
Economic Research Paper: 2009-10

# CONTRACT ENFORCEABILITY AND THE EVOLUTION OF SOCIAL CAPITAL

**KEN JACKSON***

**SEPTEMBER 2009**

* Department of Economics, School of Business and Economics, Wilfrid Laurier University. Contact: kjackson@wlu.ca

# Contract Enforceability and the Evolution of Social Capital*

Ken Jackson†

September 14, 2009

## Abstract

Social capital, in the form of generalized trust, appears to have significant consequences for economic development. Yet we know little about how social capital evolves, and more specifically, on the role of government institutions in promoting or hindering social capital. This paper develops a model of social capital evolution that focuses on the interaction between government institutions related to contract enforcement and the incentives for civic engagement. The key results suggest a non-linear relationship between government institutions and social capital development, with only intermediate levels of contracting institutions supporting social capital development. For countries with low-levels of social capital, there exists a social capital trap, as no level of contracting institutions can generate the incentives necessary to support the development of social capital. The presence of social divisions caused by factors such as ethnic diversity or wealth inequality may exacerbate this problem.

*I would like to thank Chris Barrington-Leigh, Chris Bidner, Mukesh Eswaran, Patrick Francois, Maria Gallego and participants in seminars at the University of British Columbia, Wilfrid Laurier University, and the NEUDC conference at Boston University. This is a work in progress and any further comments or suggestions are greatly appreciated.

†*E-mail* - kjackson@wlu.ca, *Website* - http://www.kjackson.net/ or http://www.wlu.ca/sbe/kjackson/

# 1 Introduction

The prevailing wisdom within economics is that institutions are the key to development. If governments enact policies that promote investment and encourage trade, prosperity follows. Yet the stark reality in many countries of the world is ineffective government, lax rule of law and consequently a dire lack of economic activity. Are the poor institutions in the countries of the "bottom billion"[1] the result of disinterest, incompetence or constraints?

While it may be clear that institutions, broadly defined, are important, it is not clear which specific institutions are critical to development, or how those institutions change over time. The two broad categories of economic institutions, formal constraints including government structures and laws, and informal constraints such as norms of behaviour (North 1994)[2] have each been shown to be relevant. Papers by Acemoglu et al. (2001, 2002, 2005) provide significant support to the notion that formal, government institutions are important, while Knack and Keefer (1997), Tabellini (2005) and Guiso et al. (2006) demonstrate that informal institutions, such as cultural norms, also have significant long-term effects.

Of further importance are questions related to the long-term persistence of institutional quality. As demonstrated in Acemoglu et al. (2001, 2002, 2005), and in Guiso et al. (2008), the quality of institutions, both formal and informal, appear to be strongly influenced by historical factors[3]. This paper develops the idea that low levels of social capital may generate an institutional trap in which the economic activity necessary to develop social capital does not occur. Under the right circumstances, the social capital trap can extend to also limit the development of formal institutions.

I develop a theoretical framework within which to consider the interaction between formal and informal institutions. An evolutionary process of social capital development is matched to a simple economic model in which agents choose between producing alone, or entering risky joint production. Legal institutions, governing the enforcement of contracts, are critical to determining the equilibrium that results in each period of the game, and therefore the resulting evolutionary development of social capital.

The evolutionary model presented here is standard, with a fraction of agents incurring a

[1] The notion of a "bottom billion" was presented in(Collier 2007) and the associated literature and refers to the approximately 1 billion people in the world that live in very poor circumstances, primarily as a result of poor governance.

[2] As an alternative to the terms formal and informal constraints, the terms public-order and private-order have been used in the institutional literature with a very similar meaning (Platteau 1994, Greif 2005).

[3] Settler mortality rates or historical density patterns affect current formal institutions in the papers by Acemoglu et al., while a historical period of independence does the same for social norms in the case of Guiso et al.

cost for dishonest actions, while the remainder simply make choices that maximize fitness. The evolutionary model then exhibits societal level changes in social capital in the direction of the group with higher average fitness. In contrast, the production model differs from previous work on this subject by assuming that the behaviour type of a particular individual is observable, though only imperfectly and at a cost. This is in keeping with an extensive literature in psychology and behavioural economics[4] that demonstrates that people are able to imperfectly determine the trustworthiness of individuals after minimal interaction. Agents are thus able to use this information to decide whether or not to enter into risky joint production, and signal acquisition becomes critical to the evolution of social capital. In terms of social capital development, signal acquisition acts as a screening mechanism that causes the honest agents a higher probability of entering joint production, and therefore increasing their average income (or fitness).

The results of the model generate three critical interactions between contracting institutions enacted by government, and the development of social capital. First, institutions may be necessary to promote joint production by reducing the associated risks, and the risks associated with joint production are the incentive to engage in the screening process. Second, the enforcement of contractual obligations reduces the benefit to opportunistic activity, and therefore encourages the development of honesty within society. Finally, strong government institutions may crowd out the benefits associated with signal acquisition, and without signal acquisition the honest individuals are at a disadvantage, leading to the downward evolution of social capital.

These interactions generate two critical barriers in the effectiveness of government institutions in the development of social capital. First, at low levels of social capital, the contracting institutions necessary to encourage joint production are also sufficient to crowd out the screening activity that promotes social capital development. This has the effect of generating a social capital trap, in which a society endowed with poor social capital is unable to use contracting institutions to escape the effects of a poor endowment. Second, the crowding out effect generates a maximum level of social capital, at less than the perfectly honest society, beyond which social capital will not increase. The final result in the paper is that reducing the cost of screening, or increasing its efficiency, has the effect of lowering the bar to social capital development, and increasing the maximum level of social capital in society. Thus it may be that government actions to promote social capital would be more effective in promoting the exchange of information in society, rather than in improving the environment for formal contracting.

[4]This literature is summarized below.

Starting with Coleman (1988) and Putnam (1993), an extensive literature has developed to understand how social structures affect economic outcomes. The initial research focused on a definition of social capital as the content of interpersonal relationships and civic involvement. However, the subsequent literature has also fixed on a notion of social capital that is far larger than the interpersonal relationships first envisioned. In an empirical analysis by Knack and Keefer (1997), the authors define social capital further to include the level of interpersonal trust within society. That is, do people believe that "'most people can be trusted"' within the society[5].

The primary focus of the paper is on the trustworthiness of a society. Essentially, a fraction of the population is unwilling to cheat once they have committed to a particular action, regardless of the possibility of external enforcement. The paper therefore deals directly with the second form of social capital, trust. Additionally, as mentioned above, individuals are able to incur a cost to identify those individuals that have trustworthy preferences. This is representative of the civic engagement form of social capital, with individuals making decisions as to their engagement with society according to private incentives. Individuals that incur the cost associated with civic engagement are then able to acquire information through their networks about a prospective match. By modeling both extensive social capital, or trust, and intensive social capital, or relationships, this paper provides a connection for the two key ideas behind the social capital literature.

The primary motivation for this project is to understand the causes of the apparently large cross-country variations in the degree of interpersonal trust held by individuals. The World Values Survey has repeatedly included the following question about generalized trust in their surveys.

> "Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?"

At the individual level, the answers to this question can be interpreted to indicate either the trust an individual has in their fellow citizens, or alternatively as a reflective measure of trustworthiness (Glaeser, Laibson, Scheinkman, and Soutter 2000). In the aggregate, this distinction is lost and the fraction of individuals reporting that most people can be trusted may be viewed as a measure of the level of trust and trustworthiness in society[6]. This fraction

[5]Their results suggest that both interpersonal trust and civic engagement have important consequences for economic development.

[6]Note that while trust and trustworthiness are very different concepts, the common assumption is that there are no systematic errors in people's equilibrium beliefs. Therefore, the level of trust, and the opposite notion, the level of trustworthiness, are assumed to be strongly correlated.

varies from a high of roughly two-thirds of the population in the Scandinavian countries, to a low in the single digits in a variety of developing and underdeveloped countries. A related question included in the World Values Survey asks:

"Do you think most people try to take advantage of you?"

At the national level, the results from this question are strongly correlated with the fraction of people that say most people can be trusted. These results, and other related findings, suggest that there are real differences in trust levels around the world.

A significant literature has focused on explaining how a social norm such as trust has developed such variation across societies. The primary mechanism for analyzing the adaptation of social norms for trust has been evolutionary theory. Guth and Kliemt (1994, 1998) are early examples of this, while Francois and Zabojnik (2005), Tabellini (2008), Ahn and Esarey (2008) and Francois (2008) are more recent adaptations. All start from the premise that there is a subset of the population that is inherently trustworthy, and incorporate evolutionary mechanisms to describe the development of trust in society.

This literature, specific to the development of trustworthy types, builds upon a growing literature on the evolution of preferences more generally. A key insight in this literature is that for preferences different from those that directly maximize fitness to be selected, there must be at least partial observability of preferences (Heifetz, Shannon, and Spiegel 2007, Dekel, Ely, and Yilankaya 2007). Observability of preferences is necessary to alter the choices of agents in a game, and it is the altered choices of other agents that create the evolutionary selection pressure. This paper, following Guth and Kliemt (1994, 1998) and Ahn and Esarey (2008), each generate evolutionary dynamics with observability as a key factor. In contrast, Francois and Zabojnik (2005) and Tabellini (2008) generate evolutionary dynamics by altering the evolutionary process to allow for a 'warm glow' effect, in which the effective fitness of trustworthy individuals is increased through a non-pecuniary benefit. Finally, Francois (2008) adopts a different type space in which there are honest individuals that never cheat, dishonest individuals that always cheat, and opportunistic individuals that play to maximize fitness. In this setup, the evolutionary dynamics are played between the honest and the dishonest individuals, and there is a constant fraction of opportunistic agents. In this case, neither observability, nor 'warm glow' effects are necessary for the evolutionary development of trustworthy types.

The notion that preference types are imperfectly observable has broad support within anthropology, biology, psychology and economics. Frank (1987) and Frank et al. (1993), first demonstrated the theoretical justification for an evolved marker of trustworthiness, and

then showed that people are able to differentiate between real and faked enjoyment of a situation. More directly, Brown and Moore (2000), Brown et al. (2003) and Verplaetse et al. (2007) provide experimental evidence that people are able to detect altruism and honesty in prospective partners. The idea that preferences are observable has been defended in, among others, Ellingsen (1997), and is also incorporated extensively in the literature on evolutionary preferences[7] The model developed here allows agents to, at a cost, acquire a signal of the preference type of a prospective match. This cost could be interpreted as the cost of conducting an extensive interview, or could be the cost associated with civic engagement that provides an individual with additional information from other sources.

