The Firm as an Intrinsic Motivation Device[†]

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Abstract

In this paper, we develop a new theory of the firm where the market is primarily an incentive system whereas the firm is an intrinsic motivation device. The firm is more efficient than the market when asset specificity and subjective risk are sufficiently high because it provides balanced incentives, fosters intrinsic motivation, and economizes on risk. An efficient firm is unambiguously the more ethical institution in the sense that the component of production effort due to intrinsic motivation and the agent's rents in exchange for commitment are higher. The exception is when the market approximates the first best.

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> Why do firms exist? What is their function, and what determines their scope? These remain the central questions in the economics of organization.
>
> Holmström and Roberts (1998, p. 73)

1. Introduction

In the theory of the firm, the latter is often characterized as essentially an incentive device. In Alchian and Demsetz (1972), the firm is more efficient than the market at monitoring team production, where "monitoring" is broadly defined (p. 782) to include incentive provision; in Holmström (1982) the firm takes the form of a budget-breaker who provides appropriate incentives; and in Grossman and Hart (1986) and Hart and Moore (1990) the firm provides efficient investment incentives. Although incentives are weak in firms in Holmström and Milgrom (1991, 1994), the firm is still an incentive device which balances competing incentives for diverse inside and outside activities. Indeed, the title of their 1994 paper is "The firm as an incentive system."

In this paper, we develop a new theory of the firm as an *intrinsic motivation device*. In our model, firms exist to motivate transactions where explicit monetary incentives have high transaction costs. Since high-powered incentives cannot be provided, a central function of management is to develop and maintain an effective institutional culture. The other main objective of the paper is understand the roles that incentives and intrinsic motivation serve in both institutions. In our model, these are strategic substitutes and while the market is primarily an incentive system, the firm is an intrinsic motivation device.

Our starting point is the *multi-tasking* theory of the firm in Holmström and Milgrom (1991, section 3) (HM91). We chose this framework because it is standard, analytically tractable, and provides a unified account of both the firm and the market (non-integration or independent contracting). As in Grossman and Hart (1986) and Hart and Moore (1990), the institution is defined by asset ownership: in the firm the principal owns the asset and in the market the agent does. The multi-tasking problem dictates low-powered incentives in firms. To make the firm a viable institution with weak incentives, HM91 assume an exogenous amount of intrinsic motivation in the sense that the agent's least-cost action is positive, so that some effort is supplied even with zero incentives.

In this paper, we complete the HM91 theory of the firm with the theory of endogenous intrinsic motivation in Casadesus-Masanell (2004) (CM04). In CM04, institutional culture is an *equilibrium* phenomenon where the principal establishes the culture and the agent chooses the degree to which he internalizes it.[1] As in Akerlof (1983), Rotemberg (1994), and Tabellini (2008), preferences are therefore *endogenous* and strategically chosen by the agent (or his parents). This literature is also closely related to the economics of identity, especially Akerlof and Kranton (2005). We chose the CM04 theory of intrinsic motivation because it effectively endogenizes the agent's least-cost action and therefore complements the existing framework in HM91. More importantly, multiple case studies including those in Akerlof (1982, 1983), Roberts (2004), and Akerlof and Kranton (2005, 2008), emphasize the equilibrium aspect of institutional culture in that both active management and employee buy-in (or internalization) are crucial.

In our model, the firm has two main distinguishing characteristics. First, the multi-tasking problem implies zero (but balanced) incentives, so the firm operates solely on the basis of endogenous intrinsic motivation. Second, the lack of incentives makes the agent indifferent between production and asset maintenance and necessitates a *relational* contract as in Coase (1937) or the exercise of allocative *authority* as in Simon (1951). This characterization of the firm mirrors that in HM91, except that now the viability of the firm is a result rather than an assumption of the model.

We then move beyond HM91 and show that the market is characterized by its own multi-tasking problem which differs from that in the firm. Although HM91 introduce intrinsic motivation for the express purpose of making the firm viable with zero incentives, the multi-tasking problem in the market implies that it too cannot survive without it when the level of *subjective* risk (objective risk scaled by the agent's degree of risk aversion) is sufficiently high. Furthermore, the firm is more efficient than the market when subjective risk is sufficiently high (as in HM91) AND the asset is sufficiently *specific*.[2] The latter condition is new because HM91 do not consider participation constraints.

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[1] CM04 analyzes the three separate cases of altruism, ethical standards, and norms, but in this paper we only consider the second.

[2] A *specific* asset is one whose value in its next best alternative use is essentially zero. See Holmström and Roberts (1998) for further discussion and examples.

Having characterized each institution, we then turn to the second main objective of the paper, which is to understand the role that intrinsic motivation serves in each. This is an age-old question addressed by Smith, Marx, Durkheim, Weber, and many others. In the classical literature, the market is often depicted as an essentially "cold" institution dominated by the autonomous price mechanism.

> 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.
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> Max Weber, *Economy and Society* (1978, p. 636).

In his survey on endogenous preferences, Bowles (1998) presents 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)

Recent experimental evidence is consistent with that view, in the sense that subjects tend to behave in a self-interested manner in market and auction-type settings but exhibit other-regarding preferences 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 potential explanation is that preferences and institutions are independent, but that certain institutions restrict the kind of preferences which can be observed; see Fehr and Schmidt (1999), Bolton and Ockenfels (2000), Falk and Fischbacher (2006), Dufwenberg, Heidhues, Kirchsteiger, Riedel, and Sobel (2008), and Sobel (2008). In perfectly competitive markets, agents with other-regarding preferences will nevertheless appear purely self-interested because they cannot influence the market price or trade volume. As summarized in the title of Sobel (2008), "Markets Make People Appear Selfish."

In this paper, we develop the complementary view in Bowles (1998) that institutions and preferences are not independent and that the former can influence the latter. We also

supplement that view with the recognition that institutions are endogenous in the long run. In that case, a comparison of *observed* institutions will be between *efficient* ones and we contrast the equilibrium level of intrinsic motivation in an efficient firm versus an efficient market. A seminal insight of CM04 is that institutional culture is an equilibrium phenomenon supported by material rewards for those who internalize it. In our model, an efficient firm is *more ethical* than an efficient market in the sense that the principal's *expenditure* on intrinsic motivation is higher in the former. Furthermore, the component of production effort attributable to intrinsic motivation (controlling for incentives) is greater in an efficient firm except when subjective risk is relatively low. The market is therefore primarily (but not exclusively) an incentive system while the firm is an intrinsic motivation device.

Tabellini (2008) considers similar issues within a version of the prisoner's dilemma where players have an endogenous preference for cooperation chosen partly by their parents. There can exist two steady-states (see his proposition 9) — one with a strong endogenous enforcement mechanism (the probability of detecting and punishing defectors) and where the majority of players have a strong preference for cooperation, and another steady-state with the opposite properties. Unlike this paper, incentives and intrinsic motivation are therefore strategic complements.

The closest paper to ours is Rotemberg (2006), who considers the formation of altruism in firms and markets. In his paper, firms have an inherent advantage over markets because monitoring can also lead 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 model of the firm (the sole exogenous institution) with a continuum of risk neutral agents. 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 form of intrinsic motivation is similar to that in CM04, except that the degree of internalization is increasing in past cooperation (a form of reciprocity). An increase in incentives increases individual effort at the expense

of cooperative effort in the current period and therefore reduces cooperation in the future. There are two potential steady-states: a "good" equilibrium with low incentives, high cooperation, and high profits, and a "bad" equilibrium. As in our model, incentives and intrinsic motivation are therefore substitutes.

The plan for the rest of the paper is as follows. We present the model in section 2, characterize the firm in section 3, and the market in section 4. In section 5, we compare the effects of intrinsic motivation in both institutions when the latter are exogenous and then endogenous. Section 6 concludes. All proofs are in the appendix.

2. The Model

The agent performs two tasks, production and asset maintenance a (i.e., investment). The final value of the asset is $f(a) = \theta a - a^2$, where θ is a positive constant.[3] As in HM91 (p. 36), the latter is non-contractible (incentives cannot be provided) because asset values are difficult to measure and verify for enforcement purposes. The principal observes a verifiable signal $y = e + \epsilon_y$ of production effort e, where ϵ_y is a normally distributed random variable with mean zero and variance σ^2. Since y is observable and verifiable it is contractible.

In HM91, it is assumed that zero asset maintenance is suboptimal. In this paper, we capture this with a simple stochastic Leontief production function

$$q = \min\{e, a\} + \epsilon_q, \tag{1}$$

where q is output and ϵ_q is a productivity shock with mean zero and variance σ^2.[4] Note that $a = 0$ implies zero expected output, which will be the source of the multi-tasking problem in the firm. We assume q is non-contractible and both variances are equal to minimize the number of parameters. The principal is a monopolist or Cournot oligopolist in the output market with linear demand $p = \theta - q$, so revenue and expected revenue are $\theta q - q^2$ and

$$\theta \min\{e, a\} - \min\{e, a\}^2 - \sigma^2, \tag{2}$$

[3] Note that asset value f is decreasing in asset maintenance for all $a \geq \theta/2$. We could assume $f(a) = \theta^2/4$ for all $a \geq \theta/2$ without substantially affecting the results because the agent never chooses a in that region.

