The Evolution of Modern Educational Systems

Technical vs. General Education, Distributional Conflict, and Growth

by

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ABSTRACT

We study the evolution of an educational system which is founded on a hierarchical differentiation between technical and general education, with a superior social status attached to general. The resulting dynamic political equilibrium is best summarized by the ratio of vocational to general education, which we interpret as a measure of the degree of stratification of the educational system. We show that this ratio first rises and then declines with the level of development, displaying an inverted U-shape which reflects the complex interaction between economic and political forces, including aggregate income growth, wealth inequality and political participation. We predict that developing countries will tend to overinvest in vocational education at the expense of general.

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1. Introduction

The new literature on growth has established the crucial role of human capital and educational attainment in the process of development. However, the role of the specific structure of the educational system is still largely unexplored. In particular, while specific aspects such as the distinction between privately and publicly provided education, or between local and state educational systems, have attracted considerable attention, the available models - and empirical measures - of educational attainment fail to distinguish between different kinds of curricula.

The aim of this paper is to focus on the distinction between technical and general education, and to study the relationship between the mix of these two alternative kinds of training and the evolution of societies, both from an economic and a socio-political perspective. Without denying the relevance of technological progress for the issue at hand, we develop a deeper explanation of the link between education mix and economic and socio-political variables, which relies on the analysis of the relationship between distributional conflict and the shaping of the educational system within a society that attaches a superior social status to general education.

The main idea stems from the observation that, historically, unequal societies have tended to produce a hierarchical differentiation of educational institutions which was founded precisely on the distinction between technical and general training. Acting as a countervailing force, in the face of the expansion of educational opportunities that technological progress inevitably calls for, curricula differentiation has served the purpose of perpetuating the pre-existing social order through a process of exclusion of the emerging middle classes from the more prestigious, academically-oriented institutions. Accordingly, in an early stage of economic development, vocational curricula have tended to expand, while the subsequent rise of the economic and political power of the middle class have provoked a pick up of general education in a later stage.

In our model, society is initially divided between an affluent "elite" and a lower class. Every individual is assumed to have the elementary skills which are taught in primary school. We therefore aim at describing the phase, in the process of development, during which an economy is already past initial industrialization and about to jump into its high industrial era. Accordingly, our focus is on the evolution of secondary education, under the assumption that the goal of universal basic literacy has already been met. Secondary education, in its general form,

is initially only available to the elite, and is associated with political power as well as a prestigious social status. The initial, static equilibrium is disrupted by the introduction of a new, modern technology, which requires a combination of general and specific skills. The elite is therefore induced to set up a vocational school system, into which it channels the children of the lower class.

Conflict in this society is mediated by the electoral process. The main issue for educational policies is the size of the general sector. Decisions are made through majority voting, which is however restricted by a minimum wealth requirement which is initially met only by the elite. The voting process is constructed so that the median voter will want his children to enter general high school, while excluding the children of everyone poorer than himself. We show that in a first stage of development the size of the vocational sector relative to the general sector increases. At a later stage, once the pool of individuals with basic education is exhausted, the vocational sector reaches a ceiling. As lower class wealths cross the voting threshold the political equilibrium increases the general sector at the expense of the vocational one. The resulting evolution of the educational system is best summarized by the *ratio of vocational to general education* (V/G), which we interpret as a measure of the stratification of the educational system and society. Following the above discussion, this ratio initially increases with income and then decreases, reflecting the complex interaction between economic and political forces in the society.

We also carry out a welfare analysis that compares the mixes of vocational and general education that occur at the political equilibrium of the model with the unique output-maximizing mix. We find that, for a wide range of parameter configurations, the vocational sector grows too large and the general sector remains too small relative to the optimum. This finding is consistent with empirical studies showing that vocational education yields lower returns than general education (Psacharopoulos (1993)). It also carries the policy implication that general education should be expanded at the expense of vocational education in developing countries.

While our model is designed to capture the specific dynamics of the education mix, it also offers consistent and useful predictions for the evolution of aggregate income, wealth distribution, relative wages and political participation. Aggregate income grows throughout the process, but at varying rates that depend not only on exogenous technological progress, but also on the endogenous evolution of the educational system. Under realistic parameter values, wages are initially higher

and grow faster for general labor, but in a later phase wages for vocationally-trained labor catch up. In the first phase the rise in the relative wage of general labor increases inequality, while the increasing employment of vocational labor relative to unskilled labor has the opposite effect. In the subsequent phase, after the pool of individuals with basic education is exhausted, inequality starts to decline unambiguously. Political participation gradually expands, but there is a tendency for the lower class not to be able to affect the political equilibrium immediately.

Our work is related to a growing literature which has its sources in the early contributions on the relationship between human capital and growth (see Lucas (1988) and Azariadis and Drazen (1990) for theoretical models, and Barro (1991), Mankiw, Romer and Weil (1992) and Barro and Lee (1994) on the empirics). Our work is also closely related to the literature on income distribution (see Banerjee and Newman (1991) and Galor and Zeira (1993)) and on social stratification and mobility (see Benabou (1993), Piketty (1995), Durlauf (1996) and Galor and Tsiddon (1997)). However, the literature to which the paper more directly belongs is the one that focuses on the distributional effects of policy in a political equilibrium (among others, see Alesina and Rodrik (1994), Persson and Tabellini (1994), Perotti (1993), Bertola (1993), Benhabib and Rustichini (1996), Verdier and Ades (1993) and Gradstein and Justman (1995)). Within the same group, particularly relevant to our approach are those studies that have focused on educational policies of various forms (see, for example, Glomm and Ravikumar (1992), Fernandez and Rogerson (1995) Saint-Paul and Verdier (1993), Boldrin (1993) and Gradstein and Justman (1993) on public vs. private provision, and Benabou (1996) and Fernandez and Rogerson (1993) on local vs. state funding). Kim and Kim (1997) and Zeira (1997) consider, as we do, different types of education, but focus on their technological functions rather than on their social role. Grossman and Noh (1994) represent a related research line which has modelled the behavior of self-interested elites. Finally, another important source of inspiration for the present paper is the stream of recent work on the connection between the sociological analysis of factors such as social status and norms and their economic implications (see Cole, Mailath and Postlewaite (1992) and Fershtman, Murphy and Weiss (1996)).

The rest of the paper is organized as follows. In section 2 we present historical and sociological evidence in support of our modelling assumptions as well as some pertinent stylized facts. In section 3 we present the model. In section 4 we derive

our results. In section 5 we conduct a welfare analysis. Section 6 draws some conclusions and derive policy implications of our results.

2. The evidence

2.1. Historical and sociological background

By "technical" education, we mean any course of study directly related to a specific occupation, where a large part of the curriculum is devoted to learning practical skills to be used immediately upon graduation. Following standard usage, we will interchangeably refer to technical education also as "vocational", "practical", "applied", sometimes "modern" education. "General" education, on the other hand, is defined by a curriculum that has no immediate connection with any occupational application, but prepares the student in basic knowledge that can be used to learn many different occupations. "Academic", "classical", or "liberal" studies therefore also fit the definition of general education [1].

In the effort to explain the observed evolution of modern educational systems, sociologists and comparative education scholars have advanced two alternative theories (Collins (1971)). According to functional theory, which emphasizes the effects on education of the technological requirements of industrial societies, the skill requirements of jobs constantly increase because of technological progress causing, at least in an initial phase, a steady expansion of vocational and applied curricula. Later on, the need for broader skills may instead push in the direction of increasing enrollment in general education. On the other hand, the conflict theory of stratification - as derived from Max Weber (1921) - studies the determination of various outcomes, including the evolution of the educational system, within a broader theory of the struggle among social groups. Its main proposition is that societies are stratified into status groups which share a common culture. Control of education is therefore crucial in the struggle between groups. With reference to the specific distinction between vocational and general education, conflict theory maintains that curricula differentiation reflects the attempt of the elite to protect its exclusiveness (Neelsen (1975)).

