Monitoring of workers and product market competition: The role of works councils

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Abstract

We analyze whether firms benefit from the introduction of industry-wide rules that prevent them from monitoring their workers and setting efficient incentives. If workers are not monitored, incentive systems are inefficient and leave rents to the workers. As a result, firms implement lower efforts and, thus, lower outputs. This can be profitable since it acts like a mitigation of product market competition. The role of works councils is discussed as a means of enforcing non-monitoring rules.

Keywords: monitoring technology, incentives, works councils

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1 Introduction

Technological advancement allows firms to more closely monitor their workers’ actions than ever before. For instance, firms can acquire worker monitoring software to monitor all activities on both workers’ computers and workers’ cell phones. Such software not only enables firms to assess whether workers play games on their computers or surf in the internet instead of working productively, but also to track workers’ exact locations. Similarly, firms scan emails or use video surveillance to monitor their workers’ behavior.

Unsurprisingly, the growing use of monitoring technologies has led to a debate on how closely firms should be allowed to monitor their workers’ actions and on whether government intervention is needed to protect workers’ privacy. At first sight, it seems that this debate centers around two different kinds of arguments: economic arguments (e.g. higher worker productivity) in favor of extensive worker monitoring against ethical issues according to which workers’ privacy must be protected. Schmitz (2005), however, demonstrates that this is not necessarily true. In a contract-theoretical model, he finds that firms employ monitoring technologies not to increase efficiency, but rather to reduce rents that must be paid to the workers in the case of imperfect monitoring. He concludes that monitoring technologies may lead to inefficiencies and thus calls for laws protecting workers’ privacy.

Whereas in the US worker protection is rather weak, it is typically stronger within the EU. Consider Germany, where works councils are important institutions that provide workers with influence on the firm level, in particular, with respect to working conditions. Within the system of "co-determination" works councils have legally guaranteed influence on management decisions concerning working conditions in the firm. For instance, the law prescribes that worker representatives must give their consent to:

- any introduction of technologies that monitor the workers’ effort and output,
- wage incentive schemes,
- size of premia or the like.\(^1\)

Given the preceding arguments and the results in Schmitz (2005) it is puzzling that firm owners do not (more strongly) oppose this limitation of their control rights. In this paper, we resolve this puzzle by analyzing the interaction between internal organization and market conduct. In particular, we extend the analysis in Schmitz (2005) by considering product market competition between several firms (instead of restricting attention to a single firm). We argue that the system of co-determination can act as a commitment device of firms to mitigate product market competition. Without monitoring technologies which enable contracts directly contingent on effort, inducing

\(^1\)More precisely, a committee where workers and management have the same voting power must agree to that. Essentially, this implies a veto power for the workers. See the German Betriebsverfassungsgesetz, § 87 (1), no. 1, 6, 10, 11.
high effort by workers gets more costly. As a result, effort levels will be lower and so will be output. This may serve a similar purpose as quantity reduction in a cartel, and it may thereby increase firm profits. An implication is that laws protecting the privacy of workers may have unintended consequences by fostering collusion between firms.

There is by now a large literature on the interaction between worker representations and firm behavior. Dowrick (1989), Naylor (2002), and Lopez and Naylor (2004) discuss how bargaining over wages (and employment levels) between local unions and firm owners affects the market results in oligopoly. Kirstein and Kirstein (2009) analyze a situation where two firms can agree on a two-part tariff they offer to their workers. They show that this allows firms to implement the collusive outcome in a subsequent Cournot game by agreeing on a flat incentive scheme. Each firm would ex post like to switch to a steeper incentive contract, but to compensate for the higher piece rate, the firm would need to reduce the fixed wage component. To the extent that the ex ante contract fixes a minimum payment in either dimension (fixed and variable pay), this deviation is not possible.