[4] We need not make any specific distributional assumptions about ϵ_q because the principal's payoff function is quadratic and therefore all that matters is its mean and variance.

respectively. We deliberately assume θ is the same in both tasks so we can address the issue of "balanced" incentives.

Institutional culture is determined as in CM04 (section 4). The principal chooses the *work ethic* v to maximize her expected profits, while the agent chooses his *commitment* λ or *degree of internalization* to maximize his economic or material payoff. An agent who truly internalizes the principal's work ethic in the sense that $\lambda > 0$ experiences *guilt* $G = (1/2)\lambda g(v, e, a)$ when his efforts fall short of the ethical standard v.[5] Note that the agent is free to choose $\lambda = 0$, in which case he completely ignores the standard. The exact nature of the work ethic, the guilt function g, and the manner in which λ is chosen depend on institutional specifics and are discussed more fully below.

The agent's utility function is negative exponential

$$-\exp\left\{-r\left[I - C(t) - G\right]\right\}, \tag{3}$$

where r is the agent's *coefficient of absolute risk aversion*, I his income, $t = e + a$ total effort, and $C(t) = (1/2)t^2$ the cost of total effort. The principal's outside option is zero, while the agent's $\overline{u}$ depends on asset ownership. Except for Proposition 9 below, we make the following assumption throughout the paper.

Assumption 1. $\theta^2 > 16\left(\overline{u} + \sigma^2\right)$.

The Firm

As in Grossman and Hart (1986), Hart and Moore (1990), and HM91, the *firm* is defined as the institution where the principal owns the asset and receives its final value. We assume the principal offers a linear contract $I = \alpha + \beta y$ in the signal y, where α is the fixed component and β the piece rate.[6] The principal therefore chooses the contract (α, β) and the work ethic v, while the agent chooses his degree λ of internalization and experiences

[5] As Rotemberg (1994) and CM04 emphasize, *guilt* relates to variables only the agent can observe (e.g., efforts subject to moral hazard), whereas *shame* refers to those others can observe.

[6] Given λ and v, linear contracts are optimal in the sense of Holmström and Milgrom (1987), since we can re-interpret $C + G$ as the agent's cost function.

guilt $G_F = (1/2)\lambda(v-t)^2$ when his total effort t falls short of the standard.[7] Since the agent does not own any assets, his outside option $\overline{u}$ is zero if he rejects the principal's contract.

The Market

The *market* is defined as the institution where the agent owns the asset. As in the firm, the principal offers a contract (α, β) and establishes the work ethic v, but now the agent owns the asset, receives its final value $f(a)$, and experiences no guilt with respect to its maintenance. Instead, his guilt $G_M = (1/2)\lambda(v-e)^2$ is based solely on his production effort on behalf of the principal, which is the only task subject to moral hazard.

Since the agent owns the asset, his outside option $\overline{u}$ depends on how valuable it is outside the relationship. If the asset is *specific* then $\overline{u} = 0$. At the opposite extreme, the agent receives the full value of independent investment

$$\overline{u} = \arg\max_{a \geq 0} f(a) - C(a) = \theta^2/6 > 0. \tag{4}$$

In general, $0 \leq \overline{u} \leq \theta^2/6$ and the exact value of $\overline{u}$ depends on the degree of asset specificity. Note that Assumption 1 restricts $\overline{u}$ and rules out (4).

Timing of the Game

The timing of the game is as follows. (1) The principal and agent allocate asset ownership through Coasian bargaining (i.e., they choose the efficient institution). (2) The agent chooses his degree λ of internalization to maximize his material payoff. (3) The principal decides whether or not to offer a contract and, if so, what the contract (α, β) and work ethic v should be. (4) The agent decides whether or not to accept the contract and, if so, how much effort to devote to each task. (5) If necessary, the principal chooses the agent's efforts from the set where the agent is indifferent.

[7] The agent therefore experiences guilt when $t > v$, which may seem unnatural. It can be shown, however, that the alternative assumption $G_F = 0$ for all $t \geq v$ produces essentially the same results. Like Akerlof (1982, Example 2) and CM04, we do not consider *pride* in the sense of increased utility when $t > v$. Note that v in our model corresponds to the norm e_n in Akerlof (1982) and not the minimum standards $e^+_{\min}$ and $e^-_{\min}$. 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.

Discussion

We now discuss the CM04 framework in more detail. The uninterested reader can skip directly to the next section.

In our view, the most attractive feature of the CM04 model is that institutional culture is an equilibrium phenomenon based on rational self-interest. As the case studies in Akerlof (1982, 1983), Roberts (2004), and Akerlof and Kranton (2005, 2008) show, institutions such as Lincoln Electric, the military, and Nokia expend considerable resources developing and maintaining an effective culture. Such investments would be worthless, however, without sufficient employee "buy-in" and the CM04 model captures both sides of this exchange through the strategic variables λ (chosen by the agent) and v (chosen by the principal). To be precise, CM04 assumes (i) the agent chooses λ to maximize his material payoff, (ii) he can subsequently commit to that choice, and (iii) he can credibly signal the value of λ to the principal. We now discuss each assumption in turn.

We first distinguish between the agent's *total* and *material* (or *economic*) payoffs. The latter is the agent's expected payoff in standard principal-agent models, which includes cash transfers, the disutility of effort, and the risk premium. The former is the agent's material payoff plus the component related to intrinsic motivation or social preferences (e.g., guilt). According to (i), the agent chooses λ to maximize his material rather than overall payoff. 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.
>
> Rotemberg (1994, p. 690)

In our model, the selfish inner self bargains with the principal over asset ownership in the first stage of the game and chooses λ to maximize his material payoff in each institution in the second stage. The outer self then takes λ as given in deciding whether or not to accept the contract and, if so, how much effort to supply in each task.

As CM04 notes, this conception of the self is common in psychology, sociology, and other disciplines. In economics, similar ideas have been used by Smith in *The Theory of Moral Sentiments* (the "impartial spectator"), 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.

In our model, it does not matter who chooses λ (the agent or his parents), as long as it is chosen to maximize the agent's material payoff. The conception of character as an object of individual choice is also central in *virtue ethics* in moral philosophy [for an elementary introduction, see Driver (2007)].

An important insight of CM04 is that altruism, ethical standards, and norms 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 λ and credibly signal this to the principal, the latter will have to increase the fixed component α of the contract to satisfy 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 Rotemberg (1994) notes, 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, Rotemberg (1994) cites body language and gifts in the context of altruism, Frank (1987, Section III) lists several 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.

Like CM04, in this paper we assume that only the "genuinely honest" can credibly signal such honesty and, for simplicity, omit the costs of such signaling.

Our focus on the work ethic is warranted by evidence from the *Five Factor Model* in personality 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 subsumed under Conscientiousness, which is often assessed using the statement "I shirk my duties." 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 that Conscientiousness is the most important. Agreeableness [which includes altruism as in CM04 and Rotemberg (2006)] is also crucial for occupations like customer service involving substantial social interaction (e.g., Rotemberg 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* (e.g., choice of effort).

3. The Firm

In the firm, the agent's utility is

$$-\exp\left\{-r\left[I-C-G_F\right]\right\} \tag{5}$$

with certainty equivalent [see Bolton and Dewatripont (2005, Chapter 4)]

$$U_F = \alpha + \beta e - (1/2)t^2 - G_F - RP, \tag{6}$$

where the first two terms are the agent's expected income and the last is the risk premium $RP = (1/2)k\beta^2$. This represents the cost of risk imposed by incentives, where $k = r\sigma^2$ is the level of subjective risk. We assume $\lambda \geq 0$ without loss of generality.[8]

The agent chooses his efforts to maximize (6) subject to $e \geq 0$ and $a \geq 0$. If $\beta > 0$ the solution is $a = 0$ and

$$e = \frac{\beta + \lambda v}{1+\lambda} \tag{7}$$

and the agent focuses exclusively on production. In that case, expected output is zero and the principal prefers to shut down. If $\beta = 0$ the agent is indifferent between the two tasks and

$$t = \frac{\lambda v}{1+\lambda}. \tag{8}$$

Although incentives are zero, the agent supplies non-zero total effort when $v > 0$ and $\lambda > 0$ because he has internalized the principal's work ethic. Note that t in (8) is increasing in both the work ethic v and the degree λ of internalization.

