DISCUSSION PAPER SERIES

No. 2701

DAS HUMAN KAPITAL

Oded Galor and Omer Moav

INTERNATIONAL MACROECONOMICS

Centre for Economic Policy Research

www.cepr.org

DAS HUMAN KAPITAL

Oded Galor, Brown University and CEPR
Omer Moav, Massachusetts Institute of Technology, Hebrew University of Jerusalem and CEPR

This Discussion Paper is issued under the auspices of the Centre's research programme in **International Macroeconomics**. Any opinions expressed here are those of the author(s) and not those of the Centre for Economic Policy Research. Research disseminated by CEPR may include views on policy, but the Centre itself takes no institutional policy positions.

The Centre for Economic Policy Research was established in 1983 as a private educational charity, to promote independent analysis and public discussion of open economies and the relations among them. It is pluralist and non-partisan, bringing economic research to bear on the analysis of medium- and long-run policy questions. Institutional (core) finance for the Centre has been provided through major grants from the Economic and Social Research Council, under which an ESRC Resource Centre operates within CEPR; the Esmée Fairbairn Charitable Trust; and the Bank of England. These organizations do not give prior review to the Centre's publications, nor do they necessarily endorse the views expressed therein.

These Discussion Papers often represent preliminary or incomplete work, circulated to encourage discussion and comment. Citation and use of such a paper should take account of its provisional character.

ABSTRACT

Das Human Kapital

This Paper hypothesizes that the demise of the nineteenth century's European class structure reflects a deliberate transformation of society orchestrated by the capitalists. Contrary to conventional wisdom, it argues that the demise of this class structure has been in part an outcome of a cooperative rather than purely a divisive process. The research suggests that the transition from this class structure may be viewed as the outcome of an optimal reaction process of the capitalists to the increasing importance of human capital in sustaining their profit rates. The Paper argues that the process of capital accumulation has gradually intensified the relative scarcity of labour and has generated an incentive to augment labour *via* human capital accumulation. Due to the complementarity between physical and human capital in production, the capitalists were among the prime beneficiaries of the potential accumulation of human capital by the masses. They had therefore the incentive to financially support public education that would sustain their profit rates and would improve their economic wellbeing, although it would ultimately undermine their dynasty's position on the social ladder.

Oded Galor
Department of Economics
Brown University
Providence RI 02912
USA
Tel: (1 401) 863 2117
Fax: (1 401) 863 1970
Email: oded_galor@brown.edu

Omer Moav
Department of Economics
Hebrew University of Jerusalem
Mt. Scopus
Jerusalem 91905
ISRAEL
Tel: (972 2) 588 3121
Fax: (972 2) 581 6071
Email: msmoav@mscc.huji.ac.il

NON-TECHNICAL SUMMARY

During the nineteenth century, Europe witnessed the onset of the decline of the existing class structure, manifested by fundamental reforms in the education system, political structure, income redistribution and taxation. This research hypothesizes that, in contrast to the prevailing wisdom, the demise of capitalists–workers class structure reflected in part a deliberate transformation of society orchestrated by the capitalists in reaction to the increasing importance of human capital in sustaining their profit rates.

The Paper argues that the process of capital accumulation has gradually intensified the relative scarcity of labour and has generated an incentive to augment labour *via* human capital accumulation. Due to the complementarity between physical and human capital in production, the capitalists were among the prime beneficiaries of the potential accumulation of human capital by the masses. They had therefore the incentive to provide financial support for public education that would sustain their profit rates and improve their economic wellbeing, although it would ultimately undermine their dynasty's position on the social ladder.

In early stages of development, due to the relative abundance of labour and scarcity of capital, augmenting labour *via* universal human capital accumulation would have had a limited effect on the marginal productivity of capital. The capitalists therefore had no incentive to support the education of the masses financially to sustain their profit rates. In later stages of development, however, capital accumulation has gradually increased the potential role of human capital in the process of development and its importance in sustaining the rate of return to physical capital. In contrast, however, to physical capital accumulation, since human capital is inherently embodied in individuals and is subjected to decreasing marginal returns at the individual level, the accumulation of human capital necessitated investment in the education of a large segment of society. Moreover, the presence of credit market imperfections implied that a class society would result in a sub-optimal investment in human capital and consequently a lower rate of return to physical capital. Hence, the emergence of human capital as the prime engine of economic growth may have brought about a non-altruistic change in the attitude of the capitalists towards public education that planted the seeds for the demise of the existing class structure.

Existing theories regarding the fading capitalists–workers class structure can be classified into two categories. The Marxist approach argues that the demise of the class society is an outcome of a class struggle between workers and capitalists due to a rise in the degree of exploitation of workers brought about by declining profit rates. The recent political economy approach accepts the basic Marxist premise regarding an increased tension between workers and capitalists (masses and elite) as the prime catalyst for the diminished

class structure. It differs, however, in the analysis of the nature of the transition. It argues that the transition in Western Europe during the nineteenth century is an outcome of deliberate concessions of the elite designed to avert political instability, expropriation, and possibly a revolution.

This Paper, in contrast, develops a growth model in which the demise of the class structure is an inevitable by-product of productive cooperation between capitalists and workers, rather than an outcome of a class struggle and socio-political transition. The model demonstrates that in early stages of development, when physical capital is the prime engine of economic growth, society is marked by a stable class structure defined according to ownership of capital. Due to capital–skill complementarity, the accumulation of capital in the process of development raises the importance of human capital accumulation for the process of development and for sustaining the rate of return to physical capital. Once the rate of return to human capital increases sufficiently, capitalists as well as workers find it beneficial to institute publicly financed education and the prime characteristics of the capitalists–workers class structure vanish gradually.

The research thus suggests that Karl Marx's highly influential prediction about the inevitable demise of capitalism due to declining profit rates, stemmed from an under-appreciation of the role that human capital would play in the production process. Had Karl Marx been exposed to Gary Becker's human capital theory, the socio-political experience of the twentieth century might have unfolded in a strikingly different manner.

Interestingly, the analysis demonstrates that the support for public education is unanimous despite the fact that the capitalists carry the prime financial burden of public schooling. That is, due to the coexistence of credit market imperfections and capital–skill complementarity, the redistribution associated with public education is welfare-improving for capitalists as well as workers. Contrary to conventional wisdom, therefore, the demise of the European class structure in the nineteenth century has been an outcome of a cooperative rather than a divisive process

"The history of society is the history of struggles between social classes"

Karl Marx

1   Introduction

During the nineteenth century, Europe witnessed the onset of the decline of the existing class structure, manifested by fundamental reforms in the education system, political structure, income redistribution, and taxation. This research hypothesizes that, in contrast to the prevailing wisdom, the demise of Capitalists-Workers class structure reflected in part a deliberate transformation of society orchestrated by the Capitalists in reaction to the increasing importance of human capital in sustaining their profit rates.

The paper argues that the process of capital accumulation has gradually intensified the relative scarcity of labor and has generated an incentive to augment labor via human capital accumulation.[1] Due to the complementarity between physical and human capital in production, the Capitalists were among the prime beneficiaries of the potential accumulation of human capital by the masses. They had therefore the incentive to financially support public education that would sustain their profit rates and would improve their economic well being, although would ultimately undermine their dynasty's position in the social ladder.[2]

In early stages of development, due to the relative abundance of labor and scarcity of capital, augmenting labor via universal human capital accumulation would have had a limited effect on the marginal productivity of capital. The Capitalists therefore had no incentive to financially support the education of the masses in order to sustain their profit rates. In later stages of developments, however, capital accumulation has gradually increased the potential role of human capital in the process of development and its importance in sustaining the rate of return to physical capital. In contrast to physical capital accumulation, however, since human capital is inherently embodied in individuals and is subjected to decreasing marginal returns at the individual level, the accumulation of human capital necessitated investment in the education

---

[1] Land abundance in America have generated incentives for outflow of labor from Europe to America, intensifying the problem of labor scarcity and preventing the use of labor inflow (rather than investment in human capital) as a remedy for labor scarcity.

[2] Since firms have limited incentive to invest in the general human capital of their workers, in the presence of credit market imperfection the level of education will be sub-optimal unless it will be provided publicly.

of a large segment of society. Moreover, the presence of credit-market imperfections implied that a class society would result in a sub-optimal investment in human capital and consequently a lower rate of return to physical capital.[3] Hence, the emergence of human capital as an engine of economic growth may have brought about a non-altruistic change in the attitude of the Capitalists towards public education planting the seeds for the demise of the existing class structure.

Existing theories regarding the fading Capitalists-Workers class structure can be classified into two categories. The Marxist approach argued that the demise of the class society is an outcome of a class struggle between Workers and Capitalists due to a rise in the degree of exploitation of Workers brought about by declining profit rates. The recent political economy approach accepts the basic Marxist premise regarding an increased tension between Workers and Capitalists (Masses and Elite) as the prime catalyst for the diminished class structure. It differs however, in the analysis of the nature of the transition. It argues that the transition in Western Europe during the 19th century is an outcome of deliberate concessions of the elite designed to avert political instability, expropriation, and possibly a revolution. In particular, Acemoglu and Robinson (2000) suggest that the extension of the franchise was a commitment devise to assure future income redistribution from the elite to the masses.[4]

This paper, in contrast, develops a growth model in which the demise of the class structure is an inevitable by-product of a productive cooperation between Capitalists and Workers, rather than an outcome of a class struggle and socio-political transition. The model demonstrates that in early stages of development, when physical capital is the prime engine of economic growth, society is marked by a stable class structure defined according to ownership of

---

[3] See Galor and Zeira (1993), Benabou (1996), Durlauf (1996), Fernandez and Rogerson (1996), and Perotti (1996) for the effect of credit markets imperfection, on investment in human capital and economic growth.

