Private incentives to vertical disintegration among firms with heterogeneous objectives[*]

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Abstract

A vertically integrated monopoly is compared to a decentralized market arrangement where production is segmented. A Labor Managed firm produces an input used by a profit maximizer manufacturer of a final good. Unlike what usually occurs between homogeneous firms we find circumstances in which the decentralised vertical arrangement is privately superior to the integrated one.

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1 Introduction

Vertical disintegration (VD) is a crucial strategic issue in markets where institutional and technological change is fast and efficiency is on the rise. Observation points to a growing domestic and cross-border outsourcing fostered by a worldwide tendency towards finer segmentation of production processes (McLaren, 2000; Grossman and Helpman, 2002).

Traditional wisdom maintains that imperfect competition in the production of inputs and outputs makes vertical integration (VI) privately and socially superior with respect to VD. When VI occurs profits are higher, the price of the final good is lower and the quantity sold is larger, making for a second best case. The culprit of this apparently vertical anticompetitive result is the so-called "double marginalization" in the vertically disintegrated market organization. The received statement is that two disintegrated monopolies (or noncompetitive firms) instead of one integrated monopoly (or noncompetitive firm) increase the degree of inefficiency. Basically, there is a negative externality that points to integration as to the most efficient arrangement. The external effect arises since the profit of the upstream (UP) firm diminishes as the price of the downstream (DW) firm increases. As a matter of fact, the UP firm would like the DW firm to set a lower price for the final good that would increase the profit of the UP firm (Spengler, 1950). However, the DW firm does not behave accordingly since it has a private incentive to do just the opposite. If we change the organizational design of production the externality may be internalized adopting vertical integration that becomes superior. This result is not entirely general since it may reverse in some specific cases, such as in a differentiated oligopoly (Lambertini and

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Rossini, 2003) or when process R&D is considered (Rossini, 2003). Here our curiousity is confined to discover whether some kind of reversal occurs also in other specific circumstances that occur when the objectives of the firm may alter the above mentioned externality. This may be the case when the individual firm supply reaction to the change of the market price is not the canonical one. We know that this is just the case of Labor Managed firms (LMF). And to this firm we devote this short analysis. Our aim is then to investigate what happens to incentives to vertically integrate when an LMF enters the picture. Accordingly, the object of this paper is to see whether the advantage of VI remains even when firms with different objective functions, such as LMFs are brought in. The interest in a LMF springs from its similarity with an entrepreneurial firm, where the owners work in the firm on an equal foot. These firms are quite common in high tech, service and other industries in advanced countries. Moreover many small firms in emerging areas and enterprises of the non-profit sector are quite close to the LMF paradigm (Moretto and Rossini, 2003). Assessing the relative efficiency of VD arrangements is also useful to explain the growth of outsourcing that takes place across countries with firm organizations which are quite different despite their common market orientation.

The paper goes through two scenarios. In the first (in section 2) a vertically integrated profit maximizer firm (PMF) is compared to a segmented production process where an UP LMF firm sells an intermediate good to a DW manufacturer. In the second scenario (in section 3) a vertically integrated LMF is compared to the same decentralized production process. Conclusions are in section 4.

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2 An Upstream LMF and a Downstream PMF

Consider production split between a sequence of two vertically stages. There is an UP phase, with only one producer of an input sold to a DW monopoly manufacturing a final good. The UP stage is made by a LMF, while in the DW stage a PMF operates. We limit the analysis to the monopoly case for the sake of simplicity. Yet the investigation can be extended also to oligopolist markets[1].

DW direct demand is assumed linear with market size a, i.e.:

$$q = a - p_{DW}. \tag{1}$$

DW marginal costs are zero for the sake of simplicity. Then, profits of the DW monopoly are:

$$\pi_{DW} = (p_{DW} - p_{UP})q \tag{2}$$

where p_{UP} is the price charged by the LMF operating in the UP section of the market. First stage profit maximization by DW firm with respect to the price gives:

$$p_{DW} = \frac{a + p_{UP}}{2}. \tag{3}$$

The UP LMF monopoly maximizes (Vanek, 1970; Delbono and Rossini, 1992), unitary value added, i.e.:

$$v = \frac{p_{UP}q - f}{L} \tag{4}$$

where f is the fixed cost and L is labor needed for production. We adopt the assumption, common to the literature on VI (Tirole, 1988; Pepall and

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[1]The extension requires numerical calculus.

Norman, 2001; Brocas, 2003; Lambertini and Rossini, 2003) that one unit of the final good requires one unit of the input (perfect vertical complementarity assumption).

Unit market wage is set to 1, while the technology of the LMF is linear in the labor input, making for $q = L$. Second stage equilibrium price and quantity of the UP firm are:

$$p^*_{UP} = a - \sqrt{2f}; \quad q^* = \sqrt{\frac{f}{2}}; \tag{5}$$

market price is nonnegative if $f \in \ ]0, \quad f_p = \frac{a^2}{2}]$, while individual profit (unitary value added minus wage) is non negative for:

$$f \in \ ]0, \quad f_a = \frac{(a-1)^2}{8}]. \tag{6}$$

The latter condition is more stringent than the former one (since $f_p \geq f_a$) and it may be interpreted as a participatory constraint for workers in the LMF to make them at least as well off as if they sold their labor services in the outside labor market.

