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A THEORY OF THE STAKEHOLDER CORPORATION

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There is a widely held view within the general public that large corporations should act in the interests of a broader group of agents than just their shareholders (the stakeholder view). This paper presents a framework where this idea can be justified. The point of departure is the observation that a large firm typically faces endogenous risks that may have a significant impact on the workers it employs and the consumers it serves. These risks generate externalities on these stakeholders which are not internalized by shareholders. As a result, in the competitive equilibrium, there is under-investment in the prevention of these risks. We suggest that this under-investment problem can be alleviated if firms are instructed to maximize the total welfare of their stakeholders rather than shareholder value alone (stakeholder equilibrium). The stakeholder equilibrium can be implemented by introducing new property rights (employee rights and consumer rights) and instructing managers to maximize the total value of the firm (the value of these rights plus shareholder value). If there is only one firm, the stakeholder equilibrium is Pareto optimal. However, this is not true with more than one firm and/or heterogeneous agents, which illustrates some of the limits of the stakeholder model.

KEYWORDS: Endogenous uncertainty, stakeholder model.

1. INTRODUCTION

THERE IS A WIDELY HELD VIEW WITHIN THE GENERAL PUBLIC that firms—especially large corporations—should act in the interests of a broader group of agents than just their shareholders, or in other words, that the quest for profit should not be the sole objective of a corporation. This stakeholder view of the corporation is especially prevalent in countries such as France, Germany, and Japan, much less so in the Anglo-Saxon countries, the United Kingdom and the United States. This has been documented in an interesting paper by Yoshimori (1995). Asked in a survey to choose between the view that the corporation should be run "for the interests of all stakeholders" versus "shareholder interest should be given first priority," 97% of CEOs in Japan and 84% in Germany

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chose the stakeholder view, whereas 76% of CEOs in the United States and 70% in the United Kingdom chose the shareholder view.

The stakeholder view expressed by most Japanese and German CEOs reflects the view commonly held by the public in these countries, but it is not shared by most economists, nor apparently by the public in the Anglo-Saxon world. One explanation for the difference may be that non-Anglo-Saxons have not understood the working of the "invisible hand": with perfect markets, maximizing profit, apparently in the exclusive interest of shareholders, ends up acting in the best interest of all stakeholders of the firm—in particular its consumers, workers, and shareholders.

There is, however, another possible explanation. Firms create externalities and this implies that markets are not "perfect." The intuition of the non-Anglo-Saxon public may be that firms need to pay attention to the interests of all the agents who are affected by their decisions, that is, their stakeholders, in addition to the profit that they generate for their shareholders. This paper presents a framework where this latter idea can be formalized.

The point of departure is the observation that all firms operate in an environment in which they face risks, some of them exogenous, linked to the general state of the economy, many of them endogenous, linked to the particular circumstances of the firm. A firm has no control over exogenous aggregate risks, while typically it can control the risks which are specific to its technology or its market by spending resources to increase the probability of favorable outcomes and/or decrease the probability of adverse outcomes; for this reason, we call these risks *endogenous*. The economics and finance literature has mainly studied exogenous risks; this paper focuses on endogenous risks over which a firm has some control, but at a cost.

When a firm is large—or at least large relative to the sector in which it operates or to the geographic area in which it draws its labor—its success or failure can have a significant impact on the consumers it serves and the workers it employs. If such a firm can spend resources to control its risks, its investment decision impacts not only its shareholders but also its consumers and employees. However, if its investment decision is based on the profit criterion, then it acts in the interests of its shareholders but fails to take into account the interests of its other stakeholders—its consumers and employees—who are also affected by its decision.

To formalize the endogenous risks, we consider a setting where a firm makes an investment decision that affects the likelihood of achieving a more or less productive technology. The more productive technology can be viewed as the outcome of a *firm-specific innovation* which will succeed with some probability—the greater the firm's investment, the greater its probability of success. Alternatively, the less productive technology can be viewed as the outcome of a failure or accident in the production process, and more investment reduces the likelihood of such adverse outcomes. Restructuring of a company and/or improvement in the technology or design of its products are examples of firm-specific innovations, while investment on maintenance and quality control and on the safety of its products to minimize the risk of adverse outcomes are examples of investment in risk reduction.

To model the fact that the firm is large, we assume that the prices on the product and labor markets differ depending on whether the "good" or the "bad" technology is realized; thus, the firm is sufficiently large to have market impact. Since investment by the firm shifts probability to the outcome where it is more productive, reducing the expected price of its output and increasing the expected wage of its employees, the firm's investment influences the expected utilities of consumers and workers: maximizing expected profit does not internalize the effect of the investment on the expected utilities of consumers and workers, so that "shareholder value maximization" is not the correct "social criterion" and leads to systematic under-investment by the firm. The inefficiency can be attributed to a form of pecuniary externality of the firm's investment: increasing investment changes expected prices and wages and, at a profit-maximizing equilibrium, the increased cost of investment equals the increase in the firm's expected profit on the spot markets, but this is less than the increase in expected total surplus.

The presence of externalities brings to mind the use of government taxes and subsidies as a corrective device. Indeed, Greenwald and Stiglitz (1986) have presented a general equilibrium framework for studying Pareto improving taxes (subsidies) in the presence of either technological or pecuniary externalities. In our setting, a subsidy to the firm's investment would improve on the shareholder equilibrium; however, we argue that the internal nature of the investment and the possible improvements to which it leads make it difficult for a regulator to have sufficient information to subsidize exactly the type of expenses that would reduce the risks of adverse outcomes or improve the productive efficiency of the firm. Assuming that agents close to the firm—the shareholders, the consumers, and certainly the workers—have better information than a regulator about the costs and possible improvements to the technology of a company, it seems natural to study whether the firm can be led to internalize the externality by including the interests of consumers and workers in the criterion it uses for its choice of investment.

We are thus led to study the equilibrium that results when the criterion of the firm is changed from maximization of expected profit to maximization of the expected total value for the stakeholders—the value to consumers measured by the consumer surplus, the value to the workers measured by the worker surplus, and the value to shareholders measured by profit. Although motivated by the desire to correct the under-investment in risk control arising with the profit criterion, the adoption of the stakeholder criterion also corrects the inefficiency in the labor-output decision arising from the firm's exploitation of its market power under the profit criterion. When consumers, workers, and shareholders are taken into account, there is no reason to exploit one group of stakeholders (the consumers or the workers) to benefit the shareholders.

As a result, when the firm under consideration is a monopoly using the stakeholder criterion, the equilibrium is Pareto optimal: the labor decision and the investment in risk reduction are optimally chosen.

Stakeholder theory has been discussed in the management science and law literatures,[2] mostly informally, but is viewed with suspicion in corporate finance and economics. Since the influential book of Berle and Means (1932), the emphasis in economics has been on disciplining the powerful CEOs of large corporations, with a renewed interest since the development of the principal agent model. In corporate finance,[3] the profit criterion is viewed as the natural yardstick by which to measure the performance of management; a stakeholder orientation is viewed as leaving too much freedom to managers. Tirole (2001) developed counter arguments to the stakeholder approach which can be summarized in the sentence: "Management can almost always rationalize any action by invoking its impact on the welfare of *some* stakeholder."[4] To avoid such pitfalls, a sound foundation for a theory of the stakeholder corporation requires that the following conditions be satisfied. It must be possible

(i) to identify well-defined *groups* of agents close to the firm that are affected by the externalities it creates;

(ii) to assign well-defined *benefits* to each group of stakeholders;

(iii) to assign *relative weights* to the benefits defined in (ii) to obtain a well-defined objective for the firm;

(iv) to provide *incentives* for the firm's management to maximize this objective.

Condition (i) implies that the set of stakeholders must be kept limited. Externalities that affect agents widely dispersed in the economy will be more effectively resolved by government intervention (regulation, taxes, or subsidies) than by the stakeholder approach.

The benchmark model that we study offers a way to solve (i)–(iv). First, the three groups of stakeholders consist of the firm's consumers, workers, and shareholders. Second, under the assumption of quasi-linearity of agents' preferences, consumer and worker surpluses measure the benefits accruing to consumers and workers and the profit measures the benefits accruing to shareholders. The weights in (iii) are equal, so that the firm's objective consists of the sum of these surpluses. However, as discussed in Tirole (2001), the consumer and worker surpluses may be difficult to measure since there are no liquid markets on which they can be evaluated, akin to the stock market for the firms' profits.

[2]See Friedman and Miles (2006) for a survey, and Dodd (1932) for a seminal article.

[3]See, for example, Shleifer and Vishny (1997).

[4]Jensen (2001) expressed the same opinion: "Stakeholder theory plays into the hands of managers by allowing them to pursue their own interests at the expense of the firm's financial claimants and society at large. It allows managers and directors to devote the firm's resources to their own favorite causes—the environment, art, cities, medical research.... By expanding the power of managers in this unproductive way, stakeholder theory increases the agency costs in the economic system."

We propose a solution to this difficulty by drawing on the Coasian idea of creating property rights for all the stakeholders. If the firm can issue consumer and worker rights and if these rights can be traded on reasonably liquid markets, then their market prices will reveal the benefits that consumers and workers derive from being stakeholders of the firm. In effect, our proposal would lead to reforming corporate accounting, by introducing new assets—employee and consumer surpluses—and corresponding liabilities—employee rights and consumer rights—in a spirit close to the proposal of Cornell and Shapiro (1987).[5] The total values of the rights attached to the firm can then serve as an objective yardstick to judge the performance of the firm's management, and hence resolve (iv).

We show that this market solution works well when agents are identical, since the value of the rights corresponds to the surpluses of the representative consumer and worker. However, when agents are heterogeneous and derive different benefits from buying from, or working for, the firm, the value of the rights corresponds to the valuation of the marginal buyer—the buyer with the *lowest* valuation—and not the *average* valuation over all agents, a problem found in a different context by Spence (1975). Thus, maximizing the total value of the rights leads to an outcome which is approximately efficient only if the heterogeneity of consumers and workers is not too large.

In the informal discussion of stakeholder theory, a much debated question is the exact definition of the relevant stakeholders. As mentioned above, we believe that a stakeholder approach can be made operational only if the stakeholders are sufficiently close to the firm to permit precise evaluations of their benefits and to be potentially represented in the institutions governing the firm. In particular, this excludes the firm from taking into account the interests of *other firms* competing on the same market, since this would negate the benefits of competition among firms. But then, as we show in the last section, when there are several firms which compete on the market, the stakeholder criterion does not lead to an optimal choice of investment. By only taking the interests of its own stakeholders into account, the firm is led to invest too much to obtain the good outcome, since it fails to take into account that the stakeholders of the other firms are better off when it has a bad outcome, and produces less. We show, nevertheless, that a stakeholder-oriented equilibrium in which the weights on consumer and worker surpluses are decreased improves on the stakeholder equilibrium.

[5]There is a theoretical literature that uses incomplete contracts models to explain why we see other forms of corporation than for profit: non-profit (Glaeser and Shleifer (2001)), government ownership (Hart, Shleifer, and Vishny (1997)), cooperative (Hart and Moore (1998), Rey and Tirole (2000)). There is also an early literature on labor managed firms. However, this paper and the contemporaneous paper of Allen, Carletti, and Marquez (2011) are the only formal models of stakeholder firms (viewed as hybrids between for profit, consumers cooperatives, and labor managed firms) that we are aware of.

Relation to the Literature

The externality which led us to consider a stakeholder rather than a shareholder criterion is close to externalities discussed in the literature, but is more limited in scope. The firm we consider can have either a good or a bad technology and can, by its investment, influence the probability of achieving the good outcome. If the implicit reference point is the "bad" or costly technology, then the model can be viewed as a model of innovation. There are, however, important differences with the models of innovation in the IO and macro growth literature.[6] Those models consider innovations which have wide ranging consequences for the current and future path of the economy: a new technique which can be adopted by all firms in a sector, a new input which makes all firms more productive, the gains in productivity being possibly acquired for all future dates. These are the types of externalities that are not good candidates for being internalized by the stakeholder approach. By contrast, we only consider firm-specific innovations which directly affect the consumers and workers of a firm, the effect on other firms being mediated by the markets. Furthermore, we do not need to consider the problem of financing, in contrast to the innovation literature that assumes constant returns to scale, so that patents are needed to generate profits to cover the cost of innovation.[7] Instead, we assume decreasing returns to scale so that the firm's profits are, in general, sufficient to cover the cost of the investment needed to appropriately increase the likelihood of finding the better technology. Our model is essentially static, but, unlike the IO literature, we adopt a general equilibrium approach (simplified by the assumption of quasi-linearity) which permits us to model externalities on consumers and workers arising from general equilibrium effects on the goods and labor markets. If, in the "bad" outcome, the firm does not operate (i.e., has zero output), while in the "good" outcome it is productive, and if the probability chosen by the firm is either zero or 1, then the model (of Section 2.4.1) is a model of entry akin to the competitive version of Mankiw and Whinston (1986). Although our model focuses more on the investment of an existing firm rather than the entry of a new firm into a market, our under-investment result corresponds to the insufficient entry result of the competitive version of Mankiw and Whinston.

If, instead, the implicit reference point is the "good" technology, then investment serves to decrease the likelihood of the adverse outcome in which the firm ends up with the bad technology. The investment then refers to expenditures on quality control, maintenance, and design procedures, and other risk

[6]See Tirole (1988), Aghion and Howitt (1998), and Acemoglu (2009) for excellent surveys of this literature.