As mentioned, in addition to the idea of generalized trust, the notion of social capital has also been used to understand the role of civic engagement, or social connections, in economic situations. Building on the ideas proposed by Coleman (1988) and Putnam (1993, 1995b, 1995a), a large literature has developed to analyze this alternate form of social capital.[8] However, the connections between the two forms of social capital are not well understood. Fafchamps (2006) models the role of social connections, and the resulting improvements in trust. The empirical predictions of this model are complicated due to both positive and negative externalities related to social capital, possibly accounting for earlier findings showing little relationship between the two forms of social capital (Knack and Keefer 1997). In the model developed here, civic engagement, in the form of the costly observation of the preference type of other individuals, is key to the evolution of trustworthiness in society, but not beneficial from the perspective of current income.

Carlin et al. (2009) develop a related model in which social capital and government institutions interact. However, in this model, agents consciously choose their trustworthiness, or social capital, in response to economic incentives. The results of that paper are similar in form to the basic results here, as regulation is found to act as a complement to trust at low levels of social capital, and as a substitute for trust at high levels of social capital. However, given the nature of social capital, the persistent impact of poor social norms, or of government institutions cannot be examined in their model.

The focus of this paper on the connection between social capital and legal institutions builds on a growing recent body of work. Platteau (Platteau 1994) and Greif (2005) each discuss the relationship between public-order and private-order institutions and their ability to coordinate complex production. More recently, Tabellini (2008) and Francois (2008) develop theoretical models of norm development in the presence of varying legal institutions.

[7] See Eaton and Eswaran (2003) for one such example.

[8] See Sobel (2002) for a summary of the early work in this area.

In both papers, the effect of legal institutions is to promote the development of social capital by creating negative consequences for dishonest behaviour. In Tabellini, as the beneficial effects of cheating are reduced, the warm glow effect for honest individuals of acting honestly dominates, thus promoting the evolutionary development of trust. In Francois, the dishonest are particularly hurt by the increase in legal institutions as they are unable to not try to cheat.

The results in this paper are more closely linked to Bohnet et al. (2001), in which legal institutions may either encourage or discourage the evolution of trustworthiness. Similarly to the model developed here, at low levels of legal institutions the incentives create a scenario in which agents only match with honest partners, thus providing an evolutionary advantage for these agents. With stronger legal institutions, the dis-incentive to matching with opportunistic partners is reduced, thus creating an environment in which the opportunistic succeed. However, that paper assumes that honesty is a freely observable trait, and this eliminates the positive complementarity between contracting institutions and social norms that is found in this paper. Guth and Ockenfels (2005) derive a similar model in which the interaction between legal institutions can crowd out trustworthiness when types are observable, but crowd-in trustworthiness when preference types are unobservable.

The notion that government institutions can crowd out social norms is not specific to the theoretical literature on the development of trust. Papers by Kumlin and Rothstein (2005) and van Oorschot and Arts (2005) demonstrate empirically that government programs can affect social capital, and in particular the development of generalized trust. This builds on previous theoretical work by Frey (1997) that overly strict legal systems crowd out civic virtue.

Fukuyama (2001) provides an interesting discussion of the critical tradeoff that is behind the results in this paper. First, he states that:

> ...states indirectly foster the creation of social capital by efficiently providing necessary public goods, particularly property rights and public safety.[p.18]

but also that:

> ...states can have a serious negative impact on social capital when they start to undertake activities that are better left to the private sector or to civil society.[p.18]

These two statements reflect the opposing effects of formal institutions present in the model developed here. First, government policy is supportive of the development of social capital

by fostering an environment in which risky, complex production can function. However, if that support is excessive it renders civic engagement unnecessary and thus causes the erosion of social norms.

In considering the interaction between formal and informal institutions, the process of institutional change is critical to the analysis. In particular, the results derived here depend on the idea that formal, government institutions, can respond to the existence of strong or weak social norms of honesty. This requires that, as defined by Roland (2004), government institutions are "'fast-moving"', whereas social norms tend to change gradually. The institutional model in this paper follows this basic format, with government institutions chosen in any period in response to the existence of social norms that evolve slowly over time. While there is significant evidence that political institutions change relatively infrequently, it is also apparent that significant shifts are possible in short periods of time.

The key result of the paper is that at low levels of social norms, there exists the possibility of a dynamic complementarity between social norms and legal institutions. As such, government institutions must be sufficiently effective to encourage the complex production methods that provide incentives for civic engagement that is necessary for the evolutionary development of social norms. However, government institutions that are too strong, eliminate the incentive for social interaction even while promoting complex production, thus eliminating the upward pressure on social norms. This result suggests that the effectiveness of government in promoting social norms is strictly limited, which leads to the possibility of an institutional trap where social norms remain low, regardless of government action.

The notion that institutional traps may exist has been explored at length in the development literature[9], and is also a key result in Tabellini (2008). However, the poverty trap in that paper is specific to the political process of decision making. Effectively, when social norms are weak, the large body of opportunistic individuals know that they would be worse off with stronger government institutions and therefore block reform that would have the effect of raising average welfare. In contrast, the institutional trap developed here is structural. A government with weak social norms is unable to implement a contracting institution that promotes social development, regardless of its preferences.

Further, the model developed here links the existing research on social diversity and institutional development. If diversity causes an increase in the cost of civic engagement, or a reduction in the accuracy of information provided by social networks, that diversity increases the level of social capital necessary to escape the institutional trap.

The next section presents the basic economic model with fixed rates of social capital

[9]See Bowles et al. (2006) for a full-length treatment of the subject.

and contracting institutions. Section 3 derives the equilibrium solution to this model and presents the resulting outcomes in graphical form. Section 5 presents the evolutionary model that defines the development of social capital. Sections 6 and 7 discuss the interaction effects between contracting institutions and social capital, and how those interactions combine to generate four distinct social capital regimes, including an institutional trap at low levels of social capital. Section 8 discusses the effects of social division on the development of social capital, and section 9 concludes.

# 2 Model

A model of cultural evolution is an inherently dynamic problem. With this in mind, I first develop a simple single-period model for exogenous levels of social capital and institutional development. Agents are paired randomly and, after possibly acquiring information about their partner, may choose to work together or apart. This model generates the behaviour and outcomes that then permit the discussion of cultural evolution and institutional development that follows.

There are three key elements to the model. First, agents may choose to work in joint production or remain on their own, and the moral hazard associated with joint production is the key factor in this decision. Second, workers are heterogeneous. A fraction of all individuals in society have an inherent preference to act honestly, and will do so even in the presence of gains to opportunism. Third, agents may acquire information regarding the behaviour type (honest or opportunistic) of their prospective partner. However, this information is both costly and imperfect. These three elements provide the basic structure necessary to proceed to the discussion of the evolution of social norms of honesty, in section 5.

## 2.1 The Population and Production Technology

There is a population of measure 1, of which a fraction $\beta \in (0,1)$ incur a non-pecuniary cost, $\psi$ of behaving dishonestly. In the model, this occurs if an honest person accepts a contract and then shirks their responsibility. However, this non-pecuniary cost does not affect the evolutionary model that follows[10]. Specifically, 2 people, one honest and the other dis-honest, that take identical actions, would have identical fitness.

[10] And would not even if it occurred in equilibrium. In the model, this is simply the sufficient incentive for honest individuals to not shirk.

Production occurs either alone, or in 2-person teams. Production alone generates a net payoff normalized to 0, while production in teams generates an amount $\alpha \in (0,1)$ for each participant. Team production, while inherently more productive than producing alone, creates a 1-sided moral hazard problem. At the beginning of the period, all individuals, regardless of type, are randomly paired, and then one is defined as Player 1(referred to by feminine pronouns), while the other is defined as Player 2(referred to by masculine pronouns). Production creates a moral hazard problem for Agent 2, and thus it will be necessary for Player 1 to determine whether she wants to undertake joint production. If joint production is undertaken, but Player 2 decides to shirk, the direct payoffs from production are (-1) for player 1 and (+1) for player 2[11].

## 2.2 Signals,Offers and Acceptance

Prior to the decision to enter joint production, player 1 has the option to pay a cost, $\theta > 0$, to acquire a signal of the behaviour type of player 2[12]. With a probability $\kappa \in (\frac{1}{2}, 1)$, the signal will correctly match the type of player 2, with a good signal if he is honest, and a bad signal if he is opportunistic. Conversely, with a probability $(1-\kappa)$, the signal is incorrect, with good signals attached to opportunistic types and bad signals associated with honest players. I restrict focus to situations in which signals are sufficiently cheap and informative as to be acquired in at least certain cases. The specific assumption that is necessary and sufficient[13] is that:

**Assumption 1**

$$\theta < \frac{\alpha(2\kappa - 1)}{1+\alpha} \tag{2.1}$$

After acquiring the signal, Agent 1 can choose to offer Agent 2 the opportunity to enter joint production, or produce on her own and receive a payoff normalized to zero. If agent 1 chooses to offer joint production, agent 2 may choose to accept or reject that offer.

[11]The net utility after shirking is therefore identical to the net production from producing alone. An alternative would be to have the total shirking outcome be lower than solo production, though this would not affect the results presented here. To see this, simply define $\alpha < 1$, and player 2 receives an amount $\mu$ where $\alpha < \mu < 1$. As player 2's utility from shirking is only relevant in this game to the extent that it is greater than $\alpha$, there is no effect on the equilibrium that results. An extension of the paper to consider optimal government choice would need to consider this issue further.

[12]As discussed in the introduction, this could be the cost of civic engagement. With greater civic engagement, a player is more likely to have access to reports from other members of society as to the personality of a randomly matched individual.

[13]I discuss the logic behind this assumption further below.

## 2.3 Institutions, Effort and Outcomes

If an offer of joint production is extended, and accepted, the two agents draw up a contract that covers as many eventualities as possible. Once the contract is written, and if it is accepted, both agents begin work. On starting production, agent 2 learns whether the contract will actually be enforceable in court, as determined by the quality of a country's institutions. With a probability, $i$, the contract is enforceable, and shirking will be punished by an amount $P$. Conversely, with a probability $1 - i$, the contract will not be enforceable, and the worker knows that there will be no punishment for shirking.

A key difference from the existing literature is that the agent knows the institutional effects prior to making his choice regarding shirking. While this approach to modeling institutions is non-standard, there is a strong reason for doing so. The natural alternative is to have the effectiveness of the contract determined after the worker makes the decision to shirk or work. In the context of this model, that would generate a binary shift in behaviour at a particular institution, below which no dishonest individual would work, while above that point all dishonest individuals work. This result would be even less realistic than the modeling choice made above. Optimally, a combination of the two concepts could be incorporated, with the agent imperfectly observing the consequences of shirking, and this may be explored in a future extension. As long as the effects of increasing institutions leads to a continuous increase in the probability of opportunistic agents working, the results will not change from those presented here.

The punishment that results from shirking in the face of an enforceable contract, $P$, is assumed to be greater than the benefits of shirking, $1 - \alpha$, and therefore when contracts are enforceable, both honest and opportunistic workers have a dominant strategy to not shirk. Similarly, the non-pecuniary cost of dishonest behaviour incurred by an honest individual, $\psi$, is also assumed to be large enough such that working dominates shirking.

