On the Limit of Human Cognition:
Is Artisanship always Dominated by Profit Motive?

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Abstract

This article examines the limit of human cognition in the following sense. While all individuals have the same utility function, their *ex-ante* objectives differ. One type of individuals maximizes the quality of their produced goods as conferred by the elaboration of their labor. The other type maximizes their pecuniary profits. The *ex-post* utility is assumed to be the sum of the quality of the provided good and the earned profit. That is, we presume that there is a limit to human cognition in the sense that individuals are unable to assess the interdependence of the quality and the price of his producing goods precisely in advance and are forced to decide their way of life between the pursuit of quality or profit. We dub the former type *artisan* and the latter type *capitalist*. It is shown by using a simple evolutionary game that, *artisanship* may flourish even in a free-will market economy and this outcome heightens economic welfare. This is not merely because artisanship enables the circulation of high quality goods, but also because artisans can feel deeper self-confidence than capitalists.

1. Introduction

Since there are very many ways of life for human beings and the choice between them is too complicated for juveniles, education, especially by parents and teachers, plays a crucial role in deciding their future. Putting it differently, the boundedness of cognition is prominent in the choice of one's way of life. This article assumes that there are two types of way of life: *artisan* and *capitalist*. They differ in the motives they bring to their jobs. Those who are educated as artisans pursue the refinement the quality of their produced goods through their associated elaboration. The rewards (profits) are only of their secondary concern. A capitalist is directed to concentrate on maximizing his/her profits (price minus the cost of elaboration) regardless of the quality of their produced goods. That is, the quality of goods that capitalists produce is only of their secondary concern to them.

The economy comprises these two types of individuals. Captives of naïve neoclassical economics might consider that artisans are swept out by capitalists in a market milieu because earned profits incentivize individuals more strongly than aesthetic consideration. Nevertheless, this prospect is narrow in scope. One must note that human beings are motivated by other reasons than pure profit. An artisan is an individual who puts much importance on the self-confidence nurtured by the articulation of his/her trade. Insomuch as the price and/or wage fully reflect the quality of produced goods (i.e., perfect information), an artisan earns much more than a capitalist although the required degree of elaboration is far higher.

As long as the probability is sufficiently high that he/she can engage with customers who can afford the quality of goods, an artisan enjoys a more fruitful life than that of a capitalist. This is because the utility of each type of individual is assumed to be the sum of the pecuniary factor (i.e., the price of goods or level of wages) and the self-confidence factor (i.e., produced quality minus the fatigue from the toil involved in production). In both factors, the utility of an artisan dominates that of capitalist in principle, because high quality goods sell dearer than low quality ones.

At present, however, the more prevalent way of life is *capitalist*. This article also explores the reason that provokes this paradox by applying a simple evolutionary game. Some kinds of *mutation* such as the widespread introduction of machinery, which had proceeded since the 18th century, and the surge of foreign direct investment (FDI) from the end of 20th century may be significant. One must note that a major surge of FDI could not be achieved until computer technology and its associated internet infrastructure had been developed. These historical economic changes possess common features. One is the *standardization* of jobs. The other is the massive use of cheap and

unskilled domestic or overseas labor.

These features come from the same origin: the mass production of cheap and less refined goods. Machinery overcomes the lack of skills of employees and enables the adequate production quality for less finished goods. Although earned wages in such a production process is lower than those earned by artisans, because cheaper and less elaborated goods are massive produced, this type of the way of life, that is, *capitalist*, becomes self-enforcing.

Once the capitalist type way of life is established, *artisanship* is thwarted. This is because the dominant part of the economy consists of low wage individuals (i.e., capitalist), and thus artisans, whose production goods are high quality but relatively expensive, find great difficulty in finding their customers. Accordingly, as Trevelyan (1944) suggests[1], rapid technological progress does not necessarily contribute to enhance the wellbeing of human beings.

