

HUMAN CAPITAL VERSUS SORTING: THE EFFECTS OF COMPULSORY ATTENDANCE LAWS*

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Under the educational sorting hypothesis a state compulsory school attendance law will increase the educational attainment of high-ability workers who are not directly affected by the law. Under the human capital hypothesis such laws affect only those individuals whose behavior is directly constrained. We find that compulsory attendance laws do increase enrollment rates in age groups they do not affect directly. Thus, our results contradict the human capital hypothesis and are consistent with the sorting hypothesis.

I. INTRODUCTION

The last decade has seen considerable debate between supporters of the human capital and sorting models of education. The former assert that the effect of education on wages reflects increased productivity. The latter maintain that it reflects, at least in part, correlation between education and unobserved ability. Workers use education to signal their ability, while employers use education to screen workers. Despite the importance of the debate, no fully convincing tests of the hypotheses have been developed. In fact, many members of the profession maintain (at least privately) that these hypotheses cannot be tested against each other and that the debate must therefore be relegated to the realm of ideology.

In this paper we show that the models can be tested against each other by examining the effects of state compulsory school attendance laws. We show that under the human capital hypothesis, such laws will affect the educational attainment only of those who in the absence of the law would have left school prior to the minimum school leaving age. On the other hand, under the sorting hypothesis the effects of the law will percolate through the system, increasing educational attainment even among workers not directly constrained by the law. Our results are consistent with the predictions of the sorting model.

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II. LITERATURE REVIEW

A difficulty that arises in testing *the* educational sorting model is that there is, in fact, no single agreed-upon formulation of the hypothesis. For example, in Riley [1979] firms observe workers' educational attainment but observe neither the resources expended on obtaining education nor workers' productivities. On the other hand, in Weiss [1983], firms receive limited information regarding productivity in the form of a pass/fail test. This information is used in conjunction with time spent in school to assess workers' productivities.

Nevertheless, all sorting models assume that productivity is either imperfectly observable or unobservable, and that education is correlated with *unobserved* ability. The sorting models maintain the standard neoclassical assumptions of rational behavior and profit and utility maximization.

In both the human capital and sorting models, the wage equation can be understood as a hedonic equation relating wages to the characteristics of the firm and worker. Firms weigh the productivity of workers with different levels of education against the wages they are paid and select the education level that maximizes profits; workers weigh increased wages against the cost of education and choose the level that maximizes their wealth (or more generally their utility). The decision processes of firms and workers are the same in both models. Consequently, it would be surprising if we could distinguish between the two hypotheses on the basis of information from a single cross section. This is the essence of the Riley [1979] critique of Taubman and Wales [1973] and of Layard and Psacharopoulos [1974].

This critique applies equally to two more recent articles. Liu and Wong [1982] maintain that the higher return to education in certificate than in noncertificate years provides support for the view that employers use certificates to screen workers. The return to certificate years will be higher only if the distribution of demand for workers is concentrated in those years. However, it is not obvious that the demand for workers should be more concentrated in certificate years under the sorting hypothesis than under the human capital hypothesis. Moreover, while observed education is concentrated in certificate years, this may reflect supply factors, since education costs often jump discontinuously in post-certificate years (as in the case of the transition between high school and college in the United States). In fact, it appears that

45 percent of the Liu and Wong sample did not end their education in a certificate year. Sorting by certificates is incompatible with rationality when a significant proportion of workers finish their education in noncertificate years. On the other hand, if knowledge is "lumpy" (for example, if knowing the entire alphabet increases productivity by more than twice as much as knowing half the alphabet) returns to certificate years (completed lumps) may exceed returns to noncertificate years even in a human capital model.

Miller and Volker [1984] claim they can reject the human capital hypothesis because science graduates do not earn notably more in science jobs than in other jobs. This result implies that the skills signaled or acquired through a science education are equally productive in science and nonscience jobs. We see no strong reasons for believing that signaled skills are more likely to be general than acquired skills.