Sociologists have tried to assess the empirical adequacy of both theories. Most

[1] At the primary level, all education tends to be general in nature, while for higher education "specialized" curricula necessarily prevail. Therefore, the focus of our investigation is the secondary level of education, for which the distinction we stress is a meaningful one.

of the available studies conclude that, while a positive association between technology and education was significant in the transition from an illiterate to a literate society, the same relationship does not hold for higher levels of education and a later phase of the development process, for which conflict theory provides a more convincing explanation. This is also the conclusion of Muller, Ringer, and Simon (1977), who provide a socio-historical and comparative account of that decisive period, in the history of European education, that goes from 1870 to WWI. Through a country by country investigation, these authors show that in England, France and Germany, during the late 19th century, educational institutions were transformed into a system which has been since modified, but never replaced. Before this time, the dominant form of secondary education was centered upon the classical languages and literature. The transformation that intervened was centered around the introduction of certain less prestigious institutions which were supposed to provide so-called modern, or technical, training. According to the functional view, the motive that determined this transformation was to bring schools in closer interaction with the occupational system of the high industrial era.

However, it is clear that specific social roles and ranks were associated with different institutions, with technical curricula being ranked very low [2]. Therefore, while it is true that access to secondary education was widely enlarged, this did not imply a real democratization of educational opportunities for the lower class, since increased enrollment was matched by a growing complexity of educational institutions. Segmentation produced parallel, non-communicating tracks, with marked differences both in their curricula and the social origin of the students enrolled. The system that emerged was meant to perpetuate the hierarchical structure of these societies and, at least as the structure of the educational system is concerned, did achieve this goal at least until WWI. The *expansion* of enrollments in secondary school was therefore accompanied by a process of *exclusion.*

The data reported indeed show that during this period we observe a quantitative stability in the traditional education sector, along with an expansion in the new, and less accredited, schools. While this analysis helps to understand specif-

[2]It should be stressed again that the focus of our analysis is the secondary level of the educational system. Therefore, we do not challenge the generally held belief - see, for example, Mokyr (1990) - that the British bias against technical education, at its higher level, may have contributed to the economic decline of this country. Zamagni (1993) also offers a more positive view of at least some local vocational school experiences in Italy.

ically the social role of institutions such as the Prussian Gymnasium, the French Lycee, and the English public school system, the same pattern was imitated by all European countries. Shavit and Blossfeld (1993) report additional supporting evidence for an investigation covering thirteen countries. For a larger set of countries, in 1967 the OECD (1967) still finds evidence of a marked institutional differentiation. Note also that the European model was exported, as a by-product of colonization, to a large portion of the less developed world. The metropolitan countries in fact generalized to their colonies the principles underlying the organization and articulation of the metropolitan educational institutions, interfering with the local process of elite formation. Moreover, the colonial educational policies are believed to have significantly affected human capital formation in these countries even after independence (Foster (1966), Clignet (1968)).

Using a more functionalist perspective, Trow (1967) describes the evolution of the education system in the United States. Many similarities with Europe do emerge. Before 1870, the American secondary school system offered a classical, liberal education to a small elite. Subsequently, a mass, largely terminal secondary school system was developed, with the purpose of providing increasingly vocational education to the emerging middle class. In a later phase, after WWII, the system underwent a second transformation, moving it in the direction of a mass preparatory, rather than a terminal, system (see also Goldin (1994)). However, a very important difference with the European dual system is the early introduction in the US of the comprehensive school. This was done under the influence of thinkers such as John Dewey (1916), with the declared goal of strengthening more general aspects of high school curricula and at the same time avoiding premature career choices and facilitating greater social cohesion. However, the OECD (1967) report suggests that the objectives of the comprehensive school have remained unfulfilled, having not been able to satisfy the claim for equality by the lower classes. Differentiated, vocational curricula do in fact still appear in the US, in a lagged fashion, at the college level, while at the same time the diffusion of tracking within the comprehensive school system can be viewed as fulfilling the same stratifying role of European vocational schools.

2.2. Stylized facts

Over a time series lasting 130 years, Bertocchi and Spagat (1997) study the evolution of the educational system in Italy after unification and, as predicted by our

model, find clear evidence of the existence of an inverted U-shape relationship for the V/G ratio, with a low starting value at 1.05 in 1861, a peak at 3.06 in 1921, and a subsequent decline to 0.71 in 1990 (Figure 1). Flora (1983) studies several European countries, and finds that whenever complete time series are available for a prolonged time span, once again there is evidence of an initial rise and a subsequent decline of V/G (as in Austria, 1881-1975, and Switzerland, 1888-1936); consistently, when data are instead available only for an earlier period, V/G grows steadily, as in Sweden, 1886-1910; while it declines monotonically over the post-war period in France and England. Finally, according to Muller, Ringer and Simon (1977), the V/G ratio in Prussia starts in 1854 at 0.39, with a steady increase to 2.4 in 1936.

Bennett (1967) presents a cross-country analysis of the ratio between vocational and general education for 1956 in 70 countries and finds that the correlation between the ratio and income is high and positive for the poorest countries, and high and negative for the most developed ones. This pattern therefore produces an inverted U-shape relationship.

We assembled a much more comprehensive data set than Bennett (1967) using UNESCO (various years). Our panel includes the V/G ratio and per capita GDP (in 1980 dollars) for 149 countries for 1950-1991. Once again, we find clear evidence of a non-linear relationship. The correlation between the ratio and income (Table 1) is low and insignificant. However, when the panel is split at GDP per capita of \$6,000, we find a significantly high and positive correlation below and a significantly high and negative correlation above \$6,000. Table 1 also gives similar results when we exclude socialist countries. Figure 2 gives a scatterplot, excluding the socialist countries.[3]

[3]Socialist countries are not included in the picture, since in these economies V/G was high, due to systemic reasons which go beyond the scope of our model, even at the early stage of the development process.

Table 1. Correlation between V/G ratio and per capita GDP*

	All Panel	All Panel Without Socialist
Correlation	0.01855 (0.95471)	0.05467 (2.73247)
Correlation<$6,000	0.09308 (4.26258)	0.14174 (6.30836)
Correlation>$6,000	−0.14643 (−3.52481)	−0.19471 (−4.64705)

* t statistics are reported in parenthesis.

To conclude, on the basis of a broad evidence, the first stage described in our model, which predicts an expansion of the ratio between vocational and general education, for the developed countries can be dated as the period that goes from the 1870s up until WWI, with a peak being reached during the interwar period. A phase of relative stability of the ratio is then followed by a final decline after WWII. Therefore, our model does capture the crucial features of the evolution of modern educational systems in advanced countries, starting from the end of last century. And it can also support the conclusions of cross-section investigations based on countries which display different levels of developments.

The predictions of our model with respect to the evolution of wealth distribution are also consistent with the historical evidence. Among economic historians (see, for example, Lindert and Williamson (1985)) there is general agreement that during the third quarter of the last century inequality started to decline. For the developed countries, the downswing phase of the Kuznets curve (see Kuznets (1955)) therefore coincides historically with the period we are referring to. Historical research also supports our conclusions regarding political participation. Following an early stage during which participation in the political process is restricted to an elite, it progressively expands in a subsequent phase (Bendix (1978)).