By substitution we get:

$$p^*_{DW} = a - \sqrt{\frac{f}{2}} \tag{7}$$

which is nonnegative in the feasible set of parameters. Then, the equilibrium profit of the DW monopoly is:

$$\pi^*_{DW} = \frac{f}{2}. \tag{8}$$

Given that the LMF profit is total value added minus wages, the aggregate profits the two firms get with VD is:

$$\pi^*_{VD} = \pi^*_{DW} + \pi^*_{UP} = \frac{(a-1)\sqrt{2f} - 3f}{2}. \tag{9}$$

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Then, we calculate the profit of the integrated PMF monopoly:

$$\pi_{VI} = ((a - q_{VI})q_{VI} - q_{VI} - f). \tag{10}$$

Optimal quantity and price are:

$$q_{VI}^* = \frac{1}{2}(a - 1); \qquad p_{VI}^* = \frac{a + 1}{2}, \tag{11}$$

while the equilibrium profit is:

$$\pi_{VI}^* = \frac{1}{4}(a - 1)^2 - f, \tag{12}$$

that is nonnegative for $f \in (0, f_{VI} = \frac{1}{4}(a - 1)^2]$.

Comparison of the two vertical arrangements leads to:

$$\pi_{VI}^* - \pi_{VD}^* = \frac{(1 + (a - 6)a + 10\sqrt{2f} - 6f)}{4}. \tag{13}$$

By inspection of (13) we can get the following

Proposition 1 *With an LMF in the UP stage of production and a PMF in the DW stage, there is an interval in the feasible set of parameters, identified by the fixed cost, in which VD is superior to VI.*

Proof. Proving the proposition above requires evaluating (13) which is negative if $f \in [0, f_1 = \frac{1}{18}\left(53 + 3a(a - 6) - 10\sqrt{28 + 3a(a - 6)}\right)]$. If we compare f_1 with f_a, it appears that $f_1 \geq f_a$ if $a \leq 3.47$ and $a \geq 37.44$. In both cases we have that for $f \in [f_a, f_1]$ Then for $f \in [0, f_a]$ we have that non integration leads to larger aggregated profits, while for $a \in [3.47, 37.44]$ we have that $f_a \geq f_1$. In this second case we have that, in the feasible interval of parameters, two alternative scenarios appear: for $f \in [f_1, f_a]$ integration

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is better for firms, while, for $f \in [0, f_1]$, non integration provides higher aggregated profits for the two UP and DW firms. ∎

This implies that, in some interval of the parameters, the negative externality going from the DW monopoly market policy to the profits of the UP LMF, may be neutralized and even be turned into a positive one. This result does not occur when PMFs occupy both the UP and the DW stage of production.

If we go through the comparison of prices in the two production schemes we can easily show that the decentralized arrangement is privately more efficient but it is socially inferior since the market price is lower when firms vertically integrate. To see this just compare p^*_{DW} with p^*_{VI}. It may be easily checked that $p^*_{DW} \geq p^*_{VI}$ in the feasible set of parameters.

3 An integrated LMF competing with a vertically disintegrated mixed firm

In a parallel market arrangement, we have the same structure for the disintegrated industry, yet the vertically integrated counterpart is an LMF.

To analyze this case we start with the integrated LMF objective function:

$$v_{IN} = \frac{p_{INL} \, q_{INL} - f}{q_{INL}}. \tag{14}$$

The technology is the same as in the previous section. Then we get the optimal output $q^*_{INL} = \sqrt{f}$ and reduced form optimal profits:

$$\pi^*_{LMIN} = (a - 1)\sqrt{f} - 2f. \tag{15}$$

The difference between aggregated profits of the segmented market and those of the integrated LMF is:

$$\pi^*_{LMIN} - \pi^*_{VD} = (a-1)(1 + \frac{1}{\sqrt{2}})\sqrt{f} - f \qquad (16)$$

which is nonnegative for $f \in (0, \ f_2 = 2(3 + 2\sqrt{2})(a-1)^2]$.

Then we can write the following

Proposition 2 *VI always dominates VD when the integrated counterpart is a LMF. An integrated LMF is better than a disintegrated industry composed by an UP LMF and a DW PMF.*

Proof. Just go through the above statements and notice that $f_2 \geq f_a$. ∎

Here again the vertically integrated organization is socially preferred, as the comparison of market prices easily suggests.

4   Conclusions

We have gone through two instances of vertical production processes organized according to different vertical arrangements in which LMFs were involved. We have seen that the introduction of a firm with a heterogeneous objective function such as the LMF in the UP segment of a vertical production chain changes the size and the sign of the externality usually associated with double marginalization in the decentralized vertical production structure. It appears that non integrated firms may do better even in imperfect markets for both inputs and final goods. This result is reversed when the performance of the segmented industry is compared to an integrated LMF.

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The disintegrated organization of production remains in both instances socially inferior as compared to the integrated counterpart since market prices are lower with integration. This result emphasizes the existence of private incentives to outsource in vertical production processes when the producers of inputs may have either an LM-like or an entrepreneurial-like internal organization that mostly replicated the LMF paradigm. This is a very common event in cross-country production processes. Therefore this short analysis adds some fresh explanation to the worldwide outsourcing wave.

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