[7]An exception is the model of endogenous growth of Hellwig and Irmen (2001), who assumed competitive markets and decreasing returns. In their model, firms are negligible but their innovations automatically enter (with a delay of one period) into the general technological knowledge of the economy. Since these future benefits cannot be priced in a market and hence do not enter the profit of an innovating firm, there is also under-investment in their competitive equilibrium.

control procedures that seek to reduce the probability of malfunction or design flaws. Although there have recently been a whole spate of much-publicized malfunctions in the automobile industry, which could have been avoided with more investment in design and production, little attention has been given to the view that the profit motive does not induce large corporate enterprises to spend enough to avoid the occurrence of adverse outcomes that can have a significant negative impact on consumers and workers. In the extreme case where the bad outcome is that the firm closes (i.e., has zero output), our model is related to that of Allen, Carletti, and Marquez (2011), who were motivated by the cost incurred by workers who are laid off when a firm goes bankrupt. They studied how the pricing strategy of a "stakeholder firm," which incorporates in its objective function the cost of layoffs for its workers, differs from the pricing strategy of a "shareholder firm" maximizing profit. Blanchard and Tirole (2004) also modeled the consequence of layoffs for workers as a cost due to imperfect labor markets, but proposed instead to internalize the external effect by a tax on layoffs. By contrast, in our model, there is no friction on the labor market, the externality coming from lower wages and reduced employment for the workers.

Organization of the Paper

Section 2 introduces the benchmark model and shows that there is underinvestment in risk reduction when the firm maximizes profit, with both competitive and non-competitive prices on spot markets. Section 3 introduces the stakeholder approach and discusses its implementation in the benchmark model. Section 4 studies the stakeholder model when there are other firms competing on the spot markets with the firm of the benchmark model. Section 5 concludes.

2. MODEL OF ENDOGENOUS PRODUCTION RISK

We model a firm that faces production risk arising from the uncertain environment in which it operates, where projects can be more or less successful. While the firm cannot completely control its environment, it can invest resources to increase the probability of better outcomes or incur costs to reduce the likelihood of adverse outcomes; in this sense, the production risk faced by the firm is *endogenous* since it can, by its investment, influence the probability distribution of its outcomes. When the investment is designed to increase the probability of achieving an improvement over its current technology, it is akin to inducing a technological *innovation*; when the investment seeks to decrease the probability of possible adverse outcomes, it is akin to *risk reduction*. Whether the firm is trying to induce some form of innovation or is implementing risk-reducing policies, the outcome is, in each case, specific to the firm and does not generate spillover effects on other firms. Because of this absence of spillover, our benchmark model has a single firm; a more complete analysis with multiple firms is studied in Section 4.

We begin in Section 2.1 by presenting a motivating example which captures the essence of the problem that motivates this paper: a profit-maximizing firm does not invest enough in innovation/risk-reducing policies, because it does not internalize the impact of these policies on consumers and/or workers.

2.1. *Motivating Example*

A small desert town has a single seller of fresh produce. Every day, the seller receives a supply y of the produce which can be sold unless adverse conditions (e.g., excess temperature) make it unfit for consumption. The inhabitants of the town consist of a unit mass of identical consumers with quasi-linear utility functions $m + u(c)$, where c is the quantity of fresh produce consumed and m is a surrogate (money) for the consumption of all other goods, $u(c)$ being increasing and strictly concave, with $u(0) = 0$. On normal days, the quantity y is sold at the price $p = u'(y)$, which gives a profit $py = u'(y)y$ to the seller, the cost of acquiring the produce being a sunk cost incurred at an earlier date. The resulting surplus accruing to consumers is $u(y) - u'(y)y$ and the total welfare is $W = u(y)$ (see Figure 1(a)). The seller can incur expenses $\gamma(\pi)$ which affect the probability π (the proportion of time) that the produce is not lost, $\gamma(\pi)$ being an increasing strictly convex function with $\gamma(\pi) \to \infty$ as $\pi \to 1$, the amortized cost of installing and running improved storage/refrigeration

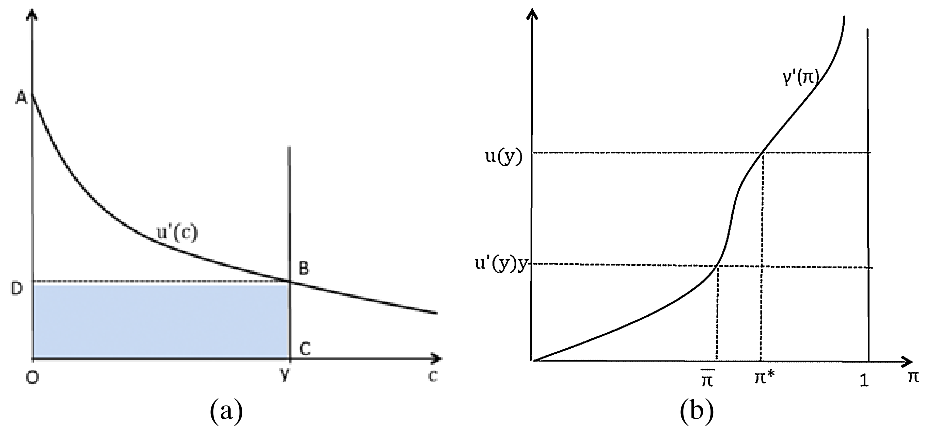

FIGURE 1.—In (a), profit = BCOD, consumer surplus = ABD, social welfare = ABCO. In (b), expected profit is maximized when $\gamma'(\bar{\pi}) = u'(y)y$ and expected social welfare is maximized when $\gamma'(\pi^*) = W = u(y)$; it follows that $\bar{\pi} < \pi^*$.

equipment becoming progressively more expensive, and prohibitively so to ensure that the product is never lost. For the seller, the optimal expense to incur is reached when the expected profit $\pi u'(y)y - \gamma(\pi)$ is maximized, that is, when $\gamma'(\bar{\pi}) = u'(y)y$. However, from the community's point of view, the socially optimal expense is realized when expected net welfare $\pi W - \gamma(\pi)$ is maximized, that is, when $\gamma'(\pi^*) = W = u(y)$. Since u is strictly concave, $u(y) > u'(y)y$, and since γ is strictly convex, $\bar{\pi} < \pi^*$. Note that the result is also true if the firm exploits its market power and rations consumers, which is profitable when the demand elasticity is low. This is due to the fact that $u(y) > \max_{q \le y} qu'(q)$.

The simplicity of this motivating example hinges on the assumption that profit and social surplus are zero in the bad outcome. If we consider a more general model in which this assumption is relaxed, the investment which maximizes expected profit will depend on the *increment to profit* between the good and bad outcomes, while for social efficiency, the optimal investment will depend on the *increment to social welfare* between the good and bad outcomes. We show that under relatively weak conditions, the increment to social welfare is greater than the increment to profit, so that the under-investment result in the example is a general phenomenon. Our final objective is to explore whether a firm using a stakeholder criterion would lead to a better outcome than a profit-maximizing firm in this type of setting. We thus explicitly introduce labor into the model, since, in practice, the employees of a firm constitute one of its most important groups of stakeholders.

2.2. *Benchmark Model*

The benchmark model has a single firm and three goods: a produced good, a composite good called "money" (used as the numeraire), and labor. At date 0, the only available resource is money, a part of which can be used to finance investment expenditures by the firm. Its technology can be one of two production functions $y_s = f_s(l)$, where s is either g (good) or b (bad). Each function $f_s : \mathbb{R}_+ \to \mathbb{R}_+$ is differentiable, increasing, concave and satisfies $f_s(0) = 0$, $f'(0) = \infty$, $s = g, b$. The marginal product of f_g is uniformly higher than that of f_b: $f_g'(l) > f_b'(l)$, $\forall l > 0$. By choosing its investment expenditure at date 0, the firm determines the probability π of having the good outcome at date 1. To retain the symmetry of notation, we let π_s denote the probability of outcome s, $s = g, b$, with $\pi_g = \pi$ and $\pi_b = 1 - \pi$.

There are three "classes" of agents: consumers, workers/employees, and finally capitalists/shareholders. Within each class, there is a continuum of identical agents of mass 1.[8] Each consumer, who consumes both money and the produced good, has the utility function

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

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 $u(0) = 0$ and $u'(c) \to \infty$ if $c \to 0$.

Each worker is endowed with 1 unit of labor at date 1, consumes only money, and has the utility function

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

where $m = (m_0, m_g, m_b)$ is a 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 $v(0) = 0$, $v'(0) = 0$, and $v'(\ell) \to \infty$ if $\ell \to 1$. When we need to make the distinction, we use the symbol "ℓ" for the labor supplied by the representative worker and "l" for the demand for labor by the firm.

Finally, there are capitalists (shareholders), who own the firm, consume only money, and have the same (linear) utility function

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

The money endowments $e^i = (e^i_0, e^i_1)$, $i = w, c, k$ are assumed to be sufficiently large so that nonnegativity constraints on consumption never bind. We let $e_0 = e^w_0 + e^c_0 + e^k_0$, $e_1 = e^w_1 + e^c_1 + e^k_1$ denote the aggregate endowments of money at date 0 and 1 and denote by $\mathcal{E} = (U, e, f, \gamma)$ the economy with preferences and endowments $(U^i, e^i)_{i=w,c,k}$ and technology (f, γ) for the firm.

[8]Assuming that there is a continuum of agents of each type simplifies the presentation of the model. However, since there is only one firm which can only use a finite amount of labor, the model should be understood as having fixed, finite but large numbers (N^w, N^c, N^k) of identical agents of each type, and a firm with production function $(F_s(L))_{s=g,b}$, where L is the total labor; the per-consumer production function is then defined as a function of the per-worker labor by $f_s(\ell) = F_s(N^w\ell)/N^c$. The market clearing equations in the analysis of this paper are the market clearing equations of the finite-agent model expressed in per-capita terms.

2.3. *Socially Optimal Investment*

Given the quasi-linearity of the agents' preferences, a Pareto optimum is an allocation[9] (π^*, m^*, c^*, l^*) that maximizes the sum of the agents' utilities

$$\max_{(\pi,m,c,l)\geq 0} \sum_{i=w,c,k} \left(m_0^i + \delta \sum_{s=g,b} \pi_s m_s^i \right) + \delta \sum_{s=g,b} \pi_s \big[u(c_s) - v(l_s) \big]$$

subject to the resource constraints for money, consumption, and labor

$$\sum_{i=w,c,k} m_0^i + \gamma(\pi) = e_0, \qquad \sum_{i=w,c,k} m_s^i = e_1, \qquad c_s = f_s(l_s), \qquad s = g, b.$$

This is equivalent to finding (π^*, l^*) that solves

$$\max_{(\pi,l)\geq 0} e_0 - \gamma(\pi) + \delta \sum_{s=g,b} \pi_s \big[e_1 + u\big(f_s(l_s)\big) - v(l_s) \big]. \tag{1}$$

The maximum problem (1) decomposes into the choice, in each outcome $s = g, b$ at date 1, of the labor allocation l_s^* that maximizes social welfare

$$W_s(l) = u\big(f_s(l)\big) - v(l), \tag{2}$$

and the firm's choice of investment at date 0, or more directly the choice of the probability of success π^* that maximizes

$$\delta\big(\pi W_g^* + (1 - \pi) W_b^*\big) - \gamma(\pi), \tag{3}$$

where W_g^*, W_b^* are the optimized values of (2). The first-order condition for the choice of consumption-labor at date 1 is, for $s = g, b$,

$$u'\big(f_s(l_s^*)\big) f_s'\big(l_s^*\big) = v'\big(l_s^*\big). \tag{4}$$

Since the social welfare $W_s(l)$ in each outcome s is a strictly concave function, there is a unique solution to the FOCs (4), which is necessary and sufficient for characterizing the optimal allocation. Since $f_g(l) > f_b(l)$ for all $l > 0$, $W_g(l) > W_b(l)$ so that $W_g^* > W_b^*$, and "g" is indeed the good social outcome. The FOC for the optimal choice of investment by the firm at date 0 is given by

$$\delta\big(W_g^* - W_b^*\big) = \gamma'\big(\pi^*\big), \tag{5}$$

and this has a unique solution π^* since γ' increases from 0 to ∞. Equation (5) requires that the marginal cost of increasing the probability of success equals

[9]We use the following notational convention: a letter without superscript or subscript summarizes the vector of indexed values of the corresponding variable. For example, $m = ((m_0^i, m_s^i), i = w, c, k, s = g, b)$ and $\ell = (\ell_s)_{s=g,b}$.

the discounted social benefit of realizing the good rather than the bad outcome of the firm.

2.4. *Shareholder Equilibrium*

Consider a market equilibrium of the above economy. Consumers buy the firm's output and workers sell their labor services on spot markets; the agents can also trade on asset markets to redistribute their income. We show that the real side of such a market equilibrium can be summarized by a vector $(\bar{\pi}, \bar{l})$ consisting of the probability of the good outcome, and the labor choices in each technology outcome. Under a competitive assumption, this vector can then be compared with the Pareto optimal choice (π^*, l^*) derived above.

At each date, the price of the composite commodity (money) is normalized to 1. At date 0, agents trade a riskless bond promising one unit of money in each outcome $s = g, b$ at date 1. The price of the bond is denoted $\frac{1}{1+r}$ so that r denotes the interest rate. There is also an equity market at date 0 on which the agents trade the shares of the firm, the price of equity being q. At date 1, for each outcome $s = g, b$, there are spot markets for the produced good and labor with prices (p_s, w_s), $s = g, b$. Since the date 1 payoff of the bond is $(1, 1)$, and the payoffs of the firm's equity are different in the two outcomes $s = g, b$, the bond and firm's equity have linearly independent payoff streams, so that the financial markets are complete with respect to the uncertainty g, b.

