Relational Contracts and the Economic Well-Being of Nations

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Abstract

The rate of time preference has been identified as a key primitive which may account for substantial differences of living standards across nations. The prevailing view on this link is based on the favorable effect of patience on individual accumulation processes. We provide a new micro-level explanation for the disparity in economic wealth which complements this view and reinforces the important role of the time preference rate of individual decision makers. We highlight that greater patience among a country’s agents allows firms to solve pertinent organizational issues more efficiently since long-term firm-supplier-relationships which mitigate hold-up problems can then be maintained. The key mechanism of our theory accords with recent firm-level evidence.

Keywords: Theory of the firm, relational contracting, firm heterogeneity, aggregate welfare

JEL-Classifications: D23, D92, L14, L22, L23, O10

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1 Introduction

Why do the standards of living differ so widely across nations? This is one of the most pertinent puzzles in economics and one of the most important research questions today. There is no unanimity on the answer, yet. However, there is broad agreement on how to approach this issue (Hall and Jones 1999; Acemoglu 2008). This consensus view distinguishes proximate causes of differences in economic performance from more fundamental (‘deeper’) determinants. Proximate causes are those stressed in the (traditional) theories of economic growth: the stocks of physical and human capital and (total factor) productivity. Abundant evidence documents that these factors differ greatly (in quantity and quality) across nations. At a deeper level the question is why such differences arise in the first place. The emerging consensus has four groups of fundamental macro-level explanations: luck (history), geography (climate), culture, and institutions (social infrastructure). There is considerable controversy about the importance of these fundamental determinants, their interrelation and their micro-level origins, however.\footnote{Acemoglu (2008: 112), for example, who favors the institution hypothesis, notes that institutions and culture are connected and that institutions themselves are endogenous so that the prevailing evidence can be interpreted in different ways.} One micro-driver that has recently attracted much attention is patience, the rate of time preference of a nation’s citizens. Theories of intertemporal optimization, such as the Ramsey-Cass-Koopmans model (e.g. Romer 2011), the Lucas (1988) human capital model and the theory of endogenous growth (e.g. Romer 1990), highlight the role of the rate of individual decision makers’ rate of time preference for the accumulation of physical and human capital and for R&D-investments. An emerging empirical literature reveals that national income per capita is positively tied up with patience. In particular, using a novel dataset on individual time preferences for over 70 countries, Dohmen et al. (2015) empirically corroborate the predictions of the dynamic choice theories.

The aim of this paper is to advance a new micro-level explanation for the disparity of living standards across nations which puts the role of the rate of time preference of individual decision makers at its center and which complements the prevailing view which is based on the favorable effect of patience on individual accumulation processes. Specifically, we highlight that firms in
modern economies in addition to solving the classical production problem of transforming inputs into outputs, solve an organizational problem which concerns the sourcing of intermediate inputs (see e.g. Antràs and Rossi-Hansberg 2009). Our explanation stresses that firms which are run by managers with low rates of time preference are able to enter efficient long-term relational contracts with their suppliers. This ability to establish trustful mutual relations which mitigate inefficiencies associated with hold-up problems in production allows firms to perform better compared to other firms which are run by impatient agents. We show that, in general equilibrium, countries where lower rates of time preference prevail on average – as proxied by a higher share of long-term oriented managers – exhibit higher aggregate welfare.

In developing this theory we take great care to ensure that our model not only provides a consistent link between individual rates of time preference and a nation’s aggregate welfare but that it’s key mechanism also accords with firm-level evidence. In fact, there is a large and important empirical literature which documents that seemingly similar enterprises have persistent performance differences and that firms within one and the same industry may solve the noted sourcing problem in different ways (Bloom and van Reenen 2007, 2010; Syverson 2011; Gibbons and Henderson 2013; Bertrand and Schoar 2003; Chew et al. 1990). An emerging view that builds on Macaulay (1963) sees superior organizational practices as the fruit of informal relational contracts which by their very nature are hard to detect from outside (Gibbons and Henderson 2012; Helper and Henderson 2014). Our theory accords with these findings. Moreover, the key mechanism stressed in our analysis – the mitigation of an underinvestment problem via trust-based contracting – has recently received strong support in an empirical analysis of the German automotive industry which draws on unique data on individual supplier-buyer relationships (Calzolari et al. 2015).

Our modeling choices are guided by the following considerations. First, since the fragmentation of the value-added chain is a particularly pervasive feature of modern production processes, we highlight the sourcing question, i.e. whether to integrate a component supplier (integration) or to acquire components through an arm’s length transaction on markets (outsourcing), as a key
organizational issue that firms have to solve. The key factor that guides this choice is the hold-up problem that emerges when the intermediate inputs are relationship-specific, have no value outside the relationship and when contracts are incomplete. We draw on a version of the seminal model by Antràs and Helpman (2004) to bring this out.

Second, to specify why some firms solve the sourcing problem more efficiently than others, we allow for the emergence of trust-based long-term relationships. We embed the static framework of Antràs and Helpman (2004) into an infinitely repeated game similarly to Baker et al. (2002). This gives rise to two governance regimes: firms can either enter a relational agreement with a supplier once and forever (relational contracting) and, thereby, mitigate hold-up problems, or they can negotiate each period on the spot and be stuck with hold-up problems of the one-shot game (spot contracting). Overall, our analysis thus allows for four organizational modes, spot integration, spot outsourcing, relational integration and relational outsourcing.

Third, we assume that firms are heterogeneous with respect to their productivities and time preference rates of their managers. Firm heterogeneity with respect to productivity is a well-documented fact (Melitz 2003; Bernard et al. 2007). The heterogeneity of individual time preference rates has been also established in many different contexts (Dohmen et al. 2015; Lawrance 1991; Samwick 1998; Warner and Pleeter 2001; Frederick et al. 2002). Graham et al. (2012). Poterba and Summers (1995) provide anecdotic evidence for differences in time horizons between CEOs. We treat the management’s time preference as an exogenous primitive factor and allow for country differences in the distribution of its managers’ patience.

Related literature. Our paper relates to several strands of research. First, there is a substantive literature on relational contracting and the role of trust. MacLeod (2007) surveys this literature and concludes (p. 609): “In a relational contract, one party trusts the other when the value from future trade is greater than the one period gain from defection.” As it is well-known from the Folk theorem, a party’s ability to enter a trust-based relational agreement crucially depends on her discount factor. In this context, time preference rate is a commonly used proxy for trust (e.g.
James Jr. 2002, Kvaloy and Olsen 2009, and Bachman and Zaheer 2006, 2008). We adopt this interpretation. The general idea that trust-based relations are important for a society’s economic success has a long tradition (Arrow 1972; Gambetta 1988; Fukuyama 1995; Putnam 1993). In fact, a high correlation between countries’ GDP per capita or their growth rates and different measures of trust and trustworthiness has been found in many studies.\(^2\) Clearly, causality could run either way: good economic performance could be the outcome of mutual confidence just as high levels of trust could be the result of higher levels of economic well-being. However, Algan and Cahuc (2010) recently provided strong evidence for a causal effect of ‘trust’ on the economic development. This provides empirical support for our theoretical conceptualization.

Second, we build on the theoretical work in organizational economics that relates the organizational design of firms to their ability to enforce trust-based contracts (see the surveys by Hart (2002), MacLeod (2007) and Malcomson (2010)). Specifically, we build on Baker et al. (2002) and Halonen (2002) in implementing a repeated game approach to overcome the hold-up problem. However, whereas these works address single firms in partial equilibrium, we focus on aggregate consequences and therefore lift the analysis to the general equilibrium.

Third, a recent literature surveyed by Antràs and Rossi-Hansberg (2009) and Helpman (2006) addresses aggregate consequences of the organizational choices of firms. This literature has not considered relational contracting, however. We introduce relational contracting in the form of a repeated game into the seminal model by Antràs and Helpman (2004).

The paper’s structure is as follows. The basic model is laid out and the general equilibrium in the spot game characterized in section 2. We start with the benchmark case of perfectly enforceable contracts and then turn to spot contracting under contractual incompleteness. Section 3 introduces relational contracts and derives our main theorems. Section 4 concludes.

\(^2\) See Knack and Keefer (1997), La Porta et al. (1997), Dincer and Uslaner (2010) and Guiso et al. (2010). Furthermore, trust has been shown to have a positive effect on a country’s financial development (Guiso et al. 2004), entrepreneurship (Guiso et al. 2006), and international trade and FDI flows (Guiso et al. 2009; Araujo and Ornelas 2007).
2 The model and general equilibrium in the spot game

2.1 The model

**General setup.** Our model draws on Antràs and Helpman (2004), henceforth denoted AH, who integrate the Property Rights Theory (Grossman and Hart 1986; Hart and Moore 1990) into a two-sector version of the Melitz (2003) model. We deviate from AH in two respects. First, we assume that the utility is logarithmic quasi-linear, \( U = x_0 + \mu \ln X \), where \( \mu > 0 \) is a constant, \( x_0 \) is the consumption of the homogeneous traditional good (numéraire), and \( X \) is the basket of differentiated varieties of the modern good.\(^3\) Second, the fixed investments needed to produce modern varieties are organization-invariant.\(^4\) Since the AH-model is well-known our exposition is deliberately brief.

**Demand.** We consider a closed economy with \( L \) workers each of whom supplies one unit of labor, the only factor of production. The modern good is a CES composite \( X = \left[ \int_0^N x(i)^\alpha \, di \right]^{1/\alpha} \) where \( x(i) \) is consumption of variety \( i \), \( N \) is the (endogenous) mass of available varieties and \( 0 < \alpha < 1 \) is a parameter related to the elasticity of substitution between any two varieties, \( \sigma \equiv 1/(1 - \alpha) \). The budget constraint is \( PX + x_0 = Y \), with \( Y \) denoting income, \( P \equiv \left[ \int_0^N p(i)^{1-\sigma} \, di \right]^{1/(1-\sigma)} \) the price index of the modern good, and \( p(i) \) the price of variety \( i \). Utility maximization implies demand functions \( X = \mu P^{-1} \) and \( x_0 = Y - \mu \). We assume \( \mu < Y \) to ensure positive consumption of the numéraire. Total (inverse) demand for variety \( i \) is obtained by aggregating individual demands over the \( L \) workers, \( p(i) = \mu x(i)^{\alpha-1} X^{-\alpha} L^{1-\alpha} \). The index \( X \) is exogenous for the firm but endogenous to the industry. Indirect utility (a measure of a consumers’ welfare) is given by

\[
V = Y - \mu + \mu \ln X. \tag{1}
\]

**Production.** The numéraire is produced under perfect competition with a unit labor input requirement. This pins down the wage at unity. The modern industry exhibits monopolistic competition

\(^3\) Our utility function is a special case of the quasi-linear utility function \( U = x_0 + (X^\alpha)/\mu \) used in AH. The logarithmic quasi-linear specification has proven to be tractable in the trade context (e.g. Pflüger and Südekum 2013).

