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TRUST, SOCIAL CAPITAL AND ECONOMIC DEVELOPMENT

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Trust, Social Capital and Economic Development*

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Abstract

Many argue that elements of a society's norms, culture or social capital are central to understanding its development. However, these notions have been difficult to capture in economic models. Here we argue that 'trustworthiness' is the economically relevant component of a society's culture and hence comprises its social capital. Individuals are trustworthy when they perform actions they have promised, even if these do not maximize their payoffs. The usual focus on incentive structures in motivating behaviour plays no role here. Instead, we emphasize more deep-seated modes of behaviour and consider that trustworthy agents are socialized to act as they do. To model this socialization, we borrow from a relatively new process of preference evolution pioneered by Bisin and Verdier (2001). The model developed endogenously accounts for social capital and explores its role in the process of economic development. It captures in a simple, formal way the interaction between social capital and the economy's productive process. The results obtained caution against rapid reform, provide an explanation for why late developing countries cannot easily transplant the modes of production that have proved useful in the West, and suggest an explanation for the pattern of reform experiences in ex-communist countries.

Keywords: Social Capital, Evolution, Technological Change

JEL: O1, O3, O4, Z1

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1 Introduction

It is often argued that the social norms, attitudes, culture or beliefs predominating in particular regions of the world have played critical determining roles in their development, or lack thereof. This intellectual tradition dates back at least as far as Weber (1958), and has seen many modern restatements, a recent one being Landes (1998). Landes argued that, in seeking to understand why the countries of sixteenth century Europe advanced beyond others that were better placed, differences in culture could not be ignored. Although the form of advance was largely technological, and the countries (on the whole) had institutions that did not block technological change, he argued that these advantages arose out of more deep-seated social attitudes.¹ This has not been a view typically favoured by most economists who instead focus on incentive structures in explaining individual behaviour, and hence the process of development. From an economist's perspective cultural explanations generally leave too much unexplained. 'Explaining' behaviour by positing an underlying disposition to act in a certain way is little more than a tautology.

But if norms or culture are critical, ignoring them will always lead to incomplete explanation, and, worse still, may result in misguided policy recommendations. The extent of culture's centrality is an empirical one, but it is one that cannot be simply resolved by a quick consultation of the empirical record. For every historical sweep which privileges cultural explanations, such as Landes, there are others which argue for more standard economic forces, such as incentives, e.g. Easterly (2002). In this respect, micro evidence, for example that gleaned from case studies, can be instructive, as the tighter focus generally allows fewer contested explanations.

Consider, for example, Uphoff's (2000) study of one specific collective irrigation project. This project started in 1981 in Gal Oya, Sri Lanka, a settlement scheme mainly composed of relocated households. As the community was constructed from migrants, it lacked many of the structures common to more long-standing communities, specifically common roles of leadership. Irrigation, which was important for production of the staple rice crop, was provided by means of a publicly owned irrigation system, which, for the preceding thirty years, had been known for its conflict. Disputes, water stealing and breaking of structures was common, and canals were poorly maintained and in disrepair. The case study documents the rapid transformation of this deteriorated and disorganized irrigation system into one of the most efficiently and cooperatively managed systems in Sri Lanka. The transformation did not involve a change in ownership structure, incentives nor enforcement. Instead, the project mobilized and reinforced certain value orientations of cooperation and generosity that were available within the culture but, up until then, had not influenced behavior regarding irrigation.

The program recruited, trained and deployed young persons called Institutional Organizers

¹Recent elaborations on this theme can also be found in Platteau (2000) and Basu (2000). Platteau (2000, p.325) argues also that this view extends back to Adam Smith.

(IOs) as catalysts for collective action and formation of organizations. These individuals lived in the farming communities, got to know farmers and their families on a personal basis and, beginning quite informally, encouraged collective problem solving efforts. The IOs appealed to norms of fairness and equity that existed in the traditional culture which were publicly articulated and proposed as criteria for irrigation management behavior. Specifically, it was suggested that farmers get together and clean clogged canals or dig new channels as a type of voluntary group labor contributed to the production of a community good. This suggestion drew on a tradition of *shramadana*, and as Uphoff suggests, exploited a custom already existing in people's "cognitive repertoire of acceptable, indeed socially approved, behavior." As such, it was easily understood by the farmers and quickly taken up. After only six weeks of IO deplacement, farmers on 90 percent of the field channels were engaging in some combination of voluntary collective cleaning of channels (some of which had not been maintained for 10 or 20 years), rotating water delivery among users along the channel, so that tail-enders got their fare share, and saving water that had been issued but was not needed for the needy (in some cases this involved donations from Sinhalese to Tamil farmers). This rapid increase in cooperation occurred in a season of severe water shortages and was a complete surprise to researchers, engineers, officials and the farmers themselves.

Researchers had expected that, when asked about the outpouring of cooperation, farmers would respond in terms of incentives and benefits. However, the most frequent response was that the new structure of organization and interaction made them realize others' needs for water and think about the effects of their own wasteful actions. They began taking others' interests into account. Four years after the project was complete, production of rice per unit of irrigation water had increased by 300 percent and the scheme became a model for all major irrigation projects in the country. It remains effective to this day.

What this example shows is that, in one place, at one time, a view limited to focusing on incentives would provide little understanding of why a system which previously did not work was transformed into one which did. In this case study, it was the underlying culture which gave rise to a possibility for collective action, and which was ultimately harnessed to ensure the project's success. Without a comprehensive survey of the case study literature, it is not possible to gauge how widespread such situations are likely to be, even though there has been a large increase in the number of such cases studies.² But, even assuming they are widespread, (and it will be argued shortly that this is the position held by a number of disciplines) the implications are not immediate. One view is that if norms of behavior, culture, attitudes or what may be more broadly termed "social capital" play a central role, then, though these should be taken

²The literature on social capital and its effect on the development process has grown exponentially over the last 5 years. Most of this literature is non-formal, and based on case-studies. An up to date archive of these studies is maintained by the World Bank at <http://www.worldbank.org/poverty/scapital/> See other examples like this in Krishna, Uphoff and Esman (1997).

into account, their existence is merely data which, though needing to be acknowledged, does not fundamentally change economic analysis. The contrasting view, maintained here, is that the norms, social capital or culture are themselves affected by society's institutions, such as the market, and by the actions of economic entities, such as firms. Where these factors are critical (development is one increasingly suggested area), it is important to understand how they both shape, and are shaped by, the more traditional economic phenomena with which we are normally concerned.

This paper presents a model of development which attempts just that. Here, culture plays a central role, and the way in which culture itself is produced and changes is tackled directly. Consistent with alternative non-incentive based approaches in other disciplines, particularly sociology, our starting point is that cultural norms are deep-seated components of individuals' natures. Moreover we are interested in a context where institutions of contract, law and enforcement are not well rooted, so that these norms of behavior will be vital to ensuring that some forms of production can succeed. The process by which behavioral norms arise in people is modeled directly via a process of preference evolution. Here, evolution is driven by the socialization efforts of parents, who are guided in inculcating values by both their own view of what constitutes moral behaviour, and the economic returns of such behaviour. By placing norms in a central position, the analysis provides a wholly new approach to economic development; it also provides insights into the problem of underdevelopment, and yields an economic theory of social capital.

The term social capital has become increasingly fashionable. Common to most definitions of it is an element of regard for others that facilitates fruitful interaction where it would otherwise not be guaranteed. Fukuyama (2000) provides a representative definition of it as "an instantiated set of informal values or norms shared among members of a group that permits them to cooperate with one another". Putnam (1993), Coleman (1990) and Granovetter (1985) provide similar treatments, and its importance in the context of economic development is increasingly emphasized. We argue here that the social norm of central importance is trustworthiness, and that social capital corresponds with a high prevalence of trustworthiness. Trustworthy people are those who keep their promises, even when doing so is both costly and requires taking actions which may not maximize payoffs. Such trustworthiness is extremely valuable when relationships cannot be fully circumscribed by contracts, but when trade would be beneficial nonetheless. When confident that non-contracted contingencies will not be exploited to one's detriment, one may be willing to trade even when promises cannot be guaranteed. A society with many trustworthy members allows people to have that confidence, and is thus rich in social capital.³

In modeling trustworthiness as a behavioural trait, we depart entirely from economists' usual

³There have been attempts to measure trustworthiness through surveys and relate these to actual behavior and economic outcomes; see Glaeser et. al. (2000a) and LaPorta et. al. (1997). Knack and Keefer (1997) also find significant relationships between social norms, trust and growth across countries.

focus on incentive structures. In our framework, *by construction*, pecuniary incentives always favor violating promises. We thus exclude the more standard economic treatment of trustworthiness as incentive compatibility, whereby a person is trusted to undertake promised actions if and only if doing so is in their pecuniary self-interest.⁴ We do this not because we believe incentives play no role in explaining behaviour but because this role has already been thoroughly explored. By shutting down the pecuniary incentive based motivation for action, and treating it more behaviourally, we are closer to the perspective taken in other social sciences.

Sociologists, anthropologists, political scientists and others who study trustworthiness, almost universally treat trustworthiness as an inherent personality disposition, and not as an optimizing response to situational opportunities. It is increasingly argued that personal trustworthiness considerations play a critical role in determining the reliability of trading partners and hence the type of production that will be feasible. This is a view which has long been held by sociologists, and, in economic contexts, has been emphasized in the large literature on supplier networks. Much of this literature is based on case studies from Northern Italy and Southern Germany as in Lane and Bachman (1996), Garofoli (1992), Pyke and Sengenberger (1992) and the survey by Powell and Smith-Doerr (1993). It is also a view which is prominent in the marketing and organization literatures that analyze inter-organizational relationships. In this literature, trust stemming from belief in a partner's inherent type, is vital to sustaining a relationship. Anderson and Narus (1990), Moorman, Deshpande and Zaltman (1992), Morgan and Hunt (1994) and Doney and Cannon (1997) are examples. The development studies literature, too, has seen an increasing focus on industrial clusters in LDCs. A pre-existing atmosphere of trust, often arising from a common earlier ethnic or social connection, pervades successful networks; see for example Schmitz (1995) and (1999), Schmitz and Nadvi (1999), Altenberg and Meyer-Stamer (1999), Weijland (1999), McCormick (1999), and the survey in Humphrey and Schmitz (1998). Finally, it is a view elaborated at length by Seligman (1997), from the perspective of political science. Though our approach clearly shares much in common with these behavioural based approaches in other social sciences, our difference is in endogenously accounting for the emergence of a society's

⁴Dasgupta (1988) is a standard economic treatment of trustworthiness in which people can be trusted to perform promised actions when they are perceived to be incentive compatible. Greif (1994) has explored the insitutional supports for maintaining incentive compatibility in historical settings. A more recent economic approach to Social Capital has been developed by Glaeser et. al (2000b). There, an individual's accumulation of social capital is treated as an investment decision, not unlike the accumulation of human or physical capital. Though they demonstrate such an approach has explanatory power, it misses at least one important aspect that has been emphasized in the sociological case studies that gave rise to the term; that is, the constitutive role that a society's social capital itself has on the individuals within that society. Dealing with this aspect requires abandoning the usual economic position of treating preferences as primitives. Our approach embraces these behavioral aspects which are emphasized in the use of the term social capital, but comes at the cost of additional complexity in the treatment of individuals. Recently a number of papers have explored the possibility of cultural characteristics arising as outcomes of models in which individuals with standard preferences, aiming only at personal gain, interact. This is the approach taken for instance in Cozzi (1998) and in Fang (2001). Our paper is different to both of these since we, in reflection of the largely non-economic literature that we discuss below, argue that in addition to pure payoff maximizers, those with non-standard preferences (the trustworthy) play a critical role.

trustworthiness.

