# Trust, Social Capital and Economic Development[*][‡]

Patrick Francois[a,b,c] and Jan Zabojnik[d]
a. Department of Economics, University of British Columbia, Vancouver, B.C. Canada.
b. CentER, Tilburg University, The Netherlands
c. CEPR
d. Marshall School of Business, University of Southern California, Los Angeles, U.S.A.

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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 explore a possible role for 'trustworthiness' as corresponding to social capital. Individuals are trustworthy when they perform in accordance with promises, even if this does 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 trustworthy agents being socialized to act as they do. To model this socialization, we borrow from a 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 processes. The results obtained caution against rapid reform and provide an explanation for why late developing countries may not easily be able to transplant the modes of production that have proved useful in the West.

**JEL**: O1, O3, O4, Z1

# 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 (1902), and has seen many modern restatements. A recent one is Landes (1998) who argues that, in seeking to understand why the countries of sixteenth century Western Europe advanced beyond others that were seemingly 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. Recent elaborations on this theme have also been advanced in Basu (2000) and Platteau (2000, p.325) who further argues that this position has earlier precedents in the work of Adam Smith.

Views like these are not typically advocated by most economists who instead focus on incentive structures in explaining individual behaviour and 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. A more typical economic emphasis would take behavioral dispositions as constant, and focus instead on other exogenous factors. An example is the emphasis on geography as in Sachs (2003), or the effect of geography on institutional choice, as recently explored by Acemoglu et. al. (2001), or similarly its effect on social infrastructure, as emphasized by Hall and Jones (1999).

While we do not wish to argue for the absolute primacy of culture, it does seem worthwhile to attempt to explore some of the key insights of a more culturalist perspective while avoiding the tautology that arises when treating a prime causal factor as exogenous. Moreover, as we will show, such a perspective ends up identifying benefits to policies that would not arise in more standard treatments. Here, culture plays a central role, but the way in which culture itself is produced and changes is directly considered. 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. We avoid the problem of tautology by modeling the way in which these behavioral norms arise in people directly via a process of preference evolution. To do this, we adopt a formulation of this process pioneered by Bisin and Verdier (2001).

Bisin and Verdier (2001) have formalized an influential perspective in evolutionary anthropology (advanced by Cavalli-Sforza and Feldman (1981) and Boyd and Richerson (1985)) which argues that, along certain dimensions, an individual's values are determined by parental upbringing. In determining the values a child will acquire, 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

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would undertake, using their own preferences. Thus, in this 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.

In the present paper, the social norm or cultural variable that will play a primary role is "trustworthiness". Trustworthy individuals are those who keep their promises even when doing so is costly, in the sense of requiring taking actions which may not maximize payoffs. Suppose a parent values trustworthiness but lives in a society where trustworthiness is costly - i.e., a child's being an alternative opportunistic type 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 generally 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 captures, in an economic framework, key elements of the increasingly widely used notion of "social capital".[1] Common to most definitions of this term is an element of regard for others that facilitates fruitful interaction where it would otherwise not be guaranteed.[2] Here, we equate society's social capital with the prevalence of trustworthy individuals. 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, according to this view, rich in social capital.[3]

The model developed here embeds this process of preference evolution into an environment where 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 from the field (that we elaborate on below) which suggest that trustworthiness considerations play a critical role in determining the reliability of trading partners and hence the type of production that will be

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[1]The literature on social capital and its effect on the development process has grown rapidly over the last 10 years. Much 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 also Rao and Walton (2004) for a number of recent contributions focusing on culture and development.

[2]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.

[3]There 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.

feasible.[4] The evolution of trustworthiness within the population, 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 so that the trustworthy types can reap additional rewards. Conversely, when firms do not allow themselves to be vulnerable to expropriation, trustworthiness yields no additional advantages, and the evolutionary process leads to its demise. This inter-relation between the society's social capital and the actions 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.

The present work thus sketches a development path in which social capital and modern production are complements. An alternative, and perhaps more common, view of development or modernization is as a process which erodes communal structures and thus undermines social capital. According to such a view, in traditional societies where interaction is limited to relatively few individuals, production is largely agrarian, and the unit of production is usually the extended kin group, high levels of trust are sustained by repeated interaction and the free-flow of information within the group. These societies, where individuals have intimate knowledge about trading partners, are seen as richer in social capital when compared with the largely anonymous interactions that characterize modernized Western economies.[5]

We take a differing view. Though traditional societies have features rendering them more able to undertake the monitoring, information flow and repetition of interaction required to make fulfilling promises incentive compatible, it is doubtful whether such traditional structures can provide the basis for the development of successful modern production. As Platteau (2000) has argued, this is because traditional societies, though characterized by pervasive intra-group trust, do not typically extend this trust, and the reciprocal notion of commitment, to outsiders and hence to anonymous interactions. When only able to trust traders with whom one is previously familiar, the functioning of market institutions is severely circumscribed because the domain of viable business relationships remains small. Kennedy's (1988) investigations in Sub-Saharan Africa are a case in point. The entrepreneurs he studied showed a marked reluctance to establish capital pooling arrangements, or business partnerships, among non-kinsmen because of the fear that such partners would cheat or not pull their weight. Another example is provided by Fafchamps (1996) who has documented a similar lack of trust and cooperativeness beyond circles of immediate acquaintance in Ghanaian firms. Because the legal environment also lacked formal contractual

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[4]This 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).

[5]Mclaren and Newman (2003) cite a number of popular sources which see globalization as undermining the stability of existing relationships, and thus increasing insecurity. The density of such stable relationships is often taken to be a measure of social capital.

discipline, as is common in LDCs, entrepreneurs ended up scrupulously avoiding transactions that would make a breach of agreement possible and resorted to a flea-market mode of behavior: "inspect the goods on the spot, pay cash, and walk away with it", (cited in Platteau, 2000, p. 314).

Successful development of modern market economies seems to require a departure from trade restricted to traditionally closed groups, and expansion of interaction to include anonymous others. This can only be undertaken when there is a fairly widespread belief that anonymous interaction will not be seen by one party as an opportunity for it to expropriate the other.[6] In accord with this view, a number of authors stress the importance of trustworthiness as a type-based inference. For example, according to Granovetter (1993), one's capacity to trust is based upon inferring the intrinsic utility which other agents derive from interaction. Like many contributors to this literature, he is at pains to emphasize that this is not because repetition of the relationship sustains incentive compatibility, arguing that the number and infrequency of interaction in modern economies simply rule out that sort of explanation: "If the incidence of such arrangements simply reflected the density of social networks and the capacity of firms to monitor one another's behavior, then we would not need to evoke culture to explain them. But frequently business networks entail ties between actors who have had little previous contact." Barrett (1997) argues that "as one's trading network expands beyond family, friends and neighbours, the quantity and quality of information about one's commercial counterparts, the likelihood of repeated interaction with them, and the availability of extralegal monitoring and contract enforcement mechanisms all tend to decline".[7] According to him, this necessitates a form of anonymous trust to develop which will allow spheres of exchange to be expanded.[8] Seligman (1997) offers a similar view. According to him, the disruption of stable relationships due to increased division of labor in the modern West undermined a traditional notion of trustworthiness based on repeated interaction. During this process, which he calls "role segmentation", trustworthiness came to be an individual specific attribute instead of a characteristic attributed based on an individual's traditional role. Finally, Sztompka (1999) argues that a legacy of communist command economies in former Soviet Union and Eastern European countries was 'civilizational incompetence' that amounted to a set of moral norms unsuitable to the establishment of market relations.

In line with these views, we shall depart entirely from economists' usual focus on incentive structures in formalizing the notion of trustworthiness. Instead, we model trustworthiness as an inherent characteristic. In our framework, *by construction*, pecuniary incentives always favor

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[6] Banfield's (1958) classic anthropological study of a Southern Italian village precisely portrays a situation where such a view of trade served to undermine development.

[7] This intuition has been formalized by Kranton (1996). An increase in trading opportunities can undermine traditional forms of enforcement by increasing opportunities and reducing the threat of punishment for deviators.