Riley [1979] and Albrecht [1981] recognize the impossibility of distinguishing between the two hypotheses on the basis of a single hedonic equation. They use the fact that under the sorting hypothesis, extra information regarding a worker's productivity diminishes the importance of education. However, Riley's division of workers into jobs with and without direct observation of productivity is open to other interpretations. For example, his results are compatible with the view that his two samples consist of workers in more and less risky jobs. Albrecht tests whether having more (generally positive) information about a worker reduces the impact of education on his probability of being hired. He finds an insignificant effect in the direction indicated by screening theory. Since the effect of the information variable is also insignificant, it is difficult to interpret his results.

Finally, Weiss [1983] attempts to test directly the assumption that unobserved ability and schooling are correlated. He finds that people with unusually high levels of educational attainment also have unusually long job tenure. Since he had access to all the information used to select job applicants, he argues that his results indicate that education can be a useful signal of stick-to-itiveness.

While all of these studies can be criticized, these remarks serve primarily to underscore the difficulties involved in testing the sorting hypothesis. Part of the problem is that the theory has yet to be fully developed. Consequently, only the assumption that education and unobserved ability are correlated can be tested. Since *ipso facto* this requires examining the relation between

education and an unobserved attribute, problems of data and interpretation ensue almost inevitably. The solution developed in the next section is to rely on the comparative statics properties of the models.

III. AN ALTERNATIVE TEST

In this section we develop a test that is valid for sorting models in which there is a continuum of ability types and a separating equilibrium. A separating equilibrium is said to exist if two workers who have different unobserved abilities have different levels of education. Thus, educational attainment signals perfectly the worker's innate ability or type. The assumption of a separating equilibrium is somewhat restrictive. Nash behavior is insufficient to rule out pooling of skill classes [Spence, 1974]. However, reasonable restrictions on firms' expectations can eliminate such equilibria [Weiss, 1983]. A Nash equilibrium may not exist if the concentration of low-ability types is low [Rothschild and Stiglitz, 1976; Riley, 1979]. However, there are indications that this condition is fulfilled in practice [Riley, 1984; Dickens and Lang, 1985]. Difficulties of non-existence arise even in more sophisticated models when firms' wage-education offers are set before individuals choose schooling levels [Stiglitz and Weiss, 1984]. Finally, in addition to the theoretical arguments for assuming that the sorting equilibrium is a separating equilibrium, there is an empirical argument: any model that does not give rise to at least some separation can be rejected, since we clearly observe individuals getting different levels of education.

While it is worth noting that in both the sorting and human capital models it is theoretically possible for education and innate ability to be negatively correlated, the positive correlation between wages and education and the armchair empiricism of academic economists indicate that innate ability and education are positively correlated. For simplicity of presentation, the following discussion assumes a positive correlation between these variables.

We are now in a position to consider the effect of a compulsory attendance law (CAL) in the presence of sorting by education. A formal proof based on Spence (1974b) can be developed within the framework of a standard sorting model in which education is continuous and innate ability is totally unobservable. However, intuition is easier, and realism better served in the case where education is discrete.

In any sorting model the wage associated with a given level of education depends on the innate ability of the individuals who obtain that level of education. If the innate ability associated with a given level of education increases, so does the wage. Conversely, if the ability level falls, the wage falls. Suppose then that for some reason a group of (lower ability) workers who previously would have left school after education $s - 1$ remain in school through s . Since the average ability among workers with schooling s declines, the wage associated with s declines. Consequently, the benefit of obtaining $s + 1$ increases. Since the distribution of ability is continuous, unless s is the highest level of education obtained, in equilibrium there is an ability type that is indifferent between education s and $s + 1$. Therefore, when the wage associated with s falls, some individuals who would have obtained education s get $s + 1$. Thus, the ability of individuals obtaining $s + 1$ falls, causing some individuals who would otherwise have obtained education $s + 1$ to obtain $s + 2$ and so on.