[4] More generally, the effect of a social conflict on political, social and educational reforms has been examined by Grossman (1994), Alesina and Perotti (1996), Benhabib and Rustichini (1996), Benabou (1996), Grossman and Kim (1998), Acemoglu and Robinson (1999), Bertocchi and Spagat (1999) and Bourguignon and Verdier (2000). They argue that reforms (equality) diminishes the tendency for socio-political instability and predation, hence it may stimulate investment and economic growth. In particular, Bourguignon and Verdier (2000) and Grossman and Kim (1998) examines in a static setting the potential benefits for the elite from educational reforms. The former suggests that if political participation is determined by the education (socioeconomic status) of citizens, the Elite may not find it beneficial to subsidize universal public education, despite the existence of positive externalities from human capital, whereas the latter argues that education decreases predation. In our approach if social unrest motivates the Elite to relinquish power (income) to the masses, education reform is the optimal mechanism.

capital.[5] Due to capital-skill complementarity,[6] the accumulation of capital in the process of development raises the importance of human capital accumulation for the process of development and for sustaining the rate of return to physical capital.[7] Once the rate of return to human capital increases sufficiently, Capitalists as well as Workers find it beneficial to institute publicly financed education and the prime characteristics of the Capitalists-Workers class structure vanish gradually.[8] The research thus suggest that Karl Marx's highly influential prediction about the inevitable demise of Capitalism, due to declining profit rates, stemmed from an under-appreciation of the role that human capital would play in the production process.

Interestingly, the analysis demonstrates that the support for public education is unanimous despite the fact that the Capitalists carry the prime financial burden of public schooling. That is, due to the co-existence of credit market imperfections and capital-skill complementarity, the redistribution associated with public education is Pareto improving.[9] Contrary to conventional wisdom, therefore, this research argues that the demise of the European class structure in the 19th century has been, at least partly, an outcome of a cooperative rather than a divisive process. In those countries that had been in the 19th Century in the midst of a process of democratization one can view the divisive force and the collusive force as reinforcing one another. Educational reforms can be viewed as an economically efficient method of implementing elements of the political transition whereas political reforms can be viewed as a by-product of the efficient educational reforms that have made political inequality harder to

---

[5]Existing models that study the effect of wealth distribution on economic growth are based on either human capital accumulation or physical capital accumulation. In contrast, the central insight of the current theory is based on the presence of two engines of economic growth whose relative importance changes endogenously in the process of development. Earlier growth models that focus on the dual role of physical and human capital in the process of development include, for instance, Lucas (1988), Caballe and Santos (1993) and Mulligan and Sala-i-Martin (1993). These models abstract from the analysis of income heterogeneity and credit market imperfections, and therefore, do not study the incentives of the rich to subsidize the education of the poor.

[6]See Goldin and Katz (1998) for evidence regarding capital-skill complementarity and Mokyr (1990, 1999) for the relationship between technology and human capital.

[7]Durlauf and Johnson (1995), provide empirical evidence for the rise in the return to human capital in early stages of development. The evolution of the returns to skills in the 20th century is analyzed in Goldin and Katz (1999).

[8]It should be noted that in mature stages of development, however, inequality might widen once again due to skilled or ability-biased technological change induced by human capital accumulation. This line of research was explored theoretically by Galor and Tsiddon (1997), Acemoglu (1998), and Galor and Moav (1998). Nevertheless, in this scenario, the sources of income inequality are less related to class association as reflected by the increased intergenerational mobility (e.g., Galor and Tsiddon (1997), Maoz and Moav (1999), Hasller and Rodriguez-Mora (2000)).

[9]It should be noted that, in the model, there are no externalities from human capital accumulation.

sustain and justify.

2 Historical Evidence

The European experience in the second half of the 19th century is consistent with the fundamental hypothesis of this research. It suggests that in the second phase of the Industrial Revolution, education reforms were designed primarily to satisfy the increasing skill requirements in the process of industrialization. The reforms were supported by capitalists and workers in autocratic societies as well as in societies in the midst of the process of democratization and have ultimately lead to the demise of the European class structure of the 19th century. The evidence suggests that, regardless of the implementation of political reforms, the pure economic forces that brought about educational reforms would have been sufficient to alter the structure of society.

2.1 Education Reforms

2.1.1 England

In the early stage of the Industrial Revolution in England skills and literacy requirements had been minimal and the state devoted virtually no resources to raise the level of literacy of the masses. During this period, illiterate labor force could operate the existing technology, and economic growth was not impeded by educational retardation.[10] Workers developed skills primarily through on-the-job training, and child labor was highly valuable. Consequently, the development of a national public system of education in England lagged behind the continental states by nearly half a century and the literacy rate had not increased in the period 1750-1830. (Sanderson, 1995, pp. 2-10).[11] As argued by Green, (1990, pp. 293-294), "Britain's early industrialization had occurred without direct state intervention and developed successfully, at least in its early stages, within a laissez-faire framework. Firstly, state intervention was

---

[10] As argued by Mitch (1992 pp. 14-15), during the first stages of the Industrial Revolution, literacy was largely a cultural skill or a hierarchy symbol that had limited value in the labor market. For instance, in 1841 only 4.9% of male workers and only 2.2% of female workers were in occupations in which literacy was strictly required.

[11] For instance, in his parliamentary speech in defense of his 1837 education bill, the Whig politician, Henry Brougham, echoed the same theme: "It cannot be doubted that some legislative effort must at length be made to remove from this country the opprobrium of having done less for education of the people than any of the more civilized nations on earth." (Green, 1990, pp.10-11).

thought unnecessary for developing technical skills, where the initial requirements were slight and adequately met by traditional means. Secondly, the very success of Britain's early industrial expansion encouraged a complacency about the importance of scientific skills and theoretical knowledge which became a liability in a later period when empirical knowledge, inventiveness and thumb methods were no longer adequate."

England had gradually reformed its education system since the 1830s and literacy rates had gradually increased. The process was initially motivated by a variety of reasons such as, religion, enlightenment, social control, moral conformity, socio-political stability, and military efficiency, as was the case in other European countries (e.g., Germany, France, Holland, Switzerland) that have supported public education much earlier. Moreover, the mechanization of domestic industry reduced the need for child labor. However, in light of the insignificant demand for skills and literacy by the capitalist, the level of governmental support has been rather small. Even in 1869 the government funded only one third of school expenditure. (Green, 1990, pp. 6-7).

In the second phase of the industrial revolution skills became necessary for production.[12] In light of industrial competition from the other countries, capitalists started to recognize the importance of technical education for the provision of skilled workers. Crafts and Thomas (1986) argue that "The source of Britain's industrial leadership in the nineteenth century was a favorable endowment of natural resources, combined with a stock of labor sufficient to exploit these advantages; Britain's handicap in the later part of the century was a scarcity of the human capital which was an essential input to the technologically progressive product-cycle industries that dominated the Second Industrial Revolution".

The pure laissez-faire policy had failed in developing a proper education system and Capitalists demanded government intervention in the provision of education. As James Kitson, a Leeds iron-master and advocate of technical education explained to the Select Committee on Scientific Instruction (1867-1868): "...the question is so extensive that individual manufacturers are not able to grapple with it, and if they went to immense trouble to establish schools they would be doing it in orders that others may reap the benefit" (Green, 1990, p. 295).

---

[12]. "Job advertisements from the 1850s occasionally mentioned literacy as a desired characteristic for employment, even for occupations of modest status" (Micth, 1993, p. 292).

As it became apparent that skills are necessary for the creation of an industrial society, replacing previous ideas that the acquisition of literate skills would make the working classes receptive to radical and subversive ideas, capitalist has pressed the government to provide education to the masses.[13] As hypothesize in this paper, there was a growing consensus among workers and capitalists about the virtues of reform. The labor union movement was increasingly calling for a national system of non-sectarian education. The National Education League, (founded in 1869 by radical Liberals and Dissenters) demanded free, compulsory, non-sectarian national system of education. (Green, 1990, p. 302).

A major turning point in the attitude of Capitalists towards public education has been the Paris Exhibition of 1867, where the limitations of the English scientific and technical education become clearly evident. Unlike the 1851 Exhibition in which England won most prizes, the English performance at Paris was rather poor: in all of the ninety classes of manufacturers, Britain was pre-eminent only in ten. Lyon Playfair, who was one of the jurors, reported that: "a singular accordance of opinion prevailed that our country has shown little inventiveness and made little progress in the peaceful arts of industry since 1862". This lack of progress "upon which there was most unanimity conviction is that France, Prussia, Austria, Belgium and Switzerland possess good systems of industrial education and that England possesses none". (Green, 1990, p. 296).[14]

In 1868 the government responded to the outcry of capitalists as well as labor unions and established the Parliamentary Select Committee on Scientific Education. This was the origin of nearly 20 years of various parliamentary investigations of the relationship between science, industry, and education. A sequence of reports by the Select Committee on Scientific Instruction, 1968, The Royal Commission on Scientific Instruction and the Advancement of Science, 1872-75, and The Royal Commission on Technical Education, 1982, underline the inadequate training for supervisors, managers, proprietors as well as workers. They argue that most managers and proprietors did not understand the manufacturing process and thus, failed

---

[13] As noted by Sanderson (1995, pp. 10-13), "reading ... enabled the efficient functioning of an urban industrial society laced with letter writing, drawing up wills, apprenticeship indentures, passing bills of exchange, and notice and advertisement reading." Moreover, manufacturers argued that: "universal education is required in order to select, from the mass of the workers, those who respond well to schooling and would make a good foremen on the shop floor." (Simon, 1987, p.104).

[14] Moreover, the Nussey brothers, who had written a report on woolen textiles at the Exhibition, returned to Leeds to start a movement for a Yorkshire College of Science.

to promote efficiency, investigate innovative techniques and value the skills of their workers (Green, 1990, pp. 297-298). In particular, W. E. Forster, The Vice President of the committee of the Council of Education told The House of Commons: "Upon the speedy provision of elementary education depends our industrial prosperity... if we leave our work-folk any longer unskilled, ... they will become overmatched in the competition of the world." (Hurt, 1971, pp. 223-224). The reports made various recommendations which highlighted the needs for the redefinition of elementary school, the revision of the curriculum throughout the entire school system, specially with respect to industry and manufacturing, and the improvement of teacher training.

