



# The stakeholder corporation and social welfare

Marc Fleurbaey, Grégory Ponthière

## ► To cite this version:

Marc Fleurbaey, Grégory Ponthière. The stakeholder corporation and social welfare. 2021. hal-03426120v1

**HAL Id: hal-03426120**

**<https://hal.science/hal-03426120v1>**

Preprint submitted on 12 Nov 2021 (v1), last revised 17 Feb 2023 (v2)

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# The stakeholder corporation and social welfare\*

Marc Fleurbaey<sup>†</sup>, Grégory Ponthière<sup>‡</sup>

November 11, 2021

## 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: “we share a fundamental commitment to all of our stakeholders”), and management

---

\*Acknowledgements: We thank Geoffrey Heal and Jean-Philippe Tropeano for very helpful comments, and John Mori for research assistance, as well as audiences in Louvain-la-Neuve, Pau, Stockholm, and at the SAET Seoul Congress.

<sup>†</sup>Paris School of Economics, marc.fleurbaey@psemail.eu.

<sup>‡</sup>Université Catholique de Louvain-la-Neuve.

experts argue for going beyond shareholder value (e.g., Kelly 2019). 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 that allowing managers to adopt broader objectives than profit is a recipe for arbitrariness, waste and corruption. 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 argue that in principle a stakeholder-value corporate purpose can be defined. 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 somewhat comprehensive microeconomic analysis of optional 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 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 is to show, not only that total stakeholder value can be rigorously defined in relation to the contribution of the firm to social welfare, but that maximizing stakeholder value can be performed, for most aspects, by simple management rules that still heavily rely on profit maximizing and on non-negative profit as a viability condition. We show how competition tends to favor profit-maximizing firms over responsible firms, even though social welfare would be greater if only the latter entered the market. It turns out that responsible firms spontaneously internalize certain competition externalities, but not all of them, leading in particular to the optimal level of entry but excessive spending in differentiation. We find that the standard price mechanism is ideal when used by stakeholder firms, whereas membership markets (often considered in the literature for this type of firm) would have deleterious effects under free entry. And we show how externalities should be internalized by firms through a Pigouvian adjustment to their profit, providing a novel justification to the polluter-pays principle in the context of free entry.

There is a large literature that is 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 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 reduced 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., 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.

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.

The paper is structured as follows. Section 2 examines the definition of the contribution of a firm to social welfare. Section 3 shows how under perfect competition and Pigouvian pricing of externalities, maximizing profit is equivalent to maximizing total surplus. 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 market 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 (Appendix A) and several important extensions of our analysis to issues not covered in the main text for brevity’s sake (Appendix B,C).

## 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

Customer surplus	<b>Total surplus</b>	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

from Fig. 1 is the generation 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 willingness 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  $\Pi$ . 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 man-



agement 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  $\alpha_i$  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:

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

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.

To conclude this section, we introduce a simpler model that will be used in a later section, and which is amenable to a simple graphical representation of the surpluses that make up  $TC$ , in absence of externalities. Consider the case in which there is only one good  $Q$  and one input  $X$ . The production possibilities are then 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 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.

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  $w(X(Q))X'(q)$  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 is represented on Fig. 2, for a firm that is a price-taker. This firm considers that its marginal cost is  $w(X(Q))X'(q)$ , and one sees on the figure that the intersection of this curve with the demand curve is also the intersection with the curve of  $w(X(q))X'(q)$  at  $Q$ , implying that the price-taking firm maximizes the total surplus. More details on this will be given in the next section.

Note that the equality

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

also reads as the familiar

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

Now, if the customers and suppliers of the firm are captive, the firm can 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 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.