Thus, if the lowest ability workers increase their educational attainment, so will some higher ability workers. Yet this is precisely the effect of a compulsory attendance law—to increase educational attainment of the lowest ability workers. Thus, a CAL will increase the educational attainment of some workers not directly affected by the law.¹ A formal proof for the case of continuous education can be provided on request. The intuition comes directly from Spence [1974a,b] who shows that with a continuum of ability types and continuous education, the set of equilibrium wage-schooling profiles is described by a single parameter family of equations. The compulsory attendance law essentially sets this parameter.

One caveat must be mentioned. The ripples may diminish as they rise through the system. This is likely to be particularly important at education levels where the cost or benefit structure changes sharply. For example, the direct cost of education rises sharply after high school education. Consequently, a high proportion of individuals leave school after high school graduation. The addition of a small number of lower ability individuals to

1. It should be noted in this respect that the sorting model does not differ from any other model, which implies that productivity is affected by the ability of others attaining the same level of education. In the case of the sorting model, it is perceived productivity that is affected. Alternatively, the quality of education might be positively related to the average quality of students in the classroom. Any model in which an externality causes relative as well as absolute levels of education to affect productivity should give rise to the same results.

this pool may not be sufficient to have a measurable effect on the return to going to college and thus on college attendance.

The effects of a compulsory attendance law under the human capital hypothesis contrast sharply with the predictions of the sorting hypothesis. Under the former hypothesis the effect of education on wages reflects only its effect on productivity. Workers invest in education until the present value of increased productivity just equals the cost of education. A CAL adds an additional constraint that the age of leaving school must be greater than or equal to a statutory minimum. If the constraint is nonbinding, it does not alter the educational investment decision.

It might appear that a CAL would change the return to education by changing the supply of workers of various age groups and levels of education. If so, it might affect all workers not just those directly constrained. However, we can draw on trade theory to establish that under the human capital hypothesis, if a state passes a compulsory attendance law, it will not affect the return to education.

According to the factor price equalization theorem [Samuelson, 1948, 1949], if there are no barriers to trade (e.g., import quotas, tariffs, transportation costs), all countries have access to the same technology, and there are at least as many traded goods as there are factors of production, the price received by each factor of production will be the same in all countries even if there is no factor mobility. In essence, trade ensures that all commodities have the same price in all countries, which in turn ensures that all factors must have the same price.

For international trade, casual empiricism suggests that the factor price equalization is invalid. This is not surprising, since the underlying assumptions of no barriers to trade and a common technology are clearly violated. However, the theorem may well be valid for trade among states. The assumptions underlying the theorem seem much more reasonable in this case, and it is not as evident whether the theorem is violated in practice.²

2. It might be argued that the existence of estimated wage equations with significant coefficients on state or regional dummy variables is sufficient to disprove the applicability of the factor price equalization theorem even to trade among states. The existence of significant state coefficients is not only consistent with the factor price equalization theorem but is a consequence of that theorem in the presence of sorting—states in which exogenous factors increase schooling levels will have negative state coefficients because for each level of education, the unobserved quality of its workers is low.

If the factor price equalization theorem is operable, the wage received by workers of a given level of acquired ability is the same in each state. Therefore, under the human capital hypothesis the wage received by each education-ability combination and the return to education is the same in all states, and a state compulsory attendance law will affect only those directly constrained by the law.

If the factor price equalization theorem is not applicable to trade among states, the effects of a CAL under the human capital hypothesis cannot be derived without additional assumptions regarding the substitutability and complementarity of different types of workers. By adopting different sets of assumptions, it is possible to establish that the effect of a state CAL will be to increase, decrease, or leave unchanged the education of individuals not directly affected by the law. However, by considering two extreme cases, we shall show that the effect of such a law on those not directly constrained should be near zero. In these examples we assume that individuals maximize the present value of their lifetime earnings and that the direct cost of education is zero.