To do this, we adopt a process of preference evolution recently formulated by Bisin and Verdier (2001). Bisin and Verdier argue that, along certain dimensions, an individual's values are determined by parental upbringing. In determining which values a child will obtain, and hence what their preferences will be, parents take into account the lifetime pecuniary returns to having such values, as in standard evolutionary models. However, they also evaluate these returns, and the actions their children would undertake, using their own preferences. Thus, in their framework, though evolution is driven by pecuniary returns, these are not the unique influence. Additionally, parents evaluate how they themselves would feel if undertaking actions consistent with the preferences. Consider the following illustration of how this might yield different results from traditional evolutionary approaches. Suppose a parent values trustworthiness but lives in a society where trustworthiness does not pay - a child's being opportunistic is certain to lead to higher lifetime pecuniary rewards. In standard evolutionary models, where the parent's values play no role in determining evolutionary selection, the fact of rewards to opportunism exceeding those to trustworthiness would imply increased opportunism will ensue. In Bisin and Verdier's framework this need not be so. If parents value trustworthiness enough, they may choose to inculcate it into their children even though it leads to lower lifetime pecuniary rewards.

This approach to preference evolution seems at least as plausible as the more standard evolutionary treatments that focus exclusively on pecuniary returns, or fitness, in that it allows for conscious reflection on the part of the primary socializing agents. Another advantage, as will be seen, is that it yields a rich set of outcomes which, though influenced by economic returns to the different behavioural dispositions, are not entirely determined by such economic returns.

The model developed here embeds this process of preference evolution into an environment in which agents' returns depend crucially on the actions of profit-maximizing firms. In modeling the productive side of the economy, our setting is motivated by observations, like those above, that personal trustworthiness considerations play a critical role in determining the reliability of trading partners and hence the type of production that will be feasible.⁵ Thus, a firm's decision to use a technology which, though more productive, requires vulnerability to expropriation, depends on its beliefs about the population's trustworthiness and hence on the society's social capital. The evolution of individuals, and therefore social capital, is in turn affected by firms' production decisions. Social capital is built and maintained when firms choose production that leaves them vulnerable to expropriation; for in this sort of production trustworthiness matters, and the trustworthy types can reap additional rewards. Conversely, when firms never allow themselves to be vulnerable to expropriation, trustworthiness becomes irrelevant, and the evolutionary process leads to its demise. This inter-relation between the society's social capital and the actions

⁵This is often couched as part of a more general argument for the essential accompaniment of social capital to economic development as in, for example, Grootaert (1997) and Woolcock (1998).

of firms will be key to the process of development here. Development succeeds when a beneficial and mutually reinforcing dynamic emerges between firms and types. This encourages high levels of modern production and high levels of social capital.

Since types are an inherent personality disposition, these adjust only slowly to changes in the underlying environment. Firms' production decisions, on the other hand, can change relatively fast. This complementarity between fast changing firms and slow changing types has significant implications. We explore a situation where, even though new opportunities are inherently more efficient, they can fail to take hold if introduced too quickly, and their introduction may lower welfare. Conversely, such changes would have succeeded and raised welfare had they been introduced slowly enough. This scenario illustrates one possible explanation for the poor performance of late developing countries who had the supposed advantage of the opportunity for rapid technological catch-up. The existence of a state variable, which is slow to adjust, can also explain why countries with the same underlying parameters that are locked into a bad steady state, may find it difficult to move to a better one.

Theoretically, the most closely related paper to the present work has been by Noe and Rebello (1994) who have examined "managerial ethics". There, ethical managers could be trusted to apply appropriate effort even when financial incentives were not sufficiently strong to mitigate agency problems. They consider how production choices vary with aggregate ethic levels, and, in turn, how ethic levels affect returns to previous levels of ethics. They similarly model choices of managerial ethics by explicitly considering the effects of parental socialization and allow for selection of non-payoff maximizing "ethical" behaviour. The focus of the economic part of the model in our framework is however entirely different. Ours is on the production process in LDCs and the possibility of self-reinforcing interaction between modern production and the trustworthy type, and policies that can help in ensuring development success. The focus of their model is cycling ethical levels within already developed countries. Another similarity is to a relatively recent literature that emphasizes the role played by agents' non-pecuniary motivations; Francois (2000), and Besley and Ghatak (2003) examine the implications of such motivations for the role of public sector provision of services, Akerlof and Kranton (2003) explore the implications of non-pecuniary motivations in the worker-firm relationship.

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 including the policy implications. A brief conclusion is provided in Section 5.

2 The Model

The economy is infinitely lived and each period is denoted by a t subscript. Each period there is born a unit measure of ex ante identical potential entrepreneurs who live for one period. These

agents decide whether to enter entrepreneurship and engage in “modern” production, which leaves them vulnerable to opportunism on the part of trading partners, or stay in “traditional” production, where there is no such vulnerability. Traditional production is normalized to have returns of 0. At the same time, the trading partners of these entrepreneurs, called “contractors”, are also born, and we assume that they are also of measure 1 in total and also live for only one period.⁶

Modern production necessarily requires the purchase of services (or goods) over which there is no possibility of formal contracting. If successful, the interaction generates a positive surplus; however, uncertainty arises because, lacking contracts, entrepreneurs are vulnerable to opportunistic trading partners. In particular, entrepreneurs must invest a fixed and sunk amount, $k > 0$, in the project before production can occur. If the services promised by their trading partner, the “contractor”, are correctly contributed, the project is successful and generates a gross surplus $\pi(p_t)$, where $p_t \in [0, 1]$ is the total number of entrepreneurs producing at time t , and the function $\pi(p_t)$ is continuous. The net potential surplus of the project is thus $\pi(p_t) - k$.

If, however, the contractor does not contribute the required inputs, then the sunk amount k is lost by the entrepreneur. The gross surplus to a single project in the modern sector is decreasing in the total number of entrepreneurs, for any of the usual reasons, so that $\pi'(p_t) < 0$, and the decline in profitability occurs at an increasing rate, $\pi''(p_t) \leq 0$.⁷ We denote $\pi(0) = \pi^u$ and $\pi(1) = \pi^l$ as the upper and lower bounds of modern production respectively. There is free entry into entrepreneurship up to the exogenous population size 1.

The lack of contracting in our model is pervasive, as in Grossman and Hart (1986): it is impossible to hold the contractor liable if the correct effort is not contributed; there is also no possibility of writing an ex ante agreement between the parties that will divide the gross surplus, $\pi(p_t)$, ex post, in case of success. When successful, we assume that the entrepreneur is able to appropriate proportion α of the gross surplus, while the contractor obtains the remaining $(1 - \alpha)$.⁸ The precise division is immaterial, all that is necessary is that α does not take on either of the extreme values, so we assume throughout that $\alpha \in (0, 1)$.

⁶It may seem artificial to assume equal numbers of traders on both sides of the market. However, this buys us nothing here, since we allow for free entry of entrepreneurs and entry never exhausts supply, i.e. is always less than 1. We could thus, without loss of generality, assume a potentially larger population of entrepreneurs without effect.

⁷This could be because there is diminishing returns at the aggregate level, or underlying heterogeneity in abilities, or simply through increased competition in the final product market which reduces the value of output. Allowing for the case of $\pi'' > 0$ does not alter the paper’s main results, but makes the analysis more complicated. We discuss this case further after the results are presented.

⁸In a successful relationship this division may occur through transfers between the parties, or perhaps directly through pricing of the input. We do not model how this division occurs. An alternative and equivalent interpretation of the shares is as arising from a Nash bargaining game over the final output $\pi(p_t)$ between the parties, with the entrepreneur’s relative bargaining strength captured through the parameter α . Thus the outcome of this bargaining game is that the entrepreneur receives amount $\alpha\pi(p_t)$ and the contractor amount $(1 - \alpha)\pi(p_t)$. Alternatively, generating such divisions from more basic primitives, such as an alternative offers bargaining game, as in Rubinstein (1982), would also change nothing.

A potential moral hazard problem arises because the contractor gains a financial benefit of amount $b > 0$ if NOT performing the actions promised to the entrepreneur. We can think of this amount b as the benefit obtained from not having to exert the effort required to produce high quality, or the savings that come from substituting cheaper inputs, or the cost saving from not engaging in proper quality control, or it could, alternatively, denote the monetary benefit the contractor can expropriate from the project. The precise form of this gain in particular applications will depend upon both the type of production and the pervasiveness of contracting limitations. A concrete example is the emphasis on quality (and its non-contractibility) that is a pervasive problem highlighted by small scale entrepreneurs in case studies of industrial networks, as documented by Katz (1987) who provides a comprehensive overview in the Latin American context. The assumption of no formal contracting may seem unrealistic, but introducing the possibility of formal contracting over some elements of the relationship would not change things provided there remained some components that could not be specified under the contract. For example, with formal contracting over the timeliness of delivery (allowing punishment for lateness), the amount b may correspond to reducing quality in a way which could not be described by the contract. If we were thus to enrich the framework to allow contracting over some elements of the interaction, the amount b would then correspond to whatever is left over after all the things that can be contracted over have been. We assume b is independent of the entrepreneur’s fixed cost, k , which shall vary in the comparative static exercise, though they could alternatively be positively linked without loss of generality.

2.1 Preferences

Entrepreneurs care only about expected returns. Contractors, on the other hand, are one of two different “types”. A contractor is either “trustworthy” or “opportunistic”. These characteristics are intrinsic to the individual, inculcated by social conditioning (described in the next section), private information, and not subject to change throughout the individual’s life. Once having *promised* to undertake the correct actions, trustworthy individuals would never choose to do otherwise. This is a short hand way of saying that they are moral (in Taylor’s (1989) sense of a strong evaluator). Though physically able to break promises, preferences are such that violating their undertaking makes them so much more worse off that they do not even consider doing it.⁹ Since these individuals effectively have fewer choices in all of their lifetime interactions, these preferences carry costs. We model these simply as an amount F , measured in the utility metric.¹⁰

⁹This is also similar to what Basu (2001) has termed an “action limiting norm” or what Platteau (2000) analyzes under the heading of “moral norms”.

¹⁰ F is measured in this way because we do not model any of the other lifetime interactions and opportunities, which we assume are orthogonal to their contracting activities. Enriching the model of lifetime interactions to allow these costs to arise endogenously, by for example allowing individuals to interact on other dimensions, would not qualitatively alter the main results.

Such individuals also “enjoy” fulfilling their commitments. That is, when making good on their promises they receive a psychological, non-pecuniary, benefit. The existence of such intrinsic rewards seems an indisputable part of many individuals’ makeups, and is well recognized in the socio-psychological literature. Platteau (2000, p. 299) provides an extensive discussion of the evidence regarding such intrinsic motivation and they are also examined in Elster (1989), Weber (1978), Opp (1979), Jones (1984) and Coleman (1990). We model such rewards here by the parameter γ , which is also measured in the utility metric.

For simplicity, utility is assumed to be linear in consumption (or equivalently income) y , and we specify γ and F so that utility of a trustworthy person, u_t^T , living in period t can simply be expressed as the addition of these three components. That is:

$$u_t^T = y_t + d_t\gamma - F,$$

where $d_t = 1$ if the individual has met promised commitments, and $d_t = 0$ if no such commitments were made. We do not explicitly denote the utility realized when breaking promised commitments as we assume this is low enough to never be chosen.¹¹

Opportunists differ in that they always maintain the possibility of violating their commitments, without personal loss. These individuals are simply homo-economicus. They neither feel a sense of remorse when violating promises, nor feel good when delivering on their promises, and are concerned only with outcomes. For opportunists then, the amount $\gamma = 0$ always, and prior promises do not restrict their actions. Their lifetime utility, u_t^O , only depends on the amount of income they earn, linearly, that is:

$$u_t^O = y_t.$$

Opportunists always cheat

By design, we are interested in situations where the pecuniary logic of the contractor’s decision favors not fulfilling their obligations. In that case, only contractors that are trustworthy will perform as required. A simple restriction that ensures this is:

$$(1 - \alpha)\pi^u < b. \tag{1}$$

Given (1), opportunists will never meet promises of reliable delivery when contracting with entrepreneurs, so $u^O = b$, if trading with an entrepreneur. A trustworthy individual, however, because of the prohibitive disutility to deceiving their trading partner, delivers the good or service as promised and realizes a successful project, their share of which is $(1 - \alpha)\pi(p_t)$. In addition, they receive the non-pecuniary benefit, γ , but, they have also suffered a lifetime loss from their

¹¹This assumption does make the model appear similar to a model in which evolution selects strategies instead of preferences. As will be seen this is not the case for the opportunists who choose actions to maximize material payoffs and will, if returns are high enough, choose to mimic the strategies of the trustworthy. More generally, the modelling of the trustworthys’ behaviour could be extended slightly to allow for them to break promises when pecuniary payoffs are high enough, without altering any of the paper’s basic findings.

reduced choice set of F , so that their lifetime utility is $u^T = (1 - \alpha) \pi(p_t) + \gamma - F$.¹² If not trading, recall that each receives their alternative pecuniary rewards normalized to 0. The lifetime utility of a trustworthy individual in that case is $u^T = -F$, and the opportunist obtains $u^O = 0$.