One must note that artisanship survived not only in the handicraft era but also in the modern industrialized era. For example, from the end of World War II to the end of 20th century, Japan's reliable and sophisticated manufactured goods are instrumental in sustaining its stable and rapid economic growth. The creation of these goods was based on numerous and anonymous process innovations and rigorous quality controls that were supported by intrinsic artisanship. Such artisanship evaporated in conjunction with the surge of FDI from the beginning of this century. Nominal wages are grievously sagging and job security is heavily impaired. As Moore (1902; p.216) argues[2], the construction of a good present economy implies to the necessity of establishing the foundation of a sound economy in the near future. The ultimate quest of this article is to

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[1] Trevelyan (1944, p.450) warns that
`` `Progress,' as we of the Twentieth Century are better aware than our Victorian ancestors, is not always change from bad to good or from good to better, and the sum total of `progress' associated with the Industrial Revolution has not been wholly for the good of man."
[2] According to Moore (1902),` `If we regard all that we do from the point of view of its rightness, that is to say as a mere means to good, we are apt to neglect one fact, at least, which is certain; namely, that a thing that is really good in itself, if it exists now, has precisely the same value as a thing of the same kind which may be caused to exist in the future. Moreover moral rules, as has been said, are, in general, not directly means to positive goods but to what is necessary for the existence of positive goods; and so much of our labor must in any case be devoted to securing the continuance of what is thus a mere means---the claims of industry and attention to health determine the employment of so large a part of our time, that, in cases where choice is open, the certain attainment of a present good will in general have the strong claims upon us. If it were not so, the whole of life would be spent in merely assuring its continuance; and, so far as the same rule were continued in the future, that for the sake of which it is worth having, would never exist at all."

examine how to regain a harmonious market economy.

This article is organized as follows. Section 2 constructs an evolutionary game model in which both the artisan-occupied equilibrium and the capitalist-occupied equilibrium form an evolutionary stable set (ESS). Section 3 determines which equilibrium is actually selected through the use of replicator dynamics methods. In Section 4, we discuss the role of education and the importance of the fidelity of teachers to realize a self-confident society instead of a meritocratic society. Section 5 provides concluding remarks.

2. The Model

2.1 The Structure of the Model

In this economy, infinite individuals exist and they produce one unit of goods. The goods are perishable and self-consumption bears no utility. Accordingly, individual is unable to enjoy consumption without mutually exchanging their goods.

It is assumed that every individual has the same utility function:

$$U \equiv p(q) + q - v(q), \text{ (1)}$$

where q is the quality of goods that he/she provides. $p(q), v(q)$ denote the price of and the production cost of the goods with quality q, respectively.

There are two types of individual: artisan and capitalist. An artisan maximizes quality q while incurring the given production cost under the *viability* condition:

$$p - v(q) \geq 0. \text{ (2)}$$

The viability condition implies that the consumption level of an artisan cannot become negative; that is, he/she solves $\max_q \left[q - v(q) \right]$ under the constraint (2). Let the result of this be denoted as

$$q^H \equiv \arg\max_q \left[q - v(q) \right]. \text{ (3)}$$

It is assumed that

$$p(q^H) - v(q^H) > 0, \text{ (4)}$$

and the viability condition (2) thus is satisfied as long as the production quality q^H is properly evaluated.

4

A capitalist solves for profit maximization (i.e., $\max_q \left[p(q) - v(q) \right]$). As long as the price is insensitive to the quality and $0 < p' < 1$ is satisfied,

$$q^L \equiv \operatorname{argmax}\left[p(q) - v(q) \right] < q^H \ (5)$$

holds. That is, the quality of goods provided by artisans is higher than that by provided by capitalists.

In addition, it is also assumed that the following relationship is held:

$$p(q^L) - v(q^H) < 0 \ . \ (6)$$

Equation (6) implies that if the product of an artisan is incorrectly evaluated as being that of a capitalist, the strategy represented by Equation (3) is no longer viable, and the viability condition (4) requires the optimal strategy moves to satisfy

$$p(q^L) - v(q^M) = 0 , \ \ q^L < q^M < q^H \ . \ (7)$$

What causes this classification of individuals emerges to emerge is to the limited cognitive ability of human beings. In general, individuals do not possess the ability to maximize fully the total utility that is represented by Equation (1). In other words, it is assumed that there is no individual who completely understands completely the relationship between the price and the quality of the goods he/she produces. Thus, an individual must decide his/her way of life (through the exercise of a value judgment) that is, whether to live as an artisan or a capitalist.

2.2 The Equilibrium of the Economy and Its Property

A simple evolutionary game is created by defining the equilibrium of the economy. Two individuals match together at random, and produce and exchange their goods. By availing the results obtained in 2.1, the payoff matrix in Table 1.1 is obtained. The left equation in each cell represents the benefit of the player who corresponds to the row. The right equation in each cell is that of the player corresponding to the column.