To make the firm viable with zero incentives, HM91 (p. 33-4) assume $C(t)$ is U-shaped with minimum at $\bar{t}$. The agent therefore provides total effort $\bar{t}$ when incentives are zero. The latter corresponds to t in (8), which minimizes the U-shaped expression $(1/2)t^2 + G_F$. The difference is that $\bar{t}$ is exogenous in HM91 and assumed to be equal in both institutions, whereas in our model we use CM04 to make it endogenous.

[8] Consider the second stage of the game when the institution is the firm and the agent chooses λ to maximize his material payoff G_F in (10). In what follows, we show that there exists a $\lambda_F > 0$ such that $G_F > 0$ in that subgame (in fact, this holds for the subgame perfect outcome). Since $G_F \leq 0$ in those subgames where $\lambda < 0$, we focus on the case where $\lambda \geq 0$.

When the principal operates, the lump sum α is chosen to make the participation constraint $U_F \geq 0$ bind, so the agent (we assume) always accepts the contract. This requires

$$\alpha = \frac{v^2\lambda}{2(1+\lambda)}, \tag{9}$$

which is increasing in v and λ. As in CM04, the agent therefore extracts rents from the principal which are increasing in his degree of internalization. As we will see, these rents are the source of potential employee buy-in and also explain why the principal sets a finite (rather than infinite) work ethic. The agent's *material* payoff is his certainty equivalent in (6) excluding guilt. Since the participation constraint binds,

$$\alpha - (1/2)t^2 = G_F \tag{10}$$

and the agent's material payoff is equivalent to his guilt.

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

$$\theta q - q^2 + f(a) - I \tag{11}$$

and expected profits

$$\theta \min\{e,a\} - \min\{e,a\}^2 + f(a) - \alpha - \beta e - \sigma^2 \tag{12}$$

[see (2)]. Note that participation in the output market imposes risk σ^2 on the principal, who will have to be compensated or she will shut down. Substituting the agent's participation constraint and $\beta = 0$,

$$\Pi_F = \theta \min\{e,a\} - \min\{e,a\}^2 + f(a) - (1/2)t^2 - G_F - \sigma^2. \tag{13}$$

The principal chooses $e \geq 0$, $a \geq 0$, and $v \geq 0$ to maximize (13) subject to $e + a \leq t$ and (8). Let

$$\lambda_{F0} = \frac{2\sigma^2}{\theta^2 - 4\sigma^2} > 0, \tag{14}$$

where the denominator is positive by Assumption 1.

Proposition 1. *If $\lambda \geq \lambda_{F0}$ the principal offers a unique contract (α_F, β_F) and work ethic v_F with zero incentives $\beta_F = 0$ and*

$$v_F = \frac{\theta(1+\lambda)}{1+2\lambda}. \tag{15}$$

The agent provides total effort

$$t_F = \frac{\theta\lambda}{1+2\lambda}, \tag{16}$$

which the principal divides equally between the two tasks. The principal's expected profit is given by

$$\Pi_F = \frac{\theta^2\lambda}{2(1+2\lambda)} - \sigma^2 \tag{17}$$

and the agent's material payoff by

$$G_F = \frac{\theta^2\lambda}{2(1+2\lambda)^2}. \tag{18}$$

If $0 \leq \lambda < \lambda_{F0}$ the principal shuts down and both parties receive zero.

Since incentives are necessarily zero because of the multi-tasking problem, the work ethic is the sole potential source of motivation in the firm. The principal's expected profit in (17) is increasing in the degree λ of internalization and $\Pi_F = 0$ at $\lambda = \lambda_{F0}$. The principal therefore operates when the agent's commitment is sufficiently great $\lambda \geq \lambda_{F0}$ and shuts down otherwise because total effort in (16) is insufficient to cover the principal's operating risk σ^2. The optimal work ethic v_F in (15) reflects a tradeoff between higher total effort in (8) versus a higher lump-sum payment α in (9). It is increasing in θ but decreasing in λ because a greater degree of commitment allows the principal to achieve the same total effort t in (8) with a lower v and therefore a lower α. With zero incentives, the agent is indifferent between the two tasks and the principal allocates his total effort in (16) between them. This allocative role of the principal is similar to the *relational* contract described in Coase (1937, p. 391) and the exercise of *authority* in Simon (1951, p. 294). Given that production is stochastic Leontief and θ is the same for both tasks, the principal divides (16) evenly between them.

In the second stage of the game the agent chooses λ to maximize his material payoff G_F.

Proposition 2. *Under Assumption 1, the agent chooses* $\lambda = \lambda_F = 1/2 > \lambda_{F0} > 0$ *so the principal operates. Furthermore,*

$$\begin{aligned} e_F &= \theta/8 & a_F &= \theta/8 \\ \beta_F &= 0 & v_F &= 3\theta/4 \\ G_F &= \theta^2/16 & \Pi_F &= (\theta^2/8) - \sigma^2 > 0. \end{aligned} \tag{19}$$

The agent's optimal λ balances the tradeoff evident in (10), between greater rent extraction α and the costs of higher total effort t. In equilibrium, the agent internalizes the principal's work ethic $\lambda_F > 0$ and internalizes it sufficiently $\lambda_F > \lambda_{F0}$ to enable the principal to operate and make positive expected profit. Note that the solution to the first best problem

$$\max_{e \geq 0, a \geq 0} \theta \min\{e, a\} - \min\{e, a\}^2 + f(a) - (1/2)t^2 \tag{20}$$

is $e^* = a^* = \theta/4$. In comparison, the second best efforts in the firm are equal but less than first best. In that sense the firm provides "balanced" incentives, whereas we will show that incentives are "unbalanced" in the market. If $\lambda = \infty$ the principal can achieve the first best by setting $\beta = 0$ and $v = \theta/2$, so the agent chooses $t^* = \theta/2$ to avoid infinite guilt. The degree of internalization is therefore less than complete in the sense that $\lambda_F < \infty$. At the optimum, $t_F < v_F$ and the agent indeed collects rents $G_F > 0$. The principal also benefits from the exchange, since the multi-tasking problem precludes the use of incentives. Note that Assumption 1 implies positive expected profit in (19).

In our model, the firm is a stylized institution which operates solely on the basis of authority/relational contracts and intrinsic motivation as opposed to explicit monetary incentives. In comparison, HM91 obtain a similar characterization of the firm under the additional assumption that the least-cost total effort for the agent is non-zero. Without this assumption, the firm is not viable because the multi-tasking problem implies zero incentives. In this paper, we use the CM04 framework to make the least-cost total effort endogenous and to establish the viability of the firm as an *equilibrium* phenomenon. Our model therefore highlights and formalizes one of the central roles of management — the development and maintenance of institutional culture.

4. The Market

In the market, the agent owns the asset and only experiences guilt in production on behalf of the principal. The agent's utility is

$$-\exp\{-r[I + f(a) - C - G_M]\} \tag{21}$$

with certainty equivalent

$$U_M = \alpha + \beta e + f(a) - (1/2)t^2 - G_M - (1/2)k\beta^2. \tag{22}$$

Proposition 3. *In the market, the agent's optimal efforts are given by*

(Region 1) $e = 0$ *and* $a = \theta/3$ *when*

$$\beta \leq (\theta/3) - \lambda v. \tag{23}$$

(Region 2) e *equals (7) and* $a = 0$ *when*

$$\beta \geq \theta(1 + \lambda) - \lambda v. \tag{24}$$

(Region 3)

$$e = \frac{3(\beta + \lambda v) - \theta}{2 + 3\lambda} \qquad a = \frac{\theta(1 + \lambda) - (\beta + \lambda v)}{2 + 3\lambda} \tag{25}$$

otherwise.

The agent devotes all of his attention to asset maintenance when incentives β are sufficiently low (23), to production when incentives are sufficiently high (24), and engages in both activities when incentives are medium (25). Since $e = 0$ and $a = 0$ imply zero expected output, an operating principal chooses (β, v) in region 3. In that case, an increase in θ raises the return on asset maintenance, which therefore increases at the expense of production effort. An increase in production incentives β and/or the work ethic v has the opposite effect. Although the effect of λ is ambiguous, in equilibrium an increase in λ increases production effort and reduces asset maintenance [see Proposition 4 below].