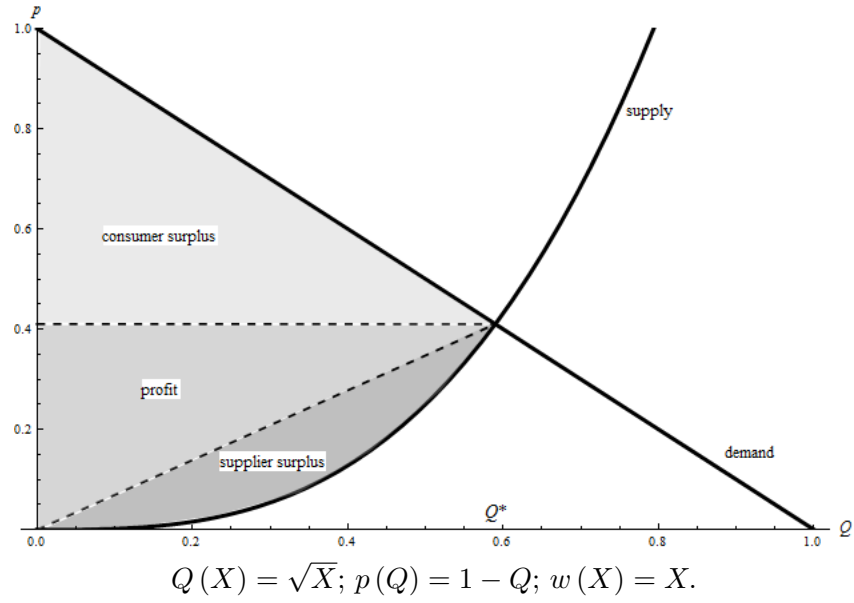


Figure 2: Surplus of a price-taking firm

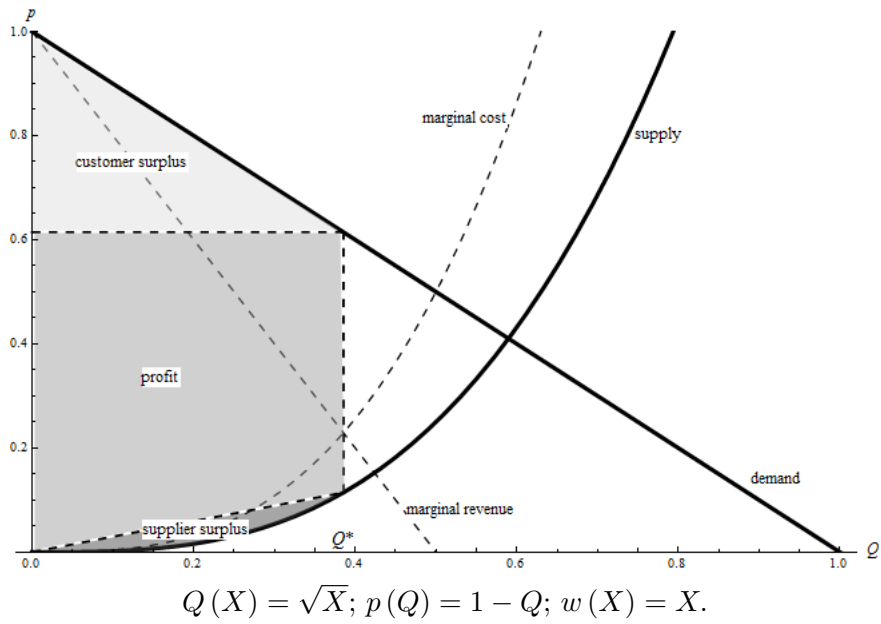


Figure 3: Surplus of a monopolistic-monopsonistic firm

Another example is a firm practicing co-determination and maximizing

$$p(Q)Q - \int_0^X w(x) dx.$$

Such a firm would choose its level of production at the intersection of the marginal revenue curve and the “supply” curve  $w(X(q))X'(q)$ . This level is intermediate between that chosen by a  $TC$ -maximizing firm and a profit-maximizing firm.

### 3 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 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.

A more precise analysis can be done, which reveals important features of the optimal allocation. The firm’s profit-maximization program can be analyzed with the Lagrangian

$$L = pY - T(pY, E) - \lambda f(Y, E),$$

where  $\lambda$  denotes the Lagrange multiplier for the technical constraint. The direct first-order conditions are as follows:

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

where  $T'$  denotes the marginal rate of taxation for profit,  $f_k$  denotes the derivative of  $f$  with respect to  $Y_k = Q_k - X_k$ ,  $T_m$  and  $f_m$  denote the derivatives of  $T$  and  $f$  with respect to  $E_m$ .

Then, eliminating the Lagrange multiplier, the decisions of the firm satisfy the following first-order conditions (for non-null quantities):

- for all  $k, k' \in \{1, \dots, K\}$ ,  $\frac{p_k}{p_{k'}} = \frac{f_k}{f_{k'}}$ ;
- for all  $m, m' \in \{1, \dots, M\}$ ,  $\frac{T_m}{T_{m'}} = \frac{f_m}{f_{m'}}$ ;
- 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 us compare this to the case in which the firm maximizes  $TC$ . The Lagrangian then becomes

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

with  $\mu$  the Lagrange multiplier.

Let  $wtp_{ik}$ ,  $wta_{ik}$  denote the partial derivatives of  $WTP_i(q_i)$ ,  $WTA_i(x_i)$  with respect to  $q_{ik}$ ,  $x_{ik}$ , respectively. The direct first-order conditions are the following (taking account of the assumption that the firm, or any  $i$ , is not at the same time seller and buyer of the same commodity  $k$ ):

- 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  $i \in \{1, \dots, N\}$ ,  $wta_{ik} = \mu f_k$ ,
- for all  $m \in \{1, \dots, M\}$ ,  $V_m = -\mu f_m$ ,

where  $V_m$  denotes the derivative of  $V$  with respect to  $E_m$ .