[8] This is, for example, argued to be a role played by industrial clusters, or networks, as summarized by Humphrey and Schmitz (1998). The role of industrial clusters, the argument goes, is to build upon a pre-existing and underlying confidence that trading partners do not wish to exploit vulnerabilities to expropriation.

violating promises. We thus exclude the more standard economic treatment of trustworthiness as incentive compatibility, i.e., promises are met if and only if doing so is in one's pecuniary self-interest.[9] This is not because we believe incentives play no role in explaining behaviour but because this notion of trust has already been thoroughly explored. Moreover, as the examples above attest, trust as incentive compatibility (which can potentially be generated in abundance by small groups of regularly interacting individuals in traditionally close-knit societies) is, at least in some instances, not wide ranging enough to provide a basis for successful modern market-based interaction. By shutting down the pecuniary incentive based motivation for action, and treating it more behaviourally, we thus take a position which is closer to that taken in other social sciences.

To sum up, our model rests on four key modelling assumptions. First, individuals can value trustworthiness, and the preferences they acquire when young are influenced by their parents who maximize their children's expected welfare. Second, each firm has a choice between two production technologies: a traditional one, which does not depend upon the trustworthiness of the firm's trading partner, and a modern one, for which the trustworthiness of the firm's trading partner is critical. Third, reflecting the more sociological treatment of trustworthiness, or social capital, as an inherent personality disposition, we model it as adjusting relatively slowly to changes in the underlying environment. This contrasts with, for example, the decisions and actions of firms, which can respond to changes relatively fast. Our last key assumption is therefore that firms adjust to new opportunities instantaneously.

It is this complementarity between the relatively quick to change decisions of firms and the relatively slow changing types that lead to this paper's significant implications. In particular, our first main result is that our framework can give rise to 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 have negative effects. More specifically, if in our model the economy suddenly gains access to a new technology, say, due to a reform, it can happen that evolutionary incentives switch to favoring opportunism and the whole economy converges to a steady state with a lower level of both trustworthiness and welfare. Conversely, the new opportunities would have succeeded and raised welfare had they been introduced slowly enough, which is our second main result. This scenario illustrates one possible explanation for the poor performance of late

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[9] Dasgupta (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. Another approach is to view social capital as a communal level resource as reflected in papers that focus on "social networks" or "social interactions". This, for instance, is the approach taken to measurement of social capital through a variable such as the density of voluntary community associations, as in Miguel, Gertler and Levine (2003). Though it should also be noted that they include a measure of "trust" at the village level, as reported by interviewed elders, as well. A number of papers have also 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).

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 work to the present paper has been that which explores the development of ethics, or cultures, within firms. An early contribution is 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. Rob and Zemsky (2002) also investigate the building of social capital, but in their analysis it is a firm-specific stock of "cooperativeness". In accord with the approach that we will take, they are interested in how this stock interacts with more traditional economic concerns - in their case, the firm's choice of incentive intensity. The focus of the economic part of the model in our framework is however entirely different to both of these. Ours is on the production process in LDCs, the possibility of self-reinforcing interaction between modern production and the trustworthy type, and policies that can help in ensuring development success. 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.[10]

Modern production necessarily requires the purchase of services (or goods) over which there is no possibility of formal contracting. Complete long term contracts are impossible, or prohibitively costly, because, for example, there are many unforeseen contingencies, or because adding each additional clause in the contract is exceedingly complex. 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 and differentiable. 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, due to a standard business stealing effect, so that $\pi'(p_t) < 0$, and the decline in profitability occurs at an increasing rate, $\pi''(p_t) \leq 0$.[11] The alternative possibility of a region with increasing returns, $\pi' > 0$, is explored in the paper's Appendix B. The consequences of such an assumption are also discussed after the main results. 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 $\alpha$ of the gross surplus, while the contractor obtains the remaining $(1 - \alpha)$.[12] The precise division is immaterial, all that is necessary is that $\alpha$ does not take on either of the extreme values, so we assume throughout that $\alpha \in (0, 1)$.

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[10]It 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.

[11]This 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.

[12]In 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 $\alpha$. 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 acting in the best interests of the entrepreneur. This is simply the benefit from cheating, and it may arise for many reasons: amount $b$ may be 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.[13] 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). In the Latin American context which he surveyed, the difficulty in obtaining quality input delivery presented a major impediment to the use of modern techniques. A detailed case study of the phenomenon we have in mind is also provided by Knorringa (1999). He studied a large hub of the Indian footwear industry in Agra. The pervasive opportunities for expropriation and the underlying caste based mistrust and antagonism between producers and retailers locked both parties into spot-based transactions when a more lucrative (but risky) form of longer term transaction was available.

More formal studies have attempted to explain regional variation in business and individual investment behavior based on measured elements of social capital, though these necessarily lack the detail of case studies. For example, Guiso, Sapienza and Zingales (2000) exploit the variation in measures of social trust across Italian regions to explain variations in investment behavior and the instutitionalization of credit. Low trust areas see firms less likely to use institutional forms of credit and less likely to finance operations by equity. This is again consistent with the assumption that potentially lucrative "modern" production requires bearing vulnerability to opportunism that cannot be mitigated by contract and is hence dependent on the nature of traders in the local context.

The assumption of absolutely 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.

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[13] A slightly different interpretation sees it as the benefit obtained by the contractor from not having to exert the effort required to produce a successful project. Under this interpretation, it makes more sense to attribute the amount $-b$ as the cost to a contractor undertaking the effort, and amount 0 to a contractor who cheats. This would, however, lead to identical results.

## 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 act in the best interests of their trading partner, trustworthy individuals would never choose to do otherwise. 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.[14] This imposes pecuniary costs on trustworthy individuals, which we model in two ways. First, in their dealings with entrepreneurs, such individuals will always meet promised commitments, so that even were cheating to be worthwhile, they would forego any potential pecuniary gains: i.e., the amount $b - (1 - \alpha)\pi$. Secondly, operating with a reduced choice set is, in general, costly. This cost is borne in all situations where potential for cheating would arise.

The potential to exploit trading partners is one of many opportunities from which a truly opportunistic person will be able to reap financial gain in their life. Even when there is not formal trade, (i.e., the myriad lifetime interactions which are not modeled here) opportunists will come across many opportunities to steal or pilfer from those that are unwitting. The trustworthy will also meet such opportunities but their underlying moral proclivity will not let them exploit these, and so this proclivity involves lifetime financial losses. We do not model these situations directly, but instead assume that trustworthy agents bear a fixed cost, $F > 0$, representing all of these foregone opportunities.[15]

If trustworthiness only imposed costs, it would never be selected, but 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 Weber (1978), Opp (1979), Jones (1984) and Coleman (1990). We model such rewards here by the parameter $\gamma$, 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 $\gamma$ so that utility of a trustworthy person, $u_t^T$, living in period $t$ can be expressed as:

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

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[14] This is also similar to what Basu (2000) has termed an "action limiting norm" or what Platteau (2000) analyzes under the heading of "moral norms".

[15] In the analysis of the model we will point out the implications of altering this treatment of costs, i.e. of setting $F \leq 0$. This could occur, for example, if trustworthiness generated a self-esteem benefit that outweighed these pecuniary costs.

where $x_t = 1$ if the individual has met promised commitments, and $x_t = 0$ 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. Thus, the T type would always choose to meet commitments, so that the variable $x_t$ simply indicates whether they have obtained the opportunity to make and honour such commitments; it takes value 1 when working in modern production and 0 otherwise.

Opportunists differ in that they always maintain the possibility of violating their commitments, without personal loss. These individuals are standard 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 term $\gamma$ plays no role, 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:

$$u_t^O = y_t.$$

To re-cap, there are three possible benefits that contractors can derive from modern production. The first two are purely pecuniary and can be experienced by either type; one is the benefit to undertaking successful production, $(1 - \alpha) \pi (p)$, the other is the benefit that would alternatively be obtained by cheating, $b$. The third type of benefit is non-pecuniary and can only be obtained by the trustworthy; the amount $\gamma$ when meeting promised commitments. Being trustworthy, however, also carries a cost that arises from the reduced set of options that this type generally has available, $F$. Unlike the other costs and benefits, $F$ is independent of interaction with entrepreneurs. Opportunists experience neither the benefits nor costs that are non-pecuniary in nature, and operate without restraints in pursuit of pecuniary gain.

