

A discusión

A NEW DISCUSSION OF THE HUMAN CAPITAL THEORY IN THE METHODOLOGY OF SCIENTIFIC RESEARCH PROGRAMMES*

Bernarda Zamora

WP-AD 2007-26

Correspondence: Departament d'Economia. Universitat Jaume I, Campus Riu Sec, E-12071 Castellón (Spain). Tf.: +34964387166. Fax: +34964728591. e-mail: zamoram@eco.uji.es.

Editor: Instituto Valenciano de Investigaciones Económicas, S.A.

Primera Edición Diciembre 2007

Depósito Legal: V-5102-2007

These working papers offer in advance the results of economic research under way in order to encourage a discussion process before sending them to scientific journals for their final publication.

* Financial support by the Spanish Ministry of Education (project SEJ2005-02829/ECON) is gratefully acknowledged. This paper was presented at the International Symposium on Economic Theory, Policy And Applications, August 21-23, 2006, Athens, Greece.

A NEW DISCUSSION OF THE HUMAN CAPITAL THEORY IN THE METHODOLOGY OF SCIENTIFIC RESEARCH PROGRAMMES

Bernarda Zamora

Abstract

This paper formally describes the Human Capital Theory as a Research Programme that fits into the classical economic Research Programmes. The fundamental “hard core” assumption which converts the Human Capital Theory into a Research Programme itself in Lakatosian terms is based upon the embodiment of the human capital in the person investing in it. The paper shows how the auxiliary “protective belt” assumptions and the empirical content of the theory are linked to and derived from the “hard core” assumptions in such a way that the Human Capital Theory satisfies the conditions to be considered a Scientific Research Programme.

Keywords: Lakatos, Research Programme, Human Capital.

JEL Classification: B41; J24

1. Introduction

In this paper, I attempt to provide arguments to explain why, in recent decades, we have not observed what Blaug's concluded in 1976 about the gradual replacement of the Human Capital Theory by the Signalling or Credentialism Theory. To do this, I firstly describe the Human Capital Theory as a research programme that fits into the Neo-Walrasian Research Programme. This idea has been informally presented by both Weintraub (1985) and Backhouse (1991).

In this paper, I describe which parts of the Human Capital Theory can be considered its 'hard core' and which parts determine its 'protective belt' to justify the inclusion of the Human Capital Theory as a sub-programme of the Neo-Walrasian programme in the sense of Weintraub's and Backhouse's considerations. Furthermore, I do not merely pursue a descriptive purpose. The main purpose of this paper is the *appraisal* of the Human Capital Theory in Lakatosian terms. That is, I wish to ascertain whether the Human Capital Theory can be considered progressive. Following Backhouse's method, three things must be done to accomplish this. (1) Find examples of novel facts, which can be (a) predictions before the event, (b) facts that were not previously explained, (c) new interpretations of old facts or (d) facts which played no role in competing research programmes. (2) Show that these novel facts follow from the hard core and heuristics of the programme. (3) Show that these were corroborated (Backhouse 1991).

The appraisal criterion followed through Section 4 finds examples of novel facts and discusses the relationship of these novel facts to both the hard core and protective belt of the program. An empirical review of the corroborated excess content of the Human Capital Theory goes beyond the objective of this paper given the huge amount of empirical literature that the theory has generated.

2. The Initial Problem

In order to appraise the Human Capital Theory as a scientific research programme in

Lakatosian terms, the starting point is to place the Human Capital Theory in its historical context and into the bigger research programme of orthodox or neoclassic economics to which the Human Capital Theory belongs.

The first question to answer refers to the development dates of the Human Capital Theory. That is, we should ask why Theodore Schultz, Gary Becker and Jacob Mincer among others ¹ pioneered the body of the Human Capital Theory in the sixties. Why was no formal theory of Human Capital developed before?. We should consider that the notion of the importance of education on labor productivity already appears in 1776 with Adam Smith's "An inquiry into the nature and causes of the wealth of nations"?.

