The Economic Consequences of Accounting Fraud in Product Markets: Theory and a Case from the US Telecommunications Industry (WorldCom)*

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This version: June 01, 2006

Abstract

This paper studies the effects of accounting fraud on the product market. The model presented in this paper relies on the idea that a firm's financial statements and actions must be consistent with each other. If the firm is behaving fraudulently, insofar as its financial statements portray it as relatively efficient, the firm must act accordingly, i.e., increase its market share and/or reduce its prices. If the firm does not behave in keeping with its fraudulent financials, the market would be able to identify the fraud. As such, the manager will take actions and make pricing decisions which are not optimal. These actions can have a significant adverse effect on social welfare. This paper utilizes the WorldCom case to illustrate the implications of such fraudulent behavior and its economic significance in product markets.

JEL classification: D18, D21, D43, G30.

Keywords: Accounting Fraud, Corporate Governance.

*This paper is based on my Ph.D. dissertation at the University of Chicago. I would like to thank Ray Ball (chair), Philip Berger, Anne Beyer, Dennis Carlton, Shahar Dilbary, Peter Easton, Merle Erickson, Danny Meidan, Casey Mulligan, Sam Peltzman, Efraim Sadka, Ronnie Sadka, Haresh Sapra, Abbie Smith, Lars Stole, Einat Szpigelman, Roman Weil, Erez Yoeli and the workshop participants at the University of Chicago and Notre Dame for valuable comments. I would also like to thank Mike Armstrong for helpful discussions of the case. Any mistakes are my own. I gratefully acknowledge financial support from Columbia University, University of Chicago Graduate School of Business, and the Ernie Wish Fellowship.

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1 Introduction

This paper develops a model in which a firm that engages in accounting fraud will affect the whole industry and social welfare as well. The hypothesis advanced in the paper is that firms' actions and pricing/output decisions must be consistent with what they report in their financial statements. For instance, if a firm in a competitive industry were to portray itself as the most efficient, i.e., having the highest profits and lowest operating costs, it must be able to offer a lower price and/or increase its quantities (market share) compared to its competitors,[1] otherwise, the fraud would be revealed. When a firm has a competitive advantage, the market expects the firm to exploit it with the purpose of increasing its market share and profits. Were the management not to exploit the firm's competitive advantage, the board and shareholders would be concerned and would inquire about the management actions. Such inquiries might also reveal the fraud. Alternatively, an alert investor and/or the SEC or other regulatory agency might use the apparent inconsistency to uncover the fraud. In sum, since managers engaged in fraud wish to avoid detection, the decision to commit fraud becomes a joint, simultaneous decision to commit fraud and distort real actions.

The existing literature on accounting fraud focuses on financial markets and corporate governance (see e.g., Agrawal, Jaffe, and Karpoff (1999), Erickson, Hanlon, and Maydew (2004), Gerety and Lehn (1997), Kane (2004), Miller (2003), and Ronen (2002)). The major concern addressed by this line of literature is that accounting fraud leads to inefficient pricing of debt and equity because it generates unrealistic expectations. This literature finds that accounting fraud has a significant effect on financial markets. False financial reporting can result in overpriced securities and overborrowing by a firm. Since most debt contracts are based on accounting figures, manipulating these figures would help firms avoid bankruptcy and/or take on additional low-interest debt at the expense of the debt holders. For this reason, enforcing accounting rules and preventing fraud are extremely important in sustaining a viable financial system.

While the literature extensively studies the effects of fraud on financial markets, it neglects to study the effects of fraud on the product market.[2] Since a fraudulent firm will act in a non-optimal manner, accounting fraud is bound to affect the other firms in the industry. Unless the products

[1] It is also possible that the sales force would offer or the market would demand lower prices. In this case, managers would not initiate the adverse pricing and/or output choices, but they would be powerless to avoid them.

[2] For more on the effect of financial reporting on product markets see Bushman and Smith (2001) and Sadka (2004, 2005).

of the fraudulent firm and other firms are totally independent, the pricing (output) of one firm's product will affect the prices (output) of the other firms' products. As a result, if the manager of one firm chooses to commit fraud and as a result changes her prices and/or output, she will affect other firms. Consider the more common case, in which a firm acts as if it were more efficient than it really is. The market price (quantity) would be lower (higher) than it would be otherwise. The price reduction and increase in the fraudulent firm's output would strain the other firms in the industry. As such, accounting fraud can potentially bankrupt the entire industry, as well as the fraudulent firm itself. The fraudulent firm will perform poorly[3] because it is acting sub-optimally, and the rest of the industry under-performs as well due to the resulting lower equilibrium price.