2.2 Matching process

We assume that each entrepreneur matches with at most one contractor once in their life. Given their opportunity costs of trade, any contractor, both opportunistic and trustworthy, is better off trading with an entrepreneur than pursuing their alternative, yielding utility 0; opportunists would cheat and obtain $b_t > 0$ from the interaction, trustworthy would trade honestly and receive $(1 - \alpha) \pi(p_t) + \gamma > 0$. Since there is a stable measure 1 of contractors in the population each period, this implies that the number of contractors who are willing to trade at least weakly exceeds the number of entrepreneurs in modern production. Thus the contractors' side of the market is always in zero or positive excess supply, but since contractors' types are unobservable, and ex post divisions of the surplus cannot be mandated by contract, the excess supply cannot be adjusted by competition between the contractors. Consequently, the contractors are rationed randomly with p_t , which denotes the proportion of entrepreneurs in modern production at time t , also denoting the probability of a contractor trading with an entrepreneur then.

For given p_t , expected lifetime utility of a contractor of either type is:

$$E[u_t^T] = p_t [(1 - \alpha) \pi(p_t) + \gamma] - F$$

and

$$E[u_t^O] = p_t b.$$

2.3 Cultural evolution of preferences

The determination of individual types, i.e., trustworthy or opportunistic, is driven by an evolutionary process of cultural selection. This part of the model borrows heavily from Bisin and Verdier (2001) who have developed a model of cultural evolution in the spirit of Boyd and Richerson (1985) and Noe and Rebello (1994) which recognizes that successful enculturation need not be equivalent with payoff maximization. Here selection is not exclusively based on fitness, as in standard evolutionary models, but instead on the parents' evaluation of lifetime returns based on their own preferences.

There is asexual 1 for 1 reproduction with the possibility of only two types in the population; the trustworthy and the opportunists, as specified above. Intergenerational transmission of pref-

¹²In reality, there can be other benefits to being trustworthy that do not depend on realizing trading opportunities. That is, it might be possible that the benefit embodied in the term γ could be realized through other forms of interaction, and thus support the evolution of trustworthiness, even in the absence of risk taking entrepreneurs. We rule this out of the modeling here, but it is one way of interpreting the recent discussion regarding the demise of voluntary and civic organizations and its impact on social capital, as raised by Putnam (2000) and others.

erences occurs through a stochastic socialization process. Increased parental effort at socialization increases the probability that an offspring will be the same type as the parent. When a parent socializes a child to have the same preferences as themselves we call this *direct socialization*. There is also a probability that an individual's characteristics will be determined by imitation of someone outside the family, a process which we call *indirect socialization*. Let the fraction of individuals who are trustworthy, or T type, be denoted β and those not, the O type, are fraction $1 - \beta$. The probability that a trustworthy parent directly socializes a child into being trustworthy is denoted $d^T(\beta_t, p_t)$; correspondingly, the probability that an opportunist directly socializes their child into being an opportunist is $d^O(\beta_t, p_t)$. Both of these probabilities are allowed to be functions of the proportions of each type in the population, β_t , and the measure of entrepreneurs in production, p_t . We will return to the precise relationship subsequently.

If a child from a family with trait $i = T$ or O is not directly socialized by their parent, then he or she is indirectly socialized with a trait by imitating a randomly chosen non-family member. This person may be a teacher, more distant family member, or anyone else with influence, but the upshot is that the probability of indirect socialization to a particular type simply reflects the frequency of that type in the population. Thus, for a family of type T , with probability $1 - d^T(\beta_t, p_t)$ the child is not directly socialized by the parent, then with probability β_t the child is indirectly socialized to be T anyway, and with probability $1 - \beta_t$ she is indirectly socialized to be O type. Conversely for a child of an opportunistic parent, with probability $d^O(\beta_t, p_t)$ the child is directly socialized by the parent; however, failing this, with probability $1 - \beta_t$, she is indirectly socialized to be the same type as her parent anyway, and with probability β_t she is indirectly socialized to be trustworthy. If we let P^{ij} denote the probability that a child from a family with type i is socialized to trait j , then, by the law of large numbers, P^{ij} will also denote the fraction of children with a type i parent who have preferences of type j .¹³ We then have the following equations describing these probabilities:

$$\begin{aligned}
P_t^{TT} &= d^T(\beta_t, p_t) + (1 - d^T(\beta_t, p_t)) \beta_t \\
P_t^{TO} &= (1 - d^T(\beta_t, p_t)) (1 - \beta_t) \\
P_t^{OO} &= d^O(\beta_t, p_t) + (1 - d^O(\beta_t, p_t)) (1 - \beta_t) \\
P_t^{OT} &= (1 - d^O(\beta_t, p_t)) \beta_t
\end{aligned} \tag{2}$$

From these, the difference equation for β is:

$$\beta_{t+1} - \beta_t = \beta_t (1 - \beta_t) [d^T(\beta_t, p_t) - d^O(\beta_t, p_t)].$$

We shall use the continuous time limit of this, as is standard in evolutionary models, from now

¹³We evoke the law of large numbers over the unit interval here, see Bisin and Verdier (2001) and the references therein for justification of this.

on. Thus:

$$d\beta_t = \beta_t (1 - \beta_t) [d^T(\beta_t, p_t) - d^O(\beta_t, p_t)]. \quad (3)$$

This differential equation describes how β_t evolves in a population depending on the socialization efforts of parents of the different types. It is clear from equation (3) that the direction of evolutionary change depends critically on the relative probabilities $d^T(\beta_t, p_t) - d^O(\beta_t, p_t)$. It, very intuitively, states that if the probability of direct socialization by a parent of type T exceeds that of a parent of type O then evolutionary pressures lead to an increase in type T and vice versa. We now structure these socialization probabilities d^i .

Direct socialization is increasing in relative returns to own type

We assume that parents, in deciding whether to socialize their own children after themselves, evaluate the expected lifetime utility of a person of their own type. The only reasonable assumption to make here is that, the better a person of their own type does relative to the other type when evaluated with their own preferences (which can involve more than just income), the higher the probability of direct socialization.

Thus, $d^T(\beta_t, p_t)$ is increasing in $E[u_t^T] - E[u_t^O]$ when evaluated using type T 's preferences, and $d^O(\beta_t, p_t)$ is increasing in $E[u_t^O] - E[u_t^T]$ when evaluated using type O 's preferences, where E denotes the expectations operator. Clearly, the only difference in parental types' evaluations of outcomes is caused by the entry of the non-pecuniary, γ , term for the trustworthy parents. Thus, with p_t firms in modern production, the evaluation from the perspective of trustworthy parents yields: $d^T(\beta_t, p_t)$ is increasing in $E[u_t^T] - E[u_t^O] = p_t[(1 - \alpha)\pi(p_t) + \gamma - b] - F$. Similarly the evaluation from the perspective of opportunistic parents yields: $d^O(\beta_t, p_t)$ is increasing in $E[u_t^O] - E[u_t^T] = p_t[b - (1 - \alpha)\pi(p_t)] + F$. It thus follows directly that the difference in probabilities, $d^T(\beta_t, p_t) - d^O(\beta_t, p_t)$, is increasing in the expression $p_t[(1 - \alpha)\pi(p_t) - b] - F + p_t\gamma/2$. Note also that because γ is arbitrary, we can with loss of generality replace the latter expression with $p_t[(1 - \alpha)\pi(p_t) - b] - F + p_t\gamma$.

Thus, let $\Phi : R \rightarrow [-1, 1]$ define the mapping from $p_t[(1 - \alpha)\pi(p_t) + \gamma - b] - F$ to the probability difference $d^T(\beta_t, p_t) - d^O(\beta_t, p_t)$. Apart from $\Phi' > 0$ derived above, the precise operation of the evolutionary process will depend critically on additional properties of this mapping. First, for simplicity, we will assume that Φ is continuous. More importantly, to provide any interesting insight into the evolution of preferences we must allow for socialization probabilities to vary with utility realizations in a way that would allow the possibility of both types being represented in the population. In particular, we need to rule out situations in which one type clearly dominates. For example, if it is always true that $d^O < d^T$, then the evolutionary dynamics implied by (3) necessarily drives $\beta \rightarrow 1$. Conversely, if always $d^O > d^T$ then $\beta \rightarrow 0$ always. At this point, this simply involves an arbitrary restriction on the value at which the Φ function changes sign. That is, we assume:

$$\Phi(0) = 0. \quad (4)$$

As will be seen, the parametric restrictions that will be imposed in section 2.5, when combined with (4), ensure that both types will be possible.

Substituting the Φ mapping into the replicator function, equation (3), we obtain an expression describing the evolution of β , the proportion of trustworthy agents in the population:

$$d\beta_t = \beta_t(1 - \beta_t) \Phi(p_t [(1 - \alpha)\pi(p_t) + \gamma - b] - F). \quad (5)$$

Note the “slow” adjustment implied by such an evolutionary specification. If direct parental socialization favors increased trustworthiness, $d^T > d^O$, then evolution will produce more trustworthy individuals, but the population will not immediately become full of trustworthy types.

2.4 Dynamic adjustment of entrepreneurs

The equation of motion for p_t is more straightforward. The critical assumption here is that entrepreneurs can enter and exit quickly relative to the speed at which individuals’ characteristics change. Entrepreneurial expected returns in modern production are:

$$E[\alpha\pi(p_t)] = \alpha\beta_t\pi(p_t) - k \quad (6)$$

We assume all of this adjustment occurs immediately.¹⁴ In particular, for given β_t define $p_t^* \in R$ such that: $\alpha\beta_t\pi(p_t^*) - k = 0$. Note that p_t^* is unique. Thus, motion in this dimension is described by the following equations. For a given p_t ,

$$\left. \begin{array}{l} \text{if } \alpha\beta_t\pi(p_t) - k < 0, \text{ then } p_t > p_t^* \text{ and entrepreneurs exit so that } p_t = \max\{0, p_t^*\}; \\ \text{if } \alpha\beta_t\pi(p_t) - k > 0, \text{ then } p_t < p_t^* \text{ and entrepreneurs enter so that } p_t = \min\{1, p_t^*\}; \\ \text{if } \alpha\beta_t\pi(p_t) - k = 0, \text{ then } p_t = p_t^* \text{ and there is no change in } p_t. \end{array} \right\} \quad (7)$$

These assumptions assure that p is a jump variable, which implies that entrepreneurs are always in equilibrium, entering or exiting risky modern production immediately.

2.5 Parameter restrictions

We first assume that trustworthiness is critical for entrepreneurial production:

Assumption 1. If everyone is trustworthy, then production is always profitable:

$$\alpha\pi(1) = \alpha\pi^l > k.$$

¹⁴Nelson and Winter (1982) in their classic application of evolutionary considerations to firms, argue that the speed of firm adjustment will be quicker than that of individual types. Here we do not treat the entrepreneurship that underlies firms as evolutionary because we are not allowing factors, other than the purely pecuniary, to enter into entrepreneurial decisions. We could modify the framework to allow for firms to respond in an evolutionary manner and this would not affect results provided that they still changed more quickly than individual types, and they continued to be driven by evolutionary forces that are pecuniary. It may seem strange to treat entrepreneurship, and thus firms, as wholly pecuniary, while at the same time treating type selection as affected by more than the purely pecuniary. However, the evolutionary pressures that come to bear on firms are much more likely to be payoff based. In particular, firms that follow explicitly non-pecuniary motivations should be driven out of the market by the forces of competition. However, in the process of cultural selection it is not necessarily true that non-payoff maximizing strategies are selected against.

Assumption 2. If no one is trustworthy, then production can never be profitable:

$$\pi^u \text{ is finite valued.}$$

Assumption 2 is sufficient to rule out production occurring without the trustworthy. It seems a natural assumption to make but we note it here explicitly since it is inconsistent with Inada conditions. Assumption 1 ensures trustworthiness has substantial impact on production. All potential entrepreneurs would be able to enter modern production if only there were enough trustworthy individuals around.

