Firms, Markets, and the Work Ethic

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Abstract

In this paper, we study the formation of the work ethic in firms and markets. We show that the firm in our model is an idealized institution that operates solely on the basis of authority and the endogenous work ethic, without any monetary incentives. We say that one institution is more ethical than another if both the work ethic and the agent’s degree of internalization of it are higher in that institution. When institutions are exogenous, the market is never more ethical than the firm, although the latter is the more ethical institution for an intermediate level of perceived risk. When institutions are endogenous, we show that firms can arise due to market failures where the market generates too much risk. In that case, the firm is the efficient institution because it has a comparative advantage in the development of an effective work ethic since the multi-tasking problem precludes the use of incentives. In contrast, an efficient market has a comparative advantage in the provision of incentives, although the market would also collapse without an effective work ethic due to its own specific multi-tasking problem.

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1. Introduction

To address these questions, Holmström and Milgrom (1991) (HM91) consider a principal-agent model where the agent performs two tasks: producing output and maintaining a productive asset. Since the latter cannot be incentivized (asset values are hard to measure), the principal has to provide muted incentives for the former because otherwise the agent would devote zero effort to asset maintenance. The multi-tasking problem therefore implies weak (but balanced) incentives in firms. Likewise, the modern property rights approach to the theory of the firm developed by Grossman and Hart (1986) and Hart and Moore (1990) shows that the party who makes the most important investment (e.g., the firm) should be assigned more extensive ownership rights to provide the appropriate investment incentives. The other party (the employee) will therefore face weaker incentives.

This raises several questions. If incentives are weak in firms, then what explains the apparently high level of motivation one often observes in them? If explicit incentive mechanisms are ineffective because of the multi-tasking problem, why not cultivate other sources of (intrinsic) motivation? How do the latter interact with endogenous incentives?

In this paper, we show that the ability to foster strong norms for hard work — what we call the work ethic — may be a comparative advantage of the firm. At the same time, we also recognize that institutions are themselves endogenous and that we should expect markets with strong incentives but a weak work ethic to prevail in environments that favor explicit incentive mechanisms (e.g., those with low risk) and firms with weak incentives.

1 Indeed, the optimal incentive is zero in HM91 because of the multi-tasking problem and they are therefore obliged to assume an exogenous amount of intrinsic motivation (in the form of a U-shaped cost of effort for the agent) to make the firm a viable institution. In this paper, we show that both the principal and agent have a strategic interest in manipulating this additional source of motivation.

2 We conceptualize the work ethic as an individual personality trait similar to that of “conscientiousness” in the psychology literature, and amenable to change over a reasonably short period of time. In contrast, Max Weber’s Protestant work ethic is a cultural phenomenon and may therefore be less subject to change. In the psychology literature, “conscientiousness” is associated with dutifulness, self-discipline, and the need for achievement. We discuss these issues in more detail in the next section.
but a strong work ethic to supplant markets in other environments where incentives are ineffective or costly.

A central thesis of the paper is therefore that preferences are *endogenous* and shaped by institutions, in the sense that the work ethic may flourish in some institutions but not in others. In his survey on endogenous preferences, Bowles (1998) gathers a substantial body of empirical, experimental, and field evidence, drawn from across the social sciences, to support his contention that

> Walrasian grocery markets support personal interactions quite distinct from the long term relationship characteristic of a lifelong employment firm; and the differences in the structure of these exchanges appear to have effects on preferences...

(p. 78)

Likewise, Akerlof (1983) and Akerlof and Kranton (2005) provide several detailed case studies of institutions that successfully mold the preferences of their members, including the military and firms like Lincoln Electric.

There is indeed considerable evidence that *behavior* differs across institutions. E.g., one widely replicated set of experimental results finds rational self-interested behavior in market and auction-type settings, but other-regarding behavior in environments like the dictator, ultimatum, and gift exchange games; see Fehr and Gächter (2000), Fehr and Fischbacher (2002), Fehr, Klein, and Schmidt (2007), and Ostrom and Walker (2007). One explanation, explored in Fehr and Schmidt (1999), Bolton and Ockenfels (2000), Falk and Fischbacher (2006), Dufwenberg, Heidhues, Kirchsteiger, Riedel, and Sobel (2008), and Sobel (2008), is that preferences are stable but can only be elicited to the extent that a particular institution allows. E.g., in perfectly competitive markets one cannot affect others’ monetary payoffs because one cannot influence either the market price or trade volume. It follows that agents will behave in a purely self-interested fashion even if their preferences reflect a concern for equity that might be manifested in other institutions. As summarized in the title of Sobel (2008), “Markets Make People Appear Selfish.”

In this paper, we consider an alternative but complementary explanation: preferences are not completely stable but depend on the institution. This, of course, is an old idea and the relationship between institutions (especially the market) and beliefs, culture, and preferences was also a central concern of classical thinkers such as Max Weber:
The market community as such is the most impersonal relationship of practical life into which humans can enter with one another. Where the market is allowed to follow its own autonomous tendencies, its participants do not look toward the persons of each other but only toward the commodity; there are no obligations of brotherliness or reverence, and none of those spontaneous human relations that are sustained by personal unions. They all would just obstruct the free development of the bare market relationship, and its specific interests serve, in their turn, to weaken the sentiments on which these obstructions rest.


In line with the experimental evidence, “personal unions” support “human relations” but the “bare market relationship” is free of “obligation” and “sentiment” because the market itself erodes these “obstructions.”

Although many such thinkers stressed the impact of institutions on the formation of preferences, few did more than sketch the relevant mechanisms.

One cannot be too far out on a limb when in the company of Adam Smith as well as Edmund Burke, Alexis de Tocqueville and Karl Marx, John Stuart Mill and Frederick Hayek: all celebrated or lamented the effects of markets and other institutions on human development. But consensus eludes any of the grand claims made concerning the nature of the effects or how they might be generated. The reason is that most writers have implicitly invoked a kind of functionalist correspondence between economic structures on the one hand and values, customs, and tastes on the other, without explaining the mechanisms by which the former might affect the latter... Nonetheless, the argument that economic institutions influence motivations and values is plausible, and the amount of evidence consistent with the hypothesis is impressive.

Bowles (1998, p. 76)

The difference is that in this paper we consider a specific mechanism: the work ethic as an equilibrium phenomenon and the product of individual and rational self-interest. Armed with this conception, which should not be too abhorrent to economists, we analyze the relationship between firms and markets, on the one hand, and the development of the work ethic on the other.

Our model combines the theory of the firm in HM91 with the formalization of the work ethic in Casadesus-Masanell (2004) (CM04), which in turn builds on Akerlof (1982, 1983), Frank (1987), Kandel and Lazear (1992), Rabin (1993), and Rotemberg (1994) (R94), among others. This literature is also closely related to that on the economics of identity, especially Akerlof and Kranton (2005). The timing of the game is as follows. First, the principal and agent bargain over the asset, whose maintenance is non-contractible. As in HM91 and Grossman and Hart (1986), the institution is determined by asset ownership. In particular, the firm (or integration) is the institution where the principal owns the
asset and the market (or non-integration) is the one where the agent does. Once the institution is determined, the agent chooses his degree of internalization based on rational self-interest, which indicates the extent to which he internalizes the principal’s work ethic. After that, the principal offers a standard linear contract and establishes the work ethic. Organizational culture is therefore an equilibrium phenomenon in that the principal sets the work ethic but the extent to which the agent internalizes it is a matter of individual choice. Finally, the agent decides whether or not to accept the contract and, if so, how much effort to devote towards production and asset maintenance.