In addition, in 1868 secondary schools were investigated by the Schools Inquiry Commission, which found a very unsatisfactory level for the vast majority of schools that employ untrained teachers and used antiquated methods. Their main proposal was to organize a state inspection over secondary schools and to provide an efficient education geared towards the specific needs of its consumers. In particular, The Royal Commission on Technical Education of 1882, confirmed that England was being overtaken by the industrial superiority of Prussia, France and the United States and recommended the introduction of technical and scientific education into secondary schools.

Consequently, the government had gradually yielded to the pressure by Capitalists as well as labor unions and increased its contributions to elementary as well as for higher education. In the 1870 Education Act, the government assumed the responsibility for ensuring universal elementary education, although it did not provide neither free nor compulsory education at elementary level. The Act created national provision without an integrated system where voluntary schools existed beside state schools. In 1880 education was made compulsory throughout England and in 1891 education fees were abolished in nearly all elementary schools. The 1889 Technical Instruction Act allowed the new local councils to set up technical instruction committees and the 1990 Local Taxation Act provided public funds that could be spent on technical education (Green, 1990, p. 299). Consequently, school enrollment of 10-year old has increased from 40% in 1870 to 100% in 1900. Finally, the 1902 Balfour Act marked the consolidation of a national education system and created state secondary schools (Ringer, 1979

and Green, 1990, p. 6).[15]

Science and its application in technology have gained prominence. New universities have been established in Manchester, Birmingham, Leeds, Sheffield, Newcastle, Bristol, and London and science schools were established and financed through the Department of Science. In particular, the University of London was cheaper than the ancient universities and it had a strong emphasis on professional training in the medical, legal, engineering and economic studies neglected at Oxford and Cambridge (Sanderson, 1995, p. 47).

2.1.2 Prussia

The early development of national education in Prussia occurred in the eighteenth century well before the Industrial Revolution. The process was motivated primarily by: the will to establish social control, religious forces, and the wish to unify the German states and to assure military efficiency. However, as was the case in England the massive educational reforms occurred only in the second half of the nineteenth century due to rising demand for skills in process of industrialization.

Frederick William I (1713-1740) made the initial steps towards compulsory education. In the "Advisory Order" in 1717 he declared attendance at village schools compulsory for all children. In 1737 he issued the "Principia Regulative" which henceforth became the fundamental School Law for the province of East Prussia. (Cubberley, 1920). His successor Frederick II, viewed education as a method for the unification of the state. In 1763 he issued the "General regulations for village school" and the code for the Catholic schools of Silesia, in 1765. Education was compulsory from the ages five to thirteen, tuition fees were standardized and fees for the children of the poor were waived. Nevertheless, these regulations were not strictly enforced due to the lack of funding for such a comprehensive project. Parents objected to taxation and to the loss of their income from child labor and the landlords objected to the financial burden.

Napoleon's triumph over the Prussians in 1806 caused Prussia to loss a large part of its army and territory and subjected it to a French influence. Prussia was heavily humiliated. These events awake a strong national movement. One of its leaders, the philosopher Johann

---

[15]The English secondary institutions were initially financially independent from the state and its recruitment was more socially exclusive than in other countries in Europe. Children from the upper middle class, professional, business and commercial backgrounds dominated secondary schools. However, they often included a lower middle class and artisan families. (Green, 1990, p.20).

Gotlieb Fitche called for patriotism to the German nation and stressed education as the means to that end. He claimed that universal, state-directed, compulsory education would teach all Germans to be good Germans and would prepare them to play whatever role, military, economic or political in helping the state reassert Prussian power. (Ramirez and Boli, 1987). Education was taken from the church control to the state. Humboldt, Head of the Bureau of Ecclesiastical Affairs and Public Instruction, created the machinery of a national education system, instituting the Volksschule, establishing provincial and district school boards, and decreeing, in 1810, that education was a secular activity and compulsory for three years. In the same year, the University of Berlin was founded followed by the Universities of Breslau, Bonn and Munich. In 1812, the Legislation reconstituted the Gymnasium as a state institution providing nine years of education for the elite. The prime motivation behind these schools was to provide the state with efficient bureaucrats. (Cubberly, 1920 and Green, 1990).

In the period 1830-1870 Prussia begun its first period of industrialization and a pressure for reforms in the educational system began to arise. As noted by Green (1990, pp. 293-294) "In continental Europe industrialization occurred under the tutelage of the state and began its accelerated development later when techniques were already becoming more scientific; technical and scientific education had been vigorously promoted from the center as an essential adjunct of economic growth and one that was recognized to be indispensable for countries which wished to close Britain's industrial lead."

Under the administration of Baron von Altenstein, the Minister for Spiritual, Educational and Medical Affairs, state administration of education was established and previous reforms for compulsory elementary schooling became effectively universal. Taxes were imposed to finance the school system and teachers training and certification were established. Secondary schools started to serve industrial needs as well, and The Realschulen, which emphasized the teaching of mathematics and science, was gradually adopted and was finally accepted in 1900. In county towns, vocational or trade schools were founded. "School courses... had the function of converting the occupational requirements of public administration, commerce and industry into educational qualifications..." (Muller, 1987, pp. 23-24).

9

2.1.3 France

In the 17th and the 18th centuries elementary and secondary education was entirely dominated by the church and religious orders. Nevertheless, the state had already demonstrated its interest in (non-popular) education through constant interventions in technical and vocational training in order to reinforce the military, technical, and vocational education, which would support the state development in commerce, manufactures and military efficiency. (Green, 1990 pp. 135-137).

After the French Revolution the National Assembly asserted the complete supremacy of the state in all educational matters and established primary schools. Primary education was universal and free, but secondary education remained highly selective, offering a general and technical instruction largely for the middle class, whilst the lycées, with a broad modern humanities curriculum, would be reserved for a tiny elite. (Green, 1990, pp.141-142). Legislative proposals during the National Convention quoted by Cubberley (1920, pp. 514-517) are quite raveling: "...Children of all classes were to receive that first education, physical, moral and intellectual, the best adapted to develop in them republican manners, patriotism, and the love of labor... They are to be taken into the fields and workshops where they may see agricultural and mechanical operations going on...". Between 1793-1803 numerous special schools were established which were designed to produce skilled workers for manufacturing and the state in a wide range of occupations. The basis of a national education system was finally established by with the laws founding the Université in 1806 and 1808. "This unique institution represented a giant secular teaching corporation whose cardinal principles were supreme central control and state monopoly over instruction." (Green, 1990, p.150).

Napoleon ignored primary education concentrating instead on developing secondary and higher education with the objective of producing an effective elite to operate the military and governmental apparatus. With the creation of the lyceé, France was the first to develop a national system of secondary schools run by the state. While France was in the vanguard of technical education in Europe, primary education for the masses remained very basic and was controlled by the church.

After 1833 the state grants for primary schools has gradually increased. Guizot, the Minister for Public Instruction introduced a law that attempted to provide primary education

in all areas, extend the higher education, and provide teacher training and schools inspection. This law however did not follow the revolutionary ideas of free and compulsory schooling. According to Green: "Guizot's legislation ... reflected the economic development of the period and thus the increasing need for skilled labor". (Green, 1990, p.157). During the Second Empire (until 1870), however, religious schools regarded as more favorable to monarchical were encouraged again and the state primary schools lost importance. In 1871 after the humiliation of France by the Prussians, the Third Republic was created, with Universal male suffrage and a new period of educational regulations and reforms. By 1881 a universal, free, compulsory and secular primary school system was finally established and technical and scientific education has been emphasized.

2.1.4 Russia

Russia as well witnessed major educational reforms during the 19th century, although political reforms were not implemented. Czar Alexander I instituted at the beginning of the 19th century educational reforms where old schools were remodeled and new schools were founded. Schools were designed to be free and under state control and provide utilitarian, scientific, and secular education. Rural peasants were supposed to be taught reading, writing, arithmetic, and elements of agriculture and pupils in the district schools of urban areas and the provincial schools were supposed to be prepared for careers as civil servants or for other white-collar occupations such as law, technology, and commerce.[16] The Czar Alexander II, enacted in 1855 a new system of local government in rural areas with a right to found free schools for the peasantry. The utilitarian trend was evident in the establishment of vocational schools.[17]

2.2 The Timing of Educational and Political Reforms:

Education reforms had taken place in autocratic states that had not relinquished political power throughout the 19th century, and they had occurred contemporaneously with political reforms in societies in the midst of the process of democratization.

---

[16] The utilitarian viewpoint of education is reflected in a statement of Nicholas I: "It is necessary that in every school the subjects of instruction and the very methods of teaching should be in accordance with the future destination of pupils, that nobody should aim to rise above that position in which it is his lot to remain."

[17] A period of reaction followed under Alexander III due to the tension between the orthodox clergy and the minister of public instruction.(Alston 1969). The result was that at the turn of the century nearly 70 percent of Russia's male population was illiterate.

In England, education reforms and political reforms were roughly contemporaneous. The Reform Act of 1832 nearly doubled the total electorate, but nevertheless only 3% of the entire population had been permitted to vote. The artisans, the working classes, and some sections of the lower middle classes remained outside of the political system. The franchise was extended further in the Reform Acts of 1867 and 1884 and the total electorate had nearly doubled in each of these episodes and working class voters became the majority in all urban constituencies. (Craig 1989).