After elimination of the Lagrange multiplier, the first-order conditions for this program are the following:

- for all  $k, k' \in \{1, \dots, K\}$ , for all  $i, i' \in \{1, \dots, N\}$ ,  $\frac{wtp_{ik}}{wtp_{ik'}} = \frac{wtp_{i'k}}{wtp_{i'k'}} = \frac{wta_{ik}}{wta_{ik'}} = \frac{wta_{i'k}}{wta_{i'k'}} = \frac{f_k}{f_{k'}}$ ,
- for all  $m, m' \in \{1, \dots, M\}$ ,  $\frac{V_m}{V_{m'}} = \frac{f_m}{f_{m'}}$ ,
- for all  $k \in \{1, \dots, K\}$ ,  $m \in \{1, \dots, M\}$ ,  $i, i' \in \{1, \dots, N\}$ ,  $\frac{V_m}{wtp_{ik}} = \frac{V_m}{wta_{ik}} = \frac{V_m}{wtp_{i'k}} = \frac{V_m}{wta_{i'k}} = -\frac{f_m}{f_k}$ .

Note that, here again, each of the equalities applies only when the underlying quantities  $q_{ik}$  and  $x_{ik}$  are not null, and, for simplicity, we neglect the corresponding inequalities for null quantities.

Now, under perfect competition, the agents maximize their surplus ( $WTP_i(q_i) - pq_i$  and  $px_i - WTA_i(x_i)$ ), which implies that whenever the underlying quantities are not null, one has, for all agents  $i$  (households or firms) and goods  $k$ :

$$wtp_{ik} = wta_{ik} = p_k.$$

This directly implies that the first of the three sets of conditions is satisfied when the firm ensures that  $\frac{p_k}{p_{k'}} = \frac{f_k}{f_{k'}}$ . Likewise, if corporate taxation makes the firm internalize the externality through a marginal tax on the externality that tracks its social impact, i.e.,  $T_m = \beta V_m$ , for any proportionality factor  $\beta$  (see next paragraph for the choice of this factor), the second set of conditions is satisfied if the firm ensures that  $\frac{T_m}{T_{m'}} = -\frac{f_m}{f_{m'}}$ .

The third set of conditions is satisfied also, but only if  $\beta = 1 - T'$ , i.e., if the Pigouvian tax on the externality is deductible from the corporate tax. One then has  $\frac{V_m}{wtp_{ik}} = -\frac{f_m}{f_k}$  thanks to the fact that the firm ensures that  $\frac{T_m}{(1-T')p_k} = -\frac{f_m}{f_k}$  and that  $T_m = (1 - T') V_m$ .

In conclusion, we have shown the following:

**Invisible Hand Theorem** Under perfect competition, and assuming that externalities are suitably treated by a Pigouvian tax that is deductible from the corporate tax, the firm that maximizes profit also automatically maximizes its total contribution to society.

In conclusion, perfect competition provides a good setting for justifying the shareholder value approach, because the surplus of the other agents cannot be influenced by the firm and—assuming Pigouvian taxes help the firm internalize its externalities, while being tax deductible—maximizing its post-tax profit is in agreement with maximizing the firm's contribution to the total surplus.

But this analysis prefigures 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.

## 4 The stakeholder value approach

The analysis of the maximization of the firm's contribution, in the previous section, provides valuable insights into what should be achieved at the optimum. The first-order conditions involve, as we have shown in the previous section: 1) equality of marginal rates of substitutions (MRS) across the parties (customers, suppliers, firm) over the goods that the firm buys or sells; 2) equality of MRS across society and the firm over the dimensions of the externalities; 3) equality of the MRS across society, parties and the firm over the dimensions of the externalities and the goods the firm buys or sells. These general equalities of MRS provide a valuable benchmark against which one can compare what actually happens in deviations from the ideal case studied in the previous section.

This benchmark represents not only an abstract social optimum. It can also be taken as the compass of a full stakeholder approach, if the firm really sought to incorporate all its impacts into its corporate goals. As we now show, this paves the way for completely alleviating 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.

## 4.1 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? The first-order conditions laid out in the previous section provide detailed guidance, and we now show that they can be obtained through a specific form of constrained profit maximization.

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

$$\sum_i WTP_i(q_i) - \sum_i WTA_i(x_i) - V(E).$$

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 have been listed in the previous section and are valid independently of the degree of market power, since they only involve quantities, not prices. When  $wtp_{ik} = wta_{ik} = p_k$



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.

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 it maximized  $TC$ , too. The adjustment for externalities is now meant to correct any gap between  $T_m$  and its optimal value  $(1 - T') V_m$  identified in the previous section. 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.

## 4.2 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, 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.

We will proceed as follows. In a first step, we neglect externalities and successively study monopolistic competition with free entry and oligopoly (Cournot, Bertrand) competition. In a second step, we examine how this analysis extends to externalities. Throughout this section we ignore taxation.

In this section, we need to focus on competition on a single product market, and the analysis is made in the simpler one-input-one-output model introduced at the end of section 2. 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  $\Pi = pQ - wX$ .

In Appendix C, we compare “capital-managed” firms which only take account of the surplus of their creditors to “labor-managed” firms which only take account of the surplus of workers, and show why 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. 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. In the simplest, extreme case that is used in this section for the graphical illustrations, the  $n$  firms share the total demand and supply equally and separately, without any price competition among them. I.e., the demand to a firm is simply  $D_j(p_j, p_{-j}) = D(p_j, \dots, p_j)/n$  and the input supply is  $S_j(w_j, w_{-j}) = S(w_j, \dots, w_j)/n$ . In that case, the inverse demand curve is represented by a simple function  $p(nQ)$ , where  $Q$  is the firm's own production, and likewise input supply is represented by a function  $w(nX)$ , where  $X$  is the firm's own input consumption. But, unlike the figures, our analysis does not rely on this extreme case.