**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 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, takes the correct actions, as promised, and realizes a successful project, their share of which is $(1 - \alpha)\pi (p_t)$.[16] If not

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[16] It may seem inconsistent to, on the one hand, evoke the existence of unforseen contingencies to justify incomplete contracting, while at the same time assuming that the trustworthy type are able to make a complete long-term promise to the entrepreneur. One may suppose that the difficulty of specifying contingencies, which makes it impossible to write complete long-term contracts, may also make it difficult to provide such promises, and to evaluate whether they have been kept. In our present context, this is not the case. Ex post, it may be clear what

trading, recall that each receives their alternative pecuniary rewards normalized to zero; that is, $u^T = u^O = 0$.

## 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 $b > 0$ from the interaction, trustworthy would trade honestly and receive $(1 - \alpha) \pi (p_t) + \gamma > 0$ from the interaction.[17] 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:

$$\overline{u}_t^T = p_t \left[ (1 - \alpha) \pi (p_t) + \gamma \right] - F$$
$$and$$
$$\overline{u}_t^O = p_t b.$$

## 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), who elsewhere provide extensive discussion of such an approach from an anthropological point of view; Boyd and Richerson (1994). The unique aspect of such an approach is that 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.

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actions were optimal from the entrepreneur's (or project viability) point of view for the contractor to take. We have in mind a situation in which the contractor promises, either explicitly or implicitly, to take the action that is in the entrepreneur's best interest, even though, ex ante, it may not be clear what that action will be. The agent may have to decide later, based on the information that arrives about the state of the world what the correct action is. The $T$ type suffer disutility when it turns out they do not take this "right" action, the $O$ type do not.

[17]Their lifetime utility in this case, however, would additionally include the exogenous losses that arise from their reduced choice set, i.e. the term $-F$.

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 preferences 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 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 called *indirect socialization*.[18] Let the fraction of individuals who are trustworthy, or $T$ type, be denoted $\beta$ 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 $d^T$; correspondingly, the probability that an opportunist directly socializes their child into being an opportunist is $d^O$. Both of these probabilities are allowed to be functions of the proportions of each type in the population, $\beta_t$, 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. For example, with a parent of type $T$, if with probability $1 - d^T$ the child is not directly socialized by the parent, then with probability $\beta_t$ the child is indirectly socialized to be $T$ anyway, and with probability $1 - \beta_t$ she is indirectly socialized to be $O$ type. 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 $j$.[19] We then have the following equations describing these transition probabilities:

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

From these, the difference equation for $\beta$ is:

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

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

---

[18]The term oblique socialization is used for this in Bisin and Verdier (2001) as adopted from Cavalli-Sforza and Feldman (1981).

[19]We 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:

$$d\beta_t = \beta_t \left(1 - \beta_t\right) \left[d^T - d^O\right].\tag{3}$$

This differential equation describes how $\beta_t$ 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 $d^T - d^O$. 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. It is assumed 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.

We take a reduced form modelling approach here and thus assume that $d^T$ is increasing in $\overline{u}_t^T - \overline{u}_t^O$ when evaluated using type $T$'s preferences, and $d^O$ is increasing in $\overline{u}_t^O - \overline{u}_t^T$ when evaluated using type $O$'s preferences, where the 'bar' above denotes average, or expected, utility of the specific type. The reasoning here is spelled out in Bisin and Verdier (2001): parents have what has been termed "partial empathy", which they use to determine how much effort to spend inculcating their child to be the same type. When doing so, they consider the expected lifetime outcomes that their child would obtain conditional upon the child's realized type; the empathic part. However, parents are only able to evaluate these outcomes using their own preferences; hence the partialness of the empathy. When they estimate a large gain in expected outcome from inculcating the child to be like themselves they will expend great effort to make this so. These efforts involve actions like instructing and monitoring the child in behavior, disciplining, selecting their contacts, etc. It is assumed that parents can exert some influence over the outcome, but that it is not perfect; hence the $d$ remain probabilities only. It is, moreover, assumed that parents are unable to inculcate for a type that is not their own; a $T$ type parent simply does not have access to the inculcation technology required to make an $O$ type off-spring. If we were to take the analysis a step further by, for example, explicitly modelling the cost of effort, as in Bisin, Topa and Verdier (2002), we would obtain a reduced form with qualitatively similar properties for standard convex cost functions. We thus proceed with the simpler analysis since our main focus is how this inculcation evolves and interacts with the wider economy.[20]

---

[20]The findings of Bisin, Topa and Verdier (2002) can be directly applied when the costs of investment are modeled. They show that, for a quadratic cost specification, the equivalent of a trustworthy parent in their model will choose a probability of direct socialization that is linear in the difference in expected utility realizations when trustworthy and opportunistic, when evaluated with their own preferences. For a generalized convex cost specification, this probability will be increasing in the difference. Adding this extra step would thus not change any of the results here, though it would make clearer the positive (negative) externality generated by $T$ ($O$) type parental socialization

The difference in parental types' evaluations of outcomes arises from the non-pecuniary, $\gamma$, term which enters for the trustworthy parents only. Thus, with $p_t$ firms in modern production, the evaluation from the perspective of trustworthy parents yields: $d^T$ is increasing in $\overline{u}_t^T - \overline{u}_t^O = p_t\left[(1-\alpha)\pi(p_t) + \gamma - b\right] - F$. Similarly, the evaluation from the perspective of opportunistic parents yields: $d^O$ is increasing in $\overline{u}_t^O - \overline{u}_t^T = p_t\left[b - (1-\alpha)\pi(p_t)\right] + F$, where the only difference is that the $\gamma$ term is not evaluated by these parents. It thus follows directly that the difference in probabilities, $d^T - d^O$, is increasing in the expression $2\left[p_t\left((1-\alpha)\pi(p_t) - b\right) - F\right] + p_t\gamma$. Note also that because $\gamma$ is an arbitrary positive parameter, we can without loss of generality replace the latter expression with the simpler $p_t\left[(1-\alpha)\pi(p_t) + \gamma - b\right] - F$.

Thus, let $\Phi : R \to [-1, 1]$ define the mapping from $p_t\left[(1-\alpha)\pi(p_t) + \gamma - b\right] - F$ to the probability difference $d^T - d^O$. 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 $\Phi$ 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 parametrizations in which one type always dominates.[21] For example, if it is always true that $d^O < d^T$, then the evolutionary dynamics implied by (3) necessarily drives $\beta \to 1$. Conversely, if always $d^O > d^T$ then $\beta \to 0$ always. At this point, this simply involves an arbitrary restriction on the value at which the $\Phi$ function changes sign. That is, we assume:

$$\Phi(0) = 0. \tag{4}$$

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 $\Phi$ mapping into the replicator function, equation $(3)$, we obtain an expression describing the evolution of $\beta$, the proportion of trustworthy agents in the population:

$$d\beta_t = \beta_t(1-\beta_t)\Phi\left(p_t\left[(1-\alpha)\pi(p_t) + \gamma - b\right] - F\right). \tag{5}$$

Note the "slow" adjustment implied by such an evolutionary specification. If, over some range, direct parental socialization favors increased trustworthiness, $d^T > d^O$, then evolutionary forces favour more trustworthy individuals, but the population adjusts only gradually, and need not eliminate the difference, $d^T - d^O$, in a single period.

## 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

efforts. However, we discuss this externality further in the policy section.

[21] This is analogous with the parameter restriction in Bisin, Topa and Verdier (2002), which ensures that the psychological gains from cooperation in their prisoner's dilemma framework are not too small.

change. Entrepreneurial expected returns in modern production are:

$$E\left[\alpha\pi\left(p_t\right)\right] = \alpha\beta_t\pi\left(p_t\right) - k. \tag{6}$$

We assume all of this adjustment occurs immediately.[22] In particular, for given $\beta_t$ define $p_t^* \in R$ implicitly by $\alpha\beta_t\pi(p_t^*) - k = 0$. Note that $p_t^*$ is unique. Thus, motion in this dimension is described by the following equations. For a given $p_t$,

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

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

## 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:

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

**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**.

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

---

[22]Nelson 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.

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, $\gamma$, is positive. If this did not hold, it could never be the case that evolutionary forces favor the selection of the trustworthy type.[23] 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 $\pi^l$ 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:

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

The sign of (8) determines the direction of evolutionary change, $d\beta$, for $\beta \neq 0$ or 1. It does not directly depend on $\beta$, 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

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

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

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

where the sign follows from $\pi', \pi'' < 0$.[24] 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 below.