In the first case, we assume that all workers with the same level of experience are perfect substitutes. We further assume that, at each level of experience, education has a multiplicative effect on the number of units of human capital that a worker provides so that if an additional year of education increases the productivity of a worker with no experience by 5 percent, it also increases the productivity of workers with one or more years of experience by 5 percent. This is the standard assumption in log wage equations. Thus, if a worker who leaves school at age fifteen provides one unit of zero-experience human capital, a worker who leaves school at age sixteen provides $1 + c$ units of zero-experience human capital. Similarly, one year later, the first individual provides one unit of one-year-experience human capital, while the second provides one plus c units of one-year-experience human capital. Under these assumptions, the wage received by workers leaving school at age sixteen is a constant fraction of the wage received by those leaving school at age fifteen. Thus, the present value of earnings at age fifteen for sixteen-year-old school leavers is given by

$$(1) \quad PV_{16} = (1 + c)w_0/(1 + r) + (1 + c)w^1/(1 + r)^2 + \dots$$

$$(2) \quad = PV_{15}(1 + c)/(1 + r),$$

where PV_{15} and PV_{16} are the present value of earnings for fifteen- and sixteen-year-old school leavers, and w_t is the wage received by fifteen-year-old school leavers with t years of experience. Thus, the present value of earnings for sixteen-year-old school leavers is a constant fraction of the present value of earnings for fifteen-year-old school leavers.³ Moreover, this fraction is independent of the relative wages received by units of human capital with different levels of experience. Consequently, even though the compulsory attendance law changes the relative numbers of workers with each level of experience, it does not change the return to education and hence does not affect the behavior of individuals not directly constrained by the law.

The second case we consider is the converse of the first. Instead of workers with the same level of education being perfect substitutes, we assume that workers with different levels of experience, but who left school at the same age, are perfect substitutes. Just as the effect of education on human capital was assumed to be multiplicative in the first example, in this example the effect of experience on human capital is multiplicative so that if a worker with one year of experience who left school at age fifteen provides $1 + c$ units of fifteen-year human capital, a worker with one year of experience who left school at age sixteen provides $1 + c$ units of sixteen-year human capital. In this case, unlike the previous case, the effect of a CAL will depend on the substitutability and complementarity of different types of human capital. We can, however, estimate the effect of a law by making some additional assumptions regarding parameters. Let us suppose that the minimum school leaving age is raised from age fourteen to age fifteen. As a result, no workers leave school at age fourteen, and we require an assumption about the production function to ascertain the impact of this change. In the simplest case fourteen- and fifteen-year-old school leavers are perfect substitutes in production, and these workers are neither substitutes nor complements for any other type of human capital. This allows us to treat the price of fourteen- and fifteen-year human capital as a function of its quantity alone. If the number of units goes up, the price

3. If leaving school a year later reduces time spent in the labor market, this argument is only approximately correct, since shifts in the relative value of the last year in the work force for fifteen-year-old school leavers will affect the return to schooling. However, for any reasonable discount rate, the last year in the work force has no effect on the decision to invest in education.

will fall, and the benefit of remaining in school until age sixteen will rise. Conversely, if the number of units of fourteen- and fifteen-year human capital falls, fewer people will remain in school until age sixteen. In the short run the number of units falls, since workers who previously would have remained in school only until age fourteen are kept out of the labor market until age fifteen. On the other hand, in the long run the supply increases.

To get a sense of the magnitude of these changes, assume that workers who would have left school at age fourteen would have spent forty years in the work force (a reasonable estimate given rates of early death, disability and the fact that workers in low-skill jobs tend to retire earlier), that the return to education is 5 percent and that the return to experience is 3 percent. In this case the number of units of human capital supplied by people leaving school at age fourteen or fifteen initially declines by about seven-tenths of 1 percent and, in the long run, increases by about three-tenths of 1 percent. Moreover, the "long run" is a long time in this case. It takes 31 years before the number of units of human capital increases at all. Thus, only in the long run does human capital predict an increase, and the effect will not be large. Moreover, the effect will be smaller if there is some substitutability among different types of human capital.