The three groups of agents trade on the spot and financial markets taking prices as given and have sequential budget equations at date 0 and in each outcome at date 1 of the form

$$m_0^i = e_0^i - \frac{1}{1+r} z^i - q\theta^i + \xi^i, \tag{6}$$
$$m_s^i = e_s^i + z^i + R_s \theta^i + w_s \ell_s^i - p_s c_s^i, \quad s = g, b,$$

where z^i is the bond holding, θ^i are the ownership shares of the firm purchased by agent i, and

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

denotes the firm's profit in outcome s. Finally

$$\begin{aligned} &\bullet \quad \xi^i = 0, \quad \text{if} \quad i = w, c, \quad \xi^i = \big[q - \gamma(\pi)\big]\theta_0^i, \quad \text{if} \quad i = k, \\ &\bullet \quad c_s^i = 0, \quad \text{if} \quad i = w, k, \quad c_s^i = c_s, \quad \text{if} \quad i = c, \\ &\bullet \quad \ell_s^i = 0, \quad \text{if} \quad i = c, k, \quad \ell_s^i = \ell_s, \quad \text{if} \quad i = w, \end{aligned} \tag{7}$$

where θ_0^i denotes the initial shareholding of shareholder i. The firm's owners finance the cost $\gamma(\pi)$ proportionally to their (initial) shares and get income from the sale of their initial shareholdings $\xi^i = [q - \gamma(\pi)]\theta_0^i$. While shareholders are assumed to finance the investment of the firm, any mode of financing, whether by debt or by issuing new shares, would lead to the same equilibrium in view of the Modigliani–Miller theorem. Only the consumers purchase the produced good ($c_s^c = c_s$) and only workers sell their labor services ($\ell_s^w = \ell_s$). All agents are assumed to know the firm's choice of π at date 0 and to correctly anticipate future spot prices and the firm's profit R_s in each outcome s at date 1.

Given the linearity of the agents' preferences in the numeraire composite commodity, the first-order conditions for the optimal choice of bond and equity holdings imply

$$\frac{1}{1+r} = \delta, \quad q = \delta \sum_{s=g,b} \pi_s R_s = \sum_{s=g,b} \frac{\pi_s}{1+r} R_s, \tag{8}$$

so that pricing is risk-neutral. Since financial markets are complete, the sequential budget constraints (6) are equivalent to the single intertemporal (present value) budget constraint

$$\begin{aligned} & m_0^i + \sum_{s=g,b} \frac{\pi_s}{1+r} m_s^i \\ & \quad = e_0^i + \frac{e_1^i}{1+r} + \xi^i + \sum_{s=g,b} \frac{\pi_s}{1+r}\big(w_s \ell_s^i - p_s c_s^i\big), \quad i = w, c, k, \end{aligned} \tag{9}$$

where (ξ^i, c^i, ℓ^i) are given by (7). In view of the linearity of the agents' preferences in $m^i = (m_0^i, m_g^i, m_b^i)$, any m^i satisfying (9) is equivalent for agent i, and when the budget constraint (9) is satisfied, the utility of agent i is

(10a) • $e_0^c + \dfrac{e_1^c}{1+r} + \displaystyle\sum_{s=g,b} \frac{\pi_s}{1+r}\big(u(c_s) - p_s c_s\big)$ for a consumer,

(10b) • $e_0^w + \dfrac{e_1^w}{1+r} + \displaystyle\sum_{s=g,b} \frac{\pi_s}{1+r}\big(w_s \ell_s - v(\ell_s)\big)$ for a worker,

(10c) • $e_0^k + \dfrac{e_1^k}{1+r} + \big[q - \gamma(\pi)\big]\theta_0^i$ for a capitalist.

Thus a consumer will choose c to maximize (10a), a worker will choose ℓ to maximize (10b), and a capitalist has no other choice than to spend his income on the composite good. His utility is maximized when the firm maximizes the shareholder value $\text{SV} = q - \gamma(\pi)$.

Summing the budget equations (9), assuming that (7) holds, gives

$$\sum_{i=w,c,k} m_0^i + \sum_{s=g,b} \frac{\pi_s}{1+r} m_s^i$$
$$= e_0 + \frac{e_1}{1+r} + q - \gamma(\pi) + \sum_{s=g,b} \frac{\pi_s}{1+r}(-p_s c_s + w_s \ell_s).$$

If the markets clear for the produced good ($c_s = f_s(l_s)$) and labor ($\ell_s = l_s$), then, in view of (8), the terms involving the firm's market value cancel out, giving

$$\sum_{i=w,c,k} m_0^i + \sum_{s=g,b} \frac{\pi_s}{1+r} m_s^i = e_0 + \frac{e_1}{1+r} - \gamma(\pi).$$

Given the indeterminacy in the choice of m^i, we can assume that when agents choose m^i to satisfy (9), they in addition choose money holdings such that

$$\sum_{i=w,c,k} m_0^i + \gamma(\pi) = e_0, \qquad \sum_{i=w,c,k} m_s^i = e_1, \quad s = g, b, \tag{11}$$

so that when the markets for the produced good and labor clear, the market for the composite good clears at date 0 and in each outcome s at date 1.

The firm makes two types of choices: at date 0, it selects its investment expenditure which determines the probability π of its "good" outcome, and at date 1, it chooses the amount of labor $l = (l_g, l_b)$ to hire when the technology is realized. The spot prices (p_s, w_s) depend on the outcome s. If at date 1 the firm acts strategically in its choice of labor (output), knowing the elasticities of the demand for its product and the supply of labor, then we say that it behaves monopolistically. If it makes its choice of labor taking prices as given, then we say it acts competitively on the spot markets. Thus there are two potential sources of inefficiency in the model: one arising from the choice of investment, the other arising from monopolistic pricing on the spot markets. For the purpose of theory, it is useful to distinguish these two imperfections, and our model permits the distinction to be made since the investment decision does not affect the spot prices; it only affects the probabilities of (p_g, w_g) and (p_b, w_b). Thus we first assume that the firm behaves competitively on the spot markets and chooses labor so as to maximize its spot profit $R_s(l_s) = p_s f(l_s) - w_s l_s$ taking (p_s, w_s) as given. We then study the case where the firm behaves as a monopolist on the spot markets.

In all cases, we use the analysis above to reduce the description of the equilibrium to the choice of consumption and labor of the consumers and workers, and the choice of labor and investment by the firm. From this reduced-form equilibrium, a complete description of the equilibrium on the spot markets for the produced good, money, and labor, and on the financial markets for the bond and equity, can readily be reconstructed using (6)–(8) and (11).

2.4.1. *Equilibrium With Competitive Prices*

In the price-taking version of the equilibrium, the firm behaves competitively on the spot market and chooses its labor l_s in each outcome to maximize its profit $R_s(l_s; p_s, w_s) = p_s f_s(l_s) - w_s l_s$, taking the spot prices (p_s, w_s) as given. Anticipating correctly the spot prices and its future labor decision, it chooses the probability π at date 0 to maximize the (net) present value of profit, which in this case is just the discounted expected profit, net of the investment cost, since agents are risk-neutral. The firm's combined choice problem amounts to choosing (π, l) to maximize its value for the shareholders, which we denote by SV:

$$\text{(12)} \qquad \mathrm{SV}(\pi, l; p, w) = \sum_{s=g,b} \frac{\pi_s}{1+r} R_s(l_s; p_s, w_s) - \gamma(\pi).$$

DEFINITION 1: A *competitive shareholder equilibrium* of the economy $\mathcal{E}$ is a vector of actions and prices $((\bar{c}, \bar{\ell}, \bar{\pi}, \bar{l}), (\bar{p}, \bar{w}))$ such that

(i) the consumption choice $\bar{c} = (\bar{c}_g, \bar{c}_b) \geq 0$ maximizes consumer's utility (10a) given $(\bar{\pi}, \bar{p})$;

(ii) the labor choice $\bar{\ell} = (\bar{\ell}_g, \bar{\ell}_b) \geq 0$ maximizes worker's utility (10b) given $(\bar{\pi}, \bar{w})$;

(iii) the firm's production plan $(\bar{\pi}, \bar{l}) = (\bar{\pi}, \bar{l}_g, \bar{l}_b) \geq 0$ maximizes shareholder value (12) given $(\bar{p}, \bar{w})$;

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

Let us compare the FOCs for the maximum problems (i)–(iii) of a shareholder equilibrium with the FOCs for a Pareto optimum. In a shareholder equilibrium, the consumers' optimal choice $\bar{c}$ satisfies

$$\text{(13)} \qquad u'(\bar{c}_s) = \bar{p}_s, \quad s = g, b,$$

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

$$\text{(14)} \qquad v'(\bar{\ell}_s) = \bar{w}_s, \quad s = g, b,$$

while the firm's profit-maximizing choices of labor $\bar{l}$ imply that, for each outcome at date 1, the real wage equals the marginal product of labor

$$\text{(15)} \qquad \bar{p}_s f_s'(\bar{l}_s) = \bar{w}_s, \quad s = g, b.$$

Using (14), (13) to eliminate spot prices and adding the market clearing condition (iv) gives the equations, for $s = g, b$:

$$\text{(16)} \qquad u'\big(f_s(\bar{l}_s)\big) f_s'(\bar{l}_s) = v'(\bar{\ell}_s),$$

which, with the conditions $\bar{l}_s = \bar{\ell}_s$, characterize the spot market equilibrium at date 1. Since (16) is identical to (4), which characterizes the maximum of the social welfare, the choice of labor in equilibrium is optimal and $(\bar{c}, \bar{\ell}, \bar{l}) = (c^*, \ell^*, l^*)$. The remaining first-order condition for the choice of investment $\bar{\pi}$ which maximizes shareholder value (12) is

$$\text{(17)} \qquad \frac{1}{1+r}(\bar{R}_g - \bar{R}_b) = \gamma'(\bar{\pi}) \quad \text{if} \quad \bar{R}_g > \bar{R}_b, \quad \bar{\pi} = 0 \quad \text{otherwise},$$

where $\bar{R}_s$ is the maximized profit of firm 1 in outcome s; this equation has a unique solution since $\gamma'(\pi)$ increases from 0 to ∞.

To show that the profit criterion underestimates the social gain from obtaining the technology f_g rather than the technology f_b, we need to compare the investment $\bar{\pi}$ defined by (17) with the optimal investment π^* defined by $\delta(W_g^* - W_b^*) = \gamma'(\pi^*)$ in Section 2.2. Since $\delta = \frac{1}{1+r}$ and γ' is increasing, showing that $\bar{\pi} < \pi^*$ is equivalent to showing $W_g^* - W_b^* > \bar{R}_g - \bar{R}_b$.

PROPOSITION 1: *There is under-investment in the competitive shareholder equilibrium of the economy* $\mathcal{E}$: $\bar{\pi} < \pi^*$.

PROOF: We need to show $W_g^* - W_b^* > \bar{R}_g - \bar{R}_b$, which is equivalent to $W_g^* - \bar{R}_g > W_b^* - \bar{R}_b$. To make this comparison, we consider the family of production functions

$$f(t, l) = tf_g(l) + (1-t)f_b(l), \quad t \in [0, 1],$$

where the production function moves continuously from the bad to the good technology. We associate with each $t \in [0, 1]$ a fictitious "t" spot economy at date 1 with the characteristics $(u, v, f(t, \cdot))$. The maximized social welfare for the t economy is

$$W(t) = \max_{l \geq 0}\{u(f(t, l)) - v(l)\}.$$

The solution $l(t)$ of this maximum problem is given by

$$\text{(18)} \qquad u'(f(t, l(t)))f_2(t, l(t)) = v'(l(t)),$$

and this allocation can be induced by letting agents and firms make their choices on spot markets at the prices

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

where $c(t) = f(t, l(t))$. Let $R(t) = p(t)f(t, l(t)) - w(t)l(t)$ denote the (optimized) profit of firm 1 under these spot prices. Lemma 2 in the Appendix shows that the function

$$D(t) = W(t) - R(t)$$

is strictly increasing on [0, 1]; this implies that $D(1) = W_g^* - \bar{R}_g > D(0) = W_b^* - \bar{R}_b$ and hence establishes the result. *Q.E.D.*

In economic terms, $D(t) = W(t) - R(t)$ is the sum of the surpluses of the consumers and workers. Lemma 2 shows that the sum of these surpluses increases when the technology improves; it also shows that the surplus of the consumer increases because the price of the good decreases, but the surplus of the workers does not necessarily increase. The increased productivity of the firm may lead it to either increase or decrease its demand for labor[10] depending on the curvatures of the functions (u, v, f_g, f_b). However, if there is a loss of worker surplus, the gain in consumer surplus is always sufficient to compensate the workers for their loss.