This expression is useful for establishing the model's existence proposition for interior steady states. In such a steady state, modern firms and evolutionary support for trustworthiness are

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[23] Without this assumption, our evolutionary framework becomes degenerate, opportunism is the only outcome and production can never occur. Necessarily, if we altered the function $\Phi$ 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.

[24] If 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.

mutually supportive: firms enter when trustworthiness levels are high enough to ensure a good enough chance of success in production, while entry by firms provides evolutionary incentives for the trustworthy type.

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

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

$$and$$

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

The formal proof of this, and all other results, is contained in Appendix A, but the way the model operates can be understood diagrammatically. Our model focuses on settings such that the net benefit to being trustworthy is positive at least for some parameter configurations. In Figure 1, the condition that $p\left[(1-\alpha)\pi(p) + \gamma - b\right] - F > 0$ ensures that there exist some values of $p$ such that the curved line, which represents the net benefit of being trustworthy over its costs, $F$, exceeds zero for some values of $p$. At low levels of $p$, profits are high but the chances of being
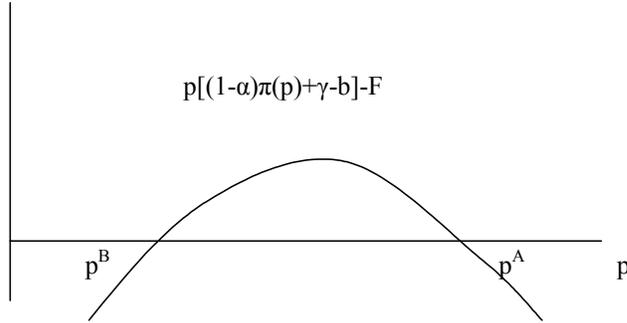


Figure 1: Evolutionary incentives as a function of $p$

hired are so low that evolutionary incentives favor opportunism, i.e., the benefit line is below zero. Conversely, at high levels of $p$ the chances of being hired are high, but profits are low due to the diminishing profitability of successful projects with increased entry. So, once again, opportunism is favored. At medium values of $p$, evolutionary incentives favor trustworthiness. Since the benefits of trustworthiness are independent of $\beta$, this implies movements in the (vertical) $\beta$ direction in $\beta, p$ space, as depicted by the vertical arrows in Figure 2 below. The $d\beta = 0$ lines correspond to the crossing points between the curved line and the horizontal axis in Figure 1. The fixed cost representing pecuniary returns to external interactions when trustworthy, $F > 0$, thus plays a critical role in supporting this configuration, by shifting the curve in Figure 1 vertically downwards. Though it does seem unlikely that pecuniary returns could be positive for these

types, who have reduced choice sets, it is possible that trustworthiness generates its own non-pecuniary returns. For instance, as these elements of the utility function are, to some degree, ad hoc, it is conceivable that the trustworthy receive a lifetime self-esteem benefit to knowing themselves to be trustworthy, which could, if large enough, change the sign of $F$. With negative values of $F$, the curve in Figure 1 would shift up so the first crossing point, labelled $p^B$, no longer exists in the positive orthant. We discuss the implications of this for steady state configurations subsequently.

Clearly, an interior steady state requires evolutionary incentives that are balanced between trustworthiness and opportunism. The point $p^A$ given implicitly by the value at which the argument of $\Phi$ in condition (11) equals zero, corresponds to one such point:
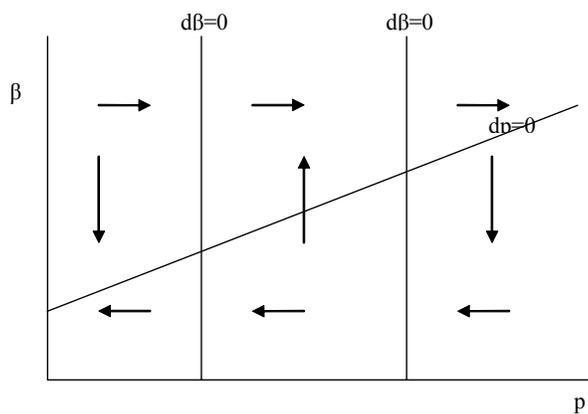


Figure 2. $d\beta = 0$, and $dp = 0$ loci

Solving for a steady state simply requires imposing the zero profit condition for entrepreneurial entry; this is given by equation (7), which determines the locus at which $dp = 0$. These are the combinations at which entrepreneurs are indifferent to entry $(\beta\alpha\pi\,(p) - k = 0)$ and is upward sloping in $\beta, p$ space, as depicted in Figure 2, since a higher level of trustworthiness can support greater entrepreneurial entry. Directional changes in $p$ are depicted by the horizontal arrows.

Since $F > 0$, there exist two values of $p$ at which evolutionary forces are balanced, and assumptions 1-4 are sufficient to ensure that the $dp = 0$ locus is flat enough for the crossing points to be in the interior of the phase space, as indicated in Figure 3 below.

In the stable interior steady state $\left(\beta^A, p^A\right)$, entry of entrepreneurs into modern production up to $p^A$ provides evolutionary incentives for maintenance of proportion $\beta^A$ trustworthy types in the population, which is the society's stock of social capital.[25] In turn, with proportion $\beta^A$ trust-

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[25] The interior steady state at $\beta^B, p^B$ is unstable. This can be seen directly from the phase diagram but is also

worthy types in the population, entrepreneurial entry up to $p^A$ just dissipates expected profits of entry.
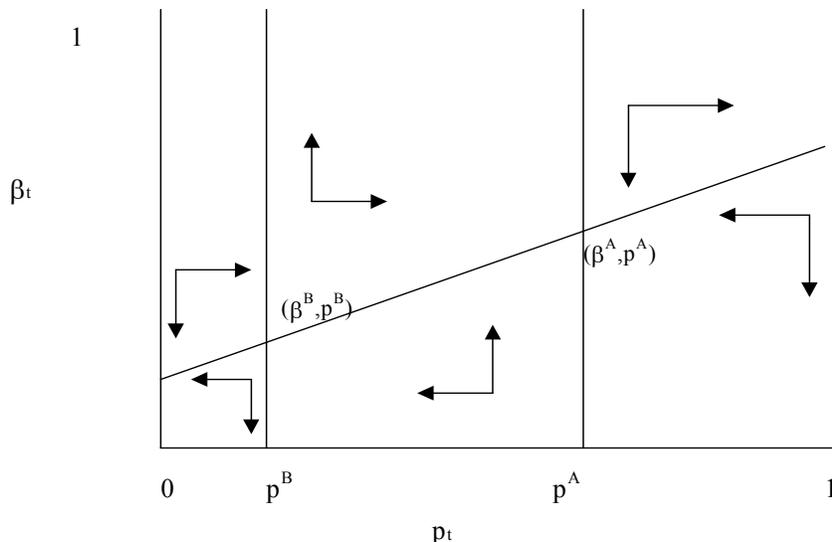


Figure 3. Interior Steady States

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), Lindbeck, Nyberg and Weibull (1998) and 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.[26]

There also exist 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.*

proved in the appendix. With $F < 0$, this unstable steady state no longer exists, but the stable interior steady state of the system persists.

[26] In 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 that it is not possible to directly observe types. This literature (e.g., 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 is not the right sort of approach to use in these settings.

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. Note that the $(0,0)$ steady state would no longer exist if trustworthiness actually generated positive returns elsewhere that turned trustworthiness into an inherently beneficial trait, i.e., $F < 0$. In this case, as sketched above, even with $p = 0$, returns to trustworthy types exceed those to opportunists, and social capital will always be created. The unique steady state then becomes the interior one, $(\beta^A, p^A)$. This suggests that were trustworthiness (social capital) to generate its own rewards, $F < 0$, economic forces would tend to bring it about in all societies.