\(^4\) The fixed costs are assumed organization-specific in AH. We return to the latter difference below.
as in Dixit and Stiglitz (1977). Each variety is produced under increasing returns by a single firm. The productivity of firms is heterogeneous (Melitz 2003). Production of variety $i$ requires two relationship-specific inputs, headquarter services $h(i)$ supplied by headquarters $H$ and components $m(i)$ supplied by manufacturers $M$. Both intermediates are produced with one unit of labor per unit of output.\footnote{Since labor is the only factor of production, units $H$ and $M$ can be understood as representing bundles of labor.} Before production can take place, the fixed labor investments of $f_H$ and $f_M$ have to be incurred by $H$ and $M$, respectively. The intermediates are combined to final goods according to the function $x(i) = \theta(i) \left( \frac{h(i)}{\eta} \right)^{\eta} \left( \frac{m(i)}{1-\eta} \right)^{1-\eta}$, where $0 < \eta < 1$ parameterizes the industry-specific headquarter intensity. The larger $\eta$ is, the more intensive the sector in headquarter services. $\theta(i)$ is a firm-specific technology parameter (which does not encompass the organizational problem).\footnote{This refers to the distinction between the ‘general production problem’ and the ‘organizational problem’ that we highlighted in the introduction (see Antràs and Rossi-Hansberg 2009). We return to this issue in section 3.2.} If $H$ decides to produce, he needs a component producer to cooperate with. He also chooses between integration of the supplier and outsourcing (an arm’s length market transaction). The specifics of these organizational options are detailed below. The joint revenue from cooperation of $H$ and $M$ is $R(i) = p(i) x(i) = \mu \left( \theta(i) \right)^{\alpha} \left( \frac{h(i)}{\eta} \right)^{\alpha \eta} \left( \frac{m(i)}{1-\eta} \right)^{\alpha (1-\eta)} X^{-\alpha} L^{1-\alpha}$. Market entry involves two steps (cf. Melitz 2003). Prior to entry, there is a large pool of potential firms who can enter the modern sector subject to an entry investment in terms of labor $f_E$ which is sunk thereafter. Firm $i$ then draws its productivity $\theta(i)$ from a commonly known distribution function $G(\theta)$. Depending on this draw and the prevailing industrial structure, $H$ decides to immediately exit or to start production. To save on notation, we drop the index $i$ from now on.

**Perfectly enforceable contracts.** The two inputs are relationship-specific and have no value outside the relationship. Hence, hold-up problems emerge with incomplete contracts. We start with the benchmark of perfectly enforceable contracts so that the two parties’ investments are undistorted (the organizational choice does not matter). Call this the first-best solution from the viewpoint of producers.\footnote{This is not the first-best solution from the point of view of the economy since firms have monopoly power in this model.} This is a reference point for the analysis of spot contracts and also crucial when we turn to relational contracts. With full contractibility, $H$ and $M$ ex ante stipulate the
investments into headquarters services and components which maximize joint firm’s profit \( \pi(h, m) = R(h, m) - m - h - f \), where \( f \equiv f_M + f_H \). This yields investments and revenue:

\[
h^* = \eta \alpha AEL\Theta X^{-\frac{1}{1-\alpha}} \quad , \quad m^* = (1 - \eta) \alpha AEL\Theta X^{-\frac{1}{1-\alpha}} \quad , \quad R^* = AEL\Theta X^{-\frac{1}{1-\alpha}},
\]

where \( \Theta \equiv \theta^{\frac{1}{1-\alpha}} \) is an alternative measure of productivity and \( A \equiv \alpha^{\frac{1}{1-\alpha}} \), \( E \equiv \mu^{\frac{1}{1-\alpha}} \) are parameters.

The pricing rule and joint pure profits in this first-best case are:

\[
p^*(\theta) = 1/(\alpha \theta) \quad , \quad \pi^*(\theta, X) = (1 - \alpha) AEL\Theta X^{-\frac{1}{1-\alpha}} - f,
\]

where \( 1/\alpha \) is the monopoly mark-up over marginal costs \( 1/\theta \). The distribution of profits is immaterial since variable labor inputs are rewarded with their marginal revenue products and fixed investments \( f = f_H + f_M \) are compensated as expressed in (3).

**Incomplete contracts.** Hold-up problems emerge when contracts are not perfectly enforceable.

We address these issues with the Property Rights Theory of the firm. Since courts are incapable of solving potential disputes, the level of each party’s investments is left out from the ex ante contract. Each agent chooses its profit-maximizing investment, taking the investment of the production partner as given. The incentives in this non-cooperative game depend on the organizational form.

Courts can verify and enforce the ex ante choice of the organizational structure.

The timing of the game is as follows. After \( H \) bears the fixed entry cost \( f_E \) and draws productivity \( \theta \), he decides to leave the industry immediately or to stay and produce. In case of entry, he chooses organizational form \( k \) in \( t_0 \). Since under this organizational form the parties negotiate ex post on the spot, we call the two options spot integration (SI) and spot outsourcing (SO), hence \( k \in \{SI, SO\} \). The supply of \( M \) is infinitely elastic, whereas the number of headquarters is strictly finite. Headquarters then stipulate an up-front transfer \( T^S \) in \( t_0 \) that has to be paid by \( M \) for participation in the relationship. The competitive fringe of suppliers implies that their participation can be secured at least cost: the expected profit of \( M \) is driven to \( M \)’s ex-ante outside option, which we
normalize to zero, and all joint pure profits accrue to $H$. Once the cooperation is founded, $H$ and $M$

simultaneously choose their investments $h_k$ and $m_k$ in $t_1$. In $t_2$, the parties negotiate about the
division of the surplus which takes place according to generalized Nash-bargaining. Each party gets her
outside option plus a share of the quasi rent (the revenue generated in the relationship net of each
party’s outside option). Let $\beta_k \in (0, 1)$ denote $H$’s share stipulated at $t_2$ under mode $k = SI, SO$. Hence, $(1 - \beta_k)$ is $M$’s share. Following AH, these shares are exogenous and the headquarter obtains
a larger revenue share under integration than under outsourcing, $\beta_{SI} = \beta + \delta(1 - \beta) > \beta = \beta_{SO}$, where $\beta \in (0, 1)$ is the bargaining weight of $H$ and $\delta \in (0, 1)$ is a parameter which formalizes the no-
tion that production falls short of potential if bargaining fails under integration. In $t_3$, headquarter
services and components are (costlessly) combined to final output according to the Cobb-Douglas
technology and then sold. In $t_4$, revenue is distributed according to the sharing rule agreed in $t_2$.

Investments and profits. The game is solved through backward induction. Start with the
investment decisions. In $t_1$, $H$ chooses $h_k$ to maximize $\beta_kR_k - h$, whereas $M$ chooses $m_k$ to
maximize $(1 - \beta_k)R_k - m$, where $R_k$ is the revenue under $k \in \{SI, SO\}$. This yields:

$$
h_k = \beta_k^{1 - \alpha(1 - \eta)} (1 - \beta_k)^{\alpha(1 - \eta)} \eta \alpha AEL \Theta X^{-\alpha} \eta^\alpha, \quad m_k = \beta_k^{\alpha \eta} (1 - \beta_k)^{1 - \alpha \eta} (1 - \eta) \alpha AEL \Theta X^{-\alpha} \eta^\alpha, \quad (4)
$$

Comparing (2) and (4), it is apparent that the revenue with incomplete contracts is smaller than
in the first-best, since $h_k < h^*$ and $m_k < m^*$. Intuitively, each party anticipates to be held up by
its partner ex post and, therefore, underinvests ex ante. This hold-up is also reflected in a higher

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8 Under spot integration, $H$ owns input $h_{SO}$ and $M$ possesses the property rights for $m_{SO}$. Since both inputs are
highly specific, their value outside the relationship is zero. Therefore, Nash-bargaining delivers $H$ an ex post payoﬀ $\beta R_{SO}$ and $M$ gets $(1 - \beta) R_{SO}$. Under spot integration, $M$ is $H$’s employee and $H$ possesses the property
rights for manufacturing inputs $m_{SI}$. While the outside option of $M$ under $SI$ is still zero, $H$’s outside option is
now positive, since he can use both inputs in the production process. However, if bargaining fails, $H$ can produce only a fraction $\delta \in (0, 1)$ of the highest possible output without cooperation of $M$. By substituting $(\delta x)$
for $x$ in the revenue function $R = \mu x^\alpha X^{-\alpha} L^{1 - \alpha}$, we get the outside option of $H$ under $SI$, $\delta^\alpha R_{SI}$. Hence, $H$
obtains $[\beta + \delta(1 - \beta)] R_{SI} = \beta_{SI} R_{SI}$ and $M$ gets payoﬀ $(1 - \beta_{SI}) R_{SI}$. 

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price charged by a firm with productivity $\theta$ and in the pure profits under spot contract $k$,

$$p_k(\theta) = \frac{1}{\theta^\alpha} \cdot \frac{1}{(\beta_k)^{\eta}} \cdot (1 - \beta_k)^{1 - \eta}, \quad \pi_k(\theta, X) = \Psi_k AEL \Theta X^{-\frac{\alpha}{1 - \alpha}} - f,$$

(5)

where $1/(\beta_k)^{\eta} (1 - \beta_k)^{1 - \eta} > 1$ ($\forall \beta_k, \eta \in (0, 1)$) is the cost factor associated with incomplete contracts and $\Psi_k \equiv \beta_k^{\frac{\alpha}{1 - \alpha}} (1 - \beta_k)^{\frac{\alpha(1 - \eta)}{1 - \alpha}} (1 - \alpha(\beta_k\eta + (1 - \beta_k)(1 - \eta)))$ embraces all terms with the organization-specific index $k$. Comparing (3) with (5) reveals that profits under spot contracts fall short of the first-best, i.e. $\pi_k < \pi^*$ if and only if $\Psi_k < (1 - \alpha)$. Since the latter condition is fulfilled, we have:

**Lemma 1.** It holds true for all permissible parameter values that $\Psi_k < (1 - \alpha)$.

*Proof.* See Appendix A.