It follows from the above analysis that the inefficiency of investment in innovation/risk-reduction exists as soon as a firm is not "perfectly" competitive[11] in the sense of Makowski and Ostroy (2001), that is, if its profit does not coincide with its contribution to social surplus. Any generalization (multi-firm, heterogeneous agents, ...) of the first-order condition (5) for the socially optimal choice of investment will compare the marginal cost of investment to the increment to social welfare from being in the good rather than the bad outcome, while the first-order condition for the optimal choice of investment for a profit-maximizing firm will compare the marginal cost to the increment in profit as in (17). If the firm's profit does not appropriate its full contribution to social welfare, then generically the increment to social welfare will differ from the increment to profit and the profit-maximizing choice of investment will be inefficient.[12] However, Proposition 1 is more precise than a statement of inefficiency since it shows that the bias is toward under-investment. This result is generalized in the Supplemental Material (Magill, Quinzii, and Rochet (2015)) to a multi-firm setting.

The advantage of studying the case where prices on the spot markets are competitive is twofold. First, it shows clearly that, while the inefficiency comes from the fact that the firm is not negligible since the spot prices depend on its outcome, this cause of inefficiency is nevertheless different from the traditional inefficiency associated with a large firm which underproduces to generate a higher price for its product (monopolistic behavior). Second, the analysis

[10] As is shown in Lemma 2(iii), workers are better off if the total labor employed increases; this occurs when the elasticity of demand is sufficiently small. In the extreme case where u is linear, the price of the output does not change ($\bar{p}_g = \bar{p}_b$) and the consumers have no surplus: all improvement in technology goes to increasing the wages of the workers.

[11] In the simplest case where the firm is a sole proprietorship so that it can be identified with the agent who is its owner, the firm is perfectly competitive in the sense of Makowski and Ostroy (2001) if the agent can be removed from the economy without affecting the welfare of the remaining agents. This condition is equivalent to the firm's profit being equal to its contribution to social welfare.

[12] The inefficiency of investment when firms have endogenous uncertainty has been studied in a different model by Magill and Quinzii (2009).

of this section serves as a preparation for Sections 3 and 4 where competitive pricing occurs endogenously when the firm maximizes a stakeholder criterion. We now relax the assumption of competitive pricing and study the firm's investment choice when it also exploits its monopoly status on the spot markets.

2.4.2. *Equilibrium With Monopolistic Prices*

Suppose the firm exercises its market power on the spot markets and chooses the wage rate and the price of its output in each outcome to maximize its spot market profit. Since monopoly pricing introduces a second source of inefficiency, to show that the profit-maximizing firm under-invests in innovation/risk-reduction, the reference point can no longer be the first best optimum. We compare the firm's choice of investment to the optimal choice of investment of a "constrained planner" who can choose investment but must accept the monopolistic pricing of labor and output on the spot markets.[13] The analysis is carried out in the Supplemental Material (Magill, Quinzii, and Rochet (2015, Section S.3)). A direct comparison of the first-order conditions for a monopolistic profit-maximizing firm and for a social planner reveals that generically they lead to distinct investment levels. With additional assumptions on the firm's technology and the elasticity of demand, the under-investment result of Proposition 1 extends to the case of monopoly pricing (Proposition S3). Thus, regardless of its pricing behavior on the spot markets, a nonnegligible firm which maximizes its shareholder value is led to a socially inefficient choice of investment.

2.5. *Inefficiency as an Externality*

In the benchmark model with a single firm, the social welfare in an equilibrium of the spot economy with prices $(p_s, w_s)_{s=g,b}$ is given by

$$W_s = u(c_s) - v(\ell_s) = \big[u(c_s) - p_s c_s\big] + \big[w_s\ell_s - v(\ell_s)\big] + [p_s c_s - w_s \ell_s] \\ = \mathrm{CS}_s + \mathrm{WS}_s + R_s, \tag{19}$$

where CS_s is the *consumer surplus*, WS_s is the *worker surplus*, and R_s is the *shareholder profit* in outcomes $s = g, b$. The expression for W_s in (19) holds regardless of the pricing behavior—competitive or non-competitive—of the firm on the spot markets. The investment γ in innovation/risk-reduction is inefficient whenever

$$W_g - W_b \neq R_g - R_b \quad \Longleftrightarrow \quad \mathrm{CS}_g + \mathrm{WS}_g \neq \mathrm{CS}_b + \mathrm{WS}_b, \tag{20}$$

[13]This is in line with the analysis of Mankiw and Whinston (1986) where the social planner maximizes social welfare under the constraint of oligopolistic pricing in the product market.

that is, whenever the sum of the surpluses of consumers and workers varies with the outcome of the firm. In Section 2.4, we explored cases where $\mathrm{CS}_g + \mathrm{WS}_g > \mathrm{CS}_b + \mathrm{WS}_b$, but more generally, investment is inefficient as soon as (20) holds.[14]

Since the firm, through its choice of investment, affects the probability of outcome s and since the welfare of consumers and workers depends on this outcome, the firm's investment decision exerts an externality on these agents. More precisely, since choosing γ is equivalent to choosing π with $\gamma(\pi) = \gamma$, the choice of investment affects the components $\pi \mathrm{CS}_g + (1 - \pi)\mathrm{CS}_b$ and $\pi \mathrm{WS}_g + (1 - \pi)\mathrm{WS}_b$ of the consumers' and workers' expected utilities in (10a), (10b). The externality can be considered either as a *direct* externality since π, which is a variable of choice for the firm, affects the agents' expected utilities, or as a *pecuniary* externality since it affects the expected price $\pi p_b + (1 - \pi) p_b$ of the good and the expected wage $\pi w_g + (1 - \pi) w_b$ of labor. Of course, this pecuniary externality[15] only exists because $p_g \neq p_b$ and/or $w_g \neq w_b$ that is, because the firm is sufficiently large to affect the spot prices. Thus (20) implies that whenever shareholders are exposed to risk, consumers and workers are also exposed to risk and maximizing expected shareholder profit does not internalize the externality imposed on consumers and workers.[16]

If the implicit reference point is the "good" technology f_g and investment decreases the probability of the bad outcome, which could be the firm's closure if $f_b = 0$, then the externality comes close to formalizing continental Europe and Japan's reservations on the merits of an excessive emphasis on the profit criterion. In the public discourse, this is often expressed as a fairness issue rather than an efficiency issue—it is unfair that workers lose their jobs when shareholders have not invested enough to ensure that the firm succeeds. In our model, shareholder value maximization results in inefficiencies, that is, under-investment in risk reduction policies when only the interests of shareholders are taken into account and the interests of workers are given zero weight.

[14] If the monopoly could extract all the surplus ($\mathrm{CS}_s = \mathrm{WS}_s = 0$, $s = g, b$) by selling units of output and hiring units of labor at different prices, the inefficiency would disappear. Circumstances where a monopolist can attain such perfect price discrimination are, however, rare.

[15] However, it is different from the two categories of pecuniary externalities that have been identified in the literature. It does not rely on the spanning role of prices in incomplete markets as in Geanakoplos and Polemarchakis (1986) or Acemoglu and Zilibotti (1997), because preferences are quasi-linear and risk-sharing considerations are absent. It does not rely either on the second category of pecuniary externalities, identified by Greenwald and Stiglitz (1986), where prices enter agents's decisions problems beyond their budget constraints through information asymmetries. Here the mechanism is different: a (nonnegligible) firm's investment decision affects the probability distribution of prices, and thus indirectly impacts the welfare of consumers and workers.

[16] If, instead of a single firm, there were a continuum of identical firms, then the risk of any individual firm would not influence the prices on the good and labor markets, the externality would disappear, and the profit-maximizing equilibrium would be efficient. See Bisin, Gottardi, and Rutta (2014) and Braido and Martins da Rocha (2014) for models with uncertainty, continuum of firms, and efficient equilibria.

If the implicit reference point is the "bad" technology f_b, then achieving the "good" technology f_g can be considered as a successful "innovation" by the firm. However, unlike the innovations studied in the macro growth literature, the innovation is firm-specific and does not have spillover effects on other firms. Thus, in our model, the only agents affected by the externality are the consumers and workers of the firm. By contrast, the macro innovation literature focuses on innovations with spillovers so that many of the agents affected by the innovation are unrelated to the innovating firm. As in our model, the investment has a positive externality and the choice of investment based on the profit criterion typically leads to under-investment.

Since both the firm-specific innovations we consider and the innovations with spillovers lead to under-investment, it is instructive to explore if the remedies proposed in the innovation literature could help in our setting. This literature recommends two types of policy for increasing investment expenditure on research for new technologies: first, assigning a patent to an innovating firm giving it a property right to its innovation, and second, subsidizing research.

By preventing other firms from using the technological innovation, a patent ensures either a cost advantage or monopoly status to the innovating firm and the resulting profit serves both to provide the incentives to innovate and to cover the cost of innovation.[17] In our model, the use of the innovation by other firms is excluded by the assumption of firm-specificity, so there is no role for a patent for excluding imitation. Furthermore, we assume that the cost of the innovation is not so large that it requires a change in the structure of competition on the spot markets to obtain sufficient profit to cover its investment cost: given the assumption of decreasing returns to scale,[18] the firm will make a positive profit on the spot markets whatever its pricing behavior. We assume this profit is sufficient to cover the optimal investment cost. If it is not, our argument is even stronger: shareholders will be unwilling to invest in a project with negative net present value, even if it is a socially useful technology.

The other way of alleviating under-investment advocated in the innovation/growth literature is to subsidize research. In our model, subsidizing the investment expenditure γ of the firm and financing the subsidy with lump-sum taxes on the agents could, in principle, resolve the inefficiency. However, the "firm-specificity" of the investment makes it unlikely that this solution can be implemented in practice. If we think of the investment as decreasing the probability of a "bad" outcome, the expenses involved could consist of increasing the labor devoted to maintenance, quality control, production control, or could

[17]Most of the innovation literature assumes that firms operate with constant marginal cost so that monopolistic profit guaranteed by a patent is necessary to cover the research cost and to provide incentives to innovate.

[18]Our model can be interpreted as a short-run equilibrium in which physical and human capital have been invested in the firm (in an un-modeled past) justifying the assumption of decreasing returns to scale.

consist of using more expensive inputs which make it more likely to obtain a satisfactory output. It would be difficult for an outside agency to distinguish these expenses from the ordinary expenses associated with production and to subsidize them. In the same way, expenses in management time to better organize the firm, and even in research and development inside the firm to improve its production processes—all expenses which make a "good" outcome more likely—would be difficult to separate from standard production expenses.[19] To formalize the difficulty arising from "non-observability," which would give rise to moral hazard problems if subsidies were involved, we assume that the investment $\gamma(\pi)$ of the firm is not observable by an outside government agency, even though it is observable by the firm's shareholders, consumers, and employees.

3. STAKEHOLDER APPROACH

When an externality cannot be resolved by government intervention in the form of taxes and subsidies, an alternative approach is to internalize the externality by merging the parties involved in the externality—those that create and those that are affected by the externality—into a larger entity whose decisions reflect the combined interests of all parties. Since, in our model, the parties affected by the firm's investment decision are close to the firm—its shareholders, consumers, and workers—it seems possible to require that when the firm (or the firm's CEO) makes its investment decision, it takes into account the joint expected surplus of all its stakeholders and not just the expected profit of its shareholders. Merging the interests of the parties to the externality in this way into a single entity leads the firm to replace the profit criterion by a stakeholder criterion which adds the surpluses (benefits) of the three groups of stakeholders.[20]

3.1. *Stakeholder Equilibrium*

Suppose the markets are those described in Section 2 and that the firm knows the utilities of its consumers and workers. We now assume that instead of maximizing a shareholder criterion, the firm chooses its production

[19] This difficulty with subsidizing research is also present for innovations with spillovers where the subsidies take the form of financing "fundamental research" by the government in universities and government agencies. The second stage of "applied research," which is typically done inside firms and which consists in going from the basic research to the industrial applications, is generally not subsidized—in large part because of the same problem of non-observability—and it is here that the patent system typically takes over.

[20] The employees provide labor, but in a more general model, other input suppliers could be considered. In the same way, if the firm were producing an intermediate good, other firms could be the customers for its output.

plan to maximize a stakeholder criterion consisting of the surpluses of all its stakeholders—its shareholders, consumers, and workers.

The surplus of the shareholders is the profit of the firm. Given spot prices (w_s, p_s), the consumer and worker surpluses are defined by

$$\text{(21)} \qquad \text{CS}(p_s) = \max_{c_s \geq 0}\{u(c_s) - p_s c_s\}, \quad \text{WS}(w_s) = \max_{\ell_s \geq 0}\{w_s \ell_s - v(\ell_s)\}.$$

Since $u(0) = 0$ and $v(0) = 0$, $\text{CS}_s(p_s)$ is the net gain in utility for the representative consumer from being able to buy the good at price p_s, while $\text{WS}_s(w_s)$ is the net utility gain for the representative worker from being able to sell labor at the wage w_s.

The firm chooses a production plan (π, l_g, l_b) anticipating that it will sell its output at the price $p_s = u'(f(l_s))$ and pay the wage $w_s = v'(l_s)$ for labor, resulting in the profit $R_s(l_s) = p_s f(l_s) - w_s l_s$ in outcome s. The stakeholder value STV, which replaces the shareholder value, is defined by

$$\text{(22)} \qquad \text{STV}(\pi, l) = \frac{1}{1+r} \sum_{s=g,b} \pi_s\big(\text{CS}(p_s) + \text{WS}(w_s) + R_s(l_s)\big) - \gamma(\pi),$$
$$p_s = u'\big(f(l_s)\big), w_s = v'(l_s).$$

DEFINITION 2: A *stakeholder equilibrium* of the economy $\mathcal{E}$ is a vector of actions and prices $((c^{\text{st}}, \ell^{\text{st}}, \pi^{\text{st}}, l^{\text{st}}), (p^{\text{st}}, w^{\text{st}}))$ such that

(i) the firm's production plan $(\pi^{\text{st}}, l^{\text{st}}) = (\pi^{\text{st}}, l_g^{\text{st}}, l_b^{\text{st}}) \geq 0$ maximizes stakeholder value (22) subject to the technology constraints.