The following two restrictions affect type selection:

Assumption 3.

$$(1 - \alpha) \pi^u + \gamma - b > 0.$$

This assumption ensures that the net pecuniary benefit to being trustworthy in the best possible case, i.e. when it yields highest possible returns relative to an opportunist, $(1 - \alpha) \pi^u - b$, plus the utility benefit to such action, γ , has to be positive.¹⁵ If this did not hold, it could never be the case that evolutionary forces could ever favor the selection of the trustworthy type. Finally we cap the returns to trustworthiness so that this is not always selected irrespective of environment:

Assumption 4.

$$(1 - \alpha) \pi^l + \gamma - b < 0,$$

recalling that the term π^l denotes the lowest level of gross profit from a successful interaction.

2.6 Steady states

The interaction between equations (5) and (7) determines the model's steady states. From (5) the term in large parentheses describes the expected returns to trustworthiness relative to opportunism, $E[u^T] - E[u^O]$:

$$p_t [(1 - \alpha) \pi(p_t) + \gamma - b] - F. \tag{8}$$

The sign of (8) determines the direction of evolutionary change, $d\beta$, for $\beta \neq 0$ or 1. It does not directly depend on β , but depends in a non-monotonic way on p . The non-monotonicity is intuitive. The chance of trading with an entrepreneur depends on their frequency, i.e., p_t outside the square brackets in (8). But the relative benefits of trading also depend on p_t , negatively, because the term $(1 - \alpha) \pi(p_t) + \gamma - b$ is monotonically decreasing in p_t – as the proportion of successful trades increases, each successive one creates less surplus. The derivative of (8) with respect to p_t yields:

$$(1 - \alpha) \pi(p_t) + \gamma - b + p_t (1 - \alpha) \pi'(p_t). \tag{9}$$

¹⁵Without this assumption, our evolutionary framework becomes degenerate, opportunism is the only outcome and production can never occur. Necessarily, if we altered the function Φ in the replicator dynamic then the values in Assumption 3 would also have to be altered, but intuitively the same relationships would have to hold. Of course, the assumption is necessary but not sufficient, since the term F is not included, but the main existence result is stated conditional on F .

The sign of this is indeterminate, however the second derivative of the expression (8) simply reduces to:

$$2(1-\alpha)\pi'(p_t) + p_t(1-\alpha)\pi''(p_t) < 0, \quad (10)$$

where the sign follows since $\pi', \pi'' < 0$.¹⁶ Since $(1-\alpha)\pi(0) + \gamma - b > 0$, the function initially slopes upwards at $p = 0$, reaches a unique turning point at which it changes slope, and then declines thereafter. Expression (8) is depicted in Figure 1.

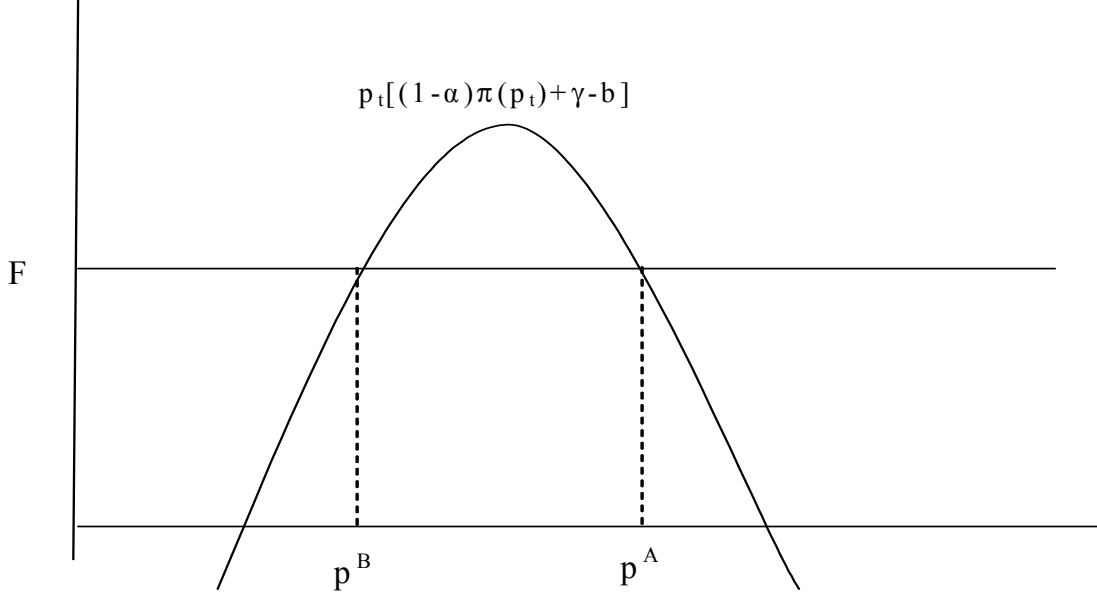


Figure 1.

This expression is useful for establishing the model's existence proposition for interior steady states.

Proposition 1 *Under Assumptions 1-4, there exists a unique stable interior equilibrium, (p^A, β^A) , if, and only if, there exists at least one value of $p \in (0, 1)$ such that $p[(1-\alpha)\pi(p) + \gamma - b] - F > 0$. In this equilibrium,*

$$\beta^A(1-\beta^A)\Phi(p^A[(1-\alpha)\pi(p^A) + \gamma - b] - F) = 0 \quad (11)$$

and

$$\beta^A\alpha\pi(p^A) - k = 0. \quad (12)$$

¹⁶If the model were extended to allow $\pi'' > 0$, then the second derivative would, in general, not be possible to sign. This would imply the possibility of multiple crossing points in the interior, which as will be seen, implies the possibility of multiple interior steady states. As stated earlier, this does not change the model's main qualitative results, which we demonstrate once these have been established.

The formal proof of this, and all other results, is contained in the appendix, but the way the model operates can be understood diagrammatically. The condition that $p[(1 - \alpha)\pi(p) + \gamma - b] - F > 0$ ensures that, in Figure 1, there exist some values of p such that the curved line which represents the net benefit of being trustworthy, exceeds the amount F , its costs. Since the benefits of trustworthiness are independent of β , this implies $d\beta$ in β, p space is as depicted in Figure 2 below, with the $d\beta = 0$ lines corresponding to the crossing points between the curved line and F in Figure 1, and the point p^A given implicitly by the value at which the term in large parentheses in condition (11) equals zero:

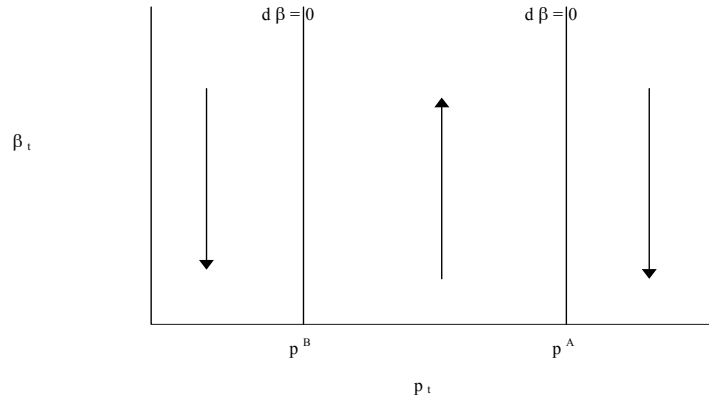


Figure 2, $d\beta = 0$ loci

In the interior between p^B and p^A , evolutionary returns favour trustworthiness since the curve in Figure 1 is above F . Otherwise it is below, so that evolutionary forces lead to declines in β . Similarly, entrepreneurial entry is given by equation (7), so the locus at which $dp = 0$ is where entrepreneurs are indifferent to entry ($\beta\alpha\pi(p) - k = 0$), depicted in β, p space as:

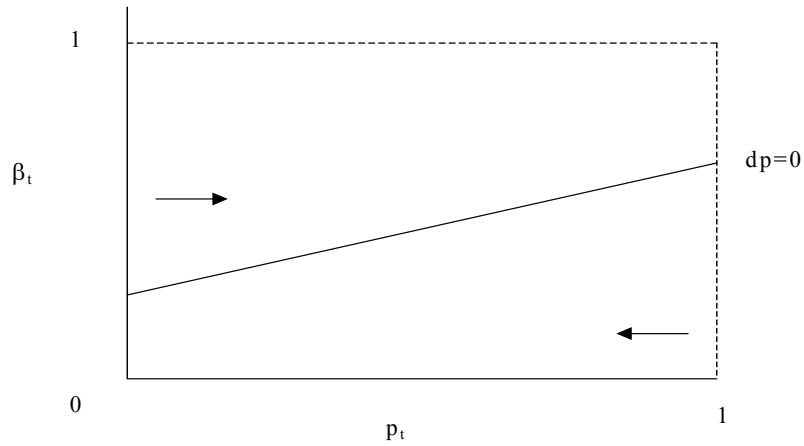


Figure 3, $dp = 0$ locus

Combining the two figures 2 and 3 yields the phase space for both endogenous variables, and steady states are the points of intersection in these. Assumptions 1-4, stated above, are sufficient to ensure that the $dp = 0$ locus is sufficiently flat for crossing points to be in the interior of the phase space.

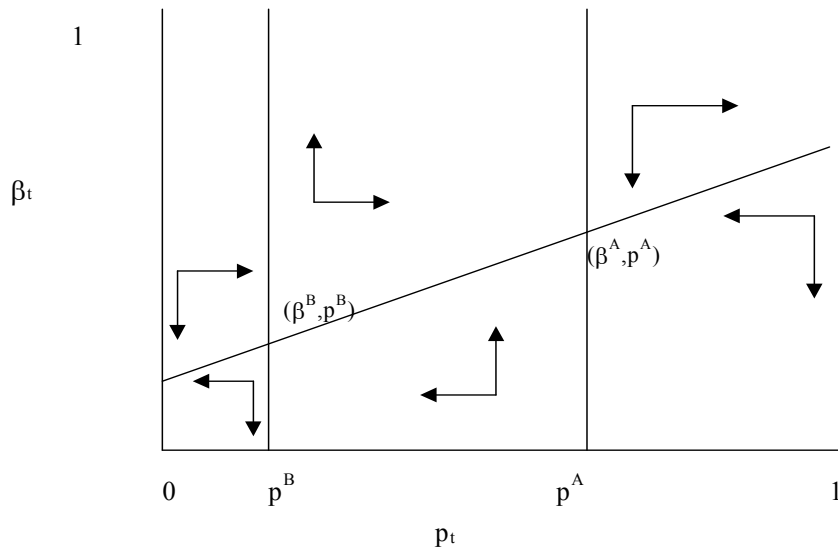


Figure 4, Interior Steady States

In the stable interior steady state (β^A, p^A) , entry of entrepreneurs into modern production up to p^A provides evolutionary incentives for maintenance of proportion β^A trustworthy types

in the population, which is the society's stock of social capital. But, in turn, with proportion β^A trustworthy types in the population, entrepreneurial entry up to p^A just dissipates expected profits of entry.

Note the central role played by the non-standard evolutionary dynamic that we have used here. By construction, condition (1), opportunists always do better than the trustworthy in a strictly pecuniary sense. If we had used a traditional replicator dynamic based only on fitness as in Nyberg (1997) or Fershtman and Weiss (1998), there would never exist an interior steady state, since trustworthiness could never exist and we would always have zero social capital.¹⁷ The dynamic we have used recognizes, however, that parental decisions regarding socialization of off-spring are based on more than pecuniary assessments, and include an evaluation of expected outcomes using their own preferences. Thus trustworthiness can persist in steady state if parents estimate that the *utility* returns to being trustworthy are high enough, as in the interior steady state.

There also exist possible steady states at the corners:

Proposition 2 *Under Assumptions 1-4 there exists a stable steady state with no modern production, complete opportunism, and hence no social capital ($\beta = 0, p = 0$). There also exists a steady state at ($\beta = 1, p = 1$) but this is unstable.*

Without entry into entrepreneurship, $p = 0$, the trustworthy earn strictly lower lifetime rewards than opportunists and none exist, $\beta = 0$. This is self-reinforcing, for without any trustworthy agents, modern production is bound to fail and entrepreneurs do not enter.