## 2.4 Timing

1. Random matching
2. Optional signal acquisition by player 1, at a cost $\theta$, of quality $\kappa$
3. Agree to joint production or not
4. Contract enforceability determined, probability $i$
5. Player 2 chooses to work or shirk

6. Production is realized

The key variables in the model are fraction of the population that is honest, $\beta$, and the quality of contracting institutions, $i$. There are three parameters of interest, $\theta$ and $\kappa$ represent the cost and quality of signals, while $\alpha$ is the value of joint production.

# 3 Equilibrium

## 3.1 Defining an Equilibrium

The relevant equilibrium concept in a game with incomplete information is a sequential equilibrium, which requires that each player's strategy incorporates optimal choices at any information set, while also placing restrictions on player's beliefs. However, given the simplicity of the game modeled here, it is sufficient to focus on Nash equilibria that result from the elimination of dominated strategies, and then confirm that these equilibria meet the requirements of a sequential equilibrium.

**Proposition 1** *For any set of parameter values, social capital, $\beta$, and contracting institutions, $i$, a sequential equilibrium exists. Further, for almost any set of parameter values, social capital and contracting institutions the equilibrium is unique.*

The exact characterization of the strategy along the equilibrium path is defined here[14].Each behaviour type of Player 2 has a dominant strategy. If he is honest, he accepts any contract and works to complete the contract. If he is opportunistic, he accepts any contract, and works if and only if the contract is enforceable. The institutional environment determines the optimal choice for player 1. First, I define 3 cut-off values:

$$I_{AB}(\beta) = \frac{\theta + (1-\beta)(1-\kappa) - \beta\kappa\alpha}{(1-\beta)(1-\kappa)(1+\alpha)} \tag{3.1}$$

$$I_{AC}(\beta) = \frac{1-\beta-\beta\alpha}{(1-\beta)(1+\alpha)} \tag{3.2}$$

$$I_{BC}(\beta) = \frac{(1-\beta)\kappa - \beta\alpha(1-\kappa) - \theta}{\kappa(1-\beta)(1+\alpha)} \tag{3.3}$$

The strategy choice along the equilibrium path for player 1 is:

1. $i \leq I_{AB}(\beta)$ & $i \leq I_{AC}(\beta)$

[14]Off equilibrium path strategies are effectively irrelevant in this game, due to the information structure of the game, and as such, I do not focus on them. They are however defined within the context of the proof.

- Player 1 does not screen prospective partners and will not offer to enter into any contracts.

2. $i \geq I_{AB}(\beta)$ & $i \leq I_{BC}(\beta)$

   - Player 1 acquires a signal of the type of player 2, and offers to enter joint production if and only if she receives a good signal.

3. $i \geq I_{AC}(\beta)$ & $i \geq I_{BC}(\beta)$

   - Player 1 does not acquire a signal of type, and offers to enter joint production with player 2.

4. At specific contracting institutions where more than one equilibrium condition is satisfied, there are multiple equilibria.

## 3.2 Proving Proposition 1

There are four decisions in the game, the first two by player 1, and the last two by player 2, and the game can be solved by backward induction. The next subsection defines the dominant strategy for player 2, which must form his strategy in any equilibrium. I then define the optimal choice for player 1 in deciding whether to offer contracts, followed by the optimal choice in determining whether to acquire a signal of player 2's behaviour type. Finally, I collect the results of these three subsections to demonstrate that a sequential equilibrium exists for all values of parameters, social capital and institutions, and that it is almost everywhere unique.

### 3.2.1 Work or Shirk

The last move of the game occurs when Player 2 chooses to either work or shirk.

**Lemma 1** *If player 2 is honest, his dominant strategy in this sub-game is to work, rather than shirk. If player 2 is opportunistic and his contract is enforceable, then his dominant strategy is to work. If he is opportunistic, and his contract is unenforceable, then his dominant strategy is to shirk.*

At this stage, he knows whether his contract is enforceable, and as he is player 2, he knows his own type. If he is honest, the payoff to working is $\alpha$, and the payoff to shirking is $1 - \psi$ is less than $\alpha$ by assumption. If he is opportunistic, and his contract is enforceable, then the payoff to working is higher than the payoff to shirking, $\alpha > 1 - P$, and he will work. If the

contract is not enforceable, the payoff to shirking is higher than the payoff to working, $1 > \alpha$ and he will shirk.

Before the enforceability of institutions is known, player 2 must decide if he will accept the contract offer.

**Lemma 2** *Player 2 will accept a contract offer under any circumstances.*

Accepting the contract offer offers a payoff of $\alpha$ if he works, and a payoff of 1 if he is opportunistic, his contract is unenforceable, and he shirks. Either payoff is greater than the alternative of not accepting the offer and receiving a payoff of 0.

**Corollary 1** *Player 2 has a dominant strategy to accept any offer, and then work unless he is opportunistic and his contract is unenforceable, in which case he will shirk.*

Any equilibrium will necessarily be based on player 1 having accurate beliefs about the expected play of player 2, and this corollary defines what those beliefs must be.

### 3.2.2 Offering a Contract

The decision to accept an offer by player 2, is preceded by the decision to make an offer by player 1. At the time that she does this, she is at one of 3 information sets. Either she has not acquired a signal, or she has acquired a signal and it was either good or bad[15]. The next 3 lemmas define the optimal strategy at each information set. At each information set, she is in one of two states of nature - either player 2 is honest or he is opportunistic.

First, I define the critical value:

$$I_{AC}(\beta) = \frac{1-\beta-\beta\alpha}{(1-\beta)(1+\alpha)}. \tag{3.4}$$

**Lemma 3** *If no signal has been acquired, it is optimal for player 1 to offer player 2 a contract if $I \geq I_{AC}(\beta)$. It is optimal for player 1 to not offer player 2 a contract if $I \leq I_{AC}(\beta)$. At $I = I_{AC}(\beta)$, either strategy is optimal.*

Proof - see appendix. If institutions are higher than the cutoff value, the expected payoff to offering a contract is greater than zero, the payoff to not offering a contract.

[15] I use the terminology good/bad as the signals may be incorrect and are therefore not interchangeable with the notation honest/dishonest. Also note that good/bad is not interchangeable with correct/incorrect - which I avoid as that is information unavailable to the player.

In the second information set under consideration, player 1 has received a signal of player 2's type, and that signal is good. Define the critical value:

$$I_G(\beta) = \frac{(1-\beta)(1-\kappa) - \beta\kappa\alpha}{(1-\beta)(1-\kappa)(1+\alpha)} \tag{3.5}$$

**Lemma 4** *After receiving a good signal, it is optimal for player 1 to offer a contract if $I \geq I_G(\beta)$. If is optimal to not offer a contract if $I \leq I_G(\beta)$. Either strategy is optimal at the critical value of institutions.*

Proof - see appendix. Again, if institutions are higher than this cutoff value, the payoff to offering a contract in this situation is higher than not offering a contract.

Similarly, we can define a cutoff value after a bad signal. Let:

$$I_B(\beta) = \frac{(1-\beta)\kappa - \beta\alpha(1-\kappa)}{\kappa(1-\beta)(1+\alpha)} \tag{3.6}$$

**Lemma 5** *After receiving a bad signal, it is optimal for player 1 to offer a contract if $I \geq I_B(\beta)$. If is optimal to not offer a contract if $I \leq I_B(\beta)$. Either strategy is optimal at the critical value of institutions.*

Proof - see appendix.

**Corollary 2** *If it is optimal to offer a contract after a bad signal, it is also optimal to offer a contract after a good signal.*

This is easily shown as $I_G(\beta) < I_B(\beta)$ when $\kappa > \frac{1}{2}$, which is true by assumption. Given this corollary, there remain three possible strategies after acquiring a signal. Either never offer a contract, always offer a contract, or offer a contract if and only if the signal was good. In the next lemma I demonstrate that the first two options will never be part of the equilibrium path.

### 3.2.3 Choosing to Screen

The first decision in the game occurs when player 1 chooses to pay to acquire a signal of player 2's type.

**Lemma 6** *It is never optimal to acquire a signal, and then ignore it.*

Proof - see appendix. Acquiring the signal is costly and if it is ignored, then there is no possibility that it provides value. We can therefore eliminate these strategies from consideration.

On the equilibrium path, player 1 was originally choosing from 6 possible strategies[16]. Three of these (2 ways of acquiring and ignoring signals, or acquiring a signal and then offering a contract if and only if the signal is bad) have been eliminated. The game is therefore reduced to player 1 choosing from one of 3 effective strategies.

A - Don't acquire signals and never enter joint production.

B - Acquire a signal, and enter joint production if and only if the signal is good. (Separating equilibrium)

C - Don't acquire signals, and enter joint production. (Pooling equilibrium)

The payoff to each strategy for player 1 is:

$$U_{1A}(i,\beta) = 0 \tag{3.7}$$

$$U_{1B}(i,\beta) = \beta\kappa\alpha + (1-\beta)(1-\kappa)i\alpha + (1-\beta)(1-\kappa)(1-i)(-1) - \theta \tag{3.8}$$

$$U_{1C}(i,\beta) = \beta\alpha + (1-\beta)I\alpha + (1-\beta)(1-i)(-1) \tag{3.9}$$

Strategy B will be preferred to strategy A if:

$$\beta\kappa\alpha + (1-\beta)(1-\kappa)i\alpha + (1-\beta)(1-\kappa)(1-i)(-1) - \theta \geq 0 \tag{3.10}$$

while strategy A would naturally be preferred to strategy B if the converse were true. If the payoffs from the 2 strategies are equal, then it is possible that either will be selected. Rearranging this equation indicates that strategy B will be preferred to strategy A if:

$$i \geq \frac{\theta + (1-\beta)(1-\kappa) - \beta\kappa\alpha}{(1-\beta)(1-\kappa)(1+\alpha)} \tag{3.11}$$

Define this as the cutoff value, $I_{AB}(\beta)$, listed with proposition 1.

Similarly, Strategy C will be preferred to strategy A if:

$$\beta\alpha + (1-\beta)I\alpha + (1-\beta)(1-i)(-1) \geq 0 \tag{3.12}$$

Rearranging results in the cut-off value:

$$I_{AC}(\beta) = \frac{1-\beta-\beta\alpha}{(1-\beta)(1+\alpha)} \tag{3.13}$$

[16] As mentioned, the off-equilibrium path elements of player 1's strategy are inconsequential for play, as these choices are completed before player 2 makes any choices. I therefore do not discuss them in detail. However, if player 1 chooses to acquire signals, then the off-equilibrium element of his strategy must be determined according to lemma 3. Similarly, if player 1 chooses to not acquire signals, his choices if he were to acquire signals are determined according to lemmas 4 and 5.