The principal's profits are $\theta q - q^2 - I$ and expected profits

$$\theta \min\{e, a\} - \min\{e, a\}^2 - \alpha - \beta e - \sigma^2. \tag{26}$$

In the market, the agent's outside option is $\overline{u}$, where $0 \leq \overline{u} \leq \theta^2/6$ depending on asset specificity. Substituting the participation constraint $U_M = \overline{u}$,

$$\Pi_M = \theta \min\{e, a\} - \min\{e, a\}^2 + f(a) - (1/2)t^2 - G_M - (1/2)k\beta^2 - \overline{u} - \sigma^2. \tag{27}$$

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

$$G_M + \overline{u} = \alpha + \beta e + f(a) - (1/2)t^2 - (1/2)k\beta^2. \tag{28}$$

Let

$$\lambda_{M0} = \frac{2(6+k)(\overline{u}+\sigma^2) - \theta^2(3-k)}{3k[\theta^2 - 4(\overline{u}+\sigma^2)]}. \tag{29}$$

Proposition 4. *If $\lambda \geq \lambda_{M0}$ the principal offers the unique contract and work ethic*

$$\beta_M = \frac{3\theta}{6+k(1+6\lambda)} \qquad v_M = \frac{\theta\,[3+k(5+3\lambda)]}{2\,[6+k(1+6\lambda)]} \tag{30}$$

and the agent's optimal efforts are

$$e_M = \frac{\theta\,[3+k(3\lambda-1)]}{2\,[6+k(1+6\lambda)]} \qquad a_M = \frac{\theta\,[3+k(3\lambda+1)]}{2\,[6+k(1+6\lambda)]}. \tag{31}$$

The principal's expected profits are

$$\Pi_M = \frac{\theta^2\,[3+k(3\lambda-1)]}{2\,[6+k(1+6\lambda)]} - \overline{u} - \sigma^2 \tag{32}$$

and the agent's material payoff is

$$\overline{u} + G_M = \frac{9k^2\theta^2\lambda}{2\,[6+k(1+6\lambda)]^2} + \overline{u}. \tag{33}$$

If $0 \leq \lambda < \lambda_{M0}$ the principal shuts down.

Proposition 4 reveals some qualitative differences between the firm and the market. First, in the market the agent owns the asset and will therefore maintain it when production incentives are positive as long as β is not too high as in (24). Since the multi-tasking problem in the firm no longer applies, incentives are zero in the firm but positive in the market. Another qualitative difference is that the agent is no longer indifferent between the two tasks, so the market does not involve allocative authority or relational contracts

(except in the most trivial sense) which is a central feature of the firm. Finally, the market provides "unbalanced" incentives when $k > 0$ in the sense that asset maintenance exceeds production effort in (31) whereas the first best requires them to be the same.

Since incentives in (30) are decreasing in subjective risk k, the classical risk-reward tradeoff continues to hold in this model. This is because an increase in subjective risk increases the agent's risk premium and therefore the cost of incentives. An increase in commitment λ reduces both incentives and the work ethic because the principal can achieve the same level of production effort with less risk and less guilt, both of which require compensation. An increase in k reduces incentives but increases the work ethic in (30) because the latter are strategic substitutes [see (A.16) in the proof]. Indeed, (25) shows the principal can increase production effort by increasing incentives and/or the work ethic.

The principal operates when $\lambda \geq \lambda_{M0}$ and shuts down otherwise, so λ_{M0} is the minimum necessary level of commitment in the market. Since λ_{M0} is increasing in the agent's outside option $\overline{u}$, the market requires more commitment when the asset is less specific to generate enough expected profit to cover an increasingly stringent participation constraint. The necessary minimum λ_{M0} is also increasing in the agent's degree r of risk aversion and σ^2 (the last result requires Assumption 1), which increase the cost of incentives and/or the principal's risk associated with the output market.

In the classical literature (e.g., Weber), the market is often depicted as an essentially "cold" institution. In contrast, the eminent sociologist Émile Durkheim argued that pure contractual relations cannot exist or be studied separately from moral considerations:

> 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 picture is less clear. If

$$r \leq r_0 \equiv \frac{3(\theta^2 - 4\sigma^2)}{\sigma^2(\theta^2 + 2\sigma^2)} \tag{34}$$

then $\lambda_{M0} \leq 0$ and the market can operate without any intrinsic motivation. On the other hand, "a contract is not sufficient unto itself" when (34) does not hold and $\lambda_{M0} > 0$. In

that case, the market is not a viable institution without a sufficient degree of commitment. This is because the market is characterized by its own multi-tasking problem which is different from that in the firm — in the market, the agent faces ownership incentives with respect to asset maintenance but the principal cannot provide such incentives for production and still make a positive expected profit. An effective work ethic is therefore necessary to motivate a sufficient amount of production effort.

We now turn to the agent's optimal choice of λ in the market. Let

$$r_M \equiv \frac{12[\theta^2 - 4(\overline{u} + \sigma^2)]}{\sigma^2[\theta^2 + 8(\overline{u} + \sigma^2)]}. \tag{35}$$

Proposition 5. *(i) If $r \leq r_M$ the agent's optimal λ is $\lambda_M = (1/6) + (1/k)$ and*

$$\begin{aligned} e_M &= \tfrac{\theta(12-k)}{8(6+k)} \qquad a_M = \tfrac{3\theta(4+k)}{8(6+k)} \qquad \beta_M = \tfrac{3\theta}{2(6+k)} \\ v_M &= \tfrac{\theta(12+11k)}{8(6+k)} \quad G_M = \tfrac{3k\theta^2}{16(6+k)} \quad \Pi_M = \tfrac{\theta^2(12-k)}{8(6+k)} - \overline{u} - \sigma^2. \end{aligned} \tag{36}$$

(ii) If $r > r_M$ the optimal λ is $\lambda_{M0} > 0$ and

$$\begin{aligned} e_{Mc} &= \tfrac{\overline{u}+\sigma^2}{\theta} \qquad a_{Mc} = \tfrac{\theta^2-\overline{u}-\sigma^2}{3\theta} \qquad \beta_{Mc} = \tfrac{\theta^2-4\left(\overline{u}+\sigma^2\right)}{\theta k} \\ v_{Mc} &= \tfrac{\theta^2-3\left(\overline{u}+\sigma^2\right)}{\theta} \quad G_{Mc} = \tfrac{\lambda_{M0}\left[\theta^2-4\left(\overline{u}+\sigma^2\right)\right]^2}{2\theta^2} \qquad \Pi_{Mc} = 0. \end{aligned} \tag{37}$$

(iii) As $k \to 0$ the market converges to the first best.

The agent's material payoff is (33) when the principal operates and $\overline{u}$ otherwise. If $r \leq r_M$ then r and/or σ^2 are relatively low and so is the required level of commitment $\lambda_{M0} \leq \lambda_M$. Since λ_M is the unconstrained maximizer for (33), the agent chooses the latter. In contrast, $\lambda_M < \lambda_{M0}$ when $r > r_M$ so the principal shuts down when $\lambda = \lambda_M$. In that case, the agent chooses λ_{M0} and gives up some rents so the principal can operate. In either case, the agent internalizes the principal's work ethic $\lambda > 0$ and does so to the extent necessary $\lambda \geq \lambda_{M0}$ to make the market viable. Since $G_M > 0$ and $G_{Mc} > 0$, the agent extracts rents from the principal, who also benefits from the exchange because incentives alone cannot solve the market's multi-tasking problem. As $k \to 0$ the market approaches the first best, whereas the firm can never do so.

In HM91, an exogenous amount of intrinsic motivation is assumed to make the firm viable with zero incentives. In this paper, we have shown that this assumption is also

necessary for the market, which is not viable without intrinsic motivation when $r > r_0$. The combination of HM91 and CM04 makes the viability of both institutions endogenous and a result, rather than an assumption, of the theory. We have also shown that the assumption that the level of intrinsic motivation is the same in both institutions is artificial and restrictive since the ethical variables λ and v clearly differ across institutions. We now turn to a detailed examination of those differences.

5. Ethical Comparisons

We consider three different definitions of what it means for one institution to be *more ethical* than another.

Definition 1. *One institution is more ethical than another if (ME1) v and λ are higher in that institution. (ME2) Production effort evaluated at zero incentives and the equilibrium v and λ are higher in that institution. (ME3) Guilt is higher in that institution.*

According to ME1, one institution is more ethical than another if both ethical variables are higher in that institution. Although an obvious definition to make, in our view what is important is not so much the relative magnitudes of the ethical variables but rather their effects, which is the focus of ME2 and ME3. The second definition compares equilibrium production effort in the firm (19) with production effort in the market (25) evaluated at $\beta = 0$ and (λ_M, v_M) in (36) or (λ_{Mc}, v_{Mc}) in (37) as the case may be. This compares the *instrumental* efficacy of the ethical variables in terms of production effort in each institution after controlling for positive incentives in the market. According to ME3, one institution is more ethical than another if equilibrium guilt (the effect of the ethical variables in terms of *rent extraction*) is higher in that institution.

Direct Comparison When Institutions Are Exogenous

In experiments, the institution (e.g., the extensive form of an ultimatum game) is often exogenous and dictated by the experimenter.[9] Institutions are also exogenous in the short

[9] Exceptions include Fehr, Klein, and Schmidt (2007), where principals were free to choose among incentive, bonus, and trust contracts.

run or when inefficient institutions are buttressed (e.g., for political purposes) or allowed to persist for whatever reason.