Let us first examine the free entry equilibrium with ordinary profit-maximizing firms. Assuming that there are increasing returns to scale at low levels of production, free entry 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. Fig. 4 illustrates the situation.

In the figure, the key feature of this equilibrium is that only profit-maximizing firms are viable at this equilibrium. A responsible firm that would seek to maximize  $TC$  would not be viable because the extra production it would want to make would push it into the red. In the figure, an ordinary firm chooses  $Q^*$ , whereas a responsible firm

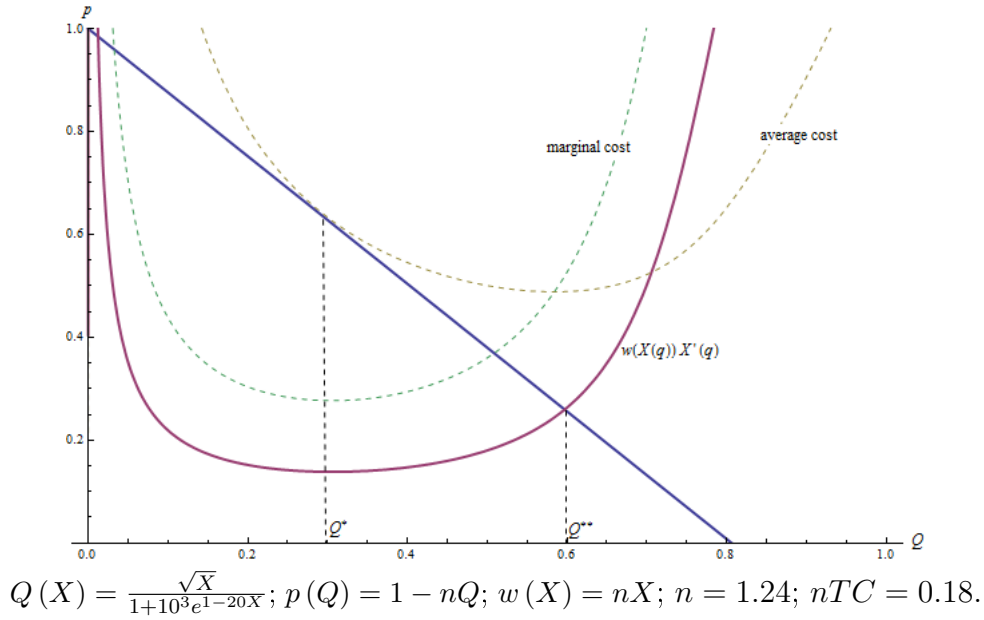


Figure 4: Free entry equilibrium

would want to choose  $Q^{**}$ .

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 other firms which are identical except for their objective 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 (the so-called optimal production scale; see Fig. 5 for an illustration). 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, 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  $p^{**} < p^*$ , since the  $D_j$  identical functions are decreasing in own price and increasing in the others' prices.)

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.  $\square$

Since we assume away any preference for diversity here (customers only buy one brand, and suppliers only sell to one firm), the number of ordinary firms at this free entry equilibrium is excessive and total surplus  $nTC$  would be larger with a lower number of firms (e.g., in the numerical example of Fig. 4, the optimal number of ordinary firms would be about half of the equilibrium number). There is a prisoner's dilemma even among ordinary firms.

Let us focus on the eviction of responsible firms. It may appear paradoxical that the survival of the fittest does not equate the survival of the best, but this is what happens here. Since the viability of the firm depends on its cash flow covering its bills, i.e., on its profit, which is only a share of  $TC$ , the firms that maximize this share narrowly are better equipped to survive competition than those that maximize their larger contribution to society.

However, Fig. 4 also shows that an ordinary firm, at this equilibrium, generates a smaller  $TC$  (area between the demand curve and the “supplier” curve  $w(X(q))X'(q)$ ) than a responsible firm, even if the latter makes a negative profit. This is even more so when a lower price by the responsible firm improves its demand curve compared to that of the ordinary firms. This should be intuitive: Just as a profit-maximizing firm generates more profit than any other, in identical circumstances, so does a  $TC$ -maximizing firm generate more surplus than any other firm.