Based on the information provided by Table 1.1, the following theorem is obtained.

Theorem 1. *Let the ratio of artisans occupied in the total population be* π *. Then,* $\pi = 1$ *is an evolutionary stable set (ESS).*

Proof. Suppose that the initial ratio is $\pi = 1$. Then, assume that a ratio ε of artisans

converts to capitalists. It is necessary and sufficient for the proof to show that such a conversion is not beneficial. This condition is expressed by the following inequality.

$$[1-\varepsilon]\Big[p\big(q^H\big)+q^H-v\big(q^H\big)\Big]+\varepsilon q^M \geq \Big[[1-\varepsilon]p\big(q^H\big)+\varepsilon p\big(q^L\big)+q^L-v\big(q^L\big)\Big]$$

$$\Leftrightarrow \Big[\big[q^H-v\big(q^H\big)\big]-\big[q^L-v\big(q^L\big)\big]\Big]\geq \varepsilon\Big[\big[q^H-v\big(q^H\big)\big]-\big[q^L-v\big(q^L\big)\big]+p\big(q^L\big)-q^M\Big]. \ (8)$$

Since

$$\Big[q^H-v\big(q^H\big)\Big]-\Big[q^L-v\big(q^L\big)\Big]>0$$

by definition, Inequality (8) holds for any sufficiently small ε. **QED**

Similarly, the following theorem is also obtained.

Theorem 2. If the quality difference, q^M-q^L, is not sufficient to incentivize a shift to an artisanship in the situation where almost all individuals are capitalists, and

$$q^L-v\big(q^L\big)>q^M-q^L \ \ (9)$$

holds, then, $\pi=0$ is also an ESS.

Proof. Assume that $\pi=0$. If the conversion from capitalists to artisans lessens individual utility, it is necessary and sufficient that the following inequality holds:

$$[1-\varepsilon]\Big[p\big(q^L\big)+q^L-v\big(q^L\big)\Big]+\varepsilon q^M \geq \Big[[1-\varepsilon]p\big(q^L\big)+\varepsilon p\big(q^M\big)+q^M-v\big(q^M\big)\Big].$$

By using Equation (7), the above inequality is transformed into

$$\Big[[1-\varepsilon]p\big(q^L\big)+\varepsilon q^M+q^L-v\big(q^L\big)\Big]\geq \Big[[1-\varepsilon]p\big(q^L\big)+\varepsilon p\big(q^M\big)+q^M-v\big(q^M\big)\Big]_{(10)}$$

$$\Leftrightarrow \Big[p\big(q^L\big)-v\big(q^L\big)\Big]-\Big[q^M-q^L\Big]+\varepsilon\Big[q^M-p\big(q^M\big)\Big]\geq 0.$$

Whenever Inequality (9) holds, Inequality(10) also holds for a sufficient small positive value for, ε. **QED**

Thus, once an equilibrium, which consists only of artisans (Type A equilibrium) or only of capitalists (Type C equilibrium), is achieved, the economy does not easily move from this position even when a small perturbation is added. In this sense, these modes of individual life become *conventional* once they are established.

Next, the following theorem is upheld concerning the welfare economic property of these equilibria.

6

Theorem 3. *Type A equilibrium achieves Pareto superior allocation to that in Type C equilibrium.*

Proof. The corresponding payoffs lead us to the following inequality:

$$\left[p\left(q^H\right) + q^H - v\left(q^H\right) \right] - \left[p\left(q^L\right) + q^L - v\left(q^L\right) \right]$$
$$= \left[p\left(q^H\right) - p\left(q^L\right) \right] + \left[\left[q^H - v\left(q^H\right) \right] - \left[q^L - v\left(q^L\right) \right] \right] > 0. \tag{11}$$

This completes the proof. **QED**

The reason why the allocation of Type A equilibrium Pareto-dominates that of Type C is as follows. The extra labor input of artisans to produce higher quality goods brings them greater revenues than capitalists, although this is a secondary motivation for them. In addition, with regard to the self-confidence, which is defined by the term, $q - v\left(q\right)$, in Equation (1), an artisan by definition achieves a higher level than a capitalist. These two effects generate the dominance of Type A equilibrium.

Finally, we provide an intuitive explanation as to why these two equilibria exist. The crucial factor is the participants' choice of their way of life. If almost all individuals choose the artisan life-style, they work more diligently and obtain higher incomes. This provides the sufficient purchasing power for high quality goods. Thus, the Type A equilibrium is self-enforcing.

