Reforming Capitalism[1]

Michael MAGILL

University of Southern California
magill@usc.edu

Martine QUINZII

University of California, Davis
mmquinzii@ucdavis.edu

Jean-Charles ROCHET

Swiss Banking Institute, University of Zürich,
SFI and Toulouse School of Economics
rochet@cict.fr.

May 27, 2010

(*Preliminary and Incomplete*)

ABSTRACT

This paper presents a model of the *stakeholder* corporation and analyzes the equilibrium of an economy with stakeholder firms. The analysis is based on a model of a production economy that differs from the standard approach based on states of nature. The property that differentiates it from the standard model (which justifies the *shareholder* approach to the corporation) is that firms' choices of investment influence the probability distributions of their outputs, and hence exert external effects on consumers and employees: as a result profit maximization and competitive behavior do not lead to Pareto optimality. Using a Coasian approach to resolve the problem of externalities, we show that if firms issue not only equity shares but also marketable property rights for employees and consumers, and if firms' managers maximize the total values of their firms (shareholder value plus consumer and employee values) then Pareto optimality of equilibrium is restored when agents are identical. In the more realistic case where agents are heterogeneous, reforming capitalism by giving some weight to employee and consumer surpluses in the objective of the firms always increases social welfare.

[1] **Acknowledgements:** We benefited from the comments and encouragements of Bruno Biais, Jacques Drèze, Zsuzsanna Fluck, Hans Gersbach, Michel Habib, Thomas Mariotti, Georg Nöldeke, Guillaume Plantin, Klaus Ritzberger, and seminar participants at Basel University, the Bank of Japan, CORE, ETH Zürich, University of Vienna and the 2010 Swiss National Bank/University of Tilburg conference at Hasliberg (especially Hans Degryse and Ludovic Phalippou).

1 Introduction

Everyone knows that corporations are not just cash machines for their shareholders, but that they also provide goods and services for their consumers, as well as jobs and incomes for their employees. Everyone, that is, except most economists. Indeed in the debate on the social responsibility of corporations, the majority of academic economists share the view expressed in unambiguous terms by Friedman (1970) "there is one and only one social responsibility of business—to use its resources and engage in activities designed to increase its profits ". By contrast, proponents of the 'stakeholder' view of corporations assert that managers should pay attention not only to the profits of the shareholders but also to the welfare of their employees and consumers. The orthodox view held by most economists is a tradition inherited from the Anglo-American view of corporations, while the so-called non-orthodox stakeholder view is that held in countries such as Japan and most continental European countries, in particular France and Germany.

The way in which a society views the role of a corporation can be traced to its legal system and to the social norms which shape the way individuals think about the role of institutions. Common Law countries such as the UK and the US view a corporation as a piece of private property and through their legal structure place exclusive emphasis on the shareholders as the owners of the firm. Civil Law countries such as France and Germany view corporations as 'mini-societies' and place emphasis on the responsibility of the firm to its employees as well as its shareholders. Social norms have pushed this view of the corporation to its extreme form in Japan where the responsibility to the interest of employees and other stakeholders such as suppliers outweighs that to the shareholders (see Yoshimori (1995)).

Viewed in historical perspective the stakeholder view of the corporation has been gaining momentum in all advanced economies over the last hundred years: the changing legal structures and the evolution of social norms have come to make most large corporations aware that they need to expand the focus of their responsibilities to a larger group than the shareholders, to include employees and consumers as well as other groups such as suppliers and subcontractors involved in their long-term productive relationship. Despite this century-long shift in the rest of society's view of the corporate entity, the remarkable phenomenon is the hegemony of the Anglo-American view of the corporation among economists: to this day the idea that the corporation should serve the exclusive interest of its shareholders remains the dominant paradigm for corporate governance (Schleifer-Vishny (1997)). Although recently there are some signs of a willingness to change (Tirole (2001, 2006)) mainstream economics has not kept abreast of the evolution of society's view of the role and responsibilities of a corporation, and continues to advocate shareholder value maximization as the primary responsibility of the management of a corporation.

As pointed out by Tirole (2001) one of the impediments to developing a stakeholder theory of the corporation acceptable to academic economists has been the lack of a formal model which can serve to articulate the basic ideas of the stakeholder approach. Underlying the faith of corporate finance in the virtue of profit maximization is the Arrow-Debreu model in which uncertainty is described by states of nature. In such a model, if there are contingent markets for all commodities, an Arrow-Debreu equilibrium leads to a Pareto optimum: in equilibrium firms maximize the present value of their profit and all agents, whether shareholders, workers or consumers agree with this objective for the firm. There are no unaccounted for externalities which might prevent profit maximization from being the best criterion. This is what Friedman had in mind when he said that businessmen are wrong to look for a broader sense of 'social responsibility', since the profit criterion accurately takes into account the interests of all the agents in the economy and hence automatically acts in the social interest.

To the extent that an equilibrium model based on states of nature provides a realistic modeling of production under uncertainty, the Arrow-Debreu model provides a solid theoretical foundation for the shareholder model of the corporation, and serves to vindicate the view advocated by Friedman. The Arrow-Debreu model is however of much more limited applicability than the literature following Arrow (1953) and Debreu (1959) would have us believe, and this for two reasons. The first was pointed out by Arrow (1971) who argued that using this approach for modeling production can lead to indivisibilities and non-convexities, with the attendant failure of existence of an equilibrium:

> ... " we have seen that it is possible to set up formal mechanisms which under certain conditions will achieve an optimal allocation of risk by competitive methods. However, the empirical validity of the conditions for the optimal character of competitive allocations is considerably less likely to be fulfilled in the case of uncertainty than in the case of certainty and, furthermore, many of the economic institutions which would be needed to carry out the competitive allocation in the case of uncertainty are in fact lacking."

The second critique is equally cogent and hinges on the strong hypotheses that need to be satisfied to make the framework applicable:

(1) it must be possible to make a complete enumeration of the primitive causes which, when combined with the actions (investment) of the firms, serve to explain the different possible outcomes;

(2) the primitive causes must have probabilities which are exogenous and independent of the actions of the firms;

(3) every primitive cause must be sufficiently simple to describe and verify to permit this cause to be made the basis for a written contingent contract.

Perhaps if we were describing farming and used the dependence of a crop of wheat on the temperature, sunshine, and humidity in a certain locality over the growing season as the primitive states, the approach might provide a useful first approximation, if the requisite contracts on such states were available. But these conditions are for too demanding for the state-of-nature approach to provide a useful way of describing the complex production processes inherent in modern corporations. This led two of us (Magill-Quinzii (2009)) to propose an alternative model of production under uncertainty in which firms' investment influences the probability distribution of their outcomes: states of nature are left unspecified in the background and only the probability distribution of the possible outcomes of the production process is known. We argued that such a model is more realistic since agents trade contracts based only on observable outcomes. However this alternative modeling of uncertainty brings with it an important consequence: since firms' actions affect the probability distribution of their outputs, they also affect the expected utilities of all agents in the economy.

In this paper we pursue the analysis of these externalities further, noting that by shifting the probability towards outcomes where it is more productive, and thus where the prices of the goods it produces are lower, and the wages of its employees are higher, the actions of each firm influence the expected utilities of its consumers and employees, and this external effect is not internalized by the market: as a result the profit criterion is no longer the correct 'social criterion' for the firm. There is thus a radical change in the view of the role and objective of a corporation when we move from an equilibrium model of production based on states of nature to an equilibrium model of production based on the probability approach advocated in this paper. From a logical perspective there is (not surprisingly) nothing wrong with Friedman's argument that the socially responsible objective of the firm is to maximize profit—it is just that he is assuming the presence of a complete system of state contingent contracts which leads every firm to fully internalize the consequence of its actions on all other agents—and we argue that in practice such state contingent contracts do not exist.

The probability approach leads to a different criterion: since firms' actions have external effects on employees and consumers, the socially optimal criterion for the firm is to maximize the sum of the profit of the shareholders, the surplus of the employees and the surplus of the consumers—providing a precise formal criterion for a stakeholder theory of the corporation. Thus the apparent mystery in the conflict between the traditional shareholder-based profit-maximizing approach advocated by economists and the stakeholder approach to the corporation widely advocated by non-economists seems to be resolved: it reduces to whether we accept to model contracts based on highly complex and mostly unobservable states of nature or whether, as we propose, contracts are based on firms' outcomes and firms can influence the probabilities of their outcomes.

Even if we agree to adopt the probability approach on the grounds it is more realistic and yields results closer to intuition, there still remains an important issue to be resolved: *how can the corporation be induced to internalize its effect on consumers and employees?* We explore a market approach to the internalization of externalities based on Coase's (1960) fundamental insight that properly defining property rights, and organizing efficient markets for trading them, allows externalities to be internalized and restores the efficiency of a competitive equilibrium. Applying Coase's insight to our model leads to an alternative mode of organization of the corporate entity which we call a 'stakeholder' corporation[2] to contrast it with a traditional 'capitalist' firm, which focuses exclusively on the welfare of its shareholders. In a stakeholder corporation consumers and employees are endowed with tradeable property rights on the surpluses that the firm will generate, and the manager is instructed to maximize the *total* value of the firm, consisting of the market value of shareholders plus the market values of 'consumers' rights' and 'employees' rights'.

Section 2 uses a simple motivating example to illustrate the difference between an equilibrium using the probability model and an Arrow-Debreu equilibrium for the same economy. Section 3 extends the analysis to the benchmark model consisting of a simple two-good economy with a single firm and a continuum of consumers and workers. The firm can make an

[2]We did not add the adverb "socially" because the discussion of "socially responsible" investment usually refers to technologically generated externalities such as pollution, or morally disputable activities such as exploitation of child labor. What we have in mind here is different and much more general. We are concerned with externalities within ordinary firms, exerted by their owners on their consumers and workers.

investment at date 0 which increases the probability of having an improved technology at date 1. In the probability model if the firm uses the shareholder criterion of maximizing the present value of profit then there is always underinvestment relative to the social optimum. Some economists might argue that it would be simpler and surer to model the economy using the Arrow-Debreu equilibrium: we show that this is not the case; indeed the economy has no Arrow-Debreu equilibrium. We then show that if in the probability model, the firm adopts a stakeholder criterion consisting of profit plus the consumer surplus and the worker surplus then it is led to the socially optimal level of investment. Thus adopting the stakeholder criterion instead of the profit criterion induces the firm to invest more and solves the externality problem.