Now, 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 responsible 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, and keep 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.  $\square$

One should emphasize that this invisible hand result does not assume that the price mechanism is used, because its starting point is the maximization of the total surplus of the industry. The number of firms only determines the share of the industry market that they face, the surplus is computed only on the basis of the quantities, and the functions  $p, w$  do not assume the price mechanism but only measure the willingness to pay and accept of the agents as a function of the quantities. These measures of willingness to pay and accept are equally relevant for other allocation mechanisms such as subscription. The result therefore jointly makes the three separate points that 1) one can 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 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

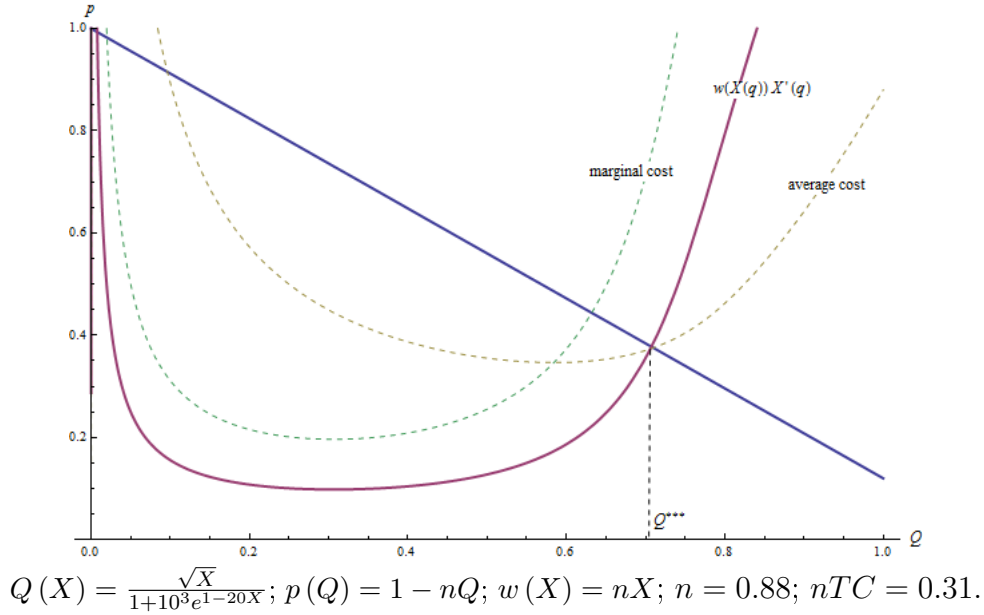


Figure 5: Free entry equilibrium with responsible firms

$pQ'(X) = w$ , 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.

The equilibrium with responsible firms is illustrated on Fig. 5, where they choose quantity  $Q^{***}$ . The optimality of this equilibrium stands in stark contrast with the equilibrium generated by ordinary firms. The equilibrium in which ordinary firms are allowed to enter leads to a smaller total surplus because of the double curse that it has an excessive number of firms and that every firm fails to maximize its own  $TC$  after eviction of the responsible firms.

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 no better than ordinary firms, though, and this is differentiation (see Appendix B for details). Insofar as differentia-

tion 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.

## 5.2 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  $p = w_1(X_1)X'(Q_1)$ , 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 can now be easily expected, 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 are identical, 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, in similar fashion as in Fig. 4. 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, a firm can enter and obtain a profit,

which will attract profit-maximizing firms and make  $TC$ -maximizing plans unprofitable. Therefore no free-entry equilibrium in Cournot competition among identical firms can have  $TC$ -maximizers in the population of remaining firms.

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. In absence of taste for diversity, this is also beneficial for the customers.

If all firms maximize  $TC$ , they behave like price-takers, and this maximizes the total 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, new firms can enter and make a profit by adopting a profit-maximizing strategy.

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.

### 5.3 Can ethical customers and investors 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. Fig. 6 illustrates the case in which consumers are willing to pay  $\alpha$  more for each unit of the product. In the figure, this makes the equilibrium viable both for ordinary and for responsible firms. If all consumers have the same parameter  $\alpha$ , this is a knife-edge situation. If the consumer premium is smaller, the profit-selection theorem remains in full force. If the premium is greater, the equilibrium will actually drive out the ordinary firms and only responsible firms can survive. If, more realistically, there is a distribution of the parameter  $\alpha$  in the consumer population, then the two types of firms can coexist, with the responsible firms getting a share of the market corresponding to a top fraction of the distribution of this parameter.