The main formal body of the Human Capital Theory can be followed through Gary Becker's work "Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education" whose third edition was published in 1993. As the author acknowledged in the first edition in 1964, "The main motivation factor has probably been a realization that the growth of physical capital, at least at conventionally measured, explains a relatively small part of the growth of income in most countries. The research for better explanations has led to improved measures of physical capital and to an interest in less tangible entities, such as technological change and human capital. Also behind this concern is the strong dependence of military technology on education and skills, the rapid growth in expenditures on education and health, the age-old quest for an understanding of the personal distribution of income, the recent growth in unemployment in the United States, the Leontief scarce-factor paradox, and several other important economic problems". Later, in the Ryserson Lecture given by Becker at the University of Chicago in 1989, he indicated "[...] that human capital analysis has been motivated partly by a desire to evaluate proposals to improve the quality of the work force through schooling, training, medical services, and child care. But its main purpose as far as I am concerned is to

¹ Can be also included Milton Friedman and Sherwin Rosen, and several others associated with the University of Chicago

remove a little of the mystery from the economic and social world that we live in.’ (G. Becker 1993 p. 25).

3. The Human Capital Research Programme

The second task we have to do to insert the Human Capital Theory into the Orthodox or Neoclassical Economics Research Programme is to describe the Human Capital Theory as a scientific research programme. ‘Research programmes consist of a ‘hard core’ or irrefutable theory surrounded by a ‘protective belt’ of auxiliary hypotheses that can be further developed and refuted. A ‘positive heuristic’ specifies how the research programme should advance.’ (Blaug 1976b).

As Backhouse indicates ², the main criticism of Lakatos’s concept of a research programme ‘is that characterizing them in terms of an invariant hard core is too narrow. A broader concept of a research programme, allowing for a greater interaction between programmes, and for hard cores which change over time, would appear to be required.’ In this line, the description of the Human Capital Research Programme will be firstly described in this work as a part of the Neo-Walrasian Research Programme, as described by Weintraub (1985) and Backhouse (1991). In addition, the Neo-Walrasian Research Programme can be considered part of the Orthodox Economics Research Programme. Yet, to present the Human Capital Theory as a research programme itself we need to specify the proper hard core which conforms to the Human Capital Research Programme.

In the present discussion of placing the Human Capital Theory into the Neo-Walrasian Research Programme, Weintraub’s view of the Human Capital Theory as a part of the protective belt of the Neo-Walrasian Research Programme is accepted regardless of the content of the hard core of this bigger program. However, as noted before, to define the Human Capital Theory as a research programme itself, some of the human capital

² ‘The Lakatosian legacy in economic methodology’, in Backhouse (ed.) *Explorations in Economic Methodology. From Lakatos to empirical philosophy of science*. London and New York: Routledge. 1998

hypotheses which form part of the protective belt of the bigger programme have to be included into the hard core of the Human Capital Research Programme. Therefore, the hard core of the Human Capital Programme contains the hypotheses inherited from the bigger programmes and the specific fundamental assumptions about human capital.

The Human Capital Theory inherits the basic metaphysical assumptions from the ‘hard core’ of the Orthodox Economics Research Programme. These basic assumptions are *Individualism*, *Rationality*, *Private property rights* and *Market economy* (Glass and Johnson, 1988). The strongest development of either the ‘protective belt’ or the positive heuristics of the Orthodox Economics Programme began with the mathematical formulation of Economics that has grown since the end of the First World War. The existence of the Walrasian equilibrium was refined and mathematically demonstrated by Arrow and Debreu in 1954, and this demonstration can be considered as the birth of the Neo-Walrasian programme. Most of the modern economic theories can be considered within the ‘protective belt’ of the Neo-Walrasian Research Programme, just as Weintraub (1985) and Backhouse (1993) point out. As noted above, whatever point of view we take on the description of the positive and negative heuristics of the Neo-Walrasian programme, the Human Capital Theory is considered a part of the programme’s protective belt. The Human Capital Research Programme then inherits the ‘hard core’ from the Neo-Walrasian programme. The basic assumption that must be added to the hard core of the Human Capital Research Programme to convert the Human Capital Theory into a research program itself can be enounced as follows:

HC1 Investments in human capital raise labor productivity and they are embodied in the person investing. That is, human capital is non-separable from the person who invests in it. Human capital investments respond to the same ‘rationality’ of benefits and costs that postulate the remaining assumptions.

Taking the ‘hard core’ Neo-Walrasian assumptions as postulated by Backhouse (1991), the remaining assumptions which apply to the Human Capital Programme are:

- HC2 There exist economic agents.
- HC3 Agents have preferences over outcomes.
- HC4 Agents independently optimize subject to constraints.
- HC5 Choices are made in interrelated markets.
- HC6 Observable economic outcomes are co-ordinated, so they must be discussed with reference to equilibrium states.