Section 4 examines a more general model with heterogeneity of consumers. This more general model illustrates the limits of our proposal, and the trade-offs involved in the 'stakeholder' mode of managing firms. A stakeholder firm is a hybrid of a capitalist firm, a cooperative of consumers and a labor managed firm. As such, it inherits some of the well known drawbacks of the latter two types of firms. In particular these firms are not 'entry free" for consumers and employees. Potential workers and consumers of a stakeholder firm have to pay a fixed fee in order to become members of the 'clubs' of 'authorized' workers and consumers. Therefore some workers and consumers with low surpluses are in general excluded from these clubs. Moreover the surplus of inframarginal members of these clubs is only accounted partially in the firm value. Indeed this firm value only takes into account the surplus of the marginal worker or consumer, which means that it is underestimated. Thus the only case where the stakeholder form of corporation fully internalizes externalities is when consumers and workers are homogeneous, like in the example of Section 3.

However, we show that reforming capitalism by shifting even marginally the responsibility of the firm from just the interests of the shareholders to the combined interests of workers-consumers-shareholders always leads to an increase in welfare. Indeed the model can be parametrized by the number of property rights issued to consumers and employees. The 'capitalist' equilibrium corresponds to the case where there is no scarcity of rights and all consumers and employees can become 'members' at no cost. Then the value of the property rights is zero and the total value of the firm is its shareholder value. We show that a marginal change to this system, whereby the number of property rights is reduced and the payment of small fixed fee is required to belong to the 'club' of the employees and consumers of the firm, always increases welfare. The welfare loss associated with the exclusion of some potential employees and consumers is more than compensated by the increase in investment generated by the internalization of some fraction of consumer and employee's surplus. In our model, 'pure' capitalism corresponds to a local minimum of social welfare.

The rest of the paper is organized as follows: Section 2 presents a motivating example. Section 3 presents the benchmark model with homogeneous agents. Section 4 extends it to heterogeneous agents. Section 5 concludes.

2 A Motivating Example

Consider a European soccer club deciding how much to invest in hiring 'star' players who will increase the probability of the team's qualification for the Champions League. Such a qualification would increase both the satisfaction of the club's supporters and the revenue of the club from the sale of tickets for the highly attended international games. We assume that the club has been sufficiently successful to have acquired the status of a publicly owned corporation. Suppose the club uses the Anglo-American criterion of profit maximization to choose its investment in star players, will its choice be socially optimal? According to standard economic theory the answer should be positive since there is no apparent monopolistic behavior or obvious external effect in the story.

2.1 The Model

Here is a simple way of modeling this setting. There are two goods: a composite good called 'money' and soccer games. There are two periods $t = 0, 1$. At date 0 the club makes an investment a: with probability $0 < \pi(a) < 1$ the team qualifies for the Champions League and the club has tickets for y_g games to sell; with probability $1 - \pi(a)$ the team fails to qualify and the club has tickets for y_b games to sell, with $y_b < y_g$. The essential ingredient is that there are two outcomes $y_g > y_b$ and that club's investment influences the probability of these outcomes. Clearly the higher the caliber of the players the greater the probability of winning, which we capture by the assumption that $\pi(.)$ is increasing. We also assume that $\pi(.)$ is concave.[3] However no matter how large the investment (how good the players are) there is always some chance that the team will fail to qualify.

There is a continuum of mass 1 of identical consumers (supporters) attending soccer games. Their preferences are given by

$$U(m, c) = m_0 + \delta \sum_{s=b,g} \pi_s(m_s + u(c_s)) \tag{1}$$

where s denotes the outcome of the season, qualify if $s = g$ or not-qualify if $s = b$, (m_0, m_g, m_b) the consumption of money at date 0 and at date 1 in the two possible outcomes, (c_g, c_b) the consumption of soccer games and δ with $0 < \delta \leq 1$ the discount factor. All agents are shareholders of the club with equal shares and have the same endowment (e_0, e_1) of money, the date 1 endowment e_1 being independent of the outcome of the soccer games. (e_0, e_1) are assumed to be sufficiently large so that non-negativity constraints on the consumption of money are never binding.

2.2 The Equilibrium

Consider an equilibrium of this economy with a profit maximizing soccer club. At date 0 there are markets for contingent bonds which permit agents to transfer income to each outcome $s = g, b$ at date 1, with prices (q_g, q_b), and an equity market for the shares of the club with

[3] The probability of winning the qualification clearly also depends on the investment of the other teams, but this simple example abstracts from this 'competition' aspect of the story.

price q_e. At each date there is a spot market for money with the price normalized to 1 and at date 1 there are spot markets for tickets for attendance to the soccer games with prices (p_g, p_b). The club manager chooses a so as to maximize the present value of the club's profit, correctly anticipating the future spot prices (p_g, p_b) at which the tickets will be sold. We assume that the shareholders finance the investment, but it would be equivalent to assume that the investment is financed by borrowing using the contingent securities. Investors/supporters maximize utility (1), taking the prices and the investment chosen by the club as given.

If the club invests $\bar{a}$ and the prices are $(\bar{q}_g, \bar{q}_b, \bar{q}_e, \bar{p}_g, \bar{p}_b)$, the problem of the representative consumer is to choose a portfolio $(\bar{z}_g, \bar{z}_b, \bar{\theta})$ and consumption $(\bar{m}_0, \bar{m}_g, \bar{m}_b, \bar{c}_g, \bar{c}_b)$ so as to maximize expected utility

$$m_0 + \delta \sum_{s=b,g} \pi_s(\bar{a})(m_s + u(c_s)), \qquad \text{with } \pi_g(\bar{a}) = \pi(\bar{a}), \quad \pi_b(\bar{a}) = 1 - \pi(\bar{a}) \tag{2}$$

subject to the constraints

$$\begin{aligned} &m_0 = e_0 + \bar{q}_e - \bar{q}_g z_g - \bar{q}_b z_b - (\bar{q}_e + \bar{a})\theta \\ &m_s = e_1 + z_s + \theta \bar{p}_s y_s - \bar{p}_s c_s, \qquad\qquad s = g, b \\ &(\bar{q}_g, \bar{q}_b, \bar{q}_e, \bar{p}_g, \bar{p}_b) \geq 0, \end{aligned}$$

where $z = (z_g, z_b)$ denotes the portfolio of contingent bonds, θ the share of equity chosen, and $c = (c_g, c_b)$ the consumption of soccer games. The agent's problem has a solution only if the prices of the securities satisfy the no-arbitrage conditions

$$\bar{q}_g = \delta\pi(\bar{a}), \quad \bar{q}_b = \delta(1 - \pi(\bar{a})), \quad \bar{q}_e = \delta(\pi(\bar{a})\bar{p}_g y_g + (1 - \pi(\bar{a})\bar{p}_b y_b) - \bar{a},$$

and, assuming that the non-negativity constraints are not binding, the first-order conditions for optimal consumption are

$$\bar{p}_s = u'(\bar{c}_s), \quad s = g, b.$$

Given the quasi-linearity assumption on the date 1 consumption of money, the pricing of the securities is risk neutral. The contingent bonds are actually not needed in this economy: riskless borrowing and lending with an interest rate $\bar{r}$ such that $\delta = \frac{1}{1+\bar{r}}$ is the only security needed transfer income from date 0 to date 1: given any choice of portfolio $z = (z_g, z_b)$of contingent bonds, the investment $z_0 = \pi(\bar{a})z_g + (1 - \pi(\bar{a})z_b$ in the riskless bond with price $\bar{q}_0 = \delta$ gives the same utility to the representative agent.

Anticipating the prices $(\bar{p}_g, \bar{p}_b)$ and knowing that the pricing of equity is risk neutral[4], the club manager chooses $\bar{a}$ to maximize shareholder value at date 0:

$$SV(a) = \left\{ \frac{1}{1+\bar{r}} \left[\pi(a)\bar{p}_g y_g + (1 - \pi(a))\bar{p}_b y_b \right] - a \right\} \tag{3}$$

[4]We use this simple example to exhibit the assumptions needed to define the concept of a 'profit-maximizing equilibrium' when investment influences the probability of outcomes. If agents were risk averse the firm would take as given the marginal utility of income in state (outcome) s (the stochastic discount factor) while perceiving the effect of its investment of the probability of the outcomes (see Magill-Quinzii (2008, 2009)).

Assuming that the optimal choice is positive, the first-order condition is

$$\frac{1}{1+\bar{r}}\pi'(\bar{a})\,[\,\bar{p}_g y_g - \bar{p}_b y_b\,] = 1$$

In equilibrium $\bar{z}_g = \bar{z}_b = 0$, $\bar{\theta} = 1$, $\bar{m}_0 + \bar{a} = e_0$, $\bar{m}_g = \bar{m}_b = e_1$, $\bar{c}_g = y_g$ and $\bar{c}_b = y_b$. Combining the market-clearing conditions with the first-order conditions of the consumers and the club we find that in equilibrium the investment $\bar{a}$ satisfies

$$\frac{1}{1+\bar{r}}\pi'(\bar{a})\left[\,u'(y_g)y_g - u'(y_b)y_b\,\right] = 1 \tag{4}$$

2.3 The Optimum

The profit maximizing choice $\bar{a}$ is however not the same as the Pareto optimal choice a^* obtained by maximizing the expected utility of the representative agent

$$\max_{a\geq 0}\{e_o - a + \delta[\pi(a)(e_1 + u(y_g)) + (1-\pi(a))(e_1 + u(y_b)]\}$$

For a^* is characterized by the first-order condition

$$\frac{1}{1+\bar{r}}\pi'(a^*)\,[\,u(y_g) - u(y_b)\,] = 1 \tag{5}$$

which is different from condition (4). The profit maximizing choice $\bar{a}$ is not optimal because it fails to take into account the external effect of investment on the preferences of the consumers: the choice of investment affects not only the expected profit of the club, it also affects the expected utility of the club's supporters by affecting the probability that they will cheer their team at a larger number of games. This can be seen most easily by noting that the first-order condition for Pareto optimality can be written as

$$\frac{1}{1+\bar{r}}\pi'(a^*)\left[(u(y_g) - u'(y_g)y_g) - (u(y_b) - u'(y_b)y_b) + (u'(y_g)y_g - u'(y_b)y_b)\right] = 1,$$

so that the *change in consumer surplus* $\Delta(u(y) - u'(y)y)$ is precisely the term which is missing in the first-order condition (4) for profit maximization. As we show in the next section, since the shareholder value criterion omits the consumer surplus term, the profit-maximizing investment is always less than the socially optimal investment: $(\bar{a} < a^*)$.