The analysis above hints at an important implication of this theory concerning accounting fraud. The model suggests that eventually, any accounting fraud that affects real actions will be discovered. Consider, for instance, the case in which a firm capitalizes expenses (e.g., WorldCom). At some point in the future, when the firm amortizes the capitalized expenses, these expenses will be realized. There are therefore no "real" cash-flow effects on the firm overall. Yet, this paper advances the hypothesis that the fraud will force the firm to act in a non-optimal manner (e.g., increase its output and lower its price). Therefore, the firm's true profitability is inevitably affected. Since investors expect profits to translate into cash flows and dividends at some point, as the firm's cash flows change inconsistently with its reported profits, the fraud will eventually be detected. Moreover, if the fraudulent firm does not have sufficient cash to pay off its debts it would become bankrupt, which would certainly prompt the detection.

While the competing firms under-perform due to this "artificial" price decline, consumers will enjoy a short-term gain. Prices fall and consumer surplus increases at the expense of industry profits. Yet, this benefit may only be a short-term one. If the fraud were to bankrupt the entire industry, it might have long-term implications on productivity, prices and consumer surplus as well.[4] The effects on the competing firms and the industry would affect the entire economy. These firms would pay less taxes, the fraud might slow down technological progress (due to shortage of funds), and these prices might drive some firms to bankruptcy, which would also be costly for the

[3]It is possible that the fraudulent firm would be better off due to the fraud. For instance, in a Cournot model, if the competitors were to reduce their output due to the false reporting, the fraudulent firm would be better off. However, the competing firms are always worse off in these cases.

[4]The costs to consumers are especially high in cases where there are benefits to having long-term relations with the firm. In this case, consumers will choose their supplier based on false information.

economy. The total social welfare implications of accounting fraud on the product market are thus the sum of the effects on industry profits and the effects on consumer welfare. This paper shows that accounting fraud has an overall adverse effect on the industry, even when taking into account the short-term benefits to consumers and ignoring the long-term adverse effects. This real cost in product markets adds to the known costs of accounting fraud in financial markets.

The model developed in this paper contributes to the understanding of the real effects of accounting and financial fraud.[5] In terms of asset prices, fraud has only a distributional effect. While some investors benefit from the stock price incline, the investors who bought the firm's securities at an unrealistically high price before it drops will have lost. In this sense, fraud is not thought to affect cash flows.[6] For example, if an expense is merely capitalized fraudulently, it will eventually be depreciated (expensed) and will have no impact on overall cash flows or overall profits. In contrast, this paper demonstrates that fraudulently capitalizing expenses can result in non-optimal pricing, which will result in real effects on the firm, its industry and consumers.

The paper also analyzes a recent example to test the implications of the theory. Specifically, this paper explores the effects of the accounting irregularities at WorldCom Inc. (henceforth WC) on the telecommunication market in the US during the fraud period 2000–2001.[7] The WC case is a good test case for several reasons. First, it is one of the largest frauds ever discovered. Second, this firm is a major player in the telecommunication industry and is relatively undiversified. Since the firm is not diversified, it is easier to test the implications on its product market. Third, it has a small number of significant competitors, i.e., Sprint[8] and AT&T (henceforth ATT), which together control more than 60% of the market. Finally, all three major competitors in the market are publicly traded and thus must provide financial statements to the public.

This case is consistent with the theoretical analysis. During the period of fraudulent accounting, WC increased its market share in most of its markets compared to ATT and Sprint. In addition, WC also reported good operating results during this period. The restated results, however, are very poor. The firm's true performance during this time period was much lower than the performance of the rest of the industry. After the fraud was discovered in 2002, WC's 2003 sales declined by much more than did the sales of its competitors. This result supports the hypothesis that

[5] See also Bar-Gill and Bebchuk (2003).

[6] Excluding tax implications, e.g., Erickson, Hanlon, and Maydew (2004).

[7] See, e.g., Sidak (2003).