In France, education reforms corresponded to political reforms as well. After the 1830 revolution, restrictions limited the electorate to less than one percent of the population. The 1848 revolution led to the Second Republic with the introduction of short-lived universal voting rights for males. Restrictions on voting rights were re-introduced in 1850, and then after the coup of Louis Napoleon in 1851 and the declaration of the Second Empire in 1852. The liberal phase was renewed from 1860 till democracy was secured in 1877 (Cole and Campbell, 1989).

Unlike the political and educational reforms in England and France that occurred contemporaneously, Political reforms in Prussia and Russia lagged behind the educational reforms. Although some political reforms were instituted as early as 1848 by the governing Prussian oligarchy (Blackbourn, 1998) and adult males over the age of 25 had the right to vote in 1870,[18] democracy was established only with the creation of the Weimar Republic in 1919.

3   The Basic Structure of the Model

Consider an overlapping-generations economy in a process of development. In every period the economy produces a single homogeneous good that can be used for consumption and investment. The good is produced using physical capital and human capital. Output per-capita grows over time due to the accumulation of these factors of production. The stock of physical capital in every period is the output produced in the preceding period net of consumption and human capital investment, whereas the stock of human capital in every period is determined by the aggregate level of public education in the preceding period.

---

[18]Voting was controlled in rural areas by the landlords (Goldstein, 1983).

3.1 Production of Final Output

Production occurs within a period according to a neoclassical, constant-returns-to-scale, production technology. The output produced at time t, Y_t, is

$$Y_t = F(K_t, H_t) \equiv H_t f(k_t) = A H_t k_t^\alpha; \quad k_t \equiv K_t/H_t; \quad \alpha \in (0,1), \tag{1}$$

where K_t and H_t are the quantities of physical capital and human capital (measured in efficiency units) employed in production at time t, and A is the level of technology.[19] The production function, $f(k_t)$, is therefore strictly monotonic increasing, strictly concave satisfying the neoclassical boundary conditions that assure the existence of an interior solution to the producers' profit-maximization problem.

Producers operate in a perfectly competitive environment. Given the wage rate per efficiency unit of labor, w_t, and the rate of return to capital, r_t, producers in period t choose the level of employment of capital, K_t, and the efficiency units of labor, H_t, so as to maximize profits. That is, $\{K_t, H_t\} = \arg\max \left[H_t f(k_t) - w_t H_t - r_t K_t \right]$. The producers' inverse demand for factors of production is therefore

$$
\begin{aligned}
r_t &= f'(k_t) = \alpha A k_t^{\alpha-1} \equiv r(k_t); \\
w_t &= f(k_t) - f'(k_t)k_t = (1-\alpha)A k_t^\alpha \equiv w(k_t).
\end{aligned}
\tag{2}
$$

3.2 Individuals

In every period a generation which consists of a continuum of individuals of measure 1 is born. Each individual has a single parent and a single child. Individuals, within as well as across generations, are identical in their preferences and innate abilities. They may differ, however, in their family wealth and thus, due to borrowing constraints, in their capability to finance their offspring's investment in human capital in the absence of public education.

Individuals live for two periods. In the first period of their lives individuals devote their entire time for the acquisition of human capital. The acquired level of human capital increases

---

[19] The abstraction from technological change is merely a simplifying assumption. As will become apparent, the introduction of endogenous technological change would not affect the qualitative results. It should be noted, however, that this simplification is consistent with empirical evidence suggesting that TFP growth over the relevant period for this study is negligible and output growth is based primarily on factor accumulation.

if their time investment is supplemented with capital investment in education.[20] In the second period of their lives, individuals supply their efficiency units of labor and allocate the resulting wage income, along with their interest income, between consumption and transfers to their children.

An individual i born in period t (a member i of generation t) receives a parental transfer, b_t^i, in the first period of life. A fraction $\tau_t \geq 0$ of this capital transfer is collected by the government in order to finance public education, whereas a fraction $1 - \tau_t$ is saved for future consumption. Individuals devote their first period for the acquisition of human capital. Education is provided publicly free of charge.[21] The acquired level of human capital increases with the real resources invested in public education. The number of efficiency units of labor of each member of generation t in period $t+1$, h_{t+1}, is a strictly increasing, strictly concave function of the government real expenditure on education per member of generation t, e_t.[22]

$$h_{t+1} = h(e_t), \tag{3}$$

where $h(0) = 1$, $\lim_{e_t \to 0+} h'(e_t) = \gamma < \infty$, and $\lim_{e_t \to \infty} h'(e_t) = 0$.[23] Hence, even in the absence of real expenditure on public education individuals posses one efficiency unit of labor - basic skills.

In the second period life, a member i of generation t supplies the acquired efficiency units of labor, h_{t+1}, at the competitive market wage, w_{t+1}. In addition, the individual receives the

[20] The qualitative results would not be affected if the time investment in education (foregone earnings) is the prime factor in the production of human capital, as long as physical capital would be needed in order to finance consumption over the education period. Both formulations assure that in the presence of capital markets imperfections, investment in human capital depends upon public education in the absence of sufficient family wealth.

[21] As will become apparent, once the level of public education is chosen optimally, individuals have no incentive to acquire private education. Furthermore, in early stages of development, the tax rate τ_t equals zero and individuals therefore do not acquire education.

[22] A more realistic formulation would link the cost of education to (teacher's) wages, which may vary in the process of development. For instance, $h_{t+1} = h(e_t/w_t)$ implies that the cost of education is a function of the number of efficiency units of teachers that are used in the education of each individual i. As can be derived from section 2.4, under both formulations the optimal expenditure on education, e_t, is an increasing function of the capital-labor ratio in the economy, and the qualitative results are therefore identical.

[23] The assumption $\lim_{e_t^i \to 0+} h'(e_t^i) = \gamma < \infty$ assures that under some market conditions investment in human capital is not optimal. This assumption is necessary in order to assure that in the early stage of development the sole engine of growth is physical capital accumulation and there is no incentive to invest in human capital. It permits, therefore, a sharp presentation of the results regarding institutional transition.

gross return on savings, $(1-\tau_t)b_t^i R_{t+1}$. The individual's second period income, I_{t+1}^i, is therefore

$$I_{t+1}^i = w_{t+1}h(e_t) + (1-\tau_t)b_t^i R_{t+1}, \tag{4}$$

where due to complete capital depreciation $R_{t+1} \equiv r_{t+1} \equiv R(k_{t+1})$.

Preferences of a member i of generation t are defined over second period consumption,[24] c_{t+1}^i, and the transfer to their offspring, b_{t+1}^i. They are represented by a non-homothetic,[25] log-linear utility function that generates the property that the average propensity to bequest is an increasing function of wealth,[26]

$$u_t^i = (1-\beta)\log c_{t+1}^i + \beta\log(\overline{\theta} + b_{t+1}^i), \tag{5}$$

where $\beta \in (0,1)$ and $\overline{\theta} > 0$.[27]

Hence, a member i of generation t allocates second period income between consumption, c_{t+1}^i, and transfers to the offspring, b_{t+1}^i. That is,

$$c_{t+1}^i + b_{t+1}^i \le I_{t+1}^i. \tag{6}$$

The individual chooses the level of second period consumption, c_{t+1}^i, and a non-negative transfer to the offspring, b_{t+1}^i, so as to maximize the utility function subject to the second period budget constraint (6).[28]

---

[24] For simplicity we abstract from first period consumption. It may be viewed as part of the consumption of the parent.

[25] The choice of a non-homothetic utility function is necessary to assure that Workers do not invest in physical capital prior to their investment in human capital – a feature that has no qualitative bearing, but sharpens the presentation of the results. This formulation is consistent with empirical evidence. For example Dynan, Skinner and Zeldes (2000), for evidence that saving rates increase with wealth and Tomes (1981) for evidence that the marginal propensity to bequeath increases with wealth.

[26] This formulation is consistent with the classical viewpoint (e.g., Adam Smith (1776) and was further interpreted and developed by Keynes (1920), Lewis (1954), Kaldor (1957), and Bourguignon (1981)), according to which, saving rates are an increasing function of wealth, and inequality therefore channels resources towards individuals whose marginal propensity to save is higher, increasing aggregate savings and capital accumulation and enhancing the process of development in its early stages. A choice of an homothetic utility function would not affect the results regarding the effect of capital skill-complementarity on institutional transition.

[27] This form of altruistic bequest motive (i.e., the "joy of giving") is the common form in the recent literature on income distribution and growth. It is supported empirically by Altonji, Hayashi and Kotlikoff (1997). Utility from net transfers would reduce the amount of intergenerational transfers but would not affect the qualitative results. In particular, under utility from net transfers equation (7) below would be

$$b_{t+1}^i = b(I_{t+1}^i, \tau_{t+1}) \equiv \begin{cases} \beta(I_{t+1}^i - \theta/(1-\tau_{t+1})) & if \quad I_{t+1}^i > \theta/(1-\tau_{t+1}); \\ \\ 0 & if \quad I_{t+1}^i \le \theta/(1-\tau_{t+1}), \end{cases}$$

[28] It should be noted that the transfer, b_{t+1}^i, is necessarily non-negative due to the assumption that the offspring has no income in the first period of life.

15

Hence the optimal transfer of a member i of generation t is:

$$b_{t+1}^i = b(I_{t+1}^i) \equiv \begin{cases} \beta(I_{t+1}^i - \theta) & if \quad I_{t+1}^i > \theta; \\ \\ 0 & if \quad I_{t+1}^i \leq \theta, \end{cases} \tag{7}$$

where $\theta \equiv \overline{\theta}(1 - \beta)/\beta$. As follows from (7), the transfer rate b_{t+1}^i / I_{t+1}^i is increasing in I_{t+1}^i.

3.3   Physical Capital, Human Capital, and Output

Let B_t denote the aggregate level of intergenerational transfers in period t,

$$B_t = \int_0^1 b_t^i di.$$

A fraction τ_t of this capital transfer is collected by the government in order to finance public education, whereas a fraction $1 - \tau_t$ is saved for future consumption.[29] The capital stock in period $t + 1$, K_{t+1}, is therefore

$$K_{t+1} = (1 - \tau_t)B_t, \tag{8}$$

whereas the government tax revenues are $\tau_t B_t$.

