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Abstract

This paper presents a theory of underdevelopment. It explains why developing countries may not be able to successfully implement the productive technologies or modes of organization used in developed ones. It also suggests ways around this problem of implementation, and provides an explanation for why already developed countries did not face the same problems. The paper examines the interaction between the population's work ethic and the actions of firms, where a person's work ethic comes to matter. It is shown that an economy can be in either a high work ethic steady state, or a welfare dominated low work ethic one. Development makes the high work ethic steady state more efficient, but, if too rapid, will not allow it to be reached. Instead, the unique trajectory is to the low one, and welfare is reduced.

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1 Introduction

A central task of development economics is to explain the huge differences in income levels and differences in growth rates between the developed West and underdeveloped countries. The recent literature investigating the determinants of these differences overwhelmingly supports the conclusion that they are not due to cross-country variations in the level of inputs, but, instead, are largely caused by differences in technology.[1] But why is it the case that some developing countries are unable to successfully implement the productive technologies or modes of organization used in developed ones, when such improvements (if not the state of the art) are apparently freely observable, and available? Conversely, what was it about other relatively late developers, those in East-Asia in particular, that allowed them to implement these modes and technology in their rapid catch-up with the West?

These questions are examined in this paper which presents a model that explains why developing countries may not be successful in implementing the productive technologies, or modes of organization used in developed ones. At the same time, it suggests ways around this problem of implementation, and provides an explanation for why already developed countries did not face the same problems. It also suggests reasons for why some countries may have been able to overcome these difficulties. The explanation presented here attributes a prominent role to a population's work ethic.[2]

Generally, notions like work ethics are seen as beyond the purview of economics, and for good reason. Attributing underdevelopment to a poor work ethic, which is treated as an exogenous endowment, is more a relabelling than an explanation and provides little insight. Here, in contrast, a population's work ethic endogenously evolves, albeit slowly, in response to economic incentives: the prevalence of a work ethic rises if it receives economic reward and falls if it is not rewarded.[3]

[1] This is the conclusion reached in: King and Levine (1994), Klenow and Rodriguez-Clare (1997), Prescott (1998), and Hall and Jones (1999).

[2] The term "work ethic" is most often associated with Max Weber (1905). He linked it with Protestantism, and argued it played a central role in explaining the comparatively advanced development of Northern Europe. Though he presented little evidence for it, a body of research in contemporary psychometrics documents its prevalence and analyzes cross-country variations, for a review see Furnham (1990). Also, many contemporary writers on development have evoked it in a Confucian guise, as an explanatory variable in successful South East Asian development (see Kunio 1994).

[3] For recent examples of evolutionary approaches to characteristics and preferences see Nyberg (1997), Lindbeck, Nyberg and Weibull (1998) and Fershtman and Weiss (1998). Many social scientist have argued the importance of other non-rational elements, like culture, in understanding economic differences. For example, Landes (1998) argues it to be a critical factor in explaining cross-country experiences. Ostrom (1990) emphasizes such considerations in explaining why societies can sometimes solve free-rider problems arising from unlimited access to natural resources. Another example is the term "social capital", used by Putnam (1993) to describe regional differences in Italian civic attitudes in explaining why different regions varied in their implementation of administrative reform.

Specifically, a good work ethic lowers the disutility of exerting effort for work. Although potential employers cannot observe an individual's work ethic directly, they may infer it from that person's work history. Whether this is possible depends on the availability of work opportunities for workers with no previous work history. We assume that, in all jobs, work effort is inherently non-supervisable and non-contractible. Moreover, all workers can directly benefit by shirking, but these benefits will be higher for individuals without a work ethic. This means that when a worker's previous work history has been good, a positive signal is obtained about the worker's ethic. Thus firms that hire young workers, about whom there is no previous work history to consult, perform a valuable screening role, and thereby generate a form of informational externality.[4]

However firms' incentives to hire workers about whom there is no previous work history depend on the perceived characteristics of the workforce: if workers are known, in general, to have a good work ethic, this inclines firms' towards hiring workers without a history. If, however, workers in the economy are reputed to be poor in work ethic, firms will prefer not to risk hiring them.

Dependence also runs in the other direction. We assume here that having a work ethic is never sufficiently useful to be its own reward. If it were that useful then a work ethic would simply evolve into the population, independently of the interaction occuring between workers and firms, because it would always be a useful characteristic. Here, in contrast, to obtain rewards to a work ethic, it is necessary that it be revealed. But this cannot happen if firms are not willing to risk hiring workers. In that case, a population's work ethic will be poor. Conversely, if many firms that are willing to hire workers without a work history exist, workers stand a good chance of having their work ethic revealed, and rewarded, and a work ethic will flourish.

This mutual interdependence between work ethics and firms can give rise to a multiplicity of steady states. A prevalence of good work ethic types together with a large number of firms willing to hire the young, is mutually reinforcing and can constitute a steady state. Similarly a steady state also exists in which a bad work ethic is widespread, and firms prefer not to risk hiring workers about whom there is no information.

However, these steady states are not equivalent in their efficiency properties. In the steady state where there are many firms and good work ethics are revealed, there is an identified pool of good workers who can be profitably employed even when narrow monetary or reputational incentives are not able to ameliorate agency problems arising for those without work ethics. This can lead to efficiency gains the size of which depend on the magnitude of the economy's agency problems. Noe and Rebello (1994) argue that

[4]The value of this informational externality depends on a form of "single crossing property" holding; the precise condition is established in the paper.

in already developed economies these problems are widespread since it is commonplace for management to be insufficiently disciplined by financial incentives. Their paper explores the implications of "managerial ethics" in mitigating these problems.[5] In LDCs, where contracts and enforcement are less well established, such agency concerns are likely to be even more important.

Our primary concern here is with how such a socially valuable characteristic interacts with the process of development in an LDC.[6] We posit the development process as the implementation of better technological, institutional and/or organizational processes. Importantly, these processes and/or technologies are assumed to be ability intensive, so that, initially at least, most of the productivity gain is to the high "ability" individuals. This could be an inherent characteristic of the new technologies used or alternatively, it would occur if "development" involves the freeing up of markets and more accurate matching of factor rewards with marginal products.[7]

Although ability is independent of work ethics, being revealed as possessing a good work ethic is more valuable to an individual with high ability than to one with low, due to their higher productivity. When setting wages to induce effort, firms take this into account and could pay the high ability workers lower wages. But this may not be optimal for firms if they cannot observe ability types, since low wages would induce the low ability to shirk. If there are too many low ability types, ability differences are small enough, or shirking is too costly, firms will prefer a high wage strategy.

Under a high wage strategy, the high types obtain an ability/informational rent and in a world where there are insufficient intrinsic motives for developing a work ethic, such rents provide the only incentives for a work ethic to emerge.[8]

[5]Noe and Rebello (1994) similarly consider the effects of an economy wide characteristic, "managerial ethics" on choices of technology. However, an important distinction between their work and the present paper is that they allow for no means by which individuals' ethics can be revealed. We discuss the precise distinctions further after presenting our own results.

[6]It may be tempting to posit the multiplicity of equilibria here as a metaphor for underdevelopment due to a development trap. This would correspond to the developed having many firms and a high work ethic, while the underdeveloped have fewer firms and a work ethic languishes. The present analysis is more ambitious than that. Simply labelling one equilibrium that of the developed economy and the other the underdeveloped provides no explanation for why differing economies developed as they did, but instead attributes all of the explanation to features that are outside the model (initial conditions). Here, in contrast, successes and failures share identical initial conditions and our analysis focuses instead on the transition process that accompanies the introduction of productivity improving technologies. It is the way in which new technologies and/or modes of organization are introduced that either encourages the right dynamic adjustment paths (development successes) or the wrong ones (failures), as will be seen.

[7]If the development process is not ability intensive then development will always succeed in our framework, we discuss this further after the main results.

[8]The general point here is that the high ability receive a higher rent when firms wish to

Now consider how this situation is affected by the introduction of ability intensive technologies or institutional changes. Initially, since this causes the informational rents enjoyed by the high types to rise, firms may choose to decrease their wages in order to extract these high rents. The cost of doing this is that, at these lower wages, the low ability types will shirk. However, if the relative gains of the high types are large enough, cost savings from reduced wages offset extra shirking costs, and firms change from the high to a low wage strategy.

This endogenous response of firms to attempted development determines whether development is a success or not. If firms do change to a low wage strategy, then the economy unambiguously converges to a steady state where all workers and firms are STRICTLY worse off than they were in the pre-development steady state. This is true even though the new technologies and/or institutions give rise to a new "development" steady state which Pareto dominates the pre-development one and which is itself a stable steady state. The reason all are worse off is that this new steady state is never reached when firms follow the low wage strategy.

The intuition for this is as follows. When firms find it optimal to provide performance incentives for those with low ability, (i.e., under the high wage strategy) then, because contracts are designed to induce effort from the low types, who cannot initially be distinguished from the high types, the high ability receive an informational rent. This rent provides evolutionary incentives for the maintenance of a work ethic.[9] Development that causes too large an increase in the relative returns of the high types may render it optimal for firms to ignore the low types altogether. If firms then provide incentives that are explicitly targeted at the high types only, the high types stop receiving an informational rent, and evolutionary incentives for the creation of work ethics are destroyed. Eventually, the population's work ethic disappears as the economy converges to the bad steady state.

Paradoxically then, the attempt to implement the more productive Western technologies not only fails in itself, but also moves the economy to a lower welfare level than before the technologies were available, by destroying any initially existing work ethics.

The outcome is different if firms persist with a high wage strategy along

induce effort from the low types too. If firms care only about inducing the high type, they can adjust wages so that the high type receive none of the rent. This feature corresponds to the ability/informational rents which occur in standard principal agent models with adverse selection, and is well known to be robust to extension, see Salanie (1997) for a treatment of this.

[9] This rent plays a similar role to the payments old individuals receive from the young in the rational cultural bubble of Cozzi (1998). Like a work ethic in our framework, culture in his model is valuable in production but cannot be directly rewarded in the market. In his model it is rewarded by the payments of the young to the old, in ours it is rewarded as an ability/informational rent to the high ability types. His model is discussed further in the final section.

the development path. In that case, since firms wish to include both the low and the high ability types in production, evolutionary incentives for the maintenance of a work ethic persist, and development succeeds. That is, the economy unambiguously converges to the new "development" steady state, and all are better off.

Thus, successful development depends critically on the size of the initial change in productivity of the high type relative to the low when development is attempted. If the magnitude of this change is too large, the economy's only trajectory becomes the path to the low level equilibrium. Another implication is that, for any development failure, there always exists a convex combination of small intermediate steps which ensures a development success. Small changes lower the magnitude of the initial increase in rents to high ability types, preventing the firms from switching to the low wage. This preserves evolutionary incentives for the development of work ethics, so that eventually more people acquire good work ethics. At that point, the economy is ready for another step in the sequence, and so on, until all the changes have been introduced.

This points to a possible reason for why development was successful in the West but may not be readily emulated in follower countries. Slow change was a condition imposed on the West by the fact that new technologies and institutions had to be "home-grown". This contrasts with the potential for rapid change which has accompanied the implementation of such "off-the-shelf" Western technologies and institutions in LDCs over the second half of this century.

However, this does not imply that the optimal policy for LDCs is to follow the West's lead and use only home-grown technologies. Development can still be a success there provided returns to the high ability do not outstrip those of the low ability by too much. That is, provided that even the low ability are induced to participate in the development process. A simple policy to achieve this is a tax on the high ability, and transfer to the low, i.e. increased progressivity in the tax scheme. This also has a positive implication. To the extent that our model captures all the relevant features of the real world, the theory predicts that development is more likely to succeed, ceteris paribus, the tighter the dispersion in earnings, or the lower the inequality that is induced by the development changes. Regional comparisons, which are briefly reviewed in a later section, are well known to be consistent with this prediction.

