Segment Disclosure under the Management Approach: The Impact of Proprietary Costs on Internal Reporting Decisions

Georg Schneider and Andreas Scholze

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ABSTRACT

Accounting standards for external segment reporting purposes stipulate aggregation of information in line with the internal structure of the firm. This method of segment reporting is referred to as the "management approach". In this paper, we analyze the optimal disclosure of proprietary information when firms face a competitive threat from potential entrants into an industry. If external segment reporting and internal information structure have to be aligned, then the incumbent faces a trade-off. On the one hand, disaggregate information allows for an efficient allocation of resources but eventually attracts competition by revealing proprietary information to potential entrants. On the other hand, aggregate information implies inefficient decisions but eventually prevents competitors from entering the market. Our results show that aggregation arises because it can be an instrument to prevent a competitor from entering the market. But aggregate information can even be optimal if the competitor's market entry cannot be avoided. In this case, aggregate information serves as a commitment device to reduce the intensity of competition.

1 Introduction

In 2006, the International Accounting Standards Board (IASB) issued IFRS 8, *Operating Segments*, which replaces IAS 14, *Segment Reporting*. IFRS 8 fundamentally changes the manner

in which firms provide segment information. Under this standard, firms must identify operating segments for external reporting purposes in the same manner that management views operating segments for internal decision-making purposes. This method of segment reporting is referred to as the "management approach", whereas IAS 14 required a firm to identify segments using a "risks and rewards approach". The IASB believes that adopting the management approach will improve financial reporting, because it allows users of financial statements to review operations "through the eyes of management". However, the IASB's main reason for issuing IFRS 8 was to align segment reporting with the requirements of SFAS No. 131 as part of the IASB's convergence project with the Financial Accounting Standards Board (FASB). In 1997, the FASB issued SFAS 131 that supersedes the previous segment-reporting rules under SFAS 14.[1] The FASB's primary motivation for the change in segment reporting from the industry approach to the management approach was to address concerns expressed by analysts and users that discretion in regard to segment definition allowed managers to report more aggregated segment information to external users than what was reported internally. Disaggregated data are extremely important to financial statement users. Epstein and Palepu (1999) report that in a survey of analysts, a majority considered segment performance data followed by the three financial statements as the most useful data for their investment decisions. The FASB believed that the management approach is to provide more disaggregated information and is, therefore, preferable to the industry approach.

Subsequent empirical studies report that the FASB was basically right. Firms disclose slightly more segments under the management approach than under the old reporting regimes, e.g. Herrmann and Thomas (2000); KPMG (2010)). Furthermore, Berger and Hann (2003) find that adoption of the management approach resulted in 23% of their sample firms disclosed more segments in their restated report than in their original, implying that about three out of four firms did not change the number of segments reported upon adoption of the management approach. At first sight, this result suggest that for more than 75% of the sample firms operating segments for external disclosure purposes have already been aligned with the internal reporting system.

However, during the SFAS No. 131 debate, competitive harm was raised as a significant cost associated with segment disclosures. Managers face proprietary costs of segment disclosure if the revelation of a segment that earns high abnormal profits attracts more competition and, hence, reduces the abnormal profits. Preparers argued that proprietary information such as cost structure information might be inferred from disaggregated

1 SFAS 14 is FASB Statement No. 14, *Financial Reporting for Segments, of a Business Enterprise*, and has been issued in 1976. SFAS 131 is FASB Statement No. 131, *Disclosures about Segments of an Enterprise and Related Information*, and has been issued in 1997.

information. In support of this claim, Botosan and Stanford (2005) provide evidence that the managers of firms forced to initiate segment disclosures under the management approach withheld segment information under the industry approach for competitive reasons. It was even argued that firms may change their organizational structure to avoid segment reporting, thereby mitigating the proprietary costs of disclosure.[2] Further evidence is provided by Ettredge et al. (2002) who investigated firms' responses on the Exposure Draft (ED) that preceded SFAS No. 131. Their results consistently indicate that manager's lobbying positions on the ED are explained by costs potentially imposed on them due to expected competitive harm related to increased disclosures rather than by the information benefits to investors from the new required disclosures. In particular, 86% of the responding industrial firms oppose the ED. Over 76% who were against the segmental disclosures in the ED asserted that the new requirement would put them at competitive disadvantage. In the appendix of their study, Ettredge et al. (2002) provide some representative examples of opposing arguments, e.g.

> "Being a leader in our industry, providing additional information to our competitors, puts us at a competitive disadvantage. The additional information provided for by this exposure draft is much more useful to our competitors than to the financial community in general." (Carnival Corporation)

or

> "If the concern with disclosing competitively harmful information is not addressed, companies may change how they manage the business to avoid disclosing this data. ... [A]ccounting standards should not drive this type of behavior." (Caterpillar Inc.)

Finally, Graham et al. (2005) conducted a comprehensive survey among 400 CFOs to describe their choices related to reporting voluntary disclosure. About 60% of survey respondents agree that giving away company secrets is an important barrier to more voluntary disclosure. CFOs do not want to explicitly reveal proprietary information "on a platter" to competitors, even if such information could be partially inferred from other sources. Interestingly, a majority of CFOs are willing to sacrifice economic value to manage financial reporting perceptions.

