Competitive Neutrality in Industry Equilibrium

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Abstract. Even if a government enterprise enjoys no special advantages over the private sector, the very fact that some economic transactions have been organized differently, changes the nature of the market. That, in turn, has an impact on both government and private enterprises. This impact varies with the nature and size of the transactions that come under government control. That is, the impact of government involvement in a market depends on the underlying characteristics of that market and the type of government involvement in it. This paper provides a framework for analyzing these issues and considers the legal implications of these changes to the market. In informationally efficient markets a policy that creates a rebuttable presumption against the involvement of a government enterprise may well be welfare increasing.

1. Introduction

The principle of competitive neutrality concerns situations where government undertakes economic activities that compete with the private sector. It holds that a government entity undertaking such activities should not enjoy a benefit, relative to the private sector, merely by virtue of being controlled by the government.

Government entities that enjoy a competitive advantage can make pricing decisions that reflect their effective (subsidized) cost, rather than the costs they would have, were they not a government body. Such pricing decisions can lessen competitive and decrease consumer welfare. Competitive neutrality policies seek to address this through a variety of measures that create a "level playing field."

These policies can place constraints on the practices that a government entity may lawfully engage in, may lead to the corporatization of government-owned entities, tax (in one way or another) government entities to internalize the negative externality they cause, or break up parts of these entities (such as in telecommunications or other large-scale infrastructure).

There is, of course, an active body of scholarship that continues to explore these issues and expands on the significant understanding that has been developed to date.[1] Here, I take this body of work as given and seek to make a complementary contribution.

The central point I make in this paper is that—even if a government enterprise enjoys no special advantages—the very fact that some economic transactions have been taken out of the market, changes the nature of the market. That, in turn, has an impact on both government and private

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[1] For an excellent summary see Fox and Healey (2015).

enterprises. This impact varies with the nature and size of the transactions that come under government control. In other words, the impact of government involvement in a market depends on the underlying characteristics of that market and the type of government involvement in it.

The main implication of this is that any analysis of competitive neutrality that focuses on factors affecting a government enterprise relative to a private enterprise is necessarily incomplete. A complete analysis must account for how government involvement changes the governance choices of firms, and hence their actions.[2]

The impact of a government enterprise on market equilibrium could operate through a variety of channels. A useful way of organizing these different channels is by thinking about the two roles that the price mechanism plays in a market: (i) it equates supply and demand; and (ii) it conveys information from informed parties to uninformed parties. Both are important, but (ii) is particularly important in so-called "stochastic economies"—settings where there is uncertainty about future states of the world. I take the view that essentially all economies are stochastic.[3]

It is illustrative to consider when the market-clearing role of the price mechanism is sufficient for thinking about how markets operate, and hence for issues pertaining to competitive neutrality. Grossman (1981: 555-556) puts it nicely: "...consider an economy with no production decisions, where people live for a single period and are endowed with apples and oranges. Suppose a planner or any single trader does not know who has what goods, or what individual preferences are for those goods. However, the existence of a market will lead people to allocate themselves to goods so that marginal rates of substitution are equalized. No one tries to learn anything from prices since there is nothing for any individual to learn. Walrasian prices constrain individuals in such a way that goods get drawn to people who value them. In this example, the mere existence of a market conveys all the information that a trader wants-namely, it tells him where he can find someone with whom to trade, and what are the terms of trade."

By contrast, in the type of stochastic economy I consider to be most relevant for policy-making purposes to do with competitive neutrality, information is conveyed by prices. Grossman, again, puts it thus: "…the worth of a risky consumption stream, or of a current production decision, to a particular agent h depends on what other agents know about the economy. The current relative value of 'risky production decision a' versus 'production decision b' depends upon all the current information possessed about the probability distribution of payoffs. In such an economy, current prices of

[2] In this sense, I link a firm's strategy to its structure, as do Gibbons, Holden and Powell (2012) (henceforth "GHP"). This concept was pioneered by Chandler (1962) and, as GHP note, plays an important role in the study of competitive strategy. GHP cite Porter (1985, 23) who noted that ''Cost leadership usually implies tight control systems, overhead minimization, pursuit of scale economies, and dedication to the learning curve; these could be counterproductive for a firm attempting'' a different strategy; and Roberts (2004, 255) who suggested that different strategies can involve ''quite different tasks, calling on different organizational capabilities and typically requiring different organizational designs to effect them.''