The multiplicity of steady states here suggests a possible explanation for why countries with seemingly equal access to technology show such marked differences in total factor productivity. Prescott (1998) argues that technology differences are an inescapably large source of differences in consumption per head across countries, and that there do not exist good theories as to why total factor productivity should vary by so much, given the relatively easy mobility of know-how across countries. The theory here suggests a partial explanation. According to our theory, the use of such technologies requires vulnerability to opportunism, and rational firms will only risk

¹⁷In their frameworks non-maximizing behavior can persist in evolutionary equilibrium because it is assumed that type is observable, at least with some probability. With this assumption, trading partners will seek out the trustworthy and punish the opportunists by simply avoiding trade with them. This generates evolutionary rewards to individuals who, by their preferences, can pre-commit to not acting opportunistically. Our framework, motivated as it is by the development literature, assumes it is not possible to directly observe types. This literature, as for example in Katz (1987), emphasizes vulnerability to unreliable trading partners precisely because opportunists cannot be readily discerned, and would suggest that direct observation of an individual's type, as in Nyberg (1997), Fershtman and Weiss (1998) or Heifetz, Shannon and Spiegel (2002), where observation is only probabilistic, is not the right sort of approach to use in these settings. The development studies literature also emphasizes the limited nature of interaction, and uncertainty regarding the future, which both thwart attempts to develop reputational trust based on repeated interaction. This is an advantage of the present approach over evolutionary models which support non-maximizing behaviour through repetition of interaction, as in Axelrod's (1984) well known example, or credible commitments based on repetition, as explored by Greif (1994).

this if they believe traders are trustworthy enough, so that social capital is high. This leads to a complementarity between users of the modern technology and social capital, which can cause some economies to be trapped in a low trust steady state, where the technology, even though available, can never be profitably utilized. We think of this as only a ‘partial explanation’ because the theory provides no insight as to why it should be the currently poor countries that are stuck in the low social capital steady state and the developed ones in the high one. The dynamics of change in this system, which we now consider, can however provide a possible explanation for this, which we explore in Section 3.

2.7 Dynamics

As the phase diagram in Figure 4 depicts, the dynamics of this system vary depending on whether β is above or below β^B . Entry into entrepreneurship is instantaneous, as given by equation (7), and evolution of types is gradual. The variable p is a jump variable, implying that adjustment in the horizontal direction is immediate, so that from any point not on the $dp = 0$ locus, adjustment involves immediate change in p until the system is on the locus. Thus for all points at which $\beta > \beta^B$ immediate adjustment in p implies a point on the $dp = 0$ locus which will eventually lead to convergence on (β^A, p^A) . Conversely, $\beta < \beta^B$ will lead to convergence on $(0, 0)$ as dictated by the evolution of β , equation (5). The trajectories of adjustment out of steady state are depicted below.

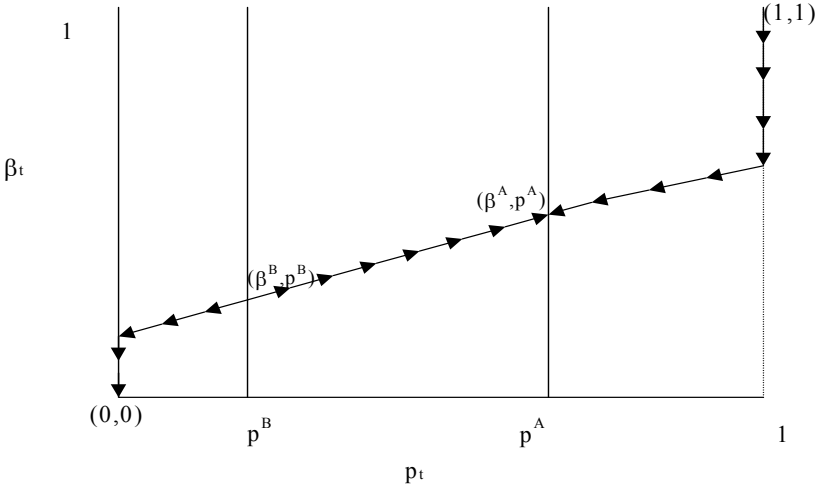


Figure 5, Convergence paths

2.8 Welfare

Since preferences are not primitives, but evolve according to the evolutionary dynamic, standard welfare assessments do not apply. Here we define a partial ordering over outcomes reflecting Pareto type considerations, which we shall use subsequently:

Definition: *Situation A is a welfare improvement over Situation B if and only if in Situation A the expected utility of each agent type – entrepreneur, trustworthy and opportunist – is at least as great as it is in situation B, and, moreover, at least one of the agent types has strictly higher expected utility in A than in B.*

This welfare ordering is only partial because it cannot rank situations where some types are made strictly better off and others strictly worse off. It is a natural analogue of the Pareto criterion for improvement in our environment where the frequency of types can differ.

Free entry into entrepreneurship in modern production always dissipates extra returns there, but in the interior steady state, contractors of both types obtain surplus from interaction with firms. We thus have:

Proposition 3 *Welfare in the stable interior steady state, (β^A, p^A) , exceeds that in the stable corner steady state, $(0, 0)$.*

3 Development Through Trade and Modern Production

We now use the framework to explore some basic implications for the process of development. The engine of development we consider here is the implementation of more productive technologies in the modern entrepreneurial sector. One obstacle to the introduction of these technologies is that they involve scale economies, and the small size of domestic markets in LDCs compared with domestic markets in developed economies, impedes exploiting these. However, the possibility of trading on world markets should allow producers in small markets to exploit scale economies in the production process, and export labour intensive production in reflection of their greater labour endowment. This was part of the reasoning motivating the shift in focus away from import substituting industrialization, which had been emphasized by post war governments in LDCs, towards export led industrialization in the early 1980s. Up until the 1960s and, in most countries until the end of the 1970s, LDCs followed policies that largely dissuaded trade. These included over-valuation of the currency, quotas on imports, tariffs, directed subsidies, low interest rates with credit rationing and directed financing to favoured sectors (usually heavy industry). Debt servicing problems that occurred through the 1980s lead to the partial abandonment of most of these measures at the behest of multinational lending organizations. Also, even where aggregate financial problems were not the direct precipitating factor, the demonstration effect of the successful late industrializers of East Asia (Japan, Taiwan, South Korea, Hong Kong and

Singapore) which, though also having a heavy role for government, focused on export markets, lead to a wave of change in policy to redress biases against trade. These effects were manifest to greater or lesser degree in most developing regions of the world. In Sub-Saharan Africa and Latin America largely through structural adjustment programs and even in South Asia, where levels of indebtedness did not mandate change externally.¹⁸

The concrete manifestation of this in policy towards LDCs occurred throughout the 1980s and into the 1990s. The modern sector in LDCs in which the concerns of trustworthiness are most clearly evident are the industrial clusters or supply networks occurring in cottage industries and small manufacturing enterprises. And it has been argued that these were the areas most challenged by the shift to openness over the period, see for example Altenberg and Meyer-Stamer (1999, p.1700) for a discussion of this. This will be the focus of the policy analysis undertaken here. We shall abstract from the details of these policy changes and model the main impact of openness in a twofold manner. An opening to trade implies, on the one hand, the possibility of import of cheaper mass produced goods from abroad which is a potential threat to producers who are selling to a local market. This was the case of clusters considered by McCormick (1999) in Africa and for those clusters of producers analyzed in Latin America by Altenberg and Meyer-Stammer (1999) where the largest threats were cheap imports from East Asia. On the other hand, the potential to access world markets and the considerable advantages in marketing and exploiting scale economies that this affords, provides an opportunity for enhanced productivity and profit if standards can be raised sufficiently to compete on an international scale.¹⁹

3.1 Modeling openness

It is immediately clear that these positive benefits could not occur if starting in the $(0, 0)$ no-trust equilibrium. In that case, free and open access to world markets would not lead to any change in levels of modern production, since entrepreneurs lack trustworthy trading partners, and even basic modern production cannot get off the ground.²⁰ However, suppose that an economy starts in a situation where there already exists sufficient trustworthiness, so that some modern production already has a foothold, i.e. an economy starting in the (β^A, p^A) steady state. In this section we consider what happens when allowing trade on world markets in this case. We allow the increases in the scale of modern production to raise technical productivity by construction, and ask whether this necessarily increases trustworthiness, entrepreneurship and welfare.

The general equilibrium consequences of accessing world markets and implementing a new

¹⁸See Krueger (1992) for further discussion of these changes.

¹⁹Our analysis is of the impact of trade in allowing industrial productivity to rise. We abstract from the usual well-known benefits arising from the reallocation of resources in line with comparative advantage. In what follows we model the move to openness in an extremely reduced form way by only considering the effects on production in the modern, or industrial sector. By also ignoring consumption benefits, we further understate the benefits of openness, so that we have attempted to be suitably circumspect in the policy analysis that follows.

²⁰Assuming that domestic entrepreneurs cannot trade with foreign contractors for their non-contractible inputs.

technology will not be modeled directly. The important features emphasized by openness in the preceding discussion are the possibility of accessing larger markets which can make the implementation of more productive technologies efficient. We capture these features in a partial and “reduced form” way through the following two exogenous changes in the model: (i) the variable k increases, reflecting the higher fixed cost involved in production at the larger scale {denote the new variable k^W , where W mnemonically denotes “world” markets}; (ii) the value π increases, reflecting the fact that, if successful, the ability to sell on a larger market will generate higher unit sales and higher gross profits. Since $\pi(\cdot)$ is a function, we define a new function $\pi^W(\cdot)$ which corresponds to an upward proportionate shift in the function $\pi(\cdot)$.²¹ The new values, $\pi^W(\cdot)$ and k^W , need to also satisfy the parameter restrictions, assumptions 1 to 4, to ensure existence.

3.1.1 The Effect of Openness on Steady States

Recall the two differential equations governing the dynamics of this system

$$d\beta = \beta_t (1 - \beta_t) \Phi(p_t [(1 - \alpha) \pi(p_t) + \gamma - b] - F) \stackrel{\geq}{\leq} 0, \quad (13)$$

$$dp = \alpha \beta_t \pi(p_t) - k \stackrel{\geq}{\leq} 0. \quad (14)$$

For given p and β substituting $\pi^W(p_t)$ for $\pi(p_t)$ in (13) and solving for points at which $d\beta = 0$ yields $p^{BW} < p^B$, and $p^{AW} > p^A$. Intuitively, this is because of an upward shift in figure 1. In (β, p) space this implies a rightward shift in the locus $d\beta = 0$ at the stable steady state and a leftward shift at the unstable one as depicted below by the dashed lines:

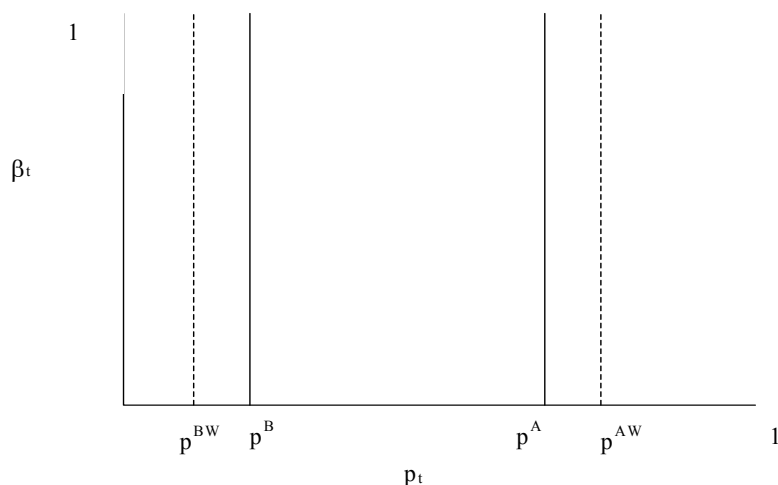


Figure 6, Change in $d\beta = 0$ loci with openness

²¹Allowing for non-proportionate shifts in this function leads to qualitatively similar, though somewhat more complicated, changes in the steady state. These are discussed subsequently.

