

The stakeholder corporation and social welfare*

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Abstract

The stakeholder (or responsible) firm is defined in this paper as one that maximizes the (weighted or unweighted) sum of the surpluses of its customers and suppliers (including workers). We show that, although this objective is hard to empirically measure, it can be pursued by simple management rules that rely on constrained profit maximization. We find that unconstrained profit maximization gives a competitive edge to ordinary firms, but that stakeholder firms are better for social welfare and internalize several important effects of their activities on society. We also show that long term entry decisions should rely on profit modified by Pigouvian pricing of externalities, incidentally providing a novel justification for the polluter-pays principle.

Keywords: stakeholder, shareholder value, profit, Pigou tax.

JEL Classification: D21, D40, D60, L21.

1 Introduction

There is growing momentum behind reconsidering the purpose of the corporation. New forms of corporations with societal and environmental goals are trendy (e.g., benefit corporations in the USA, “entreprises à mission” in France), big corporations are signing on new declarations of purpose (viz. the Aug. 2019 Business Roundtable Statement:

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“we share a fundamental commitment to all of our stakeholders”), and management experts argue for going beyond shareholder value (e.g., Kelly 2019, Mayer 2018, Edmans 2020). To some extent, this trend has parallels with the movement for going “beyond GDP” (Fitoussi, Sen, Stiglitz 2009). In both cases, there is a widespread feeling that narrow financial metrics have generated a deleterious neglect of important determinants of well-being, and that adopting broader goals of economic management would be much preferable.

In both cases, however, the challenge is that the financial metrics seem to have simplicity and objectivity on their side. In the case of business firms, Jensen (2001) and Tirole (2001, 2006), echoing Friedman (1970), argue in informal terms that allowing managers to adopt broader objectives than profit dramatically amplifies agency issues and is a recipe for arbitrariness, waste and corruption. “In a nutshell, management can almost always rationalize any action by invoking its impact on the welfare of some stakeholder” (Tirole 2001, p. 26). Even a high-minded, well-intentioned manager of a firm taking care of all the stakeholders would struggle, Tirole (2006) argues, because of the need to rely on subjective data about their preferences and surpluses, in contrast with objective financial assessments, and because of the difficulty to aggregate their disparate interests. The large management science literature on stakeholder theory (extensively reviewed in Harrison et al. 2019) does not really assuage these doubts since it has been, by and large, informal and inspirational rather than analytical and practical.

Our paper is largely inspired by Magill et al. (2015), who offer a pioneering formal analysis of stakeholder value maximization. In line with stakeholder theory, they propose to take the sum of all surpluses as the measure of a firm’s value, and to set up membership markets for consumers and workers in order to obtain an objective measurement of the surpluses. They focus on the specific case of a firm that makes an investment in its productivity and, assuming the firm is large, the success or failure of this investment affects the product and labor markets, so that consumers and workers have stakes in this investment via the price and wage effects. A profit-maximizing firm would under-invest because it would only internalize the effect of the investment on profit, and the impact on consumers and workers is then like an externality. They show that a stakeholder firm not only invests optimally but also abstains from using its market power. However, the optimality result depends on the firm being a monopoly and monopsony on the product and labor markets, because when consumers and workers can rely on other firms in case of failure of the firm, the firm tends to over-invest.

We adopt a similar stakeholder-value objective as Magill et al. (2015), but our analysis differs in several respects. First, we try to cover more aspects of the management of a stakeholder corporation and build a comprehensive microeconomic analysis of optimal management rules for such a firm. In the main text, we adopt a simpler partial equilibrium approach, whereas they introduce a general equilibrium, although, since they assume complete markets, risk neutral agents and complete separation between the populations of consumers, workers and shareholders, a partial equilibrium approach does not miss much in comparison. In the appendix we extend our main results to a fully-fledged general equilibrium framework.

We confirm their key insights, namely, that the responsible firm (defined as maximizing stakeholder value) does not exploit its market power, makes more effort to remain viable and successful, and still fails to internalize certain externalities. Our own contribution includes the following. First, we provide a general definition of stakeholder value for a multi-output, multi-input firm in partial equilibrium analysis and, for the one-output-one-input case, a heuristic graphical analysis that provides intuition about key insights. In particular, it incorporates customers' and suppliers' surpluses as well as profit in the same graph, showing that usual management rules involving marginal revenue or marginal cost are not appropriate. In particular, the notorious marginal cost pricing rule is generally flawed because it neglects the suppliers' surplus.

Second, our main result is to show that maximizing stakeholder value can be performed at the firm level by pursuing the maximization of profit taking current prices as given, while total surplus at the economy level is maximized under free entry if non-negative profit remains the entry condition. The fact that stakeholder value maximization is equivalent to constrained profit maximization means that concerns about the possibility to operationalize stakeholder value, or concerns about its drifting into arbitrary or corrupt management, can be assuaged. Stakeholder value is a magnitude that can be maximized without ever being measured by managers or monitoring authorities. Intuitively, the main reason why this holds true is that marginal values to stakeholders are the key decision parameters, and depend on price data that are observed much more easily than the stakeholders' surplus. Profit can thus remain the key performance indicator guiding management decisions, provided that the constraints embodying responsible management are respected.

Constrained profit maximization can be enshrined in the management rule dictating that no profit opportunity at current prices should be left out, or equivalently, under convexity assumptions, that for all employed inputs, the current price should equal

their marginal productivity evaluated at current product prices (whereas the current price should be greater than marginal productivity for all non-employed inputs).

We extend the analysis to larger externalities, showing how they should be internalized by firms through a Pigouvian adjustment to their profit, both in their pursuit of constrained profit maximization and as their entry condition in the market. This result provides a novel justification to the polluter-pays principle, because this Pigouvian correction to profit is key to maximizing total surplus at the economy level. The modification this implies for the entry condition is significant, as polluting firms may have to refrain from investing in profitable production lines when the profit generated by these lines is lower than the Pigouvian correction.

The fact that stakeholder value can be maximized without being measured eliminates the need to rely on membership markets (often considered in the literature for this type of firm, as in Magill et al. 2015 or Dow 2003, 2018) in which surplus for the marginal member is measured by the membership price. We find that the standard price (and wage) mechanism of ordinary product and service markets remains ideal when used by stakeholder firms, whereas membership markets fail to measure total stakeholder value for heterogeneous members, and have deleterious effects under free entry. Instead, we tentatively propose to address the corporate agency problem by a form of participatory governance in which stakeholders are only allowed to denounce deviations from the responsible management rules.

Finally, we study how, absent a special ethical preference from customers and suppliers, competition tends to favor profit-maximizing firms over responsible firms, even though social welfare would be greater if only the latter entered the market. We also observe that firms maximizing stakeholder value are likely to fail to internalize all competition externalities, leading in particular to excessive differentiation.

There is a large literature related to our work. The theme of the stakeholder approach overlaps with corporate social responsibility, and our results are in line with Arrow's (1973) and Bénabou and Tirole's (2010) general argument that market imperfections can be alleviated not only by government intervention but also, in some circumstances, by the private adoption of appropriate norms. Our rules of responsible profit-maximization are similar to those recommended on ethical grounds in the business ethics literature (see in particular Heath 2014, who is, ironically, very negative about the stakeholder approach). The theoretical economic literature focusing specifically on stakeholder value is small but, in addition to Magill et al. (2015), it includes a paper by Allen et al. (2015), in which the objective of the responsible firm is taken to

be the sum of consumer surplus and profit only. In an oligopoly model with demand or cost shocks, they compare the value (i.e., the net present value of expected profits) of shareholder firms and responsible firms. Externalities between firms sometimes give responsible firms a greater market value in spite of the fact that they do not maximize it. Similar results are obtained by Kopel and Brand (2013) and Kopel et al. (2014) for certain levels of competition in Cournot oligopolies. Brand and Grothe (2015) show that a Pareto improvement can be induced by firms' caring about consumer surplus in a bilateral monopoly of a manufacturer and a retailer. In view of this literature, we only briefly cover oligopolies and focus more on competition by entry and the advantage that profit-maximizing firms enjoy in this competition.

Cremer et al. (1989) and De Fraja and Delbono (1989) had earlier examined if a public firm maximizing the total surplus in the whole industry under a non-negative profit constraint enhances social welfare, and shown that this is not always the case. In contrast, we assume here that responsible firms care only about the surplus of their own members, as well as larger externalities, but not the total surplus of the industry.

More relevant is the recent book by Dow (2018), examining labor-managed firms and comparing them to standard capitalist firms. This follows a sizable literature on labor management (Vanek 1970, Drèze 1989, Dow 2003). A cornerstone of his analysis is that financial capital is easily acquired and transferred, whereas labor is not alienable in similar fashion, and he shows how this difference induces important consequences under specific market imperfections, leading to disadvantages for labor-managed firms. We incorporate this idea into our approach and find that the disadvantage of such firms is an instance of the general disadvantage of non-profit-maximizing firms.

There is a more extensive empirical literature that similarly compares the performances of firms with different objectives (see, e.g., Hillman and Keim 2001, Mueller 2006, Ferrell et al. 2016, Dow 2003, Blasi et al. 2018). The fact that it finds that firms with broad objectives sometimes perform as well or even better than ordinary firms suggests that the disadvantage of non-profit-maximizing firms in market competition, which we analyze in this paper, can, in favorable circumstances, be alleviated by other features such as brand reputation and employee motivation.

The literature on market selection has studied the fitness of profit-maximizing firms. After seminal remarks by Alchian (1950), Friedman (1953), and Baumol (1991), it has been developed in game-theoretic and evolutionary directions (see, e.g., Blume and Easley 2002, Kopel et al. 2014, Kopel and Lamantia 2018, Luo 2009, 2019, and a review in Blume and Easley 2010), and confirmed that competition selects not only the more

cost-efficient firms but also those that maximize profit, although there are some cases in which other firms can be more profitable (Kopel et al. 2014) or more resilient (Dutta and Radner 1999). In particular, Ding et al. (2020) and Aghion et al. (2020) study if competition pressure fosters or undermines corporate social responsibility, and find that the former can occur when relevant social norms are prevalent among customers. Our own analysis focuses on the case of imperfect competition with free entry and specifies conditions under which only profit-maximizing firms remain at the equilibrium, while responsible firms can remain viable in the presence of ethical customers.

Another important literature related to our selection result has examined the excessive entry of firms in a free entry equilibrium, due to the fact that firms do not internalize the “business-stealing” effect of their own entry on incumbents (see, in particular, Mankiw and Whinston 1986, Amir et al. 2014). Our results are very much in line with this literature, and focus on how responsible firms compare with ordinary profit-maximizing firms, showing that the former spontaneously internalize the business-stealing externality because they do not exploit their market power.

Finally, there is an empirical literature that indirectly sheds light on the importance of the issue of responsible management, by providing indications about the cost of ordinary profit-maximization. Recent estimates of the rise in markups in the USA (De Loecker et al. 2020, 2021) suggest very large negative impacts on welfare, even accounting for the associated benefits of technological innovation. And it is well known that the environmental costs of unbridled economic activity are large and will possibly reach catastrophic levels during the century. A thorough estimate of the global deadweight loss of business as usual is very complex and would require modeling a counterfactual economy with responsible businesses in order to take account of general equilibrium effects, but it is safe to assume that it is staggering and that promoting responsible business practices should be high in policy priorities.

The paper is structured as follows. Section 2 examines the definition of the contribution of a firm to social welfare. Section 3 presents an intuitive graphical preview of the results in a simple case. Section 4 studies the basic microeconomics of the responsible firm and presents the management rules such a firm would follow, showing that they (exactly or approximately) correspond to constrained profit-maximizing rules. Section 5 analyzes the viability of responsible firms in monopolistic competition and the paradox of their lower fitness in spite of their superiority for social welfare. Section 6 briefly discusses incentive mechanisms for inducing responsible management. Section 7 concludes. The appendix offers a general equilibrium extension of the main results

Customer surplus	Total surplus	Economic value (total WTP)
Profit		Price
Supplier surplus		Economic cost
Employee surplus		
Other surpluses		
Sum of reservation prices		Minimum cost of participation (total WTA)

Inspired from Harrison et al. (2019, Fig. 5.1b)

Figure 1: Stakeholder theory and value creation

(Appendix A) and several important extensions of our analysis to issues not covered in the main text for brevity’s sake, namely, suboptimal inequalities, incomplete contracts, asymmetric information, rationing, differentiation, oligopoly competition, and the comparison with labor-management (Appendix B).

2 Determining the firm’s contribution to society

Stakeholder theory describes the creation of value in the firm in terms that fit the standard microeconomic approach. The total economic value of the firm’s production adds up the market value of its sales and the consumer surplus (see Fig. 1). The stakeholders are all the parties standing to obtain a surplus from the firm: customers, shareholders, suppliers, employees, and others (e.g., taxes). To simplify the exposition, all contributors of inputs will often be lumped together in the “supplier” category. The total surplus created by the firm is the difference between the total willingness to pay (WTP) for its products and the total willingness to accept (WTA) of its contributors, i.e., the minimum they must be paid to make their contributions to the firm production.

Let us build on this to analyze under what conditions the shareholder value approach is justified and when it falls short of delivering good outcomes. One missing element from Fig. 1 is the production of broader externalities by the firm, and we will introduce them in this paper.

Consider a firm that produces multiple goods out of multiple inputs. Its production is a vector $Q \in \mathbb{R}_+^K$, and its inputs form a vector $X \in \mathbb{R}_+^K$. For simplicity, outputs and inputs are in the same K -dimensional vector space of goods, but a typical firm produces outputs that are very different from its inputs. Here, inputs include labor services. Let

$Y = Q - X$ denote the net output of the firm. The production possibilities of the firm are described by an equation $f(Y, E) = 0$, where $E \in \mathbb{R}^M$ is a vector of externalities (in M dimensions).

The firm's profit is

$$\Pi = pY - T(pY, E),$$

where pY is the gross profit and $T(pY, E)$ is a corporate tax which may include externality-sensitive adjustments (Pigouvian taxation). We ignore other taxes (e.g., payroll tax).

The firm's customers (households and other firms, all indexed by $i \in \{1, \dots, N\}$) have a willingness to pay for what they buy, and $WTP_i(q_i)$ denotes customer i 's willingness to pay for the vector q_i bought from the firm. One has $Q = \sum_i q_i$. The total customer surplus is then

$$TCS = \sum_i WTP_i(q_i) - pQ.$$

Likewise, the total supplier surplus (with suppliers also indexed by i) is

$$TSS = pX - \sum_i WTA_i(x_i),$$

where $WTA_i(x_i)$ denotes the willingness to accept to deliver the input vector x_i , with $X = \sum_i x_i$.

The firm's externalities may affect each agent i by the monetary equivalent of $V_i(E)$, and $V_0(E)$ will denote the other externality impacts (e.g., on future generations not yet born, or on other values not taken into account as a personal impact by the individual members of the current population). Let $V(E) = V_0(E) + \sum_i V_i(E)$. By convention, $V(E) > 0$ measures the net *negative* value of externalities.

We can now write the total contribution of the firm to society, denoted TC , as follows:

$$TC = TCS + TSS + \Pi + T(pY, E) - V(E).$$

After simplification, this reads as:

$$TC = \sum_i WTP_i(q_i) - \sum_i WTA_i(x_i) - V(E). \quad (1)$$

This central formula of our analysis paints a rather clearcut picture of the firm's contribution: The willingness to pay of its customers for its products, minus the willing-

ness to accept of its workers and suppliers, and the externalities. Profit and monetary transfers among the parties appear for what they are: monetary transfers that do not add anything of value.