As in HM91, the firm is the efficient institution when perceived risk (defined below) and therefore the cost of incentives is sufficiently high. In that case, the multi-tasking problem precludes the use of incentives, so both parties find it optimal to contribute to an effective work ethic: the principal sets a positive work ethic which the agent partially internalizes in the sense that the degree of internalization is non-zero but finite. As Bowles (1998, p. 78) emphasizes,

> where contracts are incompletely specified or costly to enforce, the ex post terms of an exchange may depend on the normative commitments and psychological makeup of the parties to the exchange; where the amount of work done on the job cannot be secured by a contract it will be influenced by the employee's work ethic or sense of alienation, for example.

With zero incentives, the agent is indifferent between the two tasks and the principal exercises allocative authority [similar to Simon (1951)] in dividing his total effort between them. We therefore obtain an idealization of the firm as an institution that operates solely on the basis of authority and intrinsic motivation in the form of an endogenous work ethic.

In contrast, the market is efficient when the level of perceived risk is sufficiently low. In that case, the agent owns the asset so the multi-tasking problem specific to the firm no longer applies and the principal is able to provide strong output incentives. The market, however, suffers from a different kind of multi-tasking problem: the agent faces ownership incentives with respect to asset maintenance, but the principal cannot provide comparable incentives and still make positive expected profit. An effective work ethic is therefore required to provide the necessary additional motivation and in our model the market could not exist without it. Although Weber depicted market exchange as “the most impersonal relationship of practical life,” in our model it still retains a trace of “obligation”
and “sentiment” and its participants still “look towards the persons of each other” in the sense of an effective work ethic which is the product of strategic interaction.

Our main results compare the work ethic in both institutions. We say that one institution is more ethical than another if both the work ethic and the agent’s degree of internalization are higher in that institution. When institutions are exogenous, we show that the market is never more ethical than the firm, but the latter is the more ethical institution for an intermediate range of perceived risk. These results echo those (e.g., Karl Marx) who took a rather dim view of the effects of the market on human development. On the other hand, the ethical ranking is ambiguous when perceived risk is sufficiently high or low. When institutions are endogenous, we show that an efficient market has stronger incentives but a weaker work ethic than an efficient firm. In that sense, firms arise because of market failures due to excessive risk and it is precisely the endogenous work ethic that makes the firm (and perhaps other forms of collective organization) a viable alternative.

Related Literature

The questions we ask are similar to those in Tabellini (2008), who considers a version of the prisoner’s dilemma where players have an endogenous preference for cooperation chosen partly by their parents. In general, his model possesses two steady-states (see his proposition 9) — one with a strong endogenous enforcement mechanism (the probability of detecting and punishing defectors) where the majority of players have a strong preference for cooperation and another steady-state where the opposite holds. In equilibrium, strong values are therefore positively correlated with strong enforcement mechanisms.

The closest paper to ours is Rotemberg (2006), who considers the formation of altruism in firms and markets. In his paper, he assumes firms have an inherent advantage over markets because monitoring within firms also provides learning opportunities with respect to product improvements. Given this advantage, altruism is less valuable in the firm and Rotemberg provides sufficient conditions (see his theorems 2 and 3) such that the firm prefers to deal with altruistic independent contractors rather than selfish employees.

Rob and Zemsky (2002) develop a dynamic version of HM91 with a continuum of risk neutral agents. Unlike the previous papers, the firm is the sole exogenous institution. In
each period, agents allocate effort between an individual and a cooperative task, where the latter is more profitable but the former more easily observed by the principal. The agents’ contributions to the cooperative task are driven by reciprocity, so an increase in incentives today leads to less cooperation today and therefore less cooperation tomorrow. The model can have two steady-state equilibria: a “good” equilibrium with high cooperation, high profits, and low incentives, and a “bad” equilibrium. As in our model, but in contrast with Tabellini (2008), incentives and values are therefore strategic substitutes.

The plan for the rest of the paper is as follows. In section 2, we present the model and results. All proofs are in the appendix. Section 3 concludes.

2. Model and Results

2.1 Basic Assumptions

We adopt the theory of the firm in HM91 based on asset ownership. There are two tasks: production and asset maintenance. The production function is \( q = e + \epsilon \), where \( e \) is the agent’s effort in production and \( \epsilon \) is a normally distributed shock with mean zero and variance \( \sigma^2 \). We assume the principal is a monopolist or Cournot oligopolist in the output market with linear demand \( p = \theta - q \), so the principal’s revenue and expected revenue are \( \theta q - q^2 \) and \( \theta e - e^2 - \sigma^2 \), respectively. For simplicity, we assume the final value of the asset is similar

\[
f(a) = \begin{cases} 
\theta a - a^2 & \text{if } 0 \leq a \leq \theta/2 \\
\theta^2/4 & \text{if } a > \theta/2,
\end{cases}
\]

where \( a \) is the agent’s effort in maintaining the asset.\(^4\) I.e., the expected value of the asset increases up to its maximum feasible level \( \theta^2/4 \), but is constant thereafter. Also for simplicity, and to avoid consideration of corner solutions, we assume that positive output requires at least some asset maintenance, so \( a = 0 \) implies \( q = 0 \) regardless of the

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\(^3\) This implies that output can be negative, but this is not really an issue. Alternatively, we could assume the agent’s compensation is based on a linear signal \( x = e + \epsilon \), where \( x \) can legitimately take negative values, and the production function is \( q = e + \eta \), where \( \eta \) is a random variable with mean zero and variance \( \sigma^2 \) and whose support is such that, in equilibrium, \( q \) always takes values in \([0, \theta]\). The results would be the same.

\(^4\) Ramalingam (2008) considers some extensions of the present model, including the case where \( \theta \) can differ for the two tasks. The results are qualitatively similar.
values of $e$ and $\epsilon$. Likewise, we assume the asset cannot be maintained without at least some production effort (e.g., testing the equipment requires at least some production for diagnostic purposes), so that $a > 0$ requires $e > 0$.

As in CM04, we assume the principal sets the work ethic $v$ and the agent experiences guilt $(1/2)\lambda g(v, e, a)$ when his actions fall short of the standard $v$, where the degree of internalization $\lambda$ is endogenous and chosen by the agent.\(^5\) In particular, the agent is free to choose $\lambda = 0$, in which case he ignores the standard. The specific nature of the work ethic, the guilt function $g$, and the manner in which $\lambda$ is chosen are discussed more fully below. The agent’s utility function is negative exponential

$$-\exp\left\{-r \left[I - (1/2)t^2 - (1/2)\lambda g\right]\right\}, \quad (2)$$

where $r$ is the agent’s coefficient of absolute risk aversion, $I$ is income, $t = e + a$ is total effort, and $(1/2)t^2$ the cost of total effort. Both the principal and the agent have an outside option of zero, which is what both receive if either the principal shuts down or the agent refuses the contract.