The effect of openness on (14) is more complex. The direction of change in the locus $dp = 0$, depends upon the inequality

$$\frac{\pi^W(p)}{k^w} \begin{matrix} \geq \\ < \end{matrix} \frac{\pi(p)}{k}. \quad (15)$$

It is not possible to a priori rule out either inequality. We consider two cases separately in the next two sections, each one corresponding to a different direction of inequality in (15). However, without even considering the effect on the $dp = 0$ locus, it can be immediately established that any new stable steady state, if it were to occur at a point $p^{AW} > p^A$, would constitute a welfare improvement:

Proposition 4 *Welfare across interior steady states is increasing in p .*

Intuitively, welfare in an interior steady state with openness rises because such a steady state necessarily involves higher entry, p , into modern production. Even though the new steady state has fixed costs higher, $k^W > k$, by construction, Assumption 1 still holds so that $\pi^W(1) > k^W$. Necessarily then increased entry into modern production is welfare improving. Since expected profits to firms in modern production are dissipated by entry in a steady state, welfare implications can be inferred directly from considering expected outcomes for contractors, which are higher for either type.

3.1.2 When Openness Decreases Reliance on Social Capital it Always Works

Consider first the case: $\frac{\pi^W(p)}{k^w} > \frac{\pi(p)}{k}$. In this case, the change in steady state configurations is as depicted below (with only the stable interior steady state indicated).

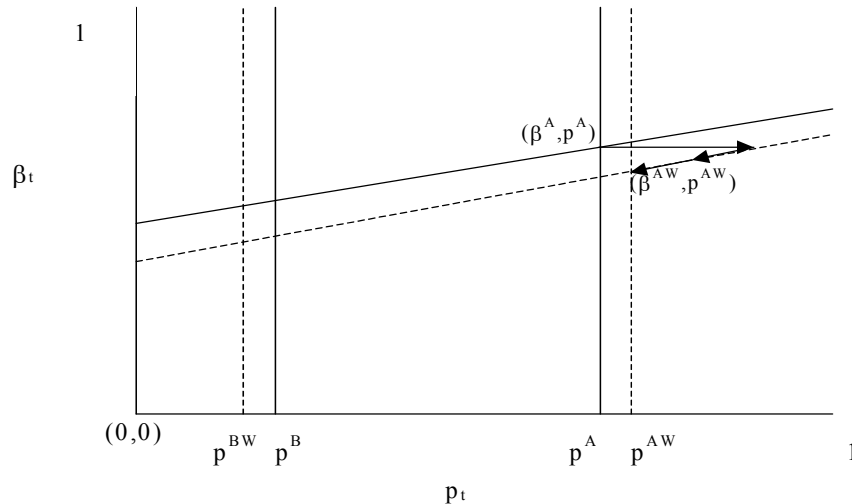


Figure 7, Convergence on interior with fall in $dp = 0$ locus

The dynamics of convergence to the new welfare improving steady state β^{AW}, p^{AW} are depicted by the arrows in the diagram. Change first implies a horizontal jump in the p direction until on the new $dp = 0$ locus, and then convergence along this to the new steady state. There is an initial increase in entrepreneurship reflecting the increased rewards, but then, with lower evolutionary pressure for trustworthiness and its consequent decline, subsequent falls in entrepreneurship follow until the new steady state is reached. In general, the change in level of β from the old to the new steady state is ambiguous (though depicted as lower in the figure) since it depends on the relative size of the shifts in either locus; however, the level of p is unambiguously higher. Ambiguity in the direction of β change is caused by the fact that because increased profitability is proportionately higher than increased fixed costs, openness requires less reliance on trustworthiness. Note also that convergence to the welfare improving steady state occurs generically for any sized shift downward in the $dp = 0$ locus. If the shift were larger so that horizontal adjustment implied $p = 1$, the convergence would simply involve a vertical decline, i.e., a reduction in β for given $p = 1$, until the $dp = 0$ locus were reached and then a similar pattern of southwest convergence.

This change paints an optimistic picture of openness as a path to development. It suggests that, when such openness involves a process that is LESS reliant on the social capital (as evidenced by the fact that the same net level of returns can be obtained with a lower level of trustworthiness)²² then it is bound to succeed, i.e. lead to more production (higher p) and higher welfare. However, even though the current case cannot be strictly ruled out, there are reasons to doubt that investing in scale in order to access world markets requires less social capital, as here. Increasing scale usually implies more vulnerability to opportunism. Katz (1987) has argued that vulnerability was a principal reason for firms in LDCs using production methods requiring lower fixed capital and smaller scale. One may reasonably expect that openness, which forces the development of larger scale modern production, should raise reliance on social capital. We consider that case now.

3.1.3 The Case When Openness Increases Reliance on Social Capital

Now consider values such that $\frac{\pi^W(p)}{k^w} < \frac{\pi(p)}{k}$. For a given chance of success, i.e., holding β fixed, the expected returns to risky modern production fall in this case. The phase diagram sees an upward shift in the $dp = 0$ locus, as shown below:

²²To see this, hold p fixed and note that when $\frac{\pi^W(p)}{k^w} > \frac{\pi(p)}{k}$, β required for $dp = 0$ is smaller.

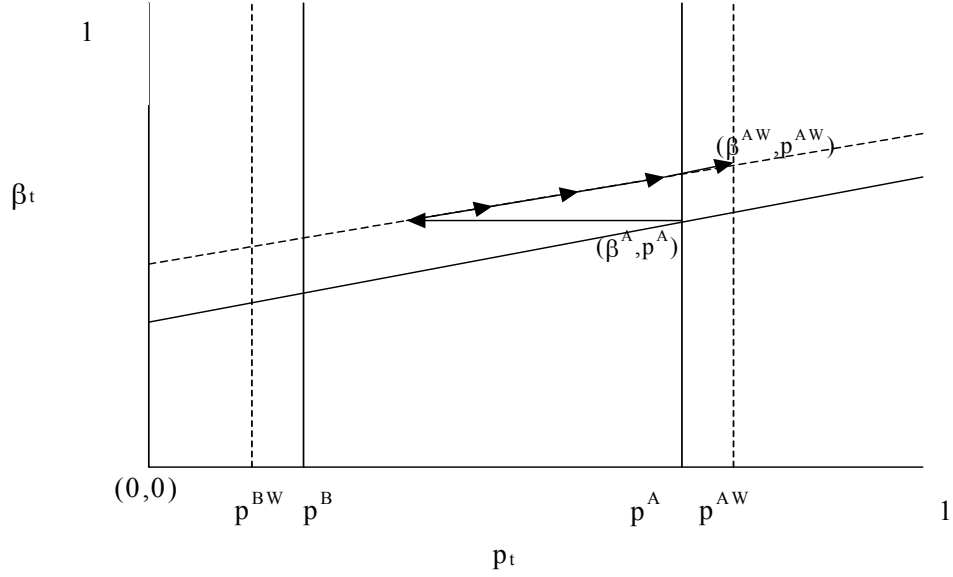


Figure 8, Convergence on interior with rise in $dp = 0$ locus

Here again the figure depicts a case of success through openness. Even though entrepreneurs are MORE reliant on trustworthiness for production to be successful, there is still more entry, and p rises in the new steady state. This is because the influence of the evolutionary forces increases β in the new steady state. This increase in β , in turn, reinforces the entry of more entrepreneurs in modern production, and the net effect is a mutually supportive higher level of both modern production and social capital, together with higher welfare in the new steady state.

The path of convergence to the new steady state depicted in the figure is the converse of that previously. As the economy opens up, there is an immediate and sharp decline in the amount of entrepreneurship in modern production. The increased riskiness of the larger scale technology required to access world markets, reflected in k^W changing more than π^W , and the initially unchanged level of β , initially lowers relative returns in modern production. The reason for this decline is the fast reaction of risk taking entrepreneurs relative to the slow adjustment of the population's type; if the population type could immediately jump to its new steady state level, β^{AW} , there would be no decline. However, despite the decline, convergence to the interior steady state still occurs because evolutionary forces lead to increased pressure for the trustworthy type, and with more trustworthy trading partners, entrepreneurs re-enter modern production, in turn, increasing evolutionary incentives for the trustworthy types, raising social capital, and moving the system towards the new better steady state.

3.1.4 A Failure of Development

The conclusion above is not generic. In particular:

Proposition 5 *Suppose $\frac{\pi^W(p)}{k^W} < \frac{\pi(p)}{k}$ and consider an economy starting in the (p^A, β^A) steady state. Let $p : \alpha\beta^A\pi^W(p) = k^W$ be denoted p' . If $p' > p^{BW}$ then the economy uniquely converges to the welfare improving (p^{AW}, β^{AW}) steady state. If $p' < p^{BW}$ then the economy uniquely converges to the welfare dominated $(0, 0)$ steady state.*

Figure 9 below sketches the movement for the case of $p' < p^{BW}$. Note that the horizontal movement of p in the figure reflects the new equilibrium $\alpha\beta^A\pi^W(p) = k^W$ yielding a value of $p < p^{BW}$ as in the statement of proposition. Thereafter, there is unique convergence on the $(0, 0)$ steady state.²³

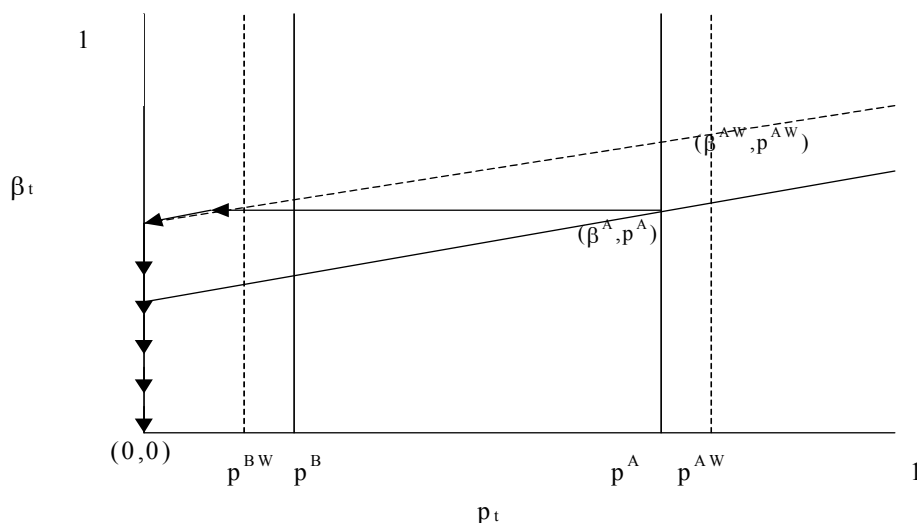


Figure 9 Convergence to corner with fall in $dp = 0$ locus.

This figure depicts the pessimistic scenario for development through openness – a complete breakdown in fledgling modern production, rampant opportunism, total distrust, dismantling of existing social capital, and reduced welfare.

²³Recall that when $\pi'' > 0$ is allowed, it is not possible to rule out multiple stable steady states in the interior of the phase space. In that case, the analogy of Proposition 5's extreme failure of development would occur when the level of β is below that required to sustain the lowest (β, p) interior steady state. There would then also be the possibility of changes that could induce smaller failures and convergence to lower interior steady states, but at least for some parameters, the dynamics sketched above would continue to hold. Allowing for non-uniform shifts in the $dp = 0$ locus would also not affect the qualitative nature of these dynamics. The main complication would however be that the inequality defined in equation (16) would no longer be independent of p . Again, the comparative static implication sketched above would continue to hold in some form, though the possibility of multiple expectations dependent outcomes could arise.

The complementarity in production between rapidly adjusting entrepreneurs and slow to adjust trustworthy types is the root cause of the difference in the two cases. The risk taking entrepreneurs – those who stand to lose from opportunistic behaviour – depend on the trustworthy, but the trustworthy also depend on the entrepreneurs to provide the trading opportunities from which they stand to benefit the most. The critical difference between the scenario above and the case previously is that, in this scenario, the slightly larger decline in entrepreneurship means that there are relatively few opportunities for the trustworthy to find trading partners. This lack of trading partners drives evolutionary incentives to favor opportunism ahead of trustworthiness. Even though the trustworthy who could find trade would be extremely productive, the lack of trading partners implies that evolutionary incentives switch to favoring opportunism. Through time, the further increases in opportunism reinforce this entrepreneurial exit, which, in turn, encourages even more opportunism and so on. The opening to world markets and the opportunity to use a more productive technology sets the economy onto a path, the end result of which is a complete erosion of the initially good social capital.