This paper provides an analytical explanation for the view that firms withhold segment details for competitive reasons under the management approach. In particular, we ask

2 A Director of Accounting at Coopers & Lybrand is quoted as stating "I've heard ... that some companies may make some internal reporting changes to get the segment groupings they want, mostly to reduce competitive harm" (Springsteel , 1998, p. 85).

the question whether firms do have an incentive to sacrifice economic value in order to avoid disclosing proprietary information to its competitors. Our analysis is based on a simple duopoly setting with Cournot quantity competition and cost uncertainty. One firm, the incumbent, initially operates as a monopolist in two markets. The individual cost of providing each unit of product is independently and identically distributed in both markets and can be either high or low. Another firm, the competitor, may enter one market and compete with the incumbent, depending on the segment information disclosed by the incumbent. Ex ante, the incumbent has to decide whether to disclose disaggregate information – thereby revealing the cost structure of each market separately –, or to disclose aggregate information. Under the management approach, external reporting and internal information structure have to be aligned. Hence, the incumbent faces the following trade-off: disaggregate segment reporting allows for an efficient allocation of resources on both markets but makes it possible for the competitor to enter one market if unit cost of production is low, thereby lowering the expected profits of the incumbent. In contrast, aggregate segment reporting implies inefficient decisions on both markets but eventually prevents the competitor from entering the market. Our results show that aggregate information can be an instrument to prevent the competitor from entering the market. But aggregate information can even be optimal if the competitor's market entry cannot be avoided. In this case, aggregate information serves as a commitment device to reduce the intensity of competition.

2 Model

We consider the reporting incentives of a firm, referred to as the *incumbent*, that operates on two markets j, where $j \in \{1, 2\}$. On market $j = 2$ the incumbent firm faces the risk that another firm, referred to as the *competitor*, may enter the market. Each of the firms is led by a manager that makes the production decision. The marginal cost of production is constant[3] and equals $\tilde{k}_j$ per unit. The random variables $\tilde{k}_1$ and $\tilde{k}_2$ are independently and identically distributed. More precisely, $\tilde{k}_j$ can take two values, $k > 0$ with probability $\phi > 0$ and 0 with probability $1 - \phi$. Hence, the expected marginal production costs are identical for both markets and equal ϕk. Inverse demand is given by $p(X_j) = a_j - X_j$, where X_j and $p(X_j)$ represent total output and price, respectively, in market j. To avoid unnecessary case distinctions we assume that $a_j > k$.

The incumbent firm is a monopolist in market 1. Therefore, his profits in market 1 equal

3 As (Schmalensee , 1987, p. 353) argues, "The assumption of constant unit costs and neglect of capacity constraints is consistent with a focus on long-lived differences in costs."

$\tilde{\Pi}_1^I = (a_1 - x_1^I - \tilde{k}_1)x_1^I$, where x_1^I is output produced by the incumbent.[4] Similarly, if the competitor does not enter market 2, the incumbent's profits are given by $\tilde{\Pi}_2^I = (a_2 - x_2^I - \tilde{k}_2)x_2^I$. If the incumbent faces competition in market 2, then total output is equal to $X_2 = x_2^I + x_2^E$, where x_2^E is the competitor's quantity sold.[5] We assume that the competitor's profit equals $\tilde{\Pi}_2^E = (a_2 - x_2^E - \gamma\tilde{k}_2)x_2^E$. The parameter $\gamma > 0$ reflects the relative production efficiency of providing each unit of output in market 2 between the incumbent and the competitor, with higher γ indicating greater efficiency.[6]

While the incumbent firm has perfect information about the marginal production costs in both markets when making the production decisions the competitor can only obtain information about these costs by analyzing the incumbents financial reports.[7] However, according to the requirements of the management approach the incumbent has to decide about the optimal internal reporting structure, thereby taking into account that the firm's internal reporting system has to be aligned with the external segment disclosure report. In particular, the incumbent has to choose either a *disaggregated information system*, or an *aggregated information system*.

(i) The disaggregated information system reports the marginal production costs for each market separately. Hence $\{\tilde{k}_1, \tilde{k}_2\}$ is known to both, the incumbent (via the internal reporting structure) and to the competitor (via segment disclosure).

(ii) The aggregated information system only reveals the sum of the unit cost of production figures in both markets, that is $\{\tilde{k}_1 + \tilde{k}_2\}$. Since unit cost of production in each market j can only be high, $\tilde{k}_j = k$, or low, $\tilde{k}_j = 0$, the true cost in each market can nevertheless be inferred under aggregate information if either $2k$ or 0 is reported. However, this is not the case if $\tilde{k}_1 + \tilde{k}_2 = k$ is reported, since this implies either $\{\tilde{k}_1, \tilde{k}_2\} = \{0, k\}$ or $\{\tilde{k}_1, \tilde{k}_2\} = \{k, 0\}$ with equal probability.

The time line is as follows. At $t = 0$ the manager the incumbent firm has to choose the reporting structure (aggregated vs. disaggregated information). At $t = 1$ the manager obtains reports about the incumbent firm's cost structure according to the information system specified at $t = 0$. Also, the competitor obtains this information via the incumbent's financial reports. Based on this information the competitor decides whether or not to enter market 2. Finally, at $t = 2$ both firms make their production decisions and profits realize.

