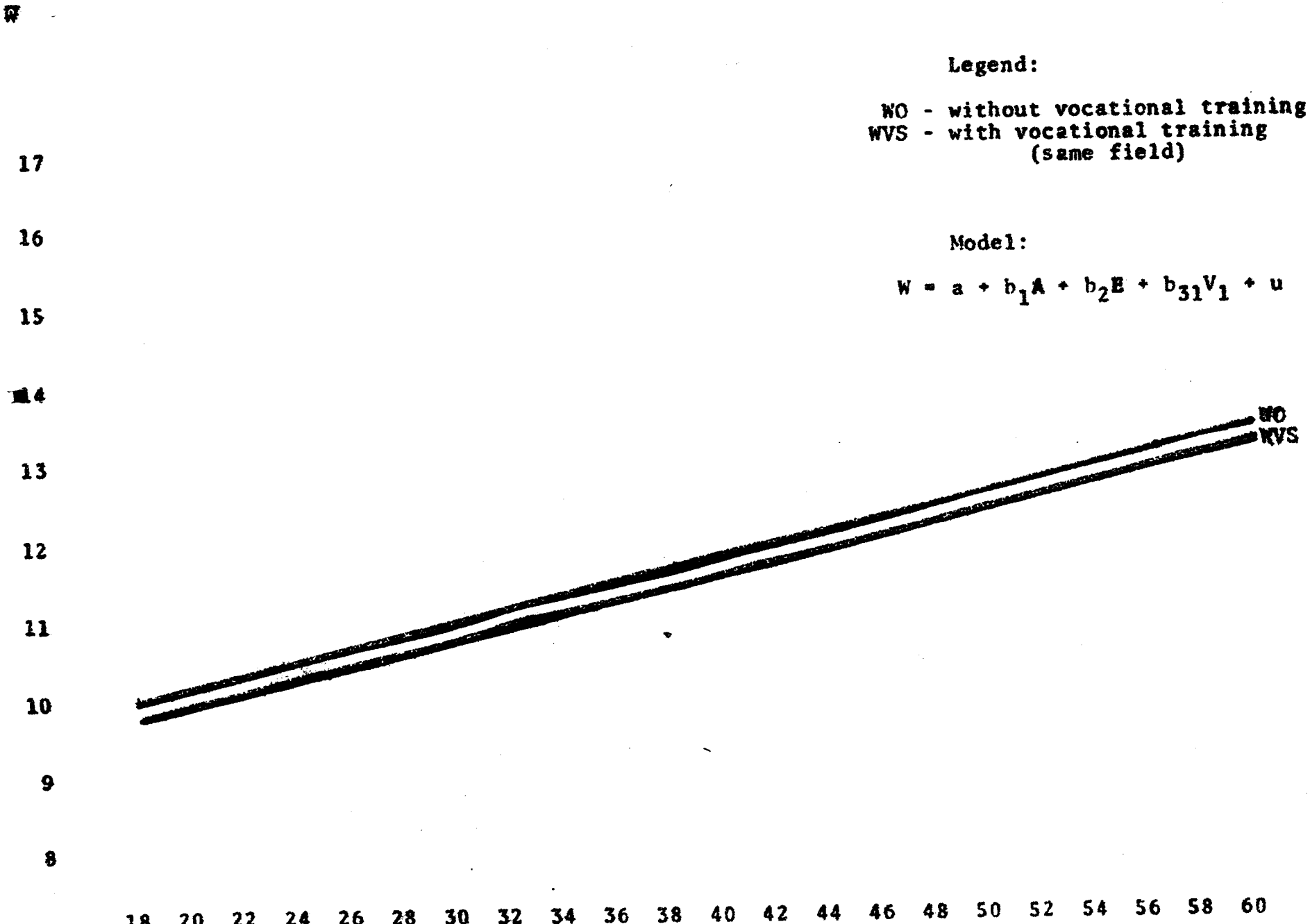