3. The model

Technology and wages Time is counted off in discrete intervals $t = 1, 2, \ldots$. At time 1 the economy adopts a new, modern technology given by

$$Q_t = A_t G_t^{\alpha} V_t^{1-\alpha} \tag{3.1}$$

where Q_t is output, G_t is the input of labor which received a general education

and V_t is the input of vocational labor at time t respectively. We assume, except in section 4.2.4, that the parameter $\alpha \geq \frac{1}{2}$, which implies that the income share of general labor is greater than the income share of vocational labor. This appears a natural assumption to make, since it implies that the superior social status which we will attribute to general education is matched by a larger income share for the people who receive it. The sequence $\{A_t\}_{t=1}^{\infty}$ describes an exogenous process of technological progress, which evolves according to

$$A_t = \gamma A_{t-1} \tag{3.2}$$

with $\gamma > 1$. It should be stressed that the production function implies complementarity between general and vocational labor. The idea is that, before time 1, the technology was different and in particular did not require vocational labor. Therefore, it is technological progress that triggers the reform of the educational system.

Production continues to occur in a constant-returns-to-scale traditional sector that uses the quantity of minimally educated labor, U_t, to produce output U_t.[4] So total output includes both the modern sector and the traditional sector and is given by $Q_t + U_t$.

All three types of labor are paid their marginal product. Therefore, at each t, simple labor receives a wage of 1, vocational labor gets $w_{Vt} = (1-\alpha) A_t G_t^{\alpha} V_t^{-\alpha}$ and general labor gets $w_{Gt} = \alpha A_t G_t^{\alpha-1} V_t^{1-\alpha}$.

Social structure and wealth distribution There is a stationary population of overlapping generations of individuals who live for two periods.[5] Each individual has one parent and one child. In each generation there is a continuum of individuals of size 1, with the generic agent denoted by $i \in [0,1]$.

Adult individual i at time t has either basic education only, or secondary education as well. Secondary education comes in two kinds: vocational or general. Accordingly, we divide the total population into three segments at each point in time: individuals $i \in [0, u_t]$ have only basic education, individuals $i \in (u_t, v_t]$ have

[4] One can indeed think of production, before time 1, as being carried out by the uneducated labor force, with the elites acting as rentiers.

[5] On the specific link between population growth and education, see Dahan and Tsiddon (1997).

vocational education and individuals $i \in (v_t, 1]$ have general education.[6] The last group, of size $G_t = 1 - v_t$, which we refer to as the "elite", initially holds a monopoly over general education. We assume that at time 1 the elite is less than half the population. The "non-elite", of size $U_t + V_t = 1 - G_t$ includes both the vocationally educated and those with only basic education.

For the sake of simplicity, we assume that all individuals who belong to the elite start with an identical level of initial wealth, b_{G1}. The non-elite, instead, have various levels of initial wealth, b_{i1}, for $\in [0, v_t]$. Without loss of generality we order the individuals so that $b_{it} \geq b_{jt}$ iff $i \geq j$. Let $F_t(\cdot)$ denote the distribution function over wealth at time t. We assume that $F_1(\cdot)'s$ only atom is at b_{G1}.

The vocational education sector At each time t the elite determine the size of the vocational sector. The elite pays a fixed cost $c > 4$ for every vocational worker that it trains.[7] These vocational school costs are covered through lump-sum taxation on elite income.[8] Thus, each elite member's after-tax income at time t when the sizes of the two sectors is V_t and G_t will be

$$w_{Gt} - c\frac{V_t}{G_t} \tag{3.3}$$

where w_{Gt} depends on V_t and G_t.

Individuals will be admitted into vocational schools in order of their wealth, with the richest getting in first.[9] In particular, the vocationally educated in period t will be all non-elite individuals such that $b_{it} \geq b_t^V$ where b_t^V satisfies $1 - F_t\left(b_t^V\right) - G_t = V_t$.

[6]Later we will show that family dynasties can only move up, from basic education to vocational education and from vocational education to general education so there will be no ambiguity over this classification.

[7]The only reason to assume $c > 4$ is to ensure that vocational labor will earn more than simple labor, a natural assumption.

[8]It is historically documented that at least initially the costs of setting up vocational schools were covered by entrepreneurs. More generally, we can also interpret these costs as on-the-job training directly provided by firms. The complementarity between general and vocational labor gives the elite an interest in paying for this training. In section 5 we will show that the vocational education sector tends to become too large in the model *despite the fact* that we do not allow non-elite individuals to contribute any money toward financing there own educations. From this perspective our set up for vocational school financing can be viewed as a strength of the model.

[9]This simple selection mechanism can be viewed as a proxy for a more complex financial side including tuition payments and liquidity constraints.

We will use the notation y_{it} to denote individual $i's$ after tax "total income" at time t defined as $y_{it} = b_{it} + w_{it}$ for $i \in U_t, V_t$ and $y_{it} = b_{it} + w_{it} - c\frac{V_t}{G_t}$ for $i \in G_t$.

Preferences In the first period of life, individuals either take a job after acquiring basic education, or they go to secondary school. At the end of the period, they receive a bequest from their parent, and in the next period they collect a wage, consume, leave a bequest to their children, and vote over educational issues to be specified below. They care not only about the income they leave to their children, but also about their childrens' social status. In this society, status is derived from access to general education, which is perceived as more prestigious than vocational education. Formally, preferences over activities at time t are given by

$$\log c_{it} + \delta \log b_{it+1} + s_{it+1} \tag{3.4}$$

where c_{it} is consumption, $0 < \delta < 1$ is a preference parameter, b_{it+1} is the bequest to the child, and the variable s_{it+1} captures the notion of social status with $s_{it+1} = \frac{1}{G_{t+1}}$ if the child is admitted to the elite and $s_{it+1} = 0$ if the child is excluded from it. Notice that, in the event the child does belong to G_{t+1}, the corresponding utility is decreasing in the size of G_{t+1}. This is consistent with general education being the exclusive and prestigious privilege of a restricted segment of the population.

Political participation and the general education sector At time t, in addition to their consumption and bequest decisions, old-age individuals also vote on the size of the general education sector in the next period, G_{t+1}. They care about this because of our assumptions on preferences.[10] There is an exogenous minimum wealth requirement, $\tilde{b}$, for participation in the voting process.[11] The people for whom $b_{it} \geq \tilde{b}$ vote on the expansion of general education, i.e., the amount by which G_{t+1} exceeds G_t.[12] Note that the qualitative predictions of the

[10]Since only old-age people have political power, the political process is reduced to an essentially static problem, in the sense that agents do not fully internalize the impact of present policy decisions on the future. Fully strategic political behavior and its complications are therefore assumed away.

[11]Saint-Paul and Verdier (1993) and Gradstein and Justman (1995) also introduce a franchise requirement. Acemoglu and Robinson (1996) study the link between the progressive extension of the franchise and growth and inequality.

[12]Consistently with the social function of the elite in this model, we assume that, once an individual makes into the elite, he will never be kicked out, i.e., $G_{t+1} \geq G_t$.

model would not be affected by the introduction of an endogenous level of $\tilde{b}$ which could, for instance, be inversely related to aggregate income, or else replaced by a minimum schooling requirement.[13] To organize the exposition we assume that, initially, the elite's income is above $\tilde{b}$, while the income of all the non-elite is below.

Elite expansion between times t and $t+1$ is decided by majority voting amongst the eligible old generation at time t with the median voter determining the result.[14] Note that at the time of the vote G_t is already determined so that the vote is really over G_{t+1}. In particular, each voter, i, selects an expansion level $G_{it+1} \in [0, 1 - G_t]$ and the actual expansion will be $median\{G_{it+1}\}$.[15] Given the resulting G_{t+1} children are enrolled into elite education in order of their parents' wealth, i.e., the richest come first. In particular, defining b_t^G by $G_{t+1} = 1 - F_{t+1}\left(b_t^G\right)$, all parents with wealth not less than b_t^G will get their children into general schools and, hence, the elite.[16]

Utility maximization There are three levels of social influence and hence three different maximization problems in the model. Non-elite individuals below the voting threshold have the least power. Each one of them, i, chooses c_{it} and b_{it+1} to maximize utility (3.4) subject to the following constraints

(i) $c_{it} + b_{it+1} \leq y_{it}$

(ii) y_{it} given.