[8] Sprint FON, excluding its wireless PCS services unit.

during 2000–2001, WC increased its market share by acting as if it were truly as efficient as its financial statements suggested. When the fraud was discovered, however, WC immediately filed for bankruptcy because it was unable to repay its debts.

The paper is organized as follows: Section 2 provides a model to illustrate the effects of financial-reporting fraud on the product market, profitability and consumer surplus. It also provides testable empirical predictions. Section 3 provides empirical evidence from the case of WorldCom accounting fraud. Section 4 briefly discusses the generalizability of the results and other considerations. Section 5 concludes.

2 The Model

The model is designed to identify the economic consequences of false disclosure on the product market. The model elicits the sources of inefficiencies generated by the untruthful disclosure, such as inefficient prices and quantities. As discussed above, in cases of fraud, these inefficient allocations could come about due to management's desire to avoid detection. Management's actions must be consistent with the financial statements, or else the fraud will be detected immediately and the management penalized. What follows describes the model setup and some of its key assumptions.

Assume a price-taking competitive economy with $n+1$ firms.[9] Also assume a linear demand function, $P = A - BQ$. To simplify the analysis, the model will concentrate on a single firm's choice to provide false disclosure, denoted as Firm 1. In this basic model, the manager receives a cash amount equal to a portion, ρ, of the reported profits $\rho \cdot \pi_1^D$, where π_i^D denotes firm i's reported profits. The firm has n competitors, which are all identical and possess the following cost function: $C_i(q_i) = \beta \cdot q_i^2$. While the firm's competitors are all identical, Firm 1 can be more efficient with probability λ_1, i.e., the firm's cost function is $C_1(q_1) = \alpha \cdot q_1^2$ with probability λ_1 and $C_1(q_1) = \beta \cdot q_1^2$ with probability $1 - \lambda_1$, where $\alpha < \beta$. This cost-function distribution is common knowledge, however, only the managers of Firm 1 can know the true cost. Because this paper concentrates on the effects of false disclosure, assume that Firm 1 draws β as its marginal cost.[10]

[9] The price-taking competition was chosen to reflect the price war in the telecommunications industry during the 2000-2001 period. In the late 90s it was clear that ATT lost its first mover's advantage, and that it therefore had to act competitively.

[10] The specific fraud (capitalizing fees to telecom providers) and the aggressive price competition employed by WC implies that the fraud influenced the perception of the marginal cost parameter and not the firm's average cost.

Assumption 1: If the manager chooses to disclose falsely, she must commit to it for T periods. This assumption is made to ensure the model's relation with accounting practices. Any sudden change in accounting practice and recognition would alert the market to the fraudulent reports made in the previous period. Thus, the manager must commit to consistently disclose falsely. A possible example is the capitalization of costs that should be expensed (e.g., WorldCom). Such untruthful disclosure would result in lower reported cost, higher reported profits, and would require the manager to commit to such accounting practice until the asset was completely amortized and there were no more such costs.

Assumption 2: At the beginning of period $T+1$, the firm is liquidated and the remaining cash is distributed among its owners. (This assumption is relaxed in Section 4.2.1.)

Assumption 3: At any period $t \leq T$, the market can detect the fraud with probability λ_2.[11] If the manager is caught, her employment will be terminated and she will be penalized with a constant exogenous amount k.[12] (The model will later identify the level of penalty which would eliminate the incentive for false disclosure. This assumption is valid only when there are no clear indications of false reporting, e.g., discrepancies between the firm's reporting and its actions).

Assumption 4: In this model, given the demand and cost function, it is possible that more efficient firms can be less profitable than the inefficient firms. To exclude such cases from our analysis it is sufficient to assume that $n > \beta/\alpha$. This assumption is important because without it there are no incentives to commit fraud. When the firm portrays itself as more efficient, it will show lower profits.

Assumption 5: The publicly available information includes the reported profit, reported cost, prices, quantities, and the type of competition. The reported cost is given prior to the simultaneous quantity choices of the firms in the economy. These assumptions are descriptive. The major source of publicly available information for competitors and owners is the firm's financial disclosure. The latter assumption is given for simplicity; it only affects the quantity choices in the first period.