These two cases taken together with the results when the factor price equalization theorem is operative suggest that it is reasonable to conclude that under the human capital hypothesis, a compulsory attendance law will not affect workers who are not directly constrained by the law. In the empirical section of this paper, we shall be examining the effects on sixteen- and seventeen-year-olds of laws requiring attendance until ages fourteen, fifteen, and sixteen. In this age group the assumption that workers with the same experience are close substitutes seems more realistic than the assumption that workers who left school at the same age are close substitutes. Finally, even under assumptions that give rise to increased education by workers not directly affected by the law, the effects are small and would be smaller if there was at least partial factor price equalization, capital mobility, or some substitutability among workers with different levels of education.

In sum, the effect on higher ability workers of a state CAL should be nonnegative in the sorting model and zero in the human capital model. The next section develops a test based on this result.

IV. EMPIRICAL METHODS

To test the sorting and human capital models against each other, we measure the effect of compulsory attendance laws on educational enrollments for different age groups. We test the hypothesis that a CAL increases the enrollment rate of age groups not directly affected by it against the hypothesis that it does not affect this rate.

Enrollment rates for sixteen- and seventeen-year-olds were obtained from the 1910, 1920, 1930, 1950, 1960, and 1970 censuses. The 1940 census was not included because differences in data gathering methods make the enrollment figures not comparable with other censuses.

Data on state CALs proved surprisingly difficult to obtain. In the end, CALs for 1908, 1918, 1928, 1945, 1958, and 1965 had to be used. The fact that the CALs precede the sample date by two to five years may actually be advantageous if their effect operates with a lag. CALs differ considerably across states. Table I gives the distribution of minimum school leaving ages over our sample. Somewhat surprisingly, there is *not* a steady increase in CALs over our sample period. In 1918, all states had CALs. By 1965, Mississippi and South Carolina had abolished their laws. Moreover, the number of states with a minimum school leaving age of 18 declined from four in 1945 to three in 1965.

The coverage of CALs varies among states. All have some exceptions to universal coverage, generally for those who are "mentally unable to benefit from education" or for individuals whose work is needed for the support of the household. Some laws extend coverage through the entire school year so that individuals reaching the minimum school leaving age in the middle of the

TABLE I
THE DISTRIBUTION OF COMPULSORY ATTENDANCE LAWS

Year	No law	12-14	15	16	17	18
1908	0.28	0.45	0.13	0.15	-	-
1918	-	0.19	0.15	0.66	-	-
1928	-	0.13	0.04	0.62	0.11	0.11
1945	-	0.06	0.02	0.70	0.09	0.13
1958	0.04	-	0.02	0.74	0.11	0.09
1965	0.04	-	-	0.72	0.15	0.09
Average	0.06	0.14	0.06	0.60	0.07	0.07

year must remain in school until the end of the year. Thus, laws requiring attendance up to sixteen, for example, may have a direct effect on sixteen-year-olds. Virginia is unique in that its law differs among counties. Virginia was therefore dropped from the analysis.

Finally, enforcement varies among states. Punishments are usually, but not universally, imposed on parents rather than students. Maximum penalties vary from small fines through imprisonment. Actual enforcement is generally left up to local officials and so may vary within states. Our dependent variable is the log odds transformation of enrollment rates for each state in each year. We have separate equations for sixteen- and seventeen-year-olds. The minimum school leaving ages are represented by dichotomous variables (CAL12/14 through CAL18). The CALs for ages twelve and fourteen were combined, since only one state in one year had a CAL of 12 and none had a CAL of 13. In the equation for sixteen-year-olds, we combine the CALs for 17 and 18, since their theoretical effects are the same. To control for time trends, we include dichotomous variables for 1920, 1930, 1950, 1960, and 1970. The reference point is a state with no CAL in 1910.

For each of the two age groups, we therefore have a time-series/cross-section model with fixed time effects. We test for the presence of fixed state effects and also for the existence of separate equations for each year. Finally, the two equations represent a system of seemingly unrelated equations that can be estimated by maximum likelihood.