The paper proceeds as follows: Section 2 sets up the model, Section 3 analyses the model, determining steady states, dynamics and welfare, and Section 4 derives the main results. A brief conclusion is provided in Section 5.

2 The Model

The economy comprises measure 2 of individuals at all times. Measure 1 of individuals is born in every period and each individual lives for two periods (young and old). There is free entry of firms. Each firm requires one unskilled worker (where young individuals will be employed) and one manager (for old individuals). Firms live for one period only.[10] Firms can be ordered according to their entry costs which are denoted E_i for firm i, and are drawn from a distribution E (density e), which is continuous and strictly positive in the interior, and has supports $[\underline{E}, \infty)$, with $\underline{E} \geq 0$. Firms incur this cost when entering. Both firms and individuals are risk neutral and there is no discounting. If not working, individuals receive utility normalized to zero each period of their lives, which is also the opportunity cost of entry to a firm.

All values in the model are expressed in the utility metric.

A worker's work ethic is determined before knowing their ability by nature (described below), and ability is revealed to a worker before period 1 of life. In period 1, young workers are unskilled and they either work at a firm or are unemployed. The output of unskilled work in period 1 is observed by all firms, together with the abilities of all workers.[11] In period 2, old individuals are either employed as managers or unemployed, after which they die. The sequence of events in each individual's life is summarized as follows:

Birth		**Young**		**Old**
Nature chooses ethic	ability revealed to worker	unskilled work or unemployed	output and ability observed	manager or unemployed

2.1 Work ethics

Individuals either have a "good", g, or a "bad", b, work ethic which cannot change, and this affects their cost of effort provision. In particular:

$$\text{effort cost} = \begin{cases} 0 \text{ for } g \text{ types} \\ \delta > 0, \text{ for } b \text{ types.} \end{cases}$$

A work ethic is inculcated at an early age (most realistically by parents, but we remain agnostic about the source) and requires an initial utility cost, F,

[10] The model's steady states are qualitatively unchanged if firms are allowed to live for an arbitrary number of periods. They could even be infinitely lived, as long as discounting is introduced.

[11] Identical results obtain if ability is non-observable.

to obtain.[12]

An individual's own work ethic is private information.

2.2 Ability

Ability is entirely exogenous and is revealed to individuals after nature has determined their work ethic, and to all firms only after the first period of an individual's employment.[13] The distribution of ability types in the population is binary:

$$\text{proportion } \theta \text{ are low ability}$$
$$\text{proportion } 1-\theta \text{ are high ability.}$$

Ability influences the level of skills a worker accumulates when young. The skill level will, in turn, determine the worker's productivity in some tasks when old. The details are spelled out in section 2.4 below.

2.3 Working when young

As discussed in the introduction, there are benefits to shirking which can not be ameliorated either by contract or by direct supervision. We assume that employers can condition payment on output, but there is limited liability so that in the event of insufficient output, the maximal penalty is zero payment.

The worker chooses to either work (contribute effort) or shirk (no effort). If working, output of value Y is produced. If shirking, output $= 0$ and the firm loses z which the shirking worker obtains herself. If w denotes wages paid, these possibilities are summarized as follows:

	firm receives	worker receives	effort cost
worker works	$Y-w$	w	0 for g type, δ for b type
worker shirks	$-z$	z	0 for both types

[12] This cost can be thought of as the cost of disciplining at an early age (again this is probably a cost also borne by parents but we will render this internal to the individual). We favour the fixed learning cost interpretation of F here, but this is not necessary. F could also arise if having a work ethic were costly in other ways, for instance, if other individuals took advantage of those agents. Our approach here has been to short cut much of the complexity of a realistic account of social evolution by internalizing all of the costs and benefits of a "type" to the individual. In reality, parents bear large costs too. However, the pattern of evolution will be qualitatively identical provided they make decisions based on some combination of their children's and their own welfare. As Bowles (1998) has argued in his survey of work on endogenous preferences, it is erroneous to consider preference formation as an individual choice in the usual economic sense of choosing actions. Preferences instead are learned or acquired by processes which may not be intentional. Once learned however, they then become generalized reasons for behavior outside the situation in which they were formed. We embed these considerations into the type choice, or investment cost, F, which is dictated by a replicator dynamic that takes account of individual benefits accruing to a work ethic, to be made explicit subsequently.

[13] The converse assumption, that ability remains private information, yields identical results.

Shirking is thus an activity like slacking on the job, or using the company's capital and good name for one's own benefit.[14] Even though, for g workers, effort costs nothing, shirking may still be attractive since it allows the possibility of obtaining z.[15] Recall that the total number of firms is endogenously determined and is denoted as γ.

2.4 Working when old

Each firm needs one old worker in a managerial position. The productivity of old workers is independent of the firm's young workers. Management requires effort and again allows a potential gain to shirking. Effort required is identical to that required when young, i.e., 0 for g, and δ for b types. If effort is provided, output depends on the manager's skills developed during the first period, which, in turn, depend on the individual's ability. A high ability type produces output valued at $H(\gamma)$ as a manager. $H(.)$ is assumed to be a decreasing function, which is meant to capture the fact that training as a manager is ability intensive, but the higher is the number of firms hiring young workers, the less efficient is the training process of young workers.[16]

The low ability type produces a lower value of output denoted L, where $L \leq H(\gamma)$.[17]

If shirking, either type receives a benefit of $\varepsilon > 0$, where $\varepsilon < L$. But we assume management is more vital to the firms than unskilled labour; the cost imposed on the firm when a manager shirks is an amount $k \to \infty$. Contracting is the same as for the young, i.e. output conditioned wages can be paid but there is limited liability, so that wages are non-negative. This implies that firms will avoid hiring a shirking manager at all costs.[18] If the

[14] The critical feature of this environment is that shirking provides some benefit to the employee and that it imposes some costs on the firm, which is ensured by the limited liability assumption. That the workers' benefits and firms' costs of shirking are equivalent, as in the current formulation, is not necessary for the results to follow, though it does serve to make the model simpler.

[15] To make the model more general, one could also assume that a worker with good work ethic benefits from shirking less than a worker with bad work ethics. A simple way to model this would be to assume that the benefit from shirking to a worker with good work ethic is αz, where $\alpha \in (0,1)$. This would not change any of our results qualitatively.

[16] For example, the training process may require some scarce resource common to all firms using the same technology. Then a high number of firms using the technology means that the price of this resource is high, which makes the training process costly and therefore less training is provided by each firm. This assumption is stricter than necessary. It is not necessary that $H(.)$ is monotonic, but we will assume it is in order to simplify the analysis.

[17] At the cost of complicating the exposition, it would be possible to allow L to be a function of γ too. This is without qualitative effect provided the assumption that training is ability intensive is preserved. Thus it is necessary that the difference in productivity between high and low ability workers falls as the amount of training increases.

[18] This assumption could be relaxed at some cost to the ease of exposition. If k were bounded, the only change would be a decrease in the equilibrium number of workers who

manager's wage is denoted $w(i)$, where $i = H$, L, or 0 denotes the three possible outputs, the possibilities can again be summarized in a table:

	firm receives	worker receives	effort cost
high ability manager works	$H - w(H)$	$w(H)$	0 for g type, δ for b type
low ability manager works	$L - w(L)$	$w(L)$	0 for g type, δ for b type
manager shirks	$-k$	ε	0 for both types

Productivity of an old individual who was unemployed in the first period is zero in any managerial position. Individuals who do not work as managers when old will be unemployed.

2.5 Dynamics

Firms adjust instantaneously according to expected profit from using each technology, but individual types do so slowly. The critical state variables are the proportion (or measure) of individuals choosing to develop a work ethic, β, and the measure of firms that enter which we denote γ.

Assume population types adjust gradually according to a replicator dynamic. That is, the proportion of individuals with a positive work ethic, β, adjusts according to:

$$\frac{\Delta\beta}{\Delta t} = (1-\beta)\,\beta\Phi\left(E\left[u^g\right] - E\left[u^b\right]\right) \tag{1}$$

where the function Φ is increasing and $E[u^i]$ denotes the expected lifetime utility of a worker with a good ($i = g$) or bad ($i = b$) work ethic.[19] There are numerous stories which could be evoked to justify the work ethic's adjustment via a replicator dynamic. One story would be that parents choose the type of values to inculcate into their children based on the expected returns of those values. Thus, at a cost, F, parents can make their children "enjoy" work, so that the effort cost of work when they are older is low. According to the dynamic above, parents will be more likely to choose this

acquire a work ethic. The source of k is not explicitly modelled but it is meant to correspond to situations where employers cannot safeguard against the actions of bad managers and will therefore only produce when they can "trust" them. We have in mind, in particular, situations where managers have important responsibilities whose timely execution is vital to the firm. Some examples are where a manager is responsible for decision making related to production and input choices, or where there is sensitive equipment that must be maintained and properly used. Once again, the delays in inferring irresponsible behaviour, and the limited liability when that occurs, make firms wary of hiring the wrong types.

[19] We take the simplest form of replicator, without drift, since we are not interested in issues of equilibrium selection, apart from the standard ruling out of locally unstable equilibria. For a general discussion of equilibrium selection and analysis with stochastic components see Samuelson's (1997) lucid exposition. We could alternatively have specified Φ to be fully backward looking, i.e. as a function of previous periods average returns to each type rather than expected returns, without affecting any results.

when it yields benefits, since the extra future returns to having a work ethic must justify the costs incurred when young. But, importantly, the replicator implies that when returns change, not all individuals immediately switch. There are, once again, a number of reasons that could be used to support this assumption: diffusion effects, underlying time-varying heterogeneity in adjustment costs or age differences and inertia. We do not explicitly tie the model to any of these as the precise form is of no consequence.[20]

The adjustment of firms, in contrast, is immediate; that is, γ is a jump variable. Letting $\pi(t)$ denote the expected profit of a firm from hiring a young worker in period t.[21] The behaviour of $\gamma(t)$ is as follows:

$$\text{if } \pi(t) < \underline{E} \text{ then } \gamma(t) = 0 \tag{2}$$

$$\begin{aligned} &\text{if } \pi(t) > \underline{E} \\ &\text{then } \gamma(t) : \int_{\underline{E}}^{E_i} x_j E(x_j)\, dj = \gamma(t) \\ &\text{and } \pi(t) = E_i \end{aligned} \tag{3}$$

The conditions above are simply the implications of assuming free and immediate entry on the part of firms. Condition (2) says that the measure of firms entering equals zero when operating profits are insufficient to cover the fixed costs of even the least costly firm. Condition (3) says that if operating profits are high enough to cover fixed costs for some firms, the number of firms entering in period t, $\gamma(t)$, will be such that expected operating profits just cover fixed costs of entry for the marginal firm.

[20] One can also interpret such an evolutionary dynamic in a more strictly biological sense, as arising when those with higher economic rewards are "fitter", more able to attract mates, and thus more able to leave behind surviving progeny. For more on the underpinnings evoked to explain a replicator dynamic see Ben Ner and Putterman (1998, Ch. 1). For some readers, an evolutionary approach to the work ethic is controversial. Its importance in our framework, however, stems only from the slow adjustment, relative to firms, which it implies. We could also think of the work ethic as a consciously chosen variable, and all results would persist provided, at the aggregate level, changes in this variable occurred slower than they do for firms. We discuss this further after the main results. Some readers will also be bothered by the coexistence of fully rational firms and a replicator dynamic which drives the choices of individuals. Apart from the replicator not being essential to the results here, we think this modelling choice is sensible for the same reasons that others have used it before, for examples see Hoffler (1999) and von Thadden (1992). The choice of what sort of work ethic to acquire is a fundamentally different choice to the choice of mode of production to employ in a firm. We believe the former is much more likely to be subject to inertia, e.g. from one's background and the practices of one's parents, than is the latter, where best practices should be implemented much more rapidly. The replicator is a reduced form way of modelling this.