I do not include the Neo-Walrasian ‘hard core’ assumption of complete information into the ‘hard core’ of the Human Capital Programme because imperfect information is a powerful assumption which can explain many novel facts derived from the Human Capital Programme.

The positive heuristic of the Neo-Walrasian Research Programme postulated by Backhouse (1991) is a set of research strategies that can be applied to most of neoclassical economic models and to the Human Capital Theory in particular.

The ‘protective belt’ of the Human Capital Programme is a long list of human capital ‘theories’ (Blaug 1976a). One strategy to describe the ‘protective belt’ of the Human Capital Programme could be that of Blaug which described the main theoretical progress of the programme. According to Blaug, this is the prediction of the demand of noncompulsory education. In contrast to Blaug’s strategy, the description of the protective belt carried through this paper consists of a list of auxiliary hypotheses that are linked to the neoclassical problem solving machinery and to the hard core to explain novel facts. A discussion of whether these auxiliary hypotheses are *ad hoc* hypotheses will be provided in the following Section along with the presentation of the novel facts that the research programme explains.

The list of hypotheses considered to shape the protective belt consists of the following six hypotheses.

- PB1 General on-the job training increases labor productivity by the same amount in different firms while specific on-the job training increases labor productivity more in the

firm providing the training.

The second hypothesis can be expressed by two different forms which relate to each other.

PB2 The way to compute earnings in the Human Capital Theory intermixes the capital and income accounts in such a way that earnings are both net of investment costs in human capital and gross of returns from investment in human capital.

PB2' The time pattern of depreciation of human capital is as follows: the economic value of a trainee increases rapidly at the beginning so that human capital experiences an appreciation during the investment period. Later there is a depreciation of human capital.

PB3 Household time can be devoted to produce human capital in addition to the time devoted to labor and goods production.

PB4 Capital markets are imperfect.

PB5 Human capital is an asset with more risk and uncertainty and with less liquidity than physical capital.

PB6 Ability and the amount invested in human capital are positively correlated.

The Human Capital Research Programme has been described by the five clauses of the hard core and the six hypotheses of the protective belt. Next, the Lakatosian appraisal criterion of corroborated excess content, or novel facts, is followed. This appraisal criterion has been criticized for lacking any firm epistemological basis (see Hands, 1991). In spite of this criticism, authors like Blaug and Backhouse recommend the Lakatosian criterion to appraise economics programmes. Among other reasons, the prediction of novel facts has a history in economics that goes back well before Lakatos.

4. Evaluating the Human Capital Research Programme

In 1976, Blaug pointed out the difficulty to evaluate the Human Capital Research Programme because there were not rival theories of similar importance which can be compared to the Human Capital Theory. However, Blaug predicted that the emerging theory

of Signalling pioneered by Arrow (1973), Spence (1974) and Stiglitz (1975), which provides education with the only role of a signal of unobserved ability instead of the role of increasing labor productivity, would become more important up to the point of replacing the Human Capital Theory.

Thirty years have lapsed since Blaug's prospects of the Signalling Theory gradually replacing the Human Capital Theory. Nevertheless, more theoretical models based on the Human Capital assumptions have emerged over the years and numerous empirical work has been done with the object of separating education effects on earnings from ability effects on earnings (see Card, 1999). Therefore, the present appraisal of the Human Capital Research Programme attempts to explain the growth and strength of the programme. This section presents a discussion of the novel facts predicted by the Human Capital Theory as well as a discussion of the programme's assumptions. This is done to counteract Blaug's criticism that human capital models 'resort to *ad hoc* auxiliary assumptions to account for every perverse result, culminating in a certain tendency to mindlessly grind out the same calculation with a new set of data, which are typical signs of degeneration in a scientific research program.'(Blaug 1976a, p. 849).

I now go on to present a discussion on several important novel facts explained by the Human Capital Theory.

4.1. Age-earnings profiles

In 1935, Walsh published tables of median earnings by age and education which showed that the discounted value of life earnings increased with the level of education. Walsh focused on returns of investment in education measured by life earnings but he did not focus on the steeper earnings profile by age. The observation of an increasing and concave age-earnings profile, more inclined for more educated persons, as seen for example in Mincer (1958), had been explained before by psychological theories of 'learning curves'. A new economic interpretation appears in the work of Gary Becker who explains the use of auxil-

ary assumptions expressed above (PB2 or PB2') which acknowledge the special meaning of observed earnings in relation to investments in human capital. Since human capital is embodied in the person investing it, observed earnings are both net of the investment and gross of returns in human capital. This is the reason why depreciation of human capital has a different time pattern to that of physical capital and it helps explain why higher investments imply steeper earnings profiles.