[11] The model does not take into consideration the role of auditors although public financial statements are audited each year. However, the model implicitly includes auditors, internal auditors, and other market participants such as the SEC who enforce truthful disclosure. The basic model assumes that the manager has a probability λ_2 of getting caught during each period. Skillful auditing can increase this probability and reduce the number of frauds perpetrated in the market. When the auditors are involved in the fraud, however, the probability of their getting caught is very low, and the expected benefit of fraud is higher.

[12] This penalty can include prison, monetary sanctions, or any other forms of financial or non-financial penalties.

The manager's incentives to falsely report are imperative in this study. The manager is required to control the reported information and have a compensation scheme which is a function of her reports. This assumption reflects the fact that managers are responsible for financial reporting and that much of their compensation is a function of their reported outcome.[13] In this paper, for the sake of simplicity, the manager is assumed to have no time preference.

At this point, it is important to note that while this model is a general one, it has some particular aspects which reflect certain industries. For instance, the price-taking competition is meant to reflect the telecommunications industry during the fraud period. In addition, the fraud choice, i.e., reporting a lower cost than the actual, reflects the WC fraud. However, these assumptions do not reduce the generalizability of the model in terms of the required consistency between the financial statements and the firm's actions. In other words, as long as financial statements are informative and enforced, the managers will have to act according to their reports in order to avoid detection (see *Lemma 1* and Section 4.1 below).

To analyze this model, some additional notation is necessary. Let $\pi_{i,t}$ and $\pi^F_{i,t}$ denote the true profits of firm i at period t when the manager of Firm 1 chooses not to commit fraud and when she chooses to commit fraud, respectively. Let $\pi^D_{i,t}$ and $\pi^{DF}_{i,t}$ denote the reported profits of firm i at period t when the manager of Firm 1 chooses not to commit fraud and when he chooses to commit fraud, respectively. Note that $\pi_{i,t} = \pi^D_{i,t}$ for all i, and $\pi^F_{i,t} = \pi^{DF}_{i,t}$ for all $i \neq 1$. Finally, denote consumer surplus and social welfare as cs_t and sw_t. Since the reported profits, true profits, consumer surplus and social welfare do not vary over time, the time subscript (t) is deleted in the analysis.

Lemma 1 *The quantity choices of any firm must be consistent with its disclosure (marginal cost, and profits).*

Proof. In the price-taking model described above, there is a one-to-one relation between the cost function and the quantity choice, $q_i = P/(2\gamma)$, where γ equals α or β, as the case may be (see Appendix). Thus, the firm's choice of quantity would reveal the "true" marginal cost parameter. Equivalently, in this model, the "true" profits would also reveal the true marginal cost parameter

[13] Since security prices are a function of available information, stock-based compensation is also a function of reported income and costs. The stock and options granted would also be a function of these reported profits. The model requires that the reported profits play a significant role in determining the manager's compensation.

(γ). The profit function is a function of the product price (P) and γ, that is $\pi_i = P^2/4\gamma$ (see Appendix). Since prices are observable, profits would reveal γ. ■

This result is important because it provides the basis for the relation between accounting fraud and product markets. The economic consequences of untruthful disclosure depend on the effects of untruthful disclosure on the firm's actions. *Lemma 1* claims that the firm's action must be in accordance with its reports, otherwise the untruthful disclosure would be detected in the short-run and the manager would be penalized.[14] This result holds for any weakly-increasing cost function, when the competitive game, prices and output are observable.

The economic consequences of accounting fraud in product markets are a result of enforcement insofar as enforcement forces the manager to act according to her reports in order to avoid detection, which would then be followed by an enforcement action (penalty). Take away enforcement (the penalty) and fraud will have no consequences in the product market. To sustain a viable financial system it is necessary to have financial reports, and to have accounting rules enforced as well. Therefore, one of the costs associated with the reporting requirements of financial markets and with their enforcement is that of the effects of fraud, because enforcement makes financial statements credible and forces fraudulent management to act consistently with its reports to avoid detection.

Corollary 1 *The quantity choices of the competing firms are consistent with Firm 1's financial statements and are independent of the market's and competitors' perceptions of their reliability.*

Proof. This result follows directly from *Lemma 1.* Each firm chooses its quantities based on the price in the economy $q_i = P/(2\gamma)$ (see Appendix). The equilibrium price is a function of firms' quantity choices. Since Firm 1 chooses its output based on its reported costs, the equilibrium price will be consistent with its reported cost. The competing firms, therefore, choose their output based on the reported cost function of Firm 1, and not the true cost. The competing firms decide on their output and pricing independently of the competing firms' beliefs about the true cost function of Firm 1. ■

[14] The model assumes that the managers understand that their actions and the financial statements must be consistent. However, it is possible that the effects on the product market were generated by either the market or other employees. For instance, the sales force can observe the high margins and reduce prices to increase market share and sales. Alternatively, the market can observe the high margins and consumers will allocate themselves to the more efficient firm, while driving down the price.