However, what we believe is the more realistic and interesting case occurs where the reduced choice set of the trustworthy implies that trustworthiness does not generally generate sufficient self-esteem rewards for it to be supported independently of firms' production choices, $F > 0$. This makes it possible for societies to converge on very differing outcomes. The ensuing multiplicity of steady states suggests a possible explanation for why countries with seemingly equal access to technology show such marked differences in total factor productivity. According to our theory, the use of such technologies requires vulnerability to opportunism, and rational firms will only risk 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. Up to now, 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 3 depicts, the dynamics of this system vary depending on whether $\beta$ is above or below $\beta^B$. 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. Note that the interior steady state denoted $B$ is unstable. This steady state derives from the first crossing of the locus in expression $(8)$ with the horizontal axis. Instability arises here because, at this point, there is local increasing returns to $p$ – a slight increase in $p$ will lead to increased evolutionary incentives for the trustworthy because the benefit of having more potential trading partners is not yet off-set by the effect of diminishing returns. The induced increase in $\beta$ in turn leads to further increases in $p$, and eventually leads the system to converge on the stable interior steady state $(\beta^A, p^A)$. Conversely, $p < p^B$ will lead to convergence on $(0,0)$ as dictated by the evolution of $\beta$, equation

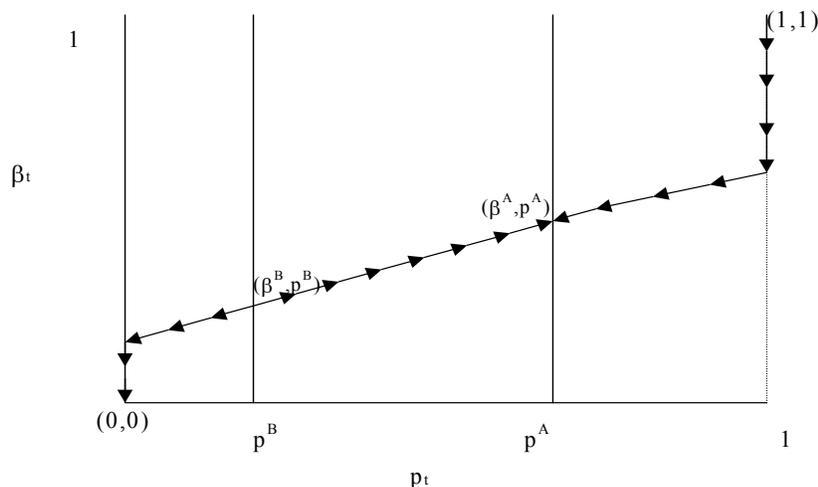(5) . The trajectories of adjustment out of steady state are depicted below.



Figure 4. Convergence paths

The assumed diminishing returns in production, $\pi' < 0$, is thus important in rendering one interior steady state to be stable. If the converse assumption held everywhere, $\pi' > 0$, there could only exist a unique crossing point between (8) and the horizontal axis, because there would always exist aggregate increasing returns to $p$, implying (8) is monotonic in $p$. Consequently, this interior steady state would behave like the one labelled $B$ above, and would not be reached. However, Appendix B shows that a qualitatively similar configuration of steady states to that above exists when $\pi' > 0$ over only a subset of $p$ values.

## 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.[27]

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[27] Our welfare criterion is not plainly acceptable in all situations. Specifically, it may be argued that a change which made all of the opportunists better off, while leaving the trustworthy no worse off should be evaluated as a

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,* $\left(\beta^A, p^A\right)$, *exceeds that in the stable corner steady state,* $(0,0)$.

## 3  Development Through Trade and Modern Production

We now use our 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 often involve larger set up costs than traditional technologies, and the small size of domestic markets in LDCs, compared with domestic markets in developed economies, impedes exploiting any such local scale economies. 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 behind 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 currency over-valuation, 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 many 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.[28]

The concrete manifestation of this in policy towards LDCs occurred throughout the 1980s and into the 1990s. We shall abstract from the details of these policy changes and model the main impact of openness in a twofold manner. We are also, in this section, not considering optimal policy, but rather the effects of a piece-meal type operation. Optimal policy will be considered

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social worsening, whereas our criterion would assess it as an improvement. However, the welfare comparisons made in what follows all involve strict improvements or worsenings for both types in the population. Thus, a welfare measure which weighted the trustworthy higher (or fully) would yield the same conclusions.

[28] See Krueger (1992) for further discussion of these changes.

in response to this section's main comparative static result subsequently. An opening to trade implies, on the one hand, the possibility to import cheaper mass produced goods from abroad, which is a potential threat to producers who are selling to a local market. 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.

The effects of such policies have been analyzed within the broader "globalization" debate, and reasons have been forwarded for why some countries may have been made worse off by such moves towards openness. A number of authors have emphasized the possibility that globalization, by increasing the instability of relationships, may undermine self-sustaining interactions that provide mutual benefits in the absence of complete contracting possibilities. A formalization of this argument has been presented by Maclaren and Newman (2003) where the net effects of such openness are shown to be, in general, ambiguous. This is because though globalization can undermine interaction, and thus reduce sustainability of self-enforcing agreements, it also has an offsetting effect which is to increase the possibility of engaging in a future beneficial relationship. Since our framework does not depend on the repetition of relationships to sustain trust, the mechanism we will highlight when examining the effects of openness (which is somewhat analogous to globalization) on social capital will operate through the evolutionary avenue.[29]

## 3.1 Modeling openness

It is immediately clear that the positive potential of openness could not be realized 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. 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 $(\beta^A, p^A)$ steady state.[30] 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

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[29]See Maclaren and Newman (2003) for further discussion of the largely informal literature which has identified increased risk and worker insecurity that is created by globalization. One way of interpreting their results is as formalizing the effects of globalization on trust as incentive compatibility - what we have characterized as the 'traditional' economic view. This contrasts with our focus which is on the effects of globalization on the more sociological notion of trust, delineated earlier. If, as seems likely, both notions of trust are operational in reality, the views represent complementary perspectives of the same phenomenon.

[30]Since the results in this section necessarily involve comparative statics around interior steady states, these would not apply under the assumption of global increasing returns, $\pi'(p) > 0 \ \forall p$, as the interior steady state there is unstable. However, with just local increasing returns, appendix B shows interior steady states can be stable, and then qualitatively similar results will follow when starting at any stable interior steady state.

welfare.

The general equilibrium consequences of accessing world markets and implementing a new 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 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 $\pi$ 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 $\pi(\cdot)$.[31] The new values, $\pi^W(\cdot)$ and $k^W$, need to also satisfy the parameter restrictions to ensure existence. The relevant restrictions are Assumptions 1 to 4, which are assumed to still hold.

### 3.1.1 The Effect of Openness on Steady States

Recall the two differential equations governing the dynamics of this system

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

$$dp = \alpha \beta_t \pi (p_t) - k \gtreqless 0. \tag{14}$$

For given $p$ and $\beta$, 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 $(\beta, p)$ 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 in Figure 5 below by the dashed lines:

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[31] Allowing for non-proportionate shifts in this function leads to qualitatively similar, though somewhat more complicated, changes in the steady state. These are discussed subsequently.
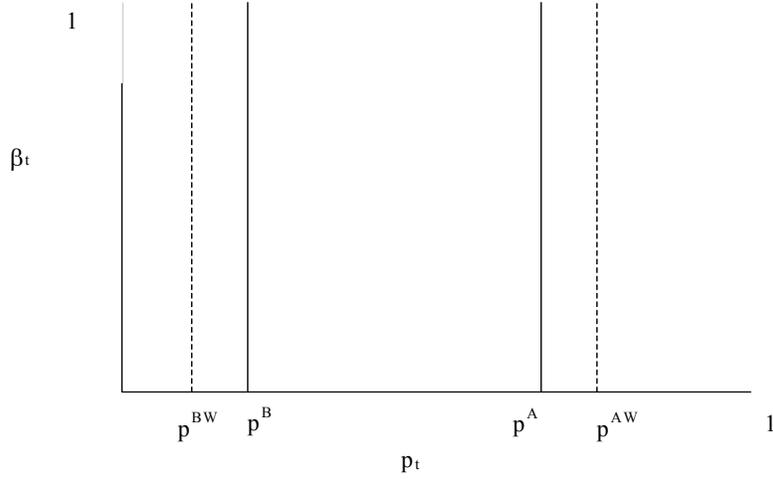
24

Figure 5. Change in $d\beta = 0$ loci with openness

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 the new steady state necessarily involves greater modern production. Even though the new steady state has fixed costs higher, $k^W > k$, by construction, Assumption 1 still holds, so that an implication is $\pi^W (1) > k^W$. Since expected profits to firms in modern production are dissipated by entry in a steady state, welfare implications derive directly from contractors' expected payoffs. The increase in firm entry implies these are necessarily higher for both types, so that welfare must rise.