This potentially damaging effect of openness has been emphasized in the development studies literature, especially with respect to the survival of small scale enterprises. McCormick (1999) in her survey covering six industrial clusters in Africa identified openness to markets as the biggest challenge faced by five of these clusters. However, it has not been clear previously why this should be of concern. True, the influx of cheaper goods undermines their potential, and their inability to attain sufficient quality, or a low enough price, hampers their capacity to compete on world markets. But the standard interpretation is simply that this is a reallocation of resources towards areas of comparative advantage, and should not be a concern per se. Though the benefits for free-trade have been well known to economists for some time, a counter argument pointing out the “de-industrializing” effect of free-trade on LDCs and even the potential for growth to fall as a consequence has been emphasized.²⁴ This is often articulated in terms of a break-down in social capital, though no formal model of this has been provided. The analysis here provides a framework in which such arguments can be formally considered. As we have shut down the usual avenues through which openness raises welfare, our framework cannot address the relative merits of openness. Such a parsimonious model, in any case, is not intended as an instrument for welfare based policy conclusions. Instead, we use the model to shed light on policies that would encourage the maintenance of industrial capability and social capital, conditional upon this being an end.

²⁴Rodriguez and Rodrik (1999) provide a clear conceptual account of these arguments. Matsuyama (1992) demonstrates formally that openness may lower growth.

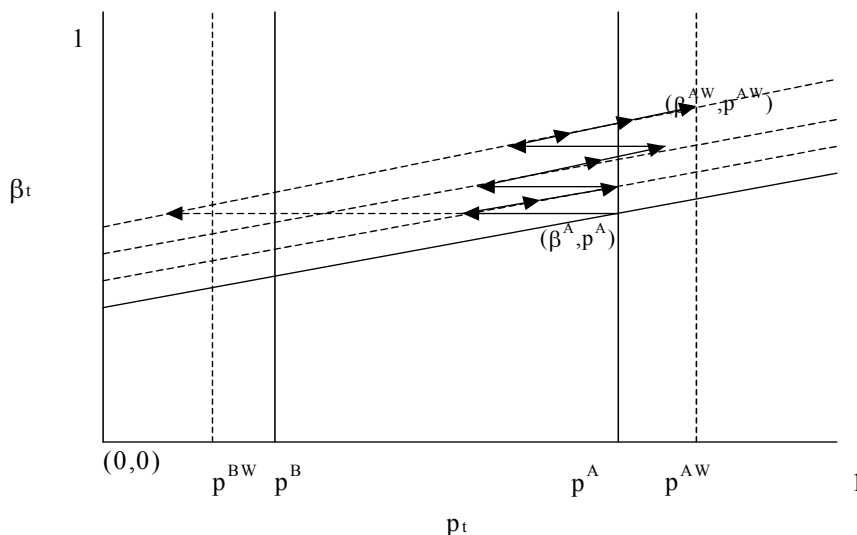
3.2 Policy

The standard prescription of the New Institutional Economics of, for example, Williamson (1985) and North (1990), is that if contracting and enforcement can be improved sufficiently, individual type considerations become less critical, and productivity improving technologies can be implemented. This is also true of the model here. If contracting is good enough, then the problems arising from type variation disappear.²⁵ The restriction we have maintained throughout is that such institutional improvements cannot occur sufficiently. As the literature cited earlier suggests, type considerations seem to play an important role today in LDCs precisely because of weakness in enforcement provided by institutional means. The policies we explore now are useful in such situations.

Gradual change is good

The large size of decline in p causes convergence on the bad steady state in the case of failure. If the change could be broken into smaller components, which are introduced sequentially and gradually, then the negative outcome can always be avoided. To see this, consider a convexification of the changes such that, instead of implementing the whole difference $(k^W - k)$ and $\pi^W(p) - \pi(p)$, only a fraction of the changes, say proportion $\delta < 1$, are implemented in $\frac{1}{\delta}$ steps. Thus, the initial change sees k increase to $k + \delta(k^W - k)$ and $\alpha\pi$ increase to $\alpha\pi + \delta\alpha[\pi^W(p) - \pi(p)]$. Then the magnitude of leftward shift in the locus $dp = 0$ is smaller, as depicted by the first dotted line below.

Figure 10, Sequential shifts in $dp = 0$.



²⁵What is needed is that the amount b that the traders can steal from entrepreneurs falls below what they could earn by obtaining their ex post share of the profits. Analogously, this also corresponds to increasing punishment for those who violate agreements.

If δ can be made small enough, the leftward jump in p can be reduced so that sufficient entrepreneurship exists to sustain positive evolutionary forces favoring increased trustworthiness. Note in the figure that the leftward jump in p to the first dotted line is sufficiently small to maintain evolutionary incentives for trustworthiness. If the change had been implemented all at once, that is, if the change involved implementation of the final dotted line, then as the dashed arrow in the figure shows, entrepreneurship would have fallen by so much that a point to the left of p^{BW} would have been reached, with, thereafter, convergence on the bad (0,0) steady state. As depicted in the sequenced change, in contrast, the movement in the system stays in the North East direction. Once β , and consequently p , have increased sufficiently then the next step in the change can be implemented increasing to $k + 2\delta (k^W - k)$ and $\alpha\pi + 2\delta\alpha [\pi^W(p) - \pi(p)]$, which is depicted as the second parallel dotted line, and the process repeated. By gradualizing the changes in this way, the economy can be forced to converge on the good equilibrium and avoid the bad one.

The dynamics of adjustment outlined above provide a possible explanation for why it is that the early industrializing countries of Western Europe that developed the technology which gave rise to sustained productivity growth may have been able to coordinate on the good steady state, whereas the countries that were late to industrialize, and who have the opportunity to do so by importing that technology dramatically, may not be successful in doing so. In particular, early industrializers had to implement productivity improvements gradually simply because technology improvements had to be discovered, and such discovery was, by its very nature, a drawn out process. Thus, the process of development in the West was one of gradual increases in productivity, similar in nature to the sequential outward shifts in the $dp = 0$ locus that we have sketched above. These gradual changes preserve evolutionary incentives for trustworthiness and allow convergence on the good state. The supposed advantage of being a follower country is that technology does not have to be invented; it can be taken “off the shelf” and implemented in production directly. However, as Figure 9 above shows, such dramatic changes can have a disastrous effect on any existing trustworthiness, and not only fail to be utilized in production, but push the economy to a steady state with lower welfare and productivity than where it started.

The policy implication here for gradualization is reminiscent of older arguments in the development literature which pointed towards a “dynamic externality” arising from small and medium scale manufacturing activity. Such externalities were argued to imply that it takes time for firms to become competitive, see for example Krueger (1992, p.7) for a critical view of this. The very slowness of type adjustment in the model here shows a new, and perhaps more plausible, rationale for these previous arguments.

The result here also suggests a benefit to gradualism which can shed light on the differential performance of ex-communist reform economies. Although these economies are still in flux, and

conclusions about the reform processes are tentative, Roland (2000) provides an authoritative account of the interim consensus view. He summarizes the reform experience that occurred through the 1990s in the light of two opposing views; one of which he terms the “Washington Consensus” which represents a big-bang or shock-therapy view, and the other the “Evolutionary-Institutionalist Perspective” which is gradualist or incrementalist. The Washington Consensus substantially influenced policy in all countries except China. The difference in the focus of reforms is summarized on p.330. The focus of the Washington Consensus is “Liberalization, Privatization and Stabilization”, whereas the Evolutionary-Institutionalist focus is the “creation of institutional underpinning of markets to encourage strong entrepreneurial entry”. It would be wrong to conclude that the Washington Consensus ignores institutions; however, it does place primary emphasis on rules of law and enforcement. The evolutionary-institutionalist approach, in contrast, takes a more primary and more comprehensive view of institutions. Included in this is the view that functioning institutions depend on more than explicitly stated rules. Institutional conditions include

“not only legal and financial change, but also conditions of law enforcement, reform of the organization of government, and the *development of self-enforcing social norms that foster entrepreneurship, trust and respect for legality and commitment.*” Roland p.333 (italics inserted).

Roland concludes that the gradual changing economies, consistent with the evolutionary-institutionalist view, have out-performed those subjected to shock-therapy in line with the Washington Consensus. The distinction between gradual and rapid changers is itself nuanced, as it depends on the dimensions being considered. For instance, some countries undertook rapid privatization of public enterprises but only gradual price liberalization, and little enterprise restructuring; also, de facto adjustment policies often varied from officially stated policy objectives. Most had a combination of rapid and slow reforming elements. Roland provides detailed analysis of theories explaining the relative dominance of the evolutionary-institutionalist view. Some relate to the political economy of reform and others to the particulars of actual privatization and liberalization programs. Another view countenanced stems from what he terms “social behaviour, social norms, and social capital”, but this is not explicitly considered, since, as he notes, this is relatively under-researched. The analysis of the previous section provides such a social capital based account for the relative benefits of gradual reform.

Direct encouragement of trustworthiness is beneficial

Trustworthiness clearly provides an externality here, since the trustworthy make production viable and hence raise expected returns of entrepreneurs. Conversely, entrepreneurs, by undertaking risky production and only receiving fraction α of the returns, provide externalities for the trustworthy. Optimal policy should encourage activities generating positive externalities. There

are numerous examples of government policies in LDCs aiming to do just this in the context of emerging industrial clusters. Altenberg and Meyer-Stamer (1999) provided a review of these policy initiatives, many of which are geared towards maintaining trustworthiness and enhancing cooperation in business networks, in the Latin American context. Some examples are: the *Proyectos de Fomento* in Chile and the *Empresas Integrados* in Mexico. These are government financed initiatives which promote the association of small enterprises, the main objectives of which are to consolidate the building of trust amongst group members. These policies work through provision of subsidies, or tax advantages to joining members, who are then encouraged, along with other members, to explore areas of mutual gain and improvement. Another example is policies that indirectly reward cooperative behaviour, for example providing financial services for micro enterprises that build on group guarantees, as in Rhyne and Otero (1992), which encourage and reward firms for building trust based bonds. In terms of the model here the government in these examples, by providing direct financial rewards for increased trusting and facilitating that behaviour, improves the relative rewards of the trustworthy type and thus improves evolutionary incentives for its maintenance. Though more focused on public good provision, a related policy example is provided by Uphoff's (2000) irrigation case study that was discussed in the introduction. The successful form of irrigation system depicted there, which encouraged cooperation and appealed to underlying norms of social fairness in activating efforts, became Sri Lankan national policy by an act of cabinet in 1988.

4 Discussion and conclusions

Our model has two main features which are non-standard. The first of which is that it rules out, by construction, the possibility of ever designing incentive compatible contracts that will ensure production is not subject to opportunism. Thus, in our framework, successful production depends critically on agents being the right "type". The type required is what we have termed "trustworthy", meaning agents who are willing to fulfill obligations even when these are not in their pecuniary self interest. We have argued that this type concern is a realistic reflection of the actual concerns which businesses have in setting up trading relationships with their suppliers, where such relationships do not depend on the incentive compatibility of the interaction but instead on an inference about trading partners' inherent reliability.

The second feature we have used is an evolutionary model which allows for selection of types using a criterion which is broader than the usual criterion of "fitness" used in standard evolutionary models. In our framework this is essential since, by construction, opportunists always do better, in a strictly pecuniary sense, than the trustworthy, and would thus always be selected using a fitness based replicator. On the grounds of realism alone, the broader non-fitness based selection is at least as plausible as the traditional one, and we have thus utilized a replicator,

pioneered by Bisin and Verdier (2001) which allows this.

We have shown that such a framework provides a possible explanation for why productivity improving changes, like for example opening to trade, can end up worsening production and actually lowering welfare. This finding also provides an interpretation for why follower countries may not be as successful in utilizing the technology pioneered in the West, and why countries with access to the same technology may exhibit such marked differences in utilization. The framework we have developed provides a number of policy conclusions which, broadly speaking, argue the benefits of gradualizing productivity improving changes in LDCs. It also provides a new perspective on the post-communist reforms undertaken through the 1990s.