Piecemeal applications of the stakeholder approach would yield intermediate formulas. For instance, consider a firm practicing co-determination (as in large German firms) involving shareholders and employees, but not other stakeholders. The objective of the firm can then be written, ignoring the other suppliers for simplification, as maximizing $TSS + \Pi$ rather than just Π . Interestingly, this objective has a simple form after simplification:

$$\begin{aligned} TSS + \Pi &= pX - \sum_i WTA_i(x_i) + pY - T(pY, E) \\ &= pQ - \sum_i WTA_i(x_i) - T(pY, E). \end{aligned}$$

This shows that incorporating one party (the employees) into the objective is tantamount to replacing what is paid to them (or received from them) by their willingness to accept (or to pay) in the formula. As another example, consider the case in which the externalities are borne by the local communities and are included in the firm's management and objective. In this case, the firm maximizes $\Pi - V(E)$, again a partial implementation of the "ideal" TC .

The computation of the firm's contribution, up to now, assumes that a dollar is a dollar and ignores the fact that some agents may have a different marginal social value of money. Let α_i denote the marginal social value of money for i , i.e., the relative importance that society attributes to bringing additional money to i . An equity-weighted measure of the firm's contribution, which can be denoted WTC , is:

$$\begin{aligned} WTC &= \sum_i \alpha_i (WTP_i(q_i) - pq_i + px_i - WTA_i(x_i) + s_i \Pi - V_i(E)) \\ &\quad + T(pY, E) - V_0(E) \end{aligned}$$

where s_i denotes i 's share in the distribution of profit, and where it is assumed that T and V_0 need no weight. In this formula the monetary transfers may have positive or negative value depending on the marginal social value of the parties. For instance, wage inequalities may matter in this formula. In the main text of this paper, we focus on TC maximization and the extension to WTC is dealt with in Appendix B.

3 Graphical heuristics

In this section, we introduce a method to graphically represent the total contribution of the firm, for the case in which there is only one good Q and one input X . With this simple graphical tool, an intuitive preview of the results of the paper can be provided. For simplicity, taxation is assumed away. This section can be skipped by readers interested in the full model.

The production possibilities are here described with a production function $Q = Q(X)$. Its inverse function will be denoted $X = X(Q)$. We assume that these curves are strictly increasing and that $Q(0) = 0$. The total demand of the firm's customers is a function that gives an inverse demand function $p(Q)$, and similarly the total supply of the firm's suppliers is a function inducing an inverse supply function $w(X)$. We assume that p is a decreasing function, whereas w is an increasing function.

Let the firm sell Q and hire the corresponding X . The total surplus (assuming away any externalities for now) is equal to

$$TC = \int_0^Q p(q) dq - \int_0^X w(x) dx.$$

In order to represent this in the (Q, p) space, one can conveniently change variables in the second term and rewrite it as:

$$\int_0^X w(x) dx = \int_0^Q w(X(q)) X'(q) dq.$$

In figures, we will call the curve of $w(X(q)) X'(q)$ the “supply” curve. It does not represent the supply of the firm, but the behavior of its suppliers expressed in terms of how much they must be paid in order to produce one more unit of product.

One can further introduce externalities in this simple framework when they are perfect complements with the input, so that in effect, one can write them as a function of production: $E(Q)$. Assume that $E(0) = 0$. One then has

$$V(E) = \int_0^E V'(e) de = \int_0^Q V'(E(q)) E'(q) dq,$$

implying that the “supply” curve is shifted by $V'(E(q)) E'(q)$, or, equivalently, the demand curve is shifted by $-V'(E(q)) E'(q)$.

Figure 2 illustrates the distribution of surplus among stakeholders (in absence of

externalities). It is well known that the customer surplus can be easily represented as the area between the demand curve and the price level:

$$\int_0^Q p(q) dq - p(Q) Q = \int_0^Q [p(q) - p(Q)] dq.$$

The supplier surplus can also be represented in the (Q, p) space, as follows:

$$w(X) X - \int_0^X w(x) dx = \int_0^Q [(w(X(Q)) - w(X(q))) X'(q)] dq.$$

Observe that, since $w(X(Q)) \geq w(X(q))$ for all $q \leq Q$, the curve of $w(X(Q)) X'(q)$ (which is named “marginal cost (price-taker)” in Fig. 2) is nowhere below that of the “supplier” curve on the range $[0, Q]$. The area between the two curves delineates the suppliers’ surplus. Finally, the area between $p(Q)$ and $w(X(Q)) X'(q)$ represents the profit.

This figure shows that a firm maximizing profit as a price-taker, equalizing the price with the marginal cost $w(X(Q)) X'(q)$, will also maximize the total surplus for all stakeholders. Thus, in absence of externalities, a firm maximizing profit without making use of its market power also maximizes TC . This result is not surprising since standard efficiency theorems involve price-taking behavior, and basic partial equilibrium analysis shows that the sum of consumer surplus and profit is maximized when the firm behaves as a price-taker on the product market. The result obtained here extends this to the input market and the maximization of the total surplus of all the stakeholders. This will be further generalized to multiple inputs and multiple outputs in section 4.

Obviously, the equality

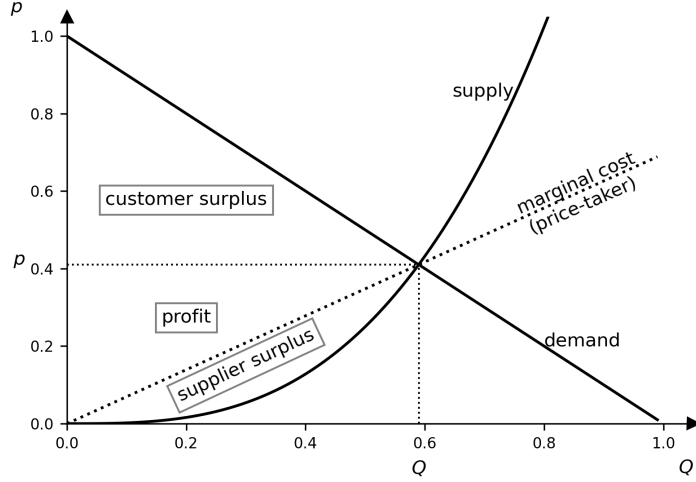
$$p(Q) = w(X(Q)) X'(Q)$$

also reads as the familiar

$$p(Q) Q'(X) = w(X).$$

In other words, a simple and well-known management rule of price-taking profit-maximizing firms—equalize input price to marginal productivity at product prices—is equivalent to maximizing TC . The search for simple management rules for TC -maximization will be pursued in sections 4 and 6.

Now, if the customers and suppliers of the firm are captive, a profit-maximizing firm would use its market power, and this increases its profit at the expense of the total surplus and therefore at the expense of the surplus of its customers and suppliers. For



$$Q(X) = \sqrt{X}; p(Q) = 1 - Q; w(X) = X.$$

Figure 2: Surplus of a price-taking firm

the record, its marginal revenue and marginal cost are computed as $p'(q)q + p(q)$ and $w'(X(q))X'(q)X(q) + w(X(q))X'(q)$. The marginal cost curve is above the “supply” curve when the supply of X is increasing in w and is finitely elastic.

Figure 4 shows the decisions following from five different objectives. A firm maximizing profit, as in Fig. 3, chooses Q_1 . A firm maximizing the total surplus, as in Fig. 2, chooses Q_4 . A firm practicing co-determination and maximizing $p(Q)Q - \int_0^X w(x)dx$ would pick Q_2 , based on the intersection of the marginal revenue curve and the “supply” curve $w(X(q))X'(q)$. A cooperative of customers, focusing on customer surplus and profit, would likely maximize $\int_0^Q p(q)dq - w(X)X$ and choose Q_3 , from the intersection of the marginal cost curve and the demand curve. Such a behavior corresponds to the marginal-cost pricing rule that has been studied in the context of natural monopolies, and appears incomplete when it neglects the possible monopsony power of the firm on the input markets.¹ Finally, a non-profit firm seeking to break even would pick Q_5 , at the intersection of the average cost curve and the demand curve.

If one adds externalities to the analysis, the responsible firm maximizes

$$\int_0^Q p(q)dq - \int_0^X w(x)dx - V(E),$$

¹Mas-Colell, Whinston and Green (1995) criticize it for a different reason, noting that in some cases, efficiency can possibly be achieved without minimizing cost when the production function is not quasi-concave.

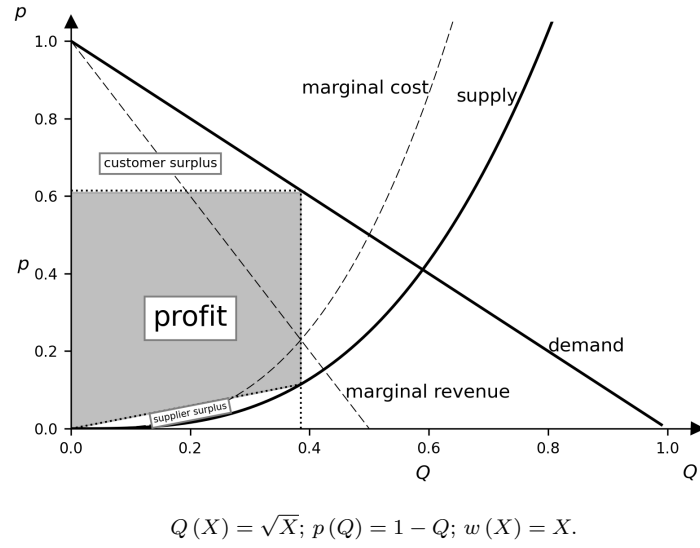


Figure 3: Surplus of a monopolistic-monopsonistic firm

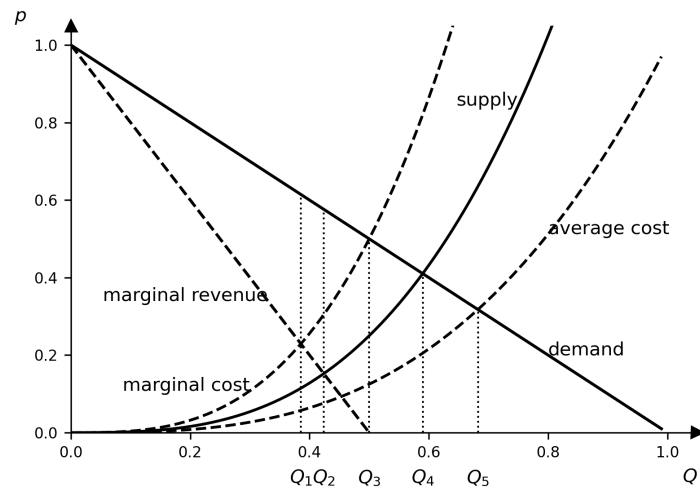


Figure 4: Five choices for five different objectives

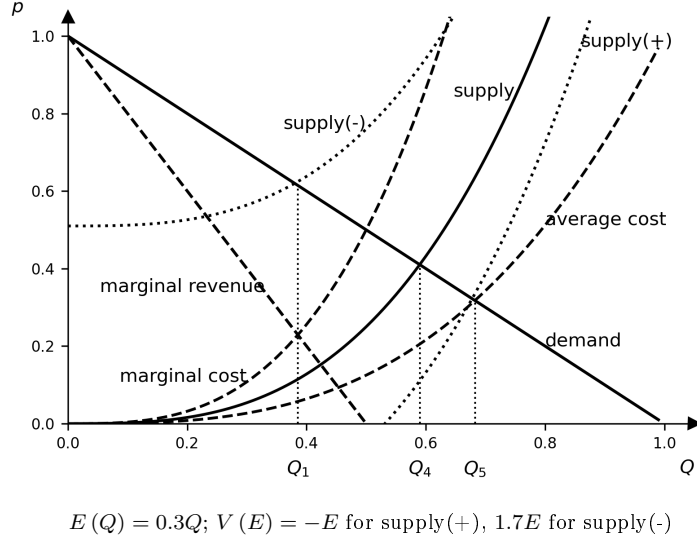


Figure 5: Shifting the supply curve for the responsible firm under externalities

which can be analyzed, as explained earlier, by shifting the level of the supply curve upward or downward depending on whether the externalities are negative or positive:

$$w(X(Q))X'(Q) + V'(E)E'(Q).$$

In Fig. 5, the two cases are illustrated, with the curve “supply(-)” illustrating the case of negative externalities, and “supply(+)” the case of positive externalities.

The graph highlights the theoretical possibility that the optimal decision for the responsible firm might coincide with the profit-maximizing firm’s decision in the case of negative externalities and with the non-profit firm’s decision in the case of positive externalities. The comparison between responsible firms and non-profit firms (social enterprises) will be revisited in section 7.

Finally, the “supply” curve generalizes to the case in which returns to scale are increasing at low production levels, as illustrated in Figure 6—although the distribution of the surplus among the three types of stakeholders is no longer as simple to represent graphically in this case.

Figure 7 illustrates the possibility that the responsible firm may not be viable when a profit-maximizing firm would be viable, thus showing the vulnerability of responsible firms in the context of imperfect competition with free entry—an issue revisited in section 5.

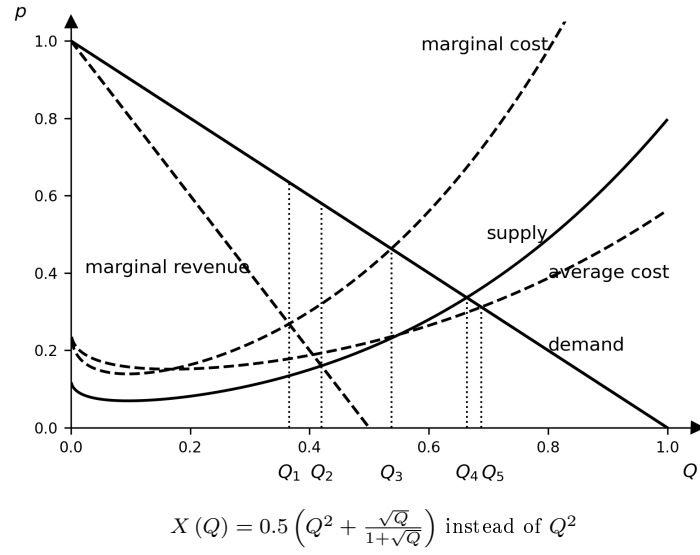


Figure 6: Variant of Fig. 4 for the typical case of increasing returns at low levels

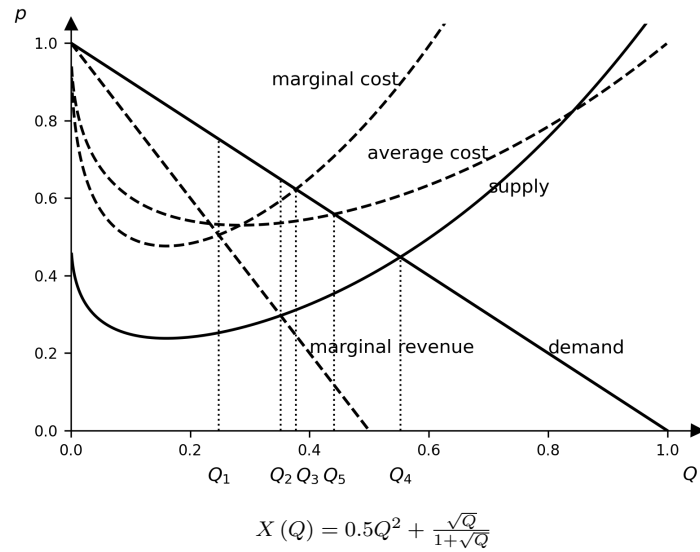


Figure 7: A responsible firm is vulnerable to competition by profit-maximizing firms

However, when responsible firms are protected against competition from profit-maximizing firms, the free-entry equilibrium is optimal for the whole sector because it makes each firm operate at the efficient scale (i.e., the level of production at which returns to scale are constant). This result extends to externalities provided that the zero-profit condition involves a notional Pigou tax:

$$p(Q)Q - w(X)X - V'(E)E = 0.$$

This is illustrated on Figure 8, where the efficient scale is identified as the minimum of the average cost curve, named “average cost(+)” in the figure and computed as

$$\frac{w(X^*)X + V'(E^*)E}{Q},$$

where stars mark the values obtained at the equilibrium. As one can check, the double equality

$$p(Q^*) = w(X^*)X'(Q^*) + V'(E^*)E'(Q^*) = \frac{w(X^*)X^* + V'(E^*)E^*}{Q^*}$$

due to TC -maximization and zero profit, respectively, entails that the minimum of the average cost is reached at Q^* .