**Organizational choice.** $M$’s transfer $T^S$ to $H$ implies that $M$ gets zero net profits, $\pi_{MK} = \beta_k^{\frac{\alpha}{1 - \alpha}} (1 - \beta_k)^{\frac{1 - \alpha}{1 - \alpha}} (1 - \alpha(\beta_k\eta + (1 - \beta_k)(1 - \eta))) AEL \Theta X^{-\frac{\alpha}{1 - \alpha}} - f_M - T^S = 0$, and that total profits under either contract $k \in \{SI, SO\}$ accrue to $H$, i.e. $\pi_{Hk} = \pi_k$. Thus, the headquarter chooses ex ante the organizational form $k$ which maximizes joint pure profits and thereby implicitly determines the *ex post* revenue share $\beta_k$. We call the resulting profits *third-best* ($TB$):

$$\pi_k^{TB} = \max_{k \in \{SI, SO\}} \pi_k(\theta, X).$$

(6)

With *identical fixed costs under both ownership structures*, the make-or-buy decision reduces to a comparison of the *operating profits*, $\Pi_k$. Let $\Pi_S(\eta)$ denote the ratio of operating profits under spot integration to those under spot outsourcing. Utilizing (5), this ratio can be expressed as

$$\Pi_S(\eta) \equiv \frac{\Pi_{SI}}{\Pi_{SO}} = \frac{1 - \alpha(\beta_{SI}\eta + (1 - \beta_{SI})(1 - \eta))}{1 - \alpha(\beta_{SO}\eta + (1 - \beta_{SO})(1 - \eta))} \left( \frac{\beta_{SI}}{\beta_{SO}} \right)^\eta \left( \frac{1 - \beta_{SI}}{1 - \beta_{SO}} \right)^{1 - \eta} \right)^{\frac{\alpha}{1 - \alpha}}.$$

As shown in Appendix B, $\Pi_S(\eta)$ rises in the headquarter intensity of production $\eta$. Intuitively, by integrating a supplier into the firm boundaries, $H$ gets higher investment incentives (and, vice versa, $M$ lower investment

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9 Exogenous revenue shares are a defining element of the Property Rights Theory of the firm. We call the profits *third-best* to contrast them with hypothetical second-best profits which would arise if the headquarter could freely choose the revenue share $\beta^* \in (0, 1)$ during ex post bargaining, cf. AH.
incentives). However, the higher $\eta$, the more important is the investment on part of $H$. Hence $\Pi_S(\eta)$ increases with $\eta$. Moreover, there is a unique critical threshold $\hat{\eta}_S \in (0, 1)$ at which spot integration becomes more profitable than spot outsourcing. This proves:

**Proposition 1. Organizational choice under spot contracting.** There exists a unique headquarter intensity $\hat{\eta}_S \in (0, 1)$ such that if $\eta < \hat{\eta}_S$ all firms will outsource manufacturing production, whereas if $\eta > \hat{\eta}_S$ all firms will integrate the suppliers. In an industry with a headquarter intensity $\hat{\eta}_S$, firms are indifferent between the two organizational forms.

*Proof.* See Appendix B.

### 2.2 General equilibrium in the spot game

Equilibrium in the modern sector is characterized by a zero cutoff profit condition and a free entry condition (cf. Melitz 2003). The former condition yields the cutoff productivity $\hat{\theta}$, which implies zero profits $\pi(\hat{\theta}, X) = 0$, whereby $\pi(\cdot)$ is given by (3) and (6) in the case of perfect contracting and contractual incompleteness, respectively. The free entry condition ensures that, in equilibrium, the expected profits of a potential entrant equal fixed cost of entry: $\int_0^\infty \pi(\theta, X) dG(\theta) = f_E$. For a given productivity distribution $G(\theta)$, these two conditions jointly determine equilibrium values of $\hat{\theta}$ and $X$. In order to obtain closed-form solutions for all endogenous variables, we follow a large part of the literature in assuming a Pareto productivity distribution (see Appendix C for a formal definition).\(^{10}\)

In this two-sector model, the general equilibrium follows immediately once the industry equilibrium in the modern sector is derived.\(^ {11}\)

We prove in Appendix C that CES consumption index under contractual incompleteness is lower than under perfectly enforceable contracts, $X_{TB}^k < X^*$. Intuitively, higher prices associated with incomplete contracting (cf. (6) and (4)) get reflected in a higher price index and lower aggregate consumption. Since aggregate income in the model is constant ($Y = L$), consumers’ welfare function

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\(^{10}\) Pareto distribution has been extensively used in the literature due to its analytical tractability and empirical relevance, see, e.g., Helpman et al. (2004) and Melitz and Redding (2014).

\(^{11}\) Equilibrium in the modern sector determines that sector’s labor use. The remaining labor is used to produce the outside good. By Walras law the expenses on the two goods just match the wage income generated in the economy.
immediately implies lower welfare under contractual incompleteness. We have thus proven

PROPOSITION 2. Comparison of equilibria. In the equilibrium with incomplete contracts, welfare is lower than in the equilibrium with perfectly enforceable contracts.

3 Relational contracting

3.1 Assumptions

Set-up. Business cooperations involving relationship-specific investments are the ones where we expect long-term relationships to prevail. For this reason we embed the one-shot game into a repeated game with infinitely lived agents. We build on Baker et al. (2002) and assume that firms can either enter a relational agreement once and forever or negotiate in each period of the repeated game on the spot. This section introduces our assumptions. The following sections take up the tradeoff between spot and relational contracting and the general equilibrium perspective.

Short- and long-term orientation. We assume heterogeneity of firms with respect to time preference $r \in [\varepsilon, 1]$ where $\varepsilon > 0$ is an arbitrarily small constant. To simplify notation, we omit the firm-index $i$ right away. Headquarters with high $r$ strongly discount future profits and, hence, are more short-term oriented than those with small $r$. In analogy to Melitz’s productivity lottery where firms draw $\theta$ from $G(\theta)$, we assume that time preferences $r$ are drawn from an ex ante known distribution function $\Gamma(r)$, after the fixed cost of entry are paid. For simplicity it is assumed that these two draws are independent.

Timing. The game proceeds as follows (see figure 1). Upon paying $f_E$, the (firm) headquarter draws productivity $\theta$ and time preference $r$ which then prevail in perpetuity and become common knowledge to the suppliers $M$. $H$ then decides whether to leave the industry immediately or to start production which involves per-period fixed production costs $f = f_M + f_H$. In the latter case, he seeks a supplier to cooperate with in perpetuity, i.e. in $t = 0, ..., \infty$. Each period $t$ consists of

$^{12}$ We exclude the case $r = 0$ that implicates infinitely long-term oriented firms.

$^{13}$ Alternatively, one could assume that suppliers possess knowledge about the distribution of $r$ in the economy. This makes the model more cumbersome to solve without altering the main results.
subperiods $t_0, ..., t_4$ in which the successive stages needed to produce the final good take place.

Headquarters that start production make two decisions in subperiod $t_0$. First, they choose whether to integrate a supplier or to source out component production. In either case, the ownership structure is stipulated in an ex ante (explicit) contract. Second, they decide whether to play the spot game ($S$) infinitely or to engage in relational contracting ($R$). In the former case, the upper path of figure 1 applies. The stages in the subperiods are as in the one-shot game. In the latter case, the headquarter offers a relational obligation to undertake first-best investment (the lower path in figure 1). We define the organizational modes under relational contracting as $\kappa = RI, RO$, i.e., relational integration and relational outsourcing, respectively. In the case of relational contracting we impose a transfer-bonus system whose rationale we explain below: the component supplier pays the per-period upfront transfer $T^R$ in order to participate in the relational cooperation in $t_0$; in $t_1$ the headquarter commits to pay in $t_4$ a bonus $B$ to the supplier if the latter provides first-best efficient investments. If both parties stick to the relational agreement, the first-best investments $(h^*, m^*)$ as specified in (2) are made in $t_2$, the first-best output $(x^*)$ is produced and sold in $t_3$ and the headquarter pays a part $B$ of the first-best revenue $R^*$ to the supplier in $t_4$. If both parties honor the contract in period $t_0$, the implicit agreement will prevail for the rest of the game (in $t = 1, ..., \infty$). The headquarter’s choice of the governance mode (spot vs. relational) is analyzed in section 3.2.

Transfer-bonus system. We maintain the idea of an up-front transfer $T^S$ in the upper path of

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$^{14}$ As these agreements are implicit, there is no difference between a spot and a relational contract from a legal perspective. Put differently, if the contracting parties stipulate, for instance, outsourcing as ownership structure, the courts cannot verify whether the cooperation proceeds via the spot or the relational governance regime.
figure 1, the spot game. All profits then accrue to the headquarter (see section 2). The transfer-bonus system specified for the relational game (the lower path in figure 1) has the same effect. Moreover, it ensures that the choices of the two parties are time-consistent. Bearing in mind that an implicit agreement cannot be verified by the courts, each party may have an incentive to deviate from it. More specifically, the supplier is tempted to underinvest ex ante and, by holding up the cooperative party, to obtain one-shot deviation profits ex post. A headquarter prevents this by demanding from $M$ the upfront per period transfer $T^R$ amounting to a supplier’s ex post deviation profits. Similarly, a headquarter can potentially renege on the implicit commitment to compensate $M$’s first-best effort with an ex post bonus $B$. In doing so, however, the trust-based cooperation is destroyed in all future periods. We show in the following section that, if a relational contract is incentive-compatible, it is in the best interest of $H$ to provide the ex post bonus to $M$.