Finally, strategy C will be preferred to strategy B if:

$$\beta\kappa\alpha + (1-\beta)(1-\kappa)i\alpha + (1-\beta)(1-\kappa)(1-i)(-1) - \theta \geq \tag{3.14}$$

$$\beta\alpha + (1-\beta)I\alpha + (1-\beta)(1-i)(-1) \tag{3.15}$$

and the associated cutoff value is:

$$I_{BC}(\beta) = \frac{(1-\beta)\kappa - \beta\alpha(1-\kappa) - \theta}{\kappa(1-\beta)(1+\alpha)} \tag{3.16}$$

These three cutoff values determine the optimal strategy for player 1, as defined in proposition 1.

Alternatively, one can rearrange these equations to solve for the critical level of social capital at which each strategy is optimal for a given institutional quality, by defining $\beta_{AB}(i), \beta_{AC}(i)$ and $\beta_{BC}(i)$. In particular, I refer to $\beta_{ii}(0)$ below to denote the level of social capital at which there is a change in strategy in the absence of contracting institutions. Assumption 1 regarding the cost of signal acquisition (or civic engagement) is necessary for $\beta_{AB}(0) < \beta_{BC}(0)$ - when contracting institutions are non-existent, there exists a range of social capital levels at which it is optimal for agents to acquire signals. If this were not true, then there would be no institutional value for which signal acquisition would be an optimal strategy.

### 3.2.4 A Sequential Equilibrium

As mentioned, a sequential equilibrium requires that all players strategies contain optimal choices at any information set (on or off the equilibrium path), given their beliefs, and that those beliefs are consistent with the strategies chosen by the respective players. The beliefs of player 1 and 2 are the easiest to deal with. Player 1 believes that player 2 will follow his dominant strategies. Player 2's beliefs about player 1 do not affect the equilibrium in any way as has full information regarding player 1's strategy when he makes his choice.

The requirement that all players make optimal choices at every information set only has the potential to affect strategy B, in which player 2's strategy calls for the acquisition of signals, and then offering a contract if and only if the signal was good. The next lemma shows that strategy is still optimal after the signal is acquired.

**Lemma 7** *For institutional values at which each strategy of player 1 is preferred, that strategy is optimal at every information set.*

Proof - see appendix. On the institutional range in which strategy B is optimal ex ante, it is optimal to offer contracts after good signals, and not offer contracts after bad signals.

The payoff functions for player 1 are well-defined and finite-valued, and therefore at least one must be weakly higher than the other two. Define the optimal strategy for player 1 as the strategy A,B, or C associated with the highest payoff.

$$U_1(i,\beta) = \underset{A,B,C}{\text{argmax}}\{U_{1A}(i,\beta), U_{1B}(i,\beta), U_{1C}(i,\beta)\} \tag{3.17}$$

If player 1 chooses the strategy (A,B,C) that maximizes his payoff, and player 2 follows his dominant strategy, and both believe that the other will do so, then the equilibrium is both rational and consistent, and forms a sequential equilibrium. Therefore an equilibrium exists, proving the first part of proposition 1.

**Lemma 8** *If $i \notin \{I_{AB}(\beta), I_{AC}(\beta), I_{BC}(\beta)\}$, the equilibrium is unique along the equilibrium path.*

There are three strategies under consideration, and if any two result in the identical payoff, then $i \in \{I_{AB}(\beta), I_{AC}(\beta), I_{BC}(\beta)\}$. Therefore, under the restriction noted, the 3 strategies for player 1 must provide different payoffs. Further, all 3 payoff functions are well-defined. Therefore, one must provide a strictly higher payoff to player 1, and therefore forms that player's strategy when combined with optimal play off the equilibrium path. If player 1 or player 2 chose a different strategy, that would not be sequentially rational. And if either believed that the other would not choose their optimal strategy, that would not be consistent. Therefore, there cannot exist any other sequential equilibrium. This proves the second part of the proposition, concerning uniqueness[17].

At the points with multiple equilibria, player 1 has multiple strategies that provide an identical payoff, and therefore also has a range of mixed strategies that are also optimal. These are the only points at which mixed strategies can be optimal for either player.

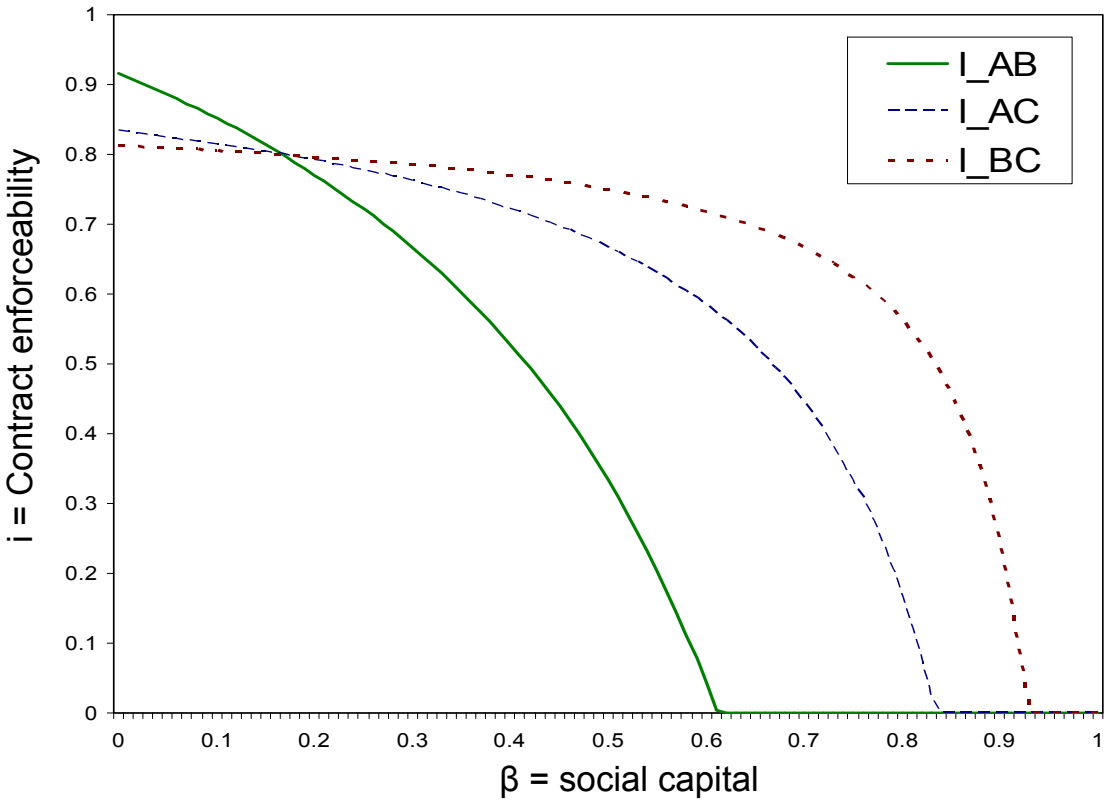
# 4 Characterization of the Equilibrium

The strategy space is easily represented graphically in terms of the cutoff values for each strategy[18].

[17] If one is concerned about the strategies on the off-equilibrium path having a unique solution, then there are three more specific institutional levels that must be excluded from the lemma. Either way, there is a small number of cases in which there could be multiple equilibria.

[18] All figures in the paper are calculated with parameter values $\alpha = 0.20, \kappa = 0.8$, and $\theta = 0.02$)

Figure 1: Critical Values for Player 1's Choice



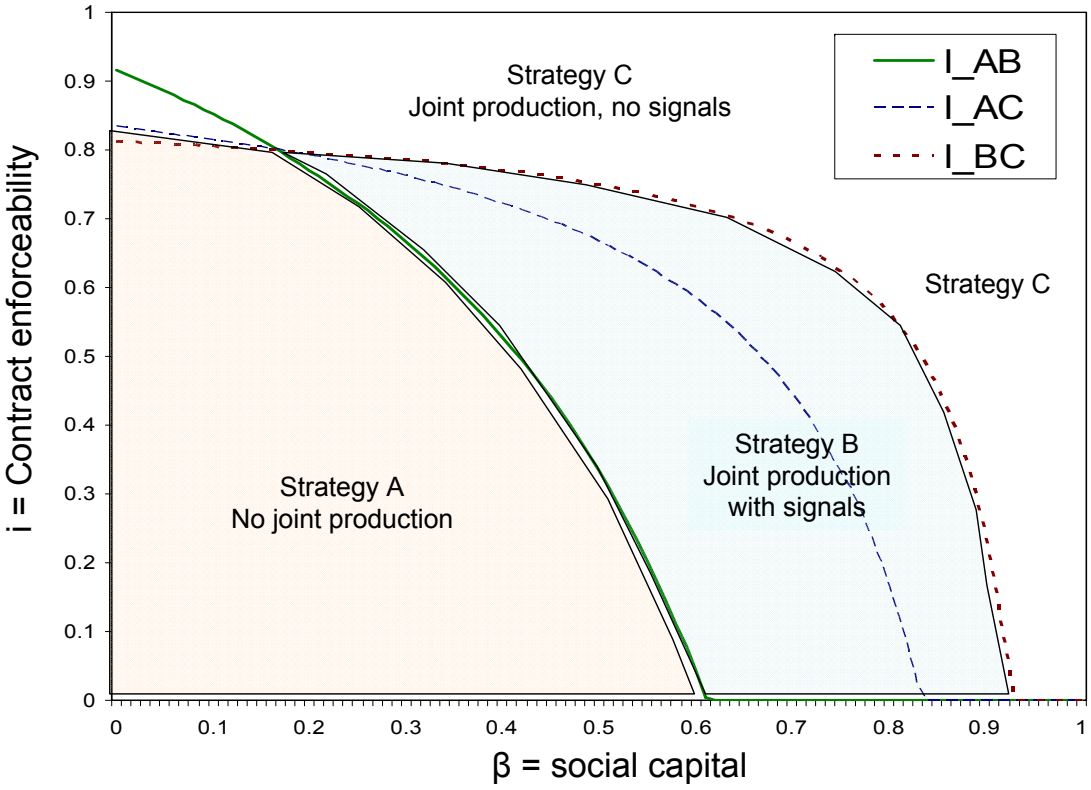

The key feature of this graph is the fact that the 3 cut-off lines cross at a single point. At this institutional pair,

$$(I^*, \beta^*) = \left( \frac{2\alpha\kappa - \alpha - \theta - \theta\alpha}{(1+\alpha)(2\alpha\kappa - \alpha - \theta)}, \frac{\theta}{\alpha(2\kappa - 1)} \right) \tag{4.1}$$

the expected utility of each strategy for player 1 is equal to zero. Further, it is easy to show that with zero social capital, $\beta = 0$, the ordering of critical values is as pictured, $I_{BC}(0) < I_{AC}(0) < I_{AB}(0)$. Similarly, given assumption 1, it is easy to show that $\beta_{AB}(0) < \beta_{AC}(0) < \beta_{BC}(0)$.