This provides a justification for a precise form of the polluter-pays principle. A more general formulation of this result is provided in section 5.

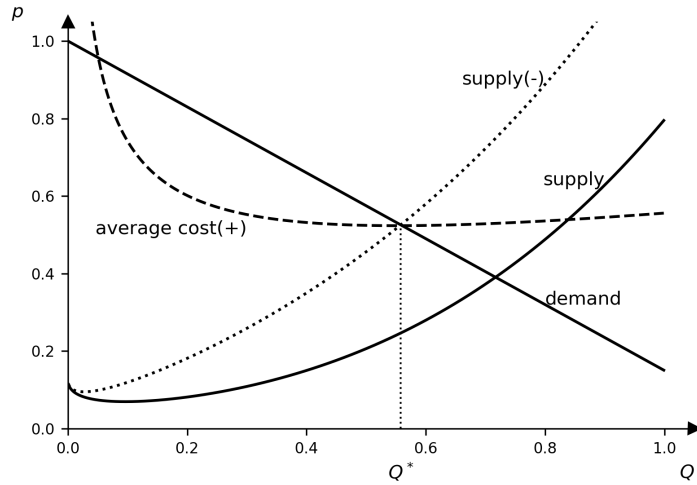
4 From shareholder value to stakeholder value

4.1 Conditions for shareholder value

Consider a purely competitive situation in which the prices are taken as given by each of the parties, including the firm. In the formula

$$TC = TCS + TSS + \Pi + T(pY, E) - V(E),$$

the firm is then unable to influence $TCS+TSS$, which are under the control of customers and suppliers, so that the only way in which the firm can contribute to this value is by increasing $\Pi + T(pY, E) - V(E) = pY - V(E)$. If there are no externalities, maximizing the pre-tax profit is then the best objective, and it leads to the same



$$X(Q) \text{ as in Fig. 6; } E(Q) = Q/2; V(E) = E^2$$

Figure 8: Optimal size at the free-entry (i.e., zero profit) equilibrium

decisions as maximizing post-tax profit if the rate of taxation is less than 100%. So, competition and absence of externalities provide a setting in which maximizing profit is in line with maximizing the total contribution of the firm to society. In the presence of externalities, a firm maximizing $\Pi = pY - T(pY, E)$ will also maximize $pY - V(E)$ provided that the tax $T(pY, E)$ provides the correct incentives—a necessary first-order condition being that $T_m = (1 - T')V_m$ for all $m \in \{1, \dots, M\}$, where $T_m = \partial T / \partial E_m$, $T' = \partial T / \partial (pY)$, $V_m = \partial V / \partial E_m$.

But these straightforward observations also indicate why deviations from perfect competition undermine the shareholder value approach. Here is a list of the reasons why the firm's influence on the larger set of stakeholders cannot be ignored:

1. Market power: the firm may affect the other agents' surplus through its influence on the market price.
2. Inadequate Pigouvian taxes: externalities may not be fully internalized, especially when they are very local and involve private information that is not accessible to the authorities.
3. Incomplete contracts: non-contractible variables will not be dealt with optimally if the firm simply maximizes profit without renegotiation as contingencies appear.
4. Asymmetric information: imperfect information about the firm's product or working conditions may trap the firm and its stakeholders in an inferior equilibrium.

5. Rationing: the firm may affect the other agents' surplus through its decisions on quantities (unemployment in the labor market is the prime example).

All these deviations from perfect competition and from perfect Pigouvian taxation point to situations in which focusing the firm on maximizing only one component of its total value contribution may produce suboptimal results. Whenever profit can be increased at the expense of other stakeholders, in a way that reduces the total surplus, there is a clash between shareholder value and the common good. Economic analysis is familiar with the problem of a monopoly which reduces consumer surplus more than it increases producer surplus, so that monopoly power is good for profit but bad for society. This pattern may have much more general validity. Any time an organization is given a goal that focuses only on a part of its total contribution, it is tempted to expand this part at the expense of the total, whenever the occasion arises.

In the following sections, we focus on market power and externalities, and leave the analysis of incomplete contracts, asymmetric information and rationing to Appendix B. Let us thus examine a firm committed to maximizing its total contribution TC . As we now show, the difficulty due to the fact that the value of TC depends on subjective variables such as willingness to pay and accept, instead of hard monetary payoffs, can be alleviated because TC -maximization is equivalent to constrained profit-maximization. In other words, a socially responsible firm does not need to abandon profit as its key performance indicator, it merely has to maximize it “responsibly.” Practical guidelines for doing so are the main subject of this paper.

4.2 Maximizing surplus through constrained profit maximization

Consider a firm that enjoys market power, i.e., it can influence prices on its own output and input markets, whereas the other side of these markets is made of price-takers. How can it practically maximize TC without measuring it directly? Throughout this paper we assume that first-order conditions of optimization are sufficient and we focus on interior solutions.²

Profit-Surplus Equivalence Theorem Assuming the firm controls the prices whereas its trading partners are price-takers, for the firm's decisions it is equivalent to

²It is straightforward but tedious to extend the results to solutions involving null quantities for some goods. As for first-order analysis, general convexity assumptions are sufficient but far from necessary for its validity, and we provide remarks in footnotes about higher-order considerations.

maximize TC and to maximize $pY - \sum_m V_m E_m$ taking p and V_m as given when choosing quantities.

To prove this, compare the first-order conditions of the two programs. For

$$L = pY - \sum_m V_m E_m - \lambda f(Y, E),$$

they are as follows, when p_k and V_m are treated as fixed parameter when optimizing on quantities:

- for all $k \in \{1, \dots, K\}$, $p_k = \lambda f_k$,
- for all $m \in \{1, \dots, M\}$, $V_m = -\lambda f_m$.

For

$$L = \sum_i WTP_i(q_i) - \sum_i WTA_i(x_i) - V(E) - \mu f(Y, E),$$

they consist of the following:

- for all $k \in \{1, \dots, K\}$, for all $i \in \{1, \dots, N\}$, $wtp_{ik} = \mu f_k$,
- for all $k \in \{1, \dots, K\}$, for all $i \in \{1, \dots, N\}$, $wt a_{ik} = \mu f_k$,
- for all $m \in \{1, \dots, M\}$, $V_m = -\mu f_m$,

where $wtp_{ik} = \partial WTP_i / \partial q_{ik}$, $wt a_{ik} = \partial WTA_i / \partial x_{ik}$. When $wtp_{ik} = wt a_{ik} = p_k$ for all i, k , which is the case when these agents are price-takers, the two sets of conditions become identical.

In other words, a firm that simply does not make use of its market power and behaves as if it was in a competitive situation will reproduce the optimal surplus-maximizing features of the truly competitive situation. Similarly, adjusting its profit for a notional Pigou tax on the externalities is also leading to the optimal decisions in this respect. One may wonder if the (notional) burden on profit that comes from deducting $\sum_m V_m E_m$ makes sense financially. The fact that V_m should be taken as shadow price in marginal calculus does not imply that a tax for negative externalities is better than a subsidy for abatement. Section 5 will actually provide a justification for this “polluter pays” accounting method, in relation to entry decisions.

This result provides a simple practical recipe to the firm that wants to substitute total surplus to profit in its objective function. It does not have to estimate the willingness to pay and accept of its trading partners. It can still focus on profit, with an

adjustment for externalities and refraining from taking advantage of the demand and supply reactions to its pricing policy. How can this be done practically? One way is simply to focus on making sure that there never remain opportunities for greater profit at current prices, and after taking account of the notional Pigou tax. Profit remains the compass, but instead of merely maximizing it, the firm must only focus on optimizing *quantities* in its production plans, at current market and Pigouvian prices. Obviously, in the background the firm must make sure that the demand will absorb its production and suppliers will provide the inputs, and it must adjust prices accordingly. Thus, some knowledge of demand is needed to implement this rule, but this is much less demanding than estimating surpluses. This maximization focused on a subset of the variables that the firm influences is similar to the behavior of a virtuous politician who seeks popularity by focusing on policy instruments and refrains from calculating the indirect effects of the induced political spin.

An adaptive implementation of this idea would work as follows. Starting from a production plan (Y, E) , the firm can seek adjustments that improve profit at current prices:

$$pdY - \sum_m V_m dE_m > 0.$$

(When implementing such a change, prices have to be adjusted by the firm according to the market elasticities in order to keep the markets in balance.) Any such adjustment raises TC because, when $wtp_{ik} = wta_{ik} = p_k$ for all i, k , one computes

$$dTC = pdY - \sum_m V_m dE_m.$$

If the firm keeps raising TC in this way, under favorable conditions it will reach the maximum.³ In practice, conditions are continuously changing, so that the optimal plan

³When first-order conditions are not sufficient, this observation may be more practically relevant than the stated theorem, for the following reason. A maximum for $pY - \sum_m V_m E_m$ at fixed $(p, (V_m)_{m \in \{1, \dots, M\}})$ is necessarily a maximum for TC assuming that $\sum_i WTP_i(q_i) - \sum_i WTA_i(x_i) - V(E)$ is quasi-concave, because the hyperplane defined by $(p, (V_m)_{m \in \{1, \dots, M\}})$ at this point separates the (convex) upper contour set for TC from the production possibility set. But the converse is not true, since a maximum for TC may correspond to a minimum for $pY - \sum_m V_m E_m$ when the production possibility set is not convex—think of a representative agent choosing from a technology with increasing returns to scale with very convex preferences, for whom the minimum profit at budget prices may be the optimal choice. This implies that the method of directly computing the maxima for $pY - \sum_m V_m E_m$ at equilibrium prices $(p, (V_m)_{m \in \{1, \dots, M\}})$ may fail to find the maximum for TC . However, anywhere in the set of attainable allocations such that (Y, E) is feasible and prices satisfy

is a moving target. Coming close to it then requires prompt adaptation.

Another way is to focus on the first-order conditions, i.e., on equalizing price ratios with marginal rates of transformations for all inputs, outputs, and externality variables (while, again, making sure that the prices make the production plan compatible with input supply and product demand):

$$\frac{p_k}{p_{k'}} = \frac{f_k}{f_{k'}} \text{ for all } k, k' \in \{1, \dots, K\},$$

4

$$\frac{p_k}{V_m} = \frac{f_k}{f_m} \text{ for all } k \in \{1, \dots, K\}, m \in \{1, \dots, M\}.$$

This result implies a somewhat surprising observation. The “weak axiom of profit-maximization” (Varian 1984), which requires checking that for all observed (p, Y) , (p', Y') ,

$$pY \geq pY' \text{ and } p'Y' \geq p'Y,$$

is actually a condition which, assuming away externalities and tax distortions, can check if the firm is a TC -maximizer both in perfectly competitive *and* in imperfectly competitive situations, whereas understood as a test of profit maximization, it is only valid in perfect competition and is not applicable in the presence of market power.

There is a variant of the above result that involves taxation, and it may be more convenient for practical applications. Suppose that there is a tax $T(pY, E)$ which may or may not deal with externalities in a socially optimal way. Consider a firm that maximizes

$$pY - T(pY, E) - \sum_m ((1 - T') V_m - T_m) E_m,$$

taking p_k, V_m, T_m and T' as fixed when choosing quantities. This firm will behave as if

$wtp_{ik} = wta_{ik} = p_k$ for all i, k , the sign of $pdY - \sum_m V_m dE_m$ is a faithful indicator of dTC . This is true even in the vicinity of a maximum for TC which happens to be a minimum for $pY - \sum_m V_m E_m$. This is because prices supporting demand and supply fulfilling any production plan define the direction of improvement for TC , while profit and TC depend on quantities in the same direction (positively on outputs, negatively on inputs)—in the example of a representative agent choosing from a technology with increasing returns to scale, the budgets supporting any plan other than the optimum have prices such that profit increases when going toward the optimum. In conclusion, with some tatonnement, the firm maximizing profit at current prices is even more likely to find the maximum for TC than with a direct computation of the optimal plan.

⁴When externalities are directly linked to components of Y , i.e., when $E_m = Y_k$ for some m, k , then the first-order condition reads: $p_k - V_m = f_k$. See appendix A for a general application of this approach.

it maximized TC , too. The adjustment for externalities is now meant to correct any gap between the marginal tax rate T_m and its optimal value $(1 - T') V_m$. To prove this result, it suffices to note that such a firm will behave as if it maximized

$$(1 - T') \left(pY - \sum_m V_m E_m \right),$$

taking the same parameters as given, and thus as if it maximized $pY - \sum_m V_m E_m$ under the same constraint.

4.3 Measuring the firm's total contribution

The previous subsection sheds light on an important issue for the measurement of the firm's TC . The stakeholders include all the customers and suppliers who end up interacting with the firm. Focus on the customers for a moment. Their demand to the firm takes account of the availability of other firms' products, and may be quite elastic when transactions costs of switching to another firm are low. However, their surplus, for the purpose of measuring TC , should not in principle rely on this demand curve, but on the virtual demand curve that the firm would face if transaction costs did make its actual customers completely captive. This is the real surplus they obtain from buying the product.

It would be a mistake to take the actual, more elastic, demand curve to compute the customers' total willingness to pay. For instance, consider the case of firms with identical products in a Bertrand competition. The actual demand curve each of them faces is extremely elastic for prices above the equilibrium price, implying that the customer surplus is zero. But the total customer surplus in the industry is not zero, and is not the sum of the null surpluses computed for each firm separately.

This observation may appear worrisome for the measurement of TC , because it means that one cannot rely on an estimation of the actual demand to the firm (and likewise for its supplies) for such measurement. Estimating the surplus it generates for its stakeholders may therefore be practically very difficult. But, as shown in the previous subsection, the management rules for the stakeholder firm, fortunately, do not depend on an actual measurement of TC . The firm can simply behave as a profit-maximizing firm that does not exploit its market power. Profit can therefore remain the compass of the firm's management, under the constraint that the firm takes prices as given. Further explorations of the role of profit for socially responsible firms will be

made in section 5.

Another way of making the same observation is that, even if one measured TC based on the actual demand and supply rather than the full surplus of the customers and suppliers, a firm that maximized this “wrong” TC would behave exactly as if it maximized the correct TC . The actual demand curve used in the mistaken computation and the virtual demand curve that should be used for the correct computation cross at the point where the firm ends up, and since it is only the price level, not the demand elasticity, that matters for the firm’s decision, the two demand curves lead to the correct decision.

A related point is that what matters for the optimal decision of the firm is the marginal willingness to pay (or accept), which happens to be equal to the price for rational price-takers, so that measuring the total willingness to pay on the basis of the Marshallian demand instead of the Hicksian demand (and likewise for the suppliers) does not make any difference.

5 Can responsible firms survive competition?

In the previous section, we have studied how a firm can maximize TC , and how that can lead to new management rules, such as refraining from using its market power, or, as shown in Appendix B, hiring more workers, or adopting lower work intensity. But obviously, these alternative management rules are detrimental to profit, and may jeopardize the survival of “responsible” firms when they coexist with ordinary profit-maximizing firms.

In this section, we first neglect externalities and study monopolistic competition with free entry. In a second step, we examine how this analysis extends to externalities. Throughout this section we ignore taxation.