There is also a line of literature that does not focus so much on wage negotiations but directly deals with the German system of "co-determination", in which works councils do not negotiate wages (this is usually done on the industry level by industry unions). Prominent examples are two important contributions by Kraft (Kraft (1998), Kraft (2001)). He looks at local unions that bargain only about the local employment level. He compares "bargaining" to "non-bargaining" firms, i.e., firms that have to bargain about the employment level with their workers, and those who do not. Surprisingly, he finds that it is the bargaining firms which earn higher profits. The reason is that the bargaining acts like a quantity pre-commitment, i.e., it grants a first-mover advantage à la Stackelberg. The interesting result is that it is a dominant strategy to bargain for the firms (and it also benefits the workers). Therefore, the subgame perfect equilibrium of a game where firms first can choose to bargain or not, and then compete in quantities in the market, is that all bargain. This makes firms worse off compared to a situation where they could commit not to bargain, and hence they would have an interest to abolish a system of co-determination that mainly implies negotiations about employment levels.

We complement this literature by focusing on the influence works councils have directly on the working conditions (instead of employment level negotiations). This allows us to rationalize why firms collectively can have an incentive to install industry-wide veto rights of workers against effective monitoring technologies.

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2Though firms do not directly negotiate employment levels with the works council (only "consult" with the works council, § 92a Betriebsverfassungsgesetz), they do have influence on personnel issues, for instance, in case of layoffs they can influence the "social criteria" for selecting the employees to be laid off (§ 102).
2 The model

Two firms with the same production technology produce a homogeneous good ("output") and sell this good on a market. In order to produce output, each firm needs to hire a worker. Each worker chooses effort $e_j \in [0,1]$, $j = 1,2$, which affects the level of output that the firm produces. A worker can produce either a low output level ($y_j = y_l$), or a high output level ($y_j = y_h > y_l$). The probability of the high output realization depends on the worker’s effort: $\text{prob}\{y_j = y_h\} = e_j$. Effort is costly and costs are given by $c_j = c(e_j)$, with $c : [0, 1] \rightarrow \mathbb{R}_+$ as an increasing and strictly convex function. We assume that $c(0) = 0$ and that $c'(1)$ is so high that the workers always finds it optimal to choose effort from the open interval $(0,1)$, i.e. all solutions are interior. The effort choice is private information of the worker. However, firms can install a costless monitoring technology which allows to write contracts contingent on effort choices. After having decided on installing the monitoring technology, each firm makes a take-it-or-leave-it contract offer to the corresponding worker. Workers’ reservation values are normalized to zero.

A firm’s revenue from selling its output depends on the own output level and that of the competing firm. We denote it as $\pi_j = \pi(y_j, y_k)$, with $k = 1,2$ and $k \neq j$, and define $
abla_{\ell} := \pi(y_l, y_l)$, $\pi_{hl} := \pi(y_h, y_l)$, $\pi_{lh} := \pi(y_l, y_h)$, $\pi_{hh} := \pi(y_h, y_h)$, $\Delta \pi_l := \pi_{hl} - \pi_{ll}$ and $\Delta \pi_h := \pi_{lh} - \pi_{lh}$. The two firms benefit from a joint coordination to low output levels. However, such coordination might not be stable because each firm gains from individually increasing its own output level. The following assumption captures these ideas.

**Assumption 1**

(i) $2\pi_{hh} < \pi_{hl} < 2\pi_{ll}$,  
(ii) $\Delta \pi_h, \Delta \pi_l > 0$

The following assumption ensures that the efforts which the firms induce the workers to choose are strategic substitutes. As a consequence, in a symmetric equilibrium the implemented effort level is always unique.

**Assumption 2** $\Delta \pi_h \leq \Delta \pi_l$

We start the analysis with the case that both firms have installed the monitoring technology. Then each firm orders the worker to choose some effort level $\hat{e}_j$ and pays him a fixed wage covering the effort costs, i.e. $\bar{w}_j = c(\hat{e}_j)$. The firm’s optimization problem becomes

$$\max_{\hat{e}_j \in [0,1]} \hat{e}_j \left( \hat{e}_k \pi_{hh} + (1 - \hat{e}_k) \pi_{hl} \right) + (1 - \hat{e}_j) \left( \hat{e}_k \pi_{lh} + (1 - \hat{e}_k) \pi_{ll} \right) - c(\hat{e}_j).$$