On the contrary, if almost all participants choose the life of capitalists and are indifferent to the quality of their produced goods, they produce low quality goods that incur limited costs. The low price of their goods implies lower incomes. Consequently, there is no purchasing power for high quality but more expensive goods, and only low quality goods circulate. This implies the self-enforceability of Type C equilibrium. The dynamic convergent path is considered in the next section.

3. To Which Equilibrium Does the Economy Converge?

In the previous subsection, it has been established that the economy will converge to either Type A or Type C equilibrium. The question becomes, which equilibrium is realized? Based on replicator dynamics, we solve this problem. According to the replicator dynamics concept, the ratio of artisans to the total population, π_t, obeys the following differential equation:

$$\dot{\pi} = \left[\left[\pi u\left(q^H\right) + [1-\pi]u\left(q^M\right)\right] - u(q,\pi)\right]\pi \quad (12)$$

where $u\left(q^H\right)$ is the utility when an artisan encounters the same type of individual, $u\left(q^M\right)$ is the utility if his/her trading partner happens to be a capitalist. $u(q,\pi)$ denotes the average utility over the participants as a whole.

These utilities are defined by the following equations:

$$u\left(q^H\right) \equiv p\left(q^H\right) + q^H - v\left(q^H\right),$$
$$u\left(q^M\right) \equiv q^M,$$
$$u(q,\pi) \equiv \pi^2 u\left(q^H\right) + \pi[1-\pi]q^M + \pi[1-\pi]\left[p\left(q^M\right) + q^L - v\left(q^L\right)\right] + [1-\pi]^2 u\left(q^L\right).(13)$$

Substituting identities in (13) into Equation (12), we have

$$\dot{\pi} = \pi[1-\pi]\left[[\kappa_1 + \kappa_2]\pi - \kappa_2\right](14)$$

where

$$\kappa_1 \equiv \left[p\left(q^H\right) - p\left(q^M\right)\right] + \left[\left[q^H - v\left(q^H\right)\right] - \left[q^L - v\left(q^L\right)\right]\right] > 0,$$
$$\kappa_2 \equiv \left[p\left(q^L\right) - v\left(q^L\right)\right] - \left[q^M - q^L\right] > 0.(15)$$

The dynamics of this economy are illustrated in Figure 1. If artisanship sufficiently permeates at the initial point, and the ratio of artisans to the total population, π_0, exceeds the critical value θ given by

$$\theta \equiv \frac{\kappa_2}{\kappa_1 + \kappa_2}, \quad (16)$$

then the economy converges to Type A equilibrium. Otherwise, since too many capitalists exists and their revenue is not sufficient to purchase the high quality goods that artisans produce, a vicious cycle emerges and artisans gradually convert to capitalists. Thus, if π_0 is located below θ, Type C equilibrium is actualized in the long run.

4. Education Promoting the Self-confidence to Artisanship

According to Hayek (1944, p.29),

> An effective competitive system needs an intelligently designed and continuously adjusted legal framework as much as any other. Even the most essential prerequisite of its proper functioning, the prevention of fraud and deception

(including exploitation of ignorance) provides a great and by no means yet fully accomplished object of legislative activity.

Indeed, there are some fundamental requisites to prevent a market economy falls dysfunctional. Education is of the utmost importance because it prescribes the activities of individuals when they participate in the economy[3]. The previous section reveals that the economy falls into the Pareto inferior equilibrium (Type C equilibrium) once the ratio of those who embody artisanship decrease below the threshold value θ. This section analyzes how to regain a vigorous economy in which high quality goods are circulated, promoted by high incomes (i.e., Type A equilibrium).

A change from education based on meritocracy is highly desirable. This is because meritocratic education strongly directs children to concentrates on the pecuniary motive. As shown in the above sections, such tendencies adversely affect the performance of the economy. The profit motive demands the production cheap low quality goods. Nevertheless, producing cheaper goods implies lower individuals' incomes, and thus the economy as a whole is impoverished against the individuals' intentions. Such a situation falls in to the category of *fallacy of composition*.