We make the following assumptions throughout the paper, where $k = r\sigma^2$ is the level of perceived risk: objective risk scaled by the agent’s sensitivity to it.

**Assumption 1.** We assume $0 < k < 12$ and

$$\theta^2 > \max \left\{8\sigma^2, \frac{8\sigma^2(6 + k)}{12 - k}\right\}. \quad (3)$$

As we will see, these assumptions are necessary for the principal’s expected profits to be nonnegative in equilibrium and to ensure that both activities, production and asset maintenance, are sufficiently valuable.

### 2.2 The Firm

As in HM91, the firm is defined to be the institution where the principal owns the asset and receives its final value. We assume output is contractible but asset maintenance is

\(^5\) As R94 and CM04 emphasize, guilt is an emotion related to variables that only the agent can observe (e.g., effort in our model), whereas shame refers to variables that others can observe.
not, because asset values are difficult to measure for third-party verification purposes. We restrict the class of feasible contracts to those that are linear in output $I = \alpha + \beta q$, where $\alpha$ is the fixed component and $\beta$ is the piece rate.$^6$ Let

$$g(z) = \begin{cases} 
  z^2 & \text{if } z \geq 0 \\
  0 & \text{otherwise.}
\end{cases}$$

(4)

The principal chooses the contract $(\alpha, \beta)$ and the work ethic $v$, while the agent chooses his degree of internalization $\lambda$ and experiences guilt $(1/2)\lambda g(v - t)$ when his total effort falls short of the standard.$^7$ The effective work ethic (the combined effect of $v$ and $\lambda$) is therefore an equilibrium phenomenon and the product of individual and rational self-interest.

### 2.3 The Market

The market is the institution where the agent owns the asset. As in the firm, the principal offers a contract $(\alpha, \beta)$ and establishes the work ethic $v$, but now the agent owns the asset and experiences no guilt with respect to his own effort in maintaining it. Instead, the agent’s guilt $(1/2)\lambda g(v - e)$ depends only on his production effort, which is the only task subject to moral hazard.

### 2.4 Timing of the Game

The timing of the game is as follows. First, the principal and agent bargain over asset ownership, which determines the institution. For simplicity, we assume efficient bargaining. Given the institution, the agent then chooses his degree of internalization $\lambda$ to maximize what Rabin (1993) calls his material payoff, which is his expected payoff excluding guilt [see (10) and (24) below]. I.e., the agent’s material payoff is precisely his certainty equivalent in HM91. After the agent commits to his choice of $\lambda$, the principal then decides whether or not to offer a contract $(\alpha, \beta)$ and, if so, what work ethic $v$ to establish. Finally, the

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$^6$ See Bolton and Dewatripont (2005, Chapter 4) and HM91 for extensive discussions on the assumption of linear contracts.

$^7$ Like Akerlof (1982, Example 2), we do not consider pride in the sense of increased utility when $t > v$. Note that $v$ corresponds to the norm $e_n$ in Akerlof (1982), not the minimum standards $e^+_{\text{min}}$ and $e^-_{\text{min}}$. The behavior of the poster girls at Eastern Utilities, in exceeding the minimum work standard, is therefore not necessarily inconsistent with the results of our model.
agent chooses whether or not to accept the contract and, in the case of acceptance, how much effort to devote to each task.

2.5 Discussion

To be precise, we assume (i) the agent chooses his degree of internalization $\lambda$ to maximize his material payoff, (ii) he can commit to that choice, and (iii) he can credibly signal its value to the principal. We now discuss each assumption in turn.

According to (i), the agent chooses $\lambda$ to maximize his economic well-being rather than his overall well-being, which equals his material payoff plus guilt [see (6) and (20) below]. This is based on the following conception of the self:

one can think of an “inner” self that is selfish and relinquishes control of actions to an “outer” self. What the inner self can do, however, is to mold the preferences that guide the outer self’s actions. Thus the inner self can make the outer self altruistic, and this altruism becomes genuine because the inner self cannot change the outer self’s preferences too rapidly.

R94 (p. 690)

In our model, the selfish inner self bargains with the principal over asset ownership in the first stage of the game and then, given the institution, chooses $\lambda$ in the second stage to maximize the agent’s material payoff. The outer self then takes $\lambda$ as given in deciding whether or not to accept the contract and, if so, what efforts to supply in each task.

As CM04 emphasizes (p. 379), this conception of the self is common in psychology, social psychology, and sociology and similar ideas have also been used in economics by Adam Smith in *The Theory of Moral Sentiments*, Akerlof (1983), Frank (1987), Raub (1990), and Rabin (1993), among others. E.g., Akerlof (1983, p. 54) argues that

Most persons attempt to choose values for their children (and perhaps also for themselves) according to their economic opportunities that allow them to get along economically. According to Robert Coles’ *Children of Crisis*, not only the wealthy... but also the poorest of the poor — immigrants, sharecroppers, and mountaineers — consciously teach their children values aimed at leading them best to survive economically.

But how does the agent benefit from his internalization of the work ethic? A central insight of CM04 is that altruism, ethical standards, and norms all enable the selfish inner self to extract material rents from the principal because the latter has to compensate him for all expected losses, including guilt. If the agent can commit to a higher value of $\lambda$ and...
can credibly signal this to the principal, then this will necessitate an increase in the fixed component \( \alpha \) of the contract to meet the participation constraint. Seabright (2004, p. 93) expresses the same mechanism when he writes that

in order to exchange with strangers people need a way to signal their trustworthiness... one of the most effective ways to do this is to create an identity for yourself, a set of internal rules in which you yourself believe and by which you live, and which will make you unhappy if you fail to honor them.

With respect to commitment (ii), Akerlof (1983, p. 57) and Bowles (1998, p. 79-80 and Section 7) discuss evidence that preferences are both endogenous and fairly stable. In particular, preferences learned in one environment tend to become ingrained and to be applied in others:

However acquired, preferences are internalized; there is considerable evidence that preferences learned under one set of circumstances become generalized reasons for behavior. Thus economic institutions may induce specific behaviors — self-regarding, opportunistic, or cooperative, say — which then become part of the behavioral repertoire of the individual.

(ibid., p. 80)

As R94 notes (see the above quote), such commitment may reflect the inability of the inner self to change the preferences of the outer self too rapidly. One potential explanation is cognitive dissonance: if only a limited subset of the agent’s attitudes, beliefs, and values can be modified at any one time, then excessive changes will create unwanted inconsistencies.