4 Hereafter we use the superscript I to denote the incumbent and the superscript E to denote the competitor.

5 Our assumption implies that the products in market 2 are perfect substitutes.

6 This exogenously determined magnitude is assumed to arise from a unique sustained competitive advantage that is not susceptible to imitation or substitution the competitor. For further discussion on this issue see (Makadok , 2010, p. 357).

7 This can be motivated by assuming that (i) marginal costs do not change between periods and (ii) the incumbent (in contrast to the competitor) has experience from prior periods.

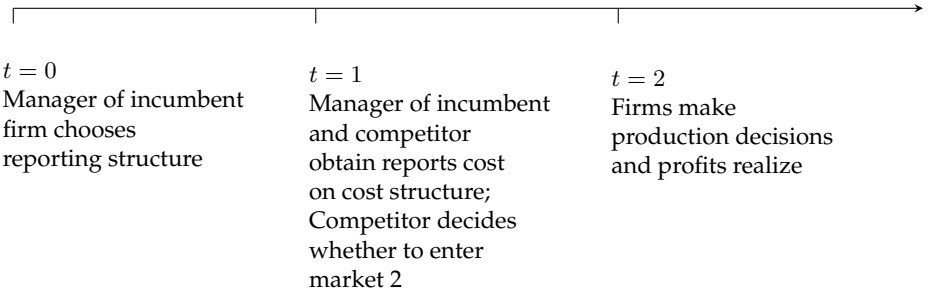

Figure 1: Time line

3 Analysis

3.1 Benchmark: Optimal Reporting and no market entry

In this section, we consider as a benchmark case the setting in which no competitor is present. As a monopolist, the incumbent chooses the production volume that maximizes his profits. Under *disaggregate information* the incumbent's expected profit in market j equals:[8]

$$\Pi^I_{j,d} = \phi\frac{(a_j - k)^2}{4} + (1-\phi)\frac{a_j^2}{4} \qquad j \in \{1,2\}. \tag{1}$$

Under *aggregate information* the incumbent maximizes profit based on expected costs, ϕk. Hence, profit in market j equals:

$$\Pi^I_{j,a} = \frac{(a_j - \phi k)^2}{4} \qquad j \in \{1,2\}. \tag{2}$$

Using equation (1) and equation (2), the benefit to the incumbent of choosing disaggregate information over aggregate information in market j is given by

$$\Pi^I_{j,d} - \Pi^I_{j,a} = \frac{(1-\phi)\phi k^2}{4} \qquad j \in \{1,2\}. \tag{3}$$

Therefore, if there is no potential competitor, we obtain the following proposition.

Proposition 1 *The incumbent (weakly) prefers disaggregate information to aggregate information.*

Proof: The preceding statement is a direct result of the convexity of the profit function with respect to unit cost. Hence, profit based on expected cost is always smaller than expected

8 Hereafter we use the subscript d to denote *disaggregated information* and the subscript a to denote *aggregate information*, respectively.

profit, i.e. $\Pi^I_{j,d} - \Pi^I_{j,a} \geq 0,\ j \in \{1,2\}$ for any $\phi \geq 0$, with strict inequality signs for $\phi > 0$. ■

The above proposition is consistent with Blackwell's theorem. Since there is no potential competitor, the incumbent faces a single decision maker setting. In such a setting Blackwell's theorem states that more precise information has a (weakly) positive economic value. Since disaggregated information represents more precise information than aggregated information the incumbent (weakly) prefers disaggregated information. Conversely, aggregated information is never beneficial. However, the above Proposition states more than that. The value of aggregated information is strictly negative whenever the probability distribution of the marginal costs is non-trivial (i.e. $\phi \neq 0, 1$). Note, that in the trivial cases $\phi = 0$ and $\phi = 1$ aggregated and disaggregated information are obviously equivalent, since in both cases the marginal costs are ex ante known to the incumbent independent of the reporting structure.

To summarize, in the benchmark scenario it is not possible to explain the empirical evidence that firms withhold information by reporting aggregated segment information. In the following section we include the potential competitor in our analysis. Therefore, the incumbent does not face a "single decision making" setting anymore and hence there is hope that the conclusions of Blackwell's theorem are no longer valid. This may give aggregated information a strictly positive value.

3.2 Optimal Reporting structure with potential market entry

As mentioned before we include a potential competitor in this section. It is obvious that in case of disaggregated information the competitor will always enter market 2 if the costs in market 2 equal $\tilde{k}_2 = 0$. This can be explained as follows. If the incumbent discloses disaggregated information the competitor can infer the costs in market 2. If $\tilde{k}_2 = 0$ then the magnitude of the relative production efficiency, γ does not matter. The competitor's profits equal $\tilde{\Pi}^E_2 = (a_2 - x^E_2)x^E_2$ and these profits are symmetric to the one of the incumbent. Hence, for the equilibrium outputs the competitor has incentives to enter market 2.

As it turns out in the analysis, not the absolute values of a_2 and k but only the ratio $\theta \equiv \frac{a_2}{k}$ matters. Hence, for notational convenience, we use θk instead of a_2.