We first compare the ethical variables (λ, v) across institutions when θ, r, and σ^2 are the same in each. Let $r_e = 3/(5\sigma^2)$, $r_F = 3/\sigma^2$, and $r_v = 24/(5\sigma^2)$.

Proposition 6. *Assume θ, r, and σ^2 are the same in both institutions. (i) $\lambda_M > \lambda_F$ when $r < r_F$, $\lambda_F > \lambda_M$ when $r_F < r < r_M$, and $\lambda_F > \lambda_{M0}$ when $r > r_M$. (ii) $v_F > v_M$ when $r < r_v$, $v_M > v_F$ when $r_v < r < r_M$, and $v_{Mc} > v_F$ when $r > r_M$.*

Figure 1 below summarizes.

Figure 1 Goes Here

Since incentives and the work ethic are strategic substitutes for the principal (see the second paragraph following Proposition 4 above), a decrease in subjective risk k increases the former and reduces the latter. As the work ethic v_M declines, the agent increases his commitment λ_M to shore up his declining rents G_M. When k is sufficiently small in the sense that $k < 3$ or $r < r_F$, the work ethic v_M in the market falls below that v_F in the firm and λ_M exceeds λ_F. In fact, $\lambda_M \to \infty$ as $k \to 0$. The opposite results obtain when k is sufficiently large.

We now compare the firm and the market on the basis of the three ethical criteria in Definition 1.

Proposition 7. *Assume θ, r, and σ^2 are the same in both institutions. (i) The firm is ME1 than the market when $r_F < r < r_v$. Otherwise, the ME1 ranking is ambiguous. (ii) The firm is ME2 when $r > r_e$ and the market ME2 when $r < r_e$. (iii) The firm is ME3 when $r < r_F$ and the market ME3 when $r > r_F$.*

The first result is immediate from Proposition 6 and Figure 1. The second follows because the market converges to the first best as $k \to 0$ and in the limit production effort is completely determined by the work ethic. To see this, note that $k \to 0$ implies $\lambda_M \to \infty$ in Proposition 5 and $e \to v$ as $\lambda \to \infty$ in (25). At $k = 0$, the ethical component of production effort is therefore maximized [see (A.26) in the appendix], so the market is ME2 than the firm when k is sufficiently small. From (36), guilt $G_M \to 0$ as $k \to 0$ and the work ethic

declines in favor of stronger incentives. As a result, the firm is ME3 than the market when k is sufficiently small.

The results are therefore ambiguous and contradictory when institutions are exogenous because the firm is ME2 when k is sufficiently large but ME3 when k is sufficiently small. We now show that a much sharper characterization emerges when institutions are allowed to be endogenous.

Endogenous Institutions

In the long run, the efficient institution should prevail because it generates more expected surplus to divide between the parties. A comparison between observed institutions will therefore be a comparison between *efficient* ones. Since generically there is only one efficient institution for each (θ, r, σ^2) combination, the previous results for the exogenous case involved comparisons between efficient and inefficient institutions.

In the first stage of the game when the institution is chosen, the selfish inner self's material payoff is $\overline{u}_i + G_i$ and the principal's expected profit is Π_i, where $i = F, M, Mc$ and $\overline{u}_i = \overline{u}$ for $i = M, Mc$ and $\overline{u}_i = 0$ for $i = F$. The efficient institution has the highest expected total payoff $V_i = \Pi_i + \overline{u}_i + G_i$.

Proposition 8. *Assume θ is the same in both institutions. (i) $V_M > V_F$ when $r < r_F$, $V_F > V_M$ when $r_F < r < r_M$, and $V_F > V_{Mc}$ when $r > r_M$. (ii) An efficient market has a higher degree of internalization $\lambda_M > \lambda_F$ and a lower work ethic $v_M < v_F$ than an efficient firm. (iii) An efficient market is ME2 when $r < r_e$ and an efficient firm is ME2 when $r > r_e$. (iv) An efficient firm is always ME3 than an efficient market.*

The first result extends HM91 to the case of endogenous intrinsic motivation and participation constraints. On the one hand, the firm's multi-tasking problem precludes the use of incentives and ensures that it can never be first best. On the other hand, the firm provides balanced incentives with zero risk, whereas the market's multi-tasking problem ensures the opposite. Since the market converges to the first best as $k \to 0$, the market is efficient when k is sufficiently small in the sense that $r < r_F$ or $k < 3$. The firm is efficient when $r > r_F$ and the asset is sufficiently specific so that Assumption 1 holds.

The existence of firms (to return to the questions with which this paper began) is therefore due to asset specificity and unbalanced incentives and excessive risk in markets.

The second result shows that the ME1 ranking is maximally ambiguous in the sense that the work ethic v is always higher in an efficient firm, whereas internalization λ is always higher in an efficient market. According to (iii) and (iv), an efficient firm is always ME3 than an efficient market and is also ME2 when $r > r_e$. In contrast, an efficient market is never unambiguously more ethical than an efficient firm. This relative consistency between ME2 and ME3 when institutions are endogenous contrasts sharply with the exogenous case.

We should therefore observe markets with strong performance incentives but weak intrinsic motivation when subjective risk is relatively low $r_e < r < r_F$, but firms with weak incentives and strong intrinsic motivation when asset specificity and subjective risk are high in the sense that $r > r_F$ and Assumption 1 holds. In the latter case, the firm is superior because it provides balanced incentives, fosters intrinsic motivation, and economizes on risk. These are aspects of both the scope and function of firms. The sole possible exception to this characterization is the case $r < r_e$ where the market is close to the first best.

The classical notion that institutions shape preferences becomes incomplete at best when institutions are endogenous. Although institutions influence the choice of incentives, efforts, and even ethics, the choice of institution in turn depends on preferences (the degree r of risk aversion) and economic fundamentals (objective risk σ^2). This mutual interaction between the economic base and preferences was a central theme in Durkheim:

> 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).

In our model, it is more accurate to say that individuals influence their own preferences through the institutions they design and/or join.

Vohs, Mead, and Goode (2006) conduct a series of experiments to determine the effects of money (not incentives, but the concept of money) on social behavior. In one experiment (experiment 7), subjects filled out a questionnaire by computer. After 6 minutes, a third of subjects (randomly assigned) saw a screensaver involving money, another third saw a

screensaver involving fish, and the final third saw a blank screen. Afterwards, subjects were asked to pull two chairs together to meet another participant. Those who saw the money screensaver kept the two chairs furthest apart. In another experiment (experiment 5), a confederate of the experimenters pretended to spill a box of pencils within view of the subject. Those who were "primed" with money (similar to the money screensaver) picked up the fewest pencils. All nine experiments had similar outcomes: "participants primed with money preferred to play alone, work alone, and put more physical distance between themselves and a new acquaintance" (p. 1154). The explanation in Sobel (2008) and related papers does not seem to apply, since the institutional framework of the experiment did not constrain behavior. A natural interpretation, in line with Bowles (1998), is that the same individual can have different sets of preferences which are optimal in different institutions and that sensory cues involving money activated those preferences associated with money and markets. Although these experiments did not address intrinsic motivation, this interpretation is also broadly consistent with the approach in this paper.

Finally, we consider the case where the agent's outside option $\overline{u}$ in the market violates Assumption 1.

Proposition 9. *If* $\theta^2 > 8\sigma^2$ *and*

$$4\left(\overline{u}+\sigma^2\right) < \theta^2 < 8\left(\overline{u}+\sigma^2\right) \tag{38}$$

the firm is never efficient.

Since expected profits in (19) are positive, the firm is still a viable institution. Given the first condition, the second inequality in (38) imposes a lower bound on $\overline{u}$ such that Assumption 1 is violated and the market is always efficient. Intuitively, an increase in the agent's outside option raises the minimum necessary level λ_{M0} of internalization so the principal can make the required payment $\overline{u}$. This increase in commitment raises the value V_{Mc} obtained in the market, which eventually exceeds that V_F in the firm.

6. Conclusion

In this paper, we addressed two classical and fundamental questions. What is the nature of the firm? In reality, firms employ a variety of different incentive mechanisms, but in

this paper our desire was to emphasize in stark relief what we believe to be an important difference between firms and markets — institutional culture and social exchange. This leads to our second question, discussed at length by Smith, Marx, Durkheim, Weber, and many other classical thinkers. To what extent do markets reflect more than naked self-interest and what is their impact on preferences?

Our starting point was the well-known multi-tasking theory of the firm in Holmström and Milgrom (1991). Although that model explains why incentives are low-powered in firms, it falls short of a fully-fledged theory of the firm in that the viability of the latter is assumed in the form of an exogenous and positive least-cost total effort which the agent supplies even when incentives are zero. Moreover, the assumption that the agent's intrinsic motivation is the same in the firm and the market is particularly egregious in light of the aforementioned classical debates. In this paper, we used the theory of intrinsic motivation in Casadesus-Masanell (2004) to complete the multi-tasking theory of the firm. Since the latter paper effectively endogenizes the agent's least-cost action, this completion is a parsimonious one which preserves the essential structure of the original multi-tasking framework.

