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Training, position, and experience in the wage rates of specialised personnel in São Paulo's manufacturing firms

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For some years now Brazil has been wholly committed to rapid economic growth. That it has been successful to date is attested by the recent growth rates. From 1968 through 1972, for example, the GNP per capita increased at an average rate of over 6 per cent per year. In an effort to maintain this momentum, the educational legislation was recently rewritten to revamp public education so as to train a more effective labour force. The new law clearly assumes that industrial productivity can be increased by providing the population with education appropriate for the occupations required by the economy of the region. The Government is especially concerned about the preparation of technical experts, managers and supervisors, and technical support personnel, here called "specialised personnel", required by the nation's factories.

The present research, conducted at the request of the Government of Brazil, was concerned with the evidence regarding the validity of this assumption. In 1970, when the project was begun, there was not much evidence regarding the effects of formal preparation on occupational productivity in Brazil or other developing countries. This is not to say, of course, that theory and some evidence were altogether lacking (Schultz, 1961; Morgan, David, Cohen and Brazer, 1962; Denison, 1966; Becker, 1967; and Blaug, 1970). But even in the richer countries, definitive multiple regression studies of the net effect of education, experience and other key variables on the income and/or wages of individuals have been appearing only within the last half-decade or so (Klevmarken, 1972; Mincer, 1974; Sewell and Hauser, 1975).

Yet even these cannot suffice to determine whether occupational preparation has a substantial effect on productivity. As Thurow (1973) has pointed out, education may operate merely to certify that the worker can learn the necessary skills once he has been hired; whether he actually learns any has yet to be shown. Indicators specifically designed to measure occupational preparation are needed. We also need better measures of productivity at the individual level in place of average or total earnings, the measure commonly employed, such as might be obtained by calculating the total monetary value of all the worker's wages and other benefits per unit time.

The present research was designed to estimate, in their proper causal order, the effects of occupational preparation, occupational position, job experience, age and seniority on standardised hourly wages, taken as a proxy for the productivity of individuals. Data obtained from a sample of specialised personnel in Brazil's manufacturing sector were subject to multivariate analyses.

In São Paulo, the State selected as the site, 20 per cent of Brazil's population produces 50 per cent of its GNP. Data were collected in 1970-71 on the 22,587 specialised workers in 688 industrial firms, which constitute a stratified random sample of

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those with more than 20 employees in the 11 most productive sectors. (For details see Pastore, Haller and Buendia, 1974.) The sample included managerial, supervisory and support personnel, amounting to 6 per cent of the total labour force of the firms.

The dependent variable is the worker's standardised hourly wage, expressed in cruzeiros (W), the sum of his wages and benefits divided by the number of hours worked during the year.

Occupational preparation (E), in approximate year equivalents, is the first antecedent variable. It includes basic educational attainment and occupationally specific training. These scores range from 4 to 17, as follows: 4 - primary school plus in-service training; 4 - some junior high school plus in-service training; 8 - junior high school; 9 - junior high school plus technical short courses (less than two years in length); 11 - high school graduation; 12 - high school graduation plus technical schooling appropriate to one's occupation; 13 - some university education appropriate to one's occupation; 14 - a three-year university degree in one's occupational speciality; 15 - same as 14, but four years; 16 - same as 14 but five years; and 17 - same as 14 but six years. Note that the scale measures occupationally relevant education rather than formal education in general.

Occupational influence level (I) is a measure of the rank of the person's job (not necessarily the occupation for which he trained) within the power hierarchy of his firm.[1] Combining span and type of influence yields a six-point index: 6 - managers and directors - wide, line; 5 - experts (scientists, attorneys, engineers, etc.) - wide, staff; 4 - department heads and supervisors - medium, line; 3 - technicians - medium, staff; 2 - foremen - narrow, line; 1 - auxiliary office personnel - narrow, staff.

Age (A) in years (Reynolds, 1964; Mincer, 1974) is included as a measure of the total accumulation of work experience. Seniority (S), or years in the firm, is a second experience variable which, net of age, measures one's knowledge of the firm's procedures. Years in the current job (J) is a third measure of accumulated experience variable, measuring one's knowledge of the routines specific to a job.

Industrial sector is a control variable included to determine the effects of the variables by sector.