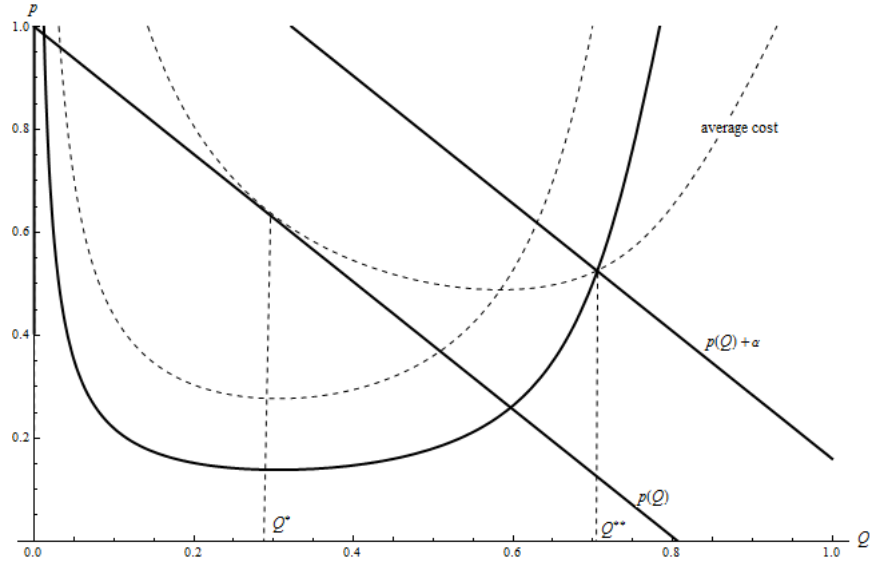


Figure 6: Free-entry competition equilibrium with both types of firms

A similar result holds for ethical investors. If they accept a lower return from responsible firms, these firms enjoy a lower cost of capital. The case of workers is similar if the labor market is balanced, but in 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.

## 5.4 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:

$$p(nQ(n)) Q(n) - w(nX_n) X_n$$

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

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 to themselves the polluter-pays principle. This also provides a valuable guideline for Pigouvian taxation, and is consistent with the earlier result that the Pigou tax should be deductible from the corporate tax, since the net profit is then null if and only if the gross profit is null, thereby providing for the correct viability condition.

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 good actors have to be protected from upsetting competition by the bad 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). Assessment of profit

opportunities at current prices and wages can serve a useful purpose in similar fashion as standard profitability assessments, including for challenging or replacing a managing team that does not give satisfaction. Moreover, we have also seen that profit (corrected for Pigouvian prices) still provides a useful yardstick for assessing the viability of the firm and the value of investing in various industries.

Thus, it seems to us that simple management rules, such as the  $pQ_X = w$  rule identified in earlier sections, provide an interesting avenue for designing appropriate incentives. If a firm deviates toward maximizing profit rather than  $TC$ , this will induce  $pQ_X > w$  and similar discrepancies against which consumers and workers can raise complaints because this reduces their share of the surplus. Making this alternative mechanism effective involves two conditions. First, the firm must be required to provide reliable information to its stakeholders (or to independent controllers) about how it implements such management rules, and stakeholders must be alerted when the management rules are violated. Second, procedures for making the complaints binding once they are recognized as based on sound evidence are needed as well.

As discussed in Appendix B, non-contractible parameters generate inefficiency problems for ordinary firms in which managers cannot commit to take account of the costs to stakeholders who are not in control. A more inclusive governance should go a long way toward making the appropriate bargaining process take place. But simple management rules such as those identified in the Appendix for the management of non-contractible variables can further enhance the decision-making process and provide suitable guidelines for the governing bodies of the firm.

Even if this approach proves effective, it remains true that a more inclusive governance can help in enlarging the objective of the firm to incorporate the surplus of various stakeholders, but cannot fully suffice to integrate all concerns for silent stakeholders such as future generations and other species. Therefore externalities are likely to remain an issue where public intervention is continuously needed, in particular via Pigouvian pricing.

## 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 very 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 all 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 may be 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.

Finally, it must be recalled that reforming the purpose and governance of the corporation toward including stakeholders cannot solve all social and environmental problems. Externalities, inequalities and unemployment, in particular, will continuously need public intervention in order to preserve the ecosystem, the social fabric, and macroeconomic balance.

## References

- [1] Aghion P., R. Bénabou, R. Martin, A. Roulet 2020, “Environmental preferences and technological choices: Is competition clean or dirty?”, NBER Working Paper 26921.
- [2] Alchian 1950, “Uncertainty, evolution and economic theory,” *Journal of Political Economy* 58: 211–221.
- [3] Amir R., L. de Castro, L. Koutsougeras 2014, “Free entry versus socially optimal entry,” *Journal of Economic Theory* 154: 112–125.
- [4] Allen F., E. Carletti, R. Marquez 2015, “Stakeholder governance, competition, and firm value,” *Review of Finance* 19: 1315–1346.
- [5] Arrow K.J. 1973, “Social responsibility and economic efficiency,” *Public Policy* 21: 303–317.
- [6] Baumol W.J. 1991, *Perfect Markets and Easy Virtue. Business Ethics and the Invisible Hand*, Oxford: Blackwell.
- [7] Bénabou R., J. Tirole 2010, “Individual and corporate social responsibility,” *Economica* 77: 1–19.