Clearly a potentially critical issue is the endogeneity of compulsory attendance laws. CALs may reflect prevailing norms in the state. Therefore, states where most individuals receive a relatively large amount of education might tend to have high minimum school leaving ages. On the other hand, CALs might constitute a response to perceptions that people are not getting enough education. In this case states where educational attainment is relatively low would tend to have high minimum school leaving ages. Thus while the direction of bias is uncertain, we need to concern ourselves with the possible endogeneity of CALs.

While we cannot control directly for endogeneity, we can show that the absence of fixed state error terms is incompatible with significant bias. To see this, note that all CALs in our sample are in effect prior to the year in which enrollment rates are measured. Even if the "stochastic" elements of CALs and enrollment rates

are contemporaneously correlated, the stochastic elements and future enrollment rates are likely to be correlated only if the error term in the enrollment rate equation is serially correlated. However, if there is significant serial correlation, a model that ignores serial correlation and estimates fixed effects will find significant fixed effects. Thus, the test for fixed effects also tests for bias due to the possible endogeneity of CALs.

The critical parameters are those on CAL12/14 and CAL15 in the sixteen-year-old equation, and CAL12/14, CAL15, and CAL16 in the seventeen-year-old equation. Under the sorting hypothesis these five parameters should be nonnegative, while they should be zero under the human capital hypothesis. It should be noted that this is a one-tailed test. The one-tailed test is a mixture of chi squared distributions [Gourieroux et al., 1982]. Significance levels cannot be obtained using standard tables but instead require simulation techniques. It should be noted that if CAL16 equals 1, individuals are required to remain in school until age sixteen, and therefore the law does not directly affect sixteen-year-olds. However, it is possible that some students who turn sixteen during the school year choose to finish the entire year, even though they would not have begun the year in the absence of the law. We therefore prefer the more conservative strategy of not using the effect of CAL16 on sixteen-year-olds and CAL17 on seventeen-year-olds as measures of the indirect effect of compulsory attendance laws.

V. RESULTS

We deliberately tried to keep the number of explanatory variables to a minimum in order to increase the power of our test. However, the presence of state effects would require the use of generalized least squares if they were uncorrelated with the other variables and would lead to omitted variable bias if they were. To test for the presence of state effects, we include dichotomous variables for the states and test for the joint significance of their coefficients. In neither of the equations were the state variables significant. The F statistics were 0.77 and 0.74; the critical value at the 0.05 level significance is about 1.4. On a purely random basis we would expect an F statistic of about 0.75 or less over 80 percent of the time. Thus, our results provide no evidence whatsoever for the presence of state effects. As argued earlier, even if compulsory attendance laws were endogenous, there would be a

serious problem of bias only if the error terms in the enrollment equations were strongly autocorrelated. However, autocorrelation would be captured by the state effects. The absence of state effects therefore indicates that even if state laws were endogenous, their endogeneity would not create statistical difficulties.

It is also possible that we are introducing bias by imposing the same parameters (except for constant terms) for all years. For both equations we could not reject the hypothesis that the parameters were the same for all years. The F statistics were 1.33 and 1.52. The critical value is about 1.7.

While we can never exclude the possibility that we have omitted an important variable that is correlated with our CAL variables, it seems unlikely that such a variable neither would be correlated with states nor would introduce different bias in different years. We therefore conclude that there is no significant bias in limiting our explanatory variables to the CALs and years.

Table II reports the results of maximum likelihood estimation of the two equations. The first notable result is that all of the crucial parameters (CAL12/14 and CAL15 for sixteen-year-olds and CAL12/14, CAL15, and CAL16 for seventeen-year-olds) are positive. If the true parameters were zero and the coefficients were independent (which they are not), the probability of this happening by chance would be 0.03, indicating that the results are more in conformity with the sorting model than with the human capital model.