Is it possible that the club adopts a 'stakeholder' rather than a 'shareholder' criterion for its choice of investment? In the next section we show that if the club adopts the stakeholder criterion consisting of the sum of profit and consumer surplus then it will indeed be led to the socially optimal choice of investment.[5]

However the reader might ask: what merit is there in analyzing this soccer economy using the probability model outlined above when we know there is a perfectly good Arrow-Debreu

[5] Franck (2009) studies the governance of European soccer clubs and suggests that some of these clubs do indeed adopt a stakeholder approach. Recent empirical studies also suggest that Spanish and English soccer clubs seem to adopt a strategy of win-maximization under a budget constraint rather than a profit maximization strategy (Garcia del Barro-Szymanski (2009)).

(AD) model of the same economy? The merit of the probability model is its simplicity and realism. Only three requirements are needed to make the model work: a knowledge by the agents of the two possible outcomes, qualify or not-qualify, and the way investment in star players affects the probability $\pi(a)$ of qualifying, and that there are contracts based on these two outcomes.

By contrast an examination of the conditions required to apply the Arrow-Debreu model will reveal that they are far more demanding. First and foremost is a complete and complex description of the soccer game setting: the whole edifice rests on the existence of a universal space Ω containing the description of all the possible primitive causes which, when combined with the club's investment, serve to explain why the team qualifies or does not qualify. Furthermore, these primitive causes must be beyond the control of the club, their probabilities being exclusively determined by 'nature'. Finally the description of the primitive causes must be made with sufficient precision to permit contracts based on these contingencies to be traded on competitive markets—in particular every contingency must be observable and verifiable by third parties. All of this excludes the costs of verifying and monitoring the contracts, and running this enormous system of markets.

Even in this simple setting it is hard to conceive of satisfying all these conditions. It would require a complete inventory of all the circumstances which influence the outcome of a season of soccer games—the accidental injury of any of the players, the fortuitous call of the goal keeper in a penalty kick, the possible mistake of a referee, the chemistry between the team's players, ... all the myriad fortuitous circumstances which can transpire during the course of a season of soccer.[6] Despite the overwhelming nature of the task, the Arrow-Debreu model boldly proceeds on the assumption that all the contingencies can be clearly listed and itemized and that tickets contingent on their occurrence can be traded on competitive markets.

Suppose, despite all these reservations, that the reader is ready to accept the validity of the state of nature model, how would an Arrow-Debreu equilibrium for this soccer economy be described? There is a (large) set Ω consisting of all possible states of nature which influence the outcome of a season of soccer games, with $\mathbb{P}(\omega)$ denoting the probability of state $\omega \in \Omega$. For each level of investment $a \geq 0$ there is a subset $\Omega(a) \subset \Omega$ with $\mathbb{P}(\Omega(a)) = \pi(a)$ which leads to the outcome y_g i.e. if $\omega \in \Omega(a)$, $y(\omega, a) = y_g$, the states in the complement $\Omega^c(a)$ leading to the outcome y_b. We assume $\Omega(a)$ is closed and $\Omega(a) \subset \Omega(a')$ if $a' > a$, so that $\pi(a') = \mathbb{P}(\Omega(a')) > \pi(a) = \mathbb{P}(\Omega(a))$. Let

$$A(\omega) = \{a \in \mathbb{R}_+ \,|\, y(\omega, a) = y_g\}$$

denote the set of investment levels which leads to the outcome g if ω occurs. Given the monotonicity assumption, if $a \in A(\omega)$ and $a' > a$ then $a' \in A(\omega)$ so that for each $\omega \in \Omega$ there

[6] Although the lack of realism involved in using the state-of-nature approach for modeling the equilibrium of a production economy—which motivated Magill-Quinzii (2009) to develop the probability approach—does not seem to have been recognized before in the general equilibrium literature, it has been discussed in two interesting papers by Ehrlich and Becker (1972) and Marshall (1976) in the context of the insurance literature. The first paper seriously questioned the ability to fi! nd primitive states whose probabilities are independent of the actions of agents.

exist $\underline{a}(\omega)$ such that $A(\omega) = [\underline{a}(\omega), \infty)$. The club's production function is

$$F(\omega, a) = \begin{cases} y_g & \text{if} \quad a \geq \underline{a}(\omega) \\ y_b & \text{if} \quad a < \underline{a}(\omega) \end{cases} \qquad \forall\, \omega \in \Omega \tag{6}$$

and the utility function of the representative agent is

$$m_0 + \delta \sum_{\omega \in \Omega} \mathbb{P}(\omega)(m_\omega + u(c_\omega)) \tag{7}$$

where for simplicity of notation we act as if Ω were finite.

At date 0 contingent markets for money and soccer tickets can be bought and sold on markets: a money ticket for state ω (or date 0) promises one unit of money if ω occurs (or at date 0) and has price q_ω (or $q_0 = 1$); a soccer ticket for state ω permits the holder attendance to the games if ω occurs and has price p_ω. Let $(q, p) = (1, q_\omega, p_\omega)_{\omega \in \Omega}$ denote the vector of prices and let $(m, c) = (m_0, m_\omega, c_\omega)_{\omega \in \Omega}$ denote the vector of the agent's money and consumption of (attendance at) soccer games. Then an AD equilibrium[7] for the economy is a vector $((\tilde{m}, \tilde{c}, \tilde{a}), (\tilde{q}, \tilde{p}))$ consisting of actions and prices such that

(i) $\tilde{a}$ maximizes shareholder value $SV(a) = \sum_{\omega \in \Omega} \tilde{q}_\omega \tilde{p}_\omega y(\omega, a) - a$

(ii) $(\tilde{m}, \tilde{c})$ maximizes (7) subject to the present value budget constraint $\tilde{q}m + \tilde{p}c = \tilde{q}e + B(\tilde{a})$

(iii) markets clear : $\tilde{m}_0 + \tilde{a} = e_0, \quad \tilde{m}_\omega = e_1,\ \omega \in \Omega \quad \tilde{c}_\omega = y(\omega, \tilde{a}),\ \omega \in \Omega$

In view of the quasi-linearity of the utility function (7), in equilibrium $\tilde{q}_\omega = \delta \mathbb{P}(\omega)$ so that the firm's criterion reduces to maximizing the expected discounted profit $\delta \sum_{\omega \in \Omega} \mathbb{P}(\omega)\tilde{p}_\omega y(\omega, a) - a$. By the First Welfare Theorem the AD equilibrium (if it exists) is such that the club's choice of investment is Pareto optimal ($\tilde{a} = a^*$): so it would seem that if we accept the assumption of contracts contingent on all possible states of nature then profit maximization could lead the club to socially optimal investment. Alas not even this strong assumption would serve to justify profit maximization since, as we show in Appendix A, the more general model which we now introduce has no AD equilibrium.

3 Benchmark Model with Homogeneous Agents

Consider a stochastic production economy with one firm, two dates ($t = 0, 1$) and three goods: labor, a produced good, and a composite good called "money" used as the numeraire. At date 0 there is only money, a part of which can be used to finance investment by the firm. The investment is risky in that there are two possible outcomes: the production function at date 1 can be either $y = f_g(l)$ or $y = f_b(l)$, where f_g and $f_b : \mathbb{R}_+ \to \mathbb{R}$ are differentiable, increasing,

[7] It is well known since Arrow's (1953) original contribution that the Arrow-Debreu equilibrium can be expressed in an equivalent sequential form: for the model here the only difference would be that soccer tickets are sold at date 1 if event ω occurs and the manager of the soccer club would need to correctly anticipate the prices $\tilde{p}_\omega$ to be able to maximize $B(a)$.

concave and satisfy $f_s(0) = 0$, $s = g, b$. The marginal product of f_g is uniformly higher than that of f_b: $f'_g(l) > f'_b(l), \forall\, l > 0$, which implies that $f_g(l) > f_b(l), \forall\, l > 0$. Thus 'g' is the good outcome. The probability $\pi(a)$ of this outcome is determined by the amount of investment a made by the firm at date 0: π is increasing and concave, $0 < \pi(a) < 1, \forall a > 0$ (no amount of investment removes uncertainty), $\pi'(a) \to \infty$ as $a \to 0$, and $\pi'(a) \to 0$ as $a \to \infty$.

There are three "classes": workers, consumers and capitalists. Each is composed of a continuum of identical agents of mass 1. The representative worker, who is also endowed with 1 unit of labor at date 1, consumes only money and has the utility function

$$U^w(m^w, \ell) = m_0^w + \delta \sum_{s=g,b} \pi_s(a)\Big(m_s^w - v(\ell_s)\Big),$$

where $m^w = (m_0^w, m_g^w, m_b^w)$ is worker's consumption of money and ℓ_s is the quantity of labor sold to the firm in outcome s, $s = g, b$. The discount factor satisfies $0 < \delta \leq 1$ and the disutility of labor, $v(\ell) : \mathbb{R}_+ \to \mathbb{R}$, is differentiable, convex and increasing, with $v'(\ell) \to \infty$ if $\ell \to 1$.

The representative consumer, who consumes both money and the produced good, has the utility function

$$U^c(m^c, c) = m_0^c + \delta \sum_{s=g,b} \pi_s(a)\Big(m_s^c + u(c_s)\Big),$$

where $c = (c_g, c_b)$ is the consumption of the produced good in the two outcomes, and u is differentiable, strictly concave and increasing, with $u'(c) \to \infty$ if $c \to 0$.

Finally the representative capitalist, who is the owner of the firm, consumes only money and has the utility function

$$U^k(m^k) = m_0^k + \delta \sum_{s=g,b} \pi_s(a) m_s^k.$$

The money endowments are assumed to be sufficiently large so that non-negativity constraints on consumption never bind.