[3] GHP cite Grossman (1981, 555) who observed that in non-stochastic economies, ''No one tries to learn anything from prices [because] there is nothing for any individual to learn.'' GHP point out that a leading case of a stochastic economy is where there is an element of common-value uncertainty.

securities will convey information to traders and affect their current decisions-if traders have rational expectations. The Walrasian model is inappropriate in situations where the current worth to trader h of a future income stream depends on other traders' current information."

Indeed, the very fact that production is organized in a *firm,* rather than undertaken by an individual, suggests a degree of complexity of the economic environment that typically involves an interdependency of optimal production decisions to which Grossman refers in the above quotation.

In this paper, I build on the framework introduced in Gibbons, Holden and Powell (2012) who analyze a rational-expectations model of price formation in an intermediate-good market under uncertainty and derive the implications for choices of governance structures by firms.

The production technology in GHP is simple: a machine converts (at a firm-specific cost) and intermediate input into a final good which is sold to consumers. There is a market for intermediate inputs, with random supply shocks so that the equilibrium price in that market conveys some information. In addition to the machine, each firm is comprised of two players: a "marketer" and an "engineer". The valuation to consumers is not known to firms *ex ante*, but can be discovered if the marketer in the firm takes a privately costly and non-contractible action.[4] Similarly, the marketer can take a private costly, non-contractible action that reduces the firms' costs. The players in the firm can, however, contract on ownership/control of the machine.[5] It turns out that in equilibrium, the party that controls the asset will invest while the other party will not.

GHP's key insight is that governance structure will end up affecting the informativeness of prices in the intermediate good market and this, in turn, will affect the optimal choice of governance structures for firms. To see this, notice that when a firm chooses marketer control they end up finding out the valuation of the final good to consumers. Consequently, they will not by an intermediate good if their costs are too high to make production profitable. This affects demand in the intermediate good market and hence the equilibrium price in that market. Crucially, however, the equilibrium price in the intermediate good market thus partially conveys the information that the firm who chose marketer control has.[6]

Armed with this insight, GHP observe that, since firms are *ex ante* identical (and small, thus no one firm having an impact on the equilibrium price by deviating) they must be indifferent between choosing market control or engineer control. Moreover, the more firms that choose marketer control, the more informative price in the intermediate good market is. But this creates an incentive for firms to choose engineer control, obtain the cost reduction that comes with it, and free ride on the

[4] The model is thus in the tradition of incomplete contracting models pioneered by Grossman and Hart (1986) and Hart and Moore (1990). See Aghion and Holden (2011) for an overview and a variety of applications of these types of models that have come to be known as "Property Rights Theory".

[5] In the context of GHP ownership rights and control rights are synonymous, since cash flows are assumed to be attached to control rights, and thus I will use the terms "ownership" and "control" interchangeably.

[6] It is in this sense that GHP is a rational expectations equilibrium model in the spirit of Grossman (1976, 1981), Grossman and Stiglitz (1976), and owing intellectual origins to the celebrated work of Hayek (1945).

information about consumer valuation contained in the intermediate-good-market price rather than organize the firm to obtain that information directly. In *industry equilibrium* these two countervailing forces must exactly balance out.[7] This implies that there must be some proportion of firms that choose marketer control and some proportion that choose engineering control. *Ex ante* homogeneity still leads to *ex post* heterogeneity of both governance structure choice and firm performance.