For these people the opportunity for vocational education, the wages for both simple and vocational labor and the chance for their children to enter the elite are beyond their control.

The next influence level belongs to non-elite individuals above the voting threshold. Each one, i, chooses c_{it}, b_{it+1} and G_{it+1} to maximize utility (3.4) subject to the constraints

(i) $c_{it} + b_{it+1} \leq y_{it}$

(ii) $G_{t+1} = median\{G_{it+1}, \{G_{jt+1} : j \neq i\}\}$

[13] Bertocchi and Spagat (1997a) document how the voting franchise, for the case of Italy, was linked not only to the level of individual income, but also to the years of schooling.

[14] The political issue is well-defined, since it is unidimensional and implies single-peaked preferences.

[15] If the median is not unique we can select the infimum of the set of media.

[16] There is no ambiguity in this definition since the only atom in the wealth distribution can be for the original elite whose offspring will always belong to the elite.

(iii) G_{it+1} is not weakly dominated

(iv) $y_{it}, G_{jt+1} \forall j \neq i$ given.

The third constraint is standard in the voting literature to prevent arbitrary voting when there are a large number of voters so that often no individual can directly affect the outcome through his vote. Its effect is to ensure sincere voting.

Each elite individual, i, chooses c_{it}, b_{it+1}, V_{it} and G_{it+1} to maximize utility (3.4) subject to the constraints

(i) $c_{it} + b_{it+1} \leq y_{it}$

(ii) $G_{t+1} = median\{G_{it+1}, \{G_{jt+1} : j \neq i\}\}$

(iii) G_{it+1} is not weakly dominated

(iv) $b_{it}, G_t, G_{jt+1} \forall j \neq i$ given.

V_{it} can be interpreted as elite individual i's vote on the number of vocational workers to be trained in period t. However, if it occurred this would be a trivial voting process because all elite members would agree to set V_t to maximize (3.3). i.e., there is a unique choice for V_t that maximizes after tax total income for all members of the elite. Notice also that elite members do not take their wages as given like the non-elite do, because it can influence wages through its choice of V_t.

The solutions to these maximization problems are simpler than it might appear. First, non-voting individuals will take their total income y_{it}, consume a fraction $\frac{1}{1+\delta}$ and bequeath a fraction $\frac{\delta}{1+\delta}$ to their offspring. Second, non-elite voters will also consume $\frac{y_{it}}{1+\delta}$ and bequeath $\frac{\delta y_{it}}{1+\delta}$. In addition, each will vote for the minimal size general education sector that will include his own child, i.e., each i sets $G_{it+1} = 1 - F_t(b_{it})$. Finally, the elite will behave exactly like the non-elite voters in setting b_{it+1} and G_{it+1} while setting V_t to maximize (3.3) as noted above.

Political equilibrium

Definition 3.1. *A political equilibrium starting from initial conditions A_1, b_{i1} for $i \in [0,1]$ and G_1 consists of a sequence $\{c_{it}, b_{it}, V_{it}, G_{it+1}\}_{t=1}^{\infty}$ such that the following hold: (i) Each agent $i \in [0,1]$ is maximizing utility subject to the appropriate constraints for all $t = 1, 2, ...$; (ii) G_t for $t = 2, 3, ...$ is a voting equilibrium, i.e., it solves $\frac{1-F_t(\tilde{b})}{2} = G_{t+1}$.*

The basic mechanics of the voting equilibrium are as follows. At time 1 the enfranchised population coincides with the elite, which cannot shrink. If enough people cross the voting threshold, $\tilde{b}$, so that the median voter is not a member of

the original elite, then the elite will expand. In particular, the child of every voter above the median wealth level for the enfranchised population will be voted into general education, while no one else will make it.

4. Analysis of the model

4.1. The size of the vocational education sector

The new technology which is introduced at time 1 requires a combination of general and specific skills. Vocational schools need to be introduced in order to provide the latter. It is the elite that sets the optimal size of the vocational sector in order to maximize (3.3). We will distinguish between two stages of economic development. In Stage 1 only some of the non-elite receive vocational education, while in Stage 2 secondary education is universal, either in the vocational or in the general form. In the following discussion, we analyze the determination of the size of the vocational education sector stage by stage.

Stage 1 Until the time τ at which $U_\tau = 0$, the optimal V_t for the elite satisfies

$$V_t = \left(\frac{\alpha(1-\alpha)A_t}{c}\right)^{\frac{1}{\alpha}} G_t \tag{4.1}$$

Equation (4.1) has reasonable properties. By complementarity, V_t increases with G_t. Moreover, V_t is increasing in A_t, the level of technology. Finally, the cost of vocational education, c, is negatively related to V_t. The corresponding wages can be computed as follows:

$$w_{Vt} = \frac{c}{\alpha} \tag{4.2}$$

and

$$w_{Gt} = (\alpha A_t)^{\frac{1}{\alpha}} \left(\frac{1-\alpha}{c}\right)^{\frac{1-\alpha}{\alpha}} \tag{4.3}$$

which show that only the wage rate for general labor follows the evolution of technological progress, while the vocational wage rate does not benefit from it. This is because improvements in technology lead to increases in the quantity of vocational workers, eliminating the pressure for wages to increase. It is instructive

to analyze the ratio of after-tax incomes, which can be interpreted as the general education premium and is given by

$$\frac{w_{Gt} - c\frac{V_t}{G_t}}{w_{Vt}} = \alpha^{\frac{1+\alpha}{\alpha}} \left[(1-\alpha)^{\frac{1-\alpha}{\alpha}} - (1-\alpha)^{\frac{1}{\alpha}}\right] A_t^{\frac{1}{\alpha}} c^{-\frac{1}{\alpha}} \tag{4.4}$$

which implies that there is a positive premium for general education when

$$A_t > c\left\{\alpha^{\frac{1+\alpha}{\alpha}} \left[(1-\alpha)^{\frac{1-\alpha}{\alpha}} - (1-\alpha)^{\frac{1}{\alpha}}\right]\right\}^{-\alpha} \tag{4.5}$$

meaning that technology has to be sufficiently advanced while costs have to be relatively moderate. It can be shown computationally that $\alpha \geq \frac{1}{2}$ implies that $\left\{\alpha^{\frac{1+\alpha}{\alpha}} \left[(1-\alpha)^{\frac{1-\alpha}{\alpha}} - (1-\alpha)^{\frac{1}{\alpha}}\right]\right\}^{-\alpha} < 5.66$. So $\frac{A_1}{c} \geq 5.66$ is a sufficient, although far from a necessary, condition for elite wages to always exceed vocational wages throughout Stage 1. Of course, the wage rate in the traditional sector, w_{Ut}, is always 1 and previous assumptions on c and α imply that $\frac{c}{\alpha} > 2$. Therefore, $w_{Vt} > 2w_{Ut}$, which means that it is better to spend one's first period of life training for vocational labor and working in the second period than it is to work one's entire life in the traditional sector.

We summarize the behavior in Stage 1 with the following proposition.

Proposition 4.1. *In Stage 1: a) V_t is increasing; b) vocational incomes exceed incomes for basic education; c) for a combination of sufficiently advanced technology and sufficiently low costs for vocational education, general incomes exceed vocational incomes.*

Stage 2 From time τ on, i.e., after the pool of individuals with only basic education has been exhausted and, consequently, $U_t = 0$, the size of the vocational sector of the educational system will be determined residually as $V_t = 1 - G_t$. The size of the vocational sector cannot increase further during this stage and may decrease at the as people move up into the general sector.