As examples of credible signals, R94 cites body language and gifts in the context of altruism, Frank (1987, Section III) lists several credible physiological symptoms, and Seabright (2004, p. 59-61) discusses smiling and laughing in connection with reciprocity. With respect to the work ethic specifically, Seabright (p. 5 and Chapter 6) suggests several attributes that derive from education, training, and an extended period of commitment to the task (the following is from p. 90-1):

almost all occupations in a modern society embody an ethic, a code. For trust requires an assurance of reliability, and some of the most effective policemen are internal, lodged in the surveillance mechanisms of the individual personality. The fiercest external vigilance will rarely be enough to ensure the honesty of a really determined cheat, so what better to deal with people whose character, training, or upbringing leads them not to want to cheat even when they have the chance? Those who can convince others of their intrinsic honesty may thereby prosper, and it may be easier for the genuinely honest to be thus convincing — the more so if honesty, or at least the true and honorable performance of a certain trade or skill, requires a degree of style, confidence, even grace, built up over a long period of commitment to the task, that are hard for an opportunist to feign.
For simplicity, in our model we omit the costs of such signaling.

Finally, there are several different forms of intrinsic motivation. Why should we be interested in the work ethic? We address this question in the context of the five-factor model of personality from psychology, which identifies the five main personality traits as Agreeableness (altruistic and optimistic), Conscientiousness (dutiful, self-disciplined, and achievement oriented), Extraversion (assertive and sociable), Neuroticism (ability to cope with anxiety and stress), and Openness to Experience (creative and imaginative). The work ethic is clearly subsumed under Conscientiousness, which is often assessed using the statement “I shirk my duties.” According to Judge and Ilies (2002, p. 798),

>a robust set of five factors has been recovered from almost every major personality inventory and from analyses of the more than 15,000 trait adjectives in English and those in many other languages... Furthermore, the structure has generalized across cultures, sources of ratings, and measures... Although acceptance of the classification is far from universal... the Big Five has provided the most widely accepted structure of personality in our time.

To determine the impact of each of the Big Five traits on job performance, Hurtz and Donovan (2000) perform a meta-analysis of previous studies which considered jobs in sales, customer service, management, and also skilled and semi-skilled positions. Their findings essentially confirm the conventional wisdom among personality psychologists that Conscientiousness is the most important. Agreeableness (which includes altruism as in CM04 and R06) is also crucial for occupations like customer service involving substantial social interaction (e.g., R06 is concerned with relationships with contractors). Likewise, the meta-analysis of Judge and Ilies (2002) reveals that Conscientiousness and Neuroticism are the two most important factors for job motivation.

2.6 Equilibrium in the Firm

We solve the model by backward induction. When the institution is the firm, the agent’s utility is

\[- \exp \{-r \left[ I - \frac{1}{2}t^2 - \frac{1}{2}\lambda g(v - t) \right] \} \]

and his expected utility is therefore [see Bolton and Dewatripont (2005, Chapter 4)]

\[ U_F = \alpha + \beta e - \frac{1}{2}t^2 - \frac{1}{2}\lambda g(v - t) - \frac{1}{2}k\beta^2, \]
where the first two terms comprise the agent’s expected income, followed by the cost of
total effort, guilt, and the risk premium (the cost of risk imposed by incentives). As in
HM91 there is a multi-tasking problem: if \( \beta > 0 \) then the agent will devote all of his effort
towards production and none to asset maintenance because the former activity is better
rewarded. Given our previous assumption that zero asset maintenance implies zero output,
the principal will either choose to shut down or to offer a contract with zero production
incentives.

In the latter case, the agent maximizes

\[
U_F = \alpha - \frac{1}{2}t^2 - \frac{1}{2}\lambda g(v - t)
\]

with solution

\[
t = \frac{v\lambda}{1 + \lambda}.
\]

Although incentives are zero, the agent is still motivated to supply effort when \( v > 0 \) and
\( \lambda > 0 \) because he has internalized the principal’s work ethic and experiences guilt when
his total effort falls short of the standard. Since both tasks are equally attractive, the
agent only cares about his total effort and not about how the latter is divided between
them. As expected, total effort in (8) is increasing in both the work ethic and the degree
of internalization.

As usual, the principal sets \( \alpha \) so the participation constraint \( U_F \geq 0 \) binds and the
agent always accepts the contract if one is offered. This requires

\[
\alpha = \frac{v^2\lambda}{2(1 + \lambda)},
\]

which is increasing in both \( v \) and \( \lambda \). In other words, an agent with a higher degree of
internalization will insist on more pay in the form of a higher \( \alpha \) and this is precisely
the mechanism through which the selfish inner self profits from an effective work ethic.
Likewise, a principal who institutes a more demanding work ethic will have to compensate
for that through a higher \( \alpha \).

The agent’s material payoff is his expected utility in (7) excluding guilt. Since the
participation constraint binds,

\[
\alpha - \frac{1}{2}t^2 = \frac{1}{2}\lambda g(v - t)
\]
and the two are in fact equivalent.\footnote{Consider the second stage of the game where the agent chooses \( \lambda \) to maximize his material payoff \((1/2)\lambda g(v - t)\). In what follows, it will be shown that there exists a \( \lambda > 0 \) such that the agent’s material payoff is positive in that subgame (indeed, this holds along the equilibrium path). Since material payoffs are negative or zero in those subgames where \( \lambda \leq 0 \), in what follows we focus on the case \( \lambda > 0 \).}

We now turn to the principal’s problem. Since the principal receives the final value of the asset, her profits are

\[
\theta q - q^2 + f(a) - I
\]

and expected profits

\[
\theta e - e^2 + f(a) - \alpha - \beta e - \sigma^2.
\]

Note that the principal bears some risk \( \sigma^2 \) from operating in the output market which she will have to be compensated for in equilibrium or she will shut down. Substituting in the agent’s participation constraint,

\[
\Pi_F = \theta e - e^2 + f(a) - (1/2)t^2 - (1/2)\lambda g(v - t) - (1/2)k\beta^2 - \sigma^2.
\]

As discussed previously, the multi-tasking problem forces \( \beta = 0 \) and the agent supplies total effort \( t \) in (8). The principal’s problem is therefore to choose \( e \geq 0, a \geq 0, \) and \( v \geq 0 \) to maximize (13) subject to the constraint \( e + a \leq t \). The proof of the following result is standard and therefore omitted. Let

\[
\lambda_1 = \frac{2\sigma^2}{\theta^2 - 4\sigma^2} > 0,
\]

where the denominator is positive by Assumption 1.

**Proposition 1.** When the institution is the firm and \( \lambda \geq \lambda_1 \), the principal offers a unique contract \((\alpha_F, \beta_F)\) and work ethic \( v_F \) with zero incentives \( \beta_F = 0 \) and

\[
v_F = \frac{\theta(1 + \lambda)}{1 + 2\lambda}.
\]

The agent provides total effort

\[
t_F = \frac{\theta\lambda}{1 + 2\lambda}.
\]
which the principal divides equally between the two tasks. The principal’s expected profit is given by

$$\Pi_F = \frac{\theta^2 \lambda}{2(1 + 2\lambda)} - \sigma^2$$

(17)

and the agent’s material payoff by

$$U_{mF} = \frac{\theta^2 \lambda}{2(1 + 2\lambda)^2}.$$  

(18)

If $0 \leq \lambda < \lambda_1$ the principal shuts down and both parties receive zero.