Model. The five independent variables were incorporated into a recursive "causal" model (Blalock, 1972) in which the standardised hourly wage of the individual worker (W) is the dependent variable. We posit that occupational influence level (I) has a direct effect upon the dependent variable, and that indirectly it may transmit part of the effects of training, seniority and age. Occupational preparation (E), an exogenous variable, is taken as a measure of trained competency, which, net of other variables, might directly affect one's wage and might also do so indirectly by raising his position in the firm. Age (A), indicating general experience, might have direct and indirect effects by way of its impact on position in the firm and on job experience. These effects, too, would

[1] This concept is more fully explained in Pastore, Haller and Buendia, 1974.

be net of those of all other variables. It is also exogenous. Seniority (S) too is exogenous, and affects the same variables as age. Years in the present job (J) is endogenous. It is taken to be partially determined by age and seniority (but not by occupational preparation or occupational influence level). It may only have direct effects on wages.

The estimation of effects assumes that the above sequence of the variables is correct. The total effect of an antecedent on a subsequent variable is taken to be the sum of its indirect and direct effects. The direct effect of a variable is taken to be its highest order partial beta weight on a dependent variable. Its indirect effect is the product of its direct effect on an intervening variable times the latter's direct effect on the dependent variable (Duncan, 1971; Finney, 1972).

The main objective of this analysis is to present an intelligible assessment and comparison of the network of effects of the five antecedent variables on standardised wages and thus on productivity. This leads to two key technical decisions. First, the common practice of analysing the lognormal transformation of the wage variable is thus unnecessary and the dependent variable was not transformed. Second, path analysis requires linear regression techniques. Both for this reason and because a separate analysis showed that little was to be gained by allowing for non-linear relations, all relations were assumed to be linear.

Results. A detailed summary of all the path analyses was prepared (Appendix A).[1] The coefficients reported in the text are taken from the total sample.

1. Occupational influence (I), indicating the level in the firm at which one exerts his influence on the company's operations, is one of the most powerful variables affecting wages: $P_{WA} = 0.323$. This means that in São Paulo's industries, wages are highly dependent upon the position the individual occupies in the power structure of the firm. The higher one's position, the higher his salary. This variable is not merely an individual attribute; it is a position in the hierarchy of the firm. In other words, rewards accrue to persons because of their location in the institutional structure.

Disaggregating the effects of this variable on wages, we find that 40 per cent of its total wage effect is due to the indirect impact of occupational preparation, 20 per cent to age, and only 3 per cent to seniority. In all, 63 per cent is thus due to the combination of formal preparation and experience. The remaining 37 per cent of its effect on wages is not relayed from any known

[1] Readers interested in the standardised multiple regression equations for wages can form them by compiling the data in the second column of Appendix A. The five values for each sample (or sector) are the partial beta (β) weights, or standardised regression coefficients, of hourly wages on each variable. Thus the estimated standardised hourly wage level ($\hat{W}_T$) in the total sample may be written as follows:

$$\hat{W}_T = .323I - .059J + .258A + .359E + .069S.$$

The standardised regression equations for the various sectors may be formed analogously.

antecedent variable. Yet the worker's occupational influence level itself is largely determined by such other factors: $R^2_{W.EAS} = 0.18$. Future research should attempt to determine what these are. In any case, the firm itself seems to take into account a number of factors in allocating men to positions - line and staff distinctions, span of control, etc., not to mention individual characteristics. One influences the operations of the firm by his exercise of the powers inherent in his position, together with whatever additional influence he can muster. The zero-order coefficient of determination provides an estimate of the total effect of position on wages: $r^2 = 0.24$. In other words, about one-quarter of the variance in standardised wages is due to one's power position. Available theory on human capital tends to ignore this aspect of the reward process, normally concentrating on experience and education.

2. Occupational preparation is one of the powerful factors determining wage differentials. Since it figures in the allocation of power positions, it plays a substantial indirect role. Its indirect effect is $\pi_{WE(I)} = 0.130$. Its direct effect is $P_{WE} = 0.329$, for a total effect of $\pi_{WE} = 0.459$. This finding appears to be consistent with the Brazilian policy of gearing formal preparation to the occupational structure. To the extent that one's value to the firm is measured by his standardised wage - an assumption which seems justified - it would appear that occupationally specific formal preparation considerably enhances it.