Though we have modeled this in a parsimonious framework, the basic insight would seem to be readily generalizable to many settings. This is because it follows from only two essential conditions. The first is that culture, in particular trustworthiness or social capital, adjusts relatively slowly in comparison with the speed at which firms are able to adjust their means of production. The second is that social capital is influenced by the mode of production undertaken by firms, and that changes which raise profits may undermine evolutionary incentives for the maintenance of social capital. We have been concerned here with elucidating these effects in a simple and uncomplicated framework; a more serious policy analysis would sacrifice simplicity and embed these concerns in a more standard model that also allowed the benefits of openness. We leave such an analysis to future research.

Finally, the role of institutions has been entirely ignored here. However, institutions almost certainly temper the relationship between social capital and economic actors in ways which mitigate the role of culture that has been emphasized here. Thus, at least for high levels of institutional advancement, our result of a monotonic relationship between social capital and economic success, need not hold. For instance, well functioning means of formal enforcement lessen vulnerability to expropriation and hence lessen firms' dependence on inherently trustworthy types. Well developed institutions of contract and enforcement in relatively rich countries can therefore act as a substitute for social capital and ensure that, even where social capital is low, efficiency enhancing improvements can be enacted. The correct focus of the present work is thus situations where institutions of contract and enforcement are weak.

Appendix

Proof of Proposition 1:

Sufficiency:

We first show that under the sufficient condition in the proposition, there exist two interior valued steady states, in the last section of the proof we shall establish that one of these is always unstable and the other stable. Suppose the sufficient condition holds so that there exists at least one value of p , denoted p' , such that $p' [(1 - \alpha)\pi(p') + \gamma - b] - F > 0$. Then there must exist another value of p denoted p^A exceeding p' with $1 > p^A$, such that $p^A [(1 - \alpha)\pi(p^A) + \gamma - b] - F = 0$. This follows immediately from the continuity of π in p , and Assumption 4. Moreover, from equations (9) and (10) this point is unique and at this point, which is point p^A in Figure 1, we have:

$$(1 - \alpha)\pi(p^A) + \gamma - b + p^A(1 - \alpha)\pi'(p^A) < 0. \quad (16)$$

The continuity and boundedness of π also ensure that there exists a lower level of p , i.e. $0 < p^B < p'$, such that $p^B [(1 - \alpha)\pi(p^B) + \gamma - b] - F = 0$. From equations (9) and (10) this point is also unique and at this point, which is point p^B in Figure 1, we have:

$$(1 - \alpha)\pi(p^B) + \gamma - b + p^B(1 - \alpha)\pi'(p^B) > 0. \quad (17)$$

Note that, for $p < p^B$ and $p > p^A$, $p [(1 - \alpha)\pi(p) + \gamma - b] - F < 0$, however for $p \in (p^B, p^A)$ the opposite holds. The evolutionary implications of these p ranges for $d\beta$ in β, p space are depicted in Figure 2.

Now consider how entrepreneurial entry is affected by “types” in the population. That is, consider $E[\alpha\pi(p_t)]$ from (6). The critical relationship is:

$$\beta\alpha\pi(p) = k \quad (18)$$

in (β, p) space. This locus of β and p values renders entrepreneurs indifferent between modern and traditional production, $dp = 0$. Since $\pi' < 0$, this function is upward sloping in (β, p) space. Note also that, for values of β, p above the function, entrepreneurs have incentive to enter modern production since expected returns exceed fixed costs, and the converse is true for points below the function. When $\beta = 0$, from Assumption 2 (18) can never hold, even for $p = 0$; thus when $p = 0$, (18) only holds when $\beta > 0$. Thus the point at which this function cuts the β (vertical axis) in β, p space is positive. When $p = 1$, it is clear that, from Assumption 1, if $\beta = 1$ then $\alpha\pi(1) = \alpha\pi^l > k$ so that (18) will not hold. The value of β at which (18) holds when $p = 1$ must then be some $\beta < 1$. Thus the $dp = 0$ function cuts the vertical axis above zero and is less than 1 at $p = 1$. The dynamics for entrepreneurs in β, p space are thus as shown in Figure 3.

Steady states occur when $d\beta = 0$ and $dp = 0$. Because the $dp = 0$ locus takes positive values of β , but less than 1, for all values of $p \in [0, 1]$, and under the assumed sufficient condition,

p^A, p^B have both been shown to be elements of $(0, 1)$, thus necessarily there exist two such points, denoted β^A, p^A and β^B, p^B . Combining the two figures 2 and 3 yields the phase space for both endogenous variables and steady states are the points of intersection in Figure 4.

Necessity: We show that if the condition in the proposition does not hold, then there either exists no interior steady state, or at most a unique one, which we demonstrate in the next section is unstable. Suppose that for all $p \in (0, 1)$ $p[(1 - \alpha)\pi(p) + \gamma - b] - F \leq 0$. Necessarily, then either $p[(1 - \alpha)\pi(p) + \gamma - b] - F < 0$ for all p in the range or for some p , $p[(1 - \alpha)\pi(p) + \gamma - b] - F = 0$. Suppose the first situation holds so that $p[(1 - \alpha)\pi(p) + \gamma - b] - F < 0$ for all p . Then, necessarily, for all p , $d\beta < 0$. Thus, the only point of stability for the system is $\beta = 0$. However if $\beta = 0$, then necessarily from Assumption 2, expected profits are $0\pi^u = 0$, so that $p = 0$, which is not an interior point.

Now suppose the second situation holds, so that, for some p at least $p[(1 - \alpha)\pi(p) + \gamma - b] - F = 0$. Firstly, note that since $\pi' < 0$ it can only be the case that this holds at a single p value. Let that value be denoted $p^\hat{}$. Thus the value $p^\hat{}$, is the unique p value in the interior where $d\beta = 0$. By the same considerations as in the previous section, there necessarily exists a value of β denoted $\beta^\hat{}$ at which the $dp = 0$ locus intersects $p^\hat{}$. Thus, when $p[(1 - \alpha)\pi(p) + \gamma - b] - F = 0$ for a single value, there exists an interior steady state denoted $(\beta^\hat{}, p^\hat{})$.

Stability:

We now show that, in the case where there exist two interior steady states (β^A, p^A) and (β^B, p^B) the latter of these is necessarily unstable, whereas the former is locally stable. In the case where there exists a unique interior steady state $(\beta^\hat{}, p^\hat{})$ this steady state is always unstable.

First note that, from equation (7), in the interior, necessarily, $dp = 0$ always. Thus $\alpha\beta\pi(p) = k$ always, which implies that, $\frac{dp}{d\beta} > 0$ in the interior. Since p adjustment is immediate to ensure this equality, the stability of the system is determined by analysis of the $d\beta$ equation. Recall this equation is:

$$d\beta = \beta(1 - \beta)\Phi(p[(1 - \alpha)\pi(p) + \gamma - b] - F).$$

The derivative with respect to β is:

$$d^2\beta = \frac{d}{d\beta} [\beta(1 - \beta)]\Phi(\cdot) + \beta(1 - \beta)\frac{d\Phi(\cdot)}{d\beta}.$$

At either interior steady state $\Phi(\cdot) = 0$, so that the first term cancels. The sign then depends on the second term and can be re-expressed as follows:

$$d^2\beta = \beta(1 - \beta)\frac{d\Phi(\cdot)}{d\beta} = \beta(1 - \beta)\frac{d\Phi(\cdot)}{dp}\frac{dp}{d\beta}.$$

From above $\frac{dp}{d\beta} > 0$, and $\frac{d\Phi(\cdot)}{dp} = \Phi'(\cdot)[p(1 - \alpha)\pi' + (1 - \alpha)\pi(p) + \gamma - b]$. Since, from (4) $\Phi'(\cdot) > 0$, the sign of the expression depends on the previous expression in square brackets. Consider first the steady state (p^B, β^B) ; the square bracketed expression there is $(1 - \alpha)\pi(p^B) +$

$\gamma - b + p^B (1 - \alpha) \pi' (p^B) > 0$, where the sign follows from (17). Thus since this implies $d^2\beta > 0$, the steady state is unstable. Consider next the steady state (p^A, β^A) . The bracketed expression is $(1 - \alpha) \pi (p^A) + \gamma - b + p^A (1 - \alpha) \pi' (p^A) < 0$, where the sign follows from (16). Thus since this implies $d^2\beta < 0$, the steady state is stable. So when there exist two interior steady states, the one denoted (p^A, β^A) is the unique stable one.

When there exists a unique interior steady state, the steady state $(\hat{p}, \hat{\beta})$ analyzed above, then $(1 - \alpha) \pi (\hat{p}) + \gamma - b + \hat{p} (1 - \alpha) \pi' (\hat{p}) = 0$. However for $\beta \rightarrow \hat{\beta}$ from the left, $d^2\beta > 0$, and for $\beta \rightarrow \hat{\beta}$ from the right, the sign of $d^2\beta > 0$, so that this steady state is also unstable. The unique stable interior steady state is thus the one denoted (p^A, β^A) . ■

Proof of Proposition 2: If $p = 0$, $d\beta < 0$ from (8). If $\beta = 0$, from equation (7) we have $p = 0$, so $(0, 0)$ is a steady state. It is immediate that this corner steady state is locally stable since $d\beta < 0$ there.

If $\beta = 1$, $d\beta = 0$ from (5), also from Assumption 1, $\beta\alpha\pi(p) > k$ for all p , thus, from equation (7) $dp = 1$. Thus $(1, 1)$ is a steady state. To consider stability, again reconsider the expression $d^2\beta$:

$$d^2\beta = \frac{d}{d\beta} [\beta(1 - \beta)] \cdot \Phi(\cdot) + \beta(1 - \beta) \frac{d\Phi(\cdot)}{dp} \frac{dp}{d\beta}.$$

At $(1, 1)$, since $\frac{d\Phi(\cdot)}{dp} \frac{dp}{d\beta} < \infty$, we have $\beta(1 - \beta) \frac{d\Phi(\cdot)}{dp} \frac{dp}{d\beta} = 0$. Then, noting that $\frac{d}{d\beta} [\beta(1 - \beta)] = 1 - 2\beta$, we obtain:

$$\begin{aligned} d^2\beta &= (1 - 2\beta) \cdot \Phi((1 - \alpha)\pi(1) + \gamma - b + (1 - \alpha)\pi'(1)) \\ &= (1 - 2\beta) \cdot \Phi\left((1 - \alpha)\pi^l + \gamma - b + (1 - \alpha)\pi'(1)\right) \\ &= -\Phi\left((1 - \alpha)\pi^l + \gamma - b + (1 - \alpha)\pi'(1)\right) \end{aligned}$$

Note that from Assumption 4 $(1 - \alpha)\pi^l + \gamma - b < 0$ and since $\pi' < 0$ always we have $d^2\beta > 0$. Thus the $(1, 1)$ steady state is unstable. ■

Proof of Proposition 3: In steady state (β^A, p^A) expected utility of an opportunist equals $p^A b$, which clearly exceeds zero. In any interior steady state, the expected utility of each type must be equal so the amount $p^A [(1 - \alpha)\pi(p^A) + \gamma] - F$ must also exceed zero. In the corner steady state $(0, 0)$ expected utility of either type is zero. In both steady states entrepreneurs earn zero expected profit. ■

Proof of Proposition 4: Consider two interior steady states, with p levels denoted p^{AW} and $p^A < p^{AW}$ respectively. The expected utility of an opportunist, $E[u^O]$ is $p^{AW}b$ and $p^A b$ in each one respectively. Since $p^{AW} > p^A$ opportunists have higher utility in the former. In steady state $E[u^O] = E[u^T]$, so the trustworthy are also better off in the former steady state. In interior steady states entrepreneurs have expected profit equal to zero, so they are indifferent. ■

Proof of Proposition 5: Immediate by using the dynamics established in section 2.7 and considering Figure 9 in the case of $p' < p^{BW}$. Note that the horizontal movement of p in the figure

reflects the new equilibrium $\alpha\beta^A\pi^W(p) = k^W$ yielding a value of $p < p^{BW}$ as in the statement of proposition. Figure 8 sketches movement in the case of $p' > p^{BW}$. ■

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