It is indispensable to emancipate children from such appalling conditions by reforming the philosophy of educational, since education determines the background fitness of children to the society. Concerning the close relationship between education and work, Dewey (1915, p.260) argues

> Most fundamental is the fact that the great majority of workers have no insight into the social aim of their pursuits and no direct personal interest in them. The results actually achieved are not the ends of *their* actions, but only of their employers. They do what they do, not freely and intelligently, but for the sake of the wage earned. It is this fact that which makes the action illiberal, and which will make any education designed simply to give skill in such undertaking illiberal and immoral. The activity is not free because not freely participated in.
>
> Nevertheless, there is already an opportunity for an education which, keeping in mind the larger features of work, will reconcile liberal nurture with training in social seviceableness, with ability to share efficiently and happily in occupations

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[3] Akerlof (1970) provides a typical example in which the market becomes dysfunctional. The opportunistic behavior of sellers possibly collapses the market under imperfect information. However, he presumes that such sellers never shame themselves. While it is certain that the opportunistic behavior is rational under their *constrained* rationality, he neglects the widely defined utility (virtue) of such practice as being honest.

which are productive. And such an education will of itself tend to do away with the evils of the existing economic situations.

He also addresses the contents of his liberal education as follows (pp. 205-206):

Psychologically, the defining characteristic of play is not amusement nor aimlessness. It is the fact that the aim is thought of as more activity in the same line, without defining continuity of action in reference to results produced. Activities as they grow more complicated gain added meaning by greater attention to specific results achieved. Thus they pass gradually into work. Both are equally free and intrinsically motivated, apart from false economic conditions which tend to make play into idle excitement for the well to do and work into uncongenial labor for the poor. Work is psychologically simply an activity which consciously includes regard for consequences as a part of itself; it becomes constrained labor when the consequences are outside of the activity as an end to which activity is merely a means. Work which remains permeated with play attitude is art---in quality if not in conventional designation.

To summarize Dewey's assertions:
(i) Education within work, which does not pay much attention to promoting employees' intelligent curiosity and personal interest concerning the social role of their jobs, inevitably becomes meritocratic. This aggravates low morale among employees, and results in stagnation in labor productivity. This dynamics correspond to the property of our model that meritocratic education tends massively to generate the capitalist-type individuals.
(ii) The education received in school is closely connected with the attitude towards work in the following sense. The accumulation of experiences in conjunction with reflection thereon, of which teachers should be in charge, leads students to more complex and more organized activities that are naturally to pass into work. This process teaches students the pleasure of work as being akin to play because the process is free and internally motivated. Consequently, a liberal education as such nurtures individuals who are fully oriented towards artisanship.
  The analysis that follows concentrates on this type of educational philosophy and considers how a liberal education contributes to regaining the Pareto superior equilibrium (i.e., Type A equilibrium). The procedure is as follows. It is assumed that a liberal education increases the population of those who choose to be in artisanship. The

ratio of increase is denoted β. By using the replicator dynamics method in Section 3, we analyze how the liberal education contributes to the stability of Type A equilibrium.

The replicator dynamics reveal that the population ratio of the artisans to the total population can be represented by the following differential equation (see Weibull (1995) for the derivation):

$$\dot{\pi} = \pi\left[1 - \pi\right]\left[\left[\kappa_1 + \kappa_2\right]\pi + \beta - \kappa_2\right]. \quad (17)$$

Thus, as illustrated by Figures 2 and 3, the range of π, where $\dot{\pi} > 0$ and the economy monotonously converges to Type A equilibrium, is widened by an increase in β. This implies that the liberal education that Dewey (1915) advocates raises the probability of the fulfillment of Type A equilibrium even though the existing population of artisans is not so large. This property comes from the fact that a liberal education, differing from the meritocratic education, promotes the interest in the work in itself and enhances the joy of achievement of young individuals, rather than focusing on making money.

One must, however, note that the background in which children grow is defined not only by the nature of education but also by the daily behavior of adults. The social responsibility of teachers is vital, especially as a society moves towards meritocracy. Teachers strive to maintain fidelity to their work.

5. Concluding Remarks

This article studied how the choice of one's way of life affects the performance of the economy as a whole, relying on the concept of bounded rationality and the evolutionary game. The following results have been obtained.