Substituting into (3.1) and calculating marginal products, we can find the corresponding wage rates, which are given by

$$w_{Vt} = (1-\alpha)A_t\left(\frac{G_t}{V_t}\right)^{\alpha} \tag{4.6}$$

$$w_{Gt} = \alpha A_t\left(\frac{V_t}{G_t}\right)^{1-\alpha} \tag{4.7}$$

both increase with technological progress and depend on the ratio $\frac{V_t}{G_t}$, positively for w_{Gt} and negatively for w_{Vt}.

The ratio of after-tax incomes, $\frac{w_{Gt}-c\frac{V_t}{G_t}}{w_{Vt}}$, will be greater than 1 if and only if we have the condition

$$\frac{1-G_t}{(1-\alpha)G_t}\left(\alpha-\frac{c}{A_t}\left(\frac{1-G_t}{G_t}\right)^{\alpha}\right)>1 \tag{4.8}$$

It is less plausible here than it was in Stage 1 to make this condition hold for all t by assuming a high enough $\frac{c}{A_t}$ ratio. For instance, suppose that $\alpha=\frac{1}{2}$ and that G_t is close to $\frac{1}{2}$ (to which it converges as we show later). Then (4.8) becomes, approximately, $\frac{c}{A_t}<0$, which is of course impossible. For $\alpha>\frac{1}{2}$ (4.8) can always be satisfied for small enough $\frac{c}{A_t}$ but, by continuity, the required $\frac{c}{A_t}$ may be extremely small if α is close to $\frac{1}{2}$. Therefore, (4.8) could easily fail for a number of time periods, although since A_t is increasing geometrically to infinity it will hold in the long run as long as we do not have $\alpha=\frac{1}{2}$. Thus, Stage 2 can witness a crossover phenomenon according to which vocational labor earns more after taxes than general labor for some period of time. This does not necessarily mean that vocational people become richer than general people, because the latter will still continue to inherit more money than the former unless the crossover is large and persistent.

Again we summarize with a proposition.

Proposition 4.2. *In Stage 2: a) V_t is not increasing and may be decreasing in t; b) general incomes are greater than (less than) vocational incomes if (4.8) holds (does not hold).*

4.2. Dynamics

We are now ready to examine in detail the dynamic implications of the introduction of the vocational education sector. We get interesting dynamics for the size of the vocational and the general education sectors, for the level of income, for the degree of inequality and for the rate of political participation. We will study the evolutions of all these variables by proceeding, once again, stage by stage. The next subsection, 4.2.1, will be devoted to the first stage, while 4.2.2 will explore Stage 2.

4.2.1. The expansion of the vocational education sector

First of all, notice that since we have assumed that the non-elite are all below the voting threshold in period 1, the size of the general education sector will be the same in period 2 as it is in period 1. After period 2 it is possible for lower class incomes to rise above the voting threshold. If enough of them do to change the class of the median voter, then the general education sector will expand. If the general sector does not expand during Stage 1 then, by equation (4.1), the dynamics of the vocational sector will be governed by the equation

$$V_{t+1} = \gamma^{\frac{1}{\alpha}} V_t \tag{4.9}$$

which predicts that there will be a continuous expansion of V_t at the rate of $\gamma^{\frac{1}{\alpha}} - 1$, driven by technological progress. If, on the other hand, the voting equilibrium does change during Stage 1, forcing expansion of the general sector, then vocational sector will grow faster than $\gamma^{\frac{1}{\alpha}} - 1$. Social and technological factors therefore contribute to the shaping of the educational system.

Again using (4.1) we have that the ratio $\frac{V_t}{G_t}$ will be increasing over time according to

$$\frac{V_{t+1}}{G_{t+1}} = \gamma^{\frac{1}{\alpha}} \frac{V_t}{G_t} \tag{4.10}$$

which holds regardless of whether or not the voting equilibrium is changing during Stage 1.

To complete the description of the evolution of the educational system, we can also study the dynamics of the secondary school enrollment ratio, which is given by $V_t + G_t$: it is clear that this fraction will also be increasing during this stage.[17]

Aggregate income dynamics can be tracked by computing the rate of growth for the output of the modern sector of the economy, i.e., the one that employs vocational and general labor. Until the voting equilibrium changes (if it does) we have, using (3.1), (3.2) and (4.9) that $g^M \equiv \frac{Q_{t+1}}{Q_t} - 1 = \gamma^{\frac{1}{\alpha}} - 1$. This modern sector growth rate is positive and greater than $\gamma - 1$, the rate that would be sustainable purely due to technological progress. Note that this growth rate does not depend on t. If the voting equilibrium does change during Stage 1 then $g^M > \gamma^{\frac{1}{\alpha}} - 1$.

[17]Recall that the total mass of individuals has been normalized to one so this really is a ratio.

Traditional sector growth is given by $g_t^T \equiv \frac{U_{t+1}}{U_t} - 1$, which is negative and equal to $\frac{V_t\left(1-\gamma^{\frac{1}{\alpha}}\right)}{U_t}$ when the voting equilibrium is not changing and even more negative when it is changing. Despite the shrinkage of the traditional sector, total output must be increasing because wages are higher in the modern sector than the in the traditional sector and every individual is paid his marginal product.[18] Since income grows monotonically with time, it is therefore legitimate to establish a positive relationship between the ratio $\frac{V_t}{G_t}$ and the level of income $Q_t + U_t$. In fact, when productivity in the modern sector is high then the traditional sector will be very small relative to the modern sector and the growth rate for the whole economy will be approximately equal to the growth rate of the modern sector. Therefore, as long as the voting equilibrium is not changing at this stage, the two variables grow at approximately the same speed. We summarize with the following.

Proposition 4.3. *In Stage 1: a) Total output and $\frac{V_t}{G_t}$ both grow; b) the growth rate of $\frac{V_t}{G_t}$ is $\gamma^{\frac{1}{\alpha}} - 1$; c) while the elite is not expanding Q_t also grows at the rate $\gamma^{\frac{1}{\alpha}} - 1$, while it grows faster otherwise.*

Let us analyze now the evolution of income distribution in the society. Utility maximization leads to the bequest function

$$b_{it+1} = \beta(y_{it}) \tag{4.11}$$

for $i \in V, G, U$, where $\beta = \frac{\delta}{1+\delta}$. For $i \in V, U$ the implied dynamics of bequests for each dynasty will be such that $b_{it+1} > b_{it}$ if and only if $\delta w_{it} > b_{it}$.[19] In other words, appropriately discounted wage income has to be larger than the individual bequests for the sequence of bequests of a dynasty to be increasing. This is a very reasonable condition for the modern sector because if this condition were not satisfied then the new technology would be inferior to the previous one, which had endowed the initial generations with bequests b_{i1}. We will therefore proceed under the assumption that this condition is indeed satisfied for workers in the modern sector. Before completing the analysis of the evolution of wealth distribution we

[18] This is true even if we only consider output net of vocational school costs because the elite only pays for vocational education to the extend that these expenditures enhance elite income.

[19] For the general sector the condition would have incomes instead of wages to adjust for the costs of financing vocational schools.

will assume that (4.5) holds, i.e., that throughout Stage 1 after-tax elite income exceeds after-tax vocational income. This makes sense both because its denial would be counterfactual, and because it would be inconsistent with the decision of the elite to adopt such a technology.

Under the above assumptions, the evolution of bequests will be given by

$$b_{it+1} = \beta \left[b_{it} + \alpha^{\frac{1}{\alpha}} \left[(1-\alpha)^{\frac{1-\alpha}{\alpha}} - (1-\alpha)^{\frac{1}{\alpha}} \right] A_t^{\frac{1}{\alpha}} c^{\frac{\alpha-1}{\alpha}} \right] \tag{4.12}$$

for the elite, and by

$$b_{it+1} = \beta(b_{it} + \frac{c}{\alpha}) \tag{4.13}$$

for vocational workers. Notice again that the income of the elite increases with technological progress while the income of individuals with vocational education does not. Since elite wages and wealth are already larger than their vocational counterparts in period 1, this lopsided wage growth exacerbates inequality. On the other hand, throughout Stage 1 the fraction of the population earning vocational wages is increasing, a factor that decreases inequality. Moreover, if the voting equilibrium is changing during Stage 1 then people are moving up to the elite, accelerating the transition from simple labor to vocational labor. Therefore, in the initial stage, the overall impact of these factors on inequality depends on relative magnitudes. It can also be noticed that the presence of a positive premium for general labor over vocational and for vocational labor over simple implies for this society a complete lack of mobility, in the sense that it is impossible for individuals to change their relative wealth rank in society.