3.2.1 Relative Production Efficiency is large

If the competitor enters market 2, both firms compete over quantities. In a Cournot duopoly, the incumbent's equilibrium amount produced equals $x^I_2 = (\theta k - (2-\gamma)\tilde{k}_2)/3$,

whereas the competitor's optimal amount produced is equal to $x_2^E = (\theta k - (2\gamma - 1)\tilde{k}_2)/3$ if disaggregated information is disclosed. Initially, we assume that the competitor only enters the market if disaggregated information is available and marginal production costs in market 2 equal $\tilde{k}_2 = 0$. Concretely, we assume that the competitor does not enter market 2 if aggregated information is disclosed. The following requirement ensures this assumption.

Assumption 3.1 *The relative production efficiency γ satisfies*

$$\gamma \geq \frac{1}{2} + \frac{\theta}{2\phi}. \tag{4}$$

In the following we say that the relative production efficiency is *large* whenever Assumption 3.1 is satisfied. Assumption 3.1 implies that in case of aggregated information the competitor does not enter the market. This can be seen as follows. The reaction function of the incumbent satisfies

$$x_2^I(x_2^E) = \frac{\theta k - x_2^E - \phi k}{2}.$$

Similarly, the competitor's reaction function is given by

$$x_2^E(x_2^I) = \frac{\theta k - x_2^I - \gamma\phi k}{2}.$$

Solving this system of equations yields

$$x_2^E = \frac{[\theta - (2\gamma - 1)\phi]\, k}{3}. \tag{5}$$

The competitor's profits are positive as long as $x_2^E \geq 0$. This is satisfied whenever $\theta - (2\gamma - 1)\phi \geq 0$.

The competitor enters the market whenever he can generate positive profits. Consequently, reversing the above inequality shows that the competitor does not enter market 2 if and only if Assumption 3.1 is satisfied. The following proposition summarizes this result.

Proposition 2 *In case of aggregated information the competitor does not enter market 2 if and only if Assumption 3.1 is satisfied.*

Since $\theta > 1$, inequality (4) implies $\gamma > 1$, that is the competitor faces higher costs of providing one unit of output than the incumbent. Let $\gamma^*(\theta, \phi)$ be the threshold-value given

by

$$\gamma^*(\theta, \phi) = \frac{\phi + \theta}{2\phi}.$$

Note that $\gamma^*(\theta, \phi)$ is increasing in both θ and ϕ. If market 2 becomes more attractive (θ increases) the threshold-value increases. Also, $\gamma^*(\theta, \phi)$ decreases with the probability ϕ. Since with increasing ϕ the probability of high costs rises and market entry gets less attractive.

Next, we calculate the incumbent's profits for both reporting regimes. As mentioned before, under *disaggregate information*, the competitor does not enter market 2 if $\tilde{k}_2 = k$. Thus, the incumbent still serves as a monopolist in the market and produces an equilibrium amount of $x_2^I = (\theta - 1)k/2$, yielding profits of $\Pi_2^I = ((\theta - 1)k)^2/4$. In the case of $\tilde{k}_2 = 0$ the competitor enters the market. The incumbent's equilibrium output equals $x_2^I = (\theta k)/3$. Therefore, his profits equal $\Pi_2^I = (\theta k)^2/9$. Hence, the incumbent's expected profits are

$$\Pi_{2,d}^I = \phi \frac{((\theta - 1)k)^2}{4} + (1 - \phi)\frac{(\theta k)^2}{9}. \tag{6}$$

Under *aggregate information*, the competitor does not enter the market, as shown in Proposition 2. Hence, the incumbent serves as a monopolist. He maximizes profit based on expected cost, ϕk, and optimally produces $x_2^I = (\theta - \phi)k/2$. His profits equal

$$\Pi_{2,a}^I = \frac{((\theta - \phi)k)^2}{4}. \tag{7}$$

In total, the benefit to the incumbent of aggregate information in market 2 is given by the difference of equation (7) and equation (6)

$$\Delta_{2,a-d}(\phi, \theta, k) \equiv \Pi_{2,a}^I - \Pi_{2,d}^I = (1 - \phi)\frac{(5\theta^2 - 9\phi)k^2}{36}. \tag{8}$$

The following Observation demonstrates how the optimal reporting structure in market 2 depends on ϕ and θ.

Observation 1 *Suppose the relative production efficiency between the incumbent and the competitor is large. Then there exist $\hat{\phi}(\theta) = (5/9)\theta^2$ and $\hat{\theta} = (3/5)\sqrt{5}$ such that*

$$\Delta_{2,a-d}(\phi, \theta, k) \begin{cases} \geq 0 & \iff \phi \leq \hat{\phi}(\theta) \\ \leq 0 & \iff \phi \geq \hat{\phi}(\theta). \end{cases} \tag{9}$$

for all $\theta \leq \hat{\theta}$, whereas $\theta \geq \hat{\theta}$ implies $\Delta_{2,a-d} \geq 0$, regardless of ϕ.