The principal’s shutdown decision therefore hinges on the value of $\lambda$. If the latter is too small, in the sense that $0 \leq \lambda < \lambda_1$, the principal shuts down because the agent’s total effort in (16) is insufficient for the principal to cover her operating risk $\sigma^2$. As an institution, the firm cannot operate successfully without an effective work ethic. On the other hand, if $\lambda \geq \lambda_1$ then the principal can make positive expected profits but she offers a unique contract with zero incentives because of the multi-tasking problem.

In that case, the sole instrument available to the principal with respect to the moral hazard problem is her choice of the work ethic, whose optimal value in (15) balances higher total effort in (8) versus a higher fixed payment in (9). As to be expected, the optimal work ethic is increasing in $\theta$ but decreasing in $\lambda$ because an increase in the latter allows the principal to obtain the same level of total effort in (8) with a lower work ethic and therefore lower $\alpha$.

Given the agent’s indifference, the principal’s other problem is to allocate the agent’s total effort in (16) between production and asset maintenance. Since the two tasks are symmetric, the principal divides (16) equally between them. In this respect, the principal’s allocative role is similar to Simon’s (1951, p. 294) definition of the exercise of authority:

We will say that B exercises authority over W if W permits B to select $x$. That is, W accepts authority when his behavior is determined by B’s decision. In general, W will accept authority only if $x_0$, the $x$ chosen by B, is restricted to some given subset (W’s “area of acceptance”) of all the possible values. This is the definition of authority that is most generally employed in modern administrative theory.

In our model, the agent voluntarily accepts the principal’s contract and his subsequent “area of acceptance” is defined by (8) and $e + a = t$. As in HM91, the firm is therefore an
idealized institution that operates solely on the basis of authority and intrinsic motivation rather than explicit monetary incentives. In our model, however, the agent’s intrinsic motivation is endogenous and reflects his choice of \( \lambda \), the principal’s choice of \( v \), and sequential rationality.

We now consider the optimal \( \lambda \), which the agent chooses to maximize his material payoff in (18). Note that Assumption 1 implies positive expected profits in (19).

**Proposition 2.** In the firm case, the agent selects \( \lambda > \lambda_1 > 0 \) so the principal does not shut down. In particular, the agent’s optimal \( \lambda \) is \( \lambda_F = 1/2 \) and

\[
\begin{align*}
  e_F &= \theta/8 \\
  a_F &= \theta/8 \\
  \beta_F &= 0 \\
  v_F &= 3\theta/4 \\
  U^m_F &= \theta^2/16 \\
  \Pi_F &= (\theta^2/8) - \sigma^2.
\end{align*}
\]

In choosing \( \lambda \), the inner self faces the tradeoff evident in (10), between a higher fixed payment \( \alpha \) versus the cost of the required higher total effort. According to Proposition 2 above, the agent finds it in his own rational self-interest to internalize the principal’s work ethic \( \lambda_F > 0 \) and, indeed, to internalize it to a sufficient degree \( \lambda_F > \lambda_1 \) so that the principal can operate and make a positive expected profit. The agent’s internalization is only partial, however, since \( \lambda_F \) is finite. Otherwise, the agent would always set \( t = v \) to avoid infinite guilt. In equilibrium, \( t_F < v_F \) so the outer self experiences guilt, which allows the inner self to extract material rents from the principal. In turn, the principal also benefits because the multi-tasking problem precludes the use of incentives and she must rely on the work ethic instead.

2.7 Equilibrium in the Market

We now turn to the market, where the agent owns the asset and therefore only experiences guilt with respect to his production for the principal.\(^9\) The agent’s expected payoff is

\[
U_M = \alpha + \beta e + f(a) - (1/2)t^2 - (1/2)\lambda g(v - e) - (1/2)k\beta^2
\]

\(^9\) We assume this here for simplicity but Ramalingam (2008) derives it endogenously.
and his optimal efforts are

\[ e = \frac{3(\beta + v\lambda) - \theta}{2 + 3\lambda} \]

\[ a = \frac{\theta(1 + \lambda) - (\beta + v\lambda)}{2 + 3\lambda}. \tag{21} \]

In the market, the agent faces a tradeoff between production and asset maintenance that does not exist in the firm, so our previous analysis cannot be considered as a special case of that here. As is intuitive, production effort \( e \) is increasing in production incentives \( \beta \), the work ethic \( v \), and the degree of internalization \( \lambda \) because they all increase the marginal benefit of production effort in terms of either an increase in expected income or a reduction in guilt.\(^{10}\) Likewise, asset maintenance is increasing in \( \theta \).

The principal’s profits are \( \theta q - q^2 - I \) and expected profits

\[ \theta e - e^2 - \alpha - \beta e - \sigma^2. \tag{22} \]

Substituting the agent’s participation constraint into (22), we obtain

\[ \Pi_M = \theta e - e^2 + f(a) - (1/2)t^2 - (1/2)\lambda g(v - e) - (1/2)k\beta^2 - \sigma^2. \tag{23} \]

Since the participation constraint binds, the agent’s material payoff is

\[ \alpha + \beta e + f(a) - (1/2)t^2 - (1/2)k\beta^2 = (1/2)\lambda g(v - e). \tag{24} \]

Let

\[ \lambda_2 = \frac{2\sigma^2(6 + k) - \theta^2(3 - k)}{3k(\theta^2 - 4\sigma^2)}. \tag{25} \]

Given \( \lambda \), Proposition 3 below establishes the agent’s optimal efforts and the unique contract and work ethic in the market.

**Proposition 3.** If the institution is the market and \( \lambda \geq \lambda_2 \) then the principal offers the unique contract and work ethic

\[ \beta_M = \frac{3\theta}{6 + k(1 + 6\lambda)} \quad v_M = \frac{\theta [3 + k(5 + 3\lambda)]}{2[6 + k(1 + 6\lambda)]}. \tag{26} \]

\(^{10}\) The efforts in (21) are optimal under the conditions that define Region 3 in the proof of Proposition 3 in the Appendix. One of those conditions is \( \beta \leq (2v/3) + (\theta/3) \), which implies the above statements about \( \lambda \).
and the agent’s optimal efforts are

\[ e_M = \frac{\theta \left[ 3 + k(3\lambda - 1) \right]}{2 \left[ 6 + k(1 + 6\lambda) \right]} \quad a_M = \frac{\theta \left[ 3 + k(3\lambda + 1) \right]}{2 \left[ 6 + k(1 + 6\lambda) \right]} \]  

(27)

The principal’s expected profits are

\[ \Pi_M = \frac{3\theta^2 - 2k\sigma^2(1 + 6\lambda) - \sigma^2 [12 - k(3\lambda - 1)]}{2 \left[ 6 + k(1 + 6\lambda) \right]} \]  

(28)

and the agent’s material payoff is

\[ U_M^m = \frac{9k^2\theta^2\lambda}{2 \left[ 6 + k(1 + 6\lambda) \right]^2} \]  

(29)

If \( 0 \leq \lambda < \lambda_2 \) then the principal shuts down and both players receive zero.