3.2 Investments and organizational choice in the relational game

**Trigger strategies.** The relational contract is implicit, so each party may renege on it. More specifically, $M$ defects ($D$) by providing suboptimal investment $m^D_κ < m^*$, while $H$ behaves cooperatively (i.e., invests $h^*$). Analogously, $H$ can cheat the cooperative party $M$ (that invests $m^*$) by delivering $h^D_κ < h^*$ and then refusing to pay the promised bonus $B$. If either party deviates from the implicit agreement, the relational contract is broken and the resulting surplus in this period is shared via generalized Nash-bargaining. We assume that, for a given ownership structure, parties’ bargaining shares in this period correspond to those under spot contracting (i.e., $β_{RI} = β_{SI}$ and $β_{RO} = β_{SO}$).\(^{15}\) Once a relational agreement is broken, the party who did not renege refuses to enter into a new relational contract with the opportunistic party. Furthermore, we assume that neither of the existing partners can enter into a new relational agreement with a third party.\(^{16}\) Therefore, in case of a failure of a relational agreement, the two parties live forever under spot governance (as

\(^{15}\) The analysis can be just as well conducted under assumptions $β_{RI} ≠ β_{SI}$ and $β_{RO} ≠ β_{SO}$.

\(^{16}\) This can be motivated by assuming that all existing cooperations are registered in a Commercial Registry, which is common knowledge for all market participants. However, neither the terms of the relational contract nor the identity of the reneging party can be detected by a third person. By assuming that a party who was cheated upon in the relational contract cannot credibly signalize her cooperative behavior to third parties, no third party will have an incentive to enter into a new relational agreement with a party who just contracted out.
specified in section 2). Following Baker et al. (2002), we allow the headquarters to choose anew the ownership form in the spot contract prevailing in all subsequent periods \( t = 1, \ldots, \infty \). Table 1 illustrates the per period pure profits and the respective investments of both parties under the trigger strategies described above. \( \pi_{H,\kappa}^{D|H} \) denotes the payoff of party \( H \) (lower index) under organizational form \( \kappa = RI, RO \) if this party defected upon the relational agreement (upper index). The defection payoff of party \( M \) is defined analogously. Both parties’ one-shot deviation profits are derived in the following section.

<table>
<thead>
<tr>
<th>( H )</th>
<th>( t = 0 )</th>
<th>( t = 1 )</th>
<th>( t = 2 )</th>
<th>( \ldots )</th>
<th>( \infty )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooperate</td>
<td>( \pi_H^<em>(h^</em>, m^*) )</td>
<td>( \frac{\pi_H}{1+r} )</td>
<td>( \pi_H^* )</td>
<td>( \ldots )</td>
<td>( \pi_H^* + \sum_{t=1}^{\infty} \left( \frac{1}{1+r} \right)^t \pi_H = \pi_H^* + \frac{\pi_H}{r} )</td>
</tr>
<tr>
<td>Defect ( (D) )</td>
<td>( \pi_{H,\kappa}^{D</td>
<td>H} (h^D, m^D) )</td>
<td>( \frac{\pi_H^{TB}(h^D, m^D)}{1+r} )</td>
<td>( \pi_H^{TB} )</td>
<td>( \ldots )</td>
</tr>
<tr>
<td>( M )</td>
<td>( t = 0 )</td>
<td>( t = 1 )</td>
<td>( t = 2 )</td>
<td>( \ldots )</td>
<td>( \infty )</td>
</tr>
<tr>
<td>Cooperate</td>
<td>( \pi_M^<em>(h^</em>, m^*) )</td>
<td>( \frac{\pi_M}{1+r} )</td>
<td>( \pi_M^* )</td>
<td>( \ldots )</td>
<td>( \pi_M^* + \sum_{t=1}^{\infty} \left( \frac{1}{1+r} \right)^t \pi_M = \pi_M^* + \frac{\pi_M}{r} )</td>
</tr>
<tr>
<td>Defect ( (D) )</td>
<td>( \pi_{M,\kappa}^{D</td>
<td>M} (h^D, m^D) )</td>
<td>( \frac{\pi_M^{TB}(h^D, m^D)}{1+r} )</td>
<td>( \pi_M^{TB} )</td>
<td>( \ldots )</td>
</tr>
</tbody>
</table>

Table 1: Trigger strategies in the repeated game.

**Profits on the deviation path.** Consider first the case where \( M \) defects on the relational contract whilst \( H \) provides the first-best investment \( h^* \). This breaks the trust-based contract and leads to a division of the surplus in this period (say \( t = 0 \)) according to generalized Nash-bargaining. \( M \)’s program is to \( \max_m (1-\beta)R(h^*, m) - m - f - T \) s.t. \( h^* = \eta\alpha AELX^{-\alpha} \) which implies the following one-shot investment and revenue on the deviation path:

\[
m_{\kappa}^D = (1 - \beta)\frac{1}{1-\gamma}(1 - \eta)\alpha AELX^{-\alpha}, \quad R(h^*, m^D) = (1 - \beta)\frac{\alpha(1-\alpha)}{1-(\alpha\gamma)} AELX^{-\alpha} \tag{7}
\]

Comparing (2), (4) and (7) it is apparent that \( m_k < m_{\kappa}^D < m^* \) for all \( \alpha, \eta, \beta_k = \beta \in (0,1) \).

On the deviation path, \( M \) underinvests in period 0 relative to the first-best case, but still invests more than in the third-best case.\(^{17}\) Hence, we have the following gradation of revenues:

\(^{17}\) This results from the complementarity of investments and the fact that \( H \) invests more than in the third-best
$R_k(h_k, m_k) < R(h^*, m^D_k) < R(h^*, m^*).$ M’s pure profit in case of his deviation in period 0, 
\[ \pi_{M \kappa}^{D|M} = (1 - \beta_\kappa)R(h^*, m^D_\kappa) - m^K_\kappa - f_M - T_R, \]
is:
\[ \pi_{M \kappa}^{D|M} = \left[ (1 - \beta_\kappa)^{1-\alpha(1-\eta)} (1 - \alpha(1 - \eta)) \right] AEL\Theta X^{1-\alpha} - f_M - T_R. \]  
(8)

A headquarter internalizes these deviation incentives by demanding from a supplier the ex ante transfer $T_R$ which drives the M’s deviation profits to zero, i.e., $\pi_{M \kappa}^{D|M} = 0$.

Consider now $H$’s pure profits on the deviation path, supposing that $M$ sticks to the relational agreement and provides the first best investment $m^*$ in period 0. $H$ then solves $\max_{h^K_\kappa} \beta_\kappa R(h^K_\kappa, m^*) - h^K_\kappa - f_H + T_R$ s.t. $m^* = (1 - \eta)\alpha AEL\Theta X^{1-\alpha}$. This maximization problem yields the following investment, revenue and one-shot pure profits of party $H$:
\[ h^K_\kappa = \beta_\kappa^{1-\alpha(1-\eta)} \eta \alpha AEL\Theta X^{1-\alpha} , \quad R(h^K_\kappa, m^*) = \beta_\kappa^{\alpha \eta} AEL\Theta X^{1-\alpha}, \]  
(9)

\[ \pi_{H \kappa}^{D|H} = \beta_\kappa^{1-\alpha(1-\eta)} (1 - \alpha \eta) AEL\Theta X^{1-\alpha} - f_H + T_R. \]

Equating (8) to zero and substituting the resulting $T_R$ in (9) yields $H$’s equilibrium deviation profits:
\[ \pi^K_{\kappa} \equiv \pi_{H \kappa}^{D|H} = AEL\Theta X^{1-\alpha} \left[ \beta_\kappa^{1-\alpha(1-\eta)} (1 - \alpha \eta) + (1 - \beta_\kappa)^{1-\alpha(1-\eta)} (1 - \alpha(1 - \eta)) \right] - f. \]  
(10)

We imply the redefinition $\pi^K_{\kappa} \equiv \pi_{H \kappa}^{D|H}$ to account for the fact that a headquarter’s one-shot deviation profits comprise both $H$’s and $M$’s one-shot deviation incentives (represented, respectively, by the first and second term in squared brackets). The following Lemma establishes that if $M$ sticks to the relational contract (i.e., provides $m^*$), $H$’s one shot pure profits from deviation are higher than joint profits in the first-best case (see (3)).

**Lemma 2.** $\pi^K_{\kappa} > \pi^*$ for all $\alpha, \eta, \beta_\kappa \in (0, 1)$. 

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15
Proof. See Appendix D.

Intuitively, by demanding an ex ante transfer \( T^R \) and refusing to pay an ex post bonus \( B \), \( H \) can collect exorbitant profits. However, these can be reaped only in \( t = 0 \). When the relational contract is broken, the spot game is played in all subsequent periods implying headquarter’s profits

\[ \pi_{TB}^{Hk} = \pi_{TB}^k < \pi^* \]

**Incentive compatibility constraint.** We now analyze the condition under which relational contracts emerge. Note first that by the construction of the transfer-bonus system, a supplier is not worse off by providing the first-best investment \( m^* \) than by defecting (i.e. by supplying \( m^D_\kappa < m^* \) in period 0). The bonus is implicitly defined by

\[
\pi^*_M(h^*, m^*) = B - m^* - f_M - T^R = 0.
\]

We assume that the supplier prefers cooperation to defection when both actions yield the same reward, i.e. \( \pi^*_M(h^*, m^*) = \pi^D_M(h^*, m^D_\kappa) \). If both parties cooperate, the headquarter’s pure profits are \( \pi^*_H(h^*, m^*) = R(h^*, m^*) - h^* - f_H + T^R - B \). Using \( B = m^* + f_M + T^R \), these profits reduce to the joint pure profits \( \pi^* \) as in (2), i.e. \( \pi^*_H = \pi^* \). Given the trigger strategy specified in Table 1 and bearing in mind that \( \pi^*_M(h^*, m^*) = \pi^D_M = \pi^D_{TB} = 0 \) and \( \pi^T_{HB} = \pi^T_{k} \) due to the choice of ex ante transfers, a relational contract is self-enforcing if and only if the following incentive compatibility constraint (ICC) holds:\(^{18}\)

\[
\text{ICC: } \frac{(\pi^* - \pi^{TB}_k)}{r} \geq \pi^D_\kappa - \pi^*.
\]  

(11)

As long as this ICC holds, there exists a bonus \( B \) which induces the first-best investment of both parties in perpetuity under organizational form \( \kappa \). Following Baker et al. (2002: 52), we can interpret the left-hand side of (11) as the present value of the net total surplus (i.e., the total surplus from continuing the relationship (\( \pi^* \)) less the best fallback if either party should renege (\( \max\{\pi^{TB}_{SO}, \pi^{TB}_{SI}\} \)). The right-hand side is the maximum reneging temptation (\( MRT \)) under relational contract \( \kappa \), i.e., the joint one-shot reneging incentives less joint profits under cooperation. Notice that both relational ownership forms (\( RI, RO \)) can induce the same investments (\( h^*, m^* \)) and deliver the headquarter the same surplus \( \pi^* \), if and only if the ICC is satisfied in either case.