3.1 Capitalist Equilibrium

We want to define an equilibrium of this economy in which the firm's investment and the choice of labor and output at date 1 are determined in each outcome $s = g, b$. In view of the quasi-linearity of the agents' utility functions, the agents are risk neutral so that neither bonds with payoffs contingent on the outcome g or b, nor an equity market are needed to allow agents to share risks. It suffices to have a riskless bond which permits the transfer of income between date 0 and date 1, and determines the interest rate. Thus a capitalist equilibrium is a sequential equilibrium in which the firm chooses its investment in the best interest of the capitalists and output and labor are allocated competitively at date 1 with spot prices for labor and output that depend on the technology (g or b) which is realized at date 1.[8] In view

[8]The assumption that the firm behaves competitively on the labor and output markets may seem unrealistic but we want to abstract from non-compe! titive behavior on the spot markets to focus on the investment decision. Thus we assume that a "'Competition Authority"' or "'Antitrust Agency"' knows enough about the production possibilities of the firm to penalize any excess profit due to restrictive practices. It would however be difficult for such an institution to use sanctions to enforce an "appropriate" level of investment (which first needs to be determined), especially in a stochastic environment.

of the quasi-linear form of the agents preferences, if we normalize the price of the money good to be 1 at each date, then the equilibrium bond price must be

$$\delta = \frac{1}{1+r}. \tag{8}$$

Let $w = (w_g, w_b)$, $p = (p_g, p_b)$, where (w_s, p_s) denote the wage and the price of the consumption good in outcomes $s = g, b$. Using the quasi-linearity of the utility function to omit the agents' budget constraints, a **capitalist equilibrium** can be defined as follows:

Definition 1: $\Big((\bar{\ell}, \bar{c}), (\bar{a}, \bar{l}), (\bar{w}, \bar{p})\Big)$ is a *capitalist equilibrium* if

(i) labor supply $\bar{\ell} = (\bar{\ell}_g, \bar{\ell}_b)$ maximizes worker's utility:

$$\sum_{s=g,b} \pi_s(\bar{a})\,(\bar{w}_s \ell_s - v(\ell_s)), \qquad s = g, b$$

(ii) consumption demand $\bar{c} = (\bar{c}_g, \bar{c}_b)$ maximizes consumer's utility:

$$\sum_{s=g,b} \pi_s(\bar{a})\,(u(c_s) - \bar{p}_s c_s), \qquad s = g, b$$

(iii) the firm's production plans $(\bar{a}, \bar{l}) = (\bar{a}, \bar{l}_g, \bar{l}_b)$ maximize its shareholder value:

$$SV(a, l) = \sum_{s=g,b} \frac{\pi_s(a)}{1+r} \Big(\bar{p}_s f_s(l_s) - \bar{w}_s l_s\Big) - a \tag{9}$$

(iv) markets clear: $\bar{\ell}_s = \bar{l}_s, \quad \bar{c}_s = f_s(\bar{l}_s), \quad s = g, b.$

In equilibrium the optimal labor choice $\bar{\ell}$ for the workers satisfies

$$v'(\bar{\ell}_s) = \bar{w}_s, \qquad s = g, b \tag{10}$$

and the consumers' optimal choice $\bar{c}$ satisfies

$$u'(\bar{c}_s) = \bar{p}_s, \qquad s = g, b \tag{11}$$

while the capitalists' profit maximizing choice of labor $\bar{l}$ implies that for each outcome at date 1 the real wage equals the marginal product of labor

$$\bar{p}_s f_s'(\bar{l}_s) = \bar{w}_s, \qquad s = g, b \tag{12}$$

Combining (10), (11) and (12) gives the pair of equations

$$u'(f_s(\bar{l}_s)) f_s'(\bar{l}_s) = v'(\bar{l}_s), \qquad s = g, b \tag{13}$$

which defines the equilibrium $\bar{l}$ on the labor market. It is easy to see that $u(f_s(l))$ is strictly concave so that the left side of (13) is strictly decreasing while the right side is increasing. Since $u'(c) \to \infty$ when $c \to 0$ and $v'(l) \to \infty$ when $l \to 1$ there is a always a solution to (13), and the solution is unique.

Let

$$R_s = p_s f_s(l_s) - w_s l_s, \quad s = g, b$$

denote the firms' profit in outcome s, $\bar{R}_s$ denoting its value at equilibrium. Noting that the equilibrium interest rate is given by (8), the equilibrium choice of investment is the solution of the first-order condition

$$\frac{\pi'(\bar{a})}{1+r}\left(\bar{R}_g - \bar{R}_b\right) = 1 \tag{14}$$

if $\bar{R}_g > \bar{R}_b$, and is $\bar{a} = 0$ if $\bar{R}_g \leq \bar{R}_b$. When $\bar{R}_g - \bar{R}_b > 0$, (14) has a unique solution since $\pi'(a)$ decreases from ∞ to 0. Thus under standard assumptions a capitalist equilibrium of this simple economy exists.

The resulting choice of investment is however not socially optimal. To see this, recall that since the agents' preferences are quasi-linear, the Pareto optimal allocation is the solution of the maximum problem

$$\max_{(c_s, l_s, a)} \left\{ e_0 - a + \delta \sum_{s=g,b} \pi_s(a)(e_1 + u(c_s) - v(l_s)) \,\middle|\, c_s = f_s(l_s),\ s = g, b \right\}$$

The first-order conditions for optimal choice of labor l^*

$$u'(f_s(l_s^*))f_s'(l_s^*) = v_s'^*), \qquad s = g, b$$

imply that $(l^*, c^*) = (\bar{l}, \bar{c})$, since (13) has a unique solution. Since the presence of e_1 in the date 1 social utility function does not affect the choice of investment, define the social welfare in outcome s by

$$W_s = u(c_s) - v(\ell_s), \qquad s = g, b$$

$\bar{W}_s = u(f(\bar{l}_s)) - v(\bar{l}_s)$ denoting the value in equilibrium and in the Pareto optimal allocation. In view of (8), the first-order condition for the socially optimal investment is

$$\frac{\pi'(a^*)}{1+r}\left(\bar{W}_g - \bar{W}_b\right) = 1 \tag{15}$$

if $\bar{W}_g > \bar{W}_b$, and $a^* = 0$ if $\bar{W}_g \leq \bar{W}_b$.

Proposition 1. *There is underinvestment in the capitalist equilibrium: $\bar{a} < a^*$.*

Proof: We first show that $\bar{W}_g > \bar{W}_b$, which implies that a^* is positive and defined by (15). Consider the parametrized family of production functions

$$f(t, l) = t f_g(l) + (1 - t) f_b(l), \qquad t \in [0, 1] \tag{16}$$

Note that[9] $f_1 > 0,\ f_2 > 0,\ f_{12} > 0,\ f_{22} < 0$, for all $(t,l) \in [0,1] \times \mathbb{R}_+$. For $t \in [0,1]$ let $l(t)$ denote the solution of the equation

$$u'(f(t,l(t)))f_2(t,l(t)) = v'(l(t)) \tag{17}$$

which generalizes equation (13) determining the optimal choice of labor and let

$$W(t) = u(f(t,l(t))) - v(l(t))$$

be the generalization of the social welfare function W_s, $s = g, b$. In view of (17)

$$\begin{aligned} W'(t) &= u'(f(t,l(t)))\Big(f_1(t,l(t)) + f_2(t,l(t))\, l'(t)\Big) - v'(l(t))\, l'(t) \\ &= u'(f(t,l(t)))f_1(t,l(t)) > 0 \end{aligned}$$

so that $\bar{W}_g = W(1) > W(0) = \bar{W}_b$. Thus $\bar{W}_g$ is indeed the 'good' social outcome. Since $\pi'(a)$ decreases from ∞ to 0, equation (15) has a unique solution $a^* > 0$ which is the socially optimal level of investment. Since the outcome g is better than the outcome b and $\pi'(0) = \infty$, it is always worthwhile for the economy as a whole to make a positive investment at date 0 to make the 'good' outcome more likely.

The social welfare in each outcome s can be expressed as a sum of three components

$$\begin{aligned} W_s &= \Big(u(c_s) - u'(c_s)c_s\Big) + \Big(u'(c_s)c_s - v'(l_s)l_s\Big) + \Big(v'(l_s)l_s - v(l_s)\Big) \\ &= CS_s + R_s + WS_s, \qquad s = g, b \end{aligned}$$

consisting of *consumer surplus* CS_s, *profit* R_s and *worker surplus* WS_s. Since the values of W_s are the same in equilibrium and in the Pareto optimal solution,

$$\bar{W}_g - \bar{W}_b = \Big(\overline{CS}_g + \overline{WS}_g\Big) - \Big(\overline{CS}_b + \overline{WS}_b\Big) + \Big(\bar{R}_g - \bar{R}_b\Big) \tag{18}$$

If $\bar{R}_g - \bar{R}_b \leq 0$ then $\bar{a} = 0$, and the proposition holds since $a^* > 0$. If $\bar{R}_g - \bar{R}_b > 0$, then in view of (14) and (15), showing that $\bar{a} < a^*$ is equivalent to showing that $\bar{W}_g - \bar{W}_b > \bar{R}_g - \bar{R}_b$, and by (18) this is equivalent to showing

$$\overline{CS}_g + \overline{WS}_g > \overline{CS}_b + \overline{WS}_b \tag{19}$$

The proof will be complete if we show that the surplus function

$$\psi(t) \equiv CS(t) + WS(t) \equiv [\, u(f(t,l(t))) - u'(f(t,l(t)))\, f(t,l(t))\,] + [\, v'(l(t))\, l(t) - v(l(t))\,]$$

is increasing on the interval $[0,1]$: note that

$$\psi' = -u'' f_1 f + \Big(v'' l - u'' f_2 f\Big) l' \tag{20}$$

[9]Subindices $i = 1, 2$ denote partial derivatives. For example $f_1 = \frac{\partial f}{\partial t}$. There is no ambiguity with f_s since $s \in \{g, b\}$. Ordenary derivatives are denoted by primes.

where the arguments of the functions are omitted to simplify the notation. Since $l(t)$ is defined by equation (17), applying the Implicit Function Theorem gives

$$l' = -\frac{u'' f_1 f_2 + u' f_{21}}{u''(f_2)^2 + u' f_{22} - v''} \tag{21}$$

where the denominator is negative. Inserting (21) into (20) and collecting terms leads to a numerator which can be written as

$$u'u'' f[\, f_2 f_{21} - f_1 f_{22}\,] + v''u'' f_1 [\, f - f_2 l\,] - v''u' f_{21} l < 0$$

where the middle term is negative since $f(t,\cdot)$ is concave and satisfies $f(t,0) = 0$ so that $f(t,l) - f_2(t,l)l > 0$. Thus $\psi' > 0$ for $t \in [0,1]$, so that $\psi(1) > \psi(0)$, implying (19) and the proof is complete. □

It is clear from the proof that the reason for under-investment in the capitalist equilibrium is that the social criterion differs from the profit criterion by the sum of consumer and worker surplus

$$W_s - R_s = CS_s + WS_s, \qquad s = g, b$$

and this sum of surpluses is greater at g than at b. The profit criterion, by failing to take into account the external effect on the expected consumer-plus-worker surplus, leads to systematic under-investment.