This important result follows directly from *Lemma 1.* Since the fraudulent firm is forced to act according to its financial statements, the other competing firms are inevitably affected. This result holds for any competitive game in which Lemma 1 holds and the output or pricing choices of any firm depend on the output choices of its competitors, e.g., Cournot-Nash equilibrium.

Lemma 2 *If the fraud is not detected by the end of period T, it will be detected at period $T+1$.*

Proof. *Lemma 2* follows directly from *Lemma 1.* The actual profits are lower than the reported ones when a manager chooses to report falsely (i.e., to overstate the profits). Therefore, when the firm is liquidated, its remaining cash will reflect the actual lower profits of previous periods. Hence, the true cost function during these periods will be revealed. ■

Lemma 2 is an intuitive result. Accounting earnings must turn into cash flow and dividends over time. It is not possible to indefinitely report higher profits with low cash flows and low dividends. Unless it does not have an effect on the true profitability of the firm, untruthful disclosure will eventually be detected.

Proposition 1 *There exists a unique level of the penalty (denoted by k^*) such that for every $k \geq k^*$ the manager will choose not to commit fraud, where:*

$$k^* = \frac{\rho\left[\pi_1^{DF}\left(\sum_{t=1}^{T}(1-\lambda_2)^t\right) - T\pi_1^D\right]}{\sum_{t=1}^{T}(1-\lambda_2)^{t-1}\lambda_2 + (1-\lambda_2)^T} \tag{1}$$

Proof. See Appendix. ■

This result shows that, in equilibrium with $k<k^*$, a manager may choose to disclose untruthfully.[15] The above expression is produced under the assumption that the manager is risk neutral and there is zero discount rate. These assumptions are not necessary, however; they merely simplify

[15] This paper assumes that managers' incentives to increase their compensation (at the expense of shareholders) are the incentives for untruthful disclosure. In contrast, Shleifer (2004) develops the theory that market pressure induces fraudulent reporting. Shleifer suggests that in order to compete for resources and capital in the economy some firms may have to use unethical behavior such as accounting manipulation. For example: "*Many young high technology firms, such as Amazon.com, financed their ongoing operations by issuing equity. Without creative accounting, their cost of capital might have been too high for them to survive.*" In other words, this paper assumes that some managers are unethical and studies the consequences of the unethical behavior, while Shleifer suggests that competition may promote unethical conduct.

the model. Generally, including higher discount factors would result in higher k^* and higher risk aversion would result in lower k^*.[16]

2.1 The Effect of Accounting Fraud on the Product Market

This section focuses on analyzing the consequences of accounting fraud on the product market. Before proceeding, it is important to recap what we have previously proven. The nature of the competition requires the manager to act in accordance with her financial reports, even when this will result in suboptimal allocations. These inefficient quantity choices will also affect the competing firms, regardless of their beliefs about the true cost function of Firm 1. Since the manager of Firm 1 must choose an output based on her financial reports, the competing firms will choose their quantities efficiently given the disclosed cost.

The effect on the product market can be broken down into three effects: Firm 1's profitability, the competing (n) firms' profitability, and consumer surplus.

Lemma 3 *The difference between the true profitability of Firm 1 in the case of false disclosure versus truthful disclosure in any period $t \leq T$, is $\Delta\pi_1 = \pi_1^F - \pi_1$,*

$$\Delta\pi_1 = \frac{(2\alpha - \beta) A^2\beta^2}{(2\alpha\beta + B\beta + nB\alpha)^2} - \frac{A^2\beta^3}{\left(2\beta^2 + B\beta(n+1)\right)^2} \tag{2}$$