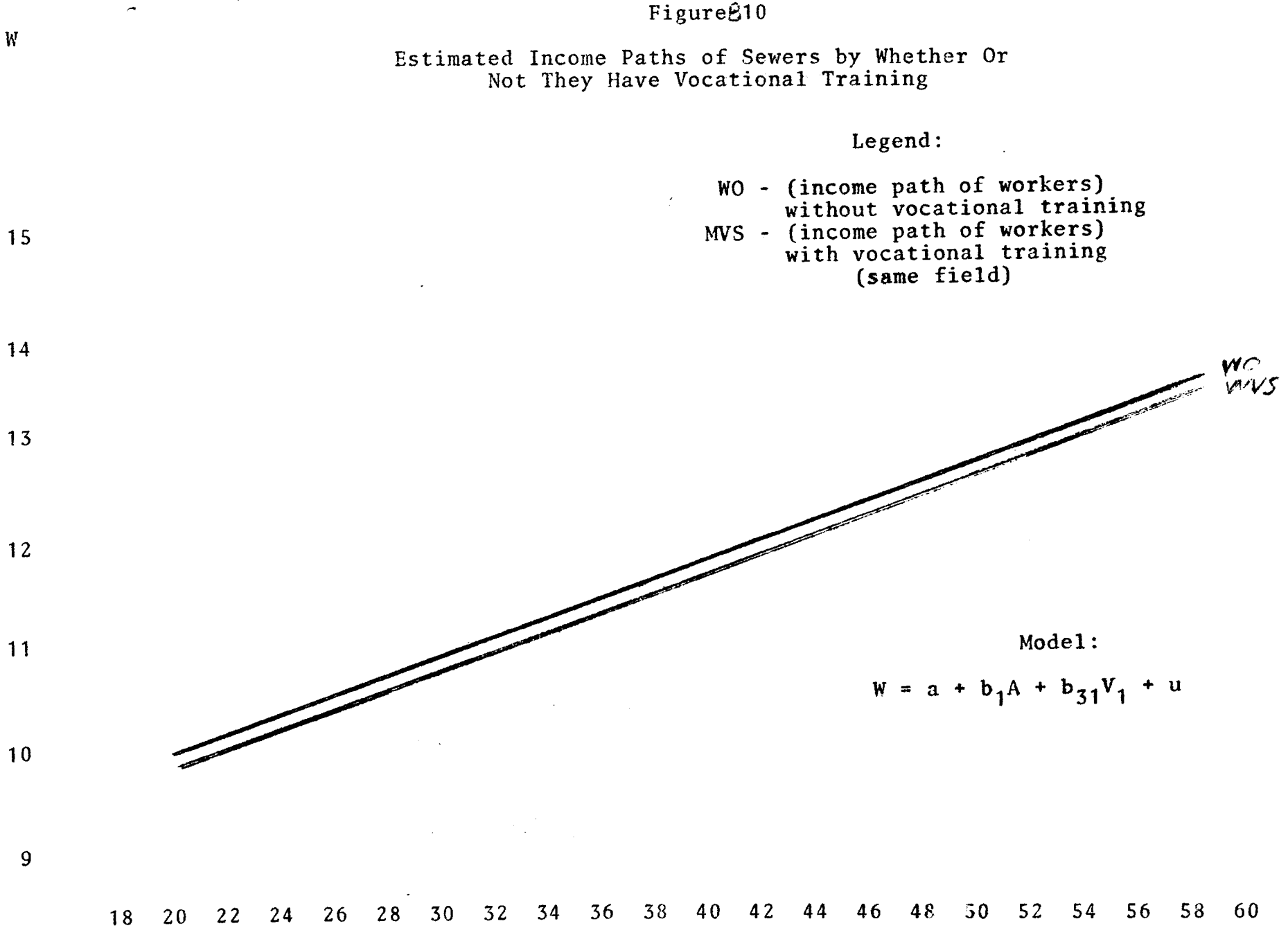