Proof: Since $\phi > 0$ and $k > 0$, $\hat{\phi}$ follows immediately by setting equation (8) to zero. Furthermore, $\phi \leq 1$ implies $\hat{\theta} \approx 1.34$ by setting $\hat{\phi}(\theta) = (5/9)\theta^2$ equal to one. ■

According to Observation 1, the optimal reporting structure in market 2 only depends on ϕ and θ. Note in particular that the sign of $\Delta_{2,a-d}(\phi, \theta, k)$ is independent of k. Since $\hat{\phi}(\theta)$ is increasing in θ, the incumbent prefers disaggregated information to aggregated information if either the attractiveness of market 2, i.e. θ is small, or if the market entry of the competitor is unlikely, i.e. ϕ is high. For all other combinations of ϕ and θ, the incumbent strictly prefers aggregated information to disaggregated information in market 2. Since $\phi \leq 1$, aggregated information always dominates disaggregated information if the size of market 2 relative to the unit cost of production is sufficiently large, in fact for all $\theta \geq 1.34$.

To summarize, under Assumption 3.1 the advantage of aggregated information is that the competitor does not enter market 2. But this is not always the case. A disaggregated information system is still optimal whenever market 2 is not important enough and the probability of market entry in case of disaggregate information, $1 - \phi$, is high enough.

In order to choose the optimal information structure, the incumbent has to consider the effect of a certain disclosure strategy in both markets. Market entry in market 2 does not affect the situation in market 1. Hence, the net benefit of aggregate information is then given by

$$\Delta_{a-d} = \Delta_{2,a-d} - \underbrace{\left(\Pi^I_{1,d} - \Pi^I_{1,a}\right)}_{\geq 0}. \tag{10}$$

Using equation (3) and equation (8) in equation (10) yields

$$\Delta_{a-d}(\phi, \theta, k) = (1 - \phi)\frac{(5\theta^2 - 18\phi)k^2}{36}. \tag{11}$$

The following Proposition demonstrates, how the overall optimal reporting structure depends on ϕ and θ.

Proposition 3 *Suppose the relative production efficiency between the incumbent and the competitor is large. Then there exist*

$$\phi^*(\theta) = \frac{5}{18}\theta^2 \tag{12}$$

such that for all $\phi \leq \phi^*$ the aggregate information system is optimal.

Proof: Since $\phi > 0$ and $k > 0$, ϕ^* follows immediately by setting equation (11) to zero. Furthermore, $\phi \leq 1$ implies $\Delta_{a-d} \geq 0$ for all $\theta \geq (3/5)\sqrt{10} \approx 1.9$, regardless of ϕ. ■

The above Proposition can be interpreted along the lines of Observation 1. As in Observation 1 Proposition 3 states that the optimal overall reporting structure only depends on ϕ and θ. The sign of $\Delta_{a-d}(\phi, \theta, k)$ is independent of k. Also, the incumbent prefers aggregated information to disaggregated information if either the attractiveness of market 2 is large or if the competitor is likely to enter market 2, i.e. ϕ is low. The incumbent always prefers disaggregated information to aggregated information, regardless of ϕ, if the size of market 2 is sufficiently large, relative to the unit cost of production, in particular for values $\theta \geq 1.9$. On market 1 the incumbent still faces a monopoly. Hence, we still have a "single decision maker" setting in this market. Therefore, on market 1 disaggregated information is (weakly) optimal.

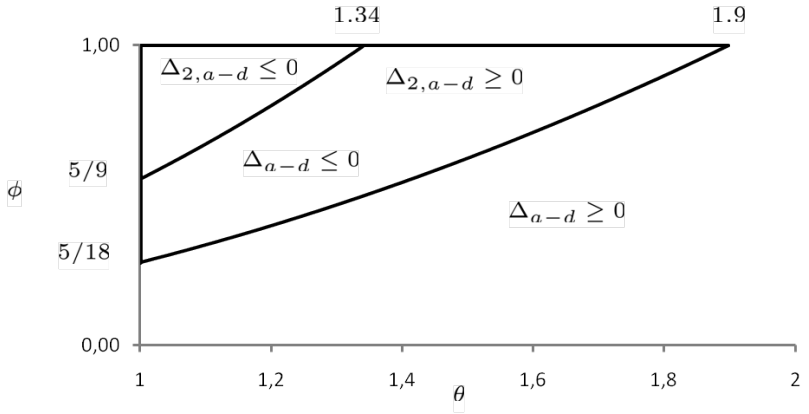

Figure 2: Set of combinations of $\{\phi, \theta\}$ outside the triangular area imply aggregate information as being the overall optimal reporting structure for both markets

As shown in figure 2, aggregated information overall dominates disaggregated information for all combinations of ϕ and θ outside the triangular area. Note that Observation 1 implies $\phi^* = (1/2)\hat{\phi}$ such that for all $\phi^* \leq \phi \leq \hat{\phi}$, disaggregated information is still overall optimal, although aggregate information dominates disaggregate information in market 2. Furthermore, it can be shown that

$$\frac{\partial \Delta_{a-d}}{\partial \phi} \leq 0 \qquad \text{for} \qquad \phi \leq \phi^*.$$

This result can intuitively explained as follows. Under disaggregated information, the competitor will enter market 2 with probability $1-\phi$. The incumbent chooses the inefficient aggregate information system in order to prevent the competitor from entering the market.