Since population is normalized to 1, the education expenditure per young individual in period t, e_t, is therefore,

$$e_t = \tau_t B_t, \tag{9}$$

and the stock of human capital in period $t + 1$, H_{t+1}, is therefore

$$H_{t+1} = \int_0^1 h_{t+1}^i di = h(e_t) = h(\tau_t B_t). \tag{10}$$

Hence, the capital-labor ratio $k_{t+1} \equiv K_{t+1}/H_{t+1}$ is,

$$k_{t+1} = \frac{(1 - \tau_t)B_t}{h(\tau_t B_t)} \equiv k(\tau_t, B_t), \tag{11}$$

[29] As will become apparent, this linear tax structure is the simplest structure that would generate the transition from a class society. Furthermore, it would assure that the chosen level of taxation is independent of the structure of the political system. That is, independent of the distribution of political power or voting rights among members of society. Furthermore, Capitalist could have not effectively forced the poor to finance their own education due to the proximity of the income of the poor to the subsistence level of consumption and the positive effect of income of the outcome of the education process.

where $k(0, B_t) = B_t,\ \ \partial k(\tau_t, B_t)/\partial \tau_t < 0,\ \ \text{and}\ \ \partial k(\tau_t, B_t)/\partial B_t > 0.$

and the output per-worker in period $t+1$ is

$$y_{t+1} = A[(1-\tau_t)B_t]^{\alpha} h\,(\tau_t B_t)^{1-\alpha} \equiv y(\tau_t, B_t). \tag{12}$$

3.4 Optimal Taxation

Given that the indirect utility function is a strictly increasing function of the individual's second period wealth, the optimal tax rate, τ_t^i, from the viewpoint of member i of generation t, (and hence the optimal expenditure on education, $e_t = \tau_t^i B_t$ from the viewpoint of this individual, given B_t) would maximize the individual's second period wealth, I_{t+1}^i.

$$\tau_t^i = \arg\max[w_{t+1} h(\tau_t^i B_t) + (1-\tau_t^i)b_t^i R_{t+1}], \tag{13}$$

where $w_{t+1} = w(k_{t+1})$ and $R_{t+1} = R(k_{t+1})$.

As follow from (13), noting (2) and (11) the optimal tax rate from the viewpoint of a member i of generation t, τ_t^i, is given by[30]

$$w(k_{t+1})h'(\tau_t^i B_t) = R(k_{t+1}) \quad for \quad \tau_t^i > 0$$
$$w(k_{t+1})\gamma \leq R(k_{t+1}) \quad\quad for \quad \tau_t^i = 0, \tag{14}$$

where $k_{t+1} = k(\tau_t, B_t)$. Hence, given $B_t,\ \tau_t^i$ is determined independently of b_t^i, and is therefore identical for all i.[31] That is $\tau_t^i = \tau_t^*$ for all i. Furthermore, there exists a unique capital-labor ratio $\widetilde{k}$, below which $\tau_t^i = 0$. That is, $R(\widetilde{k}) = w(\widetilde{k})\gamma$.

Lemma 1 (a) The optimal tax rate in period t, τ_t^*, from the viewpoint of each member of

---

[30]Substituting (2) and (11) into (13),

$$\tau_t^i = \arg\max(1-\tau_t^i)^{\alpha} h(\tau_t^i B_t)^{1-\alpha} B_t^{\alpha}[1 - \alpha + \alpha b_t^i/B_t].$$

The conditions in (14) follow from the optimization problem above, using (2).

[31]The unanimous agreement on the tax rate is a result of the linear tax rate and the unit elasticity of substitution between human and physical capital in production. Given a Cobb-Douglas production function, the shares of labor and capital are constant and wage and capital income are therefore maximized if output is maximized. If the elasticity of substitution would be larger than unity, then the poor would prefer higher taxes, whereas if the elasticity of substitution is smaller than unity, then the poor would prefer lower taxes.

generation t is equal and uniquely determined.

$$\tau_t^* = \tau(B_t) \begin{cases} > 0 & for \quad B_t > \widetilde{k} \\ = 0 & for \quad B_t \leq \widetilde{k}; \end{cases}$$

$\widetilde{k} = \alpha/(1-\alpha)\gamma.$

(b) The optimal expenditure on public education, $e_t = \tau(B_t)B_t \equiv e(B_t)$ from the viewpoint of each member of generation t is strictly increasing for $B_t > \widetilde{k}$.

Proof. Noting (2),(11) and (14) it follows from the properties of $h(\tau_t B_t)$ that τ_t^* is uniquely determined by B_t and $e'(B_t) > 0$, where as follows from the definition of $\widetilde{k}$ and (2), $\widetilde{k} = \alpha/(1-\alpha)\gamma.$ □

Hence, since the optimal tax rate in period t is identical from the viewpoint of each member of generation t, it follows that under any political structure, the chosen tax rate in period t is

$$\tau_t = \tau_t^* = \tau(B_t). \tag{15}$$

Proposition 1 *The tax rate in period t, τ_t is*

$$\tau_t \begin{cases} > 0 & for \quad k_{t+1} > \widetilde{k} \\ = 0 & for \quad k_{t+1} \leq \widetilde{k}. \end{cases}$$

Proof. Since $h(0) = 1$, it follows from (11) (14) and Lemma 1 that $k_{t+1} = B_t$ for $B_t \leq \widetilde{k}$ and hence for $k_{t+1} \leq \widetilde{k}$. Thus the Proposition follows. □

Corollary 1 *The chosen level of taxation in every period maximizes output per-worker in the following period. That is,*

$$\tau_t = \arg\max y_{t+1} \equiv \arg\max y(\tau_t, B_t).$$

Proof. Maximizing $y(\tau_t, B_t)$ with respect to τ_t yield the optimality conditions given by (14). That is, the optimality conditions for the desired level of taxation from the viewpoint of each individual. □

Hence, as long as the rate of return to human capital is lower than the rate of return on physical capital (i.e., as long as $k_{t+1} \leq \widetilde{k}$) the chosen level of investment in public education is

zero – the level of investment maximizes output per-worker. Once the rate of return to human capital equals the rate of return on physical capital (i.e., once $k_{t+1} > \widetilde{k}$) the chosen investment in public education is positive and it maximizes output per-worker.

4   The Dynamical System

Suppose that in period 0 the economy consists of two groups of individuals in their first period of their lives - Capitalists and Workers. They are identical in their preferences and differ only in their initial wealth. The Capitalists, denoted by R (Rich), are a fraction λ of all individuals in society, who equally own the entire *initial* stock of wealth. The Workers, denoted by P (Poor), are a fraction $1 - \lambda$ of all individuals in society, who have no ownership over the *initial* physical capital stock.[32]   Since individuals are initially homogenous *within* a group, the uniqueness of the solution to their optimization problem assures that their offspring who acquire the same level of education and are taxed equally are homogenous as well . Hence, in every period a fraction λ of all adults are homogenous descendents of the Capitalist, denoted by members of group R, and a fraction $1 - \lambda$ are homogenous descendents of Workers, denoted by members of group P.

The optimization of groups P and R of generation $t - 1$ in period $t > 0$, determines the aggregate intergenerational transfers in period t, B_t.

$$B_t = \int_0^1 b_t^i di = \lambda b_t^R + (1 - \lambda) b_t^P \equiv B(b_t^R, b_t^P), \tag{16}$$

where b_t^i is the intergenerational transfer of individual i in period t; $i = P, R$.

Hence, as follows from (11), (15), (16), and Proposition 1

$$k_{t+1} = \frac{[1 - \tau(B_t)]B_t}{h[\tau(B_t)B_t]} \equiv \kappa(b_t^R, b_t^P), \tag{17}$$

where as follows from (2) and (14), $\partial \kappa / \partial b_t^i > 0$, $i = R, P$, Furthermore, $\kappa(0,0) = 0$ (since in the absence of transfers and hence savings the capital stock in the subsequent period is zero).

Since members of group R equally own the entire *initial* stock of wealth in period 0 and members of group P have no ownership over the initial stock of wealth, it follows that $b_0^R > 0$

---

[32] As will become apparent this class distinction will dissipate over time. In particular, descendents of the working class will ultimately own some physical capital.

and $b_0^p = 0$. Furthermore, it is assumed that

$$b_0^R < \widetilde{k}/\lambda. \tag{A1}$$

As established in Lemma 2, and consistently with empirical evidence about the process of development, this assumption assures that in early stages of development there is no investment in public education.

Lemma 2 *Under A1,*

$$k_1 < \widetilde{k}.$$

Proof. Since $b_0^p = 0$, (11),(16) and Lemma 1, given the properties of (3), imply that $k_1 = B_0 = \lambda b_0^R$. Hence it follows from Assumption A1 that $k_1 < \widetilde{k}$. $\qquad\square$

The evolution of transfers within each group $i = R, P$, as follows from (7), is given by

$$b_{t+1}^i = \max\{\beta[w(k_{t+1})h(\tau(B_t)B_t) + (1 - \tau(B_t))b_t^i R(k_{t+1}) - \theta], 0\}; \qquad i = R, P. \tag{18}$$

Since $B_t = B(b_t^R, b_t^P)$ and $k_{t+1} = \kappa(b_t^R, b_t^P)$, it follows that the dynamical system is uniquely determined by the sequence $\{b_t^P, b_t^R\}_{t=0}^\infty$ such that

$$
\begin{aligned}
b_{t+1}^P &= \psi^P(b_t^R, b_t^P); \\
b_{t+1}^R &= \psi^R(b_t^R, b_t^P),
\end{aligned}
\tag{19}
$$

where $b_0^p = 0$ and $b_0^R > 0$.