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\(^{18}\) This ICC is conceptually identical to the one derived in the repeated games without ex ante transfers (cf. Baker et al. 2002). These transfers are imposed in the current model to accord with the original set up by AH.
However, we show in the following that the incentive to renege on a relational agreement differs under the two organizational forms.

**Deviation incentives.** To ensure that the ICC is fulfilled, the headquarter has to minimize the maximum reneging temptation \( MRT \), i.e., the right hand side of (11). This is achieved by choosing the governance mode \( \kappa \in \{RI, RO\} \) such that the associated \( \beta_\kappa \in \{RI, RO\} \) yields the minimal joint deviation incentives \( \pi^D_\kappa \) as characterized in (10).

Define \( \Pi_R(\eta) \equiv \Pi^D_{RI}/\Pi^D_{RO} \) to be the ratio of operating deviation profits under relational integration to those under relational outsourcing. Using (10) and focusing on the operating profits yields:

\[
\Pi_R(\eta) = \frac{(1 - \beta_{RI})^{\frac{1}{1-\alpha(1-\eta)}}(1 - \alpha(1 - \eta)) + \beta_{RI}^{\frac{1}{1-\alpha\eta}}(1 - \alpha\eta)}{(1 - \beta_{RO})^{\frac{1}{1-\alpha(1-\eta)}}(1 - \alpha(1 - \eta)) + \beta_{RO}^{\frac{1}{1-\alpha\eta}}(1 - \alpha\eta)}.
\]

Appendix E establishes that \( \Pi'_R(\eta) \) is a polynomial of degree 2, hence the slope of \( \Pi_R(\eta) \) is ambiguous. However, if the headquarter intensity is low enough (e.g. \( \eta = 0 \)), the reneging temptation is lower under relational outsourcing (i.e. \( \Pi_R(0) > 1 \)), whereas if \( \eta \) is high enough the converse holds (i.e. \( \Pi_R(0) < 1 \)). Furthermore, \( \Pi'_R(\eta) < 0 \) around \( \Pi_R(\eta) = 1 \). This proves:

**Proposition 3. Organizational choices under relational contracting.** There exists a unique headquarter intensity \( \hat{\eta}_R \in (0,1) \) such that in industries with \( \eta < \hat{\eta}_R \) deviation profits are lower under relational outsourcing (i.e., \( \Pi_R(\eta) > 1 \)), while in industries with \( \eta > \hat{\eta}_R \) deviation incentives are minimized under relational integration (i.e., \( \Pi_R(\eta) < 1 \)). For industries with \( \eta = \hat{\eta}_R \), headquarters are indifferent between outsourcing and integration.

**Proof.** See Appendix E.

Notice that the ordering of organizational forms in Proposition 3 is qualitatively similar to the one derived in Proposition 2: outsourcing dominates integration for low headquarter intensities \( \eta \) and vice versa. However, the intuition behind the choice of the organizational form under the two governance modes fundamentally differs. While the organizational form under spot contracting

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\(^{19} \) If the headquarter could freely choose the revenue share in the ex post bargaining, he would choose \( \beta^*_R \) that minimizes the MRT. As in the spot game (cf. footnote 17), we do not consider this hypothetical case. We provide a detailed discussion of this issue upon request.
maximizes $H$’s profits resulting from the ex post bargaining, the choice of organizational form under relational contracting aims at minimizing $H$’s deviation profits. More specifically, recall from (10) that a headquarter’s one-shot deviation profits comprises both $H$’s and $M$’s deviation incentives. If $\eta$ is small (i.e., $M$’s ex ante investments are high), $H$ has the greatest incentive to cheat and thus to reap a high one-shot deviation payoff. By leaving the property rights for components to the supplier (i.e., by strengthening $M$’s ex post bargaining position), the headquarter minimizes his own incentives to renege, thereby signalizing his willingness to cooperate. Conversely, when $\eta$ gets larger, $M$’s operating profits on the deviation path increase. For high enough $\eta$, it becomes optimal to integrate the supplier into the firm boundaries in order to minimize the joint deviation incentives. To sum up, a headquarter chooses under relational contracting the payoff-dominated organizational form in order to minimize the reneging temptation. Although this rationale is consistent with the line of reasoning by Baker et al. (2002), the link between headquarter intensity and the make-or-buy decision has not been established in the literature on relational contracts. As mentioned above, this relationship resembles the one derived under spot contracting: relational outsourcing (integration) is more likely to be chosen the lower (higher) $\eta$.

We have so far pursued the question which relational mode minimizes the $MRT$ in the repeated game. However, the organizational form $\kappa$ that minimizes (10) does not necessarily render the $ICC$ self-enforcing. Through its left-hand side, the $ICC$ crucially depends on the firm-specific time preference rate $r$. The next section seeks the organizational form that ensures the first-best outcome for the greatest range of discount factors.

**Spot vs. relational contracting.** Using (3), (5), (10), and bearing Lemma 2 in mind, the $ICC$ (11) can be rearranged as:

$$\bar{r} = \frac{\pi^* - \pi^T_B}{\pi^d_B - \pi^*} = \frac{(1 - \alpha) - \max_{k \in \{SO,SI\}} \left\{ \beta_k^{\frac{\alpha \eta}{1 - \alpha}} (1 - \beta_k)^{\frac{\alpha (1 - \eta)}{1 - \alpha}} (1 - \alpha [\beta_k \eta + (1 - \beta_k)(1 - \eta)]) \right\}}{\min_{k \in \{RO,RI\}} \left\{ \beta_k^{\frac{1}{1 - \alpha}} (1 - \alpha \eta) + (1 - \beta_k)^{\frac{1}{1 - \alpha (1 - \eta)}} (1 - \alpha (1 - \eta)) \right\}} - (1 - \alpha), \quad (13)$$

Noticing that the aggregate consumption index $X$ is one of the variables that cancel out from the $ICC$. Intuitively, $X$ is exogenous from the viewpoint of a single firm and thus independent of its organizational structure.
where \( \bar{r} \) denotes the cutoff rate of time preference which satisfies the ICC with equality. If \( r < \bar{r} \), a headquarter can achieve the first-best outcome by means of relational contracting under organizational form \( \kappa \). Otherwise, the parties negotiate in each period on the spot under organizational form \( k \). The operators \( \max_k \{ \cdot \} \) and \( \min_\kappa \{ \cdot \} \) denote the subgame perfect equilibria of the spot and relational game, respectively. Two important results are worth mentioning in view of (13). First, the feasibility of relational contracting does not depend on the firm-specific productivity \( \theta \), but on the headquarter’s time preference rate \( r \). Hence, the long-term orientation of headquarters affects their ability to conclude a relational agreement with suppliers and, thus, to achieve first-best profits. Therefore, in a given industry there may exist firms which differ in their profitability despite the identical production technology \( \theta \). Second, since the governance regime (be it spot or relational) stipulated in period 0 is a subgame perfect equilibrium in each stage of the repeated game, the parties live forever under the regime agreed upon in the very first period. Consequently, differences in profitability between firms with different rates of time preference persist over time. It thus follows:

**Proposition 4. Persistent performance differences between seemingly similar enterprises.** Persistent performance differences between seemingly similar enterprises arise due to the heterogeneity of headquarters with respect to their rate of time preference rather than firm heterogeneity with respect to productivity.

Proof. This follows immediately from equation (13) and our discussion above.

**Numerical example.** A firm’s organizational choice is completely characterized by the parameters \( \alpha, \eta, \beta_k, \beta_\kappa \in (0, 1) \) and by the firm-specific time preference \( r \). In this section we provide an example of the make-or-buy decision for an industry with the following parameter values: \( \beta_{SO} = \beta_{RO} = 0.5 \), \( \beta_{SI} = \beta_{RI} = 0.7 \) and \( \alpha = 0.9 \). Substituting these values into \( \Pi_S(\eta) = 1 \) from the spot game (cf. section 2) and solving for \( \hat{\eta}_S \) yields the threshold headquarter intensity \( \hat{\eta}_S \approx 0.58 \). Hence, in industries with headquarter intensity \( \eta < 0.58 \) firms choose spot outsourcing while in industries with \( \eta > 0.58 \) spot integration is the chosen organizational form. Analogously, by substituting

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21 We performed these calculations in MAPLE. The worksheets are provided upon request.
the parameter values into $\Pi_R(\eta)$ from (12), one numerically obtains the cutoff $\hat{\eta}_R \approx 0.61$. This threshold separates relational outsourcing and integration. Figure 2 depicts these cutoffs and the corresponding organizational modes.

![Figure 2: Cutoffs $\hat{\eta}_S$ and $\hat{\eta}_R$ for $\beta_{SO} = \beta_{RO} = 0.5$, $\beta_{SI} = \beta_{RI} = 0.7$ and $\alpha = 0.9$.](image)

Next, we can use this information in (13) to derive the cutoff rate of time preference $\bar{r}$ that pins down the choice between spot and relational governance. For each headquarter intensity $\eta$ there exists a unique $\bar{r}$ such that headquarters with $r < \bar{r}$ conclude a relational agreement with suppliers, whereas firms with $r > \bar{r}$ operate under spot contracting. In figure 3, this cutoff rate of time preference is depicted by a curve which separates relational contracting (shaded areas) from spot contracting (white area).