1. Owing to the limits of cognition of human beings, individuals are classified into two classes: artisans and capitalists. Both types of individuals possess the same utility function. However, no one can fully maximize his/her utility. An artisan maximizes the quality of goods that he/she produces by incurring the necessary costs while satisfying the viability condition. A capitalist maximizes his/her pecuniary profits without consideration for the resultant quality of produced goods. When artisans occupy the major share of the economy, they can easily find other artisans as counterparts for exchange; the economy will then be eventually filled with artisans and high quality goods will circulate sustained by high incomes or wages. That is, Type A equilibrium, which is Pareto superior to Type C equilibrium, is self-enforcing (i.e., ESS) as long as the existing population of artisans is large enough; that is, the ratio of artisans to the total population exceeds some critical value θ.

2. Conversely, whenever the ratio of artisans falls below θ, all individuals

11

metamorphose to become capitalists. The immediate reason why artisanship vanishes stems from the difficulty of the *equivalent exchange*. Even though an artisan wishes to perpetuate his/her way of life, since the market is almost occupied by low quality goods, there is scarce opportunity for exchange that awards his/her elaborations. Accordingly, Type C equilibrium, which is a Pareto inferior equilibrium, is also self-enforcing (i.e., ESS). This is an example of the *fallacy of composition*.

3. The prevalence of the liberal type education advocated by Dewey (1915) is one of the most important measures for obviating the abovementioned tragic fallacy of composition. Such education nurtures a *self-disciplined* attitude towards one's own work. This is because students learn how to capture a subject *structurally* through elaborated processes. One must note that they might not experience much displeasure in such activities since the associated trial and error is akin to play although the processes are structurally constructed beforehand. What is the most important in the liberal form of education is an attitude from teachers that is patient and generous enough to wait for students' achievement. However small these gain may be, such exciting experiences surely encourage students to advance to more complicated subjects. Thus, students gradually become more self-disciplined and discriminating, and realize that there are more fascinating interests in life than the profit motive.

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	Artisan	Capitalist
A	$p\left(q^{H}\right)+q^{H}-v\left(q^{H}\right), p\left(q^{H}\right)+q^{H}-v\left(q^{H}\right)$	$q^{M}, p\left(q^{M}\right)+q^{L}-v\left(q^{L}\right)$
C	$p\left(q^{M}\right)+q^{L}-v\left(q^{L}\right), q^{M}$	$p\left(q^{L}\right)+q^{L}-v\left(q^{L}\right), p\left(q^{L}\right)+q^{L}-v\left(q^{L}\right)$

Table 1: The Payoff Matrix of the Game

$$\pi = 0 \qquad\qquad\qquad \theta \qquad \pi_0 \qquad\qquad\qquad \pi = 1$$

Type C Equilibrium   Type A Equilibrium
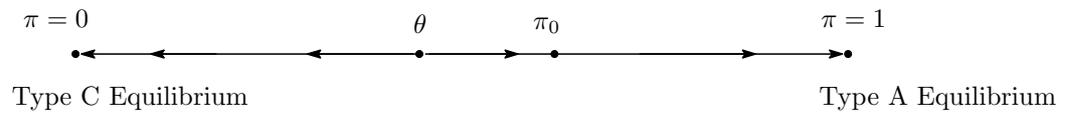
Figure 1: Replicator Dynamics
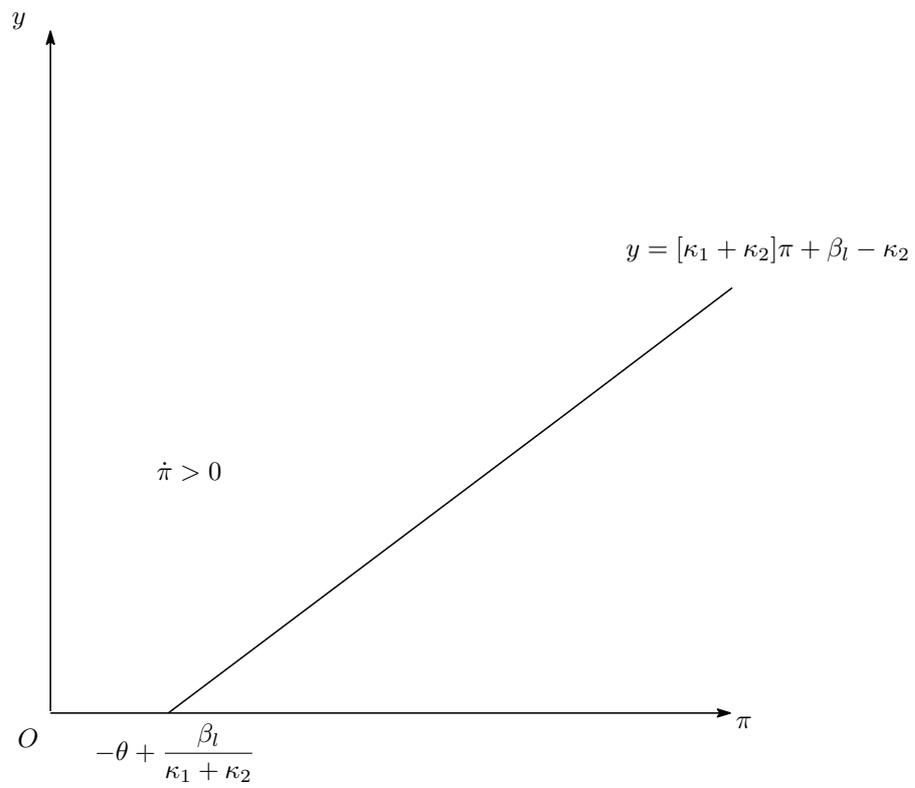
Figure 2: The Effect of Education (β is low)