In a rational economy it is to be expected that formal training for one's work will result in more effective performance. Our findings suggest that São Paulo's industrial system exhibits such rationality.

This finding is not, of course, inconsistent with previous work showing large effects of education on income (Mincer, 1974). Our main innovation (as opposed to much human capital research) is the emphasis on occupational preparation rather than education as such.

3. Age is a third important variable. In this study its effects are measured net of formal occupational preparation and of seniority in the firm. It thus seems reasonable to suppose that its remaining wage effects are due to general work experience. The large effect (total effect being 0.314) which it has on the wages of these specialised industrial personnel implies that, at least at this élite level of the firms, experience is a valuable asset. As we have just seen, a small part of its total wage effect is relayed through occupational influence level, which it influences to some extent. Yet most of its effect is normally direct. In the over-all sample, for example, its direct effect on wages is about 80 per cent of its total effect.

4. Seniority, years in the firm, is another measure, net of formal preparation, age and time in the present job, experience and knowledge, especially routines unique to the firm. Perhaps surprisingly, there is not one industrial sector in which this variable has any substantial influence, although what little it has is positive. This seems to mean that the procedures of different firms are so similar that it is not worth-while to use seniority as

anything more than a weak criterion for rewarding São Paulo's specialised industrial workers. Apparently, formal preparation and general work experience are far more important as sources of competency.

5. Net of the effects of the other variables which are sources of competence, job experience (years in the present job) goes unrewarded. Indeed, it has a small negative effect in most industrial sectors. The implication is that the more capable specialised workers do not stay in their jobs very long. They are evidently rewarded by being advanced into better-paying positions, leaving behind the less capable, who sometimes receive slightly lower salaries.

The above summaries seem generally appropriate for almost every industrial sector. The main exception is the clothing and shoe industry. This sector rewards occupational influence and age the least of all. It punishes longer job tenure most severely, and rewards seniority and occupational preparation the most highly. Perhaps it is significant that formal preparation counts most here where it is least available. That is, where trained people are especially abundant, training does not pay so well. The relationship between scarcity and impact on wages does not, however, hold for any of the other variables.

Conclusion. So far as we are aware, there are no other studies comparable to this one in which multiple regression methods are applied to the analysis of the effects of position, formal preparation, and experience on the standardised wages (or rewards) obtained by individual specialised workers in the industrial sector of a developing nation. Indeed, this project would appear to be unique in several respects: its use of total earnings standardised to an hourly basis; its adoption of an occupationally relevant measure of formal preparation; its use, under controlled conditions, of age, seniority and years on the job as measures of general work experience, experience in the firm and experience on the job; and its introduction of occupational influence level as a key variable. And it is almost unique (see Sewell and Hauser, 1975) in its application of path analysis as a method for assessing direct, indirect and total effects of antecedent variables on wages.

Beyond doubt, a more detailed discussion of the data presented herein would be profitable, although space limitations unfortunately will not permit it. In other publications, we intend to provide additional studies of them. But we hope that, by making the sectoral path analytic data and other basic statistics (Appendices B and C) available here, other researchers may be able to examine them fruitfully without waiting for further publications to appear.

The main general conclusion which we draw from the present examination is that the São Paulo industrial system appears to reward its most highly placed workers - here the top 6 per cent - according to national principles appropriate to the most highly industrialised countries. Even applying extremely restrictive constraints - linearity of relationships, measures of position, preparation and experience conceptually and operationally independent of each other, and an untransformed wage metric - we find that the five antecedent variables, reasonably placed in a causal order, account for about 36 per cent of the variance in hourly wage differentials. The most powerful of these are one's position in the firm's influence hierarchy, one's formal preparation for his occupation, and one's over-all work experience. Seniority in the firm and years on the job count for little in comparison.

We hope that the present work may make a small contribution to the growing body of evidence regarding the determinants of wage differentials in general and to the analysis of the productivity of specialised industrial workers in developing nations in particular. We also hope that similar research may be undertaken in other countries, developing and developed, and in other strata of the industrial labour force. Such comparative studies may help provide the basis by which untested myths about industry and development may be replaced by solid research findings.