As ϕ increases, the competitor's market entry in case of disaggregated information will be less likely. Hence, the advantage of aggregate information diminishes accordingly.

As an example, let unit cost of production in the bad state be equal to $k = 100$. Figure 3 then shows Δ_{a-d} as a function of $\phi \geq 0.4$, and for two different values of θ.

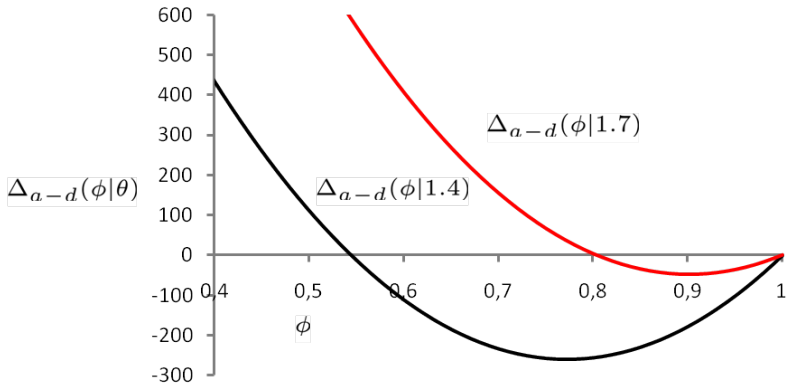

Figure 3: Net benefit of aggregate information as a function of ϕ if the relative production efficiency is large

For $\theta = 1.4$ aggregate information dominates disaggregate information if $\phi \leq (5/18) \times 1.4^2 = 0.54$, whereas $\phi \leq 0.8$ is required for $\theta = 1.7$. In order for Assumption 3.1 to be satisfied, we have to have $\gamma \geq 1.8$ in the first case and $\gamma \geq 1.56$ in the second case, respectively. Thus, in the first case we require the incumbent's relative production efficiency to be higher than in the second case. Suppose the competitor faces unit cost of production twice as large as compared to the incumbent, i.e. $\gamma = 2$. Furthermore, assume $\phi = 0.5$. Now, in the first setting ($\theta = 1.4$), Assumption 3.1 is satisfied. The incumbent chooses aggregate information according to Proposition 3, and the incumbent does not enter market 2. But in the second setting, however, for $\theta = 1.7$ we have to have $\gamma \geq 2.2$ and Assumption 3.1 is violated.

To summarize, under Assumption 3.1 aggregated information can be used as an instrument to avoid competition. This is consistent with practitioners' critique concerning the introduction of IFRS 8. In the following subsection we will show that it may be possible that the aggregated information may even be beneficial in cases where it attracts competition.

3.2.2 Relative Production efficiency is small

In the last subsection we examined a setting where the competitor will enter market 2 only in case of disaggregated information if and only if the costs in market 2 equal $\tilde{k}_2 = 0$. By assumption, in case of aggregated information the incumbent's relative production efficiency was high enough in order to prevent the competitor from entering market 2. Now, we relax this Assumption.

Assumption 3.2 *The relative production efficiency γ satisfies*

$$\frac{1}{2} + \frac{\theta}{2} \leq \gamma \leq \frac{1}{2} + \frac{\theta}{2\phi}. \tag{13}$$

In the following we say that the relative production efficiency is *small* whenever Assumption 3.2 is satisfied. Assumption 3.2 implies that in case of aggregated information the competitor does enter market 2. Using equation (5), it can be seen that the competitor's output produced is positive as long as $\gamma \leq \frac{1}{2} + \frac{\theta}{2\phi}$. The following proposition summarizes this result.

Proposition 4 *In case of aggregated information the competitor does enter market 2 if and only if Assumption 3.2 is satisfied.*

In order to eliminate the uninteresting case where the competitor always enters market 2, we restrict γ to be greater than $\frac{1}{2} + \frac{\theta}{2}$. Using $\phi = 1$ in equation (5), then the competitor's profits are positive as long as $\theta - (2\gamma - 1) \geq 0$. The competitor enters the market whenever he can generate positive profits. Consequently, reversing the above inequality shows that the competitor will not enter market 2 in case of disaggregated information if and only if the costs in market 2 equal $\tilde{k}_2 = k$.

Next, we calculate the incumbent's profits for both reporting regimes. As in the last setting, under *disaggregate information*, the competitor does enter market 2 if and only if $\tilde{k}_2 = 0$. Hence, the incumbent's expected profits are still described by equation (6). Under *aggregate information* the competitor does enter market 2, as shown in Proposition 4. The incumbent maximizes profit based on expected cost, ϕk, and produces an equilibrium amount of $x_2^I = ((\theta - (2 - \gamma)\phi)k/3$. His profits equal

$$\Pi_{2,a}^I = \frac{\left((\theta - (2 - \gamma)\phi)\, k\right)^2}{9}. \tag{14}$$

In total, the benefit to the incumbent of aggregate information in market 2, $\Delta_{2,a-d}$, is given by the difference of equation (14) and equation (6). Market entry in market 2 does not affect the situation in market 1. Hence, the net benefit of aggregate information is given by subtracting $\Pi^I_{1,d} - \Pi^I_{1,a}$ from $\Delta_{2,a-d}$ yielding

$$\Delta_{a-d}(\phi, \theta, k, \gamma) = \frac{\phi k^2(2\theta + 8\theta\gamma + 25\phi - 16\phi\gamma + 4\phi\gamma^2 - 5\theta^2 - 18)}{36}. \tag{15}$$

The following proposition demonstrates, how the overall optimal reporting structure depends on ϕ, θ and γ.