5   The Process of Development

This section analyzes the endogenous evolution of the economy from early to mature stages of development. As will become apparent, if additional plausible restrictions are imposed on the basic model, the economy endogenously evolves through two fundamental regimes:

- Regime I: In this early stage of development the rate of return to human capital is lower than the rate of return to physical capital, and there is no investment in education.

- Regime II: In these later stages of development, the rate of return to human capital increases sufficiently so as to generate support for public education.

5.1 Regime I: Physical Capital Accumulation

Regime I is defined as the time interval $0 \leq t < \widetilde{t}$, where $\widetilde{t} + 1$ is the first period in which the capital labor ratio exceeds $\widetilde{k}$ (i.e., $\widetilde{t}$ is the first period in which investment in human capital takes place). In this early stage of development the capital-labor ratio in period $t + 1$, k_{t+1}, which determines the investment in public education in period t, is lower than $\widetilde{k}$. As follows from Proposition 1 and Corollary 1, the tax rate is zero, there is no public education, and both groups of individuals acquire only basic skills. That is, $H_{t+1} = h(0) = 1$.

Let $\check{k}$ be the level of the capital-labor ratio such that $w(\check{k}) = \theta$. As follows from (4), $\check{k}$ is the critical level of the capital-labor ratio in time $t + 1$ below which in the absence of public investment in education in period t individuals who do not receive transfers from their parents in period t do not transfer income to their offspring in period $t + 1$. That is, $I_{t+1}^i \leq \theta$ and therefore $b_{t+1}^i = 0$.

In order to assure that investment in human capital will begin in a period where the poor do not invest in physical capital, it is assumed therefore that[33]

$$\widetilde{k} \leq \check{k}. \tag{A2}$$

As follows from (2), $\check{k} = [\theta/(1-\alpha)A]^{1/\alpha}$. Since $\widetilde{k} = \alpha/(1-\alpha)\gamma$, Assumption A2 implies therefore that $\gamma > (\alpha^\alpha(1-\alpha)^{1-\alpha}A/\theta)^{1/\alpha}$.

Lemma 3 *Under Assumptions A1 and A2,*

$$b_t^P = 0 \quad for \quad 1 \leq t \leq \widetilde{t}$$

Proof. As follows from Proposition 1, the definition of $\widetilde{t}$, and Assumption A1 that assures that $\widetilde{t} > 1$, for $0 \leq t < \widetilde{t}$, there is no investment in public education and hence $h_{t+1} = 1$. Hence, since Assumption A2 implies that $k_t \leq \check{k}$ and therefore $w(k_t) \leq \theta$, it follows that $b_{t+1}^P = \max[\beta[w(k_{t+1}) - \theta], 0] = 0$ if $b_t^P = 0$. Since $b_0^P = 0$ it follows therefore that $b_t^P = 0$ for $1 \leq t \leq \widetilde{t}$. □

As follows from (16),(17), proposition 1, and Lemma 3, the capital-labor ratio in period $t + 1$ is

---

[33] This assumption is designed to simplify the presentation of the results. As will become apparent, even if Assumption A2 would be violated, the Capitalists would have an incentive to support the education of Workers.

$$k_{t+1} = \kappa(b_t^R, 0) = \lambda b_t^R \quad \text{for} \quad t \in [0, \tilde{t}) \tag{20}$$

and the level of output per-worker in period $t + 1$, y_{t+1}, as follows from (1), (20), is[34]

$$y_{t+1} = A[\lambda b_t^R]^\alpha \quad \text{for} \quad t \in [0, \tilde{t}). \tag{21}$$

The Dynamics of Output Per-Worker

As follows from (19) and Lemma 3, the evolution of the economy is given by

$$\left. \begin{array}{l} b_{t+1}^R = \psi^R(b_t^R, 0) = \max[\beta[w(\lambda b_t^R) + b_t^R R(\lambda b_t^R) - \theta], 0]; \\[2mm] b_{t+1}^P = 0, \end{array} \right\} \quad for \quad t \in [0, \tilde{t}) \tag{22}$$

where $b_0^R > 0$ is given. Hence in Regime I the dynamical system is fully determined by the evolution of transfers across members of group R.

Alternatively, the evolution of the entire dynamical system in Regime I can be represented by the evolution of output per-worker. Since the aggregate income of group R is $(\lambda(1-\alpha)+\alpha)y_t$, (where α is the share of capital in total output that is fully owned by group R and $\lambda(1 - \alpha)$ is the labor share of group R), it follows from (7) (21) and (22) that the evolution of output per-worker in the time period $t \in [0, \tilde{t})$ is,

$$y_{t+1} = \max\left[A\{\beta\{[\lambda(1 - \alpha) + \alpha]y_t - \lambda\theta\}\}^\alpha, 0\right] \equiv \phi^I(y_t), \quad for \quad y_t \in [0, \tilde{y}), \tag{23}$$

where $\tilde{y} = A\tilde{k}^\alpha$.

In order to assure that the economy would ultimately take off from Regime I to Regime II (i.e., in order to assure that consistently with empirical evidence the process of development is marked by human capital accumulation) it is assumed that the technology is sufficiently productive. That is,

$$A > \tilde{A} \tag{A3}$$

where $\tilde{A}$ is the critical level of technology such that $\phi^I(\tilde{y}) = \tilde{y}$.[35]

---

[34] Note that since the size of the population is 1, $Y_{t+1} = y_{t+1}$.

[35] As follows from (23)
$$\tilde{A} = \frac{1 + \lambda(1 - \alpha)^\alpha \beta\gamma^\alpha\theta\alpha^{-\alpha}}{\beta(\alpha + (1 - \alpha)\lambda)}.$$

Lemma 4 *Under Assumptions A2 and A3, there exists $\underline{y} \in (0, \widetilde{y})$; $\widetilde{y} = A\widetilde{k}^\alpha$, such that the properties of $\phi^I(y_t)$ in the interval $y_t \in [0, \widetilde{y}]$ are*

$$\phi^I(y_t) = 0 \qquad for \quad y_t \leq \underline{y}$$

$$\partial \phi^I(y_t)/\partial y_t > 0 \qquad for \quad \underline{y} < y_t \leq \widetilde{y}$$

$$\partial^2 \phi^I(y_t)/\partial[y_t]^2 < 0 \qquad for \quad \underline{y} < y_t \leq \widetilde{y}$$

$$\phi^I(y_t) > y_t \qquad for \quad y_t = \widetilde{y}$$

Proof. As follows from (23), $\phi^I(y_t) = 0$ for $y_t \leq \underline{y} = \lambda\theta/(\lambda(1-\alpha)+\alpha)$, and $\partial\phi^I(y_t)/\partial y_t > 0$, and $\partial^2\phi^I(y_t)/\partial[y_t]^2 < 0$ for $\underline{y} < y_t \leq \widetilde{y} = A\{\alpha/[(1-\alpha)\gamma]\}^\alpha$. Consistently with Assumption A2, there exist a sufficiently small γ such that $\widetilde{y} > \underline{y}$.[36] Furthermore, Assumption A3 assures that $\phi^I(y_t) > y_t$ for $y_t = \widetilde{y}$ $\qquad\qquad\qquad\qquad\qquad$ □

Corollary 2 *Under Assumptions A2 and A3, the dynamical system $\phi^I(y_t)$ has two steady-state equilibria in the interval $y_t \in [0, \widetilde{y}]$; A locally stable steady-state, $\overline{y} = 0$, and an unstable steady-state, $\overline{y}^u \in (\underline{y}, \widetilde{y})$.*

Figure 1 depicts the properties of $\phi^I(y_t)$ over the interval $y_t \in (0, \widetilde{y}]$. If $y_t < \overline{y}^u$ then output per worker contract over time and the system converges to the steady-state equilibrium $\overline{y} = 0$. If $y_t > \overline{y}^u$ then output per worker expand over the entire interval $(\overline{y}^u, \widetilde{y}]$, crossing into Regime II. Hence, in order to assure that the process of development takes off it is assumed that

$$y_0 \in (\overline{y}^u, \widetilde{y}). \tag{A4}$$

implying that $b_0^R \in ([\overline{y}^u/A\lambda^\alpha]^{1/\alpha}, [\widetilde{y}/A\lambda^\alpha]^{1/\alpha}) = ([\overline{y}^u/A\lambda^\alpha]^{1/\alpha}, \widetilde{k}/\lambda)$. Hence, Assumption A1 is a subset of Assumption A4.

It should be noted that a sufficiently high level of A that satisfies Assumption A3 does not violate Assumption A2. An increase in A and γ^α holding their ratio unchanged, does not affect A2 and increases A relative to $\widetilde{A}$.

[36] If $\underline{\gamma} < \gamma < \overline{\gamma}$ where $\underline{\gamma} = [\alpha^\alpha(1-\alpha)^{1-\alpha}A/\theta]^{1/\alpha} < \overline{\gamma} = [\alpha^\alpha(1-\alpha)^{1-\alpha}A/\theta + \alpha^{1+\alpha}(1-\alpha)^{-\alpha}A/\lambda\theta]^{1/\alpha}$, then Assumption A2 and $\widetilde{y} > \underline{y}$ are satisfied simultaneously. Furthermore, as discussed in the previous footnote, Assumptions A3 and $\widetilde{y} > \underline{y}$ are mutually consistent.

5.2 Regime II: Education and Decline of the Class Structure

In these mature stages of development, the rate of return to human capital increases sufficiently so as to induce human capital accumulation via public education, and the process of development is fueled by human capital as well as physical capital accumulation. In stages I of Regime II, the economy witnesses the birth of public education. The Capitalists invest in human capital as well as in physical capital, whereas workers acquire education financed by the Capitalists but their income level is not sufficiently high so as to permit physical capital accumulation. In stage II, as income increases the economy witnesses the demise of the class society. All individuals acquire human capital as well as physical capital and the income gap between the classes is narrowed and eliminated in the long-run.