[21] It will be seen that hiring old workers never generates positive profit in equilibrium, so we ignore it without loss of generality here.

2.6 Parameter restrictions

We restrict parameters in order to focus on situations where interior equilibria (both ethical types) have a possibility of occurring. Given the amount of heterogeneity (both ability and ethics) in the model, these restrictions are considerably more complicated than the usual Inada conditions, so that we explain each in turn.

Assumption 1: Full employment is feasible in an ethical population

For $E_i : \int_{\underline{E}}^{E_i} xe(x)\,dx = 1, \quad E_i < Y + L - z$

This says that if all individuals have a good work ethic, then full employment is feasible. The value of output produced when young Y, plus the increased productivity a low type obtains due to training, L, net of the benefit they could obtain due to shirking, z, exceed the fixed costs of entry even if enough firms enter to guarantee full employment. If no individuals have a good work ethic, then since $\underline{E} \geq 0$, it is also the case that there can be no employment.

Assumption 2: Diminishing returns to ability intensive training

(i) $H(1) = L$;

(ii) $H'(0) = 0$; $H'(z) < 0$ for all $z > 0$; and

(iii) $H''(.) < 0$.

Assumption 2, part (i), captures the ability intensity of training in an extreme way: it ensures that if all individuals have the opportunity to be trained, training is so poor that high ability individuals have no more productivity than the low. Parts (ii) and (iii) have natural interpretations: the marginal product of high ability managers is declining in the number of them trained, and at an increasing rate.

Assumption 3: Shirking is attractive

(i) $z > H(0)$.

(ii) $\delta > \max\{H(0) - \varepsilon, Y + \varepsilon - z\}$.

If the benefits of shirking were so low that an individual's deferred benefit to being revealed as having a good ethic exceeded the benefit of shirking, then wages would be negative and shirking would not be a problem. Part (i) in Assumption 3 guarantees that shirking is attractive enough to make it a problem to firms and restricts wages to be positive. Part (ii) assumes

it is not efficient to elicit effort from workers with bad work ethics either as workers or as managers. By assuming the cost of effort, δ, is high for these types, we ensure that separation can occur between those with and without work ethics. This is analogous to a single crossing assumption for this binary production function.

3 Analysis

3.1 Job assignment and wages of old workers

The restrictions placed on the relative costs and benefits of effort in each mode of organization, and the potential for high losses to firms, ensure firms will be wary of obtaining the wrong sorts of agents as managers. That is:

Lemma 1 *(i) Workers revealed to have a good work ethic when young will be assigned to management when old and will receive wages equal to L or H, depending on their ability.*

(ii) All the other workers who were not revealed to have good work ethic when young will be unemployed.

Proofs of this and all other results are in the appendix.

Workers who have been revealed as not having work ethics will never be placed in management. The reason is that, due to limited liability and large disutility of effort, it is not profitable to elicit effort from these workers. If placed in management they would therefore shirk and impose large costs on the firm, k. Firms thus never employ old workers with no work ethic. The large cost k also implies they will not risk placing a worker about whose work ethic they are unsure in a management position. Old workers will also never be placed in unskilled jobs because, since they are in their last period of life, they have no deferred benefits to being revealed as having a good work ethic and are thus more costly to motivate than the young.

The wages of managers will be L or H, depending on their ability. The reason is that the number of these managers is limited and firms therefore compete for them. Note also that this would be equivalently the case if ability were not observed, since contracts would simply condition pay on output produced, subject to the limited liability constraint. Finally, due to competition between the firms, whether a firm employs a high or low ability manager its profit from this manager is always zero.

3.2 Ethic revelation

When young, both abilities and types are private information, but a firm's output, and the identity of its employee are common knowledge. In some situations, this knowledge may indirectly reveal information about an employee's type.

Lemma 2 *(i) If a young worker produces output of value Y, then it becomes common knowledge that this worker has a good work ethic.*

(ii) If a young worker produces output of value 0, then this worker may not have a good work ethic.

Lemma 2 says that positive output perfectly reveals a worker with a work ethic. This is because, at any feasible wages, i.e., $w \leq Y$, individuals without a work ethic would always prefer to shirk, even if not shirking ensures them management work. According to Lemma 1, then, non-shirking workers will be assigned to management. In contrast, output of 0 suggests some uncertainty as to the worker's ethic.

3.3 Wages of young workers

Firstly note that if $N < 1$, a firm could always set its wage at an arbitrarily low level and still induce participation. This would, however, not be profit maximizing as there would be insufficient incentive for a worker accepting such a wage to provide effort. To calculate the profit maximizing wage it is necessary to compute a firm's expected operating profit from hiring a young worker conditional on the wage. This will depend on the distribution of work ethics. If the probability of hiring a non-shirker is denoted p, a firm makes expected operating profit of:

$$\pi = p(Y - w) - (1 - p)z, \tag{4}$$

recalling that w is the wage paid by the firm to non-shirkers under the contract. It will be seen below that p is affected by w.

To be viable, a firm must offer a wage attracting at least some workers with a good work ethic and inducing them to work. However, any feasible (i.e., non-negative) wage will always attract bad workers too since these individuals can benefit by shirking. The profit maximizing wage for firms depends critically on the underlying ability distribution in the population, and returns to ability when working as a manager. These considerations imply:

Lemma 3 *The profit maximizing wage for firms to pay young workers is*

$$w = \begin{cases} z - L \text{ when } H(\gamma) \leq \hat{H} \\ z - H(\gamma) \text{ when } H(\gamma) > \hat{H} \end{cases}, \tag{5}$$

where $\hat{H} \equiv \frac{\theta Y + L}{1 - \theta}$.

Note that the wage setting decision of a firm is independent of its cost of entry, E_i, since these costs are sunk. Wages for the young cannot fall to clear the market in this framework, because they must also induce effort. A firm

offering a positive wage will thus always face an excess supply of workers if $N < 1$. However, there does not exist a wage that will be able to induce effort from workers with a bad work ethic. This is because such workers would always shirk when put in a management position and receive ε. From Assumption 3 part (ii) this means these individuals are better off shirking even if the firm were to promise them all of the output they produce when young. Since a work ethic is not observable, firms thus accept that they will, with some probability, hire a shirker. They thus design wages to induce no shirking in the event that they happen to hire a worker who has a good work ethic. In doing this they face a trade-off: if they offer the lower wage, $z - H(\gamma)$, only individuals with high ability will exert the appropriate effort, all others will take the job and shirk. By paying a higher wage, $z - L$, both high and low ability individuals with work ethics will work (note that part (i) of Assumption 3 immediately implies that this wage is positive). Equation (5) describes the determinants of that decision: when returns to the high ability are relatively large, firms can induce effort from these individuals much more cheaply than they can from the low, thus making the low wage strategy more attractive.

3.4 Interior equilibria

We first establish the existence of interior equilibria; those in which both ethical types exist and there is entry of firms. Since a work ethic is costly to obtain, recall that F is incurred by those with a work ethic, an interior equilibrium requires the existence of some economic rewards to it. In turn, for this to happen, some firms that hire young workers must make a non-negative profit net of their entry costs. We first discuss necessary conditions for both of these occurrences before formally describing interior equilibria.

The existence of economic rewards to a work ethic turns on the wages paid to young workers. Suppose that these firms paid the low wage in equation (5), $w = z - H(\gamma)$. Then even high ability individuals would receive no return to having a work ethic, and one could never exist in an equilibrium. To see this, suppose that a high ability individual does not shirk and is indirectly revealed as having a work ethic. This person then receives a payment of $H(\gamma)$ as a manager when old; however, this only yields for them a combined two period utility of z, at the wage $w = z - H(\gamma)$, which is what they could have had without a work ethic by simply shirking when young. That is, this is only as much as an individual without a work ethic obtains if they find work. A person with low ability would be even worse off. Consequently, returns to having a work ethic and not shirking can only be positive if firms pay young workers the high wage, that is, if $w = z - L$. However, from Lemma 3, a necessary and sufficient condition for

this to be the wage paid is

$$H(\gamma) \leq \hat{H}. \tag{6}$$

This is a plausible feature of our environment. Any cultural variable that is costly to develop can only exist if it provides a reward. Since we assume no direct utility benefit to a work ethic (because individuals without one can always shirk) this economic reward is an ability/informational rent to the high types. Thus an interior equilibrium can only arise if (6) holds. Otherwise, according to (5) , the wage is equal to $z-H(\gamma)$ and any individual with a work ethic expects a lifetime utility that is lower (at least by F) than the expected utility of individuals with no work ethic, so that β would converge to zero under the replicator dynamic.

Another necessary feature of an interior equilibrium is that the firms who allow work ethics to be indirectly revealed must obtain non-negative profits. At $w = z - L$, it can be seen from (4) that this implies $\beta(Y - z + L) - (1-\beta)z \geq \underline{E}$, since $p = \beta$ at this wage. Rearranging yields:

$$\beta \geq \beta_1 \equiv \frac{\underline{E} + z}{Y + L}. \tag{7}$$

If this condition is violated, then even the lowest cost firms would earn negative expected profit and would choose not to operate. Note, however, that values of β satisfying the above condition always exist by Assumption 1.

We are now ready to establish necessary and sufficient conditions for the existence of a unique, stable, interior steady state.

Proposition 4 *(i) If an interior equilibrium exists, i.e.,* $0 < \beta < 1$, *it corresponds to a solution to the following conditions:*

$$E_i = \beta(Y + L) - z \tag{8}$$

$$F = \gamma(1-\theta)[H(\gamma) - L] \tag{9}$$

$$\gamma = \int_{\underline{E}}^{E_i} xe(x)\,dx. \tag{10}$$

(ii) Holding all other parameters fixed, there exist $F^* > 0$ *and* $Y^*(F) \geq 0$ *such that:*

(a) If $F > F^*$ *no interior equilibrium exists.*

(b) If $F = F^*$ *and* $Y \geq Y^*(F)$ *then there exists a unique interior equilibrium* (β^*, γ^*) *with* $0 < \beta^* < 1$, $0 < \gamma^* < 1$. *This equilibrium is unstable.*

(c) If $F < F^*$ *and* $Y \geq Y^*(F)$ *then there exist exactly two interior equilibria,* (β_A^*, γ_A^*) *and* (β_B^*, γ_B^*), *with* $0 < \beta_i^* < 1$, $0 < \gamma_i^* < 1$, $i = A, B$. *If* $\beta_i^* > \beta_j^*$, $i, j \in \{A, B\}$, $i \neq j$, *and equilibrium* i *is stable while equilibrium* j *is unstable.*

The necessity part of the proposition needs little explanation; to observe positive entry of firms and both work ethics in a steady state requires that marginal firms are indifferent to entering and having a work ethic is equivalent, in expected utility, to not having one. Also condition (6) must hold, which is also reflected in the firm's wage setting in equation (8) . Sufficiency is less immediate. The first condition, that F cannot be too high, is intuitively clear, since for too high values of F, economic rewards can never justify nature's choice of a work ethic. The existence of two interior steady states for lower values of F, A and B in Figure 1, follows from counteracting effects of γ on expected returns to a work ethic. For increasing γ, the probability of having a work ethic revealed rises, but the relative return to the work ethic falls due to $H'(.) \leq 0$. The second effect eventually dominates so that the higher γ, steady state (B) in Figure 1, is the stable one. Finally, Y must be sufficiently high in order for firms to be willing to pay the higher wage, $w^n = z - L$, that induces both the low and the high ethical types to provide effort. The proof of the proposition, in the appendix, demonstrates that the sufficiency conditions ensure (7) and (6) hold, so that these do not need to be directly assumed.