- [8] Blasi S., M. Caporin, F. Fontini 2018, “A multidimensional analysis of the relationship between corporate social responsibility and firms’ economic performance,” *Ecological Economics* 147: 218–229.
- [9] Blume L.E., D. Easley 2002, “Optimality and natural selection in markets,” *Journal of Economic Theory* 107: 95–135.
- [10] Blume L., Easley D. 2010, “Heterogeneity, Selection, and Wealth Dynamics,” *Annual Review of Economics* 2: 425–450.
- [11] Brand B., M. Grothe 2015, “Social responsibility in a bilateral monopoly,” *Journal of Economics* 115: 275–289.
- [12] Cremer H., M. Marchand, J.F. Thisse 1989, “The public firm as an instrument for regulating an oligopolistic market,” *Oxford Economic Papers* 41: 283–301.
- [13] d’Aspremont C., R. Dos Santos-Ferreira 2021, *The Economics of Competition, Collusion, and In-Between*, London: Palgrave Macmillan.
- [14] De Fraja G., F. Delbono 1989, “Alternative strategies of a public enterprise in oligopoly,” *Oxford Economic Papers* 41: 302–311.
- [15] Ding W., R. Levine, C. Lin, W. Xie 2020, “Competition law, norms and corporate social responsibility,” NBER Working Paper 27493.
- [16] Dow G.K. 1996, “Replicating Walrasian equilibria using markets for membership in labor-managed firms,” *Economic Design* 2: 147–162.
- [17] Dow G.K. 2003, *Governing the Firm: Workers’ Control in Theory and Practice*, New York: Cambridge University Press.
- [18] Dow G.K. 2018, *The Labor-Managed Firm. Theoretical Foundations*, Cambridge: Cambridge University Press.
- [19] Drèze J.H. 1989, *Labour Management, Contracts and Capital Markets: A General Equilibrium Approach*, Oxford: Basil Blackwell.
- [20] Dutta P.K., R. Radner 1999, “Profit maximization and the market selection hypothesis,” *Review of Economic Studies* 66: 769–798.

- [21] Ferrell A., L. Hao, L. Renneboog 2016, “Socially responsible firms,” *Journal of Financial Economics* 122: 585–606.
- [22] Fitoussi J.P., A.K. Sen, J.E. Stiglitz 2009, *Report of the Commission on the Measurement of Economic Performance and Social Progress* (CMEPSP).
- [23] Friedman M. 1953, *Essays in Positive Economics*, Chicago: University of Chicago Press.
- [24] Friedman M. 1970, “The social responsibility of business is to increase its profit,” *New York Times Magazine*, Sept. 13.
- [25] Harrison J.S., J.B. Barney, R.E. Freeman, R.A. Phillips (eds.) 2019, *The Cambridge Handbook of Stakeholder Theory*, Cambridge: Cambridge University Press.
- [26] Heath J. 2014, *Morality, Competition, and the Firm. The Market Failures Approach to Business Ethics*, Oxford: Oxford University Press.
- [27] Hillman A.J., G.D. Keim 2001, “Shareholder value, stakeholder management, and social issues: What’s the bottom line?”, *Strategic Management Journal* 22: 125–139.
- [28] Jensen M.C. 2001, “Value maximisation, stakeholder theory, and the corporate objective function,” *European Financial Management* 7: 297–317.
- [29] Kelly C. 2019, “Repurposing our economies – and our businesses,” *Global Solutions Journal*, 4: 33–63.
- [30] Kopel M., B. Brand 2013, “Socially responsible firms and endogenous choice of strategic incentives,” *Economic Modelling* 29: 982–989.
- [31] Kopel M., F. Lamantia, F. Szidarovszky 2014, “Evolutionary competition in a mixed market with socially concerned firms,” *Journal of Economic Dynamics and Control* 48: 394–409.
- [32] Kopel M., F. Lamantia 2018, “The persistence of social strategies under increasing competitive pressure,” *Journal of Economic Dynamics and Control* 91: 71–83.
- [33] Luo G.Y. 2009, “Irrationality and monopolistic competition: An evolutionary approach,” *European Economic Review* 53: 512–526.

- [34] Luo G.Y. 2019, “Evolution and monopolistic competition in an irrational industry,” *Journal of Bioeconomics* 21: 157–182.
- [35] Magill M., M. Quinzii, J.C. Rochet 2015, “A theory of the stakeholder corporation,” *Econometrica* 83: 1685–1725.
- [36] Mankiw N.G., M. Whinston 1986, “Free entry and social inefficiency,” *Rand Journal of Economics* 17: 48–58.
- [37] Meade J. 1993, “Agothotopia: The Economics of Partnership,” in *Liberty, Equality, and Efficiency*, London: Palgrave Macmillan.
- [38] Mueller D.C. 2006, “Corporate governance and economic performance,” *International Review of Applied Economics* 20: 623–643.
- [39] Tirole J. 2006, *The Theory of Corporate Finance*, Princeton: Princeton University Press.
- [40] Vanek J. 1970, *The General Theory of Labor-Managed Market Economies*, Ithaca: Cornell University Press.
- [41] Varian H. 1984, “The non-parametric approach to production analysis,” *Econometrica* 52: 579–597.

## 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  $x_{hkj} > 0$  for a commodity bought by  $h$  and  $x_{hkj} < 0$  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  $\pi_j$ . 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

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

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  $\tau_{jk}$  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

prices  $p = (p_{jk})_{j=1,\dots,J,k=1,\dots,K}$  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  $y_j \in Y_j$ , where  $\hat{p}_j = p_j - \tau_j$ ; 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 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  $\{(x'_h, y') | U_h(x'_h, y') \geq U_h(x_h, y)\}$ . If a change in  $(x_h, y)$ , denoted  $(\Delta x_h, \Delta y)$ , is an improvement, one must then have

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

with a weak inequality  $\geq$  if it is a weak improvement. 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  $\sum_{j,k} [p_{jk} \Delta x_{hjk} + v_{hjk} \Delta y_{jk}] > 0$  for

all  $h$ , 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  $\Delta y_j$  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  $\tau_j$  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  $\hat{\bar{p}}_k = \bar{\bar{p}}_k - \tau_{jk}$ .