5.2.1 Stage I: The Birth of Public Schooling

Stage I of Regime II is defined as the time interval $\widetilde{t} \leq t < \widehat{t}$, where $\widehat{t}$ is the first time period in which members of group P transfer income to their offspring which permit investment in physical capital. In this time interval the marginal rate of return on investment in human capital is equal to the rate of return on investment in physical capital. Although workers acquire education financed by the Capitalists, their income level is not sufficiently high so as to permit transfer to their offspring.

As follows from (16),(17), proposition 1, and Lemma 3, the capital-labor ratio in period $t+1$ is

$$k_{t+1} = \kappa(b_t^R, 0) = \frac{(1-\tau_t)\lambda b_t^R}{h(\tau_t \lambda b_t^R)} \quad \text{for} \quad t \in [\widetilde{t}, \widehat{t}). \tag{24}$$

where $\partial \kappa(b_t^R, 0)/\partial b_t^R > 0$. The level of output per-worker in period $t+1$, y_{t+1}, as follows from (1) and (24), is

$$y_{t+1} = A[(1-\tau_t)\lambda b_t^R]^\alpha [h(\tau_t \lambda b_t^R)]^{1-\alpha} \quad \text{for} \quad t \in [\widetilde{t}, \widehat{t}). \tag{25}$$

The Dynamics of Output Per-Worker

As follows from (19) the evolution of the economy in the time interval $\widetilde{t} \leq t < \widehat{t}$ is given by

$$b_{t+1}^R = \psi^R(b_t^R; 0) = \beta[w(k_{t+1})h(\tau_t \lambda b_t^R) + (1 - \tau_t)b_t^R R(k_{t+1}) - \theta]; \left.\begin{array}{l} \\ \\ \end{array}\right\} \quad for \quad t \in [\widetilde{t}, \widehat{t}) \quad (26)$$
$$b_{t+1}^P = \psi^P(b_t^R; 0) = 0.$$

Alternatively, the evolution of the entire dynamical system in Stage I of Regime II can be represented by the evolution of output per-worker. Since the aggregate income of group R is $(\lambda(1-\alpha)+\alpha)y_t$, as is the case in Regime I, it follows from (7) (21) and (26) that the evolution of output per-worker in the time period $t \in [\widetilde{t}, \widehat{t})$ is,

$$y_{t+1} = A\{(1-\tau_t)\beta\{[\lambda(1-\alpha)+\alpha]y_t - \lambda\theta\}\}^\alpha \{h(\tau_t\beta\{[\lambda(1-\alpha)+\alpha]y_t - \lambda\theta\})\}^{1-\alpha}$$

$$\equiv \phi^{II}(y_t) \qquad for \qquad y_t \in [\widetilde{y}, \widehat{y}), \tag{27}$$

where $\widetilde{y} = A\widetilde{k}^\alpha$, $\tau_t = \arg\max \phi^{II}(y_t)$, and $\widehat{y} = \theta/(1-\alpha)$, is the critical level of the output per-worker such that the income level of individuals who do not receive transfer from their parents (i.e., members of group P) equals θ. As follows from (4), as long as $y_t < \widehat{y}$, members of group P do not transfer income to their offspring. Hence, since $\widetilde{y} = A\{\alpha/[(1-\alpha)\gamma]\}^\alpha$, it follows from assumption A2 that $\widehat{y} > \widetilde{y}$.

In order to assure that the economy would ultimately take off from Stage I to Stage II within Regime II it is assumed that the technology is sufficiently productive. That is,

$$A \geq \widehat{A} \equiv 1/\beta\alpha \tag{A5}$$

where as follows from (27) and Corollary 1, $\widehat{A}$ is a sufficiently high level of technology such that $\phi^{II}(\widehat{y}) > \widehat{y}$.[37]

If Assumption A5 is violated then there are two feasible scenarios. The economy may converge to a steady-state equilibrium in the interval $(\widetilde{y}, \widehat{y})$ with public education, where individuals are identical in their level of human capital and in their wage income, but they differ in their level of wealth. Alternatively, the economy may proceed, nevertheless, to a long-run steady-state equilibrium above $\widehat{y}$, where as will become apparent offspring of Capitalists and workers are indistinguishable.

---

[37] Assumptions A3 and A5 imply that $A \geq max[\widetilde{A}, \widehat{A}]$, where $\widetilde{A} < \widehat{A}$ if and only if $\gamma < (\alpha^{\alpha-1}(1-\alpha)^{1-\alpha}/\beta\theta)^{1/\alpha}$.

Lemma 5 *Under Assumptions A2 and A5, the properties of $\phi^{II}(y_t)$ in the interval $y_t \in [\widetilde{y}, \widehat{y}]$ are*

$$\partial \phi^{II}(y_t)/\partial y_t > 0$$

$$\partial^2 \phi^{II}(y_t)/\partial y_t^2 < 0$$

$$\phi^{II}(y_t) > y_t$$

Proof. Follows from (27), Assumptions A2 and A5, and the concavity of $h(e)$, noting that $\tau_t = \arg \max y_{t+1}$. $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\square$

Corollary 3 *The dynamical system $\phi^{II}(y_t)$ has no steady-state equilibria in the interval $y_t \in [\widetilde{y}, \widehat{y}]$.*

Figure 1 depicts the properties of $\phi^{II}(y_t)$ over the interval $y_t \in [\widetilde{y}, \widehat{y}]$. The transfers within each dynasty of type R expand over the entire interval crossing into Stage II.

5.2.2 Stage II: The Demise of the Class Society

Stage II of Regime II is defined as $t \geq \widehat{t}$. In this time interval all individuals acquire education and transfer income to their offspring.

As follows from Corollary 3, in stage II of Regime II the level of output per-worker exceeds $\widehat{y}$ and the wage income of members of all individuals exceeds θ. Hence, it follows from (16) and (7), that

$$B_t = \lambda b_t^R + (1 - \lambda) b_t^P = \beta[y_t - \theta]. \tag{28}$$

The capital-labor ratio in period $t + 1$, as follows from (11) and (28), is therefore

$$k_{t+1} = \frac{(1 - \tau_t)\beta[y_t - \theta]}{h(\tau_t \beta[y_t - \theta])} \quad \text{for} \quad t \in [\widehat{t}, \infty). \tag{29}$$

and the level of output per-worker in period $t + 1$, y_{t+1}, as follows from (1) and (29), is

$$y_{t+1} = A[(1 - \tau_t)\beta[y_t - \theta]]^\alpha [h(\tau_t \beta[y_t - \theta])]^{1-\alpha} \quad \text{for} \quad y_t > \widehat{y}. \tag{30}$$

The Evolution of Output Per-Worker

26

The evolution of output per worker, Y_t, in Stage II of Regime II, is independent of the distribution of intergenerational transfers and hence the dynamical system can be represented by the evolution of output per-worker. As follows from (1) and (29), the evolution of output per worker over the time interval $t > \hat{t}$ is

$$y_{t+1} = A[(1 - \tau_t)\beta[y_t - \theta]]^\alpha [h(\tau_t \beta[y_t - \theta])]^{1-\alpha} \equiv \phi^{III}(y_t) \quad \text{for} \quad y_t > \hat{y}. \tag{31}$$

where $\tau_t = \arg\max \phi^{III}(y_t)$, and therefore $\partial\phi^{III}(y_t)/\partial y_t > 0$. Furthermore, it follows from the concavity and the boundary conditions of $h(e)$ and the aggregate production function that $\partial^2\phi^{III}(y_t)/\partial y_t^2 < 0$, and $\lim_{y_t \to \infty} \partial\phi^{III}(y_t)/\partial y_t = 0$.

Corollary 4 *Under A2-A5, y_t increases monotonically in Stage II of Regime II and converges to $\overline{y} > \hat{y}$.*

Proof. Follows directly from the properties of $\phi^{III}(y_t)$. □

Proposition 2 *Under A2-A5, the economy converges to a steady-state equilibrium in which the income gap between the offspring of the Capitalist and the Workers is eliminated.*

Proof. As follows from the properties of (9),(15),(28),(29) and Corollary 4, the economy converges to a unique steady-state vector $(\overline{y}, \overline{k}, \overline{\tau}, \overline{h})$. Since

$$b_{t+1}^i = \beta[w(k_{t+1})h_{t+1} + (1 - \tau_t)b_t^i R(k_{t+1}) - \theta] \quad for \quad t > \hat{t} , \qquad i = P.R \tag{32}$$

where as follows from (14) $h_{t+1} = h(k_{t+1})$ and $\tau_t = \tau(k_{t+1})$ and therefore

$$b_{t+1}^i = \zeta(b_t^i, k_{t+1}). \tag{33}$$

Hence, given $\overline{k}$ it follows that, in the steady state, $b^i = \overline{b}^i$ where $\overline{b}^i = \zeta(\overline{b}^i, \overline{k})$, otherwise (since $\partial\zeta(b^i, \overline{k})/\partial b^i \geq 0$) either [$b^i$ decreases (increases) for all i and thus k decreases (increases)] or [b^R increases indefinitely and b^P decreases to zero, and thus k increases] in contradiction to the stationarity of $\overline{k}$. Hence, $\overline{b}^R = \zeta(\overline{b}^R, \overline{k})$, $\overline{b}^P = \zeta(\overline{b}^P, \overline{k})$, and $\overline{k} = \kappa(\overline{b}^R, \overline{b}^P)$. Since $b^P > 0$, the steady-state equilibrium is $(b^R, b^P) >> 0$, where $b^P = b^R$ since ζ is independent of $i = P, R$. □

27

6 Concluding Remarks

This paper hypothesizes that the demise of the class structure that existed in Europe in the 19th century may reflect a deliberate transformation of society orchestrated by the Capitalists. In contrast to the prevailing wisdom, the research suggests that the transition from the European class structure of the 19th century may be viewed as the outcome of an optimal reaction process of the Capitalists to the increasing importance of human capital in sustaining their profit rates. The paper argues that the process of capital accumulation has gradually intensified the relative scarcity of labor and has generated an incentive to augment labor via human capital accumulation. Due to the complementarity between physical and human capital in production, the Capitalists were among the prime beneficiaries of the potential accumulation of human capital by the masses. They had therefore the incentive to financially support public education that would sustain their profit rates and would improve their economic well being, although would ultimately undermine their dynasty's position in the social ladder and would lead to the demise of the class structure.