The main implication for the study of competitive neutrality that arises from this is that is not just *whether* a government enterprise operates in a market, or even *on what terms* it operates, but *in what way* in which it operates that is crucial for market efficiency. The first two of these possibilities are deeply familiar to scholars of competitive neutrality. For instance, the "on what terms" question raises the possibility that government enterprises may have some competitive advantage because of, say, their cost of capital, size, set of customers, or other attributes that stem merely from being government owned. This possibility, of course, gives rise to potential remedies such as corporatization, or regulations of various types.

What is arguably missing from existing analyses, however, is the "in what way" part of the preceding paragraph. In the framework developed in this paper, the governance structure chosen by a government enterprise affects the governance structures of other firms in equilibrium precisely because of the size of government enterprises. Unlike the competitive case with a very large number of individual firms that have a negligible impact on equilibrium prices in isolation, government enterprises can be large enough to affect the equilibrium. This in turn affects the informativeness of the price mechanism, and more importantly, total surplus generated in the industry.

I argue, therefore, that whenever there is the specter of government involvement, or non-involvement, in an industry, there are efficiency consequences that arises purely through the effect on the informativeness of the price mechanism. We will elaborate on this further toward the end of the paper.

The remainder of the paper proceeds as follows. Section 2 presents my model and highlights the way in which government involvement in a market changes industry equilibrium. Section 3 then goes on to consider some legal implications of these changes to the market, and Section 4 contains some brief concluding remarks.

2. A Model of Government-Market Equilibrium

To be self-contained this section presents a version of the Gibbons-Holden-Powell framework and then adapts it to issues of competitive neutrality. Readers who wish to skip past some of the notation and technical details can proceed directly to section 2.1.3.

2.1 The GHP framework

[7] This is, by design, reminiscent of the classic "Grossman-Stiglitz paradox" (Grossman and Stiglitz, 1980) whereby the price mechanism cannot be fully informative, lest there be no incentive for individuals to acquire information to be impounded into the price mechanism.

2.1.1 Statement of the Problem

The following subsection follows closely from Gibbons, Holden and Powell (2012). The outline given in prose above may serve as a useful guide. The core ingredient of the model is firms and there is assumed to be a unit mass of risk-neutral firms indexed by i ∈ $[0,1]$. Each firm consists of two players who will take actions within the firm: an Engineer E_i and a Marketer M_i. Each firm has a machine capable of transforming one "widget" (which can be thought of as an intermediate good or raw material of some sort) into one final good that consumers value at *v*. *v* is a random variable that is uniformly distributed on the support $[\underline{v}, \overline{v}]$, that is it takes on any value in that interval with equal probability.

There is a "raw" cost of transforming the widget into a final good that is firm specific and given by c_i , which is uniformly distributed on the support $[\underline{c}, \overline{c}]$. The engineer in firm *i* can invest in reducing this cost by paying K_E to reduce the cost to $c_i - \Delta$. Similarly, the marketer in firm *i* can pay K_M to find out *v* for sure.

Widget supply (i.e. the total number of widgets produced in the market) is random[8], and given by *x* which is uniformly distributed on $[\underline{x}, \overline{x}]$.

In describing governance structures, I adopt the convention that $g_i = E$ if E controls the machine and that $g_i = M$ if M controls the machine.

2.1.2 Price Formation

The question then is how prices are determined in this market. Following GHP we focus on *rational expectations equilibrium*, which is defined as follows. A rational expectations equilibrium (REE) is a price function $p(x, v)$ and a production allocation $q_i \in \{0,1\}$ such that:

(i) $q_i = q_i^*$ for all i, and
(ii) The market for widgets clears for each pair $(x, v) \in [\underline{x}, \overline{x}] \times [\underline{v}, \overline{v}]$.

The production allocation is a binary variable which takes the value produce (q=1) or not (q=0). I denote by λ the proportion of firms who choose marketer control. Now I define $c_M(v, p) = v - p$, which is the highest cost at which a marketer who has invested in information (and hence knows v) would be prepared to produce a final good. Also, let $c_E(p) = E[v|p] - p + \Delta$. This is the highest cost at which an engineer who has invested in cost reduction (but not information) would be prepared to produce.