As shown in figure 2, there are three relevant regions of strategies. In the lower left corner, where both contracting institutions and social capital are low, players choose to avoid joint production. When either institutions or social capital are high (or both), all players enter into joint production. In the skewed wedge-shaped region in the middle, the equilibrium

Figure 2: Player 1 Strategy as a Function of Institutions




strategy calls for the acquisition of signals, and then continuing to joint production if and only if there is a good signal.

## 5 The Evolution of Preferences

Whereas contracting institutions are a conscious decision of the government, social norms are assumed to adapt through a process of cultural evolution. While the underlying process is naturally complex, the model developed here is exceedingly simple. The primary reason for this is that the level of detail that must be added to the structure to derive complete analytical solutions would necessarily require specific assumptions on this process that would have little analytical value. The goal here is to provide an analysis of the interaction between government institutions and social norms that is general to a variety of processes of cultural

evolution.

The path of cultural evolution is defined by the success of honest individuals within a society, relative to the opportunistic individuals. When trustworthy individuals are seen to be rewarded, it is assumed that there is an underlying shift in preferences toward honesty. In contrast, when trustworthy individuals are at a disadvantage there is a shift toward opportunism.

The relative success of honest and opportunistic individuals is determined by the decisions to acquire signals of behaviour type or not, and to enter joint production or not. In all cases, half the agents, those assigned by nature to be player 1, will have identical expected utility regardless of behaviour type. The key for the evolutionary argument is the relative utility of honest and opportunistic agents when assigned by nature to be player 2. The following 3 lemmas define the relative utility of individuals assigned to be player 2, under each of the 3 types of equilibria that exist.

**Lemma 9** *When joint production does not occur (equilibrium A), honest and opportunistic agents have identical utility* ($U_{hA} = U_{oA}$).

When no one is willing to enter joint production, all agents have an expected utility of 0.

**Lemma 10** *If joint production occurs only after the revelation of a positive signal (equilibrium B), honest agents have strictly higher expected utility than opportunistic agents if and only if institutions are sufficiently strong.* $\left(U_{hB} > U_{oB} \text{ if and only if } i > \frac{1-\kappa-\alpha\kappa}{(1-\alpha)(1-\kappa)}\right)$

Proof - see appendix. There is contrasting evolutionary pressure in equilibrium B, as honest agents are more likely to be hired than dishonest agents, but dishonest agents receive a higher expected utility when they are hired as they have the possibility to gain from shirking. If contracts are sufficiently enforceable, then the gains from shirking are limited, and therefore the increased rate of hiring for honest agents dominates this comparison. Further, if signals are sufficiently informative, $\kappa > \frac{1}{1+\alpha}$, then honest agents have higher utility in this equilibrium, regardless of institutional quality. For future reference, I define this critical institutional level as:

$$i^e = \max\left\{0, \frac{1-\kappa-\alpha\kappa}{(1-\alpha)(1-\kappa)}\right\} \tag{5.1}$$

**Lemma 11** *When agents enter joint production without acquiring signals (equilibrium C), and contracting institutions are less than perfect* ($i < 1$), *honest agents have strictly lower expected utility than opportunistic agents* ($U_{hB} < U_{oB}$).

Proof - see appendix. In this equilibrium, honest agents gain no hiring advantage, but the advantages of shirking remain for dishonest agents. The only caveat is that if contract enforceability were perfect, then there would be no advantage from shirking and all agents receive the same utility.

### 5.1 The Evolutionary Process

The evolutionary process assumed to be at work here is extremely simple. Assuming interior values of $\beta$, if honest types have higher utility than opportunistic types then the proportion of honest types will increase. Define $F_h$ and $F_o$, as the average fitness of honest and opportunistic individuals, respectively. The evolutionary process then follows the functional form:

$$\beta_{t+1} - \beta_t = \beta_t(1 - \beta_t) * G[F_h - F_o] \tag{5.2}$$

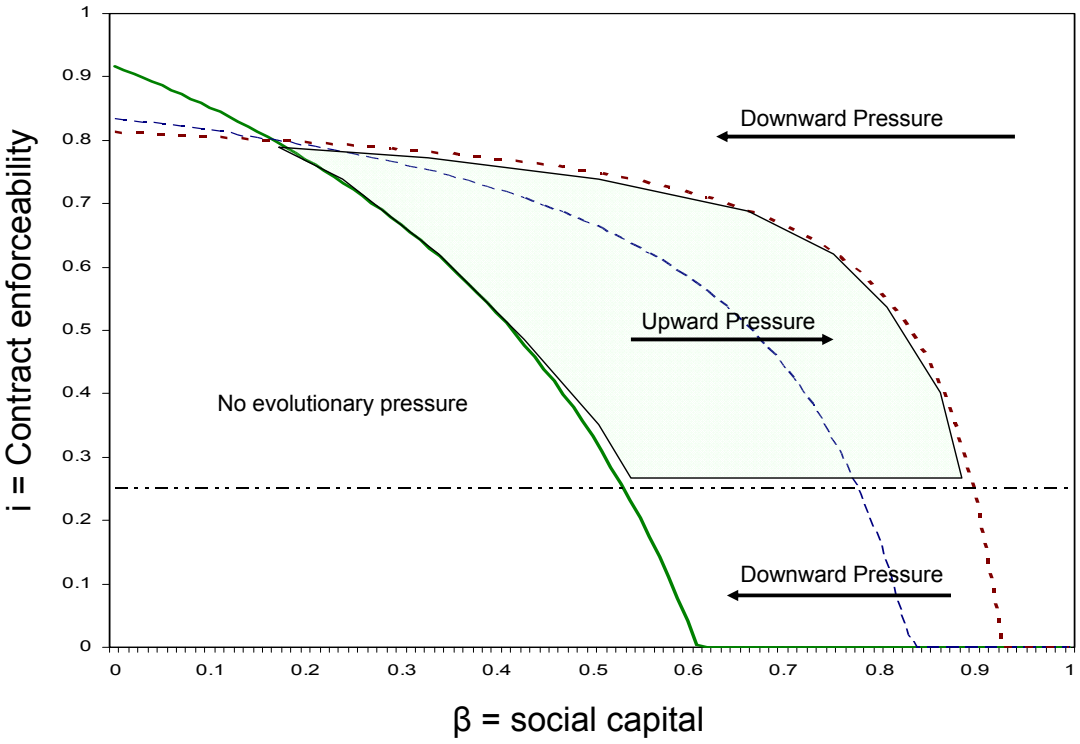
where $G(a, a) = 1$ and $G'() > 0$. Perfect honesty ($\beta = 1$) and perfect opportunism ($\beta = 0$) are therefore absorbing states, while at intermediate levels, evolutionary pressure will push in the direction of the behaviour type with higher average fitness.

This evolutionary process, with the results of Lemmas 9 to 11, creates the simple dynamics indicated in figure 3. Where agents avoid joint production, there is no evolutionary pressure. When joint production occurs, evolutionary pressure will increase social capital when signals are acquired and institutions are sufficiently strong, and reduce social capital otherwise. Where multiple equilibria exist, the dynamics depend on the specific equilibrium selected. For example, along the $I_{BC}$ cutoff, the equilibrium must result in a fraction $\gamma$ of agents following equilibrium B, and acquiring signals of type, and a fraction $1 - \gamma$ choose not to acquire signals and simply enter joint production with anyone. The fraction $\gamma$ will determine whether honest or opportunistic agents do better under the selected equilibrium.

## 6 Institutional Interaction

From this model, it is possible to identify three separate interaction effects between the two institutional forms. First, there is an **economic activity** effect, where contracting institutions promote the joint production that is partially dependent on trust. Second, there is an **enforcement** effect, in which contracting institutions are necessary to limit the gains from opportunism. Third, there is a **crowding out** effect, where contracting institutions replace the screening mechanism that preferentially hires the honest types. The combination of the three effects varies significantly accordingly to the level of generalized trust in society, as discussed in section 7.

Figure 3: The Evolution of Preferences




### 6.1 An Economic Activity Effect

For countries with relatively low trust levels, $\beta < \beta_{AB}(0)$, in the absence of contracting institutions, the economy would be unable to undertake joint production. If contracting institutions are sufficiently strong, then the risk associated with joint production is mitigated. Thus contracting institutions can generate the economic activity that is necessary before social capital can develop.

When screening is imperfect, $\kappa < 1$, this will entail a non-empty set of social capital levels[19], at which there exists an institutional level that will promote joint production. As joint production is necessary for social capital development, institutions can have a complementary effect on social capital. Effectively, contracting institutions reduce the cost of mistakes

[19]When screening is perfect, $\kappa = 1$, the $I_{AB}$ line is undefined, and lies vertically at the point $\beta = \frac{\theta}{\alpha}$. For social capital levels below that, strategy A is preferred to strategy B, and for social capital levels above that, strategy B is preferred to strategy A. Critically, institutions have no effect when screening is perfect.

in screening, and therefore encourage the use of joint production.

### 6.2 A Crowding-Out Effect

However, institutions also crowd out the screening process. When an agent screens for type, institutions only matter when her partner is opportunistic *and signals are incorrect*. In contrast, when agents do not engage in screening, the institution matters whenever ones partner is opportunistic. For this reason, at any level of social capital improvements in institutions will have a larger increase in the expected utility of agents that choose strategy C (no signals), versus agents that acquire signals and condition on their outcome, strategy B.

### 6.3 An Enforcement Effect

The two previous effects generate the strategy space shown in figure 2, where there is the potential for a range of social capital levels at which joint production occurs after a screening process. However, agents following such a strategy is not necessarily sufficient to generate positive evolution of social capital. In addition, the benefits that accrue to opportunistic agents that are lucky enough to be hired must be relatively small. As was mentioned above, the evolutionary pressure is determined by the trade-off between a greater chance of being hired for the honest, against a higher benefit if they are hired for the opportunistic. As the extra benefit to the opportunistic only occurs when contracts are unenforceable, increasing institutional effectiveness limits these gains. If signals are sufficiently strong, then the enforcement effect is unnecessary.