In the Appendix we show that there is no standard equilibrium model of the economy described in this section which is applicable to a setting with large corporations and in which profit maximization leads to a socially optimal outcome. While the Arrow-Debreu model requires an extensive system of markets— which as we discussed in Section 2 would be difficult to implement in practice— it does not require that firms are infinitesimal, provided that they do not seek to manipulate prices by restricting output: any reason which justifies price-taking behavior is acceptable and leads an AD model with profit maximization to a Pareto optimal outcome. However in Appendix A we show that if we use a state-of-nature representation for the economy in this section and introduce markets based on states of nature, then an AD equilibrium does not exist:

Proposition 2. *If we introduce a state-of-nature representation of our model, the corresponding economy has no Arrow-Debreu equilibrium.*

Proof: See Appendix A.

The reason behind inexistence of AD equilibrium is that the production set is not convex. Thus both for reasons of realism and because the requisite convexity assumptions are not satisfied, profit maximization cannot be justified by assuming markets contingent on states of nature.

We show in Appendix B that the simplest way of obtaining an equilibrium with profit maximization which is Pareto optimal is to use the probability approach adopted in this section but replace the (large) firm by a continuum of (small) identical firms with i.i.d. shocks, as in Prescott and Townsend (1984 a,b) or Zame (2002). Then the equilibrium with profit-maximizing firms is Pareto optimal, showing that infinitesimal firms do not create externalities. The model is however no longer applicable to large corporations, traded on the stock market (e.g. firms in the S&P 500) which are the focus of analysis of corporate finance and which, as emphasized by Berle and Means (1932) in their classic study, are completely different entities from the small competitive firms which populate standard equilibrium models.[10]

In the next section we introduce the concept of a stakeholder equilibrium in which the firm's manager maximizes the total value of the firm—the total value consisting of the market value to shareholders and the market value of consumer and worker rights. The objective of the firm becomes the social value of the firm's output and the investment is Pareto optimal.

3.2 Stakeholder Equilibrium

The reason behind the violation of the first Welfare Theorem (the capitalist equilibrium is inefficient) is that the investment decision of the firm impacts the probabilities of the outcomes ($\pi_g(a) = \pi(a)$ and $\pi_b(a) = 1 - \pi(a)$) and therefore the preferences of consumers and workers. This is a particular form of a production externality. Economists (see for example the discussion in Laffont, 1989) have essentially proposed three types of solutions to such externalities: government intervention (through regulation or Pigouvian taxes), internalization within larger entities (by integration of all the parties involved in the externality) or creating tradeable property rights associated with the externality (Coase, 1960).

We follow here the latter (what we call the Coasian approach) and assume that two classes of securities are issued by the firm and traded at date 0: consumer rights and employee rights. These are exclusive rights allowing their owner to buy from (respectively work for) the firm at date 1, irrespectively of the prevailing outcome $s = g, b$, but at equilibrium consumption prices p_s and wages w_s. These securities are initially owned by consumers and workers and can be traded at date 0. The quasi-linearity of preferences has two important consequences: the initial allocation of these securities does not matter, and the (maximum) equilibrium prices of these securities are equal to the expected present values of the surpluses that the firm is anticipated to generate:

$$CV(a, \ell) \equiv \sum_{s=g,b} \frac{\pi_s(a)}{1+r} \left[u(f_s(\ell_s)) - \bar{p}_s f_s(\ell_s)\right] \tag{22}$$

for consumers (where CV stands for consumer value), and

$$WV(a, \ell) \equiv \sum_{s=g,b} \frac{\pi_s(a)}{1+r} \left[\bar{w}_s \ell_s - v(\ell_s)\right] \tag{23}$$

[10]'When Adam Smith talked of "enterprise" he had in mind as the typical unit the small individual firm in which the owner perhaps with the aid of a few . . . workers, labored to produce goods for market ! . . . These units have been supplanted . . . by great aggregations in which tens or even hundreds of thousands of workers and property . . . belonging to tens or even hundred of thousands of individuals are combined through the corporate mechanism into a single producing organization under unified control", Berle and Means (1932, pp.4 &303)

for workers (where WV stands for worker value).

In a **stakeholder equilibrium** the manager is required to maximize the Total Value (TV) of the firm, defined as the sum of shareholder value, consumer value and worker value:

$$TV = SV + CV + WV. \tag{24}$$

Using the definitions of SV (formula (9)), CV (formula (22)), and WV (formula (23)) we obtain a simple expression for the total value of the firm:

$$TV(a, \ell) \equiv \sum_{s=g,b} \frac{\pi_s(a)}{1+r} \left[u(f_s(\ell_s)) - \upsilon(\ell_s)\right] - a. \tag{25}$$

Definition 2: $(\bar{\ell}, \bar{c}), (\bar{a}, \bar{\ell}), (\bar{w}, \bar{p})$ is a *stakeholder equilibrium* if

(i) labor supply $\bar{\ell} = (\bar{\ell}_g, \bar{\ell}_b)$ maximizes worker's utility:

$$\sum_{s=g,b} \pi_s(\bar{a}) \left(\bar{w}_s \ell_s - v(\ell_s)\right), \qquad s = g, b$$

(ii) consumption plans $\bar{c} = (\bar{c}_g, \bar{c}_b)$ maximize consumer's utility:

$$\sum_{s=g,b} \pi_s(\bar{a}) \left(u(c_s) - \bar{p}_s c_s\right), \qquad s = g, b$$

(iii) the firm's production plans $(\bar{a}, \bar{l}) = (\bar{a}, \bar{l}_g, \bar{l}_b)$ maximize its shareholder value:

$$TV(a, \ell) = \sum_{s=g,b} \frac{\pi_s(a)}{1+r} \Big(u(f_s(l_s)) - \upsilon(l_s)\Big) - a \tag{26}$$

(iv) markets clear: $\bar{\ell}_s = \bar{l}_s, \quad \bar{c}_s = f_s(\bar{l}_s), \quad s = g, b.$

So the only difference between this notion of competitive equilibrium (which we call stakeholder equilibrium) and the one given in definition 1 (which we called capitalist equilibrium) is that the firm is required to maximize its total value instead of its shareholder value. This change of objective function is enough to restore optimality of competitive equilibrium.

Proposition 3. *Under the above assumptions, the stakeholder equilibrium exists and is Pareto Optimal.*

Proof: As in the capitalist equilibrium, the allocation of labor $\bar{\ell}_s$ in outcome s is Pareto Optimal and is obtained as the unique solution of equation (12):

$$(12)$$

Moreover there is a unique a that maximizes the total value of the firm. It is characterized by the first order condition:

$$\sum_{s=g,b} \frac{\pi_s'(a)}{1+\bar{r}} \Big(u(f_s(\bar{\ell}_s)) - v(\bar{\ell}_s) \Big) = 1.$$

Equation (12) implies that

$$u\Big(f_s(\bar{\ell}_s) \Big) - v(\bar{\ell}_s) = \bar{W}_s \quad s = g, b.$$

Finally, $\pi_g'(a) = -\pi_b'(a) = \pi'(a)$ so that the above condition is equivalent to condition (15) that characterizes Pareto optimality:

$$\frac{\pi'(a)}{1+\bar{r}} \, (\overline{W_g} - \overline{W_b}) = 1.$$

Therefore the stakeholder equilibrium is unique and Pareto optimal, which ends the proof of Proposition 3. □

3.3 Economists' Views on Stakeholder Theory

[to be written]

4 Heterogeneous Agents

In an economy with identical workers and consumers, instructing the managers of firms to maximize the total value (shareholder + consumer + worker) of these firms restores optimality of competitive equilibrium. However, when there is heterogeneity among workers or consumers, the situation becomes more complex. This section examines the robustness of the stakeholder model to the introduction of such a heterogeneity. For simplicity we go back to the two-good model of section 2 (consumption and money) and assume that consumers' utility functions are parametrized by a parameter θ:

$$U(\theta, m, c) = m_0 + \delta \sum_{s=b,g} \pi_s \Big(m_s + u(\theta, c_s) \Big), \tag{27}$$

where u is concave increasing in c and satisfies $u(0, c) \equiv 0$ and $u_{12} > 0$ (single crossing property).

The parameter θ is privately observed by the consumer but it is common knowledge that it is drawn from a continuous distribution on $(0, 1)$ with cumulative function G and density function g. There is also a mass one of identical capitalists (parametrized by $\theta = 0$) who do not want to consume the good but have money to invest.

4.1 The Capitalists Equilibrium

As in Section 2, there exists a unique "capitalist" equilibrium where, by a straightforward adaptation of Definition 1, consumers maximize their utility function:

$$c_s(\theta) \equiv D(\theta, p_s^c) \quad \text{solves} \quad \max_c \{u(\theta, c) - p_s^c c\} \equiv V(\theta, p_s),$$

investment a^c maximizes shareholder value of the firm:

$$SV(a) = \sum_{s=g,b} \frac{\pi_s(a) p_s^c y_s}{1+r} - a, \tag{28}$$

and markets clear:

$$\int_0^1 D(\theta, p_s^c)\ dG(\theta) = y_s \quad s = g, b. \tag{29}$$

As in Section 2, there is underinvestment since the equilibrium level of investment a^c satisfies

$$\pi'(a^c)(p_g^c y_g - p_b^c y_b) = 1 + r \tag{30}$$

while the socially optimal level of investment a^s satisfies

$$\pi'(a^s) \int_0^1 \Big\{ u(\theta, c_g(\theta)) - u(\theta, c_b(\theta)) \Big\}\ dG(\theta) = 1 + r \tag{31}$$

Since $p_g^c < p_b^c$, we have that $c_g(\theta) > c_b(\theta)$ for all θ. The consumer surplus function being increasing, $u(\theta, c_g(\theta)) - p_g^c c_g(\theta) > u(\theta, c_b(\theta)) - p_b^c c_b(\theta)$ which is equivalent to $u(\theta, c_g(\theta)) - u(\theta, c_b(\theta)) > p_g^c c_g(\theta) - p_b^c c_b(\theta)$. The above integral is thus greater than $p_g^c y_g - p_b^c y_b$. Finally, π' is decreasing thus $a^c < a^s$.