![Figure 3: Organizational forms for $\beta_{SO} = \beta_{RO} = 0.5$, $\beta_{SI} = \beta_{RI} = 0.7$ and $\alpha = 0.9$.](image)

Finally, we derive the cutoff time preference rate $\tilde{r}$ for which the ex ante choice of the organizational mode in the relational contract is irrelevant. That is, we seek a $\tilde{r}$ such that firms with $r < \tilde{r}$ achieve the first-best outcome both under relational outsourcing and relational integration. Recall that for $\eta \in (0, \hat{\eta}_R)$ (for $\eta \in (\hat{\eta}_R, 1)$) relational outsourcing (relational integration) is the dominant

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22 Bearing in mind the results depicted in figure 2, we substitute for $\{\beta_k, \beta_r\}$ the values $\{\beta_{SO}, \beta_{RO}\} = \{0.5, 0.5\}$ in the interval $\eta \in (0, 0.58)$; $\{\beta_{SO}, \beta_{RI}\} = \{0.5, 0.7\}$ in the range $\eta \in (0.58, 0.61)$, and $\{\beta_{SI}, \beta_{RI}\} = \{0.7, 0.7\}$ in the range $\eta \in (0.61, 1)$. 
organizational form in the sense that it minimizes the MRT. We explore whether the ICC from (13) still holds if a dominated instead of a dominant organizational form is chosen in a relational contract. In fact, as shown in figure 3, there exists a range of time preference rates (depicted by the darkly-shaded area RO&RI) which implies cooperative behavior independent of the choice of the organizational mode, i.e. there are multiple equilibria for the organizational mode of firms.

These multiplicity of equilibria entails a co-existence of different organizational modes in equilibrium. An inspection of figure 3 reveals that our model implies a co-existence of organizational modes apart from this possibility of multiple equilibria. For headquarter intensities within the range $\eta \in (\hat{\eta}_R, \hat{\eta}_S)$ (spot) outsourcing is chosen for high values of $r$ and (relational) integration is chosen for the range $\bar{r} < r < \tilde{r}$ (in addition to the possibility that both relational integration and relational outsourcing are equilibria for low values of $r$). Summing up the results of this section we have:

**RESULT. Coexistence of organizational modes.** Different organizational modes – integration and outsourcing – may coexist among firms within one and the same industry (i.e. for a given headquarter intensity). This holds true for any level of the headquarter intensity.

It should be noticed that this result, which implicates a co-existence of organizational modes for any level of the headquarter intensity, contrasts with the prediction of AH who find that a co-existence of organizational modes can only occur in headquarter-intensive industries. These different predictions are due to the fact that AH assume that integration involves higher fixed costs than outsourcing whereas we assume identical fixed costs under either organization form. This fixed cost differential and the heterogeneity of firms in terms of their productivity yield a trade-off in AH: for sufficiently high headquarter-intensities, very productive firms bear the burden of higher fixed costs associated with integration, whereas unproductive firms choose outsourcing. The co-existence of organizational modes in our analysis is due to different rates of time preference, in contrast, and therefore hold for any level of the headquarter intensity. This difference in predictions

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23 More specifically, we utilize $\{\beta_{SO}, \beta_{RI}\} = \{0.5, 0.7\}$ in the interval $\eta \in (0, 0.58)$; $\{\beta_{SO}, \beta_{RO}\} = \{0.5, 0.5\}$ in the range $\eta \in (0.58, 0.61)$, and $\{\beta_{SI}, \beta_{RO}\} = \{0.7, 0.5\}$ in the range $\eta \in (0.61, 1)$.

24 For instance, given the parameters underlying figure 3, possible organizational forms existing in the industry with headquarter intensity below $\hat{\eta}_R$ are SO, RO, RI.

25 AH discuss that under an inverse ranking of fixed costs, different organizational modes would co-exist only in component-intensive industries.
between our analysis and AH is interesting because the available evidence on sorting patterns is not yet conclusive.²⁶ Apart from this empirical issue, which deserves further scrutiny, it may be argued that the assumption of organization-specific fixed costs sits somewhat uncomfortably with the concept of a ‘unified theory of the firm’, which seeks to endogenously derive both costs and benefits of organizational forms (cf. Grossman and Hart (1986)). We provide a further step toward such a ‘unified theory’ by eliminating exogenous cost differences between organizational forms and emphasizing managerial differences in time preference rates instead.

3.3 General equilibrium in the repeated game

General equilibrium in the repeated game is determined by the zero profit conditions of firms engaged in spot and relational contracting, the free entry condition and the incentive compatibility constraint from (13). The productivity level \( \theta^* \), above which firms obtain non-negative profits under relational contracting, is obtained from the zero profit condition \( \pi^*(\theta, X) = 0 \), with \( \pi^*(\cdot) \) given by (3). Similarly, the threshold productivity in the third-best case, \( \theta^{TB}_{k} \) requires \( \pi^{TB}_{k}(\theta, X) = 0 \), whereby \( \pi^{TB}_{k}(\cdot) \) is given by (6). The free entry condition ensures that expected profits of a potential entrant are equal to fixed cost of entry:

\[
\int_{\bar{r}}^{r} \int_{\theta^*}^{\infty} v^*(\theta, X)dG(\theta)d\Gamma(r) + \int_{\bar{r}}^{1} \int_{\theta^{TB}_{k}}^{\infty} v^{TB}_{k}(\theta, X)dG(\theta)d\Gamma(r) = f_E, \tag{14}
\]

whereby \( v^*(\theta, X) = \sum_{t=0}^{\infty} \left( \frac{1}{1+r} \right)^t \pi^* = \frac{1+r}{r} \pi^* \) and \( v^{TB}_{k}(\theta, X) = \sum_{t=0}^{\infty} \left( \frac{1}{1+r} \right)^t \pi^{TB}_{k} = \frac{1+r}{r} \pi^{TB}_{k} \) denote the present value of the profit flow under relational and spot contracting, respectively, and \( \bar{r} \) is the cutoff rate of time preference defined by (13).

Closed-form solutions can be obtained for specific parameterizations of the functions \( G(\theta) \) and \( \Gamma(r) \). While we maintain that productivities are Pareto-distributed, we assume that the rate of time preference can take on only two values, \( r_{low} < \bar{r} \) and \( r_{high} > \bar{r} \) with respective probabilities \( \lambda \) and \( (1 - \lambda) \).²⁷ Using these parameterizations, we obtain equilibrium value for the consumption index,

²⁶ See, e.g., Defever and Toubal (2007), Kohler and Smolka (2009), and Nunn and Trefler (2008) for empirical assessments of the sorting patterns.

²⁷ The focus on two values of \( r \) suffices for our purposes. However, the results can easily be replicated for general
$X^{rep}$, and the threshold productivities, $\theta^{rep}_R$ and $\theta^{rep}_S$, in the repeated (rep) game (cf. Appendix F for the derivations). A simple comparison of equilibrium cutoffs yields $\theta^{rep}_S > \theta^{rep}_R$. We thus have

**Proposition 5. Interaction of technology and organizational capabilities of the firms.**

In general equilibrium, the minimum productivity cutoff $\theta^{rep}_S$ necessary for the survival of firms governed by spot contracting is higher than the minimum productivity cutoff $\theta^{rep}_R$ required for survival of firms governed by relational contracting.

*Proof.* See Appendix F.

We have previously mentioned that our model implies a fundamental separation: irrespective of a firm’s productivity level, headquarters with low time preference are able to reap the fruits of relational contracts whereas those with high time preference are stuck with spot contracts. However, as Proposition 5 clarifies, the heterogeneity of firms with respect to technology plays a role in general equilibrium: short-sighted firms need to be on average more technologically versed than more efficiently organized long-term oriented ones in order to be able to compete with the latter and to survive along with them in general equilibrium.

Furthermore, it can be easily shown that the general equilibrium value of $X^{rep}$ is increasing in $\lambda$ (cf. Appendix F). Utilizing this result in the welfare function (1), immediately implies

**Proposition 6. Managerial long-term orientation and aggregate welfare.** A country with a higher share of firms (headquarters) with low time preference exhibits a higher welfare.

*Proof.* See Appendix F.

In the introduction we have discussed empirical evidence for the heterogeneity of individual time preference rates both within and across countries. Against this backdrop, Proposition 6 brings out the implication that the long-term orientation that prevails in countries can be a source of their superior development. Managers in such countries are on average better suited to mitigate (avoid) the inefficiencies associated with hold-up problems in production by engaging in long-term relational distributions of $r$. We provide the solution where both $G(\theta)$ and $\Gamma(r)$ are Pareto-distributed on request.
business contracts. Removing these inefficiencies transmits into higher aggregate welfare. Therefore, countries where, on average, the patience of managers is higher, will have higher aggregate welfare.

4 Conclusion

The rate of time preference is a key primitive which provides a potential micro-level source for the substantial differences of living standards across nations. The prevailing view is based on the favorable effect of patience on individual accumulation processes as a broad set of dynamic choice theories highlight that a smaller rate of time preference leads to higher stocks of physical and human capital and to the development of better technologies. This paper provides a novel explanation of how higher patience of economic agents gets transmitted into greater economic well-being, which complements this view and reinforces the important role of the time preference rate. We elaborate that higher patience among a country's agents allows to solve pertinent organizational issues more efficiently since long-term firm-supplier-relationships which mitigate hold-up problems can then be maintained. Hence, countries where lower rates of time preference prevail on average exhibit higher aggregate welfare. We view it as a strength of our theory that it is consistent with the most recent empirical findings at the level of countries and that it’s key mechanism also accords with prevailing firm-level evidence.
References


Appendices

A Proof of Lemma 1

Lemma 1 holds if and only if \( \psi_k \equiv \Psi_k + \alpha < 1 \). Using the definition of \( \Psi_k \), \( \psi_k \) is given by

\[
\psi_k(\eta) = \beta_k \left( 1 - \frac{\alpha}{\beta_k} (1 - \beta_k) \frac{\eta(1 - \eta)}{1 - \alpha[\beta_k \eta + (1 - \beta_k)(1 - \eta)]} \right) + \alpha.
\]

It follows from simple differentiation of this function with respect to \( \eta \) that \( \psi_k'(\eta) \geq 0 \) iff

\[
\gamma_k \ln \left( \frac{1 - \beta_k}{\beta_k} \right) \leq (1 - \alpha)(1 - 2\beta_k),
\]

where \( \gamma_k \equiv (1 - \alpha(\beta_k \eta + (1 - \beta_k)(1 - \eta))) > 0 \) for all \( \alpha, \beta_k, \eta \in (0, 1) \), and \( \gamma'(\eta) \geq 0 \) if \( \beta_k \leq 1/2 \). The following properties result from the inspection of inequality (15): (i) If \( \beta_k < 1/2 \), then \( \psi'(\eta) < 0 \); (ii) if \( \beta_k > 1/2 \), then \( \psi'(\eta) > 0 \); (iii) if \( \beta_k = 1/2 \), then \( \psi'(\eta) = 0 \). Using these properties, the sufficient conditions for \( \psi_k < 1 \) to hold simplify to \( \psi(0) < 1 \) for \( \beta_k \in (0, 1/2) \); \( \psi(1) < 1 \) for \( \beta_k \in (1/2, 1) \), and \( \psi(1) < 1 \) for \( \beta_k = 1/2 \). It can be easily verified that these conditions hold for all \( \alpha, \beta_k, \eta \in (0, 1) \). This implies \( \psi_k < (1 - \alpha) \).