Therefore, assumption PB2 cannot be considered an *ad hoc* assumption at all, but as a direct implication of intrinsic characteristics of the human capital that it is fundamental for the hard core of the research programme.

The form of the earnings profile helps explain the low correlation between consumption and earnings for young people. Moreover, it can explain a negative correlation between the consumption and earnings of young people, a fact that is disallowed by the Friedman's theory of the Permanent Income Hypothesis.

This assumption also helps explain an anomaly in the earnings profile that can be caused by some investments in human capital. This happens when the investment in human capital is financed by an increase in the worker's wage, the so-called productive wage increase, which is given by the firm to pay worker investments in human capital provided outside the firm.

Murphy and Welch (1990) mention the large collection of empirical literature devoted to the study of age-earnings profiles. They show that the standard formulation of age-earnings profiles understates early career earnings growth by about 30-50 percent and overstates midcareer growth by 20-50 percent. However, simple alternative specifications that fit the data are available. Also, Thornton and Rodgers (1997) survey and interpret the empirical literature that estimates age-earnings profiles from cross-sectional data.

4.2. Unemployment and turnover

Unemployment has been generally explained by macroeconomic theories such as the Phillips

curve. Becker brings the issue of turnover in employment by arguing that ‘to bring turnover into the analysis of specific training is not, therefore, to introduce a *deus ex machina* but it is made necessary by the important link between them.’ (Becker 1993, p.43). That is, Becker argues that PB1 is not an *ad hoc* assumption which allows him to explain turnover.

The differentiation of on-the-job training between general and specific training is done to discuss who pays for training, the worker or the firm?. The answer depends on the type of productivity increase that the training provides. In this way, when it is the firm which pays for training, i.e., hiring costs, the firm has an incentive to retain the worker either by paying him or her a higher wage than in competing firms or offering long term contracts. Therefore, workers who receive more specific training experience lower turnover and lower unemployment during periods of crisis than workers with training of a general type.

Topel (1993) shows evidence of higher unemployment and turnover among the non-skilled and low-wage workers although he does not specify the nature of the investment in human capital.

4.3. Wage differentials and mobility among firms

Similarly to the discussion on turnover, the explanation of both wage differentials and lack of mobility of workers among firms is provided by assumption PB1. Because of workers or firms pay for on-the-job training by either a cut or an increase in wages respectively, the Human Capital Theory can explain a differential between wages and productivity in a competitive environment. Furthermore and without having to assume mobility costs, human capital can explain wage differentials and the lack of mobility among firms given the costs of specific training.

Barron, Black and Lowenstein (1989) examine the relationship among on-the-job training, starting wages, wage growth, and productivity growth.

4.4. Demand for Schooling

The most important part of human capital is that acquired in the education system. Hence, one of the main results of the the Human Capital Theory should be to predict enrollment at different levels of education.

The demand for schooling is usually understood as the level of enrollment which is the result of an individual optimization problem which finds the equilibrium between desires and schooling opportunities. On the one hand, it models the proper demand of individual investment in education. As with every demand function, the quantity of education depends on the price of the investment in education that is expressed as the marginal rate of return. The marginal rate of return which traces the demand function decreases owing to the embodiment of human capital. Different people have different demand curves, therefore a person who has a higher marginal rate of return for the same level of education may have a higher demand curve. With this in mind, the Human Capital Theory assumes that a higher demand curve reflects higher capabilities (PB6). On the other hand, it models the supply of education that shows the increasing marginal costs of financing education. That is, people with more facilities of funding education have lower supplies curves. There are differences in the accessibility of funds because of imperfect capital markets and the non-liquidity of human capital that cannot be used as collateral in loans (PB4 and PB5). The equilibrium result, known as the observable demand for schooling (level of enrollment), implies that people with more capabilities and more facilities of financing it demand more education.

The demand curve moves upward either because of an improvement in the expectation of returns or higher ability. Thus, the present returns and employment opportunities of graduates affect the expectations of returns of investors and then the level of enrollment. On the supply side, every factor that lowers the supply curves increases enrollment. That is, factors like the kind of improvements in the capital market, richer parents, subsidies and scholarships, all of them increase the level of enrollment.