4.2 The optimal mechanism

In our quasi-linear set-up, adverse selection does not introduce any distortion as long as individual rationality constraints can be satisfied for all agents. In that case, it is possible to implement the first best optimum, which is characterized by:

$$\left\{ \begin{array}{l} \max W = e_0 + \frac{e_1}{1+r} - a + \sum_{s=g,b} \frac{\pi_s(a)}{1+r} \int_0^1 u(\theta, c_s(\theta))\ dG(\theta) \\ \\ \text{under the constraints:} \\ \int_0^1 c_s(\theta)\ dG(\theta) = y_s \quad s = g, b. \end{array} \right. \tag{32}$$

The first order conditions for $c_s(\theta)$ give:

$$\frac{\pi_s(a)}{1+r}\ u_2(\theta, c_s(\theta))\ g(\theta) = \lambda_s\ g(\theta), \tag{33}$$

where λ_s is the Lagrange multiplier associated with the feasibility constraint for outcome s. The marginal utility of consumption is thus independent of θ in each outcome s. Given the feasibility constraint, this marginal utility must be equal to the competitive price in outcome s. Thus, the social optimum can be implemented by letting a competitive market operate at $t = 1$:

$$c_s(\theta) = D(\theta, p_s^c) \quad s = g, b, \tag{34}$$

and financing a by monetary contributions $m_0(\theta)$ and $m_s(\theta)$ $(s = g, b)$ of the agents.

By quasi-linearity of consumers' preferences, these monetary contributions can be aggregated into their expected present values:

$$M(\theta) \equiv m_0(\theta) + \sum_{s=g,b} \frac{\pi_s(a)}{1+r}\, m_s(\theta). \tag{35}$$

A direct mechanism can thus be characterized by a mapping $\theta \to (M(\theta), c_g(\theta), c_b(\theta))$. Since θ is private information, the function $M(.)$ must satisfy conditions of incentive compatibility and individual rationality:

Lemma 1: *The mechanism $\theta \to \Big(M(\theta), c_g(\theta), c_b(\theta)\Big)$ is incentive compatible if and only if*

$$M(\theta) = M(0) + \sum_{s=g,b} \frac{\pi_s(a)}{1+r}\, p_s^c c_s(\theta). \tag{36}$$

It is individually rational if and only if $M(0) \leq 0$.

Proof: The utility of a consumer of type θ that declares being of type $\widetilde{\theta}$ is by definition

$$U(\theta, \widetilde{\theta}) = -M(\widetilde{\theta}) + \sum_{s=g,b} \frac{\pi_s(a)}{1+r}\, u(\theta, c_s(\widetilde{\theta})). \tag{37}$$

Incentive compatibility requires that for all θ, the maximum in $\widetilde{\theta}$ must be attained for $\widetilde{\theta} = \theta$. Assuming differentiability we get:

$$M'(\theta) = \sum_{s=g,b} \frac{\pi_s(a)}{1+r}\, u_2(\theta, c_s(\theta))\, \frac{\partial c_s}{\partial \theta}. \tag{38}$$

Since $c_s(\theta) = D(\theta, p_s^c)$ we have $u_2(\theta, c_s(\theta)) \equiv p_s^c$. Thus $M(\theta)$ and $\sum_{s=g,b} \frac{\pi_s(a)}{1+r}\, p_s^c\, c_s(\theta)$ differ by a constant. This constant is equal to $M(0)$, since $c_s(0) \equiv 0$. Finally individual rationality requires that $U(0) \geq 0$ which is equivalent to $M(0) \leq 0$. The proof of Lemma 1 is complete. □

The interpretation of Lemma 1 is natural: efficiency at date 1 requires that consumption be allocated by a competitive market; incentive compatibility requires that, for $\theta > 0$, consumer θ pays the market value $p_s^c c_s(\theta)$ of its consumption in each state while the NPV of the firm's cash flows is shared equally among all agents (capitalists, corresponding to $\theta = 0$ and consumers, corresponding to $\theta > 0$; the total mass of agents is therefore 2). The aggregate budget constraint is: $M(0)+\int_0^1 M(\theta)\, dG(\theta) = a$. Using (36), we see that this aggregate budget constraint is equivalent to:

$$-M(0) = \frac{1}{2}\left[\sum_{s=g,b} \frac{\pi_s(a)}{1+r}\, p_s^c\, y_s - a\right] \geq 0. \tag{39}$$

The only departure from the traditional competitive equilibrium is that the manager must not choose a so as to maximize shareholder value but so as to maximize the total value of the firm:

$$TV(a) = -a + \sum_{s=g,b} \frac{\pi_s(a)}{1+r} \int_0^1 u\Big(\theta, c_s(\theta)\Big)\, dG(\theta). \tag{40}$$

Proposition 4. *Assume shareholder value is positive when the firm selects the socially optimal level of investment a^w:*

$$\sum_{s=g,b} \frac{\pi_s(a^w)}{1+r}\, p_s^c\, y_s > a^w. \tag{41}$$

Then the first best can be implemented as follows:

- *The good is sold at competitive market prices $p_s^c(s = g, b)$ at date 2,*
- *a^w is chosen so as to maximize the total value of the firm (expected present value of profit plus consumer surplus) $TV(a)$,*
- *a^w is financed by equity.*

An obvious criticism to Proposition 4 is that the manager is supposed to know the distribution of types and the parametrization of preferences, in order to compute the total value of the firm $TV(.)$. We now consider the case where the manager is only supposed to observe the prices of shares and consumer rights, and select the level of a that maximizes the total value of these securities. This is what we call the "Coasian" solution.

4.3 The Coasian Solution

The firm issues a certain number N of exclusive consumer rights at date 0: only the consumers who own one of these rights are allowed to consume[11] at date 1. Of course some consumers are not ready to pay the fee attached to these rights. We denote by $\hat{\theta}$ the marginal consumer type (this means that consumers in $[0, \hat{\theta}\,]$ are excluded) so that $N = 1 - G(\hat{\theta})$.

The competitive equilibrium at date 1 in state s is obviously modified by this exclusion. Let us denote the new competitive price by $p_s(\hat{\theta})$. The market value of these consumer rights is given by

$$q = \sum_{s=g,b} \frac{\pi_s(a)}{1+r}\, V\Big(\hat{\theta}, p_s(\hat{\theta})\Big). \tag{42}$$

[11] Interestingly, some US football teams have started issuing "personal seat licenses" that give to their holders the exclusive right to purchase season-tickets. The proceeds are typically used to finance the construction of a new stadium (New York Magazine 2008).

We will parametrize the firm by $\hat{\theta}$, which characterizes the degree of "consumer friendliness" of this firm and is, for the moment, taken as given. We want to compare the social performance of the firm as a function of this parameter $\hat{\theta}$. For this, we compute social welfare (up to a constant) for a firm of type $\hat{\theta}$ that chooses investment a

$$W(\hat{\theta}, a) = -a + \sum_{s=g,b} \frac{\pi_s(a)}{1+r} \int_{\hat{\theta}}^{1} u\Big(\theta, D(\theta, p_s(\hat{\theta}))\Big) \, dG(\theta). \tag{43}$$

Finally, we assume that the firm's manager is instructed to maximize the total value of the firm (value of shares plus value of consumer rights minus investment)

$$TV(a, \hat{\theta}) = -a + \sum_{s=g,b} \frac{\pi_s(a)}{1+r} \Big[p_s(\hat{\theta}) y_s + \{1 - G(\hat{\theta})\} \; V(\hat{\theta}, p_s(\hat{\theta})) \Big]. \tag{44}$$

Denoting by $a(\hat{\theta})$ the value of a that maximizes $TV(a, \hat{\theta})$, we can evaluate the social performance of the firm of type $\hat{\theta}$ by the function $W(\hat{\theta}, a(\hat{\theta}))$. This function is continuous in $\hat{\theta}$ and has thus a maximum on the interval $[0, 1]$. The precise value of this maximum is likely to be a very complicated function of preferences and technology but the next proposition shows that it is never $\hat{\theta} = 0$, which corresponds to (classical) capitalism. Indeed when $\hat{\theta} = 0$, the value of consumer rights is 0 (this is because $V(0, p) \equiv 0$) and the firm maximizes shareholder value. The next proposition thus shows that reforming capitalism by taking into account, even marginally, the interests of consumers (and workers) can only increase social welfare.

Proposition 5. *Capitalism is a local minimum:*

$$\frac{d}{d\hat{\theta}} \Big(W(\hat{\theta}, a(\hat{\theta})) \Big)_{\hat{\theta}=0} > 0. \tag{45}$$

Proof: We have to establish that

$$\frac{\partial W}{\partial \hat{\theta}} + \frac{\partial W}{\partial a} \frac{da}{d\hat{\theta}} \text{ is positive when } \hat{\theta} = 0. \tag{46}$$

This results from three lemmas:

- **Lemma 2:** $\frac{\partial W}{\partial \hat{\theta}}(0, a(0)) = 0.$
- **Lemma 3:** $\frac{\partial W}{\partial a}(0, a(0)) > 0.$
- **Lemma 4:** $\frac{da}{d\hat{\theta}}(0) > 0.$

Proof of Lemma 2: $W(\hat{\theta}, a) = -a + \sum_{s=g,b} \frac{\pi_s(a)}{1+r} \; W_s(\hat{\theta})$ where $W_s(\hat{\theta})$ is the maximum of $\int_{\hat{\theta}}^{1} u\Big(\theta, c_s(\theta)\Big) \, dG(\theta)$ under the constraint that $\int_{\hat{\theta}}^{1} c_s(\theta) \, dG(\theta) = y_s$. By the envelope theorem: $\frac{dW_s}{d\hat{\theta}} = -g(\hat{\theta}) \Big[u(\hat{\theta}, c_s(\hat{\theta})) - p_s(\hat{\theta}) c_s(\hat{\theta}) \Big]$. Since $U(0, c) \equiv 0$, this is zero when $\hat{\theta} = 0$. $\square$

Proof of Lemma 3: This is a direct consequence of Proposition 1: there is underinvestment in the capitalist equilibrium. $\square$

Proof of Lemma 4: Since $a(\hat{\theta})$ is obtained by maximizing $TV(a, \hat{\theta})$, the desired result $\frac{da}{d\hat{\theta}} > 0$ will be a consequence of $\frac{\partial^2 TV}{\partial a \partial \hat{\theta}} > 0$. Note first that

$$\frac{\partial TV}{\partial a} = -1 + \frac{\pi'(a)}{1+r} \left[U_g(\hat{\theta}) - U_b(\hat{\theta})\right], \tag{47}$$

where $U_s(\hat{\theta}) = p_s(\hat{\theta})y_s + \{1 - G(\hat{\theta})\}\ V(\hat{\theta}, p_s(\hat{\theta}))$. Now,

$$\begin{aligned}\frac{dU}{d\hat{\theta}} = \frac{dp_s}{d\hat{\theta}}\Big[y_s + \{1 - G(\hat{\theta})\}\ \frac{\partial V}{\partial p}(\hat{\theta}, p_s(\hat{\theta}))\Big] - g(\hat{\theta})\ V(\hat{\theta}, p_s(\hat{\theta})) \\ + \{1 - G(\hat{\theta})\}\ \frac{\partial V}{\partial \hat{\theta}}(\hat{\theta}, p_s(\hat{\theta})).\end{aligned} \tag{48}$$