The stable steady state B, described in the proposition and depicted in Figure 1, has the following characteristics: firms earn positive expected operating profits from hiring unskilled young workers, some workers are unemployed when young and these ones remain so when old. All workers with a work ethic that obtain employment, are employed in the second period of life as managers, others are unemployed. The movement of individuals is sketched in Table 1:

Table 1: Steady State B

Birth	ability	probability	**Young**	output	**Old**
good work	realized			revealed	
ethic	$\rightarrow$	γ^*	work	$\rightarrow$	manager
prob β_B^*	$\rightarrow$			$\rightarrow$	
	$\rightarrow$	$1-\gamma^*$	unemployed	$\rightarrow$	unemployed
bad work	$\rightarrow$	γ	shirk	$\rightarrow$	unemployed
ethic	$\rightarrow$			$\rightarrow$	
prob $(1-\beta_B^*)$	$\rightarrow$	$1-\gamma^*$	unemployed	$\rightarrow$	unemployed

3.5 Corner Equilibria

We now consider the possibility of steady states occurring at the corners, $\beta = 0$, $\beta = 1$.

Proposition 5 *There exists a stable steady state in which* $\beta = 0$, $\gamma = 0$.

At a corner equilibrium, described by Proposition 5, the non-entry of firms, $\gamma = 0$, implies that workers with a good work ethic have no opportunity to reveal it. Consequently none obtain work ethics, $\beta = 0$, but then it is not viable for firms to exist. Note that this is a stable steady state: the introduction of a small number of workers with work ethics will not induce firms to enter because, since these workers cannot credibly communicate their work ethic, any firms entering would be inundated with applications from all workers, most of whom are going to shirk.

A steady state at the other corner, $\beta = 1$, is not possible. If all workers are employed in n firms then $H \to L$, Assumption 2 part (i). Thus having a work ethic yields no benefit since the amount of rent is $H - L$. In that case, individuals who do not have a work ethic and hence do not incur the fixed cost, F, will have higher lifetime utility; β will fall.

We now compare society's welfare in the interior steady state with that at the no work ethic steady state.

Proposition 6 *Social welfare in the interior steady state described in Proposition 4 is strictly higher than social welfare in the steady state described in Proposition 5.*

By necessity, investment in a work ethic is socially efficient in an interior steady state, that is, F is relatively low. The considerable efficiency gain to having individuals with a work ethic thus ensures that even though there is shirking by some of the young in the interior steady state, infra-marginal firms make positive expected profits. There is never shirking in management because firms are careful only to hire good workers into management. Moreover, individuals are also better off, in expectation, since those with high ability have a possibility of receiving an ability rent in the interior steady state.

3.6 Dynamics

Consider the dynamics of this system in (β, γ) space in Figure 2 below. Note that the phase space for the analysis undergoes a fundamental change at the point where conditions (7) and (6) bind. The line $H = \widehat{H}$, given by condition (6), is horizontal since it is unaffected by β, and, conversely, condition (7) is independent of γ. The curve $\frac{\Delta\gamma}{\Delta t} = 0$ comprises three parts: for values of γ above the line $H = \widehat{H}$, firms pay the high wage, $w = z - L$, so that the curve in this region is simply given directly from (8). For values of γ below the line $H = \widehat{H}$, firms pay the low wage, $w = z - H(\gamma)$, so that the entry condition for firms is given by

$$E_i(\gamma) = \beta(1-\theta)(Y - z + H(\gamma)) - (1 - \beta(1-\theta))z, \tag{11}$$

which is flatter than the part of the curve given by (8), since lowering γ also lowers the wage that needs to be paid through $H(\gamma)$, in addition to

lowering entry costs through E_i. The third part of the curve is flat and this starts where condition (7) holds at point β_1: for values of $\beta < \beta_1$ net profits in all entering firms are negative, so none enter.

When both conditions (6) and (7) are satisfied, the analysis in Proposition 4 applies and we have the two curves for (9) and one for (8) depicted which represent, $\frac{\Delta\beta}{\Delta t} = 0$ and $\frac{\Delta\gamma}{\Delta t} = 0$ respectively. (Figure 2 depicts only the stable curve for (9)). The steady state B is locally stable. Furthermore, given that firms adjust instantaneously, but workers adjust according to the replicator dynamic, movement to the steady state from any point in the region involves a vertical jump to the line $\frac{\Delta\gamma}{\Delta t} = 0$ and then gradual convergence along the arm under the dynamic in (1), as indicated by the heavy arrows.

At points where either one of conditions (6) or (7) do not hold, individuals with no work ethic always do better, since when (7) fails, there is no possibility of being revealed as having a good ethic without firms, or, if firms enter, when (6) fails, the reward to being revealed as having one is too small. In either of these cases (i.e., in the shaded region in Figure 2) $\frac{\Delta\beta}{\Delta t} < 0$ and continues so until $\beta = 0$; that is, final convergence on the steady state described in Proposition 5, point C in Figure 2.

4 Potentially beneficial development

Development is a process which is potentially beneficial. As discussed in the introduction, we consider development to be improvements in either institutions or technology that increase productivity but that tend to be ability intensive. The simplest way of modelling this is as a change which increases the average productivity of those who are skilled, while leaving unaffected the productivity of the unskilled. Further, amongst the skilled, development increases returns to the H types more than those of the L types. Once again, a number of changes seem to correspond with this: implementation of new technologies or work practices, changes in institutions (for example privatization, or allowing more competition in the labour market), or perhaps opening up to trade.[22] The crucial feature of this process that we wish to highlight is the ability intensity of development. Thus we will model these changes by assuming that development increases returns to the H types while keeping returns to the L types fixed. Since $H(.)$ is a function we do this by defining a new function corresponding to an upward shift in the previous one. Formally, we now define H to be also a function of a parameter q, $H(q, \gamma)$, with $H_q(q, \gamma) > 0$ for all $\gamma < 1$ and $H_q(q, 1) = 0$ (the latter constraint serves to preserve part (i) in Assumption 2). Thus, development

[22] The exact reason is immaterial to the analysis, and all qualitative results are unchanged provided, for any changes, returns to the high types increase relatively more than returns to the low.

in our model is represented by an increase in productivity, measured by parameter q.

4.1 Effects of a productivity increase on welfare

Consider now two different productivity parameters q_l and q_h, and let $q_h > q_l$ so that the economy with q_h has more productive skilled workers. Figure 3 sketches the change arising from a higher q and corresponding increase in H. First consider equation (9). The left hand side is unaffected by the change but the right hand side increases in value, so that the stable steady state γ_B is higher. Thus the curve γ_B or (9) shifts up. In the figure, all curves drawn with dashes correspond to values under q_l, whereas solid lines are those under q_h. (Note that γ_A shifts down as well, but this is immaterial to the analysis and is not depicted.) The curve $H = \widehat{H}(q_h)$ also rises above $H = \widehat{H}(q_l)$. This upward shift arises because the increase in relative returns of the H types implies that for firms to be indifferent between targeting them and the L types, their expected productivity should fall. This will only occur for γ higher, since $\frac{dH}{d\gamma} < 0$. A final shift is in a segment of $\frac{\Delta\gamma}{\Delta t} = 0$, i.e., (8). Note firstly that this curve does not change for values of γ above those at which $H = \widehat{H}(q_h)$. This is because, at these values, firms choose the high wage strategy, $w = z - L$, so that the change in H does not affect them. However, at lower values of γ, firms optimally choose the low wage strategy, $w = z - H$, which has become more profitable for higher H. Therefore, in order to preserve the zero expected profit condition at the entry margin, γ must increase, as depicted by the arced arrow, denoting an upward movement in the part of the curve below $H = \widehat{H}(q_h)$.

By inspection of Figure 3, it can be seen that, in the new steady state, both γ and β are higher. Intuitively, this is because, with development, the higher expected productivity, and thus rewards, for those revealed to have a good work ethic means that evolutionary forces drive more individuals towards acquiring one, β rises. Therefore, since the population are now better workers, more firms are willing to enter. This new steady state, denoted by D, is also locally stable. Finally, it is also the case that β_1 falls, but since this plays no role in the analysis, we consider it no further.

The following proposition characterizes the effect of this productivity increase on social welfare.

Proposition 7 *Let $q_h > q_l$. If q increases from q_l to q_h and the economy moves from the stable steady state corresponding to q_l to the stable steady state corresponding to q_h, social welfare in the economy increases.*

Development, if possible, is unambiguously good. By raising returns to ability, it raises the expected value of a work ethic. In turn, with a better work ethic in the population, firms respond by entering which reinforces

the population's better work ethic; β rises. Firms' profits rise because, on average, fewer workers will shirk. Workers are better off because more can reap the benefits of a good work ethic being revealed.

However, the issue of transition from the low productivity interior steady state to the development one, i.e., moving from B to D in Figure 3, has not yet been addressed.

4.2 Development may fail

Economies do not instantaneously jump between steady states. Firms are relatively fluid and can enter quickly to reflect the new opportunities. However, as our earlier discussion emphasized, the population's work ethic adjusts more slowly, a feature we have captured by using a replicator dynamic. In terms of the model's dynamics, this means that the model always converges along (8) as discussed in the previous section. This sluggishness in population adjustment renders the final outcome realized far from clear. In fact, as the following proposition shows, even though development makes a better steady state possible, such a steady state will not always be attainable.

Proposition 8 *Suppose that the economy starts in a stable interior equilibrium* (β_B^*, γ_B^*) *corresponding to* q_l. *Consider efficiency enhancing development that increases the productivity parameter to* $q_h > q_l$, *while all other parameters remain fixed. There exists a* $\triangle > 0$ *such that if* $H(q_h, \gamma_B^*) - H(q_l, \gamma_B^*) > \triangle$, *the economy converges monotonically to a steady state in which:* (1) *all workers have a bad work ethic, i.e.* $\beta = 0$, (2) *all firms shut down, and* (3) *no workers are employed.*

The proposition says that if the effects of attempted development, represented by Δ, are too large, it may not be possible to achieve the more efficient interior steady state, D in Figure 3; instead, the economy converges to an inferior corner equilibrium in which initially existing work ethics are destroyed; C in Figure 3.

Consider the dynamics of this situation graphically, in Figure 4. As depicted, the rise in equation (6) to the new $H = \widehat{H}(q_h)$ has moved it above the original equilibrium value of γ, denoted γ^*. This is the critical condition for development to fail. With β starting at point β^* maginal firms, at the old level of γ, strictly prefer to enter, reflecting the higher productivity of H, and they do so up until the point denoted γ_1 in the figure. This is the upward arrow from point B in Figure 4. But as the point (γ_1, β^*) is below $H = \widehat{H}(q_h)$, all firms now strictly prefer the low wage strategy. This is because high ability individuals have experienced a relative increase in returns, and it now becomes optimal for firms to target these individuals when setting wages. An implication of this is that not even high

ability workers can receive ability rents so that evolutionary incentives force a decline in work ethics. In the next period then, the economy has even fewer ethical workers (β falls), which leads to an increase in γ, so that the economy traverses along the arm of $\frac{\Delta\gamma}{\Delta t}(q_h) = 0$ in the South-West direction in Figure 4. This arm then monotonically converges to the zero work ethic steady state, point C, and development fails. Note that this would not have happened if β could somehow increase directly to its new interior steady state level depicted at point D. This is because, at point D, β is high enough for the relative difference between the low and high ability's returns to be small, so that firms choose to continue with the high wage strategy.