As the above result shows, one qualitative difference between the firm and the market is that incentives are zero in the former but strictly positive in the latter. In the market, the agent owns the asset so the principal no longer has to offer zero incentives to solve the multi-tasking problem. Indeed, the principal now has to motivate the agent somehow to divert some of his attention away from maintaining his asset. Another qualitative difference between the two institutions is that the agent is no longer indifferent with respect to the allocation of his efforts, so the market does not involve the exercise of allocative authority (except in the most trivial sense) which is a central feature of the firm.

Although incentives play a crucial role in the efficient operation of the market, the work ethic nevertheless still survives in the sense that \( v_M > 0 \), and the viability of the market as an effective institution depends on a sufficiently high degree of internalization \( \lambda \geq \lambda_2 \). These results seem incompatible with Weber’s characterization of the market (see the introduction) but consistent with that of Émile Durkheim (regarded by many as the father of modern sociology):

> economic phenomena cannot be adequately studied in the manner of classical economic theory, as if these were separate from the moral norms and beliefs which govern the life of individuals in society. There is no society (nor could there conceivably be a society) where economic relationships are not subject to customary and legal regulation. That is to say, as Durkheim was later to express the matter in *The Division of Labor*, “a contract is not sufficient unto itself.”

Giddens (1971, p. 69)
In our model, the market would quickly collapse without an effective work ethic because it also suffers from a multi-tasking problem whose specific nature is somewhat different from that in the firm: in the market, the agent faces ownership incentives with respect to asset maintenance but the principal cannot offer comparable incentives and still make a positive expected profit. An effective work ethic is therefore necessary, along with conventional monetary incentives, to motivate a sufficient amount of production effort.

We observe from (26) that incentives are increasing in $\theta$, which represents both the size of the principal’s product market (the vertical intercept of the demand curve) and the marginal product of effort in asset maintenance (the agent’s opportunity cost). Incentives are also decreasing in perceived risk $k$, which reflects the classical risk-reward tradeoff. Furthermore, an increase in $\lambda$ reduces both incentives and the work ethic because the principal can obtain the same level of production effort with less guilt and less risk, both of which require compensation. Finally, an increase in $k$ reduces incentives but increases the work ethic because the latter are strategic substitutes. Indeed, (21) shows that the principal can increase the agent’s production effort by increasing incentives and/or increasing the work ethic.

We now turn to the agent’s choice of $\lambda$ in the market.

**Proposition 4.** The optimal $\lambda$ in the market is

$$\lambda_M = \frac{1}{6} + \frac{1}{k} \geq \lambda_2. \quad (30)$$

It follows that

$$e_M = \frac{\theta(12-k)}{8(6+k)} \quad a_M = \frac{3\theta(4+k)}{8(6+k)} \quad (31)$$

$$\beta_M = \frac{3\theta}{2(6+k)} \quad v_M = \frac{\theta(12+11k)}{8(6+k)}$$

$$U_M = \frac{3k\theta^2}{16(6+k)} \quad \Pi_M = \frac{\theta^2(12-k)}{8(6+k)} - \sigma^2.$$

As was the case for the firm, the agent finds it optimal to internalize the principal’s work ethic $\lambda_M > 0$ and does so to the extent necessary $\lambda_M \geq \lambda_2$ to make the market

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11 I.e., an increase in perceived risk increases the cost of risk in the form of the agent’s risk premium which induces the principal to decrease incentives.

12 This can be verified formally by taking the cross-partial of the principal’s expected profits with respect to $\beta$ and $v$. 

18
viable. This allows the agent to extract material rents $U_M^m > 0$ from the principal, who also profits because incentives alone cannot solve the specific multi-tasking problem that characterizes the market. In our model, “human relations” are a central feature of both the firm and the market, where the parties “look toward the persons of each other” in the sense that the effective work ethic is an equilibrium phenomenon and the product of individual and strategic choices. As a purely technical matter, we note that the inequality in (30) requires $\theta$ to be sufficiently large in the sense of Assumptions 1 (see the proof in the appendix).

2.8 Comparison When Institutions Are Exogenous

In experiments, the institution (e.g., an ultimatum game) is often exogenous and dictated by the experimenter. Institutions are also exogenous in the short run or when inefficient ones are allowed to persist for whatever reason. We therefore first consider the causal effects of institutions on preferences when the level $k$ of perceived risk is the same in the firm and in the market.

**Proposition 5.** Let $k$ be the same for both institutions. (i) $\beta_M > \beta_F = 0$. (ii) $a_M > a_F$: asset maintenance is higher in the market. (iii) $v_F > v_M$ iff $k < 24/5$. (iv) $e_M > e_F$, $\lambda_M > \lambda_F$, $\Pi_M > \Pi_F$, and $U_F^m > U_M^m$ iff $k < 3$.

According to (ii), asset maintenance is higher in the market because the agent owns the asset. Claim (iii), which may be counterintuitive, states that the work ethic can be lower or higher in the market depending on the level of perceived risk. In particular, when $k$ is relatively small in the sense that $k < 24/5$, the principal provides relatively strong incentives in the market because the cost of incentives in terms of risk is low. At the same time, the principal institutes a relatively weak work ethic because incentives and the work ethic are strategic substitutes. As $k \to \infty$, however, incentives generate an increasing amount of risk and the principal increasingly turns to the work ethic, which actually exceeds that in the firm when $24/5 < k$. This is because the market requires

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13 Exceptions include Fehr, Klein, and Schmidt (2007), where principals were free to choose among incentive, bonus, and trust contracts.
relatively strong production motivation because the agent faces ownership incentives with respect to asset maintenance, so as incentives approach zero the effective work ethic must eventually be stronger in the market than in the firm.

According to (iv), production effort and expected profits are higher in the market when $k < 3$ and higher in the firm when $k > 3$. In our model, the inherent advantage of each institution is based on the other institution’s specific multi-tasking problem: the firm cannot offer incentives and the market has to use both incentives and the work ethic to provide “ownership motivation” for production effort to overcome ownership incentives with respect to asset maintenance. When $k < 3$ the cost of incentives is relatively low and the multi-tasking problem is less severe in the market, so production effort and expected profits are higher than in the firm. A similar statement applies when $k > 3$.

Likewise, the degree of internalization is higher and the agent’s material payoff is lower in the market when $k < 3$ and vice-versa when $k > 3$. This is because the work ethic is weak in the market when $k < 3$, which reduces the agent’s guilt and therefore his ability to extract material rents from the principal. The inner self responds by committing to a higher degree of internalization, but the overall effect is to reduce his material payoff. A similar statement applies when $k > 3$. The following table summarizes Proposition 5 with respect to the work ethic and the degree of internalization.