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

$$\frac{\pi^W (p)}{k^w} \gtrless \frac{\pi (p)}{k}. \tag{15}$$

It is not possible to a priori rule out either inequality, but, due to space considerations, we shall focus on the more interesting case where $\frac{\pi^W(p)}{k^w} < \frac{\pi(p)}{k}$ in what follows. This corresponds to openness increasing the reliance of modern production on social capital, as evidenced by the same level of net returns requiring a lower level of trustworthiness under this inequality.[32] As was argued in the introduction, the increased vulnerability to opportunism seems to be a central concern undermining investments in modernizing undertaking. Similarly, as argued by

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[32]To see this, hold $p$ fixed and note that when $\frac{\pi^W(p)}{k^w} < \frac{\pi(p)}{k}$, $\beta$ required for $dp = 0$ is larger.

Katz (1987), 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 thus raise reliance on social capital.[33]

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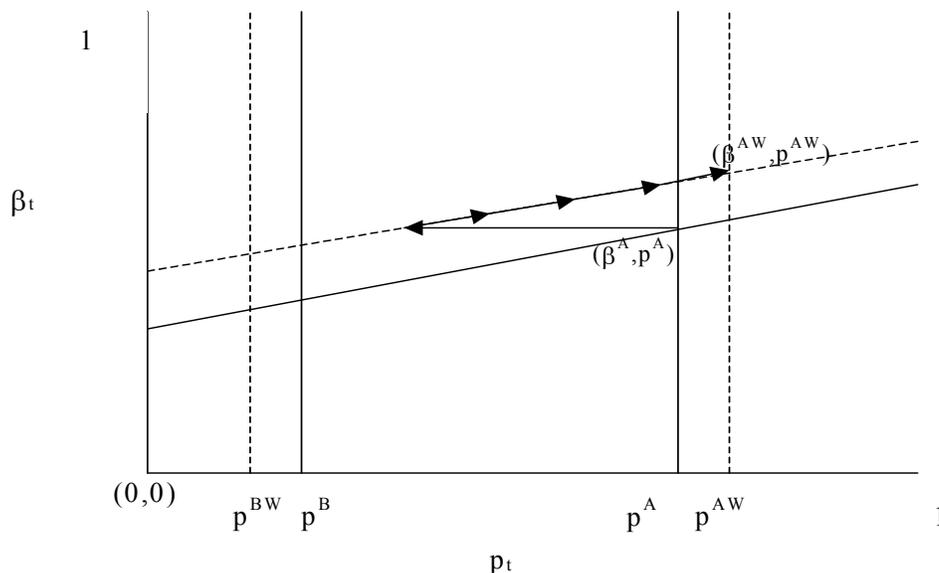


Figure 6. Convergence on interior with rise in $dp = 0$ locus

As depicted in Figure 6, however, the greater vulnerability to opportunism does not thwart convergence to the welfare improving steady state. 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. The transition path is not monotonic, however. 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 $\pi^W$, and the initially unchanged level of $\beta$, 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, $\beta^{AW}$, there would be no decline. However, despite the decline,

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[33]We analyze the alternative inequality, representing a case where openness decreases reliance on social capital, in a working paper version; Francois and Zabojnik (2004).

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, which in turn increases evolutionary incentives for the trustworthy types, raises social capital, and moves the system towards the new, better steady state.

### 3.1.2 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 $\left(p^A, \beta^A\right)$ 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 $\left(p^{AW}, \beta^{AW}\right)$ steady state. If $p' < p^{BW}$ then the economy uniquely converges to the welfare dominated $(0,0)$ steady state.*

Figure 7 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 $(0,0)$
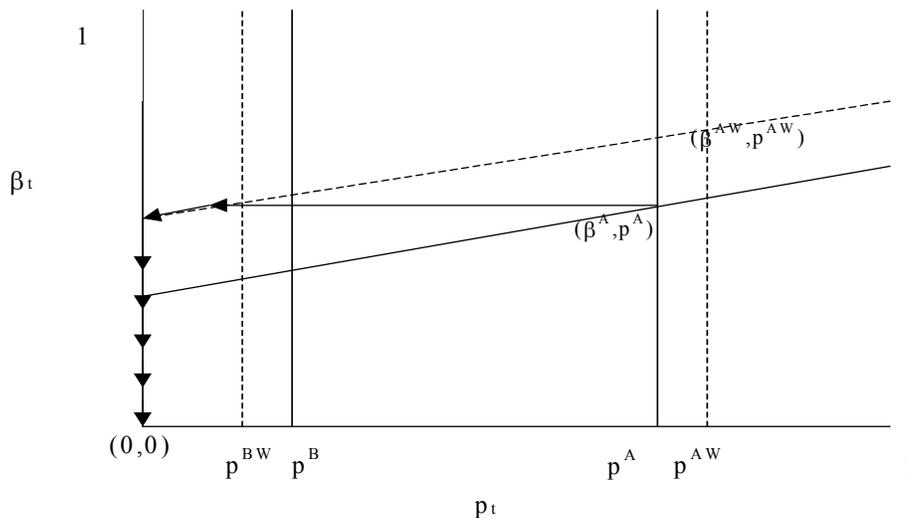


Figure 7. Convergence to corner with fall in $dp = 0$ locus.

steady state.[34]  This figure depicts the pessimistic scenario for development through openness

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[34]Recall 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 $\beta$ is below that required to sustain the lowest $(\beta, p)$ 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.

– a complete breakdown in fledgling modern production, rampant opportunism, total distrust, dismantling of existing social capital, and reduced welfare.

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 here 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 which results in the complete erosion of the initially good social capital. This is similar in outcome to a possibility that arose in Mclaren and Newman's (2003) model. They also highlight a possibility that welfare may fall through the undermining of stability of interaction. Though they are concerned with an insurance providing role, their results would seem to generalize to any interaction where there is mutual benefit, some incompleteness in contracting, and the inability to write complete long-term contracts. Here, however, it is not the stability of interaction that is undermined, but instead the evolutionary incentives for the inculcation of a social value, trustworthiness, that makes modern production feasible.

## 3.2  Policy

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. 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.[35] The restriction we

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[35]What 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.

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 be avoided. To see this, consider a convexification of the changes such that, instead of implementing the whole difference $\left(k^W - k\right)$ and $\pi^W\left(p\right) - \pi\left(p\right)$, 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 $k + \delta\left(k^W - k\right)$ and $\alpha\pi$ increase to $\alpha\pi + \delta\alpha\left[\pi^W\left(p\right) - \pi\left(p\right)\right]$. Then the magnitude of leftward shift in the locus $dp = 0$ is smaller, as depicted by the first dotted line below.
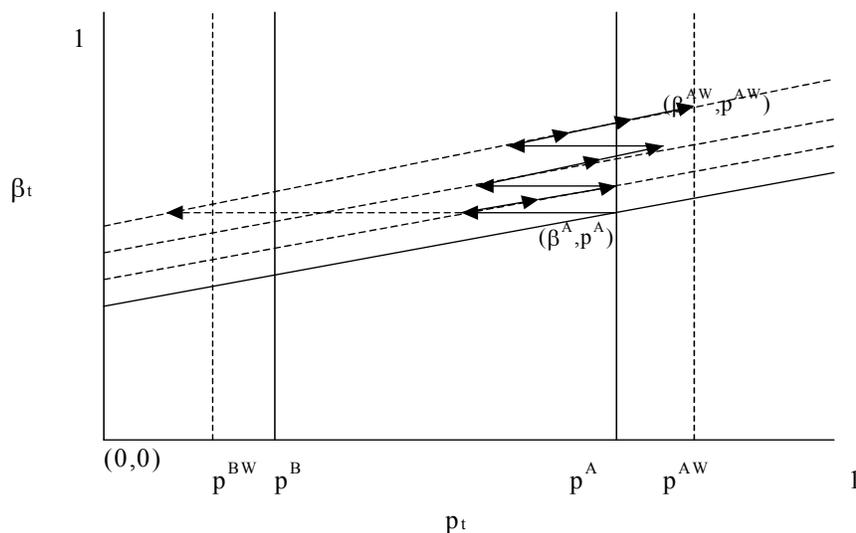


Figure 8. Sequential shifts in $dp = 0$.