In what follows, we focus on symmetric equilibria. Then the profit maximizing effort level is given by:

$$(\hat{e}_k \pi_{hh} + (1 - \hat{e}_k) \pi_{hl}) - (\hat{e}_k \pi_{lh} + (1 - \hat{e}_k) \pi_{ll}) - c'\left(\hat{e}_j^*\right) = 0,$$
and due to symmetry, $\hat{e}_j^* = \hat{e}_k^* =: e_m$, this optimality condition simplifies to

$$\Delta \pi_I + e_m (\Delta \pi_h - \Delta \pi_I) - c'(e_m) = 0. \tag{1}$$

Each firm’s expected profit is given by

$$\Pi_m = e_m \pi_{lh} + (1 - e_m) \pi_{ll} + e_m (e_m \Delta \pi_h + (1 - e_m) \Delta \pi_I) - c(e_m). \tag{2}$$

Consider now the case, in which neither firm has installed the monitoring technology. Here, the incentive contract of the worker conditions on the output that the worker produces. In particular, each firm decides to pay the worker a bonus $b_j \geq 0$ if he produces high output, whereas his wage is zero otherwise. Worker $j$’s optimal effort then solves

$$\max_{e_j \in [0,1]} e_j b_j - c(e_j),$$

and it is characterized by the first-order condition

$$b_j = c'(e_j^*).$$

It is easy to see that the worker always receives a rent, i.e. an expected payoff exceeding his reservation value. Furthermore, this rent is increasing in the strength of incentives, $b_j$.

**Lemma 1** For any $b_j > 0$ we have $r(b_j) := e_j^* b_j - c(e_j^*) > 0$. Moreover, we have $r'(b_j) > 0$.

**Proof.** Note first that we have $e_j^* > 0$ if $b_j > 0$. Because of $c(0) = 0$ and strict convexity of $c$, any $e_j^* > 0$ satisfies

$$c(e_j^*) < c'(e_j^*) e_j^* = b_j e_j^*.$$

Moreover, we have

$$r'(b_j) = e_j^* + \frac{de_j^*}{db_j} b_j - c'(e_j^*) \frac{de_j^*}{db_j} b_j = e_j^* + \frac{de_j^*}{db_j} (b_j - c'(e_j^*)) = e_j^*$$

The lemma is very important for our results. It implies that the worker’s rent is increasing in the bonus payment. As a result, the firms decide to implement lower effort levels than in the situation, in which effort is directly contractible. To demonstrate this, note that the firm determines the worker’s effort by a specific choice of the bonus. We can therefore write the firm’s maximization problem as one over effort choice alone, bearing
in mind the condition $b_j = b_j \left( e_j^* \right)$ with $b_j' \left( e_j^* \right) > 0$. Define $k(e) := c(e) + r (b_j(e))$.

Then firm $j$ solves

$$
\max_{\tilde{e}_j \in [0, 1]} \tilde{e}_j \left( \tilde{e}_k \pi_{hh} + (1 - \tilde{e}_k) \pi_{hl} \right) + (1 - \tilde{e}_j) \left( \tilde{e}_k \pi_{lh} + (1 - \tilde{e}_k) \pi_{ll} \right) - k(\tilde{e}_j).
$$

In a symmetric equilibrium, the optimal effort level $e_{nm}$ is characterized by

$$
\Delta \pi_l + e_{nm} (\Delta \pi_h - \Delta \pi_l) - k'(e_{nm}) = 0. \quad (3)
$$

Because of $k'(e) > c'(e)$, comparing (1) and (3) immediately yields the following lemma which indicates that firms implement a lower level of effort if effort is not directly contractible.