The support for public education is unanimous despite the fact that the Capitalists carry the prime financial burden of public schooling. That is, due to the coexistence of credit market imperfections and capital-skill complementarity, the redistribution associated with public education is Pareto improving. Unlike the conventional wisdom, therefore, the paper argues that the demise of the Capitalists-Workers class structure has been, at least partly, an outcome of a cooperative rather than a divisive process. These forces may have reinforced one anther. Educational reforms may have been the economically efficient method of implementing elements of the political transition whereas political reforms may have been a by-product of the educational reforms that have made political inequality harder to sustain and justify.

The paper argues that the massive reforms in the education system across the continent had been a significant component of the process that has lead to the decline of the existing class structure. The political reforms that accompanied education reforms can be viewed as an attempt by the Capitalist to diminish social unrest as well as to broadened the coalition that support public vocational (utilitarian) education against the wishes of the Clergy as well as the Landlords for whom human capital was less complementary in production.[38]

---

[38] Cultural differences across societies may have resulted in the failure of some societies to adopt the efficient

28

The study suggests a novel hypothesis regarding the causes of persistence differences in the structure of society, institutions and economic performance across countries. It proposes that these cross country differences may reflect initial differences in land abundance. In particular, the paper suggests that in land abundant societies with a high degree of polarization (e.g., some Latin American Countries), education reforms would be delayed, due to the lower degree of complementarity between human capital and land, and thus the process of development would be slowed and polarization would persist longer.

---

institutions (e.g., Greif (1994)). The timing of education reforms relative to the process of development may differ therefore across countries.

References

[1] Acemoglu, Daron and Robinson, James A (2000), "Why Did the West Extend the Franchise? Democracy, Inequality and Growth in Historical Perspective" *Quarterly Journal of Economics,* 115, pp. 1167-1199.

[2] Acemoglu, Daron and Robinson, James A (1999), "A Theory of Political Transition". Department of Economics, MIT.

[3] Alesina A, and Perotti R (1996), "Income distribution, political instability, and investment," *European Economic Review*, 40, 1203-1228.

[4] Alston, P. L. (1969), *Education and the State in Tsarist Russia.*

[5] Altonji, J. G., Hayashi, F. and Kotlikoff, L. J. (1997), "Parental Altruism and Inter Vivos Transfers: Theory and Evidence," *Journal of Political Economy,* 105, 1121-66.

[6] Becker G. S. (1964), *Human Capital,* The University of Chicago Press.

[7] Benabou, R. (1996), "Inequality and Growth," *NBER Macroeconomics Annual*, MIT Press.

[8] Benhabib J. and A. Rustichini (1996), "Social Conflict and Growth," *Journal of Economic Growth*, 1, pp 125-142.

[9] Bertocchi, G. and M. Spagat. (1999), "The Evolution of Modern Educational Systems: Technical Vs. General Education, Distributional Conflict and Growth," CEPR DP No. 1925.

[10] Blackbourn, D. (1998) *The Long Nineteenth Century: A History of Germany, 1780-1918*, Oxford University Press, New York NY.

[11] Bourguignon, F. and Verdier T. (2000), "Oligarchy, Democracy, Inequality and Growth," *Journal of Development Economics*, 62, 285-313.

[12] Bowen, James. (1981). A History of Western Education. Vol. 3: The Modern West Europe and the New World. St. Martin's Press, New York.

[13] Caballe J. and Santos M. (1993), "On Endogenous Growth with Physical and Human-Capital," *Journal of Political Economy*, 101: (6) pp.1042-1067.

[14] Cole A. and P. Campbell (1989), *French Electoral Systems and Elections since 1789*, Gower Press, Aldershot.

[15] Crafts, N.F.R, and Mark Thomas. (1986). "Comparative Advantage in UK Manufacturing Trade, 1910-1935" The Economic Journal 96, 629-645.

[16] Craig, F.W.S. (1989) *British Electoral Facts, 1832-1987*,Gower, Brookfield VT.

[17] Cubberly, E.P. 1920. The History of Education. Cambridge University Press. Cambridge, UK.

[18] Durlauf, S.N., (1996), "A Theory of Persistent Income Inequality," *Journal of Economic Growth*, 1, 75-94.

[19] Durlauf S.N., and Johnson PA, (1995), "Multiple Regimes And Cross-Country Growth-Behavior," *Journal of Applied Economics*, 10, 365-384.

[20] Dynan, Karen E., Jonathan Skinner and Stephen P. Zeldes (2000) "Do the Rich Save More?," NBER WP 7906.

[21] Fernandez R and Rogerson R. (1996) "Income Distribution, Communities, and the Quality of Public Education," *Quarterly Journal of Economics*, 111, 135-164.

[22] Galor, O. and Zeira, J. (1993), "Income Distribution and Macroeconomics," *Review of Economic Studies,* 60, 35-52.

[23] Galor, O. and Tsiddon, D. (1997), "Technological Progress, Mobility, and Growth," *American Economic Review*, 87, 363-82.

[24] Galor, O. and Moav O. (2000), "Ability Biased Technological Transition, Wage Inequality and Growth," *Quarterly Journal of Economics*, 115, 469-498.

[25] Goldin, C. and L. F. Katz (1998), "The Origins of Technology-Skill Complementary," *Quarterly Journal of Economics*, 113, 693-732.

[26] Goldin, C. and L. F. Katz, (1999), "The Return to Skill across the Twentieth Century United States," NBER Working Paper 7126.

[27] Goldstein, R.J. (1983) *Political Repression in Nineteenth Century Europe*, Croom Helm, London.

[28] Green, Andy. (1990). Education and State Formation. St. Martin's Press. New York.

[29] Greif, A. (1994), "Cultural Beliefs and the Organization of Society - A Historical and Theoretical Reflection on Collectivist and Individualist Societies," *Journal of Political Economy*, 102, 912-950.

[30] Greif, A. (1998), "Historical and Comparative Institutional Analysis" *American Economic Review*, 88: (2) pp. 80-84.

[31] Grossman,. H.I. (1994) Production, Appropriation, and Land-Reform," *American Economic Review*, 84, 705-712.

[32] Grossman, H.I. and M. Kim. (1999), "Education Policy: Egalitarian or Elitist?" Brown University.

[33] Hassler, John. and J. Rodriguez Mora, (2000), "Intelligence, Social Mobility, and Growth," *American Economic Review,* 90, 888-908.

[34] Hurt, John. (1971). Education in Evolution. Paladin. London.

[35] Kaldor, N. (1957), "A Model of Economic growth," *Economic Journal,* 57.

[36] Keynes, J. M. (1920), "The Economic Consequences of the Peace," Macmillan and Co. Limited

[37] Lewis, W.A. (1954), "Economic Development with Unlimited supply of Labor," *The Manchester School,* 22, 139-91.

[38] Maoz, Y.D. and Moav, O. (1999), "Intergenerational Mobility and the Process of Development," *Economic Journal,* 109, 677-97.

[39] Mitch, David. (1992). The Rise of Popular Literacy in Victorian England: The Influence of Private Choice and Public Policy. University of Pennsylvania Press. Philadelphia.

[40] Mitch, David. (1993). "The Role of Human Capital in the First Industrial Revolution" in J. Mokyr ed. The British Industrial Revolution: An Economic Perspective. Westview Press, San Francisco.

[41] Mokyr, J., (1990), *The Lever of Riches*, New York: Oxford University Press.

[42] Mokyr, J. (1999). "The New Economic History and the Industrial Revolution," In J.Mokyr, ed., The British Industrial Revolution: an Economic Perspective. Boulder: Westview Press, 2nd ed., 1-127.

[43] Muller, Deltef K. (1987). "The Process of Systematisation: the Case of German Secondary Education" in Muller, Ringer and Simn ed. The Rise of The Modern Educational System. Cambridge University Press. Cambridge, UK.

[44] Mulligan C.B. and X. Sala-i-Martin (1993). "Transitional Dynamics in Two Sector Models of Endogenous Growth" *Quarterly Journal of Economics,* 108, 739-773.

[45] Perotti, R. (1996), "Growth, Income Distribution, and Democracy: What the Data Say," *Journal of Economic Growth,* 1, 149-87.

[46] Ramirez, Francisco O. and Boli J. (1987) "The Political Construction of Mass Schooling: European Origins and Worldwide institutionalization". Sociology of Education, Vol. 60, (Issue 1), 2-17.

[47] Ringer, F. (1979) *Education and Society in Modern Europe*, Indiana University Press, Bloomington.

[48] Robinson, J. A. (1999) *A Political Theory of Underdevelopment*, Unpublished Book Manuscript, Department of Political Science, University of California, Berkeley.

[49] Sanderson, Michael. (1995). Education, Economic Change and Society in England 1780-1870. Cambridge University Press. Cambridge, UK.

[50] Simon, Brian. (1960). Studies in the History of Education 1780-1870. Lawrence & Wishart. London.

[51] Simon, Brian. (1987). "Systematisation and Segmantation in Education: the Case of England" in Muller, Ringer and Simn ed. The Rise of The Modern Educational System. Cambridge University Press. Cambridge, UK.

[52] Tomes, N. (1981) "The Family, Inheritance and the Intergenerational Transmission of Inequality," *Journal of Political Economy*, 89, 928-58.

[53] Wright, D.G. (1970) *Democracy and Reform 1815-1885*, Longman, London.

Figure 1