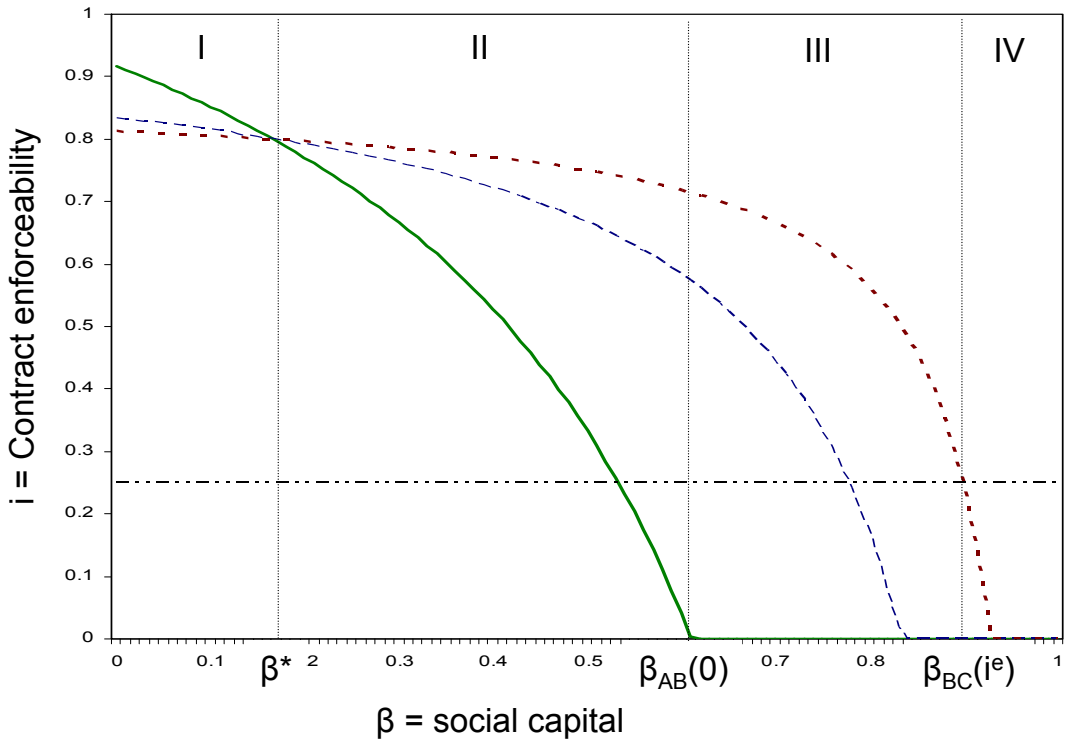
## 7 Social Capital Regimes

When can government be an effective force in promoting social capital development? Tabellini (2008) derives a result that there is always a critical level of contracting institutions such that any institution of equal or higher quality would promote social capital development. This is driven by the fact that the model in that paper is primarily based on the enforcement effect seen here, and critically, there is no crowding out effect. In this section I show that at low and high levels of social capital, government institutions cannot promote its development, while at intermediate levels of social capital, there are government institutions that could be effective. This result is driven by the relative importance of the three interaction effects defined in section 6.

**Proposition 2** *If* $\beta < \beta^* = \frac{\theta}{\alpha(2\kappa-1)}$*, or* $\beta \geq \beta_{BC}(i^e)$ *there is no contracting institution that can cause the social capital in the economy to increase, regardless of the intentions of government. Conversely, if* $\beta^* \leq \beta < \beta_{BC}(i^e)$*, there exists a level of contracting institutions that will promote the development of social capital.*

Proof - see appendix. Figure 4 shows graphically the critical values associated with the proposition, and the discussion that follows describes the relative importance of each of the interaction effects. To do so, I further divide the intermediate region of social capital into two parts, with the split occurring at $\beta_{AB}(0)$.

Figure 4: Social Capital Regimes




## 7.1 An Institutional Trap

$\beta^*$ corresponds to the social capital level associated with the intersection of the 3 cutoff values defined above. Intuitively, when social capital is below this level, there are two possibilities.

First, contracting institutions could be relatively weak, and in this case it is not worthwhile to pursue joint production. Alternatively, contracting institutions are strong enough to encourage joint production, however they are also strong enough to crowd out the use of a screening strategy. In this case, by lemma 11, social capital will decrease. As such, any society that finds itself with social capital lower than $\beta^*$, social capital will not increase, though.

This result is in contrast to the outcome of Tabellini (2008), in which institutions would promote social capital in any society, but political economy considerations prevent the development of effective institutions, and therefore generate an institutional trap. Here, it is simply not possible to use contracting institutions to promote social capital if social capital is too low.

However, it should be added that this social capital trap does not necessarily create an institutional trap that affects contracting institutions. If formal institutions are cheap enough, it may be efficient to have strong contracting institutions and allow social capital to decay toward zero. In particular, if institutions are free, then an equilibrium with perfect contracting is perfectly efficient, though social capital would tend toward zero[20].

### 7.2 Institutions to Promote Production

For countries with $\beta \in [\beta^*, \beta_{AB}(0)$, there exists a contracting institution that will generate the development of social capital. Contracting institutions are necessary to promote joint production, and also possibly to ensure that honest agents gain disproportionately from that joint production. In the absence of sufficiently strong contract enforceability, there is insufficient protection for agents to enter joint production, and social capital does not increase or decline. If institutions are overly strong, joint production will occur without screening, and therefore social capital will decline. In a middle range, institutions are strong enough to promote joint production without crowding out the use of social signals, and provide sufficient enforcement to ensure that honest agents achieve higher fitness than opportunistic agents.

The importance of contracting institutions in generating the incentives supporting the acquisition of signals is critically tied to the imperfections in the signals. As signals improve, ($\kappa \to 1$), the $I_{AB}(\beta)$ line approaches vertical, and this social capital regime no longer exists ($\beta^* = \beta_{AB}(0)$). When signals are perfect, agents that choose the strategy of acquiring signals derive no benefit from improving contracts, as they only continue to joint production with agents that are honest.

[20] If institutions are actually perfect, then there is no decay of social capital, however if contracting institutions are slightly less than perfect ($i = 1 - \epsilon$), then social capital will decline slowly.

### 7.3 Institutions as Enforcement

Similarly, for countries with $\beta \in [\beta_{AB}(0), \beta_{BC}(i^e))$, there also exists a contracting institution that will generate the development of social capital. However, in contrast with the previous range, contracting institutions are not necessary to promote joint production, as generalized trust is sufficient to allow joint production. However, in the absence of sufficient contracting institutions, social capital would decline over time as opportunistic individuals are the advantaged group. In addition, there is a maximum level of contracting institutions, beyond which no screening would take place and social capital would decline. If the screening process is sufficiently accurate, $\kappa \geq \frac{1}{1+\alpha}$, institutions have no role in enforcement, and this regime is characterized only by a maximum level of institutions that is consistent with stable or increasing levels of social capital.

### 7.4 Maximum Social Capital

For a country with $\beta > \beta_{BC}(i^e)$, it is impossible to maintain the existing levels of social capital. The economy runs on joint production, and whether or not screening is conducted, the opportunistic in society have the advantage. The starkness of this result is softened by the fact that there is no mechanism in the model by which any society would reach such a level of social capital in the first place. This regime is therefore effectively defined by the maximum level of stable social capital, $\beta_{BC}(i^e)$.

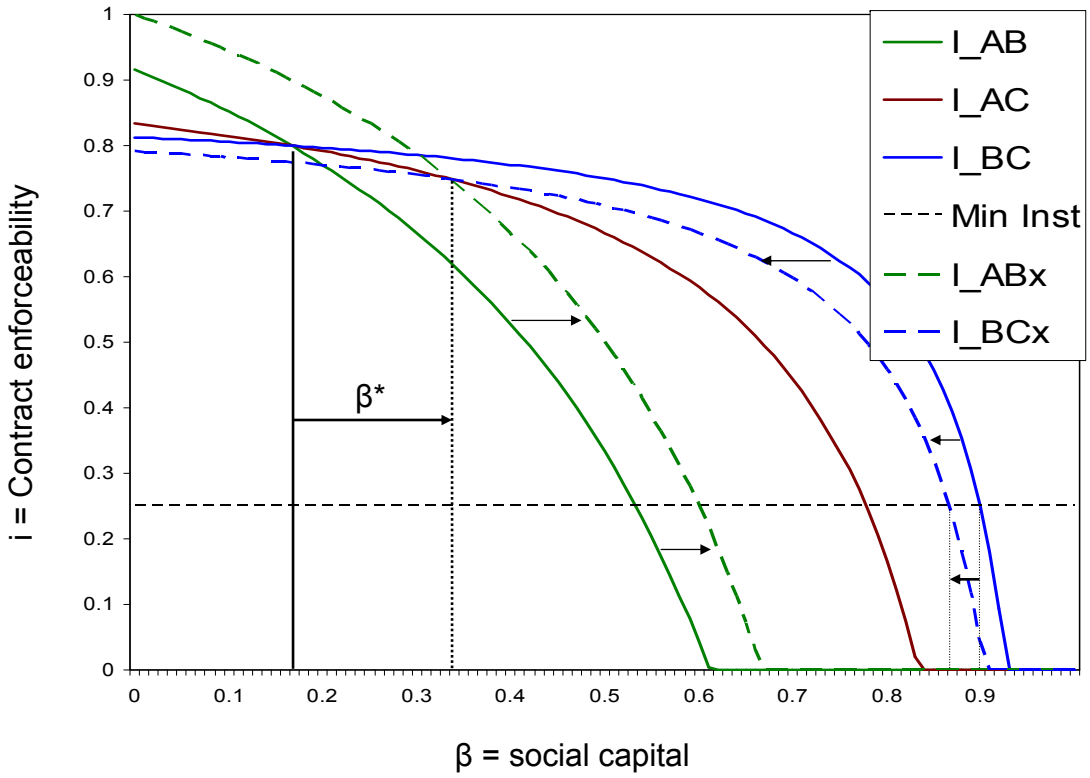
## 8 Social Diversity and the Effectiveness of Institutions

Social divisions, such as ethnic or religious diversity or wealth inequality, have been linked to lower levels of social capital (Knack and Keefer 1997). Further, ethnic diversity has been linked consistently with low levels of institutional development (Easterly 2001). A possible effect of social divisions is to either increase the cost of acquiring information about a prospective partner, or to reduce the accuracy of the information obtained. Within the context of the model developed here, this would mean increasing $\theta$ or reducing $\kappa$. Either change has the effect of increasing range of the institutional trap associated with low social capital.

**Proposition 3** *Social divisions that reduce the effectiveness of signals, or increase their cost, strictly increase the critical value of social capital below which a society is caught in an institutional trap with low social capital, and strictly decrease the maximum level of social capital.* $\left(\frac{\partial \beta^*}{\partial \theta} > 0, \frac{\partial \beta^*}{\partial \kappa} < 0, \frac{\partial \beta_{BC}(i^e)}{\partial \theta} < 0, \frac{\partial \beta_{BC}(i^e)}{\partial \kappa} > 0\right)$

Proof - see appendix. Increasing the cost of signals, or reducing their effectiveness, reduces the institutional space in which the acquisition of signals is optimal, thus increasing the level of social capital necessary to escape a social capital trap, and limiting the maximum development of social capital.

Figure 5: An Increase in the Cost of Signals




Increasing $\theta$, or reducing $\kappa$, both have the effect of reducing the profitability of acquiring signals, thus shifting out the $I_{AB}$ curve, and shifting in the $I_{BC}$ curve, thus shifting their intersection to the right. This is shown graphically in figure 5[21]. The other two lines from the figure, the $I_{AC}$ curve, and the line for a necessary set of institutions for social capital development, are not affected by a change in the cost of signal acquisition[22]. As in the

[21]The solid lines in figure 5 have not changed from the previous graphs, while the dotted lines are the result of increasing the cost of signal acquisition from $\theta = 0.02$ to $\theta = 0.04$.