(ii) $c_s^{\text{st}} = f(l_s^{\text{st}})$, $p_s^{\text{st}} = u'(c_s^{\text{st}})$, $\ell_s^{\text{st}} = l_s^{\text{st}}$, $w_s^{\text{st}} = v'(\ell_s^{\text{st}})$, $s = g, b$.

A stakeholder firm behaves like a monopolist, but with a different objective function, maximizing total stakeholder value rather than just shareholder value; this leads to a Pareto optimal outcome.

PROPOSITION 2: *A stakeholder equilibrium of the benchmark economy $\mathcal{E}$ is Pareto optimal.*

PROOF: The total surplus of the stakeholders in outcome s is

$$\text{CS}(p_s) + \text{WS}(w_s) + R_s(l_s) = u\big(f(l_s)\big) - v(l_s).$$

The maximization of the stakeholder criterion leads the firm to choose the optimal labor l_s^* that a planner would have chosen. It follows from the analysis of Section 2.4.1 that $p_s^{\text{st}} = \bar{p}_s$ and $w_s^{\text{st}} = \bar{w}_s$, that is, the firm sells its output and pays the labor at the competitive prices. The total welfare in outcome s is then maximal and equal to W_s^*. The choice of investment which maximizes (22) is therefore such that

$$\gamma'\big(\pi^{\text{st}}\big) = \frac{1}{1+r}\big(W_g^* - W_b^*\big),$$

which is the same as (5), so that $\pi^{st} = \pi^*$, the choice of investment is also socially optimal, and the result holds. *Q.E.D.*

In the definition of a stakeholder equilibrium, we have assumed that the firm takes into account the impact of its decisions on the demand for its product and the supply for its labor. However, the change in the criterion of the firm from shareholders' profit to stakeholders' total surplus has the consequence that the firm's pricing behavior on the spot markets is automatically competitive. When the welfare of all stakeholders is taken into account, there is no reason to exploit the elasticity of demand for the product at the expense of consumers, or of the supply of labor at the expense of workers, to increase the profit of the shareholders—so that the prices are competitive. Given that the firm correctly perceives the total surplus that it creates on the spot markets, it correctly evaluates its footprint on the economy and chooses the socially optimal investment.

3.2. *Implementing Stakeholder Equilibrium*

Implementing a stakeholder equilibrium requires that the firm's management adopt a stakeholder criterion of the form (22) as the basis for its decision making. In principle, this can come about in one of two ways: either because the firm operates in an environment where social norms and business practice make this the responsibility of management, or because direct incentives are in place which make it in the management's interest to adhere to such a criterion. As was shown by the survey quoted in the Introduction and as is corroborated by other studies (Jacoby (2001), Faurer and Fuerst (2006)), it is in Japan and Germany that the responsibility of the management is most clearly perceived to be in the spirit of a stakeholder criterion, social norms playing an important role in shaping the management philosophy.[21] In addition, in Germany the legal system reinforces the stakeholder orientation through the system of Codetermination by which half a corporation's Board members are representatives of the employees, and the other half includes representatives of the businesses which have close ties to the firm.

Even in countries such as the United States, where the legal system reflects the view that a corporation is the property of its shareholders, the management

[21]"Social norms" is a generic term referring to the implicit code of behavior and the explicit institutions (legal obligations, reward systems, ...) which induce the firms' management to take into account the interests of all stakeholders in countries like Germany and Japan. An interesting discussion of corporate management's view of its obligations in these countries, the reasons—in particular, historical reasons—for which these views have been formed and endure, as well as the half formal/half informal way in which employees are involved in business decisions, can be found in Jacoby (2001). In all countries, labor unions represent the interests of the employees. However, when corporate governance is almost completely shareholder oriented, as in the United States and the United Kingdom, unions serve more to bargain on the share of the revenue going to wages and benefits than to influence firms' strategic decisions in choices of investment and technologies.

philosophy in the 1950s and 1960s was very much stakeholder oriented. The authors (Sutton, Harris, Kaysen, and Tobin (1956, p. 64)) of the well-known study of American business in the 1950s stated: "corporation managers generally claim they have four broad responsibilities: to consumers, to employees, to stockholders, and to the general public ... each group is on an equal footing; the function of management is to secure justice for all and unconditional maxima for none." Such a broad view of the responsibilities of management makes it difficult to assign a precise objective for the firm, which can serve as a yardstick for evaluating the performance of management. The desire to have a quantitative measure of performance, combined with the increasingly conspicuous role of the stock market and financial markets more generally, seems to explain the subsequent shift in the United States toward the current view, advocated by the finance and economics profession, that firms' managers should only be concerned with maximizing profit, the stock market value of a company serving as an objective market-based measure of the success of management. Tirole (2001) is one of the few economists to have emphasized that since large corporations typically create significant externalities, a stakeholder orientation might be more appropriate since it might lead these firms to internalize their externalities. He concluded, however, that the main difficulty with using a stakeholder approach lies in finding quantifiable and observable measures of the costs and benefits of the different stakeholders.

Our approach provides a partial response to Tirole's critique since the criterion (22) gives a well-defined objective for the firm. However, there is no guarantee that the criterion will be used as the basis for decision making by the firm's manager: ways of measuring the "surpluses" CS and WS, as well as incentives for the management to maximize (22), must also exist. The implementation of a stakeholder equilibrium thus raises two issues:

- *Information*: to apply the stakeholder criterion, the manager needs information on the characteristics of the consumers and workers to evaluate their surpluses. In the preceding section, we assumed that the characteristics (u, v) are known by the firm's manager, but there must be some procedure which ensures that the firm's manager obtains this information.
- *Incentives*: incentives must be given to the firm's manager to apply the stakeholder criterion.

Since markets are typically good at providing both incentives and information, can we imagine a way to use markets that would provide the appropriate incentives and information to maximize the sum of the surpluses in (22)? In the spirit of Coase (1960), we introduce the idea that creating explicit tradeable property rights associated with the externalities created by the firm may help to implement a stakeholder equilibrium.[22]

[22]When all agents are identical and simultaneously consumers, workers, and shareholders, the externalities can be internalized by giving identical equity shares to all agents, since they will all agree that the firm should maximize the welfare of the representative agent as in Morgan

Suppose, therefore, that at date 0, in addition to the market for equity on which ownership shares are traded, there is a market for "consumer rights"—or more briefly, c-rights—on which agents exchange the right to buy the good produced by the firm at date 1 at the spot price $p = (p_g, p_b)$. In addition, there is a market for "worker rights"—or more briefly, w-rights—on which agents exchange the right to sell labor to the firm at date 1 at the spot price $w = (w_g, w_b)$. Suppose a mass $1 - \varepsilon$ of consumers have an endowment of one c-right and a mass $1 - \varepsilon$ of workers have an endowment of one w-right. The reason for introducing this ε shortage is that we need to create some scarcity in order to understand how the market values these rights; we then look at the valuations as ε goes to zero.

A worker with no initial w-right who observes the investment decision $\gamma(\pi)$ and anticipates a date 1 wage $w = (w_g, w_b)$ would be willing to pay up to

$$\text{(23)} \qquad \text{WV}(\pi, w) = \delta\big(\pi\,\text{WS}(w_g) + (1 - \pi)\,\text{WS}(w_b)\big)$$

to obtain the right to work for the firm, where $\text{WS}(w_s)$ defined by (21) is the surplus utility that a worker derives from selling labor at the wage w_s: $\text{WV}(\pi, w)$ is the date 0 "worker value" of being employed by the firm. A worker who owns a w-right will accept to sell it if its price is equal to or exceeds (23). Thus if $\varepsilon > 0$, equilibrium on the market for w-rights occurs at the price

$$\text{(24)} \qquad q_w(\pi, w) = \text{WV}(\pi, w).$$

If $\varepsilon = 0$ and every worker is endowed with a w-right, then no worker needs to buy a right, so that any price between 0 and $q_w(\pi, w)$ (at which every worker wants to keep the initial w-right) is an equilibrium price. To retain the symmetry of the model, we assume that every worker is endowed with a w-right and that the market price of a w-right is given by (24), since any scarcity, no matter how small, will immediately force the price to $q_w(\pi, w)$. By a similar argument, the market price $q_c(\pi, p)$ of a c-right is taken to be the discounted expected surplus utility derived by a consumer from buying the produced good at price p from the firm, namely, the "consumer value" $\text{CV}(\pi, p)$

$$\text{(25)} \qquad q_c(\pi, p) = \text{CV}(\pi, p) = \delta\big(\pi\,\text{CS}(p_g) + (1 - \pi)\,\text{CS}(p_b)\big).$$

The market values (q_c, q_w, q_e) of the c-rights and w-rights for consumers and workers and the stock market value of the firm's equity give the surpluses of the

and Tumlinson (2012). In our model, where consumers, workers, and shareholders have different preferences, there is no way of distributing equity shares among the agents that leads to the Pareto optimal investment. In a model with imperfect competition and two distinct classes of agents, Demichelis and Ritzberger (2011) showed that efficient pricing decisions can be obtained if agents trade equity shares strategically, being aware that their ability to influence the firm's decision depends on the magnitude of their ownership share.

three groups of stakeholders of the firm. We call an equilibrium, in which the objective of the manager is to maximize the total value of the rights attached to the firm net of the cost of investment, a Coasian equilibrium.

DEFINITION 3: A *Coasian equilibrium* of the economy $\mathcal{E}$ is a vector of actions and prices $((\tilde{c}, \tilde{\ell}, \tilde{\pi}, \tilde{l}), (\tilde{p}, \tilde{w}))$ such that

(i) the firm's manager chooses $(\tilde{\pi}, \tilde{l})$ to maximize the net market value of the rights attached to the firm

$$q_c\big(\pi, p(l)\big) + q_w\big(\pi, w(l)\big) + q_e\big(\pi, p(l), w(l)\big) - \gamma(\pi) \tag{26}$$

anticipating that the pricing functions $(p(\cdot), w(\cdot), q_c(\cdot), q_w((\cdot), , q_e(\cdot))$ are given by

(a) $p_s(l_s) = u'\big(f_s(l_s)\big)$,

(b) $w_s(l_s) = v'(l_s)$,

(c) $q_c\big(\pi, p(l)\big) = \dfrac{1}{1+r} \sum_{s=b,g} \pi_s\big(u\big(f_s(l_s)\big) - p_s(l_s) f_s(l_s)\big)$,

(d) $q_w\big(\pi, w(l)\big) = \dfrac{1}{1+r} \sum_{s=b,g} \pi_s\big(w_s(l_s) l_s - v(l_s)\big)$,

(e) $q_c\big(\pi, p(l), w(l)\big) = \dfrac{1}{1+r} \sum_{s=b,g} \pi_s\big(p_s(l_s) f_s(l_s) - w_s(l_s) l_s\big)$

(ii) $\tilde{p} = p(\tilde{l})$, $\tilde{w} = w(\tilde{l})$, $\tilde{q_c} = q_c(\tilde{\pi}, \tilde{p})$, $\tilde{q_w} = q_w(\tilde{\pi}, \tilde{w})$, $\tilde{c} = f(\tilde{l})$, $\tilde{l} = \tilde{\ell}$.

Equations (a) and (c) define the combined equilibrium on the markets for the good and the c-rights when the firm has chosen (π, l). If the price of the c-right were to exceed $q_c(\pi, p(l))$, all consumers would try to sell their c-rights and no agent would choose to buy the good. By the reasoning given above, we take the maximum value for q_c such that consumers willingly buy the good at the prices $p(l_s)$. In the same way, (b) and (d) define the combined equilibrium on the labor market and the market for w-rights. Replacing the values of the rights (q_c, q_w, q_e) by their values in (a)–(e), it is clear that a Coasian equilibrium coincides with the stakeholder equilibrium of Definition 2. As a result, a Coasian equilibrium leads to the socially optimal investment decision π^*.