When $\hat{\theta} = 0, \frac{\partial V}{\partial p}(\hat{\theta}, p_s(\hat{\theta})) = V(\hat{\theta}, p_s(\hat{\theta})) = 0$, and $\frac{\partial V}{\partial \hat{\theta}}(\hat{\theta}, p_s(\hat{\theta})) > 0$. Moreover $p_s(\hat{\theta})$ solves

$$\int_{\hat{\theta}}^{1} D(\theta, p)\ dG(\theta) = y_s \tag{49}$$

Thus

$$-D(\hat{\theta}, p_s(\hat{\theta}))\ g(\hat{\theta}) + \frac{dp_s}{d\hat{\theta}} \int_{\hat{\theta}}^{1} \frac{\partial D}{\partial p}(\theta, p_s(\hat{\theta}))\ dG(\theta) = 0. \tag{50}$$

Since $D(0, p) \equiv 0$ and $\frac{\partial D}{\partial p} < 0$ for $\theta > 0$, $\frac{dp_s}{d\hat{\theta}}(0) = 0$ and the proof is complete. $\square$

$\square$

5 Conclusion

This paper argues that the "state-of-nature" modeling of uncertainty in Arrow (1953) and Debreu (1959), which constitute the theoretical justifications of the profit maximizing criterion, is inappropriate for capturing the idiosyncratic risks of firms. We offer an alternative model where probabilities of productive outcomes are endogenous, and investment decisions of firms exert externalities on their consumers and employees. Since shareholders do not internalize these externalities, firms' investment decisions are typically sub-optimal, which is particularly damaging in the case of large firms.

In a sense, the problem can be viewed as a consequence of a subtle way large firms can exert their market power and increase their expected profits at the expense of social welfare. In the certainty case, this exercise of market power can be seriously limited by Competition Authorities, provided they can observe deviations between prices and marginal costs. The particular distortion identified here is likely to be difficult to monitor, given that it does not manifest itself by excessive profit margins, but by insufficient investment on quality control or productivity gains.

In fact most societies, even the most "business-friendly", have long recognized the dangers of large capitalist firms and found ways to protect consumers and workers. In the USA and the UK, the judicial system is viewed as the predominant instrument for that purpose: courts are there to enforce the laws that have been designed to protect consumers and workers from the excesses of large capitalist firms. In Continental Europe, government intervention, either through regulation (minimum wages, safety standards, product quality, controls) or even taxation (e.g. Blanchard and Tirole 2008) is viewed as the most natural mode of protection of consumers and workers.

Our approach is complementary: we consider that contracts between stakeholders are the most efficient way to improve the functioning of firms viewed as "multi-sided platforms" (and allow them to internalize the "local" externalities between the three main types of stakeholders: financiers, workers and consumers. We do not put forward any miracle solution, given the stylized character of our model of the firm. We just argue that allowing some degree of experimentation towards new, hybrid, forms of corporate charters is likely to improve upon the currently dominant form of capitalism that is only preoccupied by profit maximization.

APPENDIX

A Non-Existence of Arrow-Debreu Equilibrium

In this appendix we show if we introduce a state-of-nature representation for the model of Section 3, the corresponding economy has no AD equilibrium. Proceeding as in Section 2, we represent the states (circumstances) which explain why the investment of the firm leads to the good or the bad technology by a probability space $(\Omega, \mathcal{B}, \mathbb{P})$, where Ω is a large but finite set of states of nature, $\mathcal{B}$ is the collection of subsets of Ω and $\mathbb{P}(B)$ the probability of any subset $B \in \mathcal{B}$. We assume that all agents know this basic probability space. For each level of investment a there is a subset $\Omega(a) \subset \Omega$ with $\mathbb{P}(\Omega(a)) = \pi(a)$ which leads to the good technology f_g; $a' > a$ implies $\Omega(a) \in \Omega(a')$ so that $\pi(a') > \pi(a)$. Consider all the investment levels which lead to f_g if ω occurs

$$A(\omega) = \{a \in \mathbb{R}_+ \,|\, \omega \in \Omega(a)\}$$

Given the monotonicity assumption, $A(\omega)$ is a half line: if we let $\underline{a}(\omega) = \inf\{a \,|\, a \in A(\omega)\}$ and we assume that $A(\omega)$ is closed, then $A(\omega) = [\,\underline{a}(\omega), \infty)$. The state-dependent production function[12] for the firm is

$$F_\omega(a, l) = \begin{cases} f_g & \text{if} \quad a \geq \underline{a}(\omega) \\ f_b & \text{if} \quad a < \underline{a}(\omega) \end{cases} \tag{51}$$

The workers' preferences are given by

$$U^c = m_0^w + \delta \sum_{\omega \in \Omega} \mathbb{P}_\omega (m_\omega^w - v(\ell_\omega)) \tag{52}$$

the consumers' preferences by

$$U^c = m_0^c + \delta \sum_{\omega \in \Omega} \mathbb{P}_\omega (m_\omega^c + u(c_\omega)) \tag{53}$$

and the capitalists preferences by

$$U^k = m_0^k + \delta \sum_{\omega \in \Omega} \mathbb{P}_\omega m_\omega^k \tag{54}$$

We let $\mathcal{E}$ denote the economy with preferences,endowment and technology $(U^w, U^c, U^k, e_0, e_1, F)$.

A complete set of contingent contracts promising the delivery of one unit of money, or of the consumption good, or of labor, are traded at date 0. We normalize the price of money to be 1 at date 0. Given the agents' preferences the price of a promise to deliver 1 unit of money

[12] In order that the production set be closed we could define the production correspondence by (51) if $a \neq \underline{a}$ and by $F_\omega(a, l) \in \{t f_g(l) + (1-t) f_b(l), t \in [0, 1]\}$ if $a = \underline{a}$, but this would not change any result in the analysis below.

un state ω must be $\delta\mathbb{P}_\omega$ so we do not introduce a separate notation for this price. As for the price of a promise to deliver one unit of labor and the produced good in state ω, we denote them by $\delta\mathbb{P}_\omega w_\omega$ and $\delta\mathbb{P}_\omega p_\omega$ respectively. Factoring out $\delta\mathbb{P}_\omega$ from the prices makes it easier to write the equilibrium.

A worker chooses $(m^w, \ell) = (m^w_\omega, \ell_\omega)_{\omega\in\Omega}$ to maximize (52) subject to the budget constraint

$$m^w_0 + \delta \sum_{\omega\in\Omega} \mathbb{P}_\omega\, m^w_\omega = \frac{1}{3}(e_0 + \delta e_1) + \delta \sum_{\omega\in\Omega} \mathbb{P}_\omega\, w_\omega\, \ell_\omega \tag{55}$$

which is equivalent to choosing ℓ to maximize

$$\delta \sum_{\omega\in\Omega} \mathbb{P}_\omega \left(w_\omega\, \ell_\omega - v(\ell_\omega)\right) \tag{56}$$

the choice among money streams being then indeterminate among those satisfying (55). In the same way a consumer chooses $(m^c, c) = (m^c_\omega, c_\omega)_{\omega\in\Omega}$ to maximize (53) subject to the budget constraint

$$m^c_0 + \delta \sum_{\omega\in\Omega} \mathbb{P}_\omega \left(m^c_\omega + p_\omega\, c_\omega\right) = \frac{1}{3}(e_0 + \delta e_1) \tag{57}$$

which is equivalent to choosing c to maximize

$$\delta \sum_{\omega\in\Omega} \mathbb{P}_\omega \left(u(c_\omega) - p_\omega\, c_\omega\right) \tag{58}$$

and the agent is indifferent among the money streams satisfying (57). Finally a capitalist chooses m^k to maximize maximize (54) subject to the budget constraint

$$m^k_0 + \delta \sum_{\omega\in\Omega} \mathbb{P}_\omega\, m^k_\omega = \frac{1}{3}(e_0 + \delta e_1) + \left[\delta \sum_{\omega\in\Omega} \mathbb{P}_\omega \Big(p_\omega\, F_\omega(a, l_\omega) - w_\omega\, l_\omega\Big) - a\right] \tag{59}$$

All capitalists agree that the firm's manager should choose (a, l) so to maximize the (present value of) profit

$$R = \delta \sum_{\omega\in\Omega} \mathbb{P}_\omega \Big(p_\omega\, F_\omega(a, l_\omega) - w_\omega\, l_\omega\Big) - a \tag{60}$$

and are indifferent to all streams of money consumption satisfying (59). The indeterminacy of agents' money consumption streams implies that if the produced good market and the labor market clear in every state ω, the consumption streams of money can be chosen such that the market for money clear at each date and all states of nature: thus we can omit mentioning the markets for money in the description of the equilibrium.

Definition A1. $\Big((\tilde{\ell}, \tilde{c}), (\tilde{a}, \tilde{l}), (\tilde{w}, \tilde{p})\Big)$ is a (simplified) *Arrow-Debreu (AD) equilibrium* if

(i) $\tilde{\ell}$ maximizes (56) given $\tilde{w}$

(ii) $\tilde{c}$ maximizes (58) given $\tilde{p}$

(iii) $(\tilde{a}, \tilde{l})$ maximizes (60) given $(\tilde{w}, \tilde{p})$

(iv) markets clear: $\tilde{c}_\omega = F_\omega(a, \tilde{l}_\omega), \quad \tilde{\ell}_\omega = \tilde{l}_\omega, \quad$ for all $\omega \in \Omega$.

In Section 2 we expressed reservations about the realism of assuming that there are markets contingent on states of nature. We now show even if we accepted this strong assumption it would not suffice to solve the inefficiency, since this economy has no Arrow-Debreu equilibrium.

Proposition A1. (Non-existence) *The economy $\mathcal{E}$ has no Arrow-Debreu equilibrium.*

Proof: Suppose $\Big((\tilde{\ell}, \tilde{c}), (\tilde{a}, \tilde{l}), (\tilde{w}, \tilde{p})\Big)$ is an AD equilibrium. By the First Theorem of Welfare Economics and Proposition 1, $\tilde{a} = a^* > 0$. In all the states $\omega \in \Omega(\tilde{a})$, $F_\omega(\tilde{a}, \cdot) = f_g$ and the demand and supply conditions are the same. Thus $(\tilde{w}_\omega, \tilde{p}_\omega) = (\bar{w}_g, \bar{p}_g)$ where $(\bar{w}_g, \bar{w}_g)$ are the spot prices of the capitalist equilibrium. If $\omega \notin \Omega(\tilde{a})$, then $(\tilde{w}_\omega, \tilde{p}_\omega) = (\bar{w}_b, \bar{p}_b)$.