As we need to focus on competition on a single product market, the analysis is made in the simpler one-input-one-output model introduced in section 3. A “responsible” firm is one that maximizes $TC = \int_0^Q p(q) dq - \int_0^X w(x) dx$, whereas an “ordinary” firm is one that maximizes $\Pi = pQ - wX$. We assume away any preference for diversity (customers only buy one brand, and suppliers only sell to one firm), which is better suited to macroeconomic models with representative agents, whereas in a microeconomic context, a consumer using one product does not derive any benefit from the mere existence of more varieties.

A supplementary study of Cournot and Bertrand competition is provided in Appendix B. In this appendix, we also show how similar arguments as in this section can be applied to the comparison of “capital-managed” firms (which only take account of the surplus of their creditors) with “labor-managed” firms (which only take account of the surplus of workers), and imply that the latter may be disadvantaged in market competition.

5.1 Free entry competition

Identical firms compete for the total demand to the industry

$$D(p) = \sum_j D_j(p_j, p_{-j}),$$

where $p = (p_j)_{j \in J}$ is the vector of prices in the industry. Each D_j function is decreasing in p_j and increasing in each component of p_{-j} . We focus on the case of identical firms facing identical functions D_j , so that when all firms’ prices equal p_0 , one has

$$D(p_0, \dots, p_0) = nD_j(p_0, \dots, p_0).$$

Similarly, on the input side, there is a supply function

$$S(w) = \sum_j S_j(w_j, w_{-j}),$$

and we assume the S_j functions to be identical.

Assume that the customers and suppliers have transaction costs and cannot move easily to the most advantageous price, so that each firm retains some market power at all price levels. Assuming that there are increasing returns to scale at low levels of production (compared to total demand), and neglecting the potential issue of fractional numbers of firms, free entry in a market featuring only ordinary firms leads to the standard zero-profit equilibrium in which the demand faced by each firm is just enough to cover costs, as in textbook analysis of monopolistic competition. In this case, the number of ordinary firms at the free entry equilibrium is excessive and total surplus nTC would be larger with a lower number of firms. This a well-known prisoner’s dilemma among ordinary firms.⁵

⁵Preference for diversity, which is assumed away here, may partly or completely alleviate this

Can there be a free entry equilibrium with viable TC -maximizing firms? Suppose that free entry leads to the entry of profit-maximizing firms whenever there is profit to be made (and of responsible firms whenever they can be viable by making a non-negative profit), and that there is an opportunity for profit whenever incumbent firms currently make profit or could make profit by changing their price. The vulnerability of responsible firms is that, failing to maximize profit, they leave opportunities for profit for other firms that can enter and deplete their demand, driving them out of the market. The responsible firms are then evicted from the industry, or have to adopt the profit objective and become “ordinary”. In other words, we have an adverse selection result, which is just a special case of the more general fact that profit-maximizing firms drive the firms with other objectives out of the market or force them to conform to the profit-maximizing norm.

Profit-Selection Theorem: Assuming that entry occurs whenever incumbent firms currently make profit or could make profit by changing their price, profit-maximizing firms drive TC -maximizing firms with identical technology out of the market.

Proof By assumption, an equilibrium cannot have positive profit among incumbent firms.

Consider a possible equilibrium in which some responsible firms are present at a zero profit. All responsible firms post a price p^{**} and a wage w^{**} , whereas all ordinary firms post p^* and w^* . Responsible firms make a zero profit when their “supply” curve equals their average cost curve

$$w^{**} X'(D_j(p^{**}, p_{-j})) = w^{**} \frac{X(D_j(p^{**}, p_{-j}))}{D_j(p^{**}, p_{-j})},$$

i.e., when their marginal productivity equals their average productivity. At this point their average cost function is increasing (because wage is increasing with production scale):

$$\frac{d}{dQ} \left[w_j(X(Q^{**}), w_{-j}) \frac{X(Q^{**})}{Q^{**}} \right] = \frac{dw_j}{dX}(X(Q^{**}), w_{-j}) (X'(Q^{**}))^2 > 0,$$

where $Q^{**} = D_j(p^{**}, p_{-j})$ and $w_j(X, w_{-j})$ is the inverse function of $S_j(w_j, w_{-j})$ with respect to w_j . This implies that responsible firms have a greater production than ordinary firms with identical costs, and that their demand function,

problem. See Matsuyama (1995) for a review.

which has a negative slope, is not tangent to their average cost function. In contrast, ordinary firms stay in the increasing-returns-to-scale area, where the demand function is tangent to the decreasing part of the average cost curve. This configuration can occur only if $p^{**} < p^*$, so that the demand curve faced by each responsible firms is greater since the D_j identical functions are increasing in the others' prices, and a responsible firm has one more ordinary competitor and one less responsible competitor than an ordinary firm.

If one responsible firm raises its price slightly above p^{**} , or equivalently reduces its production below Q^{**} , while the other prices remain fixed, it makes a profit because its demand curve is not tangent to its average cost curve (recall that its demand curve does not move when it alone changes its price):

$$\begin{aligned} & \frac{d}{dQ} [p_j(Q^{**}, p_{-j}) Q^{**} - w_j(X(Q^{**}), w_{-j}) X(Q^{**})] \\ &= Q^{**} \left[\frac{dp_j}{dQ}(Q^{**}, p_{-j}) - \frac{dw_j}{dX}(X(Q^{**}), w_{-j}) (X'(Q^{**}))^2 \right] < 0, \end{aligned}$$

where $p_j(Q, p_{-j})$ is the inverse of $D_j(p_j, p_{-j})$ with respect to p_j . The demand going to other firms increases as well, allowing them to make a profit if they do not change their price. This proves that whenever there is a responsible firm in the market, there are opportunities for profit. Therefore this cannot be an equilibrium with free entry.

In contrast, if only ordinary firms remain in the market and make zero profit, there is no opportunity for profit because any change of price by one firm generates a loss for itself and is therefore not a viable move. There is no entry in this case. $\square$

However, just as a profit-maximizing firm generates more profit than any other in identical circumstances, a TC -maximizing firm generate more surplus than any other firm. This means that with another mechanism than the price mechanism, it should be possible for the responsible firm to generate greater surplus for all stakeholders: customers, suppliers, and even shareholders. An example of such a mechanism is subscription. Customers pay a fee to get a share of the product, and suppliers pay a fee to participate in the production, while shareholders add these fees to the profit. This may be hard to implement when customers and suppliers are heterogeneous, but at least in principle such a scheme would make the responsible firm more viable, not less, than the ordinary firm, at least if the subscription mechanism is accessible only to the responsi-

ble firm. If all firms had access to this mechanism, then profit-maximizing firms would maximize TC if all of TC were transferred in this way into the profit.

Assuming the subscription mechanism worked, then, the firms using it would crowd out those that don't, and under free entry this would lead to a situation in which firms would continue to enter until $TC = 0$, leading again to zero profit but also to zero surplus to all stakeholders. This is a prisoner's dilemma again, which is just similar to, but actually more catastrophic than, what happens among ordinary firms in the usual equilibrium.

What can be done to avoid the triumph of ordinary firms (under the price mechanism) or the catastrophic collapse of the surplus (under the subscription mechanism)? Regulating entry is one obvious option. But there is another possibility. Suppose one could retain the price mechanism as well as the viability condition that profit cannot be negative, but mandate that all firms must adopt the TC -maximizing objective. Responsible firms will enter the industry whenever profit is positive but will stop entering when profit is null. One then obtains the following result:

Responsible Invisible Hand Theorem: The free entry equilibrium with identical responsible firms spontaneously leads to the optimal number of firms, and maximizes the total surplus generated by the whole industry.

Proof Let $Q(n)$ denote the production of the responsible firms when there are n firms in the industry. And let $X_n = X(Q(n))$. Each firm satisfies the TC -maximizing condition

$$p(nQ(n)) = w(nX_n) X'(Q(n)).$$

Note that we can use the simplification that the price that prevails equals a function $p(nQ)$ (and likewise for $w(nX)$) because identical firms will make the same decisions and have the same price and quantity. The function $p(nQ)$ is the inverse of the function $D(p, \dots, p)/n$.

At the equilibrium, the zero-profit condition holds, because firms are not viable when profit is negative, but they enter when profit is positive.

Let us now determine the optimal number of firms, treating n as a continuous variable. Maximizing the total surplus

$$n \left[\int_0^{Q(n)} p(nq) dq - \int_0^{X_n} w(nx) dx \right]$$

with respect to n implies the first-order condition:

$$\begin{aligned} & \int_0^{Q(n)} p(nq) dq - \int_0^{X_n} w(nx) dx \\ & + np(nQ(n)) Q'(n) + \int_0^{Q(n)} p'(nq) nq dq \\ & - nw(nX_n) X'(Q(n)) Q'(n) - \int_0^{X_n} w'(nx) nxdx = 0. \end{aligned}$$

Integrating by parts, one has:

$$\begin{aligned} \int_0^{Q(n)} p'(nq) nq dq &= p(nQ(n)) Q(n) - \int_0^{Q(n)} p(nq) dq, \\ \int_0^{X_n} w'(nx) nxdx &= w(nX_n) X_n - \int_0^{X_n} w(nx) dx. \end{aligned}$$

Therefore the first-order condition simplifies into:

$$\begin{aligned} & p(nQ(n)) Q(n) - w(nX_n) X_n \\ & + n[p(nQ(n)) - w(nX_n) X'(Q(n))] Q'(n) = 0. \end{aligned} \tag{2}$$

Now, this condition holds true at the equilibrium, because the first row is null by the zero-profit condition, and the second row is also null by the TC -maximizing condition. $\square$

This result makes three separate points that deserve to be distinguished: one can 1) rely on the price mechanism, 2) retain the profit viability condition, and 3) let free entry occur in order to obtain the maximum possible surplus for all agents. The presence of the p, w functions only represents willingness to pay or to accept, not any assumption that trade occurs at linear prices. The optimality of the price mechanism is a result.⁶

The fact that responsible firms enter at the optimal rate comes from the fact that at zero profit they produce at the optimal scale. Indeed, they each satisfy the FOC

⁶The theorem relies on the first-order approach, which is not valid if increasing returns to scale are not limited to small quantities compared to total demand. In the extreme, consider the case in which returns to scale are increasing at all relevant production levels. In this case, it is well known that at most one firm should open. But a TC -maximizing firm that equalizes $p = wX'$ is not viable when $X' < X/Q$, and therefore the free entry equilibrium with responsible firms would have no firm opening, even if having one firm would maximize TC .

$pQ'(X) = w$, and at zero profit one has $pQ = wX$, so that combining the two equations one obtains $Q'(X) = Q/X$, meaning that the firm operates at a level with constant returns to scale, which minimizes average cost at the given prices.

It may be worth noting that this competitive equilibrium, in the presence of less cost-efficient firms, would weed them out again. In this way, competition retains its important efficiency function. The drama of the standard free enterprise system, in which ordinary firms are allowed, is that competition performs two functions that are at odds in terms of social welfare. It eliminates the less productive firms, which allows redirecting resources towards more productive uses and therefore enhances social welfare. But it is biased in favor of the profit-maximizing firms and against responsible firms, which is detrimental to social welfare.

There is one aspect on which responsible firms behave in similar fashion as ordinary firms, though, and this is differentiation. Insofar as differentiation strategies steal the market from competitors without creating value for the whole industry, firms end up in a prisoner's dilemma. The problem for responsible firms is that each maximizes its own TC rather than the total, and, as TC can be increased by attracting demand to the firm, differentiation strategies generate externalities on the other firms, which are not internalized by the firm. This issue is discussed in more details in Appendix B.

Let us conclude this subsection by examining if ethical customers can save responsible firms. If ethical consumers are willing to pay a premium for a product made by a responsible firm, this may help the responsible firms survive the competition. Suppose that responsible firms are recognizable by customers. In this case, ordinary firms and responsible firms effectively face two different demand functions $D^o(p), D^r(p)$, with $D^r(p, p_{-j}) > D^o(p, p_{-j})$ due to the fact that non-ethical customers are equally spread over all firms (absent any price differential) whereas ethical customers tend to flock around responsible firms. The gap between the two demand functions decreases with the number of responsible firms. In this case, a separate entry competition holds for the two types of firms, until each type reaches a zero-profit situation. At the equilibrium, responsible firms operate at optimal scale and their number is determined by the size of the demand at the corresponding price.

When the fraction of ethical customers in the population increases, this raises the demand and makes it possible to have more responsible firms, whereas the number of ordinary firms decreases because each needs to keep enough demand to stay afloat. Interestingly, at the equilibrium responsible firms are likely to have a lower price than ordinary firms, since they operate at the minimum of the average cost (computed at

equilibrium prices). Although the ordinary average cost is increasing at this point (due to increasing input prices), it is likely to remain below the average cost at the (lower) production scale of ordinary firms. This implies that even non-ethical customers will be attracted in greater numbers by responsible firms, which further pushes their number up.

A similar reasoning holds for ethical suppliers, including investors. If they accept a lower payment from responsible firms, these firms enjoy a lower cost. The case of workers is similar if the labor market is balanced, but in the case of unemployment due to wage rigidities, it is not possible to have lower wages in responsible firms and thus, workers may have little influence on the survival of responsible firms, and they cannot express their preferences for responsible firms if they are rationed and have to accept whatever jobs are available.

The question of how competitive pressure and the tastes of customers and suppliers can influence socially-conscious behavior has occurred in other contexts. For instance, in his pioneering study of discrimination in the labor market, Becker (1957) argued that competitive industries should exhibit lower discrimination than monopolistic industries, and more precisely that the degree of discrimination would be determined by the average taste for discrimination among employers in the latter industries, whereas the lowest taste for discrimination among employers would prevail in the former industries. He noted that this pattern could be modified due to variations, across industries, in discriminatory pressure from consumers and trade unions in particular. Follow-up research in economics (see, e.g., Loury 2003, Guryan and Kofi Charles 2013, Kim and Loury 2018) has emphasized the possibility of discriminatory equilibria in the absence of taste for discrimination, when endogenous human capital formation generates inequalities between groups. The fact that discrimination has been prolonged, extensive and economically very costly (Hsieh et al. 2019) might be seen as sobering, but it can also suggest, in a more positive light, that social norms can support deviations from ordinary profit-maximization in the market economy. The fact that economic efficiency is on the side of responsible profit seeking, contrary to discriminatory practices, is an important difference between the two cases.⁷

⁷Endogenous formation of specific human capital in the firm may also dampen productivity in ordinary firms when workers do not trust the management, adding to the efficiency advantages of responsible management (Dow 2003, 2018).

5.2 Extension to externalities

Let us introduce externalities into this analysis of competition. Let $Q = Q(X, E)$, where E is a scalar representing externalities, and the function Q is increasing and then decreasing in E , for every X . The partial derivatives will be denoted Q_X, Q_E . The inverse of Q with respect to X is denoted $X(Q, E)$, with partial derivatives X_Q, X_E .

We assume here that there is no regulation of the externalities, so that an ordinary firm has $Q_E = 0$.

By the profit-surplus equivalence theorem, a responsible firm makes decisions characterized by:

$$\begin{aligned} p(Q) Q_X &= w(X) \\ p(Q) Q_E &= V'(E). \end{aligned}$$

The second equality implies that $Q_E > 0$, i.e., the firm refrains from fully exploiting the cost saving made possible by externalities. Indeed, the second equation also reads (using $X_E = -X_Q Q_E = -Q_E / Q_X$):

$$-w(X) X_E = V'(E).$$

This dooms the responsible firms in free entry competition for an additional reason. They fail to exploit not only their market power, but also the free externalities. The profit-selection theorem is therefore reinforced.