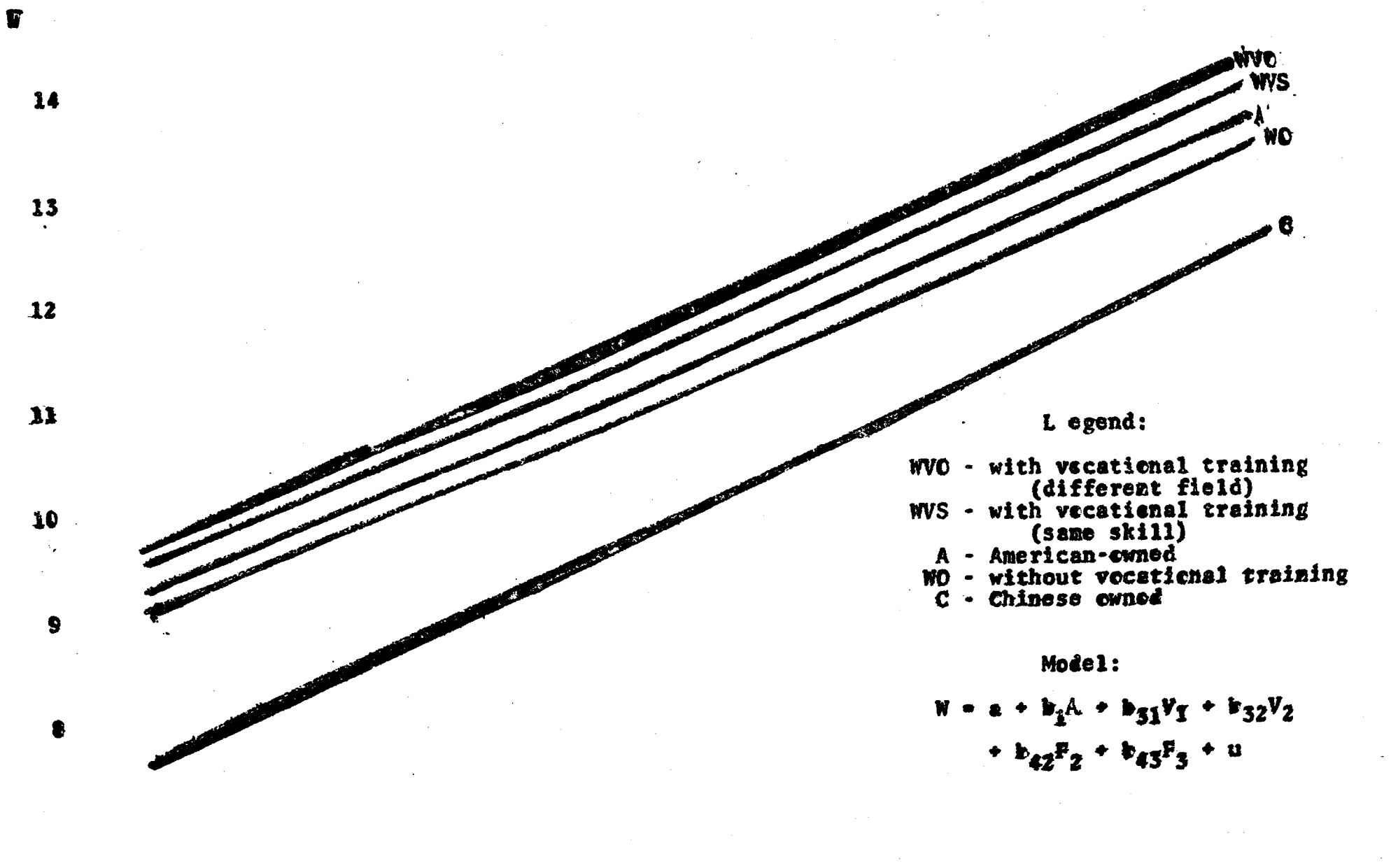