Intuitively, although efficiency enhancing, development improves productivity and rewards ability unequally - those with low ability see little (actually no change in our experiment) in productivity and rewards, while the productivity and rewards of those with high ability increase. This increases the rent of high ability individuals. If the firms choose so, they can set the wages they offer so as to extract this rent. If this is done, i.e. if $H = \widehat{H}(q_h)$ rises too much, then not even high ability individuals can receive a life-time rent on their ability, and hence on their work ethic. Thus, all individuals are better off not developing a work ethic. However, if this occurs, the economy can only eventually converge on point C.

The very capacity of high ability individuals to obtain rents to their ability depends on firms' desire to keep including low ability individuals in production. If firms decide the low ability are not worth inducing to work, then firms can set wages so as to just make the high ability indifferent to working, thereby ensuring ethical types receive no rents. Since the critical condition determining whether development will fail is whether firms continue to include the low ability types, the model suggests the importance of a development process which is inclusive, in the sense of maintaining production incentives, even for the low ability.

Another implication of this is that development which is not ability intensive will surely succeed. If L were to increase by more than H, firms would have even stronger incentives to pay the high wage, and evolutionary incentives would persist in transition to the better steady state.[23]

In summary, though the productivity improvements accompanying the attempt at "development" create the possibility of a better equilibrium, the equilibrium cannot be reached starting from the economy's old equilibrium. Moreover, not only can the new one not be reached, but the favourable characteristics of the pre-development economy: some firms entering, some workers with work ethics, and some managers being trained, are also lost. The economy converges uniquely to the bad corner equilibrium C.

[23] In terms of figure 3, the dashed curve $H = \widehat{H}$, shifts downward instead of up, so that transition from the pre-development steady state to the development interior steady state is ensured.

4.3 Gradual development

Suppose now the productivity changes occur gradually. This more closely corresponds to the emergence of such technologies and institutions in the West.[24] Here we model this as corresponding to a number of convex combinations of the dramatic increase in the productivity parameter, $q_h - q_l$, considered previously. Gradual development is a sequence of K technology or organizational changes, $K > 1$, such that in change k, $k = 1, 2, ..., K$, the productivity parameter q increases from q_{k-1} to q_k, where $q_0 = q_l$ and $q_K = q_h$. Suppose also that after each of these steps is implemented the economy is given enough time to converge to the new steady state before the next step is undertaken. This will be referred to as a *gradualization* K of development. The next proposition shows that sequenced changes allow the undesirable outcome of Proposition 8 to be avoided:

Proposition 9 *Suppose that the economy starts in a stable interior equilibrium* (β^*, γ^*) *corresponding to* q_l. *Consider an efficiency enhancing change that increases the productivity parameter to* $q_h > q_l$. *There exists a gradualization* K *of this change that ensures a unique path of development that converges on the superior interior equilibrium.*

Intuitively, developing gradually, by a series of small changes, allows the population's work ethic to keep pace with the development process. The incentives to acquire a work ethic depend on wages paid by firms that encourage a good work ethic, which in turn depend on the magnitude of rents enjoyed by high ability ethical types. Gradualization of development ensures these rents do not become so high as to tempt the firms to lower their wages, which would destroy any evolutionary incentives to acquire a work ethic.

Gradualization of development is not the only way to ensure convergence to the development steady state. In general, dramatic changes can still be implemented provided the dispersion in returns to the H and L types is limited. If earned income is observable and taxable, increased dispersion can be offset by increasing progressivity in the tax and transfer system, firms will persist with the high wage strategy, which preserves evolutionary incentives for a work ethic, causing development to succeed.

While we concede that our model is too stylized to generate unconditional policy recommendations, it is noteworthy that the prominent development success stories of the Asia Pacific all started with tightly compressed earnings distributions, comparable to OECD and high income countries, that remained stable over the periods of high per capita income growth

[24] Dramatic change did occur there too, but even large technological innovations are not likely to have presented as profound a change as the introduction of centuries of accumulated know-how in the largely agrarian economies of contemporary LDCs.

(in the range of 5% for the region as a whole) from the early 60s to the 90s. Comparison with the world's low growth regions over the same period, Latin America (approximately 1.5% per capita income growth), and Sub-Saharan Africa, (less than 1% per capita income growth) are consistent with the model.[25] Both of these regions had significantly more dispersed income distributions than the Asia Pacific (Gini coefficients in the 50's and 40's respectively, compared with the mid 30's for the Asia Pacific, see Deininger and Squire (1998)), and grew much more slowly. This negative impact of inequality on growth is already well known and has spawned a considerable literature to explain it. Our model, provides another reason to expect such a link and further relates it to the population's work ethic. At this point it should be useful to examine the considerable body of empirical work conducted by sociologists on societies' work ethics, and see if these correlate with the growth/inequality measures that are well known to be correlated together.[26] Unfortunately, relatively few of these psychometric studies have been performed for LDCs, furthermore, it is well recognized in the psychometric literature that the surveys on which work ethics measures are estimated are not comparable across countries, nor usually even across studies, (see Furnham 1990, Ch. 4). Such comparisons will not be instructive until more careful cross-country studies are available.[27]

5 Robustness and conclusions

Much of the model's structure could be generalized while preserving the main results. Our aim has not been to provide the most general treatment, nor the most realistic model of LDC labour markets, but rather to construct as simple a framework as possible to examine the critical forces at play in our argument. Here we discuss these.

The inability of firms to fully control all elements of the production relationship, either by a complete contract or supervision, ensured work ethics could have a socially beneficial role in our model. The precise way we modelled this was by assuming that contracts were limited to specifying non-negative payments for workers, i.e. limited worker liability. This ensured that shirking was costly to the firm, since it was not able to recoup all losses via a penalty payment from workers. Under the accompanying assumption that such shirking was beneficial to workers (the term z) this meant firms

[25] The precise figures vary depending on precise start and end dates and the countries defined in a region, but are always close to these approximations.

[26] Jones (1997)provides a recent surveys of this psychometric literature.

[27] We were not able to find studies directly comparing work ethics in low and high growth LDCs that controlled for differences in age and socio-economic status of those surveyed. Recent cross-country comparisons with better controls are being attempted, for example a cross-country comparison between Australia and Sri-Lanka by Niles (1999) analyzes representative samples of the two populations.

were concerned about the possibility of shirking, and work ethics played a role. If, instead, we had assumed perfect and complete contracting, a work ethic would have evolved into the population whenever its value in lowering the disutility of work were sufficiently high, and the present paper's concerns would not arise. Thus, workers' shirking being costly to firms is clearly a crucial ingredient of our model. However, that this arises through limited worker liability is not.

Another crucial ingredient was the existence of differing ability types in the population. This ensured that when firms found it optimal to provide performance incentives for those with low ability, the high type received an informational rent that was critical in maintaining evolutionary incentives for development of a work ethic. This basic effect would persist in a model with more than two types, and where firms were not able to extract all of the rents of unskilled workers. In such a world, the rents enjoyed by high ability types would fall as some of the lower ability types were ignored by firms, but perhaps not disappear altogether. As long as they fell, the same dilution of evolutionary incentives for provision of a work ethic as considered in the paper would occur, but would simply be less stark.

We couched our analysis of work ethics in an explicitly evolutionary environment because we believed that to provide a realistic framework for thinking about cultural variables. However, evolutionary environments are often criticized for their lack of individual rationality, a feature which is also evident here when the economy is transitioning to a steady state. It should be noted, however, that the evolutionary framework is not strictly necessary for our main results. It is possible to instead model the work ethic choice as being undertaken by fully rational agents. The critical factor is that, at the aggregate level, changes in work ethics should occur slowly (relative to firms' mode changes). This is, of course, a feature of replicator based evolutionary models, but not exclusively so. A non-evolutionary based reason for such slow changes in aggregate could be, for example, randomly realized heterogeneous costs of individual adjustment, or variations due to differences in age. Provided this feature of differences in speed of adjustment is preserved, the main concerns raised in this paper will still arise, since, once again, economies will not be able to instantly jump to the better steady state.

The one other formal paper directly concerned with work ethics we are aware of is by Congleton (1991). He showed that such a trait could be valuable in a number of situations where labour markets are not perfect. A more closely related paper on "managerial ethics" was due to Noe and Rebello (1994). There, ethical managers could be trusted to apply appropriate effort even when financial incentives were not sufficiently strong to mitigate agency problems. They also similarly considered how production choices varied with aggregate ethic levels, and, in turn, how ethic levels affected returns to previous levels of ethics. They modelled choices of managerial ethics in a richer way than we have here by explicitly considering the effects

of parental socialization; considerations that we have buried in our replicator dynamic. A principal difference, however, is that there are no firms (or any other such similar mechanism) which allow ethic revelation in their framework. In fact, ethical agents in their model could never obtain an economic reward to this characteristic and were, at best, just as well off as the non-ethical. Whereas in our model there is a positive dependence between ethic development and firms, leading to the possibility of both ethical and non-ethical steady states, in their model the dependence was negative; the higher the level of economic activity the greater the losses incurred by ethical managers. Ethical types could still stabilize at a non-zero level in their model, but this was because both ethical and unethical parents had positive chances of producing ethical offspring, even though these suffered lifetime losses. Different parameterizations of transition functions thus lead to either stable managerial ethical levels or cyclical ones, which they used to explain their main focus, i.e., the dependence of economic activity on ethics levels. In addition to the positive dependence between firms and work ethics, our paper also has an entirely different focus to theirs. Our focus has been on the dynamics of adjustment to positive shocks, where this type of positive shock is a metaphor for the economy's attempt at "development". We have thus abstracted from the richness of transition functions underlying work ethics, since these play no interesting role in such adjustment, and focused instead on a possible symbiosis between work ethics and the firms which depend on them.

Though structurally different, the model bears a closer conceptual resemblance to a recent model by Cozzi (1998). He similarly dealt with the inappropriability of returns to a characteristic that was productivity enhancing which he called "culture". In his model, culture was a costly to acquire trait that was useful in production and was transmitted from the old to the young by explicit learning. This broad definition of the word culture could admit an interpretation along the lines of a work ethic, as we have defined it here. He showed that, even without a direct reward to culture in production, it could persist in steady state if people paid to acquire it in anticipation of payment for training the next generation when they themselves became old. Culture thus persisted as an asset whose value was positive as part of a rational bubble. Here, in contrast, with enough firms entering, individuals can benefit directly from their investment in a work ethic. Unlike Cozzi we do not allow for individuals to benefit by selling this skill to future generations so that the returns to a work ethic, in our model, depend exclusively on the possibility of an informational rent to the high ability that is obtained when firms want to induce effort from the low ability too. This is what causes the potentially negative impact of productivity enhancing changes, since these can lead firms to give up on inducing effort from the low ability altogether.

The paper has two positive implications. Firstly, it provides a reason for why the plight of currently developing countries may be different from

that of Western countries at their own early stages of development. In the West, continued productivity growth, occurring gradually over a number of centuries, encouraged development of the right sort of work attitudes because, by its very nature, it was gradual. However, follower countries that are attempting to develop by the implementation of efficiency enhancing Western type technologies or institutions, are attempting a much more dramatic change which as the model shows may not succeed when gradual ones do. Secondly, it explains why even dramatic changes may succeed provided they do not lead to too large an increase in relative returns of those who are already relatively highly rewarded. A development process in which relative returns of the high ability do not dramatically outstrip the low is more likely to be a success. The model thus provides another explanation for the relative growth success of countries that were able to maintain compressed earnings distributions.

6 Appendix

Proof of Lemma 1:

(ii) Suppose a firm decides to assign to management a worker whom it believes has a good work ethic with probability less than 1. The firm would never do this unless it provides this manager with incentives not to shirk. That is, it must offer a wage w^m for high output such that $w^m \geq \varepsilon + \delta$ (otherwise the worker will shirk if he has bad work ethic). But, Assumption 3, part (ii), implies that $\varepsilon + \delta > H(\gamma)$ for any γ. Hence, in this case $w^m > H(\gamma)$, which means that the firm earns negative expected profit. It will therefore never assign to management a worker about whose work ethic it is not sure.