In our model, the firm operates solely on the basis of endogenous intrinsic motivation rather than monetary incentives. Since incentives are balanced, the agent is indifferent between the two tasks and the principal exercises allocative authority as in Simon (1951) or the relational contracts in Coase (1937). In equilibrium, the agent receives material rents from the principal in exchange for a sufficiently high degree of internalization to ensure positive expected profits. The viability of the firm is therefore a result rather than an assumption of the model. In contrast, the market suffers from its own multi-tasking problem, different from that in the firm, which requires high-powered incentives to offset the agent's ownership incentives for asset maintenance. When subjective risk is sufficiently high, incentives need to be supplemented with intrinsic motivation and the market cannot operate otherwise. In equilibrium, the market is characterized by an effective work ethic and therefore reflects more than pure self-interest. Ultimately, however, such commitment is also an expression of material self-interest.

We showed that the firm is more efficient than the market when asset specificity and

subjective risk are sufficiently high. In that case, the firm is the superior institution because it provides balanced incentives, fosters intrinsic motivation, and economizes on risk. Our paper therefore provides new insights on the existence, scope, and function of firms. We then showed that an efficient firm is more ethical than an efficient market in the sense that the ethical component of production effort and the material rents extracted by the agent in exchange for commitment are both higher in the firm (except when the market approximates the first best). In our model, the market is therefore primarily an incentive system while the firm is an intrinsic motivation device.

Appendix

Proof of Proposition 1

Substituting (8) into (13), the principal's problem is to choose $e \geq 0$, $a \geq 0$, and $v \geq 0$ to maximize

$$\Pi_F = \theta \min\{e, a\} - \min\{e, a\}^2 + f(a) - (1/2)\left(\frac{v\lambda}{1+\lambda}\right)^2 - (1/2)\lambda\left(\frac{v}{1+\lambda}\right)^2 - \sigma^2 \quad (A.1)$$

subject to

$$e + a \leq \frac{v\lambda}{1+\lambda}. \quad (A.2)$$

Note that e and a are chosen by the principal, while t in (8) is the actual total effort supplied by the agent. It is therefore t in (8) that enters $C(t)$ and G_F. Since expected revenue and asset value are decreasing after $\theta/2$, we may assume without loss of generality that $0 \leq e \leq \theta/2$, $0 \leq a \leq \theta/2$, and

$$0 \leq v \leq \theta\left(1 + \frac{1}{\lambda}\right), \quad (A.3)$$

where the latter follows from (8) and $t \leq \theta$. A solution therefore exists because we have a continuous function on a compact set. At the optimum (A.2) must bind because otherwise the principal could increase expected profit by reducing v with e and a held fixed. The optimum cannot entail $e > a$ because the principal could increase expected profit by reducing e and increasing a by an equivalent amount. Likewise, it cannot entail $a > e$ because an increase in e would increase the principal's expected revenue [the first two

terms in (A.1)] more than an equivalent decrease in a would reduce asset value because of diminishing returns. It follows that $e = a$ at the optimum. Substituting $e = a = t/2$ into (A.1), the principal's problem is to choose v to maximize

$$\Pi_F = \frac{\theta\lambda v}{1+\lambda} - \left(\frac{v\lambda}{1+\lambda}\right)^2 - (1/2)\lambda\left(\frac{v}{1+\lambda}\right)^2 - \sigma^2. \tag{A.4}$$

The solution is (15) and the rest follow from straightforward substitutions. Since Π_F in (17) is strictly increasing in λ and $\Pi_F = 0$ at $\lambda = \lambda_{F0}$, the principal operates when $\lambda \geq \lambda_{F0}$ and shuts down otherwise. ∎

Proof of Proposition 2

Since

$$\frac{\partial G_F}{\partial \lambda} = \frac{\theta^2(1-2\lambda)}{2(1+2\lambda)^3}, \tag{A.5}$$

$G_F = 0$ at $\lambda = 0$, increases to its maximum at $\lambda_F = 1/2$, and then decreases thereafter. From Proposition 1, the agent's material payoff is G_F in (18) when $\lambda \geq \lambda_{F0}$ and zero otherwise because the principal shuts down. Assumption 1 implies

$$\lambda_F - \lambda_{F0} = \frac{\theta^2 - 8\sigma^2}{2(\theta^2 - 4\sigma^2)} > 0. \tag{A.6}$$

The rest follows from straightforward substitutions. ∎

Proof of Proposition 3

From (22), the first-order conditions are

$$e : \beta - e - a + \lambda(v - e) \leq 0 \tag{A.7}$$

$$a : \theta - e - 3a \leq 0 \tag{A.8}$$

with complementary slackness. If $e = 0$ and $a > 0$ (Region 1) then (A.8) implies $a = \theta/3$ and (A.7) implies (23). If $e > 0$ and $a = 0$ (Region 2) then (A.7) implies (7) and (A.8) implies $e \geq \theta$ or (24). If $e > 0$ and $a > 0$ (Region 3) then (A.7) and (A.8) imply (25). Along the boundaries the solutions agree. ∎

Proof of Proposition 4

If (β, v) is in regions 1 or 2 in Proposition 3 (including their boundaries with region 3), expected revenue in (2) is negative and the principal prefers to shut down. We now divide region 3 into two subregions where $e > a$ and $e < a$. From (25), $e > a$ when

$$\beta > \frac{\theta(2+\lambda)}{4} - \lambda v \tag{A.9}$$

and $e \leq a$ otherwise. Re-written as equations, (23), (24), and (A.9) are lines with the same slope in v but different vertical intercepts for β. Since

$$\theta/3 < \theta(2+\lambda)/4 < \theta(1+\lambda), \tag{A.10}$$

the line in (A.9) lies between those in (23) and (24) and indeed splits region 3. Suppose (β, v) is such that $e > a$ in region 3 and consider a small reduction in v with β held fixed. Since $e > a$, a small reduction in v which leads to a small decrease in e and a small increase in a will increase both expected revenue in (2) and asset value. From (25),

$$t = \frac{2(\beta + v\lambda) + \theta\lambda}{2+3\lambda} \tag{A.11}$$

and

$$v - e = \frac{2v - 3\beta + \theta}{2+3\lambda}, \tag{A.12}$$

so the agent's cost of effort and guilt both fall. The agent's risk premium is unaffected, so expected profits in (27) increase. It follows that the principal never chooses (β, v) in region 3 such that $e > a$. We now consider $e < a$ in region 3 where

$$\Pi_M = \theta e - e^2 + f(a) - (1/2)t^2 - G_M - (1/2)k\beta^2 - \overline{u} - \sigma^2. \tag{A.13}$$

Substituting (25), after some tedious algebra

$$\Pi_M = -Av^2 + Bv - C\beta v + D\beta - E\beta^2 + F, \tag{A.14}$$

where

$$\begin{aligned} A &= \tfrac{2\lambda(1+6\lambda)}{(2+3\lambda)^2} & B &= \tfrac{2\theta\lambda(5+3\lambda)}{(2+3\lambda)^2} \\ C &= \tfrac{18\lambda}{(2+3\lambda)^2} & D &= \tfrac{3\theta(4+3\lambda)}{(2+3\lambda)^2} \\ E &= \tfrac{24+9\lambda+k\left(4+12\lambda+9\lambda^2\right)}{2(2+3\lambda)^2} & F &= \tfrac{\theta^2\left(4+\lambda-3\lambda^2\right)}{2(2+3\lambda)^2} + \overline{u} + \sigma^2 \end{aligned} \tag{A.15}$$

and A-E are all positive. Since Π_M in (A.14) is continuous and region 3 where $e \leq a$ is nonempty and compact, a solution to the principal's problem exists. Note that

$$\frac{\partial^2 \Pi_M}{\partial \beta \partial v} = -C < 0, \tag{A.16}$$

so incentives and the work ethic are strategic substitutes for the principal as claimed in the text. Since

$$\frac{\partial^2 \Pi_M}{\partial \beta^2} = -2E < 0 \tag{A.17}$$

and

$$\frac{\partial^2 \Pi_M}{\partial \beta^2}\frac{\partial^2 \Pi_M}{\partial v^2} - \left(\frac{\partial^2 \Pi_M}{\partial \beta \partial v}\right)^2 = \frac{4\lambda[6 + k(1+6\lambda)]}{(2+3\lambda)^2} > 0, \tag{A.18}$$