**Lemma 2** $e_m > e_{nm}$

**Proof.** The proof is by contradiction. Let $e_m \leq e_{nm}$ which implies $c'(e_m) < k'(e_{nm})$. From (1) and (3), we obtain $\Delta \pi_l + e_{nm} (\Delta \pi_h - \Delta \pi_l) < \Delta \pi_l + e_{nm} (\Delta \pi_h - \Delta \pi_l)$, which together with $\Delta \pi_h \leq \Delta \pi_l$ gives us the desired contradiction. $\blacksquare$

We conclude the analysis of the no monitoring case by calculating firms’ expected profits that are given by

$$
\Pi_{nm} = e_{nm} \pi_{lh} + (1 - e_{nm}) \pi_{ll} + e_{nm} (e_{nm} \Delta \pi_h + (1 - e_{nm}) \Delta \pi_l) - k(e_{nm}). \quad (4)
$$

Let us now turn to a comparison of expected profit in the two different regimes. In general, each firm’s expected revenue can be written as

$$
E \pi(e) = e \pi_{lh} + (1 - e) \pi_{ll} + e (e \Delta \pi_h + (1 - e) \Delta \pi_l)
$$

Differentiating $E \pi$ with respect to $e$, we obtain

$$
E \pi'(e) = \pi_{lh} - \pi_{ll} + (e \Delta \pi_h + (1 - e) \Delta \pi_l) + e (\Delta \pi_h - \Delta \pi_l)
$$

$$
= \pi_{lh} - \pi_{ll} + \Delta \pi_l + 2e (\Delta \pi_h - \Delta \pi_l)
$$

$$
= \pi_{hl} + \pi_{lh} - 2\pi_{ll} + 2e (\pi_{hh} - \pi_{lh} - \pi_{hl} + \pi_{ll})
$$

$$
= (1 - e) (\pi_{hl} + \pi_{lh} - 2\pi_{ll}) + e (2\pi_{hh} - \pi_{lh} - \pi_{hl})
$$

From Assumption 1 part (i), we immediately obtain

**Lemma 3** $E \pi'(e) < 0$

Lemmas 1 to 3 indicate that there is a trade-off between two countervailing effects that determines whether or not firms prefer to install the monitoring technology. The monitoring technology allows firms to offer an incentive contract that avoids rent payments to the worker. While, at first sight, this seems to be desirable, it induces firms to implement higher effort levels, because incentives can be set more cheaply. As a result, both firms produce higher (expected) output and, hence, suffer from lower revenue. In the following, we are going to demonstrate circumstances under which the latter effect dominates and therefore firms will prefer not to install the monitoring technology.
Proposition 1 Let $\pi_{hl} = \hat{\pi}_{hl} + \varepsilon$ and $\pi_{ll} = \hat{\pi}_{ll} + \varepsilon$. A sufficient condition for non-monitoring to yield higher firm profits than monitoring is that $\varepsilon$ is sufficiently large.

Proof. (i) Since for the first order conditions for $e_{nm}$ and $e_m$ only the incentives to choose higher effort, $\Delta \pi_h$ and $\Delta \pi_l$, matter, $e_{nm}$ and $e_m$ remain unchanged with increases in $\varepsilon$. Hence, also the wage payments, $c(e_m)$ and $k(e_{nm})$ remain unchanged. (ii) The (expected) marginal revenue from effort $E\pi'(e)$

$$E\pi'(e) = (1 - e)(\pi_{hl} + \pi_{lh} - 2\pi_{ll}) + e(2\pi_{hh} - \pi_{lh} - \pi_{hl}),$$

is increasing in $e$, with slope $2(\Delta \pi_h - \Delta \pi_l)$ and intercept $E\pi'(0) = \pi_{lh} + \Delta \pi_l - \pi_{ll}$. (iii) Thus, an increase in $\varepsilon$ shifts downwards $E\pi'(e)$, thereby increasing the revenue difference without bounds as $\varepsilon \to \infty$. See Figure ??.

Proposition 1 demonstrates that the two firms may gain from (jointly) deciding not to install the monitoring technology. Not installing the monitoring technology makes inducing effort more expensive. Hence, equilibrium effort level is smaller, and hence it is more likely that the firms will earn $\pi_{ll}$ in the product market. If $\pi_{ll}$, which can be seen as the "prize" for coordinating on low output, becomes very large, non-monitoring will be more profitable than monitoring.

The following example puts more structure on the model, but it allows for additional insights. In particular, it shows that non-monitoring to be optimal does not depend on the "prize" of coordinating on low output to be huge. Even for an arbitrarily small "prize" (as long as Assumption 1 holds), non-monitoring can lead to higher firm profits due to lower wage costs.