The advantage of having an explicit market for w-rights and c-rights in addition to the equity market is that the firm's manager maximizes an observable market value rather than an unobservable surplus. However, to provide the manager with the incentives to maximize the stakeholder value (26), workers and consumers must be able to influence the investment decision of the firm. Thus when w-rights and c-rights are issued by the firm, the owners of these rights should acquire legal voting rights in the decision making process for investment. If unanimity is required to approve a change of management, and side payments are allowed, then the management will maximize the net stakeholder value (26) or be replaced: for if a manager fails to maximize (26), a "raider" could choose a production plan with a higher stakeholder value and obtain unanimity of the stakeholders' votes to replace the current management, the gains of the groups benefiting from the change being sufficient to compensate the losers (if any). In addition to providing the manager with incentives to apply the stakeholder criterion, the existence of liquid markets for w-rights and c-rights provides the required information on the worker and consumer surpluses: knowledge of the price functions $q_w(\pi, w)$ and $q_c(\pi, p)$, which may be acquired from repeated observations of market prices, is sufficient information to be able to maximize the total surplus in the economy.[23]

3.3. *Stakeholder and Coasian Equilibrium With Heterogeneous Agents*

The equivalence between a stakeholder equilibrium and a Coasian equilibrium established in the preceding section depends on the assumption that all consumers and workers are identical: with heterogeneity of agents, the equivalence no longer holds. Consider the benchmark model generalized to allow for heterogeneity in the consumers' and workers' utility/disutility functions, the firm, its technology, and the three goods remaining unchanged. Consumers are

[23]Our model can be generalized to incorporate the possibility of moral hazard on the part of the manager. Suppose, for example, that the realized investment is not perfectly observable by the stakeholders so that the manager can secretly divert funds: 1 dollar diverted from investment allows the manager to consume λ dollars (with $\lambda \leq 1$) while $1 - \lambda$ dollars are dissipated. In this simple setup, the optimal level of investment can be implemented by promising a bonus B to the manager if the good outcome occurs, and zero otherwise. The level of B must be such that the manager does not find it optimal to divert funds and invests the total amount $\gamma(\pi^*)$ provided by the shareholders: $\text{argmax}_{\pi \leq \pi^*}\{\delta\pi B + \lambda(\gamma(\pi^*) - \gamma(\pi))\} = \pi^*$. This condition is satisfied whenever

$$\delta B \geq \lambda \gamma'(\pi^*).$$

Since π^* is characterized by

$$\delta(W_g^* - W_b^*) = \gamma'(\pi^*),$$

the level of the bonus must be such that

$$B \geq \lambda(W_g^* - W_b^*).$$

Since $W_g^* - W_b^* > \bar{R}_g - \bar{R}_b$, the bonus promised to the manager in a stakeholder firm must be higher than in a profit-maximizing firm, since it must incorporate the increase in social surplus—and not only the increase in profit—associated with $s = g$ rather than $s = b$. This suggests that corporate governance issues may become more acute in a stakeholder firm.

now indexed by a parameter α drawn from an interval $[\underline{\alpha}, \overline{\alpha}] = A$, consumer α having the utility function

$$U^c(m, c, \alpha) = m_0 + \delta \sum_{s=b,g} \pi_s\big(m_s + u(c_s, \alpha)\big), \quad \alpha \in A.$$

The parameter α has a distribution G on A and consumers are ordered by their utility for the good, $u_\alpha(c, \alpha) = \frac{\partial u(c,\alpha)}{\partial \alpha} > 0$, higher α indicating higher utility. In the same way, the workers are indexed by a parameter β drawn from an interval $[\underline{\beta}, \overline{\beta}] = B$, worker β having the utility function

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

The parameter β has a distribution H on B and the workers are ordered by their disutility for labor, a higher β indicating a lower disutility for labor: $v_\alpha(\ell, \beta) = \frac{\partial v(\ell,\beta)}{\partial \beta} < 0$. The functions $u(\cdot, \alpha)$ and $v(\cdot, \beta)$ have the same properties as the functions u and v in Section 2. We continue to assume that there is a mass 1 of identical capitalists who own the firm and only consume money. Let $\widetilde{\mathcal{E}}$ denote the resulting heterogeneous agent economy.

The results of Section 2 extend readily to this setting. Finding a Pareto optimum can be decomposed into finding a consumption-labor allocation $(c_s^*, \ell_s^*)_{s=g,b}$ which solves, for $s = g, b$,

$$\text{(27)} \qquad \max_{(c_s,\ell_s)\geq 0} \int_A u\big(c_s(\alpha), \alpha\big)\, dG(\alpha) - \int_B v\big(\ell_s(\beta), \beta\big)\, dH(\beta)$$

$$\text{subject to} \quad \int_A c_s(\alpha)\, dG(\alpha) = f_s\bigg(\int_B \ell_s(\beta)\, dH(\beta)\bigg).$$

The solution $(c_s^*, \ell_s^*)_{s=g,b}$ is defined by the first-order conditions

$$\text{(28)} \qquad u_c\big(c_s^*(\alpha), \alpha\big) f_s'\big(l_s^*\big) = v_\ell\big(\ell_s^*(\beta), \beta\big), \quad \alpha \in A, \beta \in B, s = g, b,$$

$$y_s^* = \int_A c_s^*(\alpha)\, dG(\alpha), \quad l_s^* = \int_B \ell_s^*(\beta)\, dG(\beta), \quad y_s^* = f\big(l_s^*\big).$$

Let W_g^*, W_b^* denote the optimized values of (27) for $s = g, b$. The optimal investment maximizes

$$\delta\big(\pi W_g^* + (1 - \pi) W_b^*\big) - \gamma(\pi)$$

and is defined by the first-order condition

$$\delta\big(W_g^* - W_b^*\big) = \gamma'\big(\pi^*\big).$$

As in the homogeneous agent case, there is under-investment in a shareholder equilibrium. However, if the firm maximizes a stakeholder criterion, which takes into account the surpluses of all its stakeholders, then the investment is optimal.

Let $c_s(p_s, \alpha)$ denote the demand function of a consumer of type α defined by $u_c(c(p_s, \alpha), \alpha) = p_s$. When the spot price for the good is p_s this consumer's surplus is

$$\mathrm{cs}(p_s, \alpha) = u\big(c(p_s, \alpha), \alpha\big) - p_s c(p_s, \alpha),$$

and the total consumer surplus in each outcome s is

$$\mathrm{CS}(p_s) = \int_A \mathrm{cs}(p_s, \alpha)\, dG(\alpha).$$

In the same way, if $\ell(w_s, \beta)$ denotes the labor supply of a worker of type β defined by $v_\ell(\ell(w_s, \beta), \beta) = w_s$, the worker surplus when the wage is w_s is

$$\mathrm{ws}(w_s, \beta) = w_s \ell(w_s, \beta) - v\big(\ell(w_s, \beta), \beta\big),$$

and the total worker surplus is

$$\mathrm{WS}(w_s) = \int_B \mathrm{ws}(w_s, \beta)\, dH(\beta).$$

The surplus of the equity holders is the profit

$$R_s(p_s, w_s) = p_s \int_A c_s^*(\alpha)\, dG(\alpha) - w_s \int_B \ell_s^*(\beta)\, dH(\beta), \quad s = g, b.$$

In a stakeholder equilibrium of $\widetilde{\mathcal{E}}$, the firm chooses labor $l = (l_s)_{s=g,b}$ and investment π to maximize the discounted expected total surplus net of the cost of investment

$$\frac{1}{1+r} \sum_{s=g,b} \pi_s \big(\mathrm{CS}(p_s) + \mathrm{WS}(p_s) + R_s(p_s, w_s)\big) - \gamma(\pi)$$

anticipating that (p_s, w_s) satisfy

$$(29) \qquad \int_A c_s(p_s, \alpha)\, dG(\alpha) = f_s(l_s), \quad \int_B \ell(w_s, \beta)\, dH(\beta) = l_s, \quad s = g, b.$$

It is easy to check that a stakeholder equilibrium of $\widetilde{\mathcal{E}}$ satisfies the FOCs for Pareto optimality so that, given the concavity/convexity assumptions on u, v, f, the stakeholder equilibrium is Pareto optimal.

Suppose we try to implement a stakeholder equilibrium using tradeable c-rights and w-rights, requiring the firm's manager to maximize the net market value of the rights—c-rights, w-rights, and equity—attached to the firm. As in the homogeneous case, suppose that a measure $1-\varepsilon$ of consumers own a c-right, a measure $1-\varepsilon$ of workers own a w-right, and let ε tend to 0. If consumer α, having observed the firm's investment leading to π and anticipating the spot prices $(p_s)_{s=g,b}$, faces the price q_c for a c-right, then this consumer will buy the right, or retain it if he already owns it, provided

$$\delta \sum_{s=g,b} \pi_s \,\mathrm{CS}(p_s, \alpha) \geq q_c,$$

that is, if the expected profit he gets from the right exceeds its price. Since the assumption $u_\alpha(c, \alpha) > 0$ implies that an agent of type $\alpha' > \alpha$ gets more surplus than consumer α,[24] it follows that if α buys or keeps a c-right, all consumers with $\alpha' > \alpha$ also buy or hold the c-right. If there is a measure $1-\varepsilon$ of rights on the market, then the price q_c must be such that a mass $1-\varepsilon$ of agents want to buy or hold the right, that is, it must be equal to the surplus of the marginal consumer $\alpha(\varepsilon)$ defined by

$$\int_{\alpha(\varepsilon)}^{\overline{\alpha}} dG(\alpha) = 1 - \varepsilon.$$

If $\varepsilon \to 0$, then $\alpha(\varepsilon) \to \underline{\alpha}$ and the price of a c-right tends to

$$q_c(\pi, p) = \frac{1}{1+r} \sum_{s=g,b} \pi_s \,\mathrm{cs}(p_s, \underline{\alpha}). \tag{30}$$

By the same reasoning, when $\varepsilon \to 0$, if every worker has observed the firm's investment $\gamma(\pi)$ and anticipates the wages $(w_s)_{s=g,b}$, then the price of a w-right tends to

$$q_w(\pi, w) = \frac{1}{1+r} \sum_{s=g,b} \pi_s \,\mathrm{cw}(w_s, \underline{\beta}). \tag{31}$$

In a *Coasian equilibrium* of $\widetilde{\mathcal{E}}$, the firm's manager chooses (π, l) to maximize the net market value of the firm's rights

$$q_c\big(\pi, p(l)\big) + q_w\big(\pi, w(l)\big) + q_e\big(\pi, p(l), w(l)\big) - \gamma(\pi) \tag{32}$$

anticipating that $(p(l), w(l))$ are given by (29) and the asset prices (q_c, q_w) are given by (30) and (31). In an economy with heterogeneous agents, the

[24] $\frac{d}{d\alpha}[\mathrm{cs}(p, \alpha)] = \frac{d}{d\alpha}[u(c(p, \alpha), \alpha) - pc(p, \alpha)] = u_c \frac{\partial c(p,\alpha)}{\partial \alpha} + u_\alpha - p\frac{\partial c(p,\alpha)}{\partial \alpha} = u_\alpha > 0.$

market prices of the c-rights and w-rights no longer correctly reflect the total surpluses of consumers and workers since these prices correspond to the valuations of the consumers and workers with the *lowest* surpluses. As a result, the Coasian equilibrium no longer coincides with a stakeholder equilibrium.

To understand the relation between the two equilibria, consider an economy with heterogeneous agents such that

$$u(c,\alpha)=\alpha c^a,\quad 0<a<1,\quad v(\ell,\beta)=\frac{1}{\beta}\ell^b,\quad b\geq 1,$$

where α and β are uniformly distributed on $A=[\underline{\alpha},\overline{\alpha}]$, $\underline{\alpha}>0$ and $B=[\underline{\beta},\overline{\beta}]$, $\underline{\beta}>0$. Then there are coefficients[25] θ_c and θ_w, with $0<\theta_c<1$, $0<\theta_w<1$, such that

$$\text{cs}(p,\underline{\alpha})=\theta_c\,\text{CS}(p),\quad \text{ws}(w,\underline{\beta})=\theta_w\,\text{WS}(w),$$

so that the surplus of the consumer (worker) with the lowest valuation captures the proportion θ_c (θ_w) of the total[26] surplus. The coefficients θ_c and θ_w are independent of the spot prices (p,w) and are decreasing functions of the extent of heterogeneity $\overline{\alpha}-\underline{\alpha}$ and $\overline{\beta}-\underline{\beta}$ of the group to which they refer. When $\overline{\alpha}-\underline{\alpha}\to 0$, $\theta_c\to 1$ and when $\overline{\beta}-\underline{\beta}\to 0$, $\theta_w\to 1$. In a Coasian equilibrium, the firm's manager maximizes the criterion

$$\frac{1}{1+r}\sum_{s=g,b}\pi_s\big(\theta_c\,\text{CS}(p_s)+\theta_w\,\text{WS}(p_s)+R_s(p_s,w_s)\big)-\gamma(\pi). \tag{33}$$

We call (33) a *stakeholder oriented criterion* since the surpluses of the consumers and workers are both given positive weight, but less weight than the profit of the shareholders. In the limit when the heterogeneity disappears ($\overline{\alpha}-\underline{\alpha}\to 0$, $\theta_c\to 1$, $\overline{\beta}-\underline{\beta}\to 0$, $\theta_w\to 1$), the Coasian equilibrium converges to a stakeholder equilibrium. Thus when the heterogeneity is not too large ($\overline{\alpha}-\underline{\alpha}$ and $\overline{\beta}-\underline{\beta}$ small), the weights on consumers and workers are close to 1 and the equilibrium is close to the Pareto optimum.

[25]Standard calculations give $c(p,\alpha)=(\frac{\alpha a}{p})^{1/(1-a)}$, $\text{cs}(p,\alpha)=(1-a)\alpha^{1/(1-a)}(\frac{a}{p})^{a/(1-a)}$, $\text{CS}(p)=\frac{(1-a)^2}{2-a}\frac{\overline{\alpha}^{(2-a)/(1-a)}-\underline{\alpha}^{(2-a)/(1-a)}}{\overline{\alpha}-\underline{\alpha}}(\frac{a}{p})^{a/(1-a)}$, $\theta_c=\frac{2-a}{1-a}\frac{(\overline{\alpha}-\underline{\alpha})\underline{\alpha}^{1/(1-a)}}{\overline{\alpha}^{(2-a)/(1-a)}-\underline{\alpha}^{(2-a)/(1-a)}}$. For the workers, $\ell(w,\beta)=(\frac{\beta w}{b})^{1/(b-1)}$, $\text{ws}(w,\beta)=(b-1)\beta^{1/(b-1)}(\frac{w}{b})^{b/(b-1)}$, $\text{WS}(w)=\frac{(b-1)^2}{b}\frac{\overline{\beta}^{b/(b-1)}-\underline{\beta}^{b/(b-1)}}{\overline{\beta}-\underline{\beta}}(\frac{w}{b})^{b/(b-1)}$, $\theta_w=\frac{2-a}{1-a}\frac{\underline{\beta}^{b/(b-1)}(\overline{\beta}-\underline{\beta})}{\overline{\beta}^{b/(b-1)}-\underline{\beta}^{b/(b-1)}}$.