B Proof of Proposition 1

The following proof builds on the proof of Proposition 1 in Antràs (2003). In the first step of the proof we analyze the corner solutions of \( \Pi_S(\eta) \). Using expression for \( \Pi_S(\eta) \) in the text, we establish

\[
\Pi_S(0) = \frac{1 - \alpha(1 - \beta_{SI})}{1 - \alpha(1 - \beta_{SO})} \left( \frac{1 - \beta_{SI}}{1 - \beta_{SO}} \right)^{\frac{\alpha}{1 - \alpha}} < 1 \quad \text{and} \quad \Pi_S(1) = \frac{1 - \alpha\beta_{SI}}{1 - \alpha\beta_{SO}} \left( \frac{\beta_{SI}}{\beta_{SO}} \right)^{\frac{\alpha}{1 - \alpha}} > 1.
\]

The first inequality follows from \( \beta_{SI} > \beta_{SO} \) and the fact that \( (1 - \alpha(1 - x))(1 - x)^{\alpha/(1 - \alpha)} \) is a decreasing function of \( x \) for all \( x \in (0, 1) \) and \( \alpha \in (0, 1) \). Analogously, the second inequality follows from the fact that \( (1 - \alpha x)x^{\alpha/(1 - \alpha)} \) is an increasing function.

In the second step of the proof we consider the slope of the function \( \Pi_S(\eta) \). From simple differentiation of \( \Pi_S(\eta) \), it follows that \( \Pi'_S(\eta) > 0 \) if and only if

\[
\Omega(\eta) \left( \ln \left( \frac{\beta_{SI}}{\beta_{SO}} \right) - \ln \left( \frac{1 - \beta_{SI}}{1 - \beta_{SO}} \right) \right) > (\beta_{SI} - \beta_{SO})(2 - \alpha)(1 - \alpha),
\]

where \( \Omega(\eta) \equiv (1 - \alpha(1 - \beta_{SI}) + \alpha \eta(1 - 2\beta_{SI}))(1 - \alpha(1 - \beta_{SO}) + \alpha \eta(1 - 2\beta_{SO})) \). The following properties of the function \( \Omega(\eta) \) can be proven analytically for all \( \eta \in (0, 1) \): (i) If \( \beta_{SI} > \beta_{SO} \geq 1/2 \), then \( \Omega'(\eta) < 0 \); (ii) If \( 1/2 < \beta_{SO} < \beta_{SI} \), then \( \Omega'(\eta) > 0 \). (iii) If \( \beta_{SI} > 1/2 > \beta_{SO} \), the algebraic sign of \( \Omega'(\eta) \) is ambiguous. However, in this case \( \Omega''(\eta) < 0 \), \( \forall \eta \in (0, 1) \). These properties imply that \( \Omega(\eta) \geq \min\{\Omega(0), \Omega(1)\}, \forall \beta_k, \alpha, \eta \in (0, 1) \). Without loss of generality, assume that \( \Omega(1) = (1 - \alpha\beta_{SI})(1 - \alpha\beta_{SO}) < \Omega(0) \). Therefore, if inequality (16) holds for \( \Omega(1) \), it holds a fortiori for \( \Omega(\eta) \), \( \forall \eta \in (0, 1) \). Utilizing \( \Omega(1) \) in (16) yields a sufficient condition for \( \Pi'_S(\eta) > 0 \):

28 The case \( \Omega(1) > \Omega(0) \) is symmetric and can be proven by analogy.
\[
\vartheta(\beta_{SI}) \equiv \ln \left( \frac{\beta_{SI}}{\beta_{SO}} \right) - \ln \left( \frac{1 - \beta_{SI}}{1 - \beta_{SO}} \right) - \frac{\left( \beta_{SI} - \beta_{SO} \right)(2 - \alpha)(1 - \alpha)}{(1 - \alpha \beta_{SI})(1 - \alpha \beta_{SO})} > 0.
\]

It can be seen immediately, that \( \vartheta(\cdot) = 0 \) if \( \beta_{SI} = \beta_{SO} \). Furthermore, from simple differentiation of \( \vartheta(\beta_{SI}) \) it follows that \( \vartheta'(\beta_{SI}) > 0 \) if and only if \( (1 - \alpha \beta_{SI})^2 - \beta_{SI}(2 - \alpha)(1 - \alpha)(1 - \beta_{SI}) > 0 \). It can be easily shown that this condition holds for all \( \alpha, \beta_{SI} \in (0, 1) \). Therefore, \( \beta_{SI} > \beta_{SO} \) implies \( \vartheta(\beta_{SI}) > 0 \) and thus \( \Pi'_S(\eta) > 0 \).

Combining the results concerning the corner solutions of \( \Pi_S(\eta) \) and its slope, it follows that there exists a unique \( \hat{\eta}_S \in (0, 1) \) such that \( \Pi_S(\eta) < 1 \) for all \( \eta \in (0, \hat{\eta}_S) \), \( \Pi_S(\eta) > 1 \) for all \( \eta \in (\hat{\eta}_S, 1) \) and \( \Pi_S(\eta) = 1 \) for \( \eta = \hat{\eta}_S \). The function \( \Pi_S(\eta) \) is depicted in the following figure:

![Image](image_url)

**Figure 4:** Organizational choice in the spot game.

### C General equilibrium in the one-shot game

Pareto distribution of a random variable \( \theta \) is defined as

\[
G(\theta) = 1 - \left( \frac{b}{\theta} \right)^z, \quad g(\theta) = \frac{dG(\theta)}{d\theta} = zb^z\theta^{-z-1},
\]

where \( b > 0 \) is the lower bound of the support of the productivity distribution and lower values of the shape parameter \( z \) correspond to greater dispersion in productivity. We impose \( z > 2 \) to ensure that the Pareto-distributed variable has a well-defined (finite) variance and the further assumption \( z > \sigma - 1 \) to obtain meaningful solutions (see further below).

Consider first the case of perfectly enforceable contracts. After paying \( f_E \) and drawing \( \theta \), \( H \) starts to produce if profits are non-negative. The zero cutoff profit condition defines the cutoff productivity \( \theta^* \) from which on firms are active \( \pi^*(\theta, X) = 0 \), yielding \( \theta^*(X) = X (f/((1 - \alpha)AEL))^{1-\alpha} \).

Headquarters incur the fixed entry costs \( f_E \) if these are covered by the expected pure profits: the free entry condition thus commands \( \int_{\theta^*}^\infty \pi^*(\theta, X) dG(\theta) = f_E \) with \( \pi^* \) given by (3) and \( \theta^* \) from the zero cutoff profit condition. Taking into account that the productivity measure \( \theta \) shows up with a constant component \( \alpha/(1 - \alpha) \), cf. (3) and (5), it proves convenient to define the distribution of firm sales as (cf. Helpman et al. 2004):

\[
\Phi(\theta) \equiv \int_0^\theta y^{\alpha/(1-\alpha)} dG(y) \implies \Phi(\theta) = c \cdot \theta^{z(\alpha-1)/1+\alpha} = c \cdot \theta^{z+1+\sigma-1}, \tag{17}
\]
where \( c \equiv \frac{x^\beta(1-\alpha)}{z(\alpha-1)+\alpha} = -\frac{x^\beta}{z-\sigma+1} \) is a constant.\(^\text{29}\) The transformation in (17) was obtained by utilizing the Pareto probability density function and integrating the resulting expression. Using (3), expected pure profits of a potential headquarter in the first best case simplify to

\[
\int_{\theta^a}^{\infty} \left( (1-\alpha) AEL \theta^{\frac{\alpha}{\alpha-1}} X^{\frac{1}{\alpha-1}} - f \right) dG(\theta) = (1-\alpha) AEL X^{\frac{1}{\alpha-1}} \int_{\theta^a}^{\infty} \theta^{\frac{\alpha}{\alpha-1}} dG(\theta) - f \int_{\theta^a}^{\infty} dG(\theta) = (1-\alpha) AEL X^{\frac{1}{\alpha-1}} \{ \Phi(\infty) - \Phi(\theta^*) \} - f[1 - G(\theta^*)],
\]

where \( \theta^*(X) = X f/(1-\alpha) AEL \). Since \( \Phi(\infty) = 0 \) due to \( z > \sigma - 1 \), the free entry condition simplifies to \( (1-\alpha) AEL X^{\frac{1}{\alpha-1}} [-\Phi(\theta^*)] - f[1 - G(\theta^*)] = f_E \). Solving this equation for \( X \) yields the equilibrium aggregate consumption index

\[
X^* = b \left( \frac{f}{f_E (z-\sigma+1)} \right)^{\frac{1}{\alpha}} \left( (1-\alpha) AEL \right)^{\frac{1-\alpha}{\alpha}}.
\]

(18)

This index can be utilized in \( \theta^*(X) \) to obtain the cutoff productivity in the first best case

\[
\theta^* = b \left( \frac{f}{f_E (z-\sigma+1)} \right)^{\frac{1}{\alpha}}.
\]

(19)

All other endogenous variables are easily obtained using these two equilibrium measures. In particular, the price level follows from \( P^* = \mu(X^*)^{-1} \) and the welfare is given by \( V^* = L - \mu + \mu X^* \).