Since life is finite, the present value of returns diminishes with age at the same time that the cost of the investment increases with age. The consequence is that the demand of human capital decreases with age. This is coherent with the observation of higher enrollment rates in non-compulsory education for youngsters.

The assumption that ability and the amount of investment in human capital are positively correlated is already considered by Becker and Chiswick (1966) and it supposes an advance to the Signalling or Credentialism Theory. The complementarity understood in this way and not as the rivalry between these theories has been tested for example by Card (1999) who finds an upwards ability bias around a 10 percent in the returns of education. Empirical facts on the returns to education which have been rationalized by some authors (see for example, Weiss, 1995) as anomalies of the human capital theory can be rationalized by the correlation between ability and education (PB6) which predicts heterogeneity in the returns to education across the population.

Recent policy evaluation models describe the relationship between returns to education and the enrollment level measured as the probability of going to school. The paper by Willis and Rosen (1979) pioneers these kind of models.

4.5. Financing of Education

Indeed, the Human Capital Theory has not clear predictions about who and by which means investments in human capital are financed. Its only clear prediction as to who finances human capital refers to on-the-job training. The answer to this problem depends on Assumption PB1 which predicts that workers finance their general training by means of lower wages during the investment period and firms finance specific training by offering higher wages to their employees than competing firms.

In relation to financing of education, all the weight of the financing models lies in assumptions PB4 and PB5. That is, capital markets are more imperfect to finance human capital than physical capital. Then, the private financing of education is accounted for by

one's own funds or family resources.

The rationality of the public financing of investments in human capital responds to the objective of either equalizing opportunities or the supply curve of human capital for each person. The effect it has is to diminish the dispersion of the distribution of amounts invested in human capital. An alternative rationality to explain the public financing of investments in human capital was informally anticipated by Becker who, in the Ryerson lecture given at the University of Chicago in 1989, stated that 'by combining publicly subsidized schooling with a social security system, countries may have found a very crude and indirect, but perhaps reasonably effective, way to provide loans to children that get repaid when the parents are old and collect retirement benefits (see also Becker and Murphy, 1988)'. The same idea has been formally modeled by Boldrin and Montes (2005).

Fernandez and Rogerson (2003) analyze the effects of different finance systems on educational resources and equity.

4.6. Personal distribution of earnings

According to Becker, 'The body of economic analysis rather desperately needs a reliable theory of the distribution of incomes. Whether or not this approach [human capital approach] is ultimately judged to be satisfactory, it should demonstrate that such a theory need not be a patchwork of Pareto distributions, ability vectors, and *ad hoc* probability mechanisms, but can rely on the basic economic principles that have so often proven their worth elsewhere.' (Becker 1993, p. 149).

Inequality in the distribution of earnings can be substantially explained by inequality in investments in human capital. At the same time, the Human Capital Theory can also explain why inequality in earnings is greater than the inequality in the amount invested in human capital. The main reason for the greater inequality in earnings is the positive inclination of the supply curve of human capital which is due to the increasing difficulty of financing larger amounts of human capital. That is, Assumptions PB4 and PB5 help

explain the inequality in earnings.

The dispersion in earnings of people with the same level of education is explained because a different marginal rate of return and a different marginal cost is associated to the same amount invested in equilibrium. The difference, therefore, lies in differences in abilities and opportunities to finance the investment.

The Human Capital Theory can also explain why the distribution of earnings is skewed to the right. One reason is that the product of two symmetrical distributions is a positively skewed distribution, indeed, the more skewed the distribution the more positively correlated distributions are. Therefore, although the distributions of ability and investment in human capital were symmetrical, the distribution of earnings would be positively skewed. Furthermore, although each person had the same ability, the distribution of supply curves which reflects the distribution of financial conditions is skewed. This effect could lead to inequality and would skew the earnings distribution.

Neal and Rosen (1999) explore several models that address the stylized facts of the personal earnings distributions, among them human capital models which illustrate how endowments of wealth and talent influence the investment decisions that generate observed distributions of earnings.

No discussion is presented on implications of the human capital theory on fertility and female labor participation.