Suppose the firm considers increasing the investment from $\tilde{a}$ to $a > \tilde{a}$, *taking the prices* $(\tilde{w}_\omega, \tilde{p}_\omega)$ *as given.* In the states of the subset $\omega \in \Omega(a) \backslash \Omega(\tilde{a})$ of measure $\pi(a) - \pi(\tilde{a})$ the firm operates f_g facing the prices $(\bar{w}_b, \bar{p}_b)$ leading to a change in (spot) profit

$$\Delta B^b = \max_{l \geq 0} \{\bar{p}_b f_g(l) - \bar{w}_b l\} - \max_{l \geq 0} \{\bar{p}_b f_b(l) - \bar{w}_b l\}$$

In all other states a and $\tilde{a}$ give the same profit. Thus the difference in the present value of the profit, net of investment is

$$\delta\left(\pi(a) - \pi(\tilde{a})\right) \Delta B^b - (a - \tilde{a})$$

A necessary condition for $\tilde{a}$ to be optimal is that the increase in cost is more that the additional profit i.e.

$$\delta \, \frac{\pi(a) - \pi(\tilde{a})}{a - \tilde{a}} \, \Delta B^b \leq 1, \qquad \forall \, a > \tilde{a}$$

which requires that

$$\pi'(\tilde{a}) \, \Delta B^b \leq (1 + \bar{r}) \tag{61}$$

where $\bar{r}$ is the implicit interest rate in equilibrium given by $\delta = \frac{1}{1+\bar{r}}$.

A similar reasoning for a deviation $a < \tilde{a}$ shows that the loss in profit

$$\Delta B^g = \max_{l \geq 0} \{\bar{p}_g f_g(l) - \bar{w}_g l\} - \max_{l \geq 0} \{\bar{p}_g f_b(l) - \bar{w}_g l\}$$

in the states $\omega \in \Omega(\tilde{a}) \backslash \Omega(a)$ where the firm operates f_b and faces prices $(\bar{w}_g, \bar{p}_g)$ must be higher than the saving in the investment cost:

$$\delta\left(\pi(\tilde{a}) - \pi(a)\right) \Delta B^g \geq \tilde{a} - a, \qquad \forall \, a < \tilde{a}$$

which requires that

$$\pi'(\tilde{a}) \, \Delta B^g \geq (1 + \bar{r}) \tag{62}$$

Let us show that (61) and (62) cannot hold at the same time, because $\Delta B^b > \Delta B^g$. This will show that there is no positive investment which maximizes the profit (60) and thus that there is no AD equilibrium.

To show this property we use the function $f(t,l)$ defined in (16) and the hypothetical equilibrium $(c(t), l(t), p(t), w(t))$ which would hold in a spot economy in which the characteristics of the consumer and workers are those of this section and the firm has technology $f(t,\cdot)$.

$$c(t) = f(t, l(t)), \quad w(t) = v'(l(t)), \quad p(t) = u'(f(t, l(t)))$$

where $l(t)$ is defined by (17). Define

$$R(t,t') = \max_{l\geq 0}\{p(t)f(t',l) - w(t)l\}$$

to be the profit obtained by operating the technology $f(t',\cdot)$ when prices are those corresponding to the the equilibrium with technology $f(t,\cdot)$. We want to show that

$$\Delta B^b = R(0,1) - R(0,0) > R(1,1) - R(1,0) = \Delta B^g$$

A sufficient condition for this is that $\dfrac{\partial^2 R}{\partial t \partial t'}(t,t') < 0$. The following Lemma thus concludes the proof of Proposition 2:

Lemma A2. $R_{12}(t,t') = \dfrac{\partial^2 R}{\partial t \partial t'}(t,t') < 0$ *for all* $(t,t') \in [0,1] \times [0,1]$.

Proof of Lemma A2. Let $L(t,t')$ denote the optimal labor choice which maximizes $R(t,t')$. It is defined by the first-order condition

$$p(t)f_2(t', L(t,t')) = w(t)$$

By the envelope theorem

$$R_2(t,t') = p(t)f_1(t', L(t,t'))$$

so that

$$R_{21}(t,t') = p'(t)f_1(t', L(t,t')) + p(t)f_{12}(t', L(t,t')L_1(t,t')$$

Since $f_1 > 0, p > 0, f_{12} > 0$, showing that $R_{12} < 0$ amounts to showing that (i) $p'(t) < 0$, and (ii) $L_1(t,t') < 0$. In proving (i) and (ii) we often omit the arguments of the functions in order to simplify notation.

(i) $p'(t) = \frac{d}{dt}u'''(f_1 + f_2\, l')$. Inserting the expression for l' calculated in (21), it is easy to see that $p'(t) > 0$: a better technology decreases the equilibrium price of the output.

(ii) Let $\rho(t) = \frac{w(t)}{p(t)}$ be the relative price of labor with respect to output in the 't' equilibrium. The FOC defining L can be written as

$$f_2(t', L(t,t')) = \rho(t) \Longrightarrow f_{22}(t', L(t,t'))\, L_1(t,t') = \rho'(t)$$

Since $f_{22} < 0$, the proof of (ii) consists in showing that $\rho'(t) > 0$: when the technology improves the price of labor relative to the price of output increases.

$$\rho'(t) = \frac{d}{dt}\left(\frac{u'(f(t,l(t))}{v'(l(t))}\right) = \frac{v'''(f_1 + f_2 l') - u'''l'}{(v'^2}$$

Inserting the value of l' calculated in (21) leads to

$$\rho' = \frac{v''' f_1(u''(f_2)^2 + u' f_{22} - v'') - (v''' f_2 - u''')(u'' f_1 f_2 + u' f_{12})}{(v'^2\,(u''(f_2)^2 + u' f_{22} - v'')} \equiv \frac{N}{D}$$

D is negative and after simplification

$$N = v'u'''(f_1 f_{22} - f_2 f_{21}) + (u'^2\,v'' f_{21} - v''u'' f_1(v' - u' f_2)$$

The first two terms are negative and the last one is zero since $v' - u' f_2 = 0$ is the first-order condition defining $l(t)$. Thus $N < 0$ and ρ' is positive, which concludes the proof of the lemma. □

The proof of non-existence of equilibrium rests on the fact that the price-taking assumption in an AD equilibrium implies that the firm considers deviations in which it produces with technology f_b when the prices are 'made for' technology f_g and conversely. From any candidate equilibrium investment $\bar{a}$ there is always a deviation which appears to be profitable so there is no solution to profit maximization. One might think that this comes from the assumption that there is only one firm so that the 'thought experiment' of deviating without changing the price is not reasonable. However if we assumed that there were a continuum of mass 1 of identical firms with production function F to justify the price taking assumption, an equilibrium would still not exist since the proof of Proposition A1 would be unchanged. Convexifying this type of model requires both a continuum of firms and i.i.d. shocks to their draws of technology at date 1.

B Optimality of Profit Maximization with Continuum of Firms

To be finished

References

Allen, F. (2005), "Corporate Governance in Emerging Economies",*Oxford Review of Economic Policy* 21, 164-177.

Allen, F., E. Carletti and R. Marquez (2009), "Stakeholder Capitalism, Corporate Governance and Firm Value",*discussion paper, electronic copy available at http://ssrn.com/abstract=9681411.*

Arrow K. J. (1953) , "Le Role des Valeurs Boursières pour la Répartition la Meilleure des Risques, *Econométrie, Colloques Internationaux du Centre National de la Recherche Scientifique*, **40**, 41-47; English version: "The Role of Securities in the Optimal Allocation of Risk Bearing", *Review of Economic Studies*, **31**, 91-96 (1964).

Arrow, K.J. (1971), "Appendix to: The Role of Securities in the Optimal Allocation of Risk Bearing", in *Theory of Risk Bearing* , Chicago: Markham Publishing Company.
Coase, R.H. (1960), "The Problem of Social Cost", *Journal of Law and Economics* 3, 1-44.

Demichelis, S. and K. Kirzberger (2010), "A General Equilibrium Analysis of Corporate Control and the Stock Market", forthcoming, Economic Theory.

Ehrlich I. and G.S. Becker (1972), "Market Insurance, Self Insurance, and Self Protection", *Journal of Political Economy*, 80, 623-648.

Friedman, M. (1970), "Social Responsibility of Business", *The New York Times*, September 13, 1970; reprinted in *An Economist's Protest*, New-Jersey: Thomas Horton and Co., (1972).

Garcia del Barro, P. and S. Szymanski (2009), "Goal! Profit Maximization versus Win Maximization in Soccer", *Review of Industrial Organization*, 34, 45-68.

Jensen, M. (2001), "Value Maximization, Stakeholder Theory and the Corporate Objective Function", *Journal of Applied Corporate Finance* 14, 8-21.

Laffont, J.J. (1989), *Fundamental of Public Economics*, M.I.T. Press, Cambridge USA.

Magill, M. and M. Quinzii (2008), "Normative Properties of Stock Market Equilibrium with Moral Hazard", *Journal of Mathematical Economics*, 44, 785-806.

Magill, M. and M. Quinzii (2009), "The Probability Approach to General Equilibrium with Production", *Economic Theory*, 39, 1-41.

Marshall J.M. (1976), "Moral Hazard", *American Economic Review*, 66, 880-890.

Prescott, E.C. and R.M. Townsend (1984a), "Pareto Optima and Competitive Equilibria with Adverse Selection and Moral Hazard", *Econometrica* 52,21-46.

Prescott, E.C. and R.M. Townsend (1984b), "General Competitive Analysis in an Economy with Private Information", *International Economic Review* 25,1-20.

Shleifer, A and R.W. Vishny (1997), “A Survey of Corporate Governance,” *Journal of Finance*, 52, 737-783.

Tirole, J. (2001), “Corporate Governance”, *Econometrica*, 69, 1-35.

Tirole, J. (2006), *The Theory of Corporate Finance*, Princeton: Princeton University Press.

Yoshimuri, M. (1995), “Whose Company Is It: The Concept of Corporation in Japan and in the West,” *Long Range Planning*, 28(4), 33-44.

Zame W. R. (2007), ”Incentives, Contracts and Markets: A General Equilibrium Theory of Firms,” *Econometrica*, 75, 1453-1500.