(A.14) is strictly concave in (β, v) and the solution is unique. The first-order conditions are linear, so (30) follows from straightforward calculations. Evaluating (23) at (30), we obtain

$$\beta - (\theta/3) + \lambda v = \frac{\theta(2+3\lambda)[3 + k(3\lambda - 1)]}{6[6 + k(1+6\lambda)]}, \tag{A.19}$$

which requires $\lambda \geq \lambda_{R1} \equiv (1/3) - (1/k)$. Evaluating (A.9) at (30),

$$\beta - \frac{\theta(2+\lambda)}{4} + \lambda v = -\frac{\theta k(2+3\lambda)}{4[6 + k(1+6\lambda)]} < 0, \tag{A.20}$$

so (30) is never in region 2 or region 3 with $e > a$. Expressions (31)-(33) follow from straightforward substitutions. In particular, $\Pi_M \geq 0$ iff $\lambda \geq \lambda_{M0}$. Since

$$\lambda_{M0} - \lambda_{R1} = \frac{2(\overline{u} + \sigma^2)}{\theta^2 - 4(\overline{u} + \sigma^2)} > 0, \tag{A.21}$$

$\lambda \geq \lambda_{M0}$ implies (30) is in the interior of the subregion of region 3 where $e \leq a$ with $\Pi_M \geq 0$ and is therefore the global optimum for the principal. ∎

Proof of Proposition 5

To prove (i) and (ii), we differentiate (33)

$$\frac{\partial G_M}{\partial \lambda} = \frac{9\theta^2 k^2[6 + k(1-6\lambda)]}{2[6 + k(1+6\lambda)]^3} \tag{A.22}$$

to find the unique unconstrained maximizer λ_M defined in the statement. Since

$$\lambda_M - \lambda_{M0} = \frac{\theta^2(12-k) - 8(6+k)\left(\overline{u}+\sigma^2\right)}{6k\left[\theta^2 - 4\left(\overline{u}+\sigma^2\right)\right]} \tag{A.23}$$

is strictly decreasing in r and zero at $r = r_M$, it follows that $\lambda_M \geq \lambda_{M0}$ when $r \leq r_M$ and $\lambda_M < \lambda_{M0}$ otherwise. In the former case, the agent chooses λ_M because G_M evaluated at $\lambda = \lambda_M$ in (36) is nonnegative and positive for all $k > 0$, whereas the principal shuts down for all $0 \leq \lambda < \lambda_{M0}$. In the latter case, the agent chooses λ_{M0} because G_M evaluated there in (37) is positive and decreasing for all $\lambda \geq \lambda_{M0}$, whereas again the principal shuts down for all $0 \leq \lambda < \lambda_{M0}$, including λ_M. The expressions in (36) and (37) follow from straightforward substitutions for λ in Proposition 4. To prove (iii), we note that $k \to 0$ implies $r \to 0$, $\sigma^2 \to 0$, or both. Since $r_M \to \infty$ as $\sigma^2 \to 0$, we must eventually have $r \leq r_M$ in all three cases, so (36) is relevant rather than (37). At $k = 0$, $e_M = a_M = \theta/4$ (the first best effort levels) and guilt and the risk premium in (27) are both zero. ∎

Proof of Propositions 6-8

Since

$$r_M - r_v = \frac{36\left[\theta^2 - 12\left(\overline{u}+\sigma^2\right)\right]}{5\sigma^2\left[\theta^2 + 8\left(\overline{u}+\sigma^2\right)\right]} > 0 \tag{A.24}$$

by Assumption 1, $0 < r_e < r_F < r_v < r_M$ as in Figure 1 above. We first consider $0 \leq r \leq r_M$, where $\lambda = \lambda_M$ in the market. Since

$$V_M - V_F = \frac{\theta^2(3-k)}{8(6+k)}, \tag{A.25}$$

we have $V_M > V_F$ when $k < 3$ or $r < r_F$ and $V_F > V_M$ when $r > r_F$ as in Figure 1. Likewise,

$$\begin{aligned}
\Pi_M - \Pi_F &= \frac{\theta^2(3-k)}{4(6+k)} - \overline{u} \\
G_F - G_M &= \frac{\theta^2(3-k)}{8(6+k)} \\
\lambda_M - \lambda_F &= \frac{3-k}{3k} \\
v_F - v_M &= \frac{\theta(24-5k)}{8(6+k)}.
\end{aligned} \tag{A.26}$$

Since $k < 24/5$ is equivalent to $r < r_v$, the comparison between v_F and v_M follows. Evaluating e in (25) at $\beta = 0$, $\lambda = \lambda_M$, and $v = v_M$,

$$e_M^{\beta=0} = \frac{\theta(12-5k)}{8(6+5k)} \tag{A.27}$$

and

$$e_M^{\beta=0} - e_F = \frac{\theta(3-5k)}{4(6+5k)}. \tag{A.28}$$

Since $k < 3/5$ is equivalent to $r < r_e$, the comparison between $e_M^{\beta=0}$ and e_F follows. We now consider $r \geq r_M$, where $\lambda = \lambda_{M0}$ in the market. At $r = r_M$,

$$V_F - V_{Mc} = \frac{\theta^2 - 8\left(\overline{u} + \sigma^2\right)}{16} > 0 \tag{A.29}$$

by Assumption 1. For all $r > r_M$, V_F is constant while V_{Mc} is increasing

$$\frac{\partial V_{Mc}}{\partial r} = \frac{\left[\theta^2 - 4\left(\overline{u} + \sigma^2\right)\right]^2}{2(\theta r \sigma)^2} > 0. \tag{A.30}$$

If we can show that

$$\lim_{r\to\infty} V_F - V_{Mc} = \frac{\theta^2\left[\theta^2 - 32\left(\overline{u} + \sigma^2\right)\right] + 64\left(\overline{u} + \sigma^2\right)^2}{48\theta^2} > 0 \tag{A.31}$$

then the result will follow. The numerator in (A.31) is strictly decreasing in $z = \overline{u} + \sigma^2$ and zero at $z = (\theta^2/8)(2+\sqrt{3})$. It is therefore positive when $z < (\theta^2/8)(2+\sqrt{3})$ or

$$\theta^2 > \frac{8\left(\overline{u} + \sigma^2\right)}{2+\sqrt{3}}, \tag{A.32}$$

which holds by Assumption 1. Clearly,

$$\Pi_F - \Pi_{Mc} = \Pi_F > 0 \tag{A.33}$$

and

$$v_{Mc} - v_F = \frac{\theta^2 - 12\left(\overline{u} + \sigma^2\right)}{4\theta} > 0. \tag{A.34}$$

Since

$$G_{Mc} - G_F = \frac{\theta^2 - 8\left(\overline{u} + \sigma^2\right)}{16} > 0 \tag{A.35}$$

at $r = r_M$ and

$$\frac{\partial G_{Mc}}{\partial r} = \frac{\partial V_{Mc}}{\partial r} > 0, \tag{A.36}$$

$G_{Mc} > G_F$ for all $r \geq r_M$. Likewise,

$$\lambda_F - \lambda_{M0} = \frac{\theta^2 - 8\left(\overline{u} + \sigma^2\right)}{4\left[\theta^2 - 4\left(\overline{u} + \sigma^2\right)\right]} > 0 \tag{A.37}$$

at $r = r_M$,

$$\frac{\partial \lambda_{M0}}{\partial r} = 1/(r\sigma)^2 > 0, \tag{A.38}$$

and

$$\lim_{r\to\infty} \lambda_F - \lambda_{M0} = \frac{\theta^2 - 16\left(\overline{u} + \sigma^2\right)}{6\left[\theta^2 - 4\left(\overline{u} + \sigma^2\right)\right]} > 0, \tag{A.39}$$

so $\lambda_F > \lambda_{M0}$ for all $r \geq r_M$. Evaluating e in (25) at $\beta = 0$, $\lambda = \lambda_{M0}$, and $v = v_{Mc}$,

$$e_{Mc}^{\beta=0} = \frac{\theta^4 - \theta^2(7+k)\left(\overline{u} + \sigma^2\right) + 2(6+k)\left(\overline{u} + \sigma^2\right)^2}{\theta^3(1-k) - 2\theta(2-k)\left(\overline{u} + \sigma^2\right)}. \tag{A.40}$$

Note that $0 < (2-k)/(1-k) < 1$ because $k > 3$, so

$$\theta^2 > 2\left(\frac{2-k}{1-k}\right)\left(\overline{u} + \sigma^2\right) \tag{A.41}$$

implies the denominator in (A.40) is negative (and therefore non-zero). Since

$$\frac{\partial e_{Mc}^{\beta=0}}{\partial r} = \frac{\sigma^2\left[\theta^2 - 2\left(\overline{u} + \sigma^2\right)\right]\left[\theta^2 - 4\left(\overline{u} + \sigma^2\right)\right]^2}{\theta\left[\theta^2(1-k) - 2(2-k)\left(\overline{u} + \sigma^2\right)\right]^2} > 0, \tag{A.42}$$