5. Conclusions

The main author of the Human Capital Theory, Gary Becker, argues that to bring some issues as turnover, earnings distributions, or the intermixing of income and capital account in observed earnings, is not '*a deus ex machina*', is not 'capricious', or is not 'a patchwork'. This paper attempts to justify Becker's arguments by arranging the theory minimal assumptions into the form of a research programme. The objective of this paper is to help show why the 'novel facts' explained by the theory are a direct consequence of these

minimal assumptions. The paper also attempts explain why these minimal assumptions are fundamental and natural assumptions linked to the characteristics of human capital. That is, the auxiliary assumptions that shape the protective belt of the program are not presented a posteriori to fill the program with new empirical content.

References

- Arrow, J. K. (1973) "Higher Education as a Filter", *Journal of Public Economics*, 2(3), pp. 193-216.
- Backhouse, Roger E. (1991) *Appraising Economic Theories: Studies in the Methodology of Research Programmes*, edited by Neil de Marchi and Mark Blaug, Cheltenham and Brookfield, VT: Edward Elgar, pp. 403-426.
- Backhouse, Roger E. (1998) *Explorations in Economic Methodology. From Lakatos to empirical philosophy of science*. London and New York: Routledge.
- Barron, John M., Dan A. Black, and Mark A. Loewenstein. 1989, "Job Matching and On- the-Job Training", *Journal of Labor Economics* 7(1), pp. 1-19.
- Becker, Gary S. (1993) *Human Capital. A Theoretical and Empirical Analysis with Special Reference to Education*, Third Edition, The University of Chicago Press.
- Becker G. S. and K. M. Murphy (1988) "The Family and the State", *Journal of Law and Economics*, 31(1), pp. 1-18.
- Blaug, Mark (1976a) "The Empirical Status of Human Capital Theory: A Slightly Jaundiced Survey", *Journal of Economic Literature*, 14(3), pp. 827-855.
- Blaug, Mark (1976b) "Kuhn versus Lakatos of Paradigms versus Research Programmes in the History of Economics", in Latsis, S.J. (ed.) *Method and Appraisal in Economics*, Cambridge: Cambridge University Press, pp. 149-180.
- Boldrin, M. and A. Montes (2005) "The Intergenerational State. Education and Pensions", *Review of Economic Studies*, 72(3), pp. 651-664.
- Card (1999) "The Causal Effect of Education on Earnings", in O. Ashenfelter D. Card (ed.) *Handbook of Labor Economics*, chapter 30, pp. 1801-1863.

Fernandez, R. and R. Rogerson (2003) "Equity and Resources: An Analysis of Education Finance Systems", *Journal of Political Economy*, 111(4), pp. 858-897.

Glass, J. C. and W. Johnson (1988) "Metaphysics, MSRP and Economics", *The British Journal for the Philosophy of Science*, 39(3), pp. 313-329.

Hands, D. W. (1991) "The Problem of Excess Content: Economics, Novelty and a Long Popperian Tale", in *Appraising Economic Theories: Studies in the Methodology of Research Programmes*, edited by Neil de Marchi and Mark Blaug, Cheltenham and Brookfield, VT: Edward Elgar.

Murphy, K.M. and F. Welch (1990) "Empirical Age-Earnings Profiles", *Journal of Labor Economics* 8(2), pp. 202-229.

Neal, D. and S. Rosen (2000) "Theories of the Distribution of Earnings, Theories of the distribution of earnings. In: A. Atkinson and F. Bourguignon, Editors, *Handbook of Income Distribution*, North-Holland, Amsterdam (2000).

Spence, M. (1974) "Job Market Signalling ", *Quarterly Journal of Economics*,87(3), pp. 355-74.

Stiglitz, J. (1975) "The Theory of Screening, Education and the Distribution of Income", *American Economic Review*, 65(3), pp. 283-300.

Topel, R. (1993) "What Have We Learned from Empirical Studies of Unemployment and Turnover?" *The American Economic Review*, 83(2), Papers and Proceedings of the Hundred and Fifth Annual Meeting of the American Economic Association, pp. 110-115.

Walsh, J. R. (1935) "Capital Concept Applied to Man", *Quarterly Journal of Economics*, 49(2), pp. 255-285.

Weintraub, E. Roy (1985) *General Equilibrium Analysis: Studies in Appraisal*, Cambridge: Cambridge University Press.

Weiss, A. (1995) "Human Capital vs. Signalling Explanation of Wages", *The Journal of Economic Perspectives*, 9(4), pp. 133-154.