This implies that demand for widgets is

$$\lambda \frac{v - p - \underline{c}}{\overline{c} - \underline{c}} + (1 - \lambda) \frac{E[v|p(x, v)] + \Delta - p - \underline{c}}{\overline{c} - \underline{c}},$$

so that for the market to clear requires

[8] This is a modeling device which insures that the equilibrium pricing function is not invertible, thereby leading to a fully revealing rational expectations equilibrium.

$$p = (1-\lambda)E[v|p(x,v) = p] + \lambda x - \left(\overline{c} - \underline{c}\right)x + (1-\lambda)\Delta - \underline{c}.$$

The conditional expectation of *v* given *p* therefore satisfies

$$E[v|p(.,.) = p] \equiv \frac{\left(\overline{c} - \underline{c}\right)x + \underline{c} + (1-\lambda)\Delta - \lambda v}{(1-\lambda)}.$$

GHP show that, given λ, there exists an REE characterized by a piecewise linear price function, as depicted in the following figure.

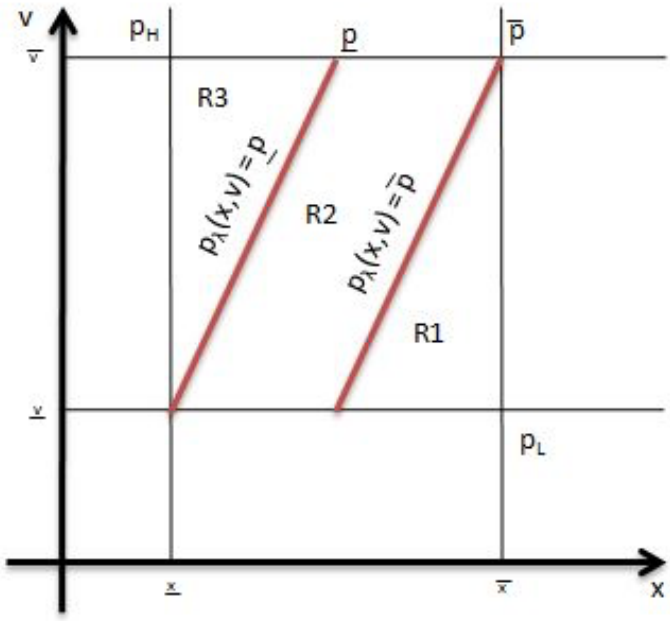

Figure 1: Drawing inferences from prices

Notice that different points in (x, v) space correspond to different supports of the posterior distribution.[9] This highlights a key fact—the informativeness of the price mechanism depends on industry structure. To that end, I now consider the firms' governance structure choice.

[9] To see this in the figure, since all the random variables in the model are uniform and stochastically independent, each point (x, v) space is equally likely. Therefore, one forms posteriors by taking a point in (x, v) space, looking at the iso-price locus parallel to the diagonal lines in the picture, and then projecting this line onto the v axis.

This involves a given firm taking the rational expectations equilibrium that will occur for a given proportion of firms that choose a certain governance structure, and maximizing its own choice of governance structure. In this sense, *industry equilibrium* involves the market clearing, prices constituting an REE, and firms optimizing their choice of governance structure simultaneously. This is captured in the following definition.

An *industry equilibrium* is a set of firms of proportion λ^*, a price function $p(x, v)$, and a production allocation $\{q_i\}_{i\in[0,1]}$, such that

(i) Each firm optimally chooses governance structure with proportion λ^* choosing *M;*
(ii) Each party optimally chooses to invest or not;
(iii) Production and widget-purchasing decisions are optimal and;
(iv) The market for widgets clears for every pair (x, v).

Armed with this, GHP show that in the case of interest here[10] the proportion of firms that choose market control in equilibrium is given by

$$\lambda^* = \frac{\sigma_v^2+\Delta^2-2(\overline{c}-\underline{c})v-\mu_x\Delta}{\frac{\sigma_v^2}{2}+\frac{\sigma_v/\sigma_x}{\overline{c}-\underline{c}}+2\Delta^2}. \qquad (*)$$

2.1.3 Summary

From this point on, I will say that a firm that chooses marketer control is *customer facing* and one that chooses engineer control is *production facing*.