<table>
<thead>
<tr>
<th>Perceived Risk</th>
<th>Work Ethic</th>
<th>Degree of Internalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 \leq k &lt; 3$</td>
<td>$v_M &lt; v_F$</td>
<td>$\lambda_M &gt; \lambda_F$</td>
</tr>
<tr>
<td>$3 &lt; k &lt; 24/5$</td>
<td>$v_M &lt; v_F$</td>
<td>$\lambda_M &lt; \lambda_F$</td>
</tr>
<tr>
<td>$24/5 &lt; k &lt; 12$</td>
<td>$v_M &gt; v_F$</td>
<td>$\lambda_M &lt; \lambda_F$</td>
</tr>
</tbody>
</table>

**Table 1.** A comparison of the work ethic and the degree of internalization when institutions are exogenous.

We define one institution to be *more ethical* than another if both the work ethic and the agent’s degree of internalization are higher in that institution. As the above table indicates, the market is *never* more ethical than the firm but the latter *is* the more ethical institution over the intermediate range $3 < k < 24/5$ of perceived risk. In the more extreme cases where $0 \leq k < 3$ or $24/5 < k < 12$, the ethical ranking is ambiguous.
2.9 Institutional Choice

In the long run, however, one would expect the prevailing institution to be determined by efficiency considerations, including transaction costs. In that case, claims about the effects of institutions on preferences are incomplete at best. As Durkheim expressed it:

One can understand nothing of the rules of morality that govern property, contract, work, etc., if one does not know the economic causes which underlie them; and, conversely, one would arrive at a completely false notion of economic development if one neglected the moral causes which influenced it.

Durkheim quoted in Giddens (1973, p. 69).

Except in borderline cases, there is only one efficient institution for any given level of perceived risk, so the direct comparison of institutions in the previous subsection was a counterfactual one. A comparison between observed institutions will therefore be a comparison of efficient ones.

In the first stage of the game, where the principal and agent bargain over the asset, the selfish inner self is focused on his material payoff $U_{mi}$, while the principal is concerned with her expected profits $\Pi_i$, where $i = F, M$. The efficient institution is therefore the one with the highest expected total payoff $V_i = \Pi_i + U_{mi}$.

**Proposition 6.** (i) $V_M > V_F$ iff $k < 3$. (ii) An efficient market is characterized by stronger incentives, a higher degree of internalization, and a lower work ethic compared with an efficient firm. (iii) The agent’s material payoff is always higher in the inefficient institution.

The first result states that the market is the efficient institution when $k < 3$ because the multi-tasking problem is more severe in the firm, but the latter is efficient when $k > 3$. As in HM91, the existence of firms (to return to the questions with which this paper began) is due to market failures where markets generate excessive risk, but it is precisely the endogenous work ethic which makes the firm a viable alternative and provides the sole source of motivation. Even when the market is efficient, it would quickly collapse without an effective work ethic because of its own specific multi-tasking problem.

Although the ethical ranking of efficient institutions is still ambiguous, (ii) provides an unambiguous ranking with respect to incentives and the work ethic when institutions
are endogenous. Since the solution (19) for the firm is independent of $k$, an efficient market with $k < 3$ always entails higher incentives and a lower work ethic than an efficient firm with $k > 3$. From Table 1 above, we see that this result does not hold for exogenous institutions, since the market entails a higher work ethic when $k$ is sufficiently high (and the market is inefficient).

This is the source of two related insights. First, we should expect to observe markets with strong incentives but a weak work ethic to prevail in environments that are conducive for the provision of incentives (e.g., those with low risk) and for firms with weak incentives but a strong work ethic to supplant them in other environments where incentives are either costly or ineffective. In particular, we expect markets to be used for those transactions where contractual performance is relatively easy to measure (e.g., sales of standardized assets or products), but not for those where “good” performance is difficult to assess or even describe, making the provision of incentives problematic. In that case, firms will arise to handle such transactions because they economize on risk and have a comparative advantage in the development of an effective work ethic. These are aspects of both the scope and functions of firms.

Second, the view that institutions shape preferences must be abandoned when the former are endogenous. Although the prevailing institution is a crucial determinant of the work ethic and its degree of internalization, the institution itself is the product of preferences and other economic fundamentals such as objective risk. Since institutions, incentives, and the work ethic are all inextricably linked, the more accurate characterization is that preferences and other economic fundamentals shape both institutions and future preferences so that each complements the other. In particular, when the agent is sufficiently risk averse (preferences) or objective risk is sufficiently high (an economic fundamental), the firm is the efficient institution because it economizes on risk and has a comparative advantage in the development of an effective work ethic. Likewise, the market is efficient when perceived risk is sufficiently low because it generates strong incentives.

Finally, (iii) suggests that wealth effects may play a significant role in the persistence of inefficient institutions. In HM91, the agent’s expected surplus is always zero because the participation constraint binds, so institutional changes need not entail cash transfers. In
our model, however, both parties can earn material rents at the bargaining stage where the
institution is determined and (iii) shows that the agent’s material payoff is always higher in
the inefficient institution. It follows that all institutional Pareto improvements will require
cash compensation by the principal. In particular, consider an economy where one class
owns all the productive assets. In that case, the economy will be dominated by inefficient
firms when there are insufficient funds (e.g., because of capital market imperfections) to
compensate workers for a move towards a more market-based economy.

3. Conclusion

Why do firms exist? What is their function? And what is the function of markets? In
this paper, we addressed these basic questions in connection with the formation of the
work ethic in both institutions. Our model combined the theory of the firm based on asset
ownership in Holmström and Milgrom (1991) with the formalization of the endogenous
Frank (1987), Kandel and Lazear (1992), Rabin (1993), and Rotemberg (1994), among
others. We focus on the work ethic because personality psychologists have emphasized the
importance of Conscientiousness, the personality trait that incorporates the work ethic,
for both job performance and motivation.

As in Holmström and Milgrom (1991), the firm (or integration) is the institution where
the principal owns the asset and the market (or non-integration) is the one where the agent
does. We showed that the firm in our model is an idealized institution that operates solely
on the basis of authority and the endogenous work ethic rather than explicit monetary
incentives. Although the market is characterized by strictly positive incentives, it too
would collapse without an effective work ethic because of its own specific multi-tasking
problem. When institutions are exogenous, a direct comparison for the same level of
perceived risk revealed that the market is never more ethical than the firm, although the
latter is the more ethical institution for an intermediate level of perceived risk. Otherwise,
the ethical ranking is ambiguous.

In the long run, however, institutions are endogenous and the view that institutions
shape preferences is at best incomplete. In particular, the market with strong incentives
but a weak work ethic is the efficient institution when perceived risk is sufficiently low, whereas the firm with weak incentives but a strong work ethic is efficient otherwise. As in Holmström and Milgrom (1991), the existence of firms is therefore attributed to market failures where the latter generate too much risk. As for function, each institution possesses an inherent advantage determined by the specific multi-tasking problem of the other: the firm cannot offer incentives because the agent will neglect asset maintenance, whereas the market is obligated to provide sufficient motivation or the agent will neglect production. The market therefore has a comparative advantage in the provision of incentives, while the firm has a comparative advantage in the development of an effective work ethic. In short, institutions and preferences develop in complementary fashion.