$e_{Mc}^{\beta=0}$ increases from

$$e_{Mc}^{\beta=0} = -\frac{\theta\left[\theta^2 - 7\left(\overline{u} + \sigma^2\right)\right]}{11\theta^2 - 32\left(\overline{u} + \sigma^2\right)} < 0 \tag{A.43}$$

at $r = r_M$ up to

$$\lim_{r\to\infty} e_{Mc}^{\beta=0} = (\overline{u} + \sigma^2)/\theta. \tag{A.44}$$

Finally,

$$e_F - \frac{\left(\overline{u} + \sigma^2\right)}{\theta} = \frac{\theta^2 - 8\left(\overline{u} + \sigma^2\right)}{8\theta} > 0, \tag{A.45}$$

so $e_{Mc}^{\beta=0} < e_F$ for all $r \geq r_M$. Figure 1 summarizes all these comparisons. ∎

Proof of Proposition 9

The firm is still a viable institution because $\theta^2 > 8\sigma^2$ implies $\Pi_F > 0$ in (19). Since

$$r_M - r_F = \frac{9\left[\theta^2 - 8\left(\overline{u} + \sigma^2\right)\right]}{\sigma^2\left[\theta^2 + 8\left(\overline{u} + \sigma^2\right)\right]} < 0, \tag{A.46}$$

$V_M > V_F$ for all $0 \leq r \leq r_M$. From (A.29), $V_{Mc} > V_F$ at $r = r_M$ and (A.30) V_{Mc} is increasing while V_F is constant. It follows that $V_{Mc} > V_F$ for all $r \geq r_M$. ∎

References

Alchian, A.A., Demsetz, H., 1972. Production, information costs, and economic organization. Amer. Econ. Rev. 62, 777-795.

Akerlof, G.A., 1982. Labor contracts as partial gift exchange. Quart. J. Econ. 97, 543-569.

Akerlof, G.A., 1983. Loyalty filters. Amer. Econ. Rev. 73, 54-63.

Akerlof, G.A., Kranton, R.E., 2005. Identity and the economics of organizations. J. Econ. Persp. 19, 9-32.

Akerlof, G.A., Kranton, R.E., 2008. Identity, supervision, and workgroups. Amer. Econ. Rev. 98, 212-217.

Bolton, G.E., Ockenfels, A., 2000. ERC: A theory of equity, reciprocity, and competition. Amer. Econ. Rev. 90, 166-93.

Bolton, P., Dewatripont, M., 2005. Contract Theory. MIT Press, Cambridge, Mass.

Bowles, S., 1998. Endogenous preferences: the cultural consequences of markets and other economic institutions. J. Econ. Lit. 36, 75-111.

Casadesus-Masanell, R., 2004. Trust in agency. J. Econ. Man. Strat. 13, 375-404.

Coase, R.H., 1937. The nature of the firm. Economica 4, 386-405.

Driver, J., 2007. Ethics: the fundamentals. Blackwell Publishing, Malden, Mass.

Dufwenberg, M., Heidhues, P., Kirchsteiger, G., Riedel, F., Sobel, J., 2008. Other-regarding preferences in general equilibrium. Working paper.

Falk, A., Fischbacher, U., 2006. A theory of reciprocity. Games Econ. Behav. 54, 293-315.

Fehr, E., Fischbacher, U., 2002. Why social preferences matter – the impact of non-selfish motives on competition, cooperation, and incentives. Econ. J. 112, C1-C33.

Fehr, E., Gächter, S., 2000. Fairness and retaliation: the economics of reciprocity. J. Econ. Persp. 14, 159-181.

Fehr, E., Klein, A., Schmidt, K.M., 2007. Fairness and contract design. Econometrica 75, 121-154.

Fehr, E., Schmidt, K.M., 1999. A theory of fairness, competition, and cooperation. Quart. J. Econ. 114, 817-68.

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.

Giddens, A., 1971. Capitalism and Modern Social Theory: An Analysis of the Writings of Marx, Durkheim, and Max Weber. Cambridge University Press, Cambridge, UK.

Grossman, S.J., Hart, O.D., 1986. The costs and benefits of ownership: a theory of vertical and lateral integration. J. Polit. Econ. 94, 691-719.

Hart, O., Moore, J., 1990. Property rights and the nature of the firm. J. Polit. Econ. 98, 1119-58.

Holmström, B., 1982. Moral hazard in teams. Bell J. Econ. 13, 324-340.

Holmström, B., Milgrom, P., 1991. Multitask principal-agent analyses: incentive contracts, asset ownership, and job design. J. Law Econ. Org. 7, 24-52.

Holmström, B., Milgrom, P., 1994. The firm as an incentive system. Amer. Econ. Rev. 84, 972-991.

Holmström, B., Roberts, J., 1998. The boundaries of the firm revisited. J. Econ. Persp. 12, 73-94.

Hurtz, G.M., Donovan, J.J., 2000. Personality and job performance: the Big Five revisited. J. Appl. Psych. 85, 869-879.

Judge, T.A., Ilies, R., 2002. Relationship of personality to performance motivation: a meta-analytic review. J. Appl. Psych. 87, 797-807.

Kandel, E., Lazear, E.P., 1992. Peer pressure and partnerships. J. Polit. Econ. 100, 801-17.

Ostrom, E., Walker, J., 2007. Trust and reciprocity as foundations for cooperation: individuals, institutions, and context. Working paper W07-3, Workshop in Political Theory and Policy Analysis, Indiana University.

Rabin, M., 1993. Incorporating fairness into game theory and economics. Amer. Econ. Rev. 83, 1281-1302.

Ramalingam, A., 2008. Firms, markets, and the work ethic: some extensions. Working paper.

Raub, W., 1990. A general game-theoretic model of preference adaptations in problematic social situations. Rationality and Soc. 2, 67-93.

Rob, R., Zemsky, P., 2002. Social capital, corporate culture, and incentive intensity. RAND J. Econ. 33, 243-257.

Roberts, J., 2004. The modern firm: organizational design for performance and growth. Oxford University Press, New York.

Rotemberg, J.J., 1994. Human relations in the workplace. J. Polit. Econ. 102, 684-717.

Rotemberg, J.J., 2006. Endogenous altruism in buyer-seller relations and its implications for vertical integration. Working paper.

Seabright, P., 2004. The Company of Strangers: A Natural History of Economic Life. Princeton: Princeton University Press.

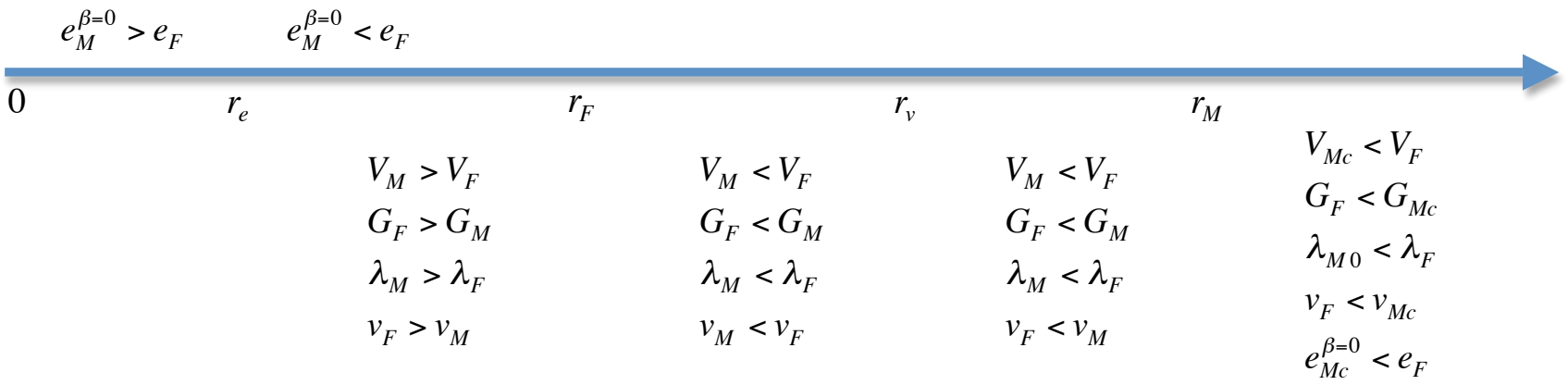
Simon, H.A., 1951. A formal theory of the employment relationship. Econometrica 19, 293-305.

Sobel, J., 2008. Markets make people appear selfish. Working paper.

Tabellini, G., 2008. The scope of cooperation: values and incentives . Quart. J. Econ. 123, 905950.

Vohs, K.D., Mead, N.L., Goode, M.R., 2006. The psychological consequences of money. Science 314, 1154-1156.

Weber, M., 1978. Economy and society: an outline of interpretive sociology. Eds. Roth, G, Wittich, C. Berkeley: University of California Press.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