Notice that equation (*) gives the proportion of firms that are customer facing absent any government enterprise being in the market. The comparative statics of this industry equilibrium are important. GHP Proposition 3 provides these comparative statics for the noisy outside demand case and shows:

Comparative Statics:

(i) an increase in the uncertainty of either the supply of the intermediate good or the value of the final good or a decrease in the average supply of the intermediate good leads to an increase in the fraction of firms that choose to be customer facing; and
(ii) an increase in the level of potential cost reduction leads to an increase in the fraction of dyads that choose to become production facing if there is sufficient uncertainty regarding the value of the final good, but if this level of uncertainty is low, the opposite may be true.

This is the support of the posterior distribution, and the expected value of v is the midpoint of the support, since the posterior is uniformly distributed.

[10] See what GHP refer to as the "noisy outside demand case".

An important feature of the industry equilibrium characterized by equation (*) is that production parameters such as the value of cost reduction (Δ in the model) affect the informativeness of the price mechanism.

A further important observation is that, in the industry equilibrium with no government involvement, since firms are *ex ante* identical, all firms must be indifferent between being customer facing or production facing. However, the firms are certainly not identical *ex post*. The most obvious way in which this is the case is that some firms choose to let customer facing and some chose to be production facing.

In addition to this, however, among the firms that choose (optimally) to be production facing, some will produce at a profit and some will produce at a loss. This occurs because they do not know the true value of the final good to consumers (*v* in the model) but draw inferences about it from the price of widgets in the intermediate good market. Even though they optimize their production and widget-purchase choices, some of those production-facing firms will expect the value of the final good to be higher than it actually turns out to be. In this sense, some of these firms will produce final goods (and have purchased intermediate goods/widgets) but wish that they had not, despite having maximized *ex ante*.

This gives rise to the following important observation: the proportion of firms that choose to be production facing affects total surplus in the system, all else equal. This arises through the effect that firms choosing to be production facing have on the informativeness of the price mechanism, and hence the number of firms (a subset of the firms that are production facing) that choose to produce when they are, in fact, too high cost relative to consumer valuations to be profitable. The central point that we will make below is that the way in which the government chooses to be involved, or not involved, in the market has a direct bearing on total surplus precisely through this channel.

2.2 Government Enterprises

Now that I have characterized industry equilibrium with no government involvement, I can provide a taxonomy of the different ways in which government can become involved in the market and how that involvement affects industry equilibrium.

A government enterprise could, in principle, either be customer facing or production facing. It is also possible, in the context of the market I have analyzed thus far, that a government enterprise could produce in the intermediate good market. This latter possibility is of no consequence given my assumptions about the intermediate good/widget market and I therefore ignore it in this paper.[11]

[11] If the intermediate good market had a richer market structure itself then government involvement could be consequential, but such a possibility would have potentially significant effects on the structure of the rational expectations equilibrium and I thus leave a proper treatment of such issues for another time.

The other relevant dimension of government involvement is whether or not they enjoy a competitive advantage over their private-sector counterparts. There are thus four possible ways for the government to be involved in this market, as illustrated in the following figure.[12]