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

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

The total demand is  $D(p, y) = \sum_h x_h(p, y)$ , and in particular,  $D_{jk}(p, y) = \sum_h x_{hjk}(p, y)$ . Let the elasticity of demand be denoted:

$$\varepsilon_{jk}(p, y) = \frac{\partial D_{jk}}{\partial p_{jk}}(p, y) \frac{p_{jk}}{D_{jk}(p, y)},$$

and the cross-price elasticity (for a multi-product firm):

$$\varepsilon_{jkl}(p, y) = \frac{\partial D_{jk}}{\partial p_{jl}}(p, y) \frac{p_{jl}}{D_{jk}(p, y)}.$$

With the sign conventions, one typically has  $\varepsilon_{jk} < 0$  for outputs and  $\varepsilon_{jk} > 0$  for inputs.

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

2'. Every firm maximizes  $\pi_j = \tilde{p}_j y_j$  under the constraint  $y_j \in Y_j$ , where  $\tilde{p}_{jk} = p_{jk} \left( 1 + \sum_l \frac{p_{jl} y_{jl}}{\varepsilon_{jkl} p_{jk} y_{jk}} \right)$ ; if the maximum  $\pi_j$  is negative, then  $y_j = 0$ .

In this maximization, the firm formally takes the price  $\tilde{p}_j$  as fixed when choosing  $y_j \in Y_j$ . Of course, this price actually depends on the chosen plan. To understand the formula for  $\tilde{p}_j$ , consider the following maximization problem:

$$\max_{y_j} p_j(y_j) y_j \text{ such that } \Phi(y_j) = 0,$$

where  $p_j(y_j)$  captures the firm's market power (its dependence on the other firms strategies is left implicit in order to shorten notations) and the function  $\Phi$  depicts the technological constraints. The first-order condition for  $y_{jk}$  reads as follows:

$$p_{jk} + \sum_l \frac{\partial p_{jl}}{\partial y_{jk}} y_{jl} = \lambda \frac{\partial \Phi}{\partial y_{jk}},$$

where  $\lambda$  is the Lagrange multiplier of the technology constraint. The left-hand side can be written as

$$p_{jk} \left( 1 + \sum_l \frac{\partial p_{jl}}{\partial y_{jk}} \frac{y_{jk}}{p_{jl}} \frac{p_{jl} y_{jl}}{p_{jk} y_{jk}} \right),$$

yielding the desired formula for  $\tilde{p}_{jk}$ .

The price condition captures profit maximization under imperfect competition. It takes account of the (cross-)price elasticity of demand as well as the income and externality effects of production on demand. 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.

One can then determine conditions under which the equilibrium with ordinary firms is Pareto-efficient. The following theorem is a direct corollary of the previous theorem, given the definition of  $\tilde{p}_{jk}$ , which suggests that efficiency can be obtained if  $\tilde{p}_{jk} = p_{jk} - \tau_{jk}$ .

**Theorem** The free-entry equilibrium with profit-maximizing firms is Pareto-efficient if for all  $j = 1, \dots, J$ ,  $k = 1, \dots, K$ ,  $p_{jk} \left( \sum_l \frac{p_{jl} y_{jl}}{\varepsilon_{jkl} p_{jk} y_{jk}} \right) = \sum_h v_{hjk}$ .

This result shows how imperfect competition, which tends to reduce production (when  $\varepsilon_{jk} < 0$  for outputs and  $\varepsilon_{jk} > 0$  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  $\mu$ ) 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  $\beta$ , 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  $k \in \{1, \dots, K\}, m \in \{1, \dots, M\}$ ,  $\frac{T_m}{(1-T')p_k} = -\frac{f_m}{f_k}.$

As in section 3, 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  $wta_{ik} = p_k(1 - I'_i)$ . This destroys the equality  $wtp_{ik} = wta_{jk}$  (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  $\frac{\sum_i \alpha_i (s_i - \frac{Y_{ik}}{Y_k})}{\sum_i \alpha_i s_i}$  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  $\frac{\sum \alpha_i (s_i - \frac{Y_{ik}}{Y_k})}{\sum_i \alpha_i s_i}$ . This means that the firm can still take prices as parametric, provided they are equal to the market prices adjusted in the following way:

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

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

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

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

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

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  $\gamma$ , yield the pricing equation:

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

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  $\alpha_i$  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.

## 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  $w_S X = pQ_S$  can then be rewritten  $X = pQ_S S_w$ , 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. 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  $A$ . 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  $TC$ -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 advertising and other differentiation efforts, an inefficient allocation will arise. A solution to this problem requires some central coordination or external regulation.

## Appendix C: 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, his 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  $wt a_i(l) < w_L$  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 simple 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.