Finally, we can examine the evolution of political participation in the society. For individuals with access to vocational education, income grows over time. If wealth levels start surpassing $\widetilde{b}$ then the voting pool expands. This event, by itself, is not be sufficient to alter the voting outcome, since a mass at least equal to G_1 get the franchise the median voter will still be an offspring from the original elite.

To sum up we have both *expansion* of educational opportunities through the introduction of vocational schools and *exclusion* from the elite of those individuals who did not belong to the original elite, since at best the elite will only expand gradually during Stage 1. Also, economic growth affects wealth inequality in a complex way, by creating a new middle class with vocational skills but also

by leaving behind people who cannot acquire them. At the same time political participation will tend to gradually increase.

4.2.2. The contraction of the vocational education sector

Stage 2 is reached at the time τ that all individuals are enrolled in secondary school, i.e., it is defined by the condition $U_\tau = 0$ which implies that the secondary school enrollment ratio is 1. Equations (3.2) and (4.1) together imply that Stage 2 must eventually be reached. From now on V_t will be determined as a corner solution rather than through (4.1).

Define ζ to be the first period reflecting a change in the voting equilibrium, i.e., ζ is the smallest number such that $G_\zeta > G_1$. Note that this must happen for some finite ζ because, by (3.2) and (4.6), vocational wages grow without bound in Stage 2 and so eventually everyone must cross get the franchise in this stage if they did not already get it in Stage 1.

Suppose for the moment that $\zeta > \tau$ and consider the dynamics during this substage. From τ to ζ both G_t and V_t are constant, and so is their ratio. The growth rate of output in the modern sector, which is the only one left, equals $\gamma^{\frac{1}{\alpha}} - 1$ so it is slower than in Stage 1.

The evolution of bequests is given by the equations

$$b_{it+1} = \beta(b_{it} + \alpha A_t(\frac{V_t}{G_t})^{1-\alpha} - c(\frac{V_t}{G_t})) \tag{4.14}$$

for elite individuals and

$$b_{it+1} = \beta(b_{it} + (1-\alpha)A_t(\frac{G_t}{V_t})^{\alpha}) \tag{4.15}$$

for non-elite individuals. Recall that (4.8) governs the relationship between after-tax income for the two groups. If (4.8) holds then the elite will continue to earn more than the non-elite throughout Stage 2. The reverse is true if (4.8) does not hold. In the latter case inequality is clearly decreasing. It turns out that the same is true even in the former case, because, by inspection of (4.8), the ratio of after-tax income is decreasing over time.

Now consider together the case where $\zeta \leq \tau$ and the case where $\zeta > \tau$ and $t \geq \zeta$. The median voter now is not a member of the original elite, and is able to vote his child into the general education sector, thus expanding the size of G_t. The sequence of events is as follows: since G_t can only expand at the expense of

V_t, the expansion of G_t comes with a reduction in V_t. The ratio $\frac{V_t}{G_t}$ therefore falls, at a speed that depends on the initial wealth distribution, and will be faster the smaller the dispersion in the initial wealth levels of the lower class b_{i1}. Moreover, as G_t grows, w_{Vt} rises, pushing towards income equalization and accelerating expansion of political participation. The identity of the median voter will change accordingly, and more and more people will be able to vote their children into general education.

The rest of this subsection is completely general for Stage 2. Aggregate output growth will be given by

$$g = \gamma(\frac{G_{t+1}}{G_t})^{\alpha}(\frac{V_{t+1}}{V_t})^{1-\alpha} - 1 \tag{4.16}$$

which depends on the dynamics of $\frac{V_t}{G_t}$ and will be greater than 0 as long as $G < \alpha$. This condition will always by satisfied because no more than half the population can ever be voted into general education.[20]

In the long run, the economy and society reaches a steady state with full political participation. At that time the ratio $\frac{V_t}{G_t}$ stabilizes at 1 and aggregate output growth equals $\gamma - 1$. Individual incomes tend toward equalization. However, since the outcome of the voting process implies that G_t will never rise above $\frac{1}{2}$, it follows from (4.8) that in the long run the elite will earn more than the non-elite as long as $\alpha > \frac{1}{2}$. On the other hand, the children of the original elite will progressively lose their monopoly over general education, the voting process and much of the economic privilege attached to this social status. The following proposition summarizes these results.

Proposition 4.4. *In Stage 2: a) Output grows; b)* $\frac{V_t}{G_t}$ *may remain constant initially; c) eventually* $\frac{V_t}{G_t}$ *will decrease monotonically to* 1.

Mobility can be more interesting in Stage 2 than it was in Stage 1. If (4.8) holds there is no mobility just like in Stage 1. But if (4.8) does not hold then it is possible that at least some of the non-elite will become wealthier than the elite. Note that the failure of (4.8) by itself is not sufficient for wealth crossover, due

[20] In fact, as welfare analysis will demonstrate in Section 5, g is going to be higher than $\gamma - 1$ but higher or lower than $\gamma^{\frac{1}{\alpha}} - 1$depending on income distribution.

to the elite's history of giving its offspring larger bequests than the non-elite were giving theirs.[21]

Combining Propositions 4.3 and 4.4 leads to the main result of the paper, which is that the relationship between $\frac{V_t}{G_t}$ and income follows an inverse U-shape.

Proposition 4.5. *In Stage 1 $\frac{V_t}{G_t}$ increases with the level of income; in Stage 2 $\frac{V_t}{G_t}$ initially decreases with the level of income, and then becomes a constant.*

4.2.3. Summary

For expositional clarity, we will now summarize the evolution of each variable of interest, stage by stage. For simplicity consider the case in which $\zeta > \tau$.

The educational system The evolution of the education system is depicted in Figure 3. In Stage 1 the vocational sector grows at the rate $\gamma^{\frac{1}{\alpha}} - 1$. In Stage 2, it is constant from time τ to time ζ, and then it decreases until some time ξ after which it equals $\frac{1}{2}$. The general sector is constant through Stage 1 and continues so until time ζ of Stage 2. After that it decreases until ξ and stabilizes at $\frac{1}{2}$. The ratio $\frac{V_t}{G_t}$, which we take as the crucial indicator of the evolution of the educational system, rises from 1 to τ, is constant between τ and ζ and decreases between ζ and ξ at which point it stabilizes at 1. The secondary school enrollment ratio grows steadily over time and reaches 100% by Stage 2.

Aggregate income Aggregate income always rises in this model, but at varying rates, reflecting endogenously the evolution of the educational system (see Figure 4). Initially, as the economy exploits more and more intensively the new technology by employing vocational labor, the rate is highest at $\gamma^{\frac{1}{\alpha}} - 1$. By Stage 2, the traditional sector has disappeared and growth is slower because the opportunities to shift labor into the modern sector have disappeared: the growth rate is $\gamma - 1$ from τ to ζ and from ξ on, and higher between ζ and ξ.

[21] In the case where the elite earns less than the non-elite one could question the voting behavior of individuals who, in our model, would push their children into general education even when it is leading to lower wages than vocational education. The reason is that people are motivated by the prestige attached to general education.