The responsible invisible hand theorem has to be revisited. It is not obvious what viability condition should apply in the presence of externalities. Should a polluter-pays principle apply? We have the following revised theorem:

Responsible Invisible Hand Theorem with Externalities The free entry equilibrium with responsible firms spontaneously leads to the maximum possible surplus, with the optimal number of firms and the optimal amount of externalities, provided that the viability condition for firms deducts EV' from their profit.

Proof The total surplus, with n identical firms, is now equal to

$$n \left[\int_0^{Q(n)} p(nq) dq - \int_0^{X_n} w(nx) dx \right] - V(nE(n))$$

Differentiating this with respect to n implies the first-order condition:

$$\begin{aligned}
& \int_0^{Q(n)} p(nq) dq - \int_0^{X_n} w(nx) dx \\
& + np(nQ(n)) Q'(n) + \int_0^{Q(n)} p'(nq) nq dq \\
& - nw(nX_n) [X_Q(Q(n), E(n)) Q'(n) + X_E(Q(n), E(n)) E'(n)] - \int_0^{X_n} w'(nx) nxdx \\
& = (E(n) + nE'(n)) V'(nE).
\end{aligned}$$

Using the same simplifications as in the previous proof, one obtains:

$$\begin{aligned}
& p(nQ(n)) Q(n) - w(nX_n) X_n \\
& + n[p(nQ(n)) - w(nX_n) X_Q(Q(n), E(n))] Q'(n) \\
& - nw(nX_n) X_E(Q(n), E(n)) E'(n) = (E(n) + nE'(n)) V'(nE).
\end{aligned}$$

Consider a free entry equilibrium with responsible firms. The middle row vanishes because

$$p(nQ(n)) = w(nX_n) X_Q(Q(n), E(n)).$$

Likewise, as mentioned at the beginning of this subsection, one has

$$-w(nX_n) X_E(Q(n), E(n)) = V'(nE).$$

Therefore the condition further simplifies into

$$p(nQ(n)) Q(n) - w(nX_n) X_n - E(n) V'(nE) = 0.$$

This should then be the viability condition for the firms, proving that the polluter pays principle should apply, with the shadow price of the externality V' . $\square$

Here again, the optimal rate of entry with responsible firms obtains because they operate at the optimal scale when they have a zero profit. The zero profit equation $pQ = wX + EV'$, combined with the conditions $pQ_X = w$ and $pQ_E = V'$, implies $Q = Q_X X + Q_E E$, which is the constant returns to scale equation, satisfied at the level which minimizes the average cost (at given prices).

This theorem provides a justification for responsible firms applying to their profitability accounting a shadow price for the externalities multiplied by the full quantity of the externality. Responsible firms apply the polluter-pays principle to themselves. In general, the key efficiency argument for Pigouvian taxation is about the marginal tax and economic theory says little about the net monetary transfers. A tax that increases with pollution can have the same effect as a subsidy that decreases with pollution. But here we have obtained a result that says something about the net monetary transfers, because the optimal number of firms and the total size of the industry depend on that.

6 Incentivizing responsible management

How to implement a change of purpose in organizations has to do with governance, and we can only briefly touch on this topic in this paper. If a deep sense of responsibility cannot be expected from all the decision-makers in the business world, some intervention to level the playing field and eliminate the unfair advantage of the ruthless profit-maximizing firms is needed. The socially responsible actors have to be protected from upsetting competition by the other actors. Mandating an inclusive governance that gives a voice to all stakeholders seems the most promising way to change the incentives of managers, given that it may be very hard for external public agencies to monitor the firm's management. It appears easier for law enforcement to check the decision procedures and governing rules than to check the productive and commercial decisions themselves. However, how a reform in governance can induce TC -maximization is not a simple matter. Here we discuss two main options.

Starting with Meade's and Dow's work (see in particular Meade 1993, Dow 1996, 2018), the idea of setting up membership markets for workers in order to provide appropriate incentives for the firm's management has attracted interest. Magill et al. (2015) take up the idea and apply it to all stakeholders, each type (consumers, workers, shareholders) having their own membership market. There are two possible versions of such markets. The version that these authors have considered has the membership rights being valued as assets held by current tenants, and sold to newcomers by departing members. A variant would have the firm itself sell these membership rights on a regular basis to the highest bidder, with a time-limited validity, and they could be partly refundable if a member departs before the end of the validity period.

There are three serious problems with stakeholder rights of this sort. The first

has to do with the inefficient excess of entry alluded to in section 5.1. When a new firm enters, it has to emit membership rights, and this captures the surplus of the initial members into the profit. As a consequence, there are opportunities for profit whenever incumbent firms generate a positive surplus. This encourages new entries until the surplus generated by each firm, and therefore the whole sector, vanishes, which is even more inefficient than the standard free entry equilibrium with the usual price mechanism.

The second problem is that stakeholders have little surplus left, if they are homogeneous in each category, since the value of their membership ticket will exhaust their surplus. The need to buy a membership right may create hardship for liquidity-constrained potential members. This problem is partly alleviated if the stakeholders are quite heterogeneous, because the value of membership, in equilibrium, will equal the value to the marginal buyer, and this value may be much lower than the value to many of the members—if the marginal member has zero surplus, in particular, the membership market collapses and is useless. Insofar as the value of rights differs from the value to many members, this discrepancy may hamper the alignment of incentives around the firm’s management. Therefore, such membership markets suffer from a tension between the distributive concern about making membership accessible and the efficiency goal of aligning the value of assets with the surplus generated by the firm.

The third main problem is that membership markets do not directly align the incentives of the stakeholders of different types. While each market may contribute to the convergence of interests of each type of stakeholders separately, the distinct values of consumer rights, worker rights, and shareholder rights do not vary in parallel when the firm considers various possible decisions. Therefore, conflicts between stakeholders are bound to remain vivid. Magill et al. (2015) invoke the possibility of monetary side payments among stakeholders in order to obtain a maximization of the total value of all membership rights, but how such payments are organized may itself have complex incentive and distributional consequences. For instance, if consumers and workers have to pay shareholders in order to obtain an expansion of production that reduces profit but increases consumer and worker surplus, this will affect the value of their assets and may discourage some of them to push for such expansion.

The variant of the mechanism which involves temporary rights sold by the firm solves this third problem, because the firm’s profit then equals the total value of the rights, making profit maximization identical to total value maximization. But it makes the tension between distribution and efficiency concerns even more vivid, since shareholders

then reap all the surplus from marginal members, so that either they capture most of the surplus of other stakeholders (if stakeholders are identical by category) or profit fails to fully represent TC (if stakeholders are heterogeneous in each category).

The membership market approach assumes that adequate incentives have to rely on making the goals of the relevant agents correlate with TC . But we have shown in this paper that a constrained maximization of profit is equivalent to an unconstrained maximization of TC , and this paves the way to another approach to the incentive-compatibility problem. Indeed, it is possible to give specific rights to stakeholders, enabling them to challenge departures from “good” management rules, without allowing them to push their interests in any way they wish (Arrow 1973). Since most deviations from the “good” management rules hurt the interests of at least a subset of stakeholders, it is instrumental to give them the right to block decisions that deviate from those rules, and to require the return to those rules when a departure is ascertained.

From the results of section 4, the main rules can be depicted as follows:

1. For each separate production line of the firm, profit net of Pigouvian correction for externalities is not negative. This can rely on standard accounting methods (splitting the cost of shared facilities of the firm among the production lines).

2. No opportunity for profit (net of Pigouvian correction for externalities) is left out, at current prices and wages. This means that proposals for alternative management strategies must be considered and if deemed promising, lead to a change in the top management by the board of stakeholders. Coalitions of stakeholders who would not benefit from the change may seek to block the move. But at least one type of stakeholder necessarily stands to benefit from such a move, because it increases TC . The governance rules must give the right to any stakeholder to raise a complaint against such blocking coalitions.

3. The marginal productivity of each input (or category of input), measured at current product prices, is equal to the input price (for employed inputs, and less than the input price for non-employed inputs).⁸ With suitable use of analytic accounting, this can be monitored, at least in approximate terms. When marginal productivity is above the input price, customers and suppliers can raise a complaint, while in the opposite situation, shareholders can do so.

4. The Pigouvian pricing of externalities reflects societal willingness to pay. For each externality, this requires the equivalent of a cost-benefit analysis. A prominent

⁸This rule is a logical consequence of rule 2 and is thus redundant, but may be useful in practice.

example is the social cost of carbon, for which well-established methods give a range of values that the firm can adopt. For externalities that affect local populations, national values cannot be produced, and it may appear costly for the firm to conduct a specific survey of population willingness to pay and to account for consequences on future generations and other silent stakeholders (such as other species in ecosystems). But current ESG reporting practices are converging toward something very similar to this idea, therefore it is not farfetched to imagine a generalized adoption of such reporting in terms of Pigouvian pricing. In order to assess such reporting and make it possible to have complaints when externalities are not dutifully accounted for, it may be necessary to mandate the recruitment of independent board members.

Additional rules are discussed in Appendix B. For instance, for non-contractible work intensity, the rule is to equalize the marginal productivity of intensity with the marginal premium on total wages it induces. The latter may be hard to estimate as it requires an estimate of the elasticity of the market wage to work intensity. Likewise, for non-observable quality (such as product longevity), the rule is to equalize the customers' marginal willingness-to-pay for quality with its marginal cost at current input prices. It is conceivable, however, that consumer organizations and labor unions would be willing to fund surveys estimating such market elasticities, making it easier for the firms to incorporate these values into their management.

Even if this inclusive governance approach proves effective, for general externalities affecting a diffuse set of interests (and in particular silent stakeholders such as future generations and other species), government agencies can usefully relieve firms from some of the management burden by imposing an external Pigouvian pricing scheme.

7 Conclusion

As recalled in the introduction, the idea of broadening the purpose of the corporation in order to incorporate other stakeholders than the shareholders has been famously criticized for leading either to multiple goals rendering management arbitrary, or to fuzzy management rules because of a surplus goal that depends on unreliable subjective data. While our analysis confirms that the total contribution of the firm is a sum of surpluses and therefore relies on subjective data that may be very hard to estimate precisely, we have also found out that it did not matter much, because of the surprising result that a subjective goal can be pursued using rather straightforward objective management

rules. The reason for this fortunate feature of socially responsible management is that the demand and supply facts that underlie the surpluses that the firm should maximize lead to very objective prices and wages that the firm must deal with in its transactions, and that such prices and wages provide most of the needed information about demand and supply to pursue surplus maximization. A responsible firm may still maximize its profit, but refraining from using any market power device or non-linear pricing, and internalizing externalities via a Pigouvian adjustment to profit. These positive results about the possibility to tweak profit maximization to the benefit of all stakeholders are extended in the Appendix to the presence of inequalities, incomplete contracts, asymmetric information and rationing, as well as to general equilibrium analysis. The only negative result is that firms maximizing their own total surplus will not internalize the negative externality their differentiation efforts exert on their competitors.

Taking stock, this paper suggests an interesting narrative about the firm and about capitalism. Regarding the firm, it depicts it as the meeting point of agents who want some products and services and agents who can deliver them. The creation of these products and services is not done in the market itself because it is not a simple transfer against money, and the coordination that production requires takes place in certain physical infrastructures. The firm is not a nexus of contracts, but a cooperative venture that goes beyond trade and involves multilateral coordination. There is value creation not because some intermediary is able to make a profit out of this coordination effort, but because, and when, this cooperative venture realizes the potential benefit of satisfying the wants of some parties while also benefiting those who incur a cost in providing inputs. The traditional focus on profit is fixated on the narrow benefit of a subset of the parties, and obviates the broader benefits brought about by the whole cooperative venture. The narrow focus is actually detrimental to realizing the full potential of the firm.

Regarding capitalism, our paper suggests that the stakeholder approach is at the core not just of equity but also of efficiency issues. Under imperfectly competitive conditions, but with a sufficient degree of competition that drives profit down, the market selects profit-maximizing firms, i.e., the standard capitalist firms. The more responsible firms that take account of other stakeholders (customers, workers and suppliers), as well as larger externalities, tend to be eliminated. This triumph of capitalism is, therefore, a tragedy, because the total surplus generated by the economy is much smaller than it could be if the responsible firms prevailed. The key paradox of capitalism is that market competition is a double-edged sword. It eliminates cost-ineffective firms, which is good

for the social surplus, but it also eliminates responsible firms, which is detrimental. The capitalist firm is great at surviving competition, but it does so by squeezing the surplus out of the other stakeholders and by socializing as much of its costs as possible through externalities.

One partial solution to this problem is to promote *perfect* competition. This does take care of the stakeholders, as we have shown in this paper, but it does not take care of externalities and therefore some intervention such as Pigouvian taxation remains warranted. Moreover, perfect competition appears a very unrealistic perspective in a Schumpeterian world with constant renewal of products and firms as well as substantial fixed costs and economies of scale. In the real world, competition is imperfect, therefore biased, and is part of the problem rather than the full solution.

There are four characteristics of the standard capitalist economy:

1. Firms maximize profit;
2. Free entry lets firms enter whenever this is viable;
3. A firm is viable whenever it makes a non-negative profit;
4. Transactions rely on voluntary trades at linear prices.

The last three items in this list foster the first one. One could think of reforming the market economy by altering one or several of these three items. Relaxing item 2 by regulating the number of firms could help keep a diversity of profit-maximizing and other firms. Relaxing item 3 by subsidizing responsible firms may also help them compete with other firms. Relaxing item 4 by allowing for other forms of non-linear pricing, or setting up membership markets, would also enhance the viability of responsible firms. But our analysis showed that changing item 1 while keeping the other items untouched would work wonders. Firms that *maximize profit without exploiting their market power and adjust their profit for a shadow cost reflecting externalities*, would spontaneously, through the same competition mechanism that generates the problems that have just been described, produce a surplus maximizing outcome (with the exception of the prisoner's dilemma due to excessive differentiation).

This puts the spotlight on the issue of the purpose of the corporation, which is being currently debated in business and policy circles, as recalled in the introduction. We believe that the principle of constrained profit maximization and the simple management rules identified in this paper can help in designing suitable incentive mechanisms.

This appears more practical than trying to explicitly measure the value of the total contribution of the firm to society, which involves subjective surplus values that are hard to elicit, and also more practical than creating membership markets, because such markets have serious limitations with respect to satisfying distributional and incentive concerns at the same time.

The issue of corporate purpose is often associated, in public debates, to the promotion of the third sector of social enterprises, for which a social or environmental mission comes before income creation. As shown in section 3, when a firm generates net positive externalities (which might be seen as the criterion for a social enterprise to deserve its name), it might be optimal to keep it going even when not financially viable, and additional revenue in the form of grants or subsidies is fully justified in this case. The difference between responsible firms and non-profit organisations that obtain part of their income on the market appears blurry in this light. One could perhaps use our analysis to develop guidelines for non-profits as well. A measure of the positive externalities they produce could help determine their optimal scale. Compared to income-seeking firms, the difficulty is that externalities would represent a large part of their impact, so that the difficulty of measuring externalities would render the application of our proposed management rules quite delicate and imprecise. At least, one might hope that the general stakeholder approach of measuring impact in terms of total surplus including externalities provides a useful unified conceptual framework for economic firms and social enterprises.

Our paper leaves many issues for supplementary research, and here is a non-exhaustive list. As mentioned in the introduction, empirical estimates of the deadweight loss of irresponsible profit-seeking would help show the importance and urgency of this topic in policy. The literature on market power (e.g., De Loecker et al. 2021) and externality pricing (Murtin et al. 2017) provides useful ingredients that need to be put together and further completed. Another important issue comes from behavioral studies that show how vulnerable households are in their economic transactions (Akerlof and Shiller 2015, Heidues et al. 2016). We have adopted the usual rationality assumptions in this paper, and it would be important to develop guidelines of responsible management when the firm faces customers and workers with inconsistent preferences or systematic cognitive biases. Finally, more specific applied recommendations incorporating time and uncertainty explicitly need to be elaborated, in particular to shed light on what responsible management means for risky investment decisions.