(i) Now suppose a worker was revealed as having good work ethic. Then she will provide effort when assigned to management as long as $w^m \geq \varepsilon$. Since $\varepsilon < L$ this can be easily satisfied. Competition for these workers will then lead the firms to bid their wages up to L and H, depending on the ability.■

Proof of Lemma 2:

(i) To prove this claim, look at an individual with no work ethic employed in a firm. Suppose the wage this firm pays is $w^{'}$. Then if this individual provides effort, her lifetime utility is $w^{'} - \delta + \varepsilon$, because when old she will be assigned to management and then shirk (this follows from the argument in the proof of part (ii) in Lemma 1 above). If she shirks, in contrast, her payoff is z. Thus, the worker will provide effort only if $w^{'} \geq \delta + z - \varepsilon$, which from part (ii) in Assumption 3 implies $w^{'} > Y$. The firm will therefore never offer this wage, which means that a worker without good work ethic will always shirk when employed.

Part (ii) is immediate.■

Proof of Lemma 3:

According to the proof of Lemma 2, a firm will never want to elicit effort from a worker with bad work ethic. The wage in these firms is therefore determined so as to provide incentives to workers with a good work ethic. The utility to a job for a high type with a work ethic who does not shirk is $w + H(\gamma)$, since the worker receives payments w and then $H(\gamma)$ as a manager (Lemma 2). If this worker shirks, he receives z only, so that a wage of $w = z - H(\gamma)$ just induces an H worker with a work ethic not to shirk. Correspondingly a higher wage of $w = z - L$ induces both the high and the low types who have a work ethic not to shirk. The individuals without a work ethic, who are proportion $(1 - \beta)$ of the labor force, will always take a job and shirk. Thus the expected profit from the high wage strategy exceeds that from the low if and only if:

$$\beta(Y - z + L) - (1 - \beta) z \geq \beta(1 - \theta)(Y - z + H(\gamma)) - (1 - \beta(1 - \theta)) z.$$

This rearranges to the condition in the lemma.■

Proof of Proposition 4:

(i) We first show that if an interior equilibrium exists, it solves conditions (8) to (10). In an interior equilibrium, the expected utility of individuals with good or bad work ethics must be equal, and firms hiring the young must make non-negative profit at the equilibrium values of β and γ. If not, then either β and/or γ will change from their conjectured equilibrium values.

Both shirkers and non-shirkers strictly prefer to obtain work when young. The shirkers, because they can cheat and obtain the positive amount z without effort, and the non-shirkers because, by working at one of these firms and not shirking they obtain w, are revealed to have a good work ethic, and receive payment as a manager which is commensurate with their abilities; H or L for a low type. If an equilibrium has γ firms hiring, the probability of an individual receiving one of these jobs when young is $\gamma < 1$; because these jobs are assumed to be rationed randomly. Reciprocally, measure $1 - \gamma$ of the young who do not obtain work are unemployed.

The dynamic governing an individual's work ethic conditions on expected ability, the θ distribution. In an interior equilibrium, condition (6) must hold (otherwise the wage would equal $z - H(\gamma)$ and any individual with a work ethic would do strictly worse than one without one, so that β would converge to zero). Thus, an individual with a work ethic has expected utility $-F + \gamma[(1-\theta)(H(\gamma) - L) + z] + (1 - \gamma)(0)$. If one has a bad work ethic the expected utility is $(1 - \gamma)(0) + \gamma z$, since this individual will shirk. Combining these yields a condition that is necessary for a positive proportion of each type in steady state:

$$\gamma z = -F + \gamma[(1 - \theta)(H(\gamma) - L) + z]. \tag{12}$$

Rearranging, we obtain the condition (9) in the proposition.

Next consider the profits of firms using each type of production. Given a measure of good workers, β, the expected profit of a firm is $\beta(Y-w)-(1-\beta)z$, which from Lemma 3 implies that $\pi=\beta(Y+L)-z$ if condition (6) holds. Thus there is entry up until:

$$E_i=\beta(Y+L)-z, \tag{13}$$

which is condition (8) from the proposition. For (12) and (13) to be consistent it is necessary that

$$\gamma=\int_{\underline{E}}^{E_i} xe(x)\,dx,$$

which is condition (10) in the proposition. For simplicity we can denote the function $E_i(\gamma)$ as the value of E corresponding to a particular value of γ in the distribution. Clearly, this function is increasing.

(ii) Figure 1 plots equations (8) and (9) in (β,γ) space. Consider equation (9) first.

Step 1. Existence of a solution to equation (9).

Both the right hand side (RHS) and the left hand side (LHS) of this equation are plotted in Fig. A1. It is easy to check that parts (ii) and (iii) of Assumption 2 imply that RHS is concave in γ. At the same time, when $\gamma=0$ RHS is equal to zero and increasing in γ, where the latter follows from parts (i) and (ii) of Assumption 2. Finally, when $\gamma=1$ then RHS <0, which follows from $H(1)=L$ (part (i) of Assumption 2). Thus, there exists a $\hat{\gamma}\in(0,1)$ such that RHS increases in γ if $\gamma<\hat{\gamma}$, decreases if $\gamma>\hat{\gamma}$ and reaches a maximum when $\gamma=\hat{\gamma}$, while RHS$(\hat{\gamma})>0$.

Therefore, if $F>F^*\equiv RHS(\hat{\gamma})$ then (9) has no solution and claim (a) follows. If $F=F^*$ then (9) has exactly one solution, $\gamma\in(0,1)$. If $F<F^*$ then (9) has exactly two solutions, γ_A and γ_B, both from $(0,1)$; this case is depicted in Figure A1. Note that (9), and therefore also γ, γ_A and γ_B, are independent of β, so that γ_A and γ_B are represented as horizontal lines in Figure 1.

Step 2. Existence of an interior solution to the system of equations (9) and (8). Suppose $F<F^*$ (when $F=F^*$ the proof is similar). From Step 1 above we know that (8) has exactly two solutions γ_A and γ_B that are between 0 and 1. Now look at equation (8). Solving for β we obtain $\beta(\gamma)=\frac{E_i(\gamma)+z}{Y+L}$, so that differentiating with respect to γ yields

$$\frac{d\beta(\gamma)}{d\gamma}=\frac{E_i'(\gamma)}{Y+L}>0,$$

where the inequality follows since $E_i'(.)$ is an increasing function. Thus the function $\beta(\gamma)$ is upward sloping, as depicted in Figure 1. Because $\beta(\gamma)$ is

always between 0 and 1 (from Assumption 1, parts (ii) and (iii)), there exist β_A and β_B from $(0,1)$ such that $\beta_A = \beta(\gamma_A)$ and $\beta_B = \beta(\gamma_B)$. By monotonicity, β_A and β_B are unique and (8) and (9) have exactly two interior solutions.

Step 3. β_A and β_B obtained in the previous step satisfy conditions (6) and (7) . Condition (6) holds for any $\hat{\gamma}^n$ that satisfies (9) if $Y^*(F)$ is chosen so that $H(\hat{\gamma}) \leq \frac{\theta Y^*(F)+L}{1-\theta}$. $Y^*(.)$ is a function of F because $\hat{\gamma}$ is a function of F. Then (9) holds for any $Y \geq Y^*(F)$. To see that (7) holds note that $\beta_i = \frac{E(\gamma_i^s)+z}{Y+L} \geq \frac{E+z}{Y+L} = \beta_1, for\ i = A$ or B.

Step 4. Stability. Suppose first that $F < F^*$. Suppose also that $\beta_A^* < \beta_B^*$ (this can be assumed without loss of generality). By comparing expected utilities of workers with and without a work ethic we find that the expected utility of individuals with a work ethic is higher if and only if

$$F < \gamma\,(1-\theta)\,(H\,(\gamma) - L). \tag{14}$$

Because of the concavity of the RHS, this holds if and only if $\gamma \in (\gamma_A^*, \gamma_B^*)$, thus, if $\gamma \in (\gamma_A^*, \gamma_B^*)$ the number of individuals with a work ethic, β, tends to increase, otherwise it tends to decrease.

Similarly, the number of firms entering, γ, rises iff the expected profit of these firms is larger than the entry costs:

$$E\,(\gamma) < \beta\,(Y + L) - z. \tag{15}$$

This is true iff $\beta > \beta(\gamma)$.

Look at equilibrium A and suppose that γ increases slightly above γ_A^*. Then (14) holds, which implies that β increases, which in turn implies the inequality in condition (15) holds, so that γ rises further, and so on. Equilibrium A is therefore unstable.

Now consider equilibrium B. Suppose γ increases slightly above γ_B^*. Then the opposite of (14) holds and β tends to decrease below β_B^*. But then this means that the opposite of (15) holds so that γ decreases back to γ_B^*. The opposite happens when we consider a slight decrease of γ below γ_B^*. Similarly, if β deviates below β_B^*, the opposite of (15) holds so that γ starts decreasing below γ_B^*, which in turn implies that (14) holds and β rises back towards β_B^*. The opposite happens when β deviates slightly above β_B^*.

The instability of the unique equilibrium of part (b) follows immediately from the fact that the reverse of (14) holds for all $\gamma \neq \gamma^*$, so that β has a tendency to decrease whenever $\beta \neq \beta^*$.■

Proof of Proposition 5: Suppose no individuals have a good work ethic, $\beta = 0$. Then the profits from entry are strictly negative for all firms, from (4). Thus, from (2) $\gamma = 0$. Furthermore, since there are no firms, no young workers are revealed as having work ethics and consequently returns to nature choosing a good work ethic are strictly less than the returns to a bad one, so that evolutionary forces drive $\beta = 0$. ■

Proof of Proposition 6:

Compare firms' expected profits in each steady state. In the corner steady state, firms do not exist. In the interior steady state, infra-marginal firms earn positive expected profits. Now consider individuals. In the corner steady state, all individuals have expected utility equal to zero. In the interior steady state individuals with a good work ethic must have equal expected utility to those with a bad work ethic, that is: $E[u^g] = E\left[u^b\right]$. Thus, consider the expected utility of individuals with bad work ethics. Since, such individuals have a positive probability of obtaining work, where they will shirk and obtain z, their expected utility is $\gamma z > 0$. Thus these individuals are strictly better off in the interior steady state, as are, in expectation, individuals who have a work ethic. Thus economy wide welfare is higher in the interior steady state.■

Proof of Proposition 7: Look at the expected utility of workers in steady state, $W(q)$, in the economy for a given q:

$$W(q) = \beta\gamma[w + \theta L + (1-\theta)H(q,\gamma) - F] + (1-\beta)[\gamma z].$$

The first term reflects the fact that only individuals with a work ethic work when young are employed. These individuals are then revealed as having a work ethic and are assigned to management, where their output depends on their ability. The last term captures the fact that individuals without a work ethic take a job and shirk. Now consider two values for q, $q_l < q_h$, and their corresponding steady states, denoted with l and h subscripts respectively. In these it is the case that: $\beta_h > \beta_l$ and $\gamma_h > \gamma_l$. In any steady state, by evolutionary pressures it must be the case that the two terms in square brackets in $W(q_h)$ are equalized. But since $\gamma_h > \gamma_l$ then $W(q_h) > W(q_l)$. So workers have higher expected utility in steady state with higher q. Firms have higher expected profits as a whole since $\gamma_h > \gamma_l$ implies that there are more infra-marginal firms earning positive profit.■