Let $c(e) = 0.5e^2$, with $c > \Delta \pi_h$ to ensure that optimal effort always lies within the interval $(0, 1)$. Then, we have $k(e) = eb = ec'(e) = ce^2$ and it follows that

$$e_m = \frac{\Delta \pi_l}{c + \Delta \pi_l - \Delta \pi_h}$$

$$e_{nm} = \frac{\Delta \pi_l}{2c + \Delta \pi_l - \Delta \pi_h}$$

$$c(e_m) = \frac{c \cdot (\Delta \pi_l)^2}{2(c + \Delta \pi_l - \Delta \pi_h)^2}$$

$$k(e_{nm}) = \frac{c \cdot (\Delta \pi_l)^2}{(2c + \Delta \pi_l - \Delta \pi_h)^2}$$

Since non-monitoring always yields higher revenues, a sufficient condition for non-monitoring to be optimal is that wage costs are smaller under non-monitoring: $k(e_{nm}) \leq \ldots$
This can be rewritten as:

\[
\frac{c \cdot (\Delta \pi_{l})^2}{(2c - \Delta \pi_{h} + \Delta \pi_{l})^2} \leq \frac{c \cdot (\Delta \pi_{l})^2}{2(c - \Delta \pi_{h} + \Delta \pi_{l})^2} \quad \Leftrightarrow \quad 2(c - \Delta \pi_{h} + \Delta \pi_{l})^2 \leq (2c - \Delta \pi_{h} + \Delta \pi_{l})^2
\]

\[
c > \Delta \pi_{h} - \Delta \pi_{l} \left( \sqrt{2} - 1 \right) (\Delta \pi_{l} - \Delta \pi_{h}) \leq \left( 2 - \sqrt{2} \right) c
\]

This condition is fulfilled if \( \Delta \pi_{l} - \Delta \pi_{h} \) is sufficiently small or if \( c \) is sufficiently large. For both conditions, the intuition is similar. In terms of wage costs, the disadvantage of non-monitoring is that an information rent has to be paid. The advantage is that lower effort is implemented, and hence less effort needs to be compensated. If the latter effect dominates, wage costs are lower with non-monitoring. This is the case if the effort cost function is very convex, i.e., if \( c \) is large, since implementing high effort becomes costly in particular under non-monitoring (the ratio \( e_{m}/e_{nm} \) is increasing in \( c \)). The latter effect also dominates if \( \Delta \pi_{l} - \Delta \pi_{h} \) is very small. \( \Delta \pi_{h} \) is the return on implementing high effort if the other firm has chosen high effort, too. This is relevant in particular under monitoring, since in this case higher effort levels are implemented, and therefore each firm knows that more frequently its opponent produces high output. Therefore, a large \( \Delta \pi_{h} \) leads to high equilibrium effort under monitoring. By similar reasoning, a low \( \Delta \pi_{l} \) leads to a low effort under non-monitoring. Hence, effort will be much smaller under non-monitoring than under monitoring if \( \Delta \pi_{l} - \Delta \pi_{h} \) approaches zero, and wages will be smaller under non-monitoring.

3 Discussion

We have shown that there are circumstances under which firms gain from collectively abstaining from installing a monitoring technology, even if it is costless. However, firms might well gain from deviating by having it installed unilaterally. In order for non-monitoring to be stable, a commitment device is needed. A possibility, as outlined in the introduction, is the industry-wide adoption of works councils that are provided with veto power against monitoring technologies. Since workers also gain from not being monitored (since this allows for an information rent) also workers are happy to agree to such an arrangement. Clearly, this "collusion" encompassing firms and workers of the industry has to be paid by consumers. In a similar vein, laws that are aimed at protecting workers' privacy could have unintended effects by fostering collusion between firms at the expense of consumers.

The effect discussed in this note could also be investigated empirically. Some empirical results indicate that indeed industries with works councils have a higher profitability, as suggested by our model (see Mueller (2009)). One way to identify our effect would be to compare industries acting on national markets (where all competitors are subject
to the German law and have a works council with veto power) to firms acting in international markets. Only for the former, works councils should have a positive impact on profits. We plan such empirical research for the future.

References