Wealth distribution Without stronger assumptions, inequality can either increase or decrease in Stage 1. By the time ζ at which $\frac{V_t}{G_t}$ starts to decline, vocational wages pick up thanks to the relative scarcity of vocational labor, but only under the condition $\alpha = \frac{1}{2}$ will they reach the level of general wages. When this condition is not satisfied, inequality will persist in the long run.

Political participation As income rises for everyone, after a while it will start a process of expansion. However, enfranchisement of the lower class will not immediately affect the voting outcome, because initially the median voter will still be a member of the original elite. At time ζ the median voter does not come from the elite but successfully votes his child in. Political participation is full in the long run

4.2.4. The case of $\alpha < \frac{1}{2}$

While the above analysis has been conducted under the assumption of a higher income share for the generally educated, it is instructive to analyze also the opposite case. For $\alpha < \frac{1}{2}$, under the maintained assumptions of high enough A_t and low enough c, we still observe a positive premium on general education during Stage 1. During Stage 2, however, there will necessarily be a reversal, with pre-tax wages for vocational labor rising above those for general labor. Of course, after taxes the situation would be even more in favor of vocational labor (see equation (4.8)). As noted in footnote 21 this implies a tension between the superior social role attached to general education and its inferior remuneration. We resolve this issue by assuming that social status dominates. In this case, the ratio $\frac{V_t}{G_t}$ reaches the same constant value of 1 in the long run, but there will be a faster process of equalization between general and vocational people, with vocational people eventually becoming richer during Stage 2. Therefore, there is strong social mobility in this case.

4.2.5. The Role of Status

What is the importance of our use of status in agents' utility functions rather than childrens' wages? First, one might question separate arguments in utility functions for both bequests and childrens' wages. More importantly, as mentioned in the previous subsection in Stage 2 the model can generate wage crossover under which vocational wages exceed general wages. Obviously, in these cases there is a

big difference between status-driven behavior and wage-driven behavior. Finally, there is a subtle but important role for status in Stage 1. A purely wage-driven elite would have no incentive to restrict access to general education in this Stage 1 because expanding both general and vocational sectors proportionately would hold elite wages constant. Thus, without status the elite would be indifferent over a wide range of sizes for the general education sector. Introducing status has the effect of resolving the indifference at the smallest possible size.

5. Welfare analysis

We now turn to normative analysis by deriving the mix between general and vocational education that would maximize the economy's output net of education costs and comparing it with the mixes that actually occur at the political equilibrium of the model. We stress that this exercise also illustrates the role of the status component in individual preferences, which is ignored by an output-maximizing social planner. Consider the problem of maximizing

$$A_t G_t^{\alpha} V_t^{1-\alpha} + (1 - G_t - V_t) - cV_t \tag{5.1}$$

subject to the constraints $G_t \geq 0$, $V_t \geq 0$ and $1 - G_t - V_t \geq 0$ and under the assumption that $\alpha \geq \frac{1}{2}$. There are only two possible solutions: $G_t = \alpha$, $V_t = (1 - \alpha)$ and $G_t = V_t = 0$. The first is the correct solution if and only if $A_t(\alpha)^{\alpha}(1 - \alpha)^{1-\alpha} \geq 1 + c$ and otherwise the second is the correct solution. In other words, if technology is sufficiently advanced that it is optimal to have any secondary education at all, then secondary education should be universal and the ratio of vocational to general education should be equal to $\frac{1-\alpha}{\alpha}$.

Crucial results follow from this simple calculation. First, consider Stage 2 of the development process. We know unambiguously that throughout this stage too many people receive vocational education and too few people receive general education. Recall that the elite never grows larger than $\frac{1}{2}$ despite the fact that output maximization requires that $G_t = \alpha \geq \frac{1}{2}$. It is true that this inefficiency decreases over time as the elite grows in size. But it is never eliminated. So our model predicts that, at least for countries with universal secondary education, the vocational sector will be overdeveloped and, therefore, the economic returns to vocational education are less than the returns to general education. This is exactly the thrust of the findings surveyed in Psacharopoulos (1993).

Next consider Stage 1. The economy never achieves an optimum during this stage since, as noted above, partial access to secondary education cannot be efficient. If technology is sufficiently strong then the elite should expand to the size α. So general education is certainly underdeveloped during Stage 1 just as it is in Stage 2. On the other hand, it is easy to show that if the elite is sufficiently (and suboptimally) small then the vocational sector will also be below its optimal level. But this is only a possibility. The vocational sector can also be too big during Stage 1.

These results can be summarized as follows.

Proposition 5.1. *In Stage 1 in a political equilibrium general education is underdeveloped. In Stage 2 vocational education is overdeveloped while general education is underdeveloped.*

This results from the role of status in our model, i.e., from the elite's desire to maintain general education as a small and exclusive sector.

Recall that we have assumed that vocational education is completely financed by the elite. This might seem like a restrictive assumption but now it can be viewed as a strength of our approach, because we find that even under these conditions the vocational sector becomes too large. If we allowed non-elite individuals to contribute to their education then the vocational sector would become even bigger.

Note, however, that this welfare analysis is deeply affected if one removes the assumption of $\alpha \geq \frac{1}{2}$. In the opposite case, the political equilibrium of the model will display an excess of general education, and the associated inefficiencies could be attributed to its status role.

6. Conclusion

To conclude, we would like to indicate a few possible policy implications of our model, in particular for educational policies in developing countries.

Policy-oriented research on the economics of education has developed along two lines. The first is a micro-oriented approach, which has focused primarily on the compilation of rate-of-returns estimates to investment in education (see Psacharopoulos (1993) for a recent assessment). These studies have explicitly recognized the distinction between vocational and general education, reaching the

conclusion that the academic secondary school curriculum is a better investment than the technical/vocational track, with even wider differences in the relative profitability of social, as opposed to private, returns, because of the higher costs associated with practically-oriented training. The rate-of-returns approach can be criticized on several grounds (see Heyneman (1995)). First of all, the international classifications of vocational curricula is largely outdated and fails to capture the evolution which has occurred within this sector of the educational system. Second, this approach has adopted a narrowly-defined perspective, with a tendency to ignore the fact that returns to vocational education are determined not only by the specific skills it provides, but also by its social role. Nevertheless, there is almost certainly truth in the results indicating lower rates of return on vocational education. Our model predicts such an empirical result.

The second stream of literature, closer to our approach, is directly linked to growth theory and its macroeconomic implications. In this work the role of vocational vs. general education for development has been addressed only very superficially. The conventional wisdom, in accordance with a functionalist view, used to be that vocational education should have higher priority in developing economies than in developed countries. This conclusion, which permeated the orientation of international organizations and less-developed countries' governments in the early post-war period, was challenged, among others, by Foster (1968), who suggested that a series of crucial variables and, in particular, socio-political considerations, needed to be taken into account for the design of a policy that can actually stimulate growth. Working from the welfare analysis of the previous section, we can be more specific on this point. In particular, we have shown how socio-political factors can lead to an overemphasis on vocational education and an underemphasis on general education. Therefore, addressing this inefficiency is a policy that can foster growth.

It is not surprising that international organizations fell into the vocational education trap. The local policymakers who negotiate with these institutions are invariably members of the elite that has an interest in restricting access to general education. The main lesson from this paper is that international policymakers involved in human capital development planning must develop a keener awareness of the socio-political considerations that interfere with strictly economic ones and act accordingly.