Figure 10

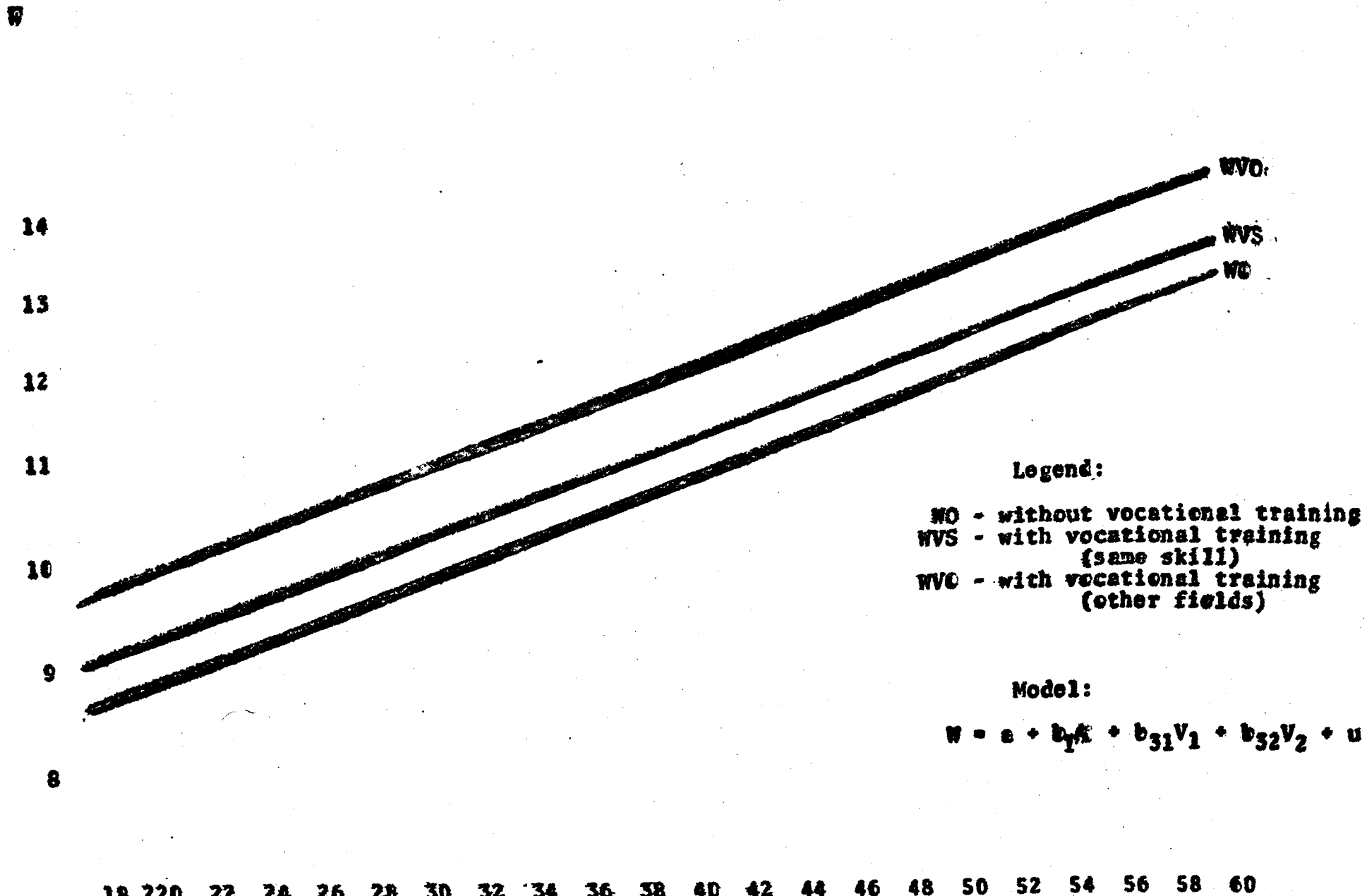
Estimated Income Paths of Sewers by Whether Or Not They Have Vocational Training



Estimated Income Paths of Weavers by Vocational Training and Firm-Ownership



Vocational Training They Have



Legend:

WO - without vocational training
WVS - with vocational training (same skill)
WVO - with vocational training (other fields)

Model:

$$W = a + b_1 A + b_{31} V_1 + b_{32} V_2 + u$$