[26]As noted in footnote 8, all the quantities in the paper should be understood as per capita quantities. The total surplus referred to in the text is actually the average surplus, which is larger than the surplus of the agent with the lowest valuation.

4. MULTIPLE FIRMS

In this section, we extend the benchmark model with homogeneous agents and a single firm to the case of multiple firms. We focus on the simplest case where only the firm in the benchmark model (now called firm 1) has an exposure-to-risk decision, the other firms competing with firm 1 having deterministic technologies; this case suffices to show the new elements that enter when there is more than one firm. Let $f_2, \dots, f_J$ denote the production functions by which the firms transform labor into the consumption good, each function f_j being concave, increasing, and satisfying $f_j(0) = 0$, $f_j'(0) = \infty$. These firms are small and act as price takers on the spot markets. There is thus no loss of generality in aggregating them into a single surrogate firm (called firm 2 for convenience) with technology $\hat{f}$ defined by

$$\hat{f}(\hat{l}) = \max\{f_2(l_2) + \cdots + f_J(l_J) | l_2 + \cdots + l_J = \hat{l}\}$$

with the same properties as the functions f_j. Firms $2, \dots, J$ constitute the "competitive fringe" which shares the spot markets with the "large" firm 1; let $\mathcal{E}_J$ denote the resulting economy. If $y_s = f_s(l_s)$ and $\hat{y}_s = \hat{f}(\hat{l}_s)$ denote the outputs of the two firms, then the social welfare in outcome s is $W_s = u(y_s + \hat{y}_s) - v(l_s + \hat{l}_s)$. If the allocation is obtained through spot markets with prices (p_s, w_s), then this welfare can be decomposed as

$$\begin{aligned} W_s &= \big(u(y_s + \hat{y}_s) - p_s(y_s + \hat{y}_s)\big) + \big(w_s(l_s + \hat{l}_s) - v(l_s + \hat{l}_s)\big) \\ &\quad + \big(p_s(y_s + \hat{y}_s) - w_s(l_s + \hat{l}_s)\big) \\ &= \mathrm{CS}_s + \mathrm{WS}_s + R_s + \hat{R}_s, \end{aligned}$$

where the two surplus terms can be further decomposed

$$\begin{aligned} \mathrm{CS}_s &= \big(u(\hat{y}_s) - p_s\hat{y}_s\big) + \big(\big[u(y_s + \hat{y}_s) - u(\hat{y}_s)\big] - p_s y_s\big), \\ \mathrm{WS}_s &= \big(w_s\hat{l}_s - v(\hat{l}_s)\big) + \big(w_s l_s - \big[v(l_s + \hat{l}_s) - v(\hat{l}_s)\big]\big), \end{aligned}$$

into the surplus created by firm 2 and the additional surplus attributable to firm 1.

To be an "ideal" stakeholder firm in the economy $\mathcal{E}_J$, firm 1 would need to choose investment to maximize $\delta \sum_s \pi_s(\mathrm{CS}_s + \mathrm{WS}_s + R_s + \hat{R}_s) - \gamma(\pi_s)$; this would require that the firm take into account not only the difference between the good and the bad outcome for the profit of its shareholders and the surplus it generates for its consumers and workers, but also for the consumer and worker surpluses created by the other firms, as well as the profit of the other firms. This would indeed be an encompassing vision of the "stakeholders" of the firm, but it would be difficult to reconcile with competition between firms on the product and labor markets.

Realistically, the most that can be expected of a corporation is that it take into account the interests of its own stakeholders—its shareholders, the consumers it serves, and the workers it employs. Let us therefore define the value of firm 1 for consumers and workers as the additional consumer and worker surplus it creates over the surplus attributable to firm 2:

$$\text{(34)} \qquad \begin{aligned} &\mathrm{CV}(y_s, \hat{y}_s, p_s) = u(y_s + \hat{y}_s) - u(\hat{y}_s) - p_s y_s, \\ &\mathrm{WV}(l_s, \hat{l}_s, w_s) = w_s l_s - \big[v(l_s + \hat{l}_s) - v(\hat{l}_s)\big]. \end{aligned}$$

CV and WV are the money equivalent of the increase in utility attributable to the ability to buy from firm 1 for the consumers, and to work for firm 1 for the workers, taking the decisions of other firms as given. The consumer and worker values are firm 1's contribution to the total consumer and worker surpluses—but are not equal to the total surpluses.

We define a *stakeholder firm* as a firm that maximizes the total value it creates for its stakeholders—consumers, workers, shareholders—taking the production of the other firms as given.

DEFINITION 4: A *stakeholder equilibrium* of the economy $\mathcal{E}_J$ is a vector of actions and prices $((c^{\mathrm{st}}, \ell^{\mathrm{st}}, \pi^{\mathrm{st}}, l^{\mathrm{st}}, \hat{l}^{\mathrm{st}}), (w^{\mathrm{st}}, p^{\mathrm{st}}))$ such that

(i) firm 1 chooses $(\pi^{\mathrm{st}}, l^{\mathrm{st}})$ to maximize

$$\text{(35)} \qquad \frac{1}{1+r} \sum_{s=g,b} \pi_s \big(\mathrm{CV}\big(y_s, \hat{y}^{\mathrm{st}}, p_s\big) + \mathrm{WV}\big(l_s, \hat{l}^{\mathrm{st}}, w_s\big) + R(l_s, w_s, p_s)\big) - \gamma(\pi)$$

under the constraints

$$\text{(36)} \qquad y_s = f(l_s), \quad p_s = u'\big(y_s + \hat{y}_s^{\mathrm{st}}\big), \quad w_s = v'\big(l_s + \hat{l}_s^{\mathrm{st}}\big),$$

(ii) firm 2 chooses $\hat{l}^{\mathrm{st}} = (\hat{l}_g^{\mathrm{st}}, \hat{l}_b^{\mathrm{st}})$ to maximize $\frac{1}{1+r} \sum_{s=g,b} \pi_s^{\mathrm{st}} (p_s^{\mathrm{st}} \hat{f}(\hat{l}_s) - w_s^{\mathrm{st}} \hat{l}_s)$,

(iii) $c_s^{\mathrm{st}} = y_s^{\mathrm{st}} + \hat{y}_s^{\mathrm{st}}$, $\ell_s^{\mathrm{st}} = l_s^{\mathrm{st}} + \hat{l}_s^{\mathrm{st}}$, $s = g, b$.

Thus, in a stakeholder equilibrium of $\mathcal{E}_J$, firm 2 (each of the firms of the competitive fringe) maximizes discounted expected profit, taking prices and the probabilities of the outcomes as given, while firm 1 acts like a Cournot competitor, taking the actions of other firms as given, and maximizes the discounted expected total values it creates for its stakeholders, net of the cost of investment. The FOCs for the consumers and workers are incorporated as constraints (36) for firm 1. The next proposition shows that, in a stakeholder equilibrium of $\mathcal{E}_J$, the labor is optimally allocated on the spot markets and prices are competitive, but firm 1 is induced to undertake excess investment to control its exposure to risk.

PROPOSITION 3: *Let* $(c_s^*, \ell_s^*, \pi_s^*, l_s^*, \hat{l}_s^*)$ *denote the Pareto optimum of the economy* $\mathcal{E}_J$. *A stakeholder equilibrium of* $\mathcal{E}_J$ *is such that*

(i) $(c_s^{\text{st}}, \ell_s^{\text{st}}, l_s^{\text{st}}, \hat{l}_s^{\text{st}}) = (c_s^*, \ell_s^*, l_s^*, \hat{l}_s^*)$, $s = g, b$ (*the spot market allocation is optimal*),

(ii) $\pi^{\text{st}} > \pi^*$ (*there is over-investment*).

PROOF: (i) Substituting (34) into the criterion (35), firm 1 chooses l_s to maximize $(u(f_s(l_s) + \hat{y}_s^{\text{st}}) - u(\hat{y}_s^{\text{st}})) - (v(l_s + \hat{l}_s^{\text{st}}) - v(\hat{l}_s^{\text{st}}))$, so that l_s^{st} is defined by

$$u'\big(f_s\big(l_s^{\text{st}}\big) + \hat{y}_s^{\text{st}}\big)f_s'\big(l_s^{\text{st}}\big) - v'\big(l_s^{\text{st}} + \hat{l}_s^{\text{st}}\big) = 0, \tag{37}$$

while firm 2's choice of labor satisfies $p_s^{\text{st}}\hat{f}'(\hat{l}_s^{\text{st}}) = w_s^{\text{st}}$. Thus, the FOCs for maximization of social welfare in outcome s, $s = g, b$, are satisfied and prices are competitive.

(ii) The FOC for maximizing (35) with respect to π is

$$\begin{aligned}(1+r)\gamma'\big(\pi^{\text{st}}\big) &= \big[\big(u\big(y_g^* + \hat{y}_g^*\big) - u\big(\hat{y}_g^*\big)\big) - \big(u\big(y_b^* + \hat{y}_b^*\big) - u\big(\hat{y}_b^*\big)\big)\big] \\ &\quad - \big[\big(v\big(l_g^* + \hat{l}_g^*\big) - v\big(\hat{l}_g^*\big)\big) - \big(v\big(l_b^* + \hat{l}_b^*\big) - v\big(\hat{l}_b^*\big)\big)\big] \\ &= \big[W_g^* - W_b^*\big] - \big[\widehat{W}_g^* - \widehat{W}_b^*\big],\end{aligned}$$

where W_s^* is the maximum social welfare in outcome s and $\widehat{W}_s^* = u(\hat{f}(\hat{l}_s^*)) - v(\hat{l}_s^*)$ is the social welfare that can be attributed to firm 2. The socially optimal investment π^* is defined by $\gamma'(\pi^*) = \frac{1}{1+r}(W_g^* - W_b^*)$. Thus, $\pi^{\text{st}} > \pi^*$ is equivalent to $\widehat{W}_g^* - \widehat{W}_b^* < 0$. Intuitively, in the bad outcome, firm 2 "fills in" for firm 1, produces more, and creates more surplus than in the good outcome. To show this inequality, note that firm 2's surplus function

$$\widehat{W}(\hat{l}) = u\big(\hat{f}(\hat{l})\big) - v(\hat{l}) \tag{38}$$

is a concave function which is increasing on the interval $[0, \hat{l}_o]$, where $\hat{l}_o$, defined by $u'(\hat{f}(\hat{l}_o))\hat{f}'(\hat{l}_o) - v'(\hat{l}_o) = 0$, is the value for which $\widehat{W}$ attains its maximum. We show that $\hat{l}_g^{\text{st}}$ and $\hat{l}_b^{\text{st}}$ belong to the interval $[0, \hat{l}_o]$. Suppose $\hat{l}_s^{\text{st}} > \hat{l}_o$. Then

$$\begin{aligned}u'\big(y_s^{\text{st}} + \hat{f}\big(\hat{l}_s^{\text{st}}\big)\big)\hat{f}'\big(\hat{l}_s^{\text{st}}\big) &< u'\big(y_s^{\text{st}} + \hat{f}(\hat{l}_o)\big)\hat{f}'(\hat{l}_o) < u'\big(\hat{f}(\hat{l}_o)\big)\hat{f}'(\hat{l}_o) \\ &= v'(\hat{l}_o) < v'\big(l_s^{\text{st}} + \hat{l}_s^{\text{st}}\big),\end{aligned}$$

which would contradict that the allocation of labor is optimal at the stakeholder equilibrium. Since $\widehat{W}$ is increasing on $[0, \hat{l}_o]$, the result of Lemma 1 completes the proof of Proposition 3.

LEMMA 1: $\hat{l}_g^{st} < \hat{l}_b^{st}$.

The proof of this lemma requires calculation of the spot equilibria in outcomes g and b when prices are competitive. These calculations are made in the Supplemental Material (Magill, Quinzii, and Rochet (2015)), which generalizes Section 2.4.1 to the case of several firms. The proof of Lemma 1 is thus given in Section S.4 in the Supplemental Material. *Q.E.D.*

The stakeholder criterion overstates the benefit of the good versus the bad outcome for consumers and workers because it does not take into account that these agents get more surplus from the other firms when firm 1 has a bad outcome. A way of correcting this overstatement—which leads to the overinvestment result of Proposition 3—is to decrease the weight placed on consumers and workers in the criterion of firm 1. This will tend to decrease investment, but will also lead to imperfectly competitive prices on the spot markets. The next proposition shows that, modulo an assumption on the response of firm 2 to a change in prices, decreasing the weights on consumer and worker values does improve welfare. Since the welfare in the spot economies at date 1 is at its maximum at a stakeholder equilibrium, the change in prices when the weight on consumer and worker values decreases is a second-order effect, while the change in investment is a first-order effect. As in Section 3.3, we call an equilibrium in which firm 1 places a positive weight on consumer and worker values a *stakeholder-oriented* equilibrium.