The graph shows the π (horizontal) and y (vertical) axes with origin O. A line labeled $y = [\kappa_1 + \kappa_2]\pi + \beta_l - \kappa_2$ rises from the π-axis at the point $-\theta + \dfrac{\beta_l}{\kappa_1 + \kappa_2}$. The region to the left of the line is labeled $\dot{\pi} > 0$.
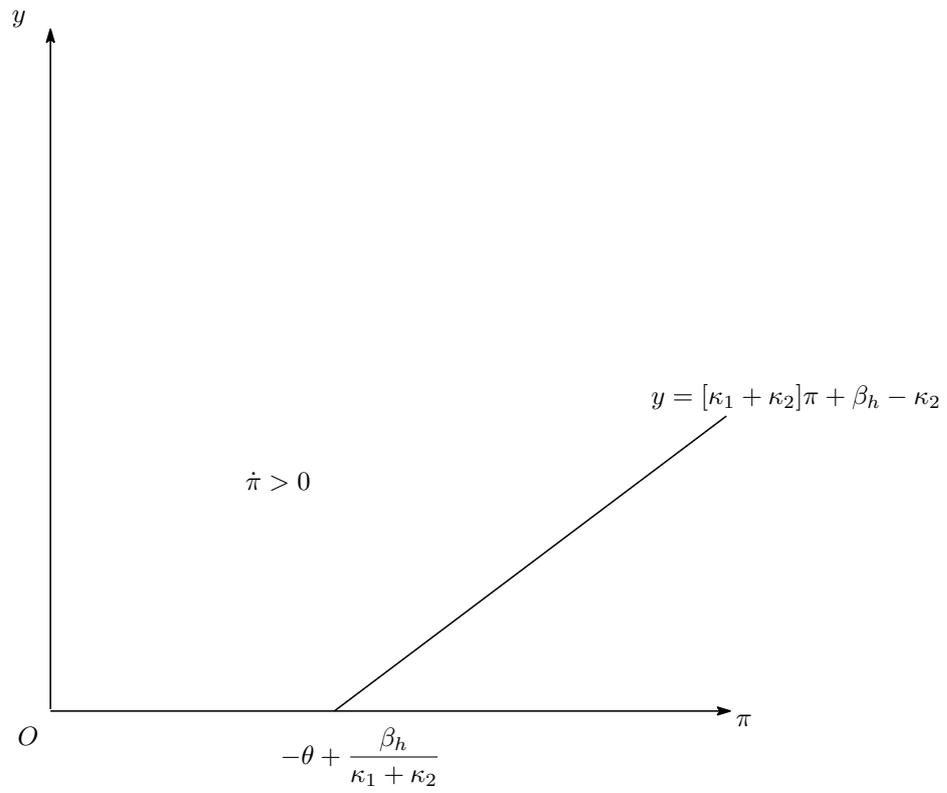
Figure 3: The Effect of Education (β is high)

The figure shows a coordinate plane with y on the vertical axis and π on the horizontal axis, origin labeled O. A line rises from the horizontal axis, labeled:

$$y = [\kappa_1 + \kappa_2]\pi + \beta_h - \kappa_2$$

The region above/left of the line is labeled $\dot{\pi} > 0$.

The horizontal intercept is labeled:

$$-\theta + \frac{\beta_h}{\kappa_1 + \kappa_2}$$