If $\delta$ 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. 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 $\beta$, and consequently $p$,

have increased sufficiently, then the next step in the change can be implemented, increasing to $k + 2\delta \left( k^W - k \right)$ and $\alpha\pi + 2\delta\alpha \left[ \pi^W \left( p \right) - \pi \left( p \right) \right]$, which is depicted as the second parallel dotted line, and the process is 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 the early industrializing countries of Western Europe, that developed the technology which gave rise to sustained productivity growth, may have been able to converge to 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 7 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. Here the externality is the positive benefit that entering firms provide in sustaining evolutionary incentives for social capital formation.

The result here also suggests a benefit to gradualism which can shed light on the differential performance of ex-communist reform economies. Roland (2000) 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 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 underpinnings of markets to encourage strong entrepreneurial entry". 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*

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*that foster entrepreneurship, trust and respect for legality and commitment."* Roland,
p. 333 (italics inserted).

Roland concludes that the gradually 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, but to the extent that slow adjustment provided some benefits, it is consistent with the social capital based account developed above.

### Direct encouragement of trustworthiness is beneficial

Since the $T$ type make modern production viable, and receive only proportion $(1 - \alpha)$ of the benefit, optimal policy should involve inducements for $T$ parents to directly socialize their children, and conversely inducements for $O$ type parents not to. Alternatively, the government can take a direct role, as in Laffont (1975). He provided an early analysis of government policy initiatives that were concerned with establishing a norm of morality so that individuals would not act as Homo economicus, and briefly discussed examples in support. An example of a state with the means of coercion necessary to establish this is argued by Platteau (2000) to be that of late 19th Century Japan. The then government was able to use the newly implemented compulsory education system as an instrument for the inculcation of selfless loyalty to the country. Much of the curriculum was devoted to the study of ethics, and Platteau (p. 311) is amongst many who have argued that this program inculcated values which "permitted the development of complex hierarchically-structured business organizations... characterized by considerable amount of trust between a large number of unrelated people". Contemporary policy examples focused explicitly on building trust in business networks, e.g., Altenberg and Meyer-Stamer (1999) and Rhyne and Otero (1992), reward firms for building trust based bonds. These policy initiatives, however, are less directly supportive of the analysis here, as one may equally interpret them in the more standard way, i.e. as increasing relative external returns to "doing good" by increasing pecuniary inducement to cooperating. This would correspond to reversing the inequality in (1) so that cooperation becomes incentive compatible. In reality, there is no reason why policies aimed at inducing cooperation may not work on both dimensions. The interaction between the internal (value changing) dimension, and the external one is now receiving more attention; see for example Frey and Jegen (2001) for a survey of empirical and experimental evidence.

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# 4 Discussion and conclusions

Our model has two main features which are non-standard. The first is that it rules out, by construction, the possibility of ever designing incentive compatible contracts that will ensure that 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 realistically reflects actual concerns 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 when types are not observable. 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 potential productivity enhancing changes, like for example opening to trade, can end up worsening production and actually lowering welfare. We have also provided 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 and encourages the building of trust.

Though we have modeled this in a stylized framework, the basic insight would seem to be readily generalizable to many settings, as long as two essential conditions are met. 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.

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 miti-

gate 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. But it is also likely that, even without formal institutions, informal institutions that sustain incentive compatible interaction (what we have called the 'traditional' economic notion of trust which we have shut down) play some role. It would be of some interest to analyze the interaction between these different types of trust. One possibility would be a model in which type based trust is allowed to evolve, but where interaction is repeated, at least probabilistically, so that incentive based trust could also play a role. We leave such an extension to future work.

## Appendix A: Proofs of Propositions

**Proof of Proposition 1:** 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. Consider the expected returns to trustworthiness relative to opportunism, $\overline{u}^T - \overline{u}^O$, as given by expression (8). Suppose the sufficient condition holds so that there exists at least one value of $p$, denoted $p'$, such that $p'\left[(1-\alpha)\pi\left(p'\right) + \gamma - b\right] - F > 0$. Then there must exist another value of $p \in (p',1)$, denoted $p^A$, such that $p^A\left[(1-\alpha)\pi\left(p^A\right) + \gamma - b\right] - F = 0$. This follows immediately from the continuity of $\pi$ 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:

$$(1-\alpha)\pi\left(p^A\right) + \gamma - b + p^A\left(1-\alpha\right)\pi'\left(p^A\right) < 0. \tag{16}$$

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

$$(1-\alpha)\pi\left(p^B\right) + \gamma - b + p^B\left(1-\alpha\right)\pi'\left(p^B\right) > 0. \tag{17}$$

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

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

$$\beta\alpha\pi\left(p\right) = k \tag{18}$$

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in $(\beta, p)$ space. This locus of $\beta$ and $p$ values renders entrepreneurs indifferent between modern and traditional production, $dp = 0$. Since $\pi' < 0$, this function is upward sloping in $(\beta, p)$ space. Note also that, for values of $\beta, p$ 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 $p = 0$; hence, when $p = 0$, (18) only holds when $\beta > 0$. Thus the point at which this function cuts the $\beta$ (vertical axis) in $\beta, p$ 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 $\beta$ 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 $\beta, p$ space are then as shown by the upward sloping schedule in Figure 2.

Steady states occur when $d\beta = 0$ and $dp = 0$. Because the $dp = 0$ locus takes positive values of $\beta$, 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 $(0, 1)$, there must exist two such points. We denote these $\beta^A, p^A$ and $\beta^B, p^B$, as depicted in Figure 3.

*Stability*:

We now show that of the two interior steady states $(\beta^A, p^A)$ and $(\beta^B, p^B)$, the latter is necessarily unstable, whereas the former is locally stable.

First note that, in the interior, it must always be $dp = 0$, from equation (7). 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 that this equation is:

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

The derivative with respect to $\beta$ yields:

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

At either interior steady state $\Phi (\cdot) = 0$, so that the first term cancels. The sign then depends on the second term, which 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 the 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, $\Phi' (\cdot) > 0$ from $(4)$, the sign of the expression depends on the previous expression in square brackets. Consider first the steady state $(p^B, \beta^B)$; 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 $(17)$. Because this implies $d^2\beta > 0$, steady state B must be unstable. Consider next the steady state $(p^A, \beta^A)$. The bracketed expression is $(1 - \alpha) \pi (p^A) + \gamma - b + p^A (1 - \alpha) \pi' (p^A) < 0$, where the sign follows from $(16)$.

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Because this implies $d^2\beta < 0$, the steady state is stable. Thus, $(p^A, \beta^A)$ is the unique stable interior steady state. ∎

**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, equation $(7)$ implies $dp = 1$. Consequently, $(1,1)$ is a steady state. To assess stability, again reconsider the expression $d^2\beta$:

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

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 $\frac{d}{d\beta}\left[\beta(1-\beta)\right] = 1 - 2\beta$, we obtain:

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

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 $(\beta^A, p^A)$, 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 $p^A\left[(1-\alpha)\pi(p^A) + \gamma\right] - F$ 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, $\overline{u}^O$, 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 $\overline{u}^O = \overline{u}^T$, 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 7 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 6 sketches movement in the case of $p' > p^{BW}$. ∎

## Appendix B. Increasing Returns in $\pi$

In this appendix we explore the possibility of $\pi' > 0$. This alternative to the globally decreasing returns that has been maintained in the body of the paper is relatively common in developing

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country contexts. The idea is that, over a range of values at least, a greater number of entrepreneurs can allow for greater specialization and thus for greater productivity (a "specialization effect"). On the other hand, as is standard, there is a countervailing effect that profits per firm should be decreasing in the number of firms (a "business-stealing effect"). It is likely that if the specialization effect ever prevails, it would be when the number of firms in the economy is relatively small, so that new entrants can either be established in industries that were not previously served, or at least differentiate themselves sufficiently from the existing firms. However, as the number of firms grows, differentiation becomes harder and harder, the benefits to specialization become smaller, and the business-stealing effect ultimately prevails. In order to explore the consequences of this, replace Assumptions 3 and 4 in the text with:

**Assumption 3':** $\pi(p)$ is strictly concave, with $\pi'(0) > 0$ and $\pi'(1) < 0$.

Under this assumption, the $\pi$ function first increases, but ultimately decreases in $p$.

In addition, because the role of the cost $F$ is less critical here, we will set $F = 0$ in the following analysis, in order to streamline the exposition. In this alternative setting, we obtain the following analog to Proposition 1.