This emphasizes the importance of joint tests on all the crucial parameters. While individually all the critical parameters except CAL15 for sixteen-year-olds are insignificant, their joint distribution may be unlikely. The Wald statistic for the coefficients is 9.05, which is significant only at the 0.12 level for a standard two-tailed test. However, the human capital hypothesis should not be tested on the basis of a two-tailed test. If the coefficients are zero, as required by the human capital hypothesis, the probability of obtaining a Wald statistic of 9.05 and five positive coefficients is quite low. A Monte Carlo experiment confirms that the human capital hypothesis can be rejected at the 0.05 significance level. Moreover, our results conform to the predictions of the sorting model: the effects of compulsory attendance laws ripple through the system, increasing enrollment rates even in age groups not directly affected.

Under the sorting model the effect of a nonbinding compulsory attendance law should increase as the age until which chil-

TABLE II
DETERMINANTS OF THE LOG ODDS ENROLLMENT RATE

	16-Year-olds	17-Year-olds
CAL12/14	0.126 (0.124)	0.028 (0.115)
CAL15	0.272 (0.149)	0.168 (0.139)
CAL16	0.258 (0.123)	0.143 (0.115)
CAL17/18	0.497 (0.139)	-
CAL17	-	0.335 (0.131)
CAL18	-	0.308 (0.131)
1920	-0.093 (0.097)	-0.078 (0.091)
1930	0.423 (0.102)	0.399 (0.095)
1950	1.144 (0.105)	1.183 (0.098)
1960	1.587 (0.105)	1.660 (0.098)
1970	2.113 (0.106)	2.254 (0.099)
Constant	0.041 (0.103)	-0.553 (0.096)

Standard errors are in parentheses.

dren must remain in school increases.⁴ In fact, the point estimates for the effect of CAL16 are less than those for CAL15 in both equations. However, in both cases the 95 percent confidence interval for the effect of CAL16 minus the effect of CAL15 contains a large range of positive numbers. The results are therefore consistent with the sorting hypothesis.

VI. SUMMARY AND CONCLUSIONS

This paper showed that if sorting gives rise to a separating equilibrium and there is a continuum of ability classes, a com-

4. Note that whether a law requiring attendance until age fourteen has a bigger effect on enrollment rates for sixteen-year-olds or seventeen-year-olds depends on the distribution of school leaving ages in the absence of the law and cannot be determined a priori.

pulsory attendance law will increase the educational attainment of individuals who are not directly affected. On the other hand, under the human capital hypothesis, the effect of the law would be to leave unchanged the education received by those not directly affected.

We rejected the human capital model against a sorting alternative. Moreover, all of the relevant coefficients had the positive sign predicted by the sorting hypothesis. Using both the information on the signs and the size of the Wald statistic, we were able to reject the hypothesis that the coefficients were zero as required by the human capital hypothesis. Of course, any empirical result has many possible explanations. A compulsory attendance law might affect individuals it does not directly constrain if having weaker students in class lowers the quality of education or if forcing people to go to school longer teaches them that they are benefiting from higher level schooling. Both these (and probably other) human capital theoretic explanations of the results require substantial revision to the policy implications of the standard human capital model. In addition, both represent *ex post* reformulations of the theory in response to empirical evidence that contradicts the original formulation. Consequently, even though alternative explanations of the results exist (as they always do), the findings presented in this paper are supportive of the sorting model.

The approach developed here is significant not only because it casts light on the human capital-sorting debate but also because it points the way to a series of further tests that could be performed to distinguish among the hypotheses. The argument developed here is applicable to any law that increases the educational attainment of the lowest productivity workers. Thus, the test might be replicated using state minimum wage laws, for example. In addition, stronger tests can be performed on individual data. Higher educational attainment under CALs implies that the return to education should be higher in their presence. In addition, the wage associated with each level of education should be lower. Thus, the approach developed in this paper suggests the possibility for further studies and replication to confirm or disconfirm the findings presented here.

Q.E.D.

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