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Appendix A: General equilibrium analysis

In this appendix, we provide a “first welfare theorem” for an economy with free entry, responsible firms and externalities. We assume away informational asymmetries and incomplete contracts. After stating and proving the theorem, we provide an illustration of the inefficiency generated by profit-maximizing firms in this setting.

There are K commodities indexed by $k = 1, \dots, K$, H households indexed by $h = 1, \dots, H$, and J firms, indexed by $j = 1, \dots, J$. The model is a variant of the Arrow-Debreu model, but introduces imperfect competition.

Household h has preferences over consumption-labor bundles $x_h = (x_{hjk})_{j=1, \dots, J, k=1, \dots, K}$, where x_{hjk} denotes the transaction of commodity k done between household h and firm j . This allows households to have specific preferences about particular firms (e.g., due to familiarity, ethical principles, and so on). In addition, we assume that households are subject to externalities generated by firm activities. If $y_j = (y_{jk})_{k=1, \dots, K}$ denotes the production plan of firm j , household h ’s preferences bear on the vector (x_h, y) , where $y = (y_j)_{j=1, \dots, J}$. Sign conventions are that $x_{hjk} > 0$ for a commodity bought by h and $x_{hjk} < 0$ for a commodity sold by h (such as labor services); $y_{jk} > 0$ for a commodity sold by j , and $y_{jk} < 0$ for a commodity bought by j .

Household h holds a share of firm j denoted by s_{hj} , and receives this share of firm j ’s profit π_j . Households are price-takers. The preference ordering of a household is denoted R_h (with strict preference P_h and indifference I_h) and is assumed to be transitive, complete, smooth and convex. The budget of household h is $px_h \leq s_h \pi$, where $s_h = (s_{hj})_{j=1, \dots, J}$ and $\pi = (\pi_j)_{j=1, \dots, J}$. Let $U_h(x_h, y)$ denote direct utility, and let the indirect utility be

$$V_h(m, y; p) = \max \{U_h(x_h, y) \mid px_h \leq m\}.$$

From this indirect utility one can derive the (dis)value to h of every externality-

generating component of firm j 's plan:

$$v_{hjk}(m, y; p) = \frac{\partial V_h / \partial y_{jk}}{\partial V_h / \partial m},$$

and typically, given the sign conventions on outputs and inputs, $v_{hjk} < 0$ for an output generating negative externalities or an input generating positive externalities, and conversely.

Firm j is assumed to maximize its profit in a “responsible” way, which means taking prices as given when choosing its production plan (even though it posts its own prices), and deducting a Pigouvian tax from its profit to guide its choices and determine its own viability. We do not introduce a government, therefore this tax is not taken by governments and the profit that is actually paid to shareholders does not include it. There is therefore a distinction to be made between the ordinary profit $\pi_j = p_j y_j$ and the adjusted profit $\hat{\pi}_j = \hat{p}_j y_j$, which involves Pigou-adjusted prices $\hat{p}_{jk} = p_{jk} - \tau_{jk}$, where τ_{jk} is the Pigou tax for commodity k in firm j . The firm has technological possibilities described by the constraint $y_j \in Y_j$. There is a potential set of firms, $j = 1, \dots, J$, and in the free entry context, all of these firms can enter, but not all of them will generally choose to, when opportunities for profit are lacking.

In order to keep the model simple, we assume away any trade between firms. Firms only trade with households, and each firm has its own prices, that are taken as given by households. The introduction of inter-firm trading is discussed later in this appendix.

The equilibrium is defined by the following conditions: There exists a system of prices⁹ $p = (p_{jk})_{j=1, \dots, J, k=1, \dots, K}$ and Pigou taxes $\tau = (\tau_{jk})_{j=1, \dots, J, k=1, \dots, K}$ such that:

1. Every household chooses x_h by maximizing $U_h(x_h, y)$ under the budget constraint $p x_h \leq s_h \pi$ and the physical constraint $x_h \in X_h$, where $\pi_j = p_j y_j$;
2. Every firm maximizes $\hat{\pi}_j = \hat{p}_j y_j$ under the constraint $y_j \in Y_j$, and taking $\hat{p}_j = p_j - \tau_j$ as given; if the maximum $\hat{\pi}_j$ is negative, then $y_j = 0$;
3. There is equilibrium on every market: $\sum_h x_{hj} = y_j$ for all j .

The non-negative profit condition embodies the free entry feature of this equilibrium, as in d’Aspremont and Dos Santos-Ferreira (2021). That is, there is a price for each

⁹This formulation exploits the equivalence between an equilibrium in which firms fix prices but maximize profit taking their prices as parametric, and an equilibrium in which they simply behave as price-takers.

product of each firm, including those which choose not to enter the market. Concretely, this can be thought of as the firm figuring out what prices it can realistically post, and determining that possible prices, given the state of demand, are not making itself profitable.

Obtaining efficiency from the polluter-pays principle under free entry is confirmed for the general equilibrium setting by the following theorem.

Theorem The free-entry equilibrium with responsible firms is Pareto-efficient if for all $j = 1, \dots, J$, $\tau_j = -\sum_h v_{hj}$, where $v_{hj} = (v_{hjk}(m, y; p))_{k=1, \dots, K}$.

Proof Consider household h at its best bundle for prices p . Given that individual preferences are smooth and convex, the vector $\left(\frac{\partial V_h}{\partial m} p_{jk}, \frac{\partial V_h}{\partial y_{jk}}\right)_{j=1, \dots, J, k=1, \dots, K}$ defines a hyperplane that supports the (convex) upper-contour set $\{(x'_h, y') \mid U_h(x'_h, y') \geq U_h(x_h, y)\}$. If a change in (x_h, y) , denoted $(\Delta x_h, \Delta y)$, is an improvement, one must then have

$$\frac{\partial V_h}{\partial m} \sum_{j,k} p_{jk} \Delta x_{hjk} + \sum_{j,k} \frac{\partial V_h}{\partial y_{jk}} \Delta y_{jk} > 0.$$

This expression is equal to

$$\frac{\partial V_h}{\partial m} \sum_{j,k} [p_{jk} \Delta x_{hjk} + v_{hjk} \Delta y_{jk}].$$

If the change is good for every household (more precisely, not bad for any household and strictly good for at least one), one must have $\sum_{j,k} [p_{jk} \Delta x_{hjk} + v_{hjk} \Delta y_{jk}] \geq 0$ for all h , with a strict inequality for some h , implying by summation over all households that

$$\sum_{j,k} \left[p_{jk} \left(\sum_h \Delta x_{hjk} \right) + \left(\sum_h v_{hjk} \right) \Delta y_{jk} \right] > 0.$$

By feasibility, one has $\sum_h \Delta x_{hjk} = \Delta y_{jk}$ for all k , so that the above expression also reads

$$\sum_{j,k} \left[p_{jk} + \sum_h v_{hjk} \right] \Delta y_{jk} > 0.$$

Assuming that for all $j = 1, \dots, J, k = 1, \dots, K$, $\tau_{jk} = -\sum_h v_{hjk}$, this can be rewritten as

$$\sum_j (p_j - \tau_j) \Delta y_j > 0.$$

However, this is impossible to achieve, with the existing and potential firms, when firms maximize profit (condition 2 of the equilibrium). $\square$

This also proves the standard first welfare theorem for a fixed population of firms. The usual theorem should really be taken as being about constrained Pareto efficiency, in absence of possibility of changing the number of production units. The welfare theorem with free entry is a more comprehensive efficiency result.

The condition $\tau_{jk} = -\sum_h v_{hjk}$ can be read as the application of the Bowen-Lindahl-Samuelson condition to the “public good” embodied in the externality generated by y_{jk} : The sum of willingness-to-pay over all impacted agents is equal to the cost (virtually) incorporated in the firm’s maximization. The theorem introduces this as a sufficient condition for efficiency, but it is close to being a necessary condition as well. Indeed, if a firm j maximizes another objective (with different virtual Pigou taxes in its computation), then generically it will be possible to find Δy_j such that

$$\sum_k \left[p_{jk} + \sum_h v_{hjk} \right] \Delta y_{jk} > 0,$$

thus making it possible to improve the allocation for everyone.

The simple summation of willingness-to-pay in the determination of τ_j may suggest that firms need not worry about distributional issues, but the situation is more complex. Typically, an efficient allocation produced by a market equilibrium maximizes social welfare $\sum_h \alpha_h U_h$ for so-called “Negishi weights” $\alpha_h = 1/\frac{\partial V_h}{\partial m}$, meaning that the current distribution of resources at the equilibrium is socially optimal, with the marginal social value of money being equalized over all households. Efficiency under externalities is obtained, as shown in the above result, provided that the firms rely on the same social welfare weights when aggregating utility impacts over households, since the v_{hjk} terms are precisely equal to the utility impact $\partial V_h/\partial y_{jk}$ multiplied by the Negishi weight $1/\frac{\partial V_h}{\partial m}$. This is intuitive: efficiency is achieved only if the firms use the same social welfare weights for externality management as the whole economy does in the distribution of resources.

Let us briefly examine how to adjust the model in order to introduce inter-firm trading. Let $y_j = \bar{y}_j + \bar{\bar{y}}_j$, where $\bar{y}_j$ is the net trade of the firm with households, and $\bar{\bar{y}}_j$ its net trade with other firms. Since firms simply maximize profit (under “responsible” constraints), they have no preferences over their trading partners, and we must therefore assume that prices for a commodity or service on the inter-firm market do not depend

on the identity of the traders. If there are costs to getting products from certain firms, these are incorporated in the identification of the product itself. Therefore, we have two price vectors: $(\bar{p}_{jk})_{j=1,\dots,J,k=1,\dots,K}$ is the price vector for firm-household trades, and $(\bar{\bar{p}}_k)_{k=1,\dots,K}$ is the price vector for intra-firm trading. The profit of the firm is now equal to $\pi_j = \bar{p}\bar{y}_j + \bar{\bar{p}}\bar{\bar{y}}_j$. Since externalities depend only on the total vector y , and not on how it is split between households and other firms, the price adjustment by Pigou taxes is the same for both price vectors. The adjusted prices are $\hat{p}_{jk} = \bar{p}_{jk} - \tau_{jk}$ and $\hat{\bar{p}}_{jk} = \bar{\bar{p}}_k - \tau_{jk}$.

The definition of the equilibrium is revised as follows. There exists a system of prices $\bar{p}, \bar{\bar{p}}$ and Pigou taxes $\tau = (\tau_{jk})_{j=1,\dots,J,k=1,\dots,K}$ such that:

1. Every household chooses x_h by maximizing $U_h(x_h, y)$ under the budget constraint $\bar{p}x_h \leq s_h\pi$ and the physical constraint $x_h \in X_h$;
2. Every firm maximizes $\hat{\pi}_j = \hat{p}_j\bar{y}_j + \hat{\bar{p}}_j\bar{\bar{y}}_j$ under the constraint $y_j \in Y_j$; if the maximum $\hat{\pi}_j$ is negative, then $y_j = 0$;
3. There is equilibrium on every market: $\sum_h x_{hj} = \bar{y}_j$ for all j ; $\sum_j \bar{\bar{y}}_j = 0$.

With these additions to the model, the theorem and its proof carry through with no essential complication, except in tedious notations.

Let us now come back to the model without inter-firm trade, and examine the equilibrium with ordinary firms. Assume that each household's demand is single-valued, defining a function

$$x_h(p, y) = \arg \max_{x_h \in X_h} \left\{ U_h(x_h, y) \mid \bar{p}x_h \leq \sum_j s_{hj}p_jy_j \right\}.$$

The total demand is $D(p, y) = \sum_h x_h(p, y)$, and in particular, $D_{jk}(p, y) = \sum_h x_{hjk}(p, y)$. Assume that the equation

$$y_j = D_j(p_j, p_{-j}, y)$$

can be solved uniquely for p_j , yielding a function determining the price vector at which the firm can implement a production plan y_j , given the strategies p_{-j}, y_{-j} of other firms:

$$p_j = P_j(p_{-j}, y).$$

This function incorporates the impact that the firm has on demand through its profit and its externalities in addition to the immediate price effect. This amounts to a form

of rational expectations assumption which may appear demanding, but it is a local condition. The firm only needs to have an accurate perception of the marginal impact of its choice of production plan on the price it currently posts. And this does not include any general equilibrium impact on the other firms' plans and prices.

The imperfect competition equilibrium with ordinary firms can then be defined similarly as the previous equilibrium, except that condition 2 is replaced by:

2'. Every firm maximizes $\pi_j = p_j y_j$ under the constraints $y_j \in Y_j$, $p_j = P_j(p_{-j}, y)$, taking (p_{-j}, y_{-j}) as given; if the maximum π_j is negative, then $y_j = 0$.

One can then determine conditions under which the equilibrium with ordinary firms is Pareto-efficient.

Theorem The free-entry equilibrium with profit-maximizing firms is Pareto-efficient if for all $j = 1, \dots, J$, $k = 1, \dots, K$, $p_{jk} \sum_l \varepsilon_{jkl} \frac{p_{jl} y_{jl}}{p_{jk} y_{jk}} = \sum_h v_{hjk}$, where ε_{jkl} is the inverse (cross-)elasticity of demand defined as

$$\varepsilon_{jkl} = \frac{\partial P_{jl}}{\partial y_{jk}}(p_{-j}, y) \frac{y_{jk}}{P_{jl}(p_{-j}, y)}.$$

Proof In the firm's maximization, the mark-up that firm j applies to the price of good k is computed from differentiating $P_j(p_{-j}, y) y_j$ with respect to y_{jk} :

$$\begin{aligned} p_{jk} + \sum_l \frac{\partial P_{jl}}{\partial y_{jk}} y_{jl} &= p_{jk} \left(1 + \sum_l \frac{\partial P_{jl}}{\partial y_{jk}} \frac{y_{jk}}{p_{jl}} \frac{p_{jl} y_{jl}}{p_{jk} y_{jk}} \right) \\ &= p_{jk} \left(1 + \sum_l \varepsilon_{jkl} \frac{p_{jl} y_{jl}}{p_{jk} y_{jk}} \right). \end{aligned}$$

The equilibrium is also an equilibrium with price-taking firms that maximize profit $\tilde{p}_j y_j$, taking $\tilde{p}_{jk} = p_{jk} \left(1 + \sum_l \varepsilon_{jkl} \frac{p_{jl} y_{jl}}{p_{jk} y_{jk}} \right)$ as given when choosing $y_j \in Y_j$.

The result is then, given the definition of $\tilde{p}_{jk}$, a direct corollary of the previous theorem, according to which efficiency is obtained if $\tilde{p}_{jk} = p_{jk} - \tau_{jk}$. $\square$

This result shows how imperfect competition, which tends to reduce production (when $\varepsilon_{jkk} < 0$ for outputs and $\varepsilon_{jkk} > 0$ for inputs, given the sign conventions on y_{jk}) can compensate for the negative externalities of outputs ($v_{hjk} < 0$) and the negative externalities of inputs ($v_{hjk} > 0$). But the chances of this happening are much more remote than the consensus on Pigou pricing needed in the previous theorem, since it is hard to imagine how the degree of market power could align with the negative

externalities of production. Moreover, the mix of inputs is likely to be distorted when some actually have positive externalities (such as labor employment).