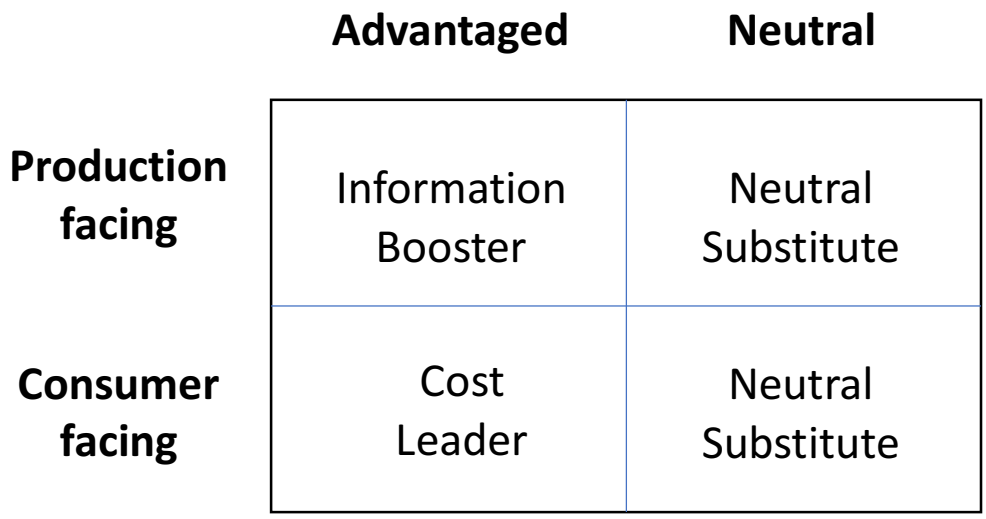

Figure 2: A taxonomy of government enterprises

I must specify one other detail of how government enterprises enter the industry, and that is "how many" or "how large" they are. Since my model contains a continuum of firms, there will be no impact of having a "single" government enterprise do one thing or another, as it is measure zero (that is, of negligible size). I will thus assume that any change to the industry configuration through the involvement of a government enterprise involve mass *m* of firms being switched from private to government control.[13]

The key issue, however, is how the involvement of a government enterprise affects the industry equilibrium considered above. It is to this question that we now turn.

2.3 Government-Market equilibrium

We will consider the impact of a government enterprise on the industry equilibrium under two possible scenarios. In the first, the government enterprise enjoys no special advantage (e.g. a cost advantage) over its private-sector rivals. In the second, the government enterprise enjoys a cost

[12] An additional dimension of government involvement is whether they replace (through acquisition, or crowding out) and existing firm, or are an additional firm in the market. Although this is of interest, a proper treatment of it would involve analyzing an entry game, raising some intriguing possibilities, but which is beyond the scope of the present exercise. I will assume here that a GE always replaces/substitute for a private sector firm of the same size.

[13] For technical reasons one does not want $m \geq \lambda^*$, and although the latter variable in endogenous, it is always possible to make assumptions on primitives that ensure this will not arise, and henceforth I implicitly make such assumptions.

advantage. Our goal is to highlight the informational and allocative efficiency consequences of the involvement of a government enterprise in each of these scenarios.

2.3.1 Level playing field

I first consider the case where a government enterprise (GE) is identical to a private-sector firm.

If other firms have already made their governance-structure choices, and if those choices cannot be changed, then the GE being involved in the market has one of two effects. Since, by assumption, the GE replaces a private firm of the same size, if the GE has the same governance structure as the private firm it is replacing the industry equilibrium is unchanged. If, however, the GE replaces a firm with a different governance structure then the new industry equilibrium (denoted $\lambda^{GE} \neq \lambda^*$) can entail a higher or lower degree of informational efficiency.

It should be immediately clear that a greater degree of informational efficiency has positive allocative efficiency benefits, too, since uninformed firms will, in general, have a more accurate posterior belief about *v* and hence make fewer *ex post* production errors.

Of course, if the GE entered at the same time as private firms, then this conclusion could be different, in principle. Here there are two sub-cases. The simplest is where the GE chooses governance structure in an optimizing way at the same time as private firms. Clearly, then, they would be part of the industry equilibrium considered above, and the proportion of firms that are customer facing would be unchanged, and given by equation (*).

The second sub-case is where the GE can credibly commit to one or another governance structure. In this setting, the timing of the GE's governance structure choice is immaterial and again we have $\lambda^{GE} \neq \lambda^*$. For instance, if the GE commits to be customer facing then $\lambda^{GE} > \lambda^*$. To see this, observe that the GE choosing to be customer facing is, from the perspective of the other firms, like changing the production parameters of the market in such a way that $\lambda^* = \lambda^{GE}$, and they then optimally choose their governance structures as if they were in that new environment.