Proposition 5 *Suppose the relative production efficiency between the incumbent and the competitor is small. Then there exist*

$$\phi^*(\theta, \gamma) = \frac{18 + 5\theta^2 - 2\theta - 8\theta\gamma}{(25 - 16\gamma + 4\gamma^2)} \tag{16}$$

such that for all $\phi^* \leq \phi \leq \frac{\theta}{2\gamma - 1}$ the aggregate information system is optimal.

Proof: Since, $\phi > 0$ and $k > 0$, ϕ^* follows by setting equation (15) to zero. The upper bound for ϕ is implied by Assumption 3.2. It can be obtained by solving $\gamma = \frac{1}{2} + \frac{\theta}{2\phi}$ for ϕ. ■

According to Proposition 5, the optimal overall reporting structure now depends on ϕ, θ and γ. The sign of $\Delta_{a-d}(\phi, \theta, k, \gamma)$ is independent of k. Interestingly, Proposition 5 combined with Proposition 4 states that for $\phi \geq \phi^*$ the incumbent optimally chooses the aggregated information system even so he cannot prevent the competitor from entering market 2. In contrast to the previous setting, with relative production efficiency being small, aggregated information does not serve as an instrument to avoid competition but rather as a commitment device to reduce the intensity of competition. This can be explained as follows. Under disaggregated information, the competitor will enter market 2 with probability $1 - \phi$. In this case, the incumbent's relative production efficiency, γ, does not matter, because $\tilde{k}_2 = 0$. Under aggregated information, however, the competitor will always enter market 2. Hence, by choosing the inefficient information system, the incumbent can force the competitor to include his efficiency disadvantage into his optimal decision (in expectation), thereby producing a lesser amount of output. In contrast to Proposition 3, it can now be shown that

$$\frac{\partial \Delta_{a-d}}{\partial \phi} \geq 0 \qquad \text{for} \qquad \phi \geq \phi^*.$$

This result follows from the fact that, in contrast to the previous setting, under aggregated information market entry by the competitor will always occur, whereas under disaggregated information, the competitor will enter market 2 with probability $1 - \phi$. As ϕ increases, the competitor's market entry in case of disaggregated information will be less likely. It is therefore less likely for the competitor to produce with the same marginal costs (of zero) as the incumbent. In addition, an increasing ϕ lowers $\frac{1}{2} + \frac{\theta}{2\phi}$, the upper bound of Assumption 3.2. Hence, for any given $\bar{\gamma}$ satisfying Assumption 3.2, it is more costly for the competitor to produce under aggregate information.

As an example, let unit cost of production in the bad state be equal to $k = 100$ and $\theta = 1.7$. Assumption 3.2 then requires γ to satisfy:

$$1.35 \leq \gamma \leq \frac{1}{2} + \frac{1.7}{2\phi}. \tag{17}$$

Let the relative production efficiency be equal to $\gamma = 1.8$. The right hand side of (17) implies that Assumption 3.2 is satisfied if $\phi \leq 0.6538$. Figure 4 then shows Δ_{a-d} as a function of $\phi \geq 0.2$.

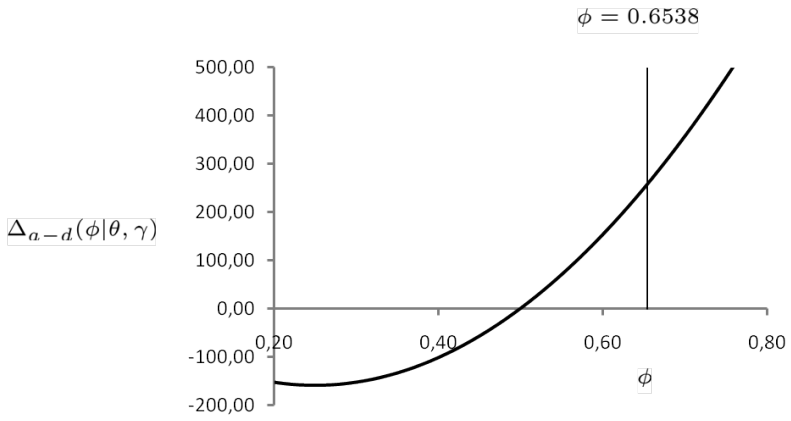

Figure 4: Net benefit of aggregate information as a function of ϕ if the relative production efficiency is small

Using equation (16), the parameter values imply $\phi^* = 0.4989$, that is if $0.4989 \leq \phi \leq 0.6538$ the incumbent chooses the aggregate information system although the competitor enters market 2. If $\phi \geq 0.6538$ then the assumed efficiency parameter $\gamma = 1.8$ is considered to be large, i.e. the previous setting applies. Then the incumbent still chooses the aggregate information system but the competitor does not enter market 2.