REFERENCES

Becker, Gary S.: Human capital and the personal distribution of income (Ann Arbor, University of Michigan Press, 1967).

Blalock, Hubert M.: Causal models in the social sciences (Chicago, Aldine, 1972).

Blaug, Mark: An introduction to the economics of education (London, Penguin Books, 1970).

Denison, Edward: "Measuring the contribution of education to the economic growth" in E.A.G. Robinson and J.E. Vaizey (eds.), The economics of education (London, Macmillan, 1966), pp. 202-260.

Duncan, Otis D.: "Path analysis: sociological examples" in Hubert M. Blalock (ed.), Causal models in the social sciences (Chicago, Aldine, 1971), pp. 115-138.

Finney, John M.: "Indirect effects in path analysis" (Sociological Methods and Research, 1, 1972), pp. 175-186.

Haworth, C.T. and Rasmussen, D.W.: "Human capital and inter-industry wages in manufacturing" (Review of Economics and Statistics, 53, Nov. 1971), pp. 376-380.

Klevmarken, Anders: Statistical methods for the analysis of earning data (Stockholm, Sweden, Almqvist and Wiksell, 1972).

Mincer, Jacob: Schooling, experience, and earnings (New York, National Bureau of Economic Research and Columbia University Press, 1974).

Morgan, James, David, Martin, Cohen, Wilbur and Brazer, Harvey: Income and welfare in the United States (New York, McGraw-Hill, 1962).

Pastore, Jose, Haller, Archibald O., and Buendia, Hernando Gomez: "Determinants of wage differentials in São Paulo's industrial labour force" (presented at the annual meeting of the American Sociological Association, Montreal, Aug. 1974).

Reynolds, Lloyd G.: Labour economics and labour relations (New Jersey, Prentice Hall, 1964).

Schultz, Theodore W.: "Investment in human capital" (American Economic Review, 51, Mar. 1961), pp. 1-17.

Sewell, William H. and Hauser, Robert M.: Education, occupation, and earnings: achievement in the early career (New York, Academic Press Inc., 1975).

Thurow, Lester C.: "Education and economic equality" (The Public Interest, 28, Summer 1973), pp. 66-81.

APPENDIX A

Partitioned effects of independent and intervening variables on wages by industrial sector

Sector	Variable (i)	Total effect of the ith variable: π_{Wi}	Direct effect of the ith variable: P_{Wi}[1]	Indirect effects of the ith independent variable: (P_{Ii}	x P_{Wi})	+ (P_{Ji}	x P_{WJ})	Total indirect	$R^2_{W.IJAPE}$	Sample size
All sectors									0.363	22 587
	I	0.323	(0.323)	-	-	-	-	-		
	J	-0.059	(-0.059)	-	-	-	-	-		
	A	0.314	0.258	0.200	0.323	0.154	-0.059	0.056		
	E	0.459	0.329	0.401	0.323	-	-	0.130		
	S	0.047	0.069	0.033	0.323	0.552	-0.059	0.022		
Food processing									0.330	1 341
	I	0.316	(0.316)	-	-	-	-	-		
	J	-0.103	(-0.103)	-	-	-	-	-		
	A	0.258	0.249	0.140	0.316	0.168	-0.103	0.027		
	E	0.482	0.347	0.427	0.316	-	-	0.135		
	S	-0.033	0.007*	0.049*	0.316	0.531	-0.103	-0.040		
Clothing and shoes									0.389	183
	I	0.253	(0.253)	-	-	-	-	-		
	J	-0.107	(-0.107)	-	-	-	-	-		
	A	0.167	0.158	0.062*	0.253	0.066*	-0.107	0.009		
	E	0.541	0.433	0.428	0.253	-	-	0.108		
	S	0.168	0.240	0.059*	0.253	0.809	-0.107	-0.072		
Textiles									0.330	1 578
	I	0.343	(0.343)	-	-	-	-	-		
	J	0.014	(0.014)	-	-	-	-	-		
	A	0.310	0.272	0.106	0.343	0.135	0.014*	0.038		
	E	0.426	0.279	0.427	0.343	-	-	0.147		
	S	-0.056	-0.062	-0.010*	0.343	0.659	0.014*	0.006		