[22]If instead the figure demonstrated a reduction in the effectiveness of signals, the $i^e$ line would also shift up, thus further reducing the maximum level of social capital.

proposition, and as shown in the figure, the range of social capital levels in regime 1, the institutional trap, and in regime 4, above the maximum social capital level, increase with social divisions. This result is consistent with the data demonstrating a negative link between social divisions and social capital.

# 9 Conclusion

This paper models the cultural evolution of trust that can occur if agents are able to screen potential partners for trustworthiness at a cost. When that screening is imperfect, then sufficiently strong government institutions can promote the development of social capital by reducing the risk associated with joint production in the face of a moral hazard problem, and reducing the potential opportunities for dishonest behaviour. However, the use of institutions to promote social capital is limited, as at high levels of government involvement, the civic engagement that is critical to the development of social capital is crowded out.

In countries with low levels of trust and trustworthiness, government institutions are unable to promote risky production without crowding out civic engagement. This results in the presence of a critical level of social capital, below which a society will find themselves in an institutional trap. A secondary feature of the model is the presence of a maximum level of social capital, beyond which an economy cannot move.

The advent of an institutional trap defined here is quite different from the institutional trap present in related work by Tabellini (2008), where the trap is created primarily by political economy concerns, where the group of opportunistic individuals gains from poor institutions and therefore blocks the development of better institutions. In contrast, the model developed here does not depend on a political economy consideration - a benevolent dictator would be similarly unable to extract the economy from the trap through the use of government institutions.

I then consider the role of social divisions on the development of social capital and contracting institutions. If social divisions increase the cost or reduce the effectiveness of social signaling, then those divisions will tend to exacerbate the problems of an institutional trap. This result is consistent with the extensive literature demonstrating the negative effects of ethnic diversity on the development of both formal and informal institutions. In addition, these results provide a positive message regarding the development of social capital. If government choices can promote civic engagement, by making investments in social signals cheaper, or more informative, then those choices may be more effective in promoting social capital than any investment in contracting institutions. In addition, to escape a social capital trap, it

may be necessary to strongly promote civic engagement while developing an effective, intermediate level of legal institutions to promote economic activity. This suggests the possibility that economic development requires the interaction of various institutional elements, rather than a simple focus on one element of institutional quality.

# A Proofs

## A.1 Proving Lemma 3

The cutoff value comes from a comparison of the payoffs associated with offering or not offering a contract. The expected utility to player 1 of choosing to not offer a contract is zero. The expected utility of offering a contract, in the absence of signals, is:

$$U_{1C}(\beta, i) = \beta\alpha + (1-\beta)I\alpha + (1-\beta)(1-i)(-1) \tag{A.1}$$

There are two nodes in the sequential game that are within this information set - either player 2 is honest or dishonest. If player 2 is honest, with probability $\beta$, or is dishonest but the contract is enforceable, then player 1 will receive a payoff of $\alpha$. If he is dishonest and contracts are unenforceable, then player 1 will receive a payoff of (-1).

Player 1 will optimally offer a contract if the payoff from doing so is greater than zero, or:

$$U_{1C}(\beta, i) = \beta\alpha + (1-\beta)I\alpha + (1-\beta)(1-i)(-1) > 0 \tag{A.2}$$

Rearranging equation A.2, results in the cutoff value defined in lemma 3.

## A.2 Proving Lemma 4

If player 1 does not offer player 2 a contract, her total payoff in the game is $(-\theta)$, as she has paid to receive a signal. If player 1 does offer player 2 a contract, her total payoff is:

$$U_{1|G}(\beta, i) = -\theta + \frac{\beta\kappa\alpha + (1-\beta)(1-\kappa)i\alpha + (1-\beta)(1-\kappa)(1-i)(-1)}{\beta\kappa + (1-\beta)(1-\kappa)} \tag{A.3}$$

Either the partner is honest and the signal was correct, or the player was dishonest and the signal was incorrect. In the latter case, the expected outcome is dependent on the quality of institutions. The denominator is simply the ex ante probability of being in this state. Making an offer will be optimal if and only if:

$$U_{1|G}(\beta, i) = -\theta + \frac{\beta\kappa\alpha + (1-\beta)(1-\kappa)i\alpha + (1-\beta)(1-\kappa)(1-i)(-1)}{\beta\kappa + (1-\beta)(1-\kappa)} > -\theta \tag{A.4}$$

Solving this for $I$ results in the defined cutoff value.

## A.3 Proving Lemma 5

As before, the payoff to not offering a contract is $-\theta$. The payoff to offering a contract is:

$$U_{1|B}(\beta, i) = -\theta + \frac{\beta(1-\kappa)\alpha + (1-\beta)\kappa i\alpha + (1-\beta)\kappa(1-i)(-1)}{\beta(1-\kappa) + (1-\beta)\kappa} \tag{A.5}$$

Setting $U_{1|B}(\beta, i) = -\theta$, results in the bad signal cutoff value.

## A.4 Proving Lemma 6

As shown after lemma 3, the expected payoff to player 1 after not acquiring a signal is:

$$U_{1N} = \max(0, \beta\alpha + (1-\beta)I\alpha + (1-\beta)(1-i)(-1)) \tag{A.6}$$

The first element is the payoff if no contract is offered, while the second is the payoff if a contract is offered. The payoff to acquiring the signal, and then not offering a contract, regardless of the signal is $-\theta$. Alternatively, the payoff to acquiring the signal, and then offering a contract, regardless of the signal is:

$$U_{1SY} = -\theta + \beta\alpha + (1-\beta)I\alpha + (1-\beta)(1-i)(-1) \tag{A.7}$$

Neither of these can be larger than the payoff associated with not acquiring a signal, and therefore neither can be part of an optimal strategy.

## A.5 Proving Lemma 7

This is only relevant in the case where player 1 chooses to acquire signals of player 2's type[23]. That is, for institutional values where the overall payoff is highest to signal acquisition, it is optimal to offer contracts if a signal has been good, and not to offer a contract if the signal has been bad. Combining equations 3.5, 3.6, 3.1 and 3.3, the institutional cutoffs can be ordered as $I_G(\beta) < I_{AB}(\beta) < I_{BC}(\beta) < I_B(\beta)$. In words, if institutions are sufficient for strategy B to be optimal, then $I_{AB}(\beta) \leq i \leq I_{BC}(\beta)$. If so, then it must be that $I_G(\beta) < i < I_B(\beta)$, the institutions are sufficient to offer contracts if a signal has been good, but not offer a contract if the signal was bad. Therefore the strategy is sequentially rational.

[23]Sequential rationality of strategies A or C require that optimal off-equilibrium strategies are chosen, but as has been pointed out, this does not affect the equilibrium. The strategies in this case are drawn directly from 4 and 5 and are therefore sequentially optimal.

## A.6 Proving Lemma 10

Expected utility of honest agents that are assigned to be Player 2 in the equilibrium where Player 1 chooses strategy B is:

$$E[U_{h2B}] = \kappa\alpha \tag{A.8}$$

With a probability $\kappa$, the honest individual will be correctly identified, joint production will occur and player 2 receives a payoff of $\alpha$. The remainder of the time, the player is incorrectly identified as opportunistic and joint production does not occur.

For the opportunistic agent assigned to be player 2 in the same equilibrium, the expected utility is:

$$E[U_{o2B}] = (1-\kappa)(i\alpha + (1-\alpha) * 1) \tag{A.9}$$

The opportunistic agent is hired if they are incorrectly identified, and once hired receive a payoff of $\alpha$ when institutions are effective, and 1 when contracts are unenforceable.

The expected utility of honest individuals is greater than opportunistic individuals if:

$$\kappa\alpha > (1-\kappa)(i\alpha + (1-\alpha) * 1) \tag{A.10}$$

$$i_m > \frac{1-\kappa-\alpha\kappa}{(1-\alpha)(1-\kappa)} \tag{A.11}$$

Further, when $\kappa > \frac{1}{1+\alpha}$, the critical institution, $i_m < 0$, and thus there will always be increasing evolutionary pressure on social capital in a type B equilibrium.

## A.7 Proving Lemma 11

The expected utility of honest agents that are assigned to be player 2 in a match where player 1 chooses strategy C is $\alpha$ - he will always enter joint production and work productively.

For the opportunistic agent assigned to be player 2 in the same equilibrium, the expected utility is:

$$E[U_{o2C}] = i\alpha + (1-\alpha) \tag{A.12}$$

If institutions are enforceable, the opportunistic agent does as well as the honest agent, but when institutions are not enforceable, he is able to shirk and receives a higher payoff. As long as contracting is not perfect, $i < 1$, opportunistic agents have the advantage in this equilibrium.

## A.8 Proving Proposition 2

There are three parts to the proposition, and the proof deals with each in sequence.

### A.8.1 The Existence of a Social Capital Trap

The proposition states that if social capital is less than a critical level, $\beta^* < \frac{\theta}{\alpha*(2\kappa-1)}$, then there cannot be an equilibrium in which there is evolutionary pressure for social capital to increase. As shown in lemmas 9 to 11, evolutionary pressure for social capital to increase only occurs if strategy B is chosen at equilibrium - agents acquire signals and use them to determine entry into joint production. In addition, contracting institutions must be strong enough to ensure that honest agents have the advantage over opportunistic agents.

Strategy B is only chosen if $i \geq I_{AB}(\beta)$ and $i \leq I_{BC}(\beta)$. However, this option cannot exist if $I_{AB}(\beta) > I_{BC}(\beta)$.

$$I_{AB}(\beta) = \frac{\theta + (1-\beta)(1-\kappa) - \beta\kappa\alpha}{(1-\beta)(1-\kappa)(1+\alpha)} > \frac{(1-\beta)\kappa - \beta\alpha(1-\kappa) - \theta}{\kappa(1-\beta)(1+\alpha)} = I_{BC}(\beta) \tag{A.13}$$

Simplifying and solving this expression for $\beta$ results in:

$$\beta^* < \frac{\theta}{\alpha(2\kappa-1)} \tag{A.14}$$

which is the critical value of social capital below which countries find themselves in the social capital trap.

### A.8.2 A Cap on Social Capital

As shown in lemma 10, social capital development requires two elements. First, strategy B must be chosen, and second, institutions must provide sufficient enforcement that the honest agents in society receive higher utility than the opportunistic.

At $\beta > \beta_{BC}(i^e)$, there cannot exist an institution that satisfies both requirements. First, if $i \leq i^e$, then honest agents receive no advantage. This is shown in 10.