Thus far I have considered the environment where governance structures are fixed once chosen. If firms could change their governance structure at any time then, in the context of the model we have specified, nothing would change because each firm is infinitesimal and thus cannot affect the equilibrium through a unilateral deviation.[14]

2.3.2 Government enterprise cost advantage

Now suppose the GE has a lower cost than its private-sector competitors. This gives rise to a host of considerations that are familiar from the competitive neutrality literature. In the context of the framework considered here, however, there are additional considerations, and we will focus on those.

Suppose the GE has a lower cost of acquiring information about consumer valuations (i.e. $K_M^{GE} < K_M$) but the same cost of making the cost-reduction investment (i.e. $K_E^{GE} = K_E$). From a welfare perspective it clearly makes sense for the GE to make the investment which is lower cost for it, and

[14] I refer the interested reader to Grossman and Stiglitz (1980) and Gibbons, Holden and Powell (2012) for further consideration of the finite, non-negligible mass case.

given their size or commitment power this can arise naturally in equilibrium, as discussed above. Notice that, in this case, not only does welfare rise directly from the lower investment costs, welfare rises indirectly because the price mechanism becomes more informative ($\lambda^*$is higher) and this creates an indirect benefit for private firms).

It will be immediately clear to the reader that there are other cases with less sanguine implications[15], but it is worth pointing out that a government enterprise having a cost advantage and being involved in the market can actually *improve* efficiency in some circumstances.

The main implication of this analysis is that there is an *informational channel* that affects economic efficiency, in addition to the standard competitive channel emphasized in existing analyses of competitive neutrality.

3. Legal Implications

The legal prescriptions that arise out of standard analysis of government enterprises and, by now, well understood, as mentioned in the introduction. This short section outlines some of the addition implications that stem from thinking about government enterprises in industry equilibrium, as I have done above.

The main implication of my analysis is that informational efficiency is an instrumental goal for achieving allocative efficiency in this setting and optimal policy and legal rules should take account of this. Government enterprises that do not contribute to the informativeness of the price mechanism should attract significant skepticism. In the context of my model these are production facing government enterprises, but one could imagine the concept being more general than this.

The comparative statics derived above also provide guidance about the types of markets where informational efficiency is likely to be low, all else equal. This is likely, for instance, when the returns to cost reduction are large, markets will tend to have low informational efficiency and government enterprises could improve matters. When returns to cost reduction are low, markets will tend to have a high degree of informational efficiency and government enterprises will be hard-pressed to improve matters, but could make things worse.

This suggest that, in addition to the standard welfare analysis involved in assessing competitive neutrality, informational efficiency of the market should be added as a consideration. In markets where informational efficiency is already high, it may be appropriate to have a rebuttable presumption against the participation of a government enterprise. That assumption could be rebutted only by demonstrating efficiency that obtain or externalities that are internalized in other ways.

4. Concluding Remarks

In this paper I have sought to highlight the fact that firms—government and non-government— do not only operate in similar markets and interact with each other through product-market competition.

[15] Consider, for instance, the case where (i.e. $K_M^{GE} > K_M$) and (i.e. $K_E^{GE} = K_E$), among others.

They also shape the nature and efficiency of these markets through their effect on the informativeness of the price mechanism.

In general, the effect of a government enterprise participating in a market can be positive or negative, depending on how it affects the informativeness of the price mechanism, and hence welfare. I do not offer any definitive suggestion for how this plays out in different markets, but I have offered a framework for thinking logically about the different, some competitive effects.

In informational efficient markets a policy that creates a rebuttable presumption against the involvement of a government enterprise may well be welfare increasing.

In section 2.3 I bracketed a number of interesting issues concerning how government enterprises enter or exit the market, such as whether they are additional firms or might be different in size. Exploring such issues may be a promising direction for future work.

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