**Proposition A1.** *Under Assumptions 1-3', one can find $\underline{\gamma}$ and $\bar{\gamma}$, $0 \le \underline{\gamma} < \bar{\gamma}$, such that for any $\gamma \in (\underline{\gamma}, \bar{\gamma})$ there exist at least two interior steady states, $(p^A, \beta^A)$ and $(p^B, \beta^B)$, $p^A > p^B$, such that equilibrium B is unstable and equilibrium A is stable. A sufficient condition for A to be the unique stable equilibrium is $\pi'''(.) \le 0$. In equilibrium A,*

$$\beta^A \left(1 - \beta^A\right) \Phi \left(p^A \left[(1 - \alpha) \pi \left(p^A\right) + \gamma - b\right]\right) = 0 \tag{19}$$

*and*

$$\beta^A \alpha \pi \left(p^A\right) - k = 0. \tag{20}$$

**Proof:** Let $m \equiv b - \gamma$ and define $G(p)$ as

$$G(p) \equiv p\left[(1 - \alpha) \pi (p) - m\right].$$

The proof proceeds by demonstrating that there exists a non-empty interval $(\underline{m}, \bar{m})$, such that $G(p) = 0$ has at least two interior solutions, one of them, $p^A$, with $G'(p^A) < 0$ and the other, $p^B < p^A$, with $G'(p^B) > 0$. $\underline{\gamma}$ and $\bar{\gamma}$ are then obtained as $\underline{\gamma} = b - \underline{m}$ and $\bar{\gamma} = b - \bar{m}$. The rest of the proof then follows the arguments outlined in the proof to Proposition 1.

*Step 1.* First, in any interior steady state, it must be that $G(p) = 0$; otherwise, evolutionary forces would push either for an increase in $\beta$ if $G' > 0$ or for a decrease in $\beta$ if $G' < 0$. Next, note that $p = 0$ solves $G(p) = 0$ for any $m$ and that

$$G'(p) = (1 - \alpha) \pi (p) - m + p(1 - \alpha)\pi'(p)$$

and

$$G''(p) = (1 - \alpha) \left[2\pi' (p) + p\pi''(p)\right].$$

Thus, $G''(p = 0) = (1 - \alpha) 2\pi'(0) > 0$, which by continuity implies that $G'' > 0$ for all $p$ sufficiently close to zero, i.e., $G$ is strictly convex in the neighborhood of $p = 0$. Similarly, $G''(p = 1) = (1 - \alpha)[2\pi'(1) + \pi''(1)] < 0$, which by continuity implies that $G'' < 0$ for all $p$ sufficiently close to one, i.e., $G$ is strictly concave in the neighborhood of $p = 1$. Thus, there must exist $p_1$ and $p_2$, $0 < p_1 \leq p_2 < 1$, such that $G$ is strictly convex on $[0, p_1]$ and strictly concave on $[p_2, 1]$ (note that $p_1$ and $p_2$ are independent of $m$ because $m$ only interacts with $p$ in the linear term $mp$).

*Step 2.* Evaluating $G'(p)$ at $p = 1$, we have

$$G'(p = 1) = (1 - \alpha)\pi(1) - m + (1 - \alpha)\pi'(1),$$

which means that $G'(p = 1) < 0$ for all $m > m_1 \equiv (1 - \alpha)\pi(1)$. Moreover, for $m = m_1$ we have $G(p = 1, m_1) = 0$. Hence, when $m = m_1$, it must be that $G(p, m_1) > 0$ for $p$ smaller than but close to one, i.e., there exists a non-empty interval $[p_3, p_4]$, $0 < p_3 < p_4 < 1$, such that $G(p, m_1)$ is positive and bounded away from zero on $[p_3, p_4]$.

*Step 3.* Set $m = m_1$ and suppose first that $G'(p = 0, m_1) < 0$. Then $G(p, m_1) < 0$ for $p$ greater than but sufficiently close to zero. Thus, we have $G(p, m_1) < 0$ for $p$ close to zero and $G(p, m_1) > 0$ for $p$ close to one, which means that by continuity of $G$, there must exist a $p^B \in (0, 1)$ such that $G(p^B, m_1) = 0$ and $G'(p^B, m_1) > 0$. Thus, $G(p, m_1) = 0$ is solved at two values greater than zero: $p^B < 1$ and $p^A = 1$, with $G'(p^B, m_1) > 0$ and $G'(p^A, m_1) < 0$.

Now suppose that $m$ increases slightly. Since $G(p)$ decreases in $m$, $G(p) < 0$ continues to hold for small $p$. Also, by continuity, $G(p, m)$ must remain positive and bounded away from zero on a non-empty subset of $[p_3, p_4]$ for small increases in $m$, although now $G(p = 1) < 0$. Hence, there must again exist two solutions to $G(p) = 0$, such that $0 < p^B(m) \leq p^A(m) < 1$. Differentiating $G(p, m) = 0$ implicitly with respect to $m$, we get

$$\frac{\partial p}{\partial m} = \frac{p}{G'(p, m)},$$

which is negative at $p^A$ (because $G'(p^A, m) < 0$) and positive at $p^B$ (because $G'(p^A, m) > 0$). Thus, $p^A$ and $p^B$ approach each other as $m$ keeps increasing, until for some $m_2 > m_1$ we have $p^A(m_2) = p^B(m_2)$. Setting $\underline{m} = m_1$ and $\bar{m} = m_2$, we have shown that, in this case, there exists a non-empty interval $(\underline{m}, \bar{m})$, such that $G(p) = 0$ has at least two interior solutions, $p^B < p^A$, with $G'(p^A) < 0$ and $G'(p^B) > 0$.

*Step 4.* Now suppose that $G'(p = 0, m_1) \geq 0$. Since, $G'$ decreases in $m$ and $\lim_{m \to \infty} G'(p, m) = -\infty$, there must exist an $m_3 \geq m_1$ such that $G'(p = 0, m_3) = 0$. Also, by strict convexity of $G$ around $p = 0$, it must be that $G(p, m_3) > 0$ for all $p > 0$ sufficiently close to zero. In other words, there exists a non-empty interval $[p_5, p_6]$, $0 < p_5 < p_6 < 1$, such that $G(p, m_3)$ is positive and bounded away from zero on $[p_5, p_6]$.

Now increase $m$ slightly above $m_3$. By continuity, $G(p, m_3)$ must remain positive and bounded away from zero on a non-empty subset of $[p_5, p_6]$. On the other hand, since $G'$ decreases in $m$, it must now be that $G'(p = 0, m) < 0$, which means that $G(p, m_3) < 0$ for $p$ close to zero. Hence, there must exist some $p^B(m) \in (0, 1)$ such that $G(p^B, m) = 0$ and $G'(p^B, m) > 0$. Similarly, $G(p = 1, m) < 0$ for any $m > m_1$ and therefore there must exist some $p^A(m) \in (p^B(m), 1)$ such that $G(p^A, m) = 0$ and $G'(p^A, m) < 0$. Because this reasoning holds for all $m$ sufficiently close to but greater than $m_3$, there must once again exist a non-empty interval $(\underline{m}, \bar{m})$ such that $G(p) = 0$ has at least two interior solutions, $p^B < p^A$, with $G'(p^A) < 0$ and $G'(p^B) > 0$.

*Step 5.* If $\pi''' \leq 0$, then $G'''(p) = (1 - \alpha) [3\pi''(p) + p\pi'''(p)] < 0$ for all $p$, which combined with Step 1 means that there exists a $p^* \in (0, 1)$ such that, for any given $m$, $G$ is strictly convex on $[0, p^*)$ and strictly concave on $(p^*, 1]$. Consequently, $G(p, m) = 0$ can have at most three distinct solutions. Because one of them is $p = 0$, if $p^A$ and $p^B$ above exist, they must be unique. ∎

Note that the qualitative nature of the equilibria so obtained is identical to that in the body of the paper. Moreover, though it is assumed here that $F = 0$, results can also be obtained for $F \gtrless 0$, with a similar caveat to that in Proposition 1 to ensure existence. Intuitively, the increasing returns component to modern production allows the relative returns to trustworthiness to first fall, and then rise, as $p$ increases. In contrast with the main model, this is because there is a region of the space over which the gross returns from production increase, even as the probability of meeting a trading partner rises. Thus the function which is an analog to that in Figure 1 can have more than one turning point, and the corner conditions in the new Assumption 3' ensure at least two points of intersection, the upper of which is stable as in the main model.

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