Appendix

Proof of Proposition 2

From Proposition 1, the agent’s material payoff is (18) if $\lambda \geq \lambda_1$ and zero otherwise because the principal shuts down. The unconstrained maximizer for (18) is $\lambda_F = 1/2$ and

$$\lambda_F - \lambda_1 = \frac{\theta^2 - 8\sigma^2}{2(\theta^2 - 4\sigma^2)} > 0$$

(A.1)

by Assumption 1. The optimal $\lambda$ is therefore $\lambda_F$. ■

Proof of Proposition 3

As before, we focus on the case $\lambda > 0$. We first consider the agent’s problem and note that he never chooses $a > \theta/2$ because it is costly and provides no additional value (1). The agent might, however, choose $e > v$ when $\beta$ is sufficiently large, so we need to consider the following two (overlapping) cases: (i) $e \geq v$ and (ii) $0 \leq e \leq v$. In case (i), the agent’s expected utility is

$$U_{C1} = \alpha + \beta e + \theta a - a^2 - (1/2)t^2 - (1/2)k\beta^2$$

(A.2)

since $g = 0$. The unconstrained maximizers for (A.2) are

$$e = \frac{3\beta - \theta}{2}, \quad a = \frac{\theta - \beta}{2}.$$  

(A.3)
In case (ii), the agent’s expected utility is
\[ U_{C2} = \alpha + \beta e + \theta a - a^2 - (1/2)t^2 - (1/2)\lambda(v - c)^2 - (1/2)k\beta^2. \] (A.4)

with unconstrained maximizers in (21). Given \( \lambda > 0 \), a straightforward application of the usual Kuhn-Tucker method reveals the agent’s optimal efforts on the following regions of \((\beta, v)\) space.

**Region 1**

If \( \beta \leq \theta \) and \( \beta \geq (2v/3) + (\theta/3) \) then the agent’s optimal efforts are given in (A.3). The first condition \( \beta \leq \theta \) ensures \( a \geq 0 \) while the second ensures \( e \geq v \geq 0 \).

**Region 2**

If \( \beta \geq \theta \) and \( \beta \geq v \) then the agent’s optimal efforts are \( e = \beta \) and \( a = 0 \). The corner solution for \( a \) follows from the first condition \( \beta \geq \theta \), while the second implies \( e \geq v \).

**Region 3**

If \( \beta \leq (2v/3) + (\theta/3) \), \( \beta \geq (\theta/3) - v\lambda \), and \( \beta \leq \theta(1 + \lambda) - v\lambda \), then the optimal efforts are given in (21). The first condition implies \( e \leq v \), the second \( e \geq 0 \), and the third \( a \geq 0 \).

**Region 4**

If \( \beta \leq (\theta/3) - v\lambda \) then \( e = 0 \) and \( a = \theta/3 \).

**Region 5**

If \( \beta \leq v \) and \( \beta \geq \theta(1 + \lambda) - v\lambda \) then
\[ e = \frac{\beta + v\lambda}{1 + \lambda} \] (A.5)

and \( a = 0 \).

***

25
We now turn to the principal’s problem. Given our assumptions that $e = 0$ implies zero asset value and $a = 0$ implies zero output, the principal never offers a contract in regions 2, 4, and 5. To investigate region 1, we substitute (A.3) into the principal’s expected profits

$$\Pi_{R1} = \theta e - e^2 + \theta a - a^2 - (1/2)t^2 - (1/2)t; \beta^2 - \sigma^2 \quad (A.6)$$

($g = 0$ on region 1) to obtain

$$\Pi_{R1} = (1/2) \left[ 6\beta \theta - \beta^2 (6 + k) - 2\sigma^2 - \theta^2 \right]. \quad (A.7)$$

The optimal $\beta$ for $\Pi_{R1}$ is

$$\beta = \frac{3\theta}{6 + k}, \quad (A.8)$$

which satisfies the first constraint $0 \leq \beta \leq \theta$ for region 1. The other constraint requires

$$0 \leq v \leq \frac{\theta(3 - k)}{2(6 + k)}. \quad (A.9)$$

Note that if $k > 3$ then contracts in this region cannot be implemented since $v \geq 0$. Substituting (A.8) into (A.7), the principal’s maximum expected profits on region 1 are

$$\Pi_{R1} = \frac{\theta^2(3 - k)}{2(6 + k)} - \sigma^2. \quad (A.10)$$

We now consider region 3, where $e \leq v$ and the principal’s expected profits are

$$\Pi_{R3} = \theta e - e^2 + \theta a - a^2 - (1/2)t^2$$

$$- (1/2)\lambda(v - e)^2 - (1/2)t; \beta^2 - \sigma^2. \quad (A.11)$$

Substituting (21) into (A.11), we obtain a messy negative definite quadratic form in $\beta$ and $v$ which we do not record here. Its unconstrained maximizers are given in (26), which satisfy $\beta < (2v/3) + (\theta/3)$ and $\beta < \theta(1 + \lambda) - v\lambda$, but the other constraint $\beta \geq (\theta/3) - v\lambda$ for region 3 requires

$$\lambda \geq \lambda_3 \equiv \frac{1}{3} - \frac{1}{k}. \quad (A.12)$$

At the solution (26), the principal’s expected profit is given by (28).
A comparison of the principal’s expected profits on regions 1 and 3 reveals that

\[
\Pi_M - \Pi_{R1} = \frac{9k^2 \theta^2 \lambda}{2(6 + k)[6 + k(1 + 6\lambda)]} > 0, \quad (A.13)
\]

so the principal never offers contracts in region 1. Finally,

\[
\Pi_M \geq 0 \iff \lambda \geq \lambda_2. \quad (A.14)
\]

Since

\[
\lambda_2 - \lambda_3 = \frac{2\sigma^2}{\theta^2 - 4\sigma^2} > 0 \quad (A.15)
\]

(see Assumption 1), the principal chooses the contract in (26) if \( \lambda \geq \lambda_2 \) and shuts down otherwise. The rest of the statement follows from straightforward substitutions.  

**Proof of Proposition 4**

The agent’s material payoff is given in (29) when \( \lambda \geq \lambda_2 \) and zero otherwise because the principal shuts down. The expression in (29) is positive for all \( \lambda > 0 \), strictly increasing up to \( \lambda_M \) in (30), and strictly decreasing thereafter. It follows that \( \lambda_M \) is optimal for the agent provided that

\[
\lambda_M - \lambda_2 = \frac{\theta^2(12 - k) - 8\sigma^2(6 + k)}{6k(\theta^2 - 4\sigma^2)} \geq 0, \quad (A.16)
\]

which follows from Assumption 1. The rest of the statement follows from straightforward substitutions.  

**Proof of Propositions 5 and 6**

Straightforward calculations yield

\[
e_M - e_F = \frac{\theta(3 - k)}{4(6 + k)} \quad a_M - a_F = \frac{\theta(3 + k)}{4(6 + k)}
\]

\[
v_F - v_M = \frac{\theta(24 - 5k)}{8(6 + k)} \quad \lambda_M - \lambda_F = \frac{3 - k}{3k} \quad (A.17)
\]

\[
\Pi_M - \Pi_F = \frac{\theta^2(3 - k)}{4(6 + k)} \quad U_F^m - U_M^m = \frac{\theta^2(3 - k)}{8(6 + k)}
\]

and

\[
V_M - V_F = \frac{\theta^2(3 - k)}{8(6 + k)}, \quad (A.18)
\]
which completes the proof.

References


Frank, R.H., 1987. If homo economicus could choose his own utility function, would he want one with a conscience? Amer. Econ. Rev. 77, 593-604.