Proof of Proposition 8: Consider an initial interior steady state (β_B^*, γ_B^*) corresponding to the productivity parameter q_l. At this steady state, condition (6) must hold, i.e. $H(q_l, \gamma_B^*) \leq \hat{H}$. Let $\triangle = \hat{H} - H(q_l, \gamma_B^*)$ and consider a market reform that shifts the productivity from $H(q_l, \gamma_B^*)$ to $H(q_h, \gamma_B^*) > H(q_l, \gamma_B^*) + \triangle$. Since condition (8), determining equilibrium levels of γ, is independent of H, provided (6) continues to hold the numbers of firms γ does not react to this productivity increase immediately; rather, they adjust slowly with β, which follows a gradual replicator dynamic. Therefore, the economy moves away from the initial equilibrium B slowly and continuously. Meanwhile, a sudden increase in H by $H(q_h, \gamma^*) - H(q_l, \gamma^*) > \triangle$ causes a discrete jump in $H(., \gamma_B^*)$, to $H(q_h, \gamma_B^*)$, so that

$$\hat{H} - H(q_h, \gamma_B^{n*}) < \hat{H} - H(q_l, \gamma_B^{n*}) - \triangle = 0,$$

where the inequality follows from $H(q_h, \gamma_B^{n*}) > H(q_l, \gamma_B^{n*}) + \triangle$. This obviously violates condition (6) . The number of workers with ethic therefore gradually starts to decrease and the economy monotonically converges to the $\beta = 0$ steady state as described in the dynamics section above.■

Proof of Proposition 9: Let $\left(\beta_{k-1}^*, \gamma_{k-1}^*\right)$ be the stable interior equilibrium corresponding to t_{k-1}, $k = 1, 2, ..., K$. Define $\triangle(q_{k-1})$ as $\triangle(q_{k-1}) \equiv \hat{H} - H(q_{k-1}, \gamma_{k-1}^*)$ and choose the gradualization $1, 2, ..., K$ so that $H(q_k, \gamma_{k-1}^*) < H(q_{k-1}, \gamma_{k-1}^*) + \triangle(q_{k-1})$. By continuity of $H(.,.)$, it is always possible to find a finite K such that this holds for all $k \leq K$. In each of these K the increase in q causes first a discrete jump in $H(.,.)$ from $H(q_{k-1}, \gamma_{k-1}^*)$ to $H(q_k, \gamma_{k-1}^*)$ and then a gradual decrease from $H(q_k, \gamma_{k-1}^*)$ to $H(q_k, \gamma_k^*)$ as γ slowly increases with β. Moreover, $H(q_k, \gamma_k^*) < H(q_{k-1}, \gamma_{k-1}^*)$, which follows from condition (9) and from $\gamma_k^* > \gamma_{k-1}^*$. Thus, a transition from an interior stable steady state $\left(\beta_{k-1}^*, \gamma_{k-1}^*\right)$ to an interior stable steady state (β_k^*, γ_k^*) can occur only if condition (6) holds for $\beta_1(q_k, \gamma_{k-1}^*)$ and β_{k-1}^*, because β^* adjusts slowly. But it holds because

$$\hat{H} - H(q_k, \gamma_k^*) > \hat{H} - H(q_k, \gamma_{k-1}^*) > \hat{H} - H(q_{k-1}, \gamma_{k-1}^*) - \triangle(q_{k-1}) = 0,$$

where the first inequality follows from $\gamma_k^* > \gamma_{k-1}^*$ and the second inequality follows from $H(q_k, \gamma_{k-1}^*) < H(q_{k-1}, \gamma_{k-1}^*) + \triangle(q_{k-1})$.

Thus, if enough time is allowed for β to adjust in every step, condition (6) can remain satisfied, and the economy can gradually move from the interior stable steady state corresponding to q_l to the interior stable steady state corresponding to q_h. ■

References

[1] Ben-Ner, A. and Putterman, L. eds. (1998) *Economics, values, and organization*, Cambridge: Cambridge University Press.

[2] Bowles, S. (1998) Endogenous preferences: the cultural consequences of markets and other economic institutions, *Journal of Economic Literature*, XXXVI, 75-111.

[3] Congleton, R. D. (1991) The economic role of a work ethic, *Journal of Economic Behavior and Organization,* 15, 365-385.

[4] Cozzi, G. (1998) Culture as a bubble, *Journal of Political Economy*, April, 106(2), 376-94.

[5] Deininger, K. and L. Squire (1998) New ways of looking at old issues: inequality and growth, *Journal of Development Economics*, 57(2), 259-287.

[6] Fershtman, C. and Y. Weiss (1998) Social rewards, externalities and stable preferences, *Journal of Public Economics*, 70, 53-73.

[7] Furnham, A. (1990) *The protestant work ethic: the psychology of work-related beliefs and behaviours,* London and New York: Routledge.

[8] Hall, R. E. and C.I. Jones (1999) Why do some countries produce so much more output per worker than others? *Quarterly Journal of Economics* 114(1): 83-116.

[9] Hoffler, F. (1999) Some Play Fair, Some Don't: Reciprocal Fairness in a Stylized Principal-Agent Problem, *Journal of Economic Behavior and Organization*; 38(1), 113-31.

[10] Jones, H.B. jr. (1997) The protestant ethic: Weber's model and the empirical literature, *Human Relations*, 50(7), 757-778.

[11] King, R.G. and R. Levine (1994) Capital fundamentalism, economic development and economic growth, *Carnegie Rochester Series on Public Policy*, 40: 259-292.

[12] Klenow, P. J. and A. Rodriguez-Clare (1997) The neo-classical revival in growth economics: has it gone too far? *NBER Macroeconomics Annual 1997*, Cambridge, MA: MIT Press.

[13] Kunio, Y. (1994) *Japanese economic development*, 3rd edition, Oxford: Oxford University Press.

[14] Landes, D.S. (1998) Culture counts, *Challenge*, July-August, 41(4) 14.

[15] Lindbeck, A., Nyberg, S., Weibull,J.W. (1999) Social Norms and Economic Incentives in the Welfare State, *Quarterly Journal of Economics*,114, (1) p.1.

[16] Niles, F.S. (1999) Toward a cross-cultural understanding of work-related beliefs, *Human Relations* 52(7), 855-867.

[17] Noe, T. H., and M. J. Rebello (1994) The dynamics of business ethics and economic activity, *American Economic Review*, 84(3) June, 531-47.

[18] Nyberg, S. (1997) The honest society: stability and policy considerations, *Journal of Public Economics*, 64, 83-99.

[19] Ostrom, E. (1990) *Governing the commons: the evolution of institutions for collective action,* Cambridge: Cambridge University Press.

[20] Pejovich, S. (1997) Law, tradition and the transition in Eastern Europe, I*ndependent Review, Fall*, 2(2), 243-55.

[21] Prescott, E. C. (1998) Needed: a theory of total factor productivity, *International Economic Review 39(3): 525-551.*

[22] Putnam R. D. (1993) *Making Democracy Work: Civic Traditions in Modern Italy*, Princeton University Press, Princeton, New Jersey.

[23] Saeed, S. M. (1986) *Managerial challenges in the third world*, New York: Praeger.

[24] Salanie, B. (1997) *The economics of contracts*, Cambridge, MIT Press.

[25] Samuelson, L. (1997) *Evolutionary games and equilibrium selection*, Cambridge: MIT Press.

[26] Sen, A. (1996) A matter of choice: is culture merely an adjunct to development? *Unesco Courier*, September, 10-14.

[27] von Thadden E.-L. (1992) Optimal pricing against a simple learning rule, *Games and Economic Behavior*, 4, 627-649.

[28] Weber, M. (1905) [1970] *The protestant work ethic and the spirit of capitalism*, London: George Allen and Unwin.

[29] Weibull, J. (1995) *Evolutionary game theory,* Cambridge: MIT Press.