The equilibrium under contractual incompleteness is derived by analogy. The zero cutoff profit condition in this third-best case requires \( \pi_{TB}^*(\theta, X) = 0 \) and implies the cutoff productivity \( \theta_{TB}^*(X) = X f/(\Psi_k AEL) \) \( \frac{1-\alpha}{\alpha} \). All firms with productivities exceeding this threshold start to produce. The free entry condition under contractual incompleteness requires \( \int_{\theta^a}^{\infty} \pi_{TB}^*(\theta, X) dG(\theta) = f_E \), where \( \pi_{TB}^* \) and \( \theta_{TB}^* \) are given by (6) and zero cutoff profit condition, respectively. This condition can be solved by analogy to the first best case for the aggregate consumption index

\[
X_{TB}^* = b \left( \frac{f}{f_E (z-\sigma+1)} \right)^{\frac{1}{\alpha}} \left( \Psi_k AEL \right)^{\frac{1-\alpha}{\alpha}}.
\]

(20)

and for the cutoff productivity, \( \theta_{TB}^* = b \left( \frac{f}{f_E (z-\sigma+1)} \right)^{\frac{1}{\alpha}} \). Bearing in mind Lemma 1, a simple comparison of (18) and (18) immediately implies \( X_{TB}^* < X^* \). This is reflected in a higher price index, \( P_{TB}^* = \mu(X_{TB}^*)^{-1} > P^* = \mu(X^*)^{-1} \), and lower welfare, \( V_{TB}^* = L - \mu + \mu X_{TB}^* < L - \mu + \mu X^* = V^* \) under contractual incompleteness (Proposition 2).

D Proof of Lemma 2

Using (3) and (10), Lemma 2 (\( \pi_{TB}^* \equiv \pi_{H_k}^* > \pi^* \)) holds if and only if

\[
LHS(\alpha) \equiv (1-\beta)^{\frac{1}{1-\alpha}} (1-\alpha(1-\eta)) + \beta^{\frac{1}{\alpha-1}} (1-\alpha\eta) > (1-\alpha) \equiv RHS(\alpha).
\]

\(^\text{29}\) Pareto-distributed variable has a well-defined (finite) variance if and only if \( z > 2 \). To ensure that the variance of the distribution of firm sales is finite and integral converges (i.e., \( \Phi(\infty) = 0 \)), we need to impose additionally \( z > \sigma - 1 \), where \( \sigma > 1 \) is the elasticity of substitution.
In the first step of the proof we consider the corner solutions of both sides. We can establish:

\[ LHS(0) = RHS(0) = 1, \quad LHS(1) = (1 - \beta)^{\frac{1}{1-\alpha}} \eta + \beta^{\frac{1}{1-\alpha}} (1 - \eta) > 0 = RHS(1). \]

Next, consider the slopes of \( LHS(\alpha) \) and \( RHS(\alpha) \). The first order derivative of \( RHS \) with respect to \( \alpha \) is a constant: \( RHS'(\alpha) = -1 \). Bearing in mind the corner solutions from above, the sufficient condition for \( LHS(\alpha) \) to lie above \( RHS(\alpha) \) is \( LHS'(\alpha) > -1 \). Taking the first order derivative of \( LHS(\alpha) \) with respect to \( \alpha \) and rearranging, this sufficient condition, \( SC \) can be expressed as:

\[ SC(\alpha) = (1 - \beta)^{\frac{1}{1-\alpha}} (1-\eta) \left( 1 - \frac{\ln(1-\beta)}{1 - \alpha(1-\eta)} \right) + \beta^{\frac{1}{1-\alpha}} \eta \left( 1 - \frac{\ln \beta}{1 - \alpha \eta} \right) \]

It can be shown that \( SC'(\alpha) > 0 \). Hence, if \( SC(1) < 1 \) holds, \( SC(\alpha) < 1 \) holds a fortiori for all \( \alpha \in (0,1) \). In fact, it can be shown that \( SC(1) < 1 \) for all \( \beta, \eta \in (0,1) \). This implies \( LHS(\alpha) > RHS(\alpha) \) and completes the proof of Lemma 2.

### E Proof of Proposition 3

In the first step of the proof, consider the corner solutions of \( \Pi_R(\eta) \). From equation (12) we establish

\[ \Pi_R(0) = \frac{(1 - \beta_{RI})^{\frac{1}{1-\alpha}} (1-\alpha) + \beta_{RI}}{(1 - \beta_{RO})^{\frac{1}{1-\alpha}} (1-\alpha) + \beta_{RO}} > 1 \quad \text{and} \quad \Pi_R(1) = \frac{(1 - \beta_{RI}) + \beta_{RI}^{\frac{1}{1-\alpha}} (1-\alpha)}{(1 - \beta_{RO}) + \beta_{RO}^{\frac{1}{1-\alpha}} (1-\alpha)} < 1. \]

The first inequality follows from \( \beta_{RI} > \beta_{RO} \) and the fact that \( (1-x)^{\frac{1}{1-\alpha}} (1-\alpha) + x \) is an increasing function of \( x \) for all \( x \in (0,1) \) and \( \alpha \in (0,1) \). Analogously, the second inequality follows from the fact that \( (1-x) + x^{\frac{1}{1-\alpha}} (1-\alpha) \) is a decreasing function.

In the second step of the proof we consider the slope of the function \( \Pi_R(\eta) \). From simple differentiation of (12), it follows that \( \Pi'_R(\eta) < 0 \) if and only if

\[
\Pi_R \cdot \left( \frac{(1 - \beta_{RI})^{\frac{1}{1-\alpha(1-\eta)}} \alpha [1 - \alpha(1-\eta) - \ln(1 - \beta_{RI})]}{1 - \alpha(1-\eta)} - \frac{\beta_{RI}^{\frac{1}{1-\alpha}} \alpha [1 - \alpha \eta - \ln \beta_{RI}]}{1 - \alpha \eta} \right) < 0
\]

\[
\Pi_R \cdot \left( \frac{(1 - \beta_{RO})^{\frac{1}{1-\alpha(1-\eta)}} \alpha [1 - \alpha(1-\eta) - \ln(1 - \beta_{RO})]}{1 - \alpha(1-\eta)} - \frac{\beta_{RO}^{\frac{1}{1-\alpha}} \alpha [1 - \alpha \eta - \ln \beta_{RO}]}{1 - \alpha \eta} \right),
\]

whereas \( \Pi_R \) is given in equation (12). Since \( [1 - \alpha \eta - \ln x] > 0 \) holds for all \( \alpha, y, x \in (0,1) \), all terms in squared brackets and therefore all fractions are positive. From this it follows that the left-hand side of inequality (21) is smaller than zero. While \( \Pi_R \) is strictly positive, the sign of the second term on the right-hand side is ambiguous. Numerical simulation have shown that above inequality does not hold for all parameter values. Hence, the sign of \( \Pi'_R(\eta) \) is ambiguous.

Nevertheless, it can be proven analytically that (21) is fulfilled if evaluated at \( \Pi_R = 1 \). To show this, denote the first fraction on the left-hand side of inequality (21) as \( T_1(\beta_{RI}) \) and the second fraction on the left-hand side of inequality (21) as \( T_2(\beta_{RI}) \). Both functions are positive and their
first order derivatives are given, respectively, by

\[ T'_1(\beta_{RI}) = \alpha \frac{(1 - \beta_{RI})^\alpha (1 - \eta)}{(1 - \alpha(1 - \eta))^2} \ln(1 - \beta_{RI}) < 0 \quad \text{and} \quad T'_2(\beta_{RI}) = -\alpha \beta_{RI} \frac{\alpha \eta}{(1 - \alpha \eta)^2} \ln \beta_{RI} > 0. \]

Thus, if inequality (21) holds for \( T_1(1) \), it holds a fortiori for all \( \beta_{RI} \in (0, 1) \). Analogously, if (21) holds for \( T_2(\beta_{RI} = \beta_{RO}) \), it holds a fortiori for all \( \beta_{RI} \in (\beta_{RO}, 1) \). By substituting \( \beta_{RI} = 1 \) and \( \beta_{RI} = \beta_{RO} \) respectively in the first \( T_1(\beta_{RI}) \) and second \( T_2(\beta_{RI}) \) term on the left-hand side of inequality (21) and, by utilizing \( \Pi_R = 1 \) on the right-hand side of (21), this inequality simplifies to

\[ 0 < \frac{(1 - \beta_{RO})^\alpha - \alpha(1 - \eta) - \ln(1 - (1 - \beta_{RO}))}{1 - \alpha(1 - \eta)}. \]

Since this inequality holds for all parameter values, the function \( \Pi'_R(\eta) \), if evaluated at \( \Pi_R(\eta) = 1 \), has a negative slope for all \( \alpha, \eta, \beta \in (0, 1) \). Next, it can be shown that the polynomial \( \Pi'_R(\eta) \) has a degree 2. Thus, the function \( \Pi_R(\eta) \) has at most two extreme values. Given our results concerning corner solutions, the slope and the degree of polynomial \( \Pi_R(\eta) \), it follows that there exists a unique \( \hat{\eta}_R \in (0, 1) \) such that \( \Pi_R(\eta) > 1 \) for all \( \eta < \hat{\eta}_R \), \( \Pi_R(\eta) < 1 \) for all \( \eta > \hat{\eta}_R \), and \( \Pi_R(\eta) = 1 \) for \( \eta = \hat{\eta}_R \).

**F Proof of Propositions 5 and 6**

Following the approach sketched in Appendix C, equation (14) can be solved for the aggregate consumption index

\[ X^{rep} = b \left( \frac{1}{\frac{f}{fE} (z - \sigma + 1)} \right)^{1/2} \cdot \left( \frac{AEL}{f} \right)^{1/\alpha} \cdot \Omega^{1/2}, \]

and equilibrium productivity cutoffs in the repeated game \((rep)\) game for firms engaged in relational and spot contracting, respectively:

\[ \theta^{rep}_R = \theta^* \cdot (1 - \alpha)^{-\frac{1 - \alpha}{\alpha}} \cdot \Omega^{1/2}, \quad \theta^{rep}_S = \theta^* \cdot \Psi^1 \cdot \Omega^{1/2}, \]

where \( \theta^* \) is given by (19) and

\[ \Omega = \left( \lambda \frac{1 + r_{low}}{r_{low}} \cdot (1 - \alpha) \frac{z(1 - \alpha)}{\alpha} + (1 - \lambda) \frac{1 + r_{high}}{r_{high}} \cdot \Psi^z \right). \quad (22) \]

Bearing in mind Lemma 1, a simple comparison of equilibrium cutoffs immediately implies \( \theta^{rep}_S > \theta^{rep}_R \) (Proposition 5). Furthermore, given that \( \Psi_k < (1 - \alpha) \) due to Lemma 1 and \( r_{low} < r_{high} \), a simple differentiation of (22) with respect to \( \lambda \) yields \( \frac{\partial \Omega}{\partial \lambda} > 0 \). Hence \( X^{rep} \) and, thereby, \( V \) from (1) is increasing in \( \lambda \) (Proposition 6).