PROPOSITION 4: *If*, *instead of the criterion of* (35), *firm* 1 *maximizes the stakeholder-oriented criterion*

$$\frac{1}{1+r}\sum_{s=g,b}\pi_s\big(\theta\big[\mathrm{CV}\big(y_s,\hat{y}^{st},p_s\big)+\mathrm{WV}\big(l_s,\hat{l}^{st},w_s\big)\big]+R(l_s,w_s,p_s)\big)$$
$$-\gamma(\pi)$$

with θ *less than*, *but close to*, 1, *and if* $\frac{\partial\hat{l}_g}{\partial\theta}|_{\theta=1}\leq\frac{\partial\hat{l}_b}{\partial\theta}|_{\theta=1}\leq 0$, *then the stakeholder-oriented equilibrium improves on the stakeholder equilibrium*.

PROOF: Let $((c(\theta),\ell(\theta),\pi(\theta),l(\theta),\hat{l}(\theta)),(p(\theta),w(\theta)))$ denote the stakeholder-oriented equilibrium of $\mathcal{E}_J$ as a function of the weight θ on the consumer and worker values. Let $W_s(\theta)=u(c_s(\theta))-v(\ell_s(\theta))$ be the associated social welfare in outcome s and $\widehat{W}_s(\theta)=u(\hat{f}(\hat{l}_s(\theta)))-v(\hat{l}_s(\theta))$ be the welfare attributable to firm 2. The discounted expected welfare is

$$\mathcal{W}(\theta)=\delta\sum_{s=g,b}\pi_s(\theta)W_s(\theta)-\gamma\big(\pi(\theta)\big),$$

so that

$$\mathcal{W}'(\theta) = \pi'(\theta)\big[\delta\big(W_g(\theta) - W_b(\theta)\big) - \gamma'\big(\pi(\theta)\big)\big] + \delta \sum_{s=g,b} \pi_s(\theta) W_s'(\theta).$$

To prove Proposition 4, we need to prove that $\mathcal{W}'(1) < 0$. We have shown in the proof of Proposition 3 that the term in the square bracket is negative at the stakeholder equilibrium ($\theta = 1$) and, because W_s is maximized at the stakeholder equilibrium, $W_s'(1) = 0$. Thus, $\mathcal{W}'(1) < 0$ is equivalent to $\pi'(1) > 0$. Firm 1's optimal choice of π is defined by the FOC

$$(1+r)\gamma'\big(\pi(\theta)\big) = \theta\big(\big(W_g(\theta) - W_b(\theta)\big) - \big(\widehat{W}_g(\theta) - \widehat{W}_b(\theta)\big)\big) + (1-\theta)\big(R_g(\theta) - R_b(\theta)\big),$$

which implies

$$\begin{aligned} (39) \qquad & (1+r)\gamma''\big(\pi(\theta)\big)\pi'(\theta) \\ &= \big(W_g(\theta) - R_g(\theta)\big) - \big(W_b(\theta) - R_b(\theta)\big) - \big(\widehat{W}_g(\theta) - \widehat{W}_b(\theta)\big) \\ &\quad + (1-\theta)\big(R_g'(\theta) - R_b'(\theta)\big) \\ &\quad + \theta\big(\big(W_g'(\theta) - W_b'(\theta)\big) - \big(\widehat{W}_g'(\theta) - \widehat{W}_b'(\theta)\big)\big). \end{aligned}$$

When $\theta = 1$, (i) $W_g(1) - R_g(1) = W_g^* - \bar{R}_g > W_b^* - \bar{R}_b = W_b(1) - R_b(1)$. This follows from Lemma S1, the extension of Lemma 2 to the case of multi firms in Section S.1 in the Supplemental Material. (ii) $\widehat{W}_g(1) - \widehat{W}_b(1) = \widehat{W}_g^* - \widehat{W}_b^* < 0$ by Proposition 3. (iii) $W_g'(1) - W_b'(1) = 0$ since the welfare W_s is maximum for $\theta = 1$.

Let $\widehat{W}(\hat{l})$ be firm 2's surplus function defined in (38). Then $\widehat{W}_s(\theta) = \widehat{W}(\hat{l}_s(\theta))$, so that $\widehat{W}_s'(1) = \frac{d\widehat{W}(\hat{l}_s^{\mathrm{st}})}{d\hat{l}} \frac{d\hat{l}_s}{d\theta}|_{\theta=1}$. Since $\widehat{W}$ is concave increasing on $[0, \hat{l}_o]$ and since $\hat{l}_g^{\mathrm{st}}$ and $\hat{l}_b^{\mathrm{st}}$ belong to this interval with $\hat{l}_g^{\mathrm{st}} < \hat{l}_b^{\mathrm{st}}$, it follows that $\frac{d\widehat{W}(\hat{l}_g^{\mathrm{st}})}{d\hat{l}} > \frac{d\widehat{W}(\hat{l}_b^{\mathrm{st}})}{d\hat{l}} > 0$. If $\frac{\partial \hat{l}_g}{\partial \theta}|_{\theta=1} \le \frac{\partial \hat{l}_b}{\partial \theta}|_{\theta=1} \le 0$ as assumed[27] in Proposition 4, then $\widehat{W}_g'(1) - \widehat{W}_b'(1) < 0$. Thus, all nonzero terms on the right hand side of (39)

[27] It can be shown by the same method as in the proof of Lemma 1 that $\frac{\partial \hat{l}_s}{\partial \theta} < 0$ for $s = g, b$: when θ decreases, firm 1 puts more weight on profit, charges higher prices, and the other firms produce more. Thus, the negative sign for the derivative is not an assumption. The property needed is that in outcome b where firm 2 produces more, it does not react more to a decrease $\Delta\theta$ than in outcome g: $|\Delta \hat{l}_b| \le |\Delta \hat{l}_g|$. This depends in a complicated way on the interactions between firms' technologies, consumer demand, and worker supply of labor. The condition is only sufficient: if $|\Delta \hat{l}_b| > |\Delta \hat{l}_g|$, but the difference is small, then the term $\widehat{W}_g'(1) - \widehat{W}_b'(1)$ can still be negative, and even if this term is positive, the positive terms in the first line of (39) can dominate the term $-(\widehat{W}_g'(1) - \widehat{W}_b'(1))$.

are positive and, since $\gamma''(\pi(1)) > 0$, it follows that $\pi'(1) > 0$ and the proof is complete. *Q.E.D.*

5. CONCLUSION

Berle and Means's (1932) classic study of the corporation is best known for showing that the emergence of the very large scale modern corporation led inevitably to the separation between ownership and control, and that as a result, incentives have to be created to induce managers (the control) to perform their fiduciary duty to the shareholders. However, in the final chapter on "The New Concept of the Corporation," they focused on another idea which has not been given the same attention—that at the end of the day, it is not at all clear that a corporation should be run exclusively in the interest of its shareholders. When a large corporation in the pursuit of its regular activities uses "private property" (financed by its shareholders), which, in view of the scale of the corporation, has important consequences for agents other than its shareholders, then the "privateness" of the property (and hence its fiduciary aspect) comes into question. As a result, a large corporation must focus on the consequences of its actions for the interests of all parties with whom it interacts on a regular basis.[28]

This broader view of the responsibility of the corporation has not caught on in the United Kingdom or the United States, where it has even been vigorously attacked. To quote 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." In other countries, however, especially Germany, France, and Japan, corporations are run in a way that is closer to a stakeholder approach with a significant weight placed on the workers. Thus, a stakeholder approach has made its way into the practice of some countries, even though a widely accepted theory justifying this approach has yet to be worked out.[29]

A valid *theoretical* foundation for a stakeholder theory of the firm requires two preconditions: (1) decisions taken by the firms must have an external effect on stakeholders; (2) these externalities must not be readily resolved by government intervention (regulation or taxation). In this paper, we have presented a

[28]... "neither the claims of ownership nor those of control can stand against the paramount interests of the community.... When a convincing system of community obligations is worked out and is generally accepted, in that moment the passive property right of today must yield before the larger interests of society. Should the corporate leaders, for example, set forth a system comprising fair wages, security to employees, reasonable service to their public, and stabilization of business, all of which would divert a portion of the profits from the owners of passive property, and should the community generally accept such a scheme as a logical and human solution of industrial difficulties, the interests of passive property owners would have to give way." (Berle and Means (1932, p. 310)).

[29]There is, however, a discussion of stakeholder theory in the management literature which defines a stakeholder firm as one which "pursues multiple objectives of parties with different interests" (Kochan and Rubinstein (2000)).

model where both these preconditions are present: the external effect comes from the fact that the risks of large firms have consequences for agents other than their shareholders—in particular, their consumers and employees—and the firms can typically invest to control these risks. Such investments, however, are not easily observable and thus difficult to subsidize. We have studied whether adopting a stakeholder criterion can improve on the shareholder profit-maximizing equilibrium.

If the elements of a stakeholder theory seem to fall into place in the idealized case of an economy with a single firm, extending the theory to the more general setting where several firms compete on the product and labor markets presents new difficulties. For in this setting, to achieve the social optimum, each firm would need to take into account the effect of its investment on the expected utilities of all agents in the economy, including the consumers, workers, and shareholders of the other firms. Placing the welfare of the stakeholders of competing firms directly into the objective function of a firm is not, however, a realistic proposal since it would come into conflict with competition on the spot markets, which is required for efficiency. Just including the surpluses of the firm's own consumers and workers in a stakeholder equilibrium does not lead to efficiency, but we show that decreasing the weight on the surpluses of the firm's consumers and workers from the full weight in the stakeholder criterion improves on the stakeholder allocation. For when full weight is placed on the surpluses of its own consumers and workers, then the firm exaggerates the benefit of achieving a good outcome since it neglects the fact that its competitors produce more and create more surplus for the economy when it is less productive. Modifying the stakeholder criterion by decreasing the weight placed on the surpluses of the firm's consumers and workers implicitly takes into account the offsetting surpluses created by the other firms.

There remain the informational and incentive problems of evaluating the surpluses and ensuring that they are taken into account by a firm's manager. In the case of a single firm, we introduce Coasian markets for the right to buy from, or to work for, the firm. With homogeneous agents, maximizing the total value of the rights attached to the firm leads to an efficient outcome. Extending the idea to the multi-firm setting is not easy with the simple model of this paper in which firms produce homogeneous goods using homogeneous labor. Extending the Coasian idea of creating consumer and worker rights requires that firms produce differentiated products and use different types of labor or in different locations. Since in a setting with heterogeneous consumers and workers, the price of a right will not reveal the full surplus, only the surplus of the marginal buyer, maximizing the total value of rights seems commensurate with the theoretical result that only part of a firm's consumer and worker surpluses should be taken into account in a multi-firm setting. More research is needed to find robust and practical ways of introducing markets for consumer and worker rights, thereby enabling corporations to simultaneously take the interests of their stakeholders into account, while retaining an objective market-based criterion for measuring management performance.

APPENDIX

LEMMA 2: (i) *The function* $D(t) = W(t) - R(t)$ *is strictly increasing on* [0, 1]; (ii) $p(t)$ *is decreasing and the consumer surplus is increasing on* [0, 1]; (iii) *if* $l(t)$ *increases* (*decreases*), *the worker surplus increases* (*decreases*).

PROOF: (i) By the envelope theorem,

$$W'(t) = u'\big(c(t)\big)f_1\big(t, l(t)\big),$$

$$R'(t) = p'(t)f\big(t, l(t)\big) + p(t)f_1\big(t, l(t)\big) - w'(t)l(t).$$

Thus, $D'(t) = -p'(t)f(t, l(t)) + w'(t)l(t)$,

$$p'(t) = u''\big(c(t)\big)\big[f_1\big(t, l(t)\big) + f_2\big(t, l(t)\big)l'(t)\big], \quad w'(t) = v''\big(\ell(t)\big)l'(t). \tag{40}$$

The change in the optimal allocation of labor $l'(t)$ can be obtained by differentiating the FOCs for the optimal allocation of labor (18). This gives

$$l' = -\frac{u''f_1f_2 + u'f_{21}}{u''(f_2)^2 + u'f_{22} - v''}. \tag{41}$$

The denominator is negative since f_{22} and u'' are negative and v'' is positive, while the sign of the numerator is ambiguous. However, substituting this expression into $D'(t) = -u''f_1f + (v''l - u''f_2f)l'$ gives

$$D'(t) = \frac{1}{den}\big[u'u''f[f_2f_{21} - f_1f_{22}] + v''u''f_1[f - f_2l] - v''u'f_{21}l\big],$$

where "*den*" is the negative denominator of l'. Since by concavity of f, $f - f_2l > 0$, all the terms in the numerator are negative and $D'(t) > 0$; thus, moving toward the good outcome constantly increases the welfare by more than the increase in profit.

(ii) Let $\mathrm{CS}(t) = u(c(t)) - p(t)c(t)$ be the consumer surplus. Since $\frac{d\,\mathrm{CS}(t)}{dt} = -p'(t)c(t)$, if the price is decreasing, the consumer surplus is increasing. Inserting the value of l' in (41) into (40) leads to

$$p' = \frac{u''}{den}\big[u'(f_1f_{22} - f_{21}f_2) - v''f_1\big] < 0.$$

(iii) Let $\mathrm{WS}(t) = w(t)l(t) - v(l(t))$ denote the worker surplus. Since $\frac{d\,\mathrm{WS}(t)}{dt} = w'(t)l(t)$ and, by (40), $w'(t)$ has the sign of $l'(t)$, the result follows. *Q.E.D.*

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