FIGURE 1

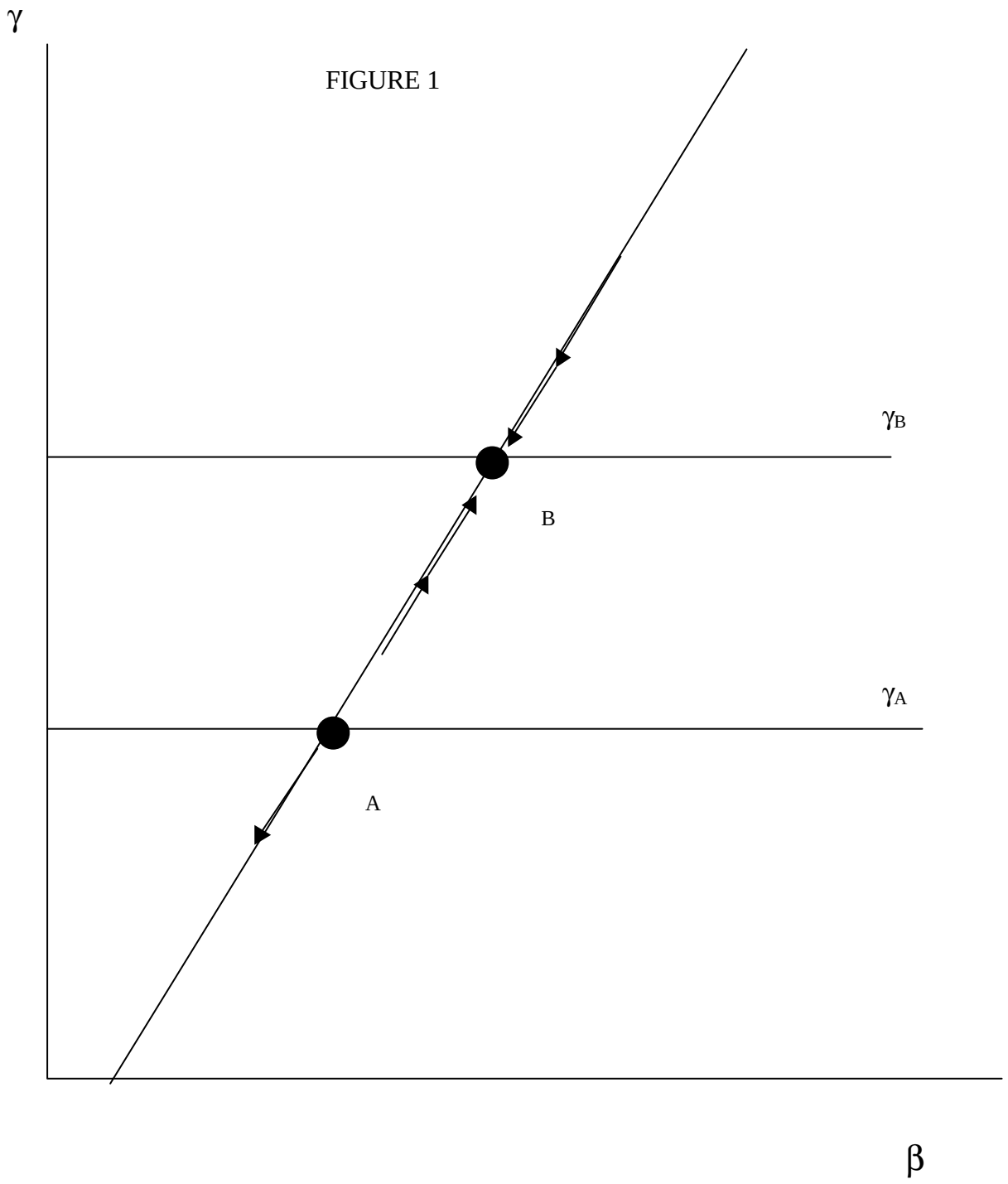


FIGURE 2

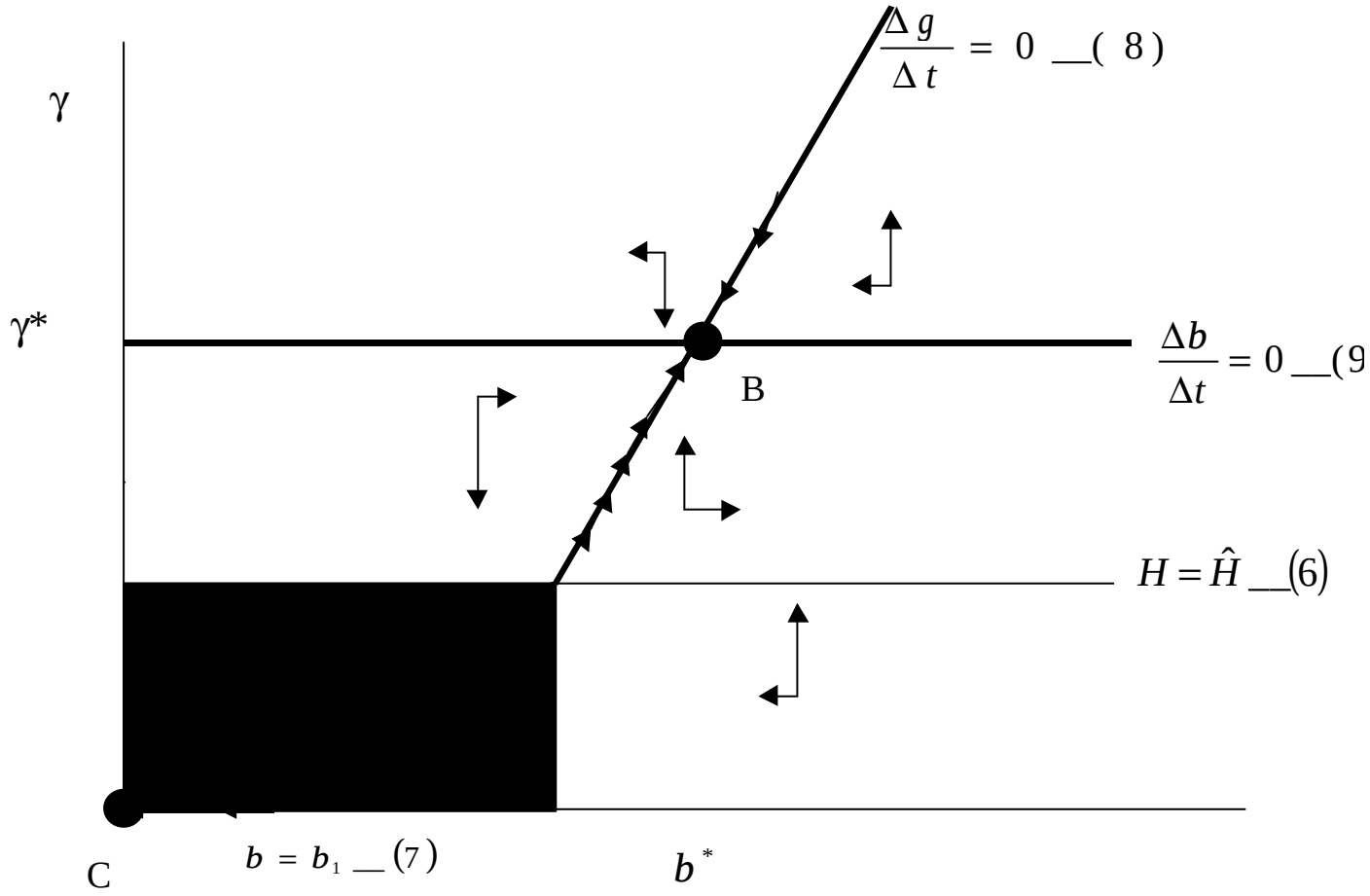
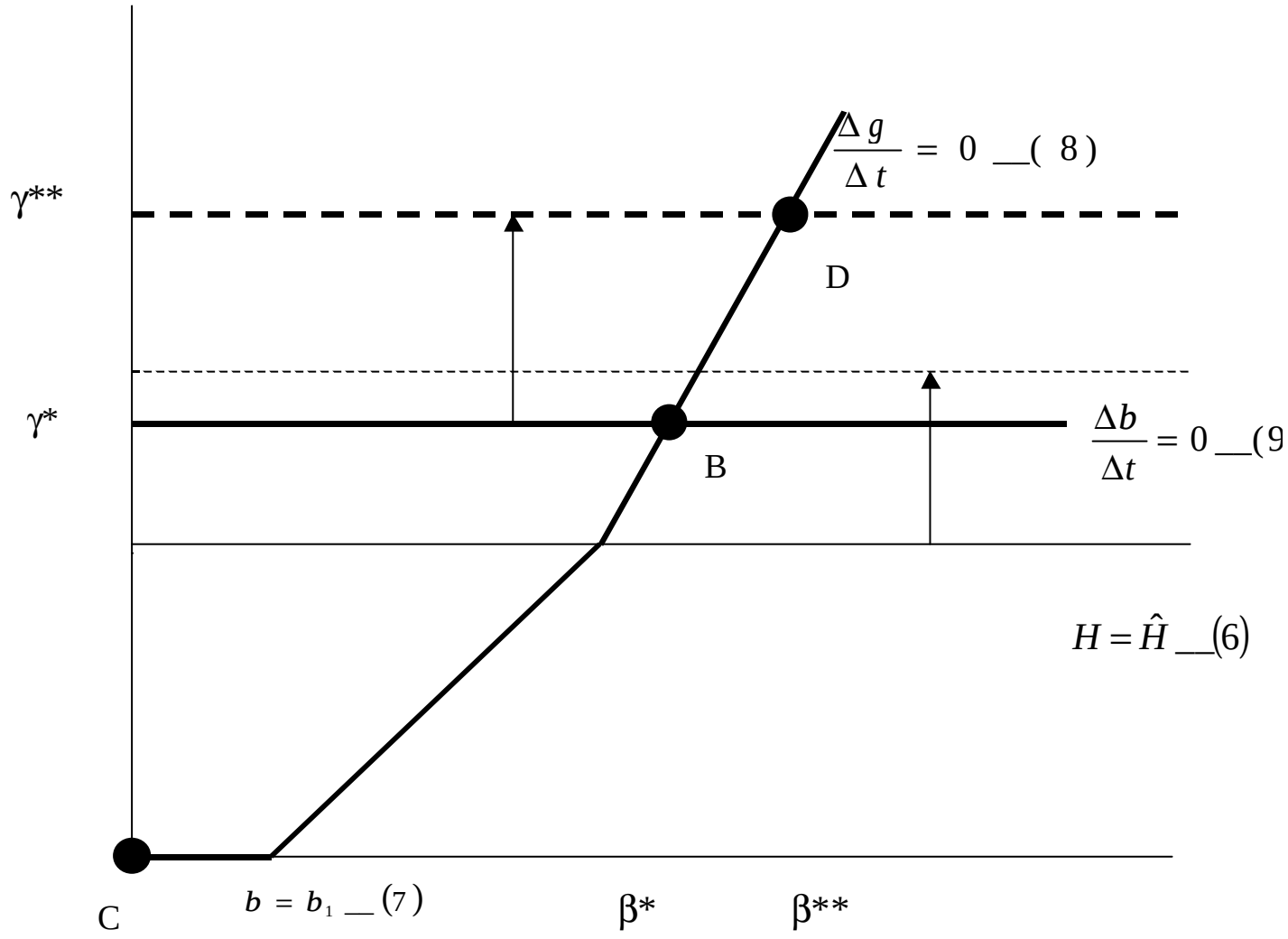

$\frac{\Delta g}{\Delta t} = 0$ __(8)
γ
γ*
$\frac{\Delta b}{\Delta t} = 0$ __(9
B
$H = \hat{H}$ __(6)
$b = b_1$ __(7)
C
b^*

FIGURE 3


γ**
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$\frac{\Delta g}{\Delta t} = 0$ __(8)
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B
$\frac{\Delta b}{\Delta t} = 0$ __(9
$H = \hat{H}$ __(6)
C
$b = b_1$ __(7)
β*
β**

FIGURE 4

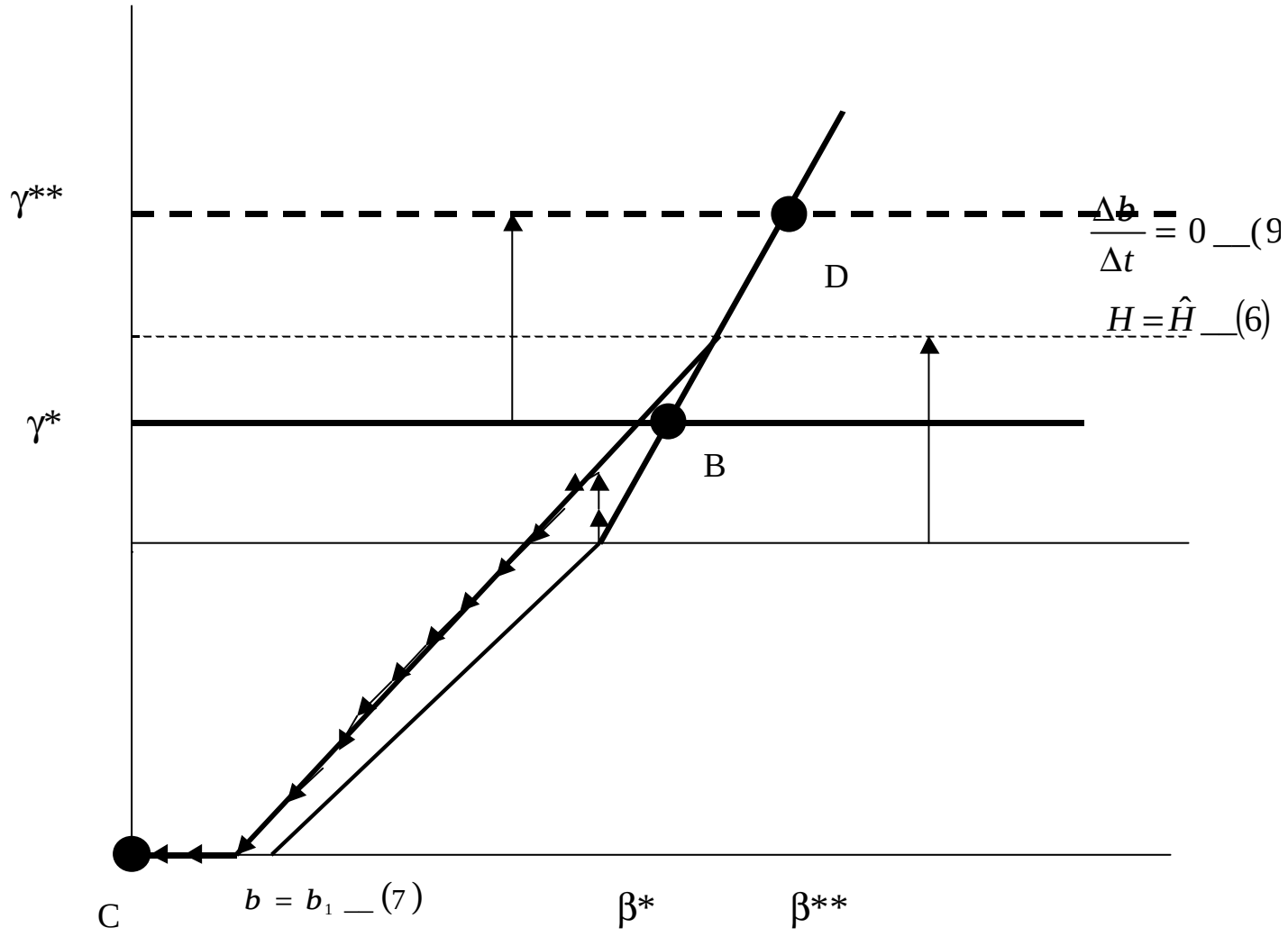

FIGURE A1