The following figure 5 combines figure 3 and figure 4 and therefore illustrates both settings together. Parameter values are $k = 100$, $\theta = 1.7$ and $\gamma = 1.8$.

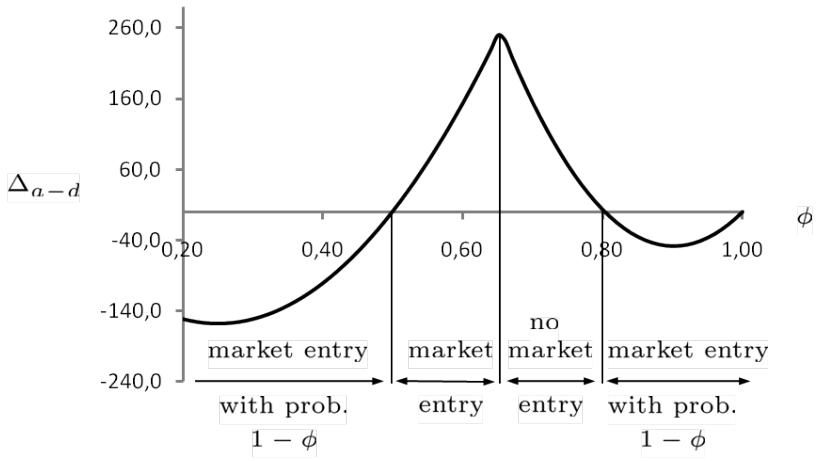

Figure 5: Net benefit of aggregate information as a function of ϕ

To summarize, if $\phi \leq 0.4989$ and $\phi \geq 0.8$, the incumbent optimally chooses the disaggregate information system and the competitor does enter market 2 with probability $1 - \phi$. In case of $0.4989 \leq \phi \leq 0.6538$ the competitor uses the aggregate information system as a commitment device to reduce the intensity of competition with the competitor, whereas in case of $0.6538 \leq \phi \leq 0.8$ the competitor uses the aggregate information system as an instrument to avoid competition. Note that the maximum net benefit of aggregate information is obtained at $\phi = 0.6538$, where the competitor is indifferent between market entry and no market entry.

4 Conclusion

Under IFRS 8 and SFAS No. 131, firms must identify operating segments for external reporting purposes in the same manner that management views operating segments for internal decision-making purposes. This method of segment reporting is referred to as the "management approach". FASB as well as IASB believe that adopting the management approach will improve financial reporting, because it is to provide more disaggregated information and allows users of financial statements to review operations "through the eyes of management". However, Preparers argued that proprietary information such as cost structure information might be inferred by competitors from disaggregated information. This paper provides an explanation for the view that firms withhold segment

details for competitive reasons under the management approach. In particular, we ask the question whether firms do have an incentive to sacrifice economic value in order to avoid disclosing proprietary information to its competitors. Our analysis is based on a simple duopoly setting with Cournot quantity competition and cost uncertainty.

The results of our model suggest that firms might have incentives to report aggregate segment information for two reasons. If the competitive advantage of the incumbent firm over the market entrant is large then aggregated information can be used as an instrument to prevent the competitor from market entry. This is consistent with practitioners' critique concerning the expected costs due to competitive harm associated with the management approach. However, if the competitive advantage of the incumbent firm over the market entrant is small then the incumbent optimally chooses the aggregated information system even so the competitor does enter the market. Now, aggregated information does serve as a commitment device to reduce the intensity of competition, because the competitor is forced to produce by taking his efficiency disadvantage into account.

References

Berger, Philip G. and Hann, Rebecca (2003) "The Impact of SFAS No. 131 on Information and Monitoring", Journal of Accounting Research, 41, 163–223.

Botosan, Christine A. and Stanford, Mary (2005) "Managers' Motives to Withhold Segment Disclosures and the Effect of SFAS No. 131 on Analysts' Information Environment", The Accounting Review, 80, 751–771.

Epstein, Marc J. and Palepu, Krishna G. (1999) "What Financial Analysts Want", Strategic Finance, 49–52.

Ettredge, Michael; Kwon, Soo Young and Smith, David (2002) "Competitive Harm and Companies' Positions on SFAS No. 131", Journal of Accounting, Auditing & Finance, 17, 93–109.

Graham, John R.; Harvey, Campbell R. and Rajgopal, Shiva (2005) "The economic implications of corporate financial reporting", Journal of Accounting and Economics, 40, 3–73.

Herrmann, Don and Thomas, Wayne B. (2000) "An Analysis of Segment Disclosures under SFAS No. 131 and SFAS No. 14", Accounting Horizons, 14, 287–302.

KPMG (2010) The Application of IFRS: Segment reporting, available under kpmg.com.

Makadok, Richard (2010) "The Interaction Effect of Rivalry Restraint and Competitive Advantage on Profit: Why the Whole Is Less Than the Sum of the Parts", Management Science, 56, 356–372.

Schmalensee, Richard (1987) "Competitive advantage and collusive optima", International Journal of Industrial Organization, 5, 351–367.

Springsteel, Ian (1998) "Sliced, Diced, and Still Obscure: New rules on reporting business segment information set by the Financial Accounting Standards Board", CFO: The Magazine for Senior Financial Executives, 14, 57–59.