Second, at $\beta_{BC}(i^e)$, the cutoff institution that is the maximum for employing strategy B is $I_{BC}(\beta_{BC}(i^e) = i^e$, as that is how the function was defined. Any institution greater than $i^e$ would result in strategy C being chosen. Given that $I_{BC}(\beta)$ is declining in $\beta$, this is also true for any level of social capital higher than $\beta_{BC}(i^e)$.

As institutions must either be less than or equal to the cutoff value, or greater than it, it is impossible to choose an institution that promotes social capital development.

### A.8.3 The Effective of Institutions in the Intermediate Range

If $\beta^* \leq \beta < \beta_{BC}(i^e)$, then there exists a contracting institution that will promote the development of social capital. This will occur if $I_{BC}(\beta) \geq I_{AB}(\beta)$ and $I_{BC}(\beta) > 0$ (there is an institution for which strategy B is chosen) and $I_{BC}(\beta) > i^e$ (there is an institutional option that generates sufficient enforcement), and $I_{BC}(\beta) > 0$. The second two requirements are effectively identical, as $i^e \geq 0$ by definition. If both are satisfied, choosing $i = I_{BC}(\beta) - \epsilon$ will promote the development of social capital, for small enough $\epsilon$.

As shown in the earlier part of the proof, $I_{BC}(\beta) \geq I_{AB}(\beta)$, if and only if $\beta \geq \beta^*$. Additionally, as shown previously, $I_{BC}(\beta_{BC}(i^e) = i^e$. With $I_{BC}(\beta)$ declining in $\beta$, this implies that $I_{BC}(\beta) > i^e \forall \beta < \beta_{BC}(i^e)$. As such, all intermediate levels of social capital meet both requirements.

Finally, we have not assured that this intermediate range exists. An additional assumption would be necessary to ensure that $\beta^* < \beta_{BC}(i^e)$. After rearranging the relevant definitions, the necessary assumption is that:

$$\kappa > \frac{2\alpha + \alpha\theta + \theta}{\alpha(3+\alpha)} \tag{A.15}$$

or rearranging:

$$\theta < \frac{\alpha(\kappa(3+\alpha) - 2)}{1+\alpha} \tag{A.16}$$

If signals are sufficiently informative relative to cost, or cheap enough relative to accuracy, then the intermediate range exists.

## A.9 Proving Proposition 3

The critical value of social capital is $\beta = \frac{\theta}{\alpha(2\kappa-1)}$. The relevant derivatives as related to the poverty trap are therefore:

$$\frac{\partial \beta^*}{\partial \theta} = \frac{1}{\alpha(2\kappa-1)} > 0 \tag{A.17}$$

$$\frac{\partial \beta^*}{\partial \kappa} = \frac{-2\alpha\theta}{(\alpha(2\kappa-1))^2} < 0 \tag{A.18}$$

For the maximum level of social capital, $\frac{\partial \beta_{BC}(i^e)}{\partial \theta}$, and $\frac{\partial \beta_{BC}(i^e)}{\partial \kappa}$ must similarly be shown to be negative and positive, respectively.

With regards to the cost of signals, $\theta$, the level of institutions necessary to ensure enforceability is unaffected by the change. Therefore, it is sufficient to show that $\frac{\partial \beta_{BC}(i)}{\partial \theta} < 0$,

or equivalently, that $\frac{\partial I_{BC}(\beta)}{\partial \theta} < 0$. This last point is easily demonstrated as:

$$I_{BC}(\beta) = \frac{(1-\beta)\kappa - \beta\alpha(1-\kappa) - \theta}{\kappa(1-\beta)(1+\alpha)} \tag{A.19}$$

$$\frac{\partial I_{BC}(\beta)}{\partial \theta} = \frac{-1}{\kappa(1-\beta)(1+\alpha)} < 0 \tag{A.20}$$

For the effectiveness of signals, if the enforcement level of institutions is relevant, $i^e = \frac{1-\kappa-\alpha\kappa}{(1-\alpha)(1-\kappa)} \in [0,1)$, then this level increases with the reduction in signal quality , $\frac{\partial i^e}{\partial \kappa}$ if $i^e < 1$.

As with increasing the cost of signals, the maximum cutoff institution necessary to encourage the use of a screening strategy also falls with the decrease signal effectiveness, $\frac{\partial I_{BC}(\beta)}{\partial \kappa} > 0$. Shifting the $I_{BC}(\beta)$ curve down, while shifting the $i^e$ line up, necessarily results in their intersection at a lower level of social capital, $\beta$. Thus, the maximum level of social capital achievable in society is reduced when the effectiveness of signals falls.

## References


Acemoglu, D., and S. Johnson (2005): "Unbundling Institutions," *Journal of Political Economy*, 113, 949–995.

Acemoglu, D., S. Johnson, and J. A. Robinson (2001): "The Colonial Origins of Comparative Development:An Empirical Investigation," *The American Economic Review*, 91, 1369–1401.

——— (2002): "Reversal of Fortune:Geography and Institutions in the Making of the Modern World Income Distribution," *The Quarterly Journal of Economics*, 117, 1231–1294.

Ahn, T., and J. Esarey (2008): "A Dynamic Model of Generalized Social Trust," *Journal of Theoretical Politics*, 20(2), 151.

Bohnet, I., B. Frey, and S. Huck (2001): "More Order with Less Law: On Contract Enforcement, Trust, and Crowding," *American Political Science Review*, 95(01), 131–144.

Bowles, S., S. Durlauf, and K. Hoff (2006): *Poverty Traps*. Princeton University Press.

Brown, W., and C. Moore (2000): "Is prospective altruist-detection an evolved solution to the adaptive problem of subtle cheating in cooperative ventures? Supportive evidence using the Wason selection task," *Evolution and Human Behavior*, 21(1), 25–37.

Brown, W., B. Palameta, and C. Moore (2003): "Are there nonverbal cues to commitment? An exploratory study using the zero-acquaintance video presentation paradigm," *Evolutionary Psychology*, 1, 43.

Carlin, B., F. Dorobantu, and S. Viswanathan (2009): "Public trust, the law, and financial investment," *Journal of Financial Economics*.

Coleman, J. (1988): "Social Capital in the Creation of Human Capital," *American Journal of Sociology*, 94(S1), 95.

Collier, P. (2007): *The Bottom Billion: Why the Poorest Countries Are Failing and What Can Be Done About It*. Oxford University Press.

Dekel, E., J. C. Ely, and O. Yilankaya (2007): "Evolution of Preferences," *Review of Economic Studies*, 74, 685–704.

Easterly, W. (2001): "Can Institutions Resolve Conflict," *Economic Development and Cultural Change*, 49(4), 687–706.

Eaton, B., and M. Eswaran (2003): "The evolution of preferences and competition: a rationalization of Veblen's theory of invidious comparisons," *Canadian Journal of Economics*, pp. 832–859.

Ellingsen, T. (1997): "The Evolution of Bargaining Behavior*," *Quarterly Journal of Economics*, 112(2), 581–602.

Fafchamps, M. (2006): "Development and social capital," *Journal of Development Studies*, 42(7), 1180–1198.

Francois, P. (2008): "Norms and Institution Formation," Mimeo.

Francois, P., and J. Zabojnik (2005): "Trust, Social Capital and Economic Development," *Journal of the European Economics Association*, 3, 51–94.

Frank, M. G., P. Ekman, and W. V. Friesen (1993): "Behavioral markers and recognizability of the smile of enjoyment," *Journal of personality and social psychology*, 64(1), 83–93.

Frank, R. H. (1987): "If Homo Economicus Could Choose His Own Utility Function, Would He Want One with a Conscience?," *American Economic Review*, 77, 593–604.

Frey, B. (1997): "A constitution for knaves crowds out civic virtues," *The Economic Journal*, pp. 1043–1053.

Fukuyama, F. (2001): "Social capital, civil society and development," *Third World Quarterly*, 22(1), 7–20.

Glaeser, E., D. Laibson, J. Scheinkman, and C. Soutter (2000): "Measuring Trust*," *Quarterly Journal of Economics*, 115(3), 811–846.

Greif, A. (2005): "Commitment, Coercion, and Markets: The Nature and Dynamics of Institutions Supporting Exchange," *Handbook of New Institutional Economics*, pp. 727–786.

Guiso, L., P. Sapienza, and L. Zingales (2006): "Does Culture Affect Economic Outcomes?," *The Journal of Economic Perspectives*, 20(2), 23–48.

——— (2008): "Long Term Persistence," NBER Working Papers 14278.

Güth, W., and H. Kliemt (1994): "Competition or Co-operation: On the Evolutionary Economics of Trust, Exploitation and Moral Attitudes," *Metroeconomica*, 45(2), 155–187.

——— (1998): "The Indirect Evolutionary Approach: Bridging the Gap Between Rationality and Adaptation," *Rationality and Society*, 10(3), 377.

Güth, W., and A. Ockenfels (2005): "The Coevolution of Morality and Legal Institutions: An Indirect Evolutionary Approach," *Journal of Institutional Economics*, 1(02), 155–174.

Heifetz, A., C. Shannon, and Y. Spiegel (2007): "The Dynamic Evolution of Preferences," *Economic Theory*, 32(2), 251–286.

Knack, S., and P. Keefer (1997): "Does Social Capital Have an Economic Payoff? A Cross-Country Investigation," *The Quarterly Journal of Economics*, 112, 1251–1288.

Kumlin, S., and B. Rothstein (2005): "Making and Breaking Social Capital: The Impact of Welfare-State Institutions," *Comparative Political Studies*, 38(4), 339.

North, D. (1994): "Economic performance through time," *The American Economic Review*, pp. 359–368.

Platteau, J. (1994): "Behind the market stage where real societies exist-part I: The role of public and private order institutions," *Journal of Development Studies*, 30(3), 533–577.

Putnam, R. (1995a): "Bowling Alone: America's Declining Social Capital," *JOURNAL OF DEMOCRACY*, 6, 65–65.

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

——— (1995b): "Tuning In, Tuning Out: The Strange Disappearance of Social Capital in America," *Political Science and Politics*, 28(4), 664–683.

Roland, G. (2004): "Understanding institutional change: Fast-moving and slow-moving institutions," *Studies in Comparative International Development (SCID)*, 38(4), 109–131.

Sobel, J. (2002): "Can We Trust Social Capital," *Journal of Economic Literature*, 40, 139–154.

Tabellini, G. (2005): "Culture and Institutions: Economic Development in the Regions of Europe," Mimeo.

——— (2008): "The Scope of Cooperation: Values and Incentives*," *Quarterly Journal of Economics*, 123(3), 905–950.

van Oorschot, W., and W. Arts (2005): "The social capital of European welfare states: the crowding out hypothesis revisited," *Journal of European Social Policy*, 15(1), 5.

Verplaetse, J., S. Vanneste, and J. Braeckman (2007): "You can judge a book by its cover: the sequel. A kernel of truth in predictive cheating detection," *Evolution and Human Behavior*, 28(4), 260–271.