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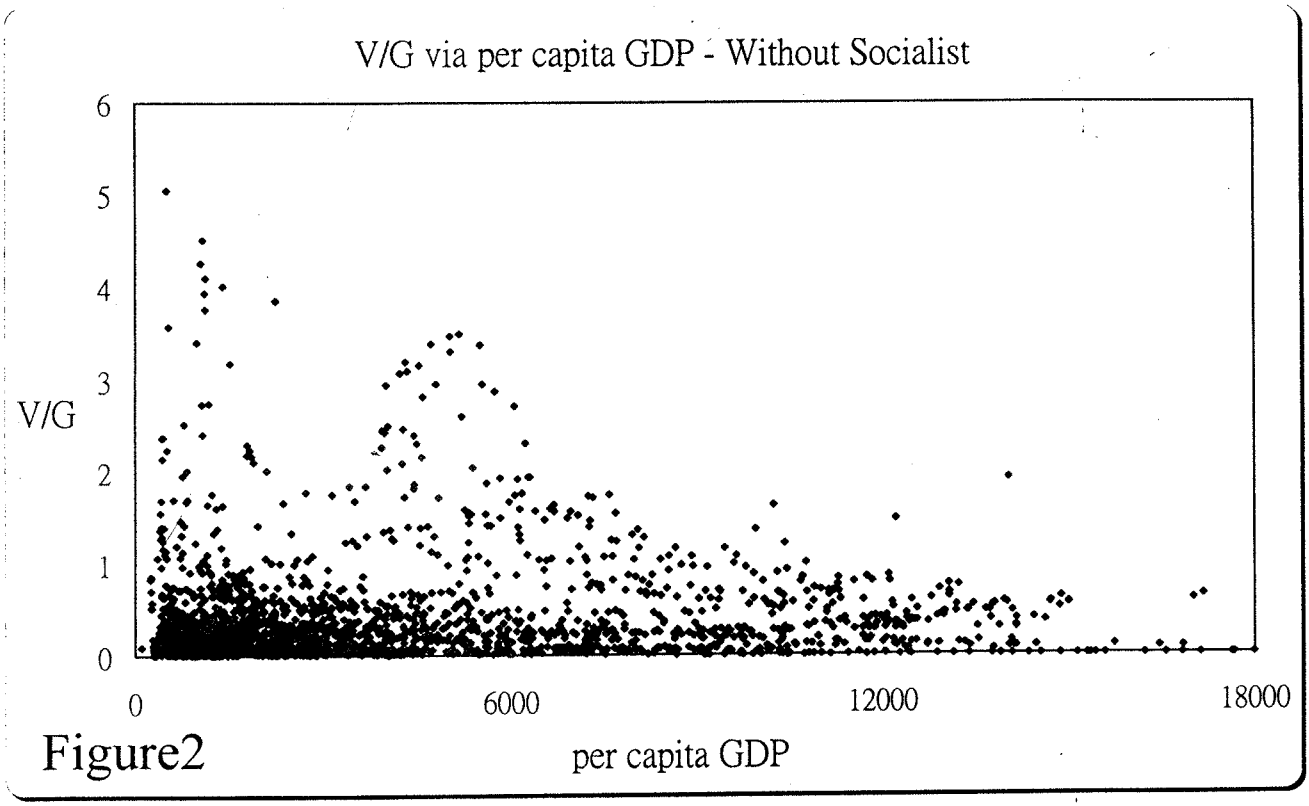
Figure 1



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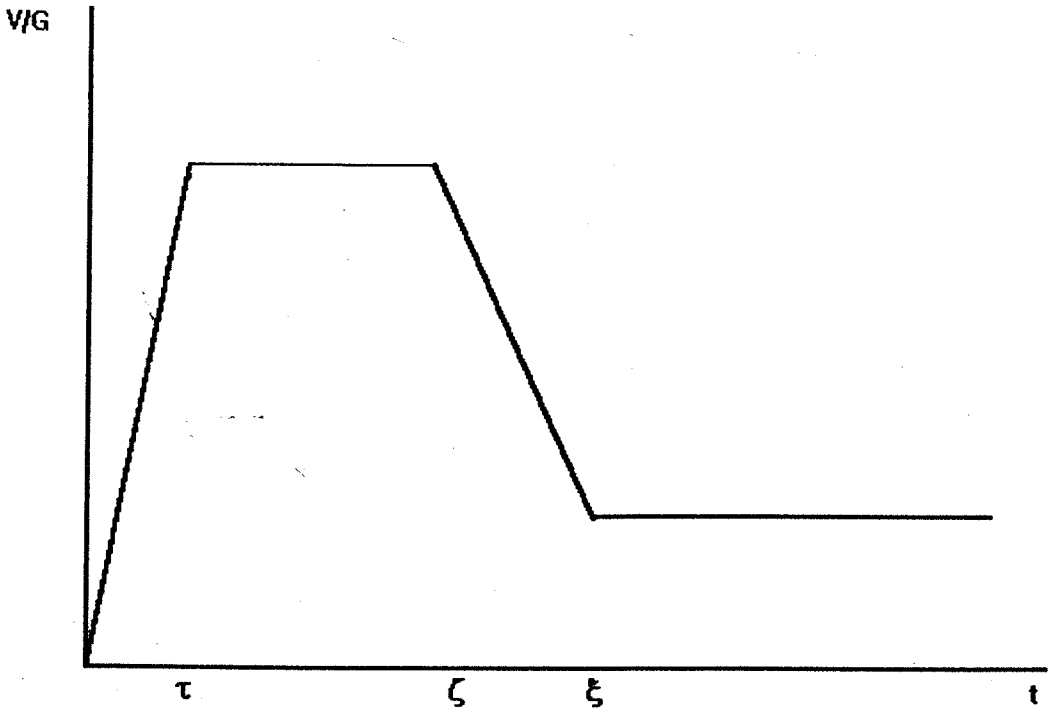

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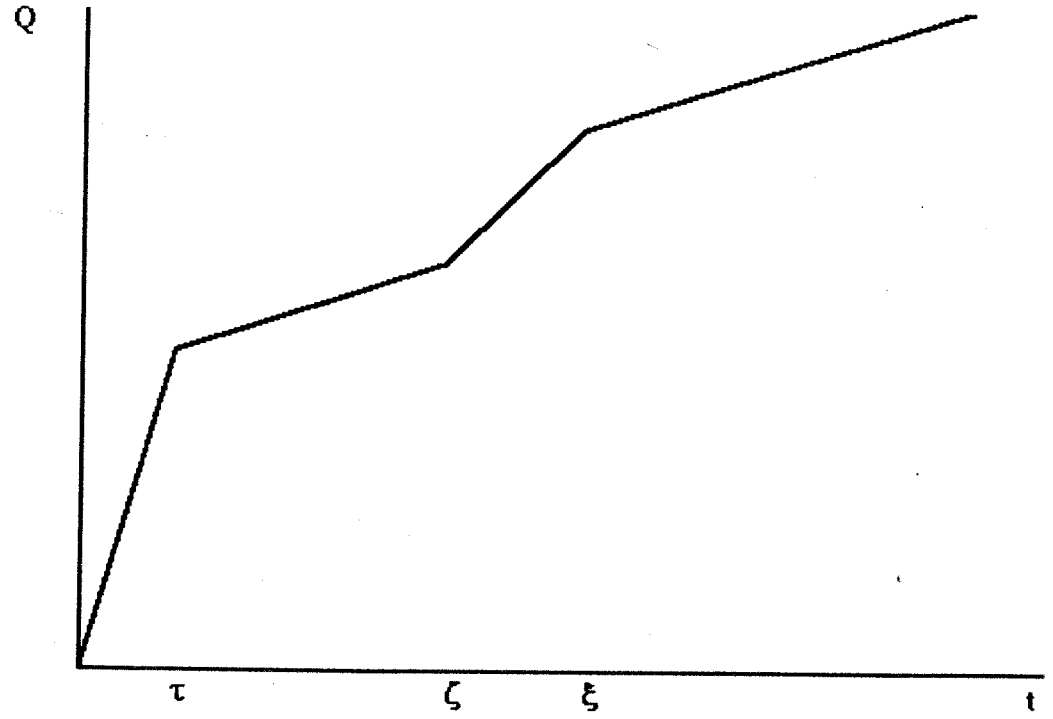

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