Appendix B: Extensions

Inequalities

The program for a firm maximizing

$$WTC = \sum_i \alpha_i (WTP_i(q_i) - pq_i + px_i - WTA_i(x_i) + s_i \Pi - V_i(E)) + T(pY, E) - V_0(E)$$

is analyzed with the Lagrangian

$$L = \sum_i \alpha_i (WTP_i(q_i) - pq_i + px_i - WTA_i(x_i) - V_i(E)) \\ + \left(\sum_i \alpha_i s_i \right) (pY - T(pY, E)) + T(pY, E) - V_0(E) - \mu f(Y, E)$$

and the direct first-order conditions based on the first-order partial derivatives of the Lagrangian (before elimination of μ) are:

- $\alpha_i (wtp_{ik} - p_k) + \sum_i \alpha_i s_i p_k (1 - T') + T' p_k = \mu f_k$
- $\alpha_i (wta_{ik} - p_k) + \sum_i \alpha_i s_i p_k (1 - T') + T' p_k = \mu f_k$
- $-\sum_i \alpha_i V_{im} - \sum_i \alpha_i s_i T_m + T_m - V_{0m} = \mu f_m$.

Let us first examine the case of perfect competition. Under perfect competition, the agents equalize price and willingness to pay or accept. The first two conditions therefore simplify to:

- $((\sum_i \alpha_i s_i - 1)(1 - T') + 1) p_k = \mu f_k$.

This implies that the following first-order condition of profit-maximization will be satisfied:

- for all $k, k' \in \{1, \dots, K\}$, $\frac{p_k}{p_{k'}} = \frac{f_k}{f_{k'}}$.

Now suppose that $T_m = \beta (\sum_i \alpha_i V_{im} + V_{0m})$, for some coefficient β , meaning that the Pigouvian tax takes account of the inequalities. Then the third direct condition above simplifies to:

- $((\sum_i \alpha_i s_i - 1) \beta + 1) \frac{T_m}{\beta} = -\mu f_m,$

and this entails the satisfaction of another first-order condition of profit-maximization:

- for all $m, m' \in \{1, \dots, M\}$, $\frac{T_m}{T_{m'}} = -\frac{f_m}{f_{m'}}.$

It remains to find conditions guaranteeing the last first-order condition of profit-maximization:

- for all $k \in \{1, \dots, K\}, m \in \{1, \dots, M\}$, $\frac{T_m}{(1-T')p_k} = -\frac{f_m}{f_k}.$

Let $\beta = 1 - T'$. The simplified first-order condition can then be written as

- $((\sum_i \alpha_i s_i - 1) (1 - T') + 1) \frac{T_m}{(1-T')} = -\mu f_m,$

which, combined with $((\sum_i \alpha_i s_i - 1) (1 - T') + 1) p_k = \mu f_k$, directly yields the desired result. A profit-maximizing firm will also maximize TC under these conditions. The only restriction, compared to the main text, is that inequalities must now be taken into account in the Pigouvian tax, via the condition $T_m = (1 - T') (\sum_i \alpha_i V_{im} + V_{0m})$.

Therefore, although the introduction of unequal marginal social values of money requires additional assumptions for the Pigouvian tax, social optimality is still compatible with shareholder value. This may appear surprising, but, intuitively, it comes from the simple fact that the firm cannot affect the distribution because the other parties maximize their own surplus taking the prices as given, and the distribution of dividends is governed by the fixed s_i shares. Only if the firm was allowed to use its profit for corporate philanthropy would its responsibility toward the distribution become pressing.

As an aside, let us introduce income taxation for the suppliers in order to check how the interaction between corporate tax and income tax plays out in this context. Suppose that each supplier's surplus is equal to:

$$px_i - WTA_i(x_i) - I_i(px_i),$$

where I_i denotes the income tax paid by i . The index i in the income tax I_i is meant to allow for other aspects of i 's situation, not related to transactions with this firm, to affect the income tax. For simplicity, it is assumed here that dividends are not taxed. The value of the unweighted total surplus is not altered, since this income tax is

received by the government. The income tax induces the agent i to seek the optimality condition $wt a_{ik} = p_k (1 - I'_i)$. This destroys the equality $wtp_{ik} = wt a_{jk}$ (for all i, j, k) and makes it impossible for the firm to maximize the total surplus. Indeed, supplier i is no longer maximizing her own pre-tax surplus and, in the competitive situation, there is nothing the firm can do to alter that.

One solution to this distortion would consist in making the income tax bear on surplus rather than income, just like the corporate tax bears on profit rather than sales. But it is completely impractical to make taxes depend on a subjective variable like WTA_i .

Observe that a progressive income tax (i.e., inversely correlated to the marginal social values of money) is good for the weighted social surplus as measured here, which may provide a justification for imposing such a distortion. Indeed, the income tax adds a term to the total contribution TC which is equal to:

$$- \sum_i \alpha_i I_i (px_i) + \sum_i I_i (px_i),$$

and this depends negatively on the correlation between the marginal social values of money and the tax.

Coming back to our main analysis, the Profit-Surplus Equivalence Theorem can be extended as follows. Now the firm maximizing WTC may actually want to use its market power to promote social welfare. The “mark-up” referred to in the statement of the theorem follows the Lerner definition (i.e., the inverse of demand elasticity).

Profit-Surplus Equivalence Theorem Assuming the firm controls the prices whereas

its trading partners are price-takers, for the firm’s decisions it is equivalent:

- 1) to maximize $pY - \sum_m \left(\frac{\sum_i \alpha_i V_{im} + V_{0m}}{\sum_i \alpha_i s_i} \right) E_m$ taking $\sum_i \alpha_i V_{im} + V_{0m}$ as given and adjusting its mark-up on good k by the factor $\frac{\sum_i \alpha_i \left(s_i - \frac{Y_{ik}}{Y_k} \right)}{\sum_i \alpha_i s_i}$ when choosing quantities; and
- 2) to maximize

$$WTC = \sum_i \alpha_i (WTP_i(q_i) - pq_i + px_i - WTA_i(x_i) - V_i(E)) + \left(\sum_i \alpha_i s_i \right) pY - V_0(E).$$

To prove this, first consider a firm maximizing $pY - \sum_m \left(\frac{\sum_i \alpha_i V_{im} + V_{0m}}{\sum_i \alpha_i s_i} \right) E_m$ taking

$\sum_i \alpha_i V_{im} + V_{0m}$ as given (*but not* p). Its Lagrangian is:

$$L = pY - \sum_m \left(\frac{\sum_i \alpha_i V_{im} + V_{0m}}{\sum_i \alpha_i s_i} \right) E_m - \lambda f(Y, E) - \kappa g(p, Y),$$

where $g(p, Y) \leq 0$ delineates the market combinations of prices and quantities that are available to the firm. This entails the following first-order conditions:

- $p_k = \lambda f_k + \kappa g_{Y_k}$,
- $Y_k = \kappa g_{p_k}$,
- $\sum_i \alpha_i V_{im} + V_{0m} = -\lambda (\sum_i \alpha_i s_i) f_m$.

The first two conditions provide a classical price equation, letting $\frac{\partial p_k}{\partial Y_k} = -\frac{g_{Y_k}}{g_{p_k}}$:

$$p_k = \lambda f_k - Y_k \frac{\partial p_k}{\partial Y_k}.$$

The Lerner mark-up in this case is

$$-\frac{Y_k}{p_k} \frac{\partial p_k}{\partial Y_k}.$$

Observe that such a firm behaves in the same way as a firm that takes prices as parametric but incorporates the mark-up through the following formula:

$$\tilde{p}_k = p_k \left(1 + \frac{Y_k}{p_k} \frac{\partial p_k}{\partial Y_k} \right).$$

Indeed for such a firm, the Lagrangian is:

$$L = \tilde{p}Y - \sum_m \left(\frac{\sum_i \alpha_i V_{im} + V_{0m}}{\sum_i \alpha_i s_i} \right) E_m - \lambda f(Y, E),$$

and the first-order conditions are:

- $\tilde{p}_k = \lambda f_k$,
- $\sum_i \alpha_i V_{im} + V_{0m} = -\lambda (\sum_i \alpha_i s_i) f_m$.

The first condition is equivalent to $p_k = \lambda f_k - Y_k \frac{\partial p_k}{\partial Y_k}$, and therefore this firm behaves in the same way as the firm that uses its market power.

Now add the constraint that the mark-up must be adjusted by the factor $\frac{\sum \alpha_i \left(s_i - \frac{Y_{ik}}{Y_k}\right)}{\sum_i \alpha_i s_i}$. This means that the firm can still take prices as parametric, provided they are equal to the market prices adjusted in the following way:

$$\tilde{p}_k = p_k \left(1 + \frac{Y_k}{p_k} \frac{\partial p_k}{\partial Y_k} \frac{\sum \alpha_i \left(s_i - \frac{Y_{ik}}{Y_k}\right)}{\sum_i \alpha_i s_i} \right).$$

For such a firm, the first-order conditions are as above with respect to $\tilde{p}$, but now implying that

$$p_k = \lambda f_k - Y_k \frac{\partial p_k}{\partial Y_k} \frac{\sum \alpha_i \left(s_i - \frac{Y_{ik}}{Y_k}\right)}{\sum_i \alpha_i s_i}.$$

Let us finally turn to the *WTC*-maximizing firm, for which the Lagrangian is

$$\begin{aligned} L = & \sum_i \alpha_i (WTP_i(q_i) - pq_i + px_i - WTA_i(x_i) - V_i(E)) \\ & + \left(\sum_i \alpha_i s_i \right) pY - V_0(E) - \mu f(Y, E) - \gamma g(p, Y). \end{aligned}$$

The direct first-order conditions based on the first-order partial derivatives of the Lagrangian are, after simplification for $wtp_{ik} = wta_{ik} = p_k$:

- $(\sum_i \alpha_i s_i) p_k = \mu f_k + \gamma g_{Y_k},$
- $(\sum_i \alpha_i s_i) Y_k - \sum_i \alpha_i Y_{ik} = \gamma g_{p_k},$
- $\sum_i \alpha_i V_{im} + V_{0m} = -\mu f_m.$

The first two conditions, after elimination of γ , yield the pricing equation:

$$p_k = \frac{\mu}{\sum_i \alpha_i s_i} f_k - Y_k \frac{\partial p_k}{\partial Y_k} \frac{\sum \alpha_i \left(s_i - \frac{Y_{ik}}{Y_k}\right)}{\sum_i \alpha_i s_i}.$$

Letting $\mu = \lambda (\sum_i \alpha_i s_i)$, the first-order conditions for this firm are identical as those for the profit-maximizing firm with adjusted mark-up. This proves the theorem.

The correction term on the mark-up makes the firm raise its product price, compared to a profit-maximizing firm, when low-priority customers have a greater share in the sales than in equity, and raise its input price when high-priority suppliers (or workers)

have a greater share in that input than in equity. However, when there is no presumption that the shares Y_{ik}/Y_k are distributed toward high-priority individuals differently than equity shares, or if every individual has the same priority (i.e., the weights α_i are equal among all stakeholders), the firm then behaves as a price-taker and one retrieves the theorem presented in the main text.

Interestingly, by choosing who gets to own equity in the firm, it is possible to make profit more or less “socially desirable,” and thereby alter the need to use market power for the social good. When equity owners are representative of the group of customers, for instance, there is no need to manipulate the product price. Regarding the workforce, having a diverse set of workers with unequal skills would require seeking some degree of wage compression, whereas having workers with mid-level skills (compared to the average equity owner) would make it possible to treat wages as parametric. And so on.

We conjecture that third-degree price discrimination would be optimal if the firm could separate markets for customers with different social priority, charging a lower price to customers with greater social priority. This issue is left for future research.

Incomplete contracts

For simplicity, we rely on the simple one-output-one-input model in this section, and model non-contractible variables in terms of absence of commitment. To fix ideas, consider the case in which the labor contract specifies hours but not intensity, while production depends on both: $Q(X, S)$, where S denotes work intensity. While Q is increasing in X , it reaches a maximum in S at a given level $\bar{S}$, because beyond that level intensity is excessive and counterproductive. The wage rate is $w(X, S)$, incorporating a premium for intensity. However, when S is non-contractible, the market wage rate does not depend on the actual S set by the firm but on the expected intensity.

The profit-maximizing firm, in absence of bargaining with workers, will set $S = \bar{S}$. The reason is that it maximizes

$$p(Q(X, S))Q(X, S) - w(X, \hat{S})X$$

with respect to X and S , where $\hat{S}$ stands for the expected S that influences labor supply. In equilibrium with rational expectations, one has $S = \hat{S}$, but when making decisions, the firm does not internalize the market effect of raising intensity. This configuration is generally suboptimal because the firm ignores the cost of intensity on workers. Even

if, on the labor market, the wage rate is adjusted upward due to high intensity, the mix of hours and intensity is not optimal for workers. Moreover, when unemployment prevails, the market adjustment of the wage for high intensity may be muted.

What does the stakeholder firm do instead? It internalizes the cost of intensity because intensity affects the surplus of workers. It maximizes

$$\int_0^Q p(q) dq - \int_0^{X(Q,S)} w(x, S) dx.$$

We therefore obtain again the familiar condition $p = wX_Q$, where X_Q is the inverse of $\partial Q/\partial X$. In addition, the first-order condition with respect to S is:

$$\int_0^{X(Q,S)} w_S(x, S) dx + wX_S = 0. \quad (3)$$

In other words, the total willingness to accept with respect to intensity is minimized, but this does not mean that intensity is minimized, because low intensity has a cost via X_S , and this cost is captured in the second term of the condition.

This condition, however, does require $S < \bar{S}$. For $S = \bar{S}$, one has $Q_S(X, \bar{S}) \equiv 0$, which implies $X_S \equiv 0$, and therefore

$$\int_0^{X(Q,S)} w_S(x, S) dx + wX_S = \int_0^{X(Q,S)} w_S(x, S) dx > 0.$$

Since this is a minimization, this positive derivative means that $\bar{S}$ is an excessive intensity.

Can a firm easily find how to satisfy condition (3)? Using the fact that $p = wX_Q$ and $X_S = -Q_S/Q_X = -Q_S X_Q$ the optimality condition also reads as

$$\int_0^X w_S(x, S) dx = pQ_S.$$

Assuming that $w_S(x, S)$ does not vary much with x , one then obtains the approximate condition

$$w_S X = pQ_S,$$

which is a rather straightforward equality between the wage premium on intensity and its impact on sales, at fixed prices and wages. This is the condition that a price-taking profit-maximizing firm would satisfy if intensity was contractible. This gives us another

extension of the profit-surplus theorem, in which the profit-maximizing firm is not only taking prices as given when choosing its scale of production, but is overcoming the commitment problem on intensity and internalizes the effect of its choice of intensity on the market wage.

Profit-Surplus Equivalence Theorem Assuming the firm controls the prices whereas its trading partners are price-takers, and that $w_S(x, S)$ is independent of x , for the firm's decisions it is equivalent:

- 1) to maximize $p(Q(X, S))Q(X, S) - w(X, S)X$ taking p as given and w as independent of X when choosing X, S ; and
- 2) to maximize $\int_0^Q p(q) dq - \int_0^{X(Q, S)} w(x, S) dx$.

In conclusion, the stakeholder corporation, by better taking account of the stakeholders' interests, would seek to adjust working conditions in a similar fashion as a competitive profit-maximizing firm which overcomes the commitment problem (e.g., practices ex post bargaining).

Observe that the above analysis can also be interpreted in terms of efficiency wage effect. Let $S(w, X)$ be the inverse of $w(X, S)$ with respect to S , and interpret S as the dedication that employees give to their work, for a given wage and employment level. The condition $w_S X = p Q_S$ can then be rewritten $X = p Q_S S_w$, representing the optimal choice of wage for the firm, given its impact on productivity.

Another example of a non-contractible feature of the firm is the effort of the management to keep the firm viable, or to innovate and make it more productive. This is again a variable that would influence the workers' willingness to work for the firm, as they would want a risk premium to accept joining it if their expectations about this effort level were low. If this management effort affects the productivity of the firm, this phenomenon is captured by a goal like

$$p(Q(X, M))Q(X, M) - w(X, \hat{M})X - C(M),$$

where M is the effort ($\hat{M}$ is the expected effort), and $C(M)$ is the convex cost function of the effort to the managers. The profit-maximizing firm would ignore the workers' ex post interests and would satisfy a first-order condition

$$p'Q_M Q + pQ_M = C',$$

whereas a TC -maximizing firm (that would take account of the managers' cost) would

have, making a similar approximation as above (i.e., assuming that w_M is approximately constant in X),

$$pQ_M - w_M X = C'.$$

Observe that, assuming $p', w_M < 0$ and $Q_M > 0$, one has $pQ_M > C'$ for the profit-maximizing firm, but $pQ_M < C'$ for the TC -maximizing firm. By convexity of C , this means that, other things equal, the latter tends to exert much more effort to keep the firm viable, and thereby obtains wage concessions from workers.

The stakeholder firm, by internalizing the effect of intensity and management effort on workers and on the wage, stands to benefit from lower wage demands and this may partly compensate its disadvantage in the free-entry competition studied in section 5. However, the wage differential between ordinary and responsible firms may be muted under unemployment due to minimum wages above the equilibrium level.

Asymmetric information

As in the previous section, let us work with the simple one-input-one-output model, and focus on the example of a particular issue, such as product quality. Suppose the product price (marginal willingness to pay) is $p(Q, Z)$, where Z is the product quality. If the customers cannot probe the quality, their actual willingness to pay will be $p(Q, \hat{Z})$, where $\hat{Z}$ is their expectation of quality (e.g., the average quality in their segment of the market). Quality is costly and this is represented by the input requirement $X(Q, Z)$, which is increasing in Z beyond some level.

A profit-maximizing firm will maximize

$$p(Q, \hat{Z}) Q - w(X(Q, Z)) X(Q, Z),$$

and since it does not benefit from improving quality, it will settle for the quality $\bar{Z}$ which minimizes cost: $X_Z(Q, \bar{Z}) = 0$. Each firm adopting this behavior, a standard adverse selection equilibrium then arises in which firms for which $\bar{Z}$ is high may fail to be profitable (if they have greater costs) and no firm makes any effort at improving quality beyond its own $\bar{Z}$.

Can responsible firms do better? If they maximize surplus for the given perception of the customers:

$$\int_0^Q p(q, \hat{Z}) dq - \int_0^{X(Q, Z)} w(x) dx,$$

then, just like profit-maximizing firms, they settle for $\bar{Z}$, and the same mediocre equilibrium will ensue.

But we can define responsibility as incorporating the true effect of product quality on the customers, in which case their objective is

$$\int_0^Q p(q, Z) dq - \int_0^{X(Q, Z)} w(x) dx,$$

implying the first-order conditions

$$p(Q, Z) = w(X(Q, Z)) X_Q(Q, Z),$$

$$\int_0^Q p_Z(q, Z) dq = w(X(Q, Z)) X_Z(Q, Z).$$

Assuming that $p_Z(q, Z)$ does not vary much with q , this yields the simple management rule $p_Z Q = w X_Z$, which corresponds to what a profit-maximizing firm would do if quality was transparent and perfect competition prevailed on the input market. This gives us yet another equivalence result:

Profit-Surplus Equivalence Theorem Assuming the firm controls the prices whereas its trading partners are price-takers, and that $p_Z(q, Z)$ is independent of q , for the firm's decisions it is equivalent:

- 1) to maximize $p(Q, Z) Q - w(X(Q, Z)) X(Q, Z)$ taking p as independent of Q and w as given when choosing Q, Z ; and
- 2) to maximize $\int_0^Q p(q, Z) dq - \int_0^{X(Q, Z)} w(x) dx$.

Here again, responsible profit maximization may not only alleviate the mediocre quality problem but actually maximize the surplus for all stakeholders.

The formal similarity between the treatment of incomplete contracts and asymmetric information is that, in the former case, even though workers correctly anticipate the value of S , the lack of commitment makes the firm ignore the effect of its decision on workers. The same ignorance of effects happens under asymmetric information but for a different reason, namely, the impossibility to credibly convey the correct quality information to customers. The solution to both problems consists in internalizing the effects, treating workers and customers as stakeholders with a claim on the objective of the firm. That this can be done retaining a (responsible) profit-maximizing approach rather than shifting to a surplus-maximizing one hinges on an assumption (about w_S or

p_Z) but is interesting because it extends the scope of responsible profit-maximization substantially.

Rationing

Consider the case in which workers are rationed on the labor market because of downward wage rigidities. At the equilibrium, firms have to ration workers. What should a firm do if it wants to maximize TC ?

As we have seen, TC only depends on demand for output and supply of input, and is not affected by how the total surplus is shared among the stakeholders. Therefore, a firm that maximizes TC will still want to implement the usual first-order conditions. For instance, in the case of the one-output-one-input model, it will have:

$$p(Q) Q'(X) = w(X), \quad (4)$$

but in the presence of unemployment, one has $w(X) < \bar{w}$, where $\bar{w}$ is the prevailing wage rate.

One therefore has

$$X^* < X < X^{**},$$

where X^* is the level for a price-taking firm that simply maximizes profit:

$$p(Q) Q'(X^*) = \bar{w},$$

and X^{**} is the labor supply at the prevailing wage: $w(X^{**}) = \bar{w}$.

Depending on the level of $\bar{w}$, the firm may or may not be able to shoulder the level of employment determined by (4). Keeping a non-negative profit may constrain this hiring policy.

Labor Hiring Theorem A firm that maximizes TC will hire workers, assuming this is financially viable, until marginal productivity equals the labor supply wage rate.

This hiring policy does not eliminate unemployment but contributes to reducing it, compared with standard behavior. It may not be easy to implement because it has to rely on estimating labor supply at a wage that is not the actual wage. Concretely, one should ask new employees if they would accept to work if they were only paid at the marginal productivity.

A slack labor market also offers the firm substantial leeway in its pay scale policy. As analyzed earlier in this Appendix, if inequalities are taken into account, the socially responsible firm should want to have a compressed scale compared to the labor market.

Differentiation

In the main text, it is assumed that the demand to the firm is influenced only by its price, although in this appendix product quality has been introduced. But the firm can also spend resources to differentiate its product and develop brand loyalty among its customers. The literature has shown that, with few but famous exceptions, endogenous differentiation involves a coordination failure among firms and entails inefficiencies (Matsuyama 1995). How does a TC -maximizing firm behave in this respect, compared to a profit-maximizing firm?

A profit maximizing firm would maximize

$$p(Q, A)Q - w(X(Q))X(Q) - r(A)A,$$

where A denotes the input that enhances the differentiation of its product (like advertising) and r is the price of A .¹⁰ The first-order condition with respect to A is

$$p_A(Q, A)Q = r(A) + r'(A)A.$$

What does a TC -maximizing firm do instead? The relevant terms of TC are

$$\int_0^Q p(q, A) dq - \int_0^A r(a) da,$$

and the first-order condition for A is

$$\int_0^Q p_A(q, A) dq = r(A).$$

If p_A does not vary much with q , this condition simplifies into $p_A(Q, A)Q = r(A)$. Apart from refraining from using any market power on the supply of A , this is no different than a profit-maximizing strategy. In other words, just as it can maximize its profit without exploiting its market power when choosing a production plan, the

¹⁰In some cases, such as a location decision, there may be no differential cost for different locations. Then one simply sets $r(A) = 0$.

TC -maximizing firm will pursue the same goal with the same restraint when choosing its differentiation strategy.

Clearly, if the effect of A is relative, in the sense that what influences demand is the share of the firm in the total A spent on the market by the competitors, a prisoner's dilemma among firms arises, and there is nothing in TC -maximization that tends to alleviate this problem. The firm is only interested in its own TC , and in absence of coordination among firms to restrain their advertizing and other differentiation efforts, an inefficient allocation will arise.

However, differentiation does not simply, and always, involve business stealing. It can develop the loyalty of consumers without stealing them from other firms. Greater loyalty from consumers may mean that their surplus is greater, and the firm will indeed maximize the total surplus including by promoting their loyalty and satisfaction with the product. In this respect at least, the TC -maximizing firm is doing the right thing. In contrast, increased differentiation by a profit-maximizing firm will then not only increase consumer satisfaction but also make demand less elastic and induce an increase in the mark-up, and thus in the deadweight loss due to market power. So, there is a sense in which differentiation is more problematic in the case of profit-maximizing firms.

When differentiation (e.g., through advertising) involves business stealing, one could in theory imagine that responsible firms could incorporate the negative externality in their Pigouvian pricing. The Pigou price of differentiation expenses would be equal to the marginal reduction in the sum of other firms' TC . But it is hard to imagine that a firm should involve its competitors in its own governance bodies in order to be incentivized to implement this correction. It may be more realistic to consider setting up coordination mechanisms in industries suffering from this problem. Joint advertising campaigns are an example of such initiatives.

Cournot and Bertrand competition

Consider a Cournot competition in which the n firms are identical, except that firm 1 is a TC -maximizer whereas firms $2, \dots, n$ are profit-maximizers. The (inverse) demand function is $p\left(\sum_j Q_j\right)$, and let $e_D\left(\sum_j Q_j\right)$ denote the elasticity of demand.

Firm 1 will set $p = w_1(X_1) X'_1(Q_1)$, i.e., $pf'(X_1) = w_1(X_1)$, whereas the other firms $j = 2, \dots, n$ will have

$$pf'(X_j) \left(1 + \frac{1}{e_D}\right) = w_j(X_j).$$

As $e_D < 0$, this implies that $X_1 > X_j$ if they face the same w function, and that the price is lower than it would be otherwise. The fact that firm 1 is a TC -maximizer makes it a larger firm on the market and hurts the other firms, at the benefit of the customers.

As one can expect, a Cournot equilibrium with only responsible firms in the market will maximize the total surplus and mimic the competitive equilibrium. This is because each firm will then have $pf'(X_j) = w$. In other words, the Responsible Invisible Hand Theorem is valid for Cournot competition as well.

Like monopolistic competition, Cournot competition with free entry involving ordinary firms and TC -maximizers simultaneously will push the latter out of the market. Suppose that the firms have identical costs, and consider a number of firms n such that, at the Cournot equilibrium, the ordinary firms make no profit. This means that their residual demand curve is tangent to their average cost curve, as in monopolistic competition. The TC -maximizing firms sell at the same price, at a greater scale as shown above, and generally make a profit since their greater quantity implies that their residual demand must be larger and, at this price, lies above the average cost curve. Thus, this cannot be a free entry equilibrium. Therefore, at a free entry equilibrium in which ordinary firms make zero profit, there can be no TC -maximizing firm left. Now, consider a free entry equilibrium in which only TC -maximizing firms remain and make zero profit. Since they leave profit opportunities on the table (they could make a profit by reducing their production), this again fails to be a free-entry equilibrium when profit-maximizing firms can enter the market. Therefore no free-entry equilibrium in Cournot competition among identical firms can have TC -maximizers in the population of remaining firms.¹¹

For Bertrand competition, consider the case of an oligopoly in which the identical firms face a demand curve $D_j(p_j, p_{-j})$ that is decreasing in own price and increasing in the competitors' prices. If one firm is responsible whereas the others maximize profit, the former will have a lower price than if it maximized profit, and this will reduce the demand going to its competitors. Therefore, as in the Cournot equilibrium, the TC -maximizing firm is harming the others and benefiting the customers.

If all firms maximize TC , they behave like price-takers, and this maximizes the total

¹¹One may question the definition of a free-entry equilibrium in terms of zero profit, in the case of oligopoly for which, presumably, increasing returns to scale prevail up to a significant scale compared to market demand. New entrants may not always find it possible to make a profit when the number of incumbents is small and a new entry would split demand too substantially. As observed in d'Aspremont and Dos Santos-Ferreira (2021, p. 30), it is also possible that incumbents can deter potential entrants if they commit to keeping the same production scale.

surplus in the market once again, for a fixed number of firms. But this is not viable in a free entry competition with ordinary firms, because even if the incumbent firms make zero profit, they leave profit opportunities on the table.

One very interesting difference between profit-maximizing firms and responsible firms is that the latter have no interest in colluding or merging, unlike the former. Whether they are in a Cournot or a Bertrand competition, if two profit-maximizing firms can join forces and keep their joint demand, they can increase their total profit. In contrast, coordination between two responsible firms cannot increase their total surplus if they keep their joint demand. Therefore, they have little incentive to do so.

Labor-management

There is a substantial literature on why the average firm is under the control of the shareholders rather than the workers. A recent synthesis can be found in Dow (2018). A key element, in his analysis, is that labor cannot be appropriated, divided and traded like capital shares. However, Dow's analysis assumes perfect competition throughout. Our model helps understand another central consequence of this fact under imperfect competition.

Consider a firm that has one output Q and two inputs, K and L . Suppose that the providers of K have a very elastic supply, because they invest in other firms if the rate of return in this firm is below the normal market rate. In contrast, the providers of L have a less elastic supply, and in particular once they are settled in the firm, their willingness to accept goes down because they have several commitments linked to their job (specific investments in the job, family and housing arrangements). In other words, they would stay even if the wage went down noticeably. This phenomenon is reinforced by unemployment.

This difference means that for the providers of K , one has $wt a_i(k) \simeq w_K$ for all k , where w_K is the market rate for K , where for the providers of L , one has $wt a_i(l) < w_L$ for all $l \leq L_i$, where w_L is the market wage rate. When the firm is controlled by the capital providers, it therefore maximizes an objective that is close to the profit

$$p(Q)Q - w_K K - w_L(L)L,$$

because $w_K K$ is approximately the total willingness to accept of capital providers. In other words, capital providers have the firm's profit as their only surplus. Therefore, a

firm controlled by capital providers maximizes profit, unless the capital providers have a special attachment to the firm and would accept a lower return than the market (e.g., in a family business).

In contrast, when workers control the firm, it maximizes an objective that is more like

$$p(Q)Q - w_K K - \sum_{i \in \mathcal{L}} WTA_i(L_i),$$

where $\mathcal{L}$ is the set of workers, which leads to a more expansive employment policy since $wta_i(l) < w_L$ for all $l \leq L_i$, and this deviates from profit maximization because the firm will refrain from using its market power against workers. As reviewed in Dow (2018), the empirical literature on the objective of labor-managed firms suggests that they are not too far from maximizing profit but with a more expansive employment policy. This is consistent with our analysis.

Therefore, the lower profitability of labor-controlled firms is a serious impediment to their survival in the free entry competition. The profit-selection theorem implies a capital-preference theorem:

Capital-Preference Theorem Assuming that the supply of capital funds to the firm is very elastic, unlike the supply of labor, the free entry equilibrium eliminates labor-controlled firms which are identical in other respects to capital-controlled firms.

Note that, although the free entry equilibrium has zero profit, in the transition toward the equilibrium there is positive profit to be reaped, and capital-controlled firms therefore provide a promise of greater surplus to capital providers than labor-controlled firms. This undermines the formation of labor-controlled firms. Such firms are therefore disadvantaged at both ends of their life.

The family businesses in which owners have special attachment to the firm will behave more like labor-controlled firms because their expansive attitude toward investment generally leads to an expansive hiring policy. Our simple model thus sheds some light on the clash between family capitalism and ruthless corporations.

Observe also that in our model, there is no difference in the objective pursued by a labor-controlled firm and that of a firm practicing co-determination between capital providers and workers (as described in section 2). However, there probably are differences between the two types of firms in how profit is shared among these stakeholders, and this may influence firm formation, but this model is not capturing it.