The difference between the profits of the other competitors in the case of false disclosure versus truthful disclosure in any period $t \leq T$, $n \cdot \Delta\pi_2 = n \cdot \left(\pi_2^F - \pi_2\right)$, is

$$n \cdot \Delta\pi_2 = n \cdot \left[\frac{A^2\alpha^2\beta}{(2\alpha\beta + B\beta + nB\alpha)^2} - \frac{A^2\beta^3}{\left(2\beta^2 + B\beta(n+1)\right)^2}\right] \tag{3}$$

The difference in consumer surplus due to the lower equilibrium prices in the case of false disclosure versus truthful disclosure in any period $t \leq T$, Δcs, is

$$\Delta cs = \frac{A^2 B(\beta + n\alpha)^2}{2(2\alpha\beta + B\beta + nB\alpha)^2} - \frac{A^2 B\beta^2 (n+1)^2}{2\left(2\beta^2 + B\beta(n+1)\right)^2} \tag{4}$$

Hence, the total social welfare costs in the product market, which sums all these effects, Δsw, is

[16] Managers may also derive utility from obeying the law, and not reporting falsely. This will lower k^*, possibly all the way down to zero.

$$\Delta sw = \Delta\pi_1 + n \cdot \Delta\pi_2 + \Delta cs \tag{5}$$

Equation (5) summarizes the social cost of accounting fraud with respect to the product market. The sub-optimal quantity choices will affect industry profits. Moreover, Firm 1's untruthful disclosure and inefficient quantity choices will affect the entire market, including consumers who will be affected by price variations.

Proposition 2 *Firm 1 has lower true profits when its managers chooses to report false financial statements than when they report the truth, i.e.,* $\Delta\pi_1 < 0$*, its reported profits are higher than the profits without fraud,* $\pi_1^{DF} > \pi_1$*, and thus, its reported profits under fraud are higher than their true fraudulent profits,* $\pi_1^{DF} > \pi_1^F$*.*

Proof. See Appendix. ■

Proposition 2 is a result of the suboptimal actions undertaken by the fraudulent firm. Since the manager commits to acting consistently with her financial reporting, the firm suffers a decline in profitability.[17] This result is especially strong in price-taking competition because of marginal cost pricing. In this case, Firm 1 sells products for a price lower than its marginal cost. However, the firm's profits are negative only when the firm is "pretending" to be much more efficient than its competitors, i.e., $2\alpha - \beta < 0$. Specifically, ignoring fixed costs, Firm 1 will have zero (negative) profits if it acts as if its cost parameter α is half (less than half) of the industry's cost parameter.

Proposition 3 *The profits of the other (n) firms in the industry are lower and consumer surplus is higher than they otherwise would be without fraud,* $\Delta\pi_2 < 0$*,* $\Delta cs > 0$*.*

Proof. See Appendix. ■

In sum, this model illustrates the negative effects of fraud on the product market. It shows the effects on the fraudulent firm's performance, the performance of its competitors and the change in the effects on consumer surplus. The overall social welfare implications of accounting fraud are the sum of the above implications.

[17] It is important to note that it is possible for Firm 1 to benefit from fraudulent financial reporting. When other firms adjust their quantity choices, a Cournot competition could result in a benefit to Firm 1. This paper, however, chose price-taking competition to be consistent with the telecommunications industry.

Lemma 4 *Accounting fraud has a negative effect on social welfare, i.e.,* $\Delta sw < 0$.

Proof. Note that in a competitive, price-taking competition, the equilibrium under truthful reporting maximizes social welfare (the First Optimality Theorem of the Welfare Economics). Therefore, since the fraud equilibrium varies from this first-best equilibrium, fraud has a negative effect on social welfare. ■

2.2 Testable Implications

The model above provides some empirical predictions about the effects of accounting fraud on the product market. First, the model predicts that the fraudulent firm will perform according to its reported productivity – i.e., if the firm states in its financial reports that it has very low costs (relative to its competitors), then the firm's market share should increase. Note that since the firm is not truly as efficient as it claims, the firm should be producing less or the same rather than more relative to its competitors. Second, since the firm had been acting suboptimally during the fraud period, after the fraud is discovered its market share will decline. Finally, the firm's true performance (the restated performance) can be expected to be much lower than that of its competitors.

The empirical predictions above allow for changing aggregate demands and supply. When the demand and supply remain constant, the model has more empirical implications and predicts that the quantities in the industry will increase and that prices will fall. Since demand and supply rarely remain constant through time, however, it is unlikely that these implications can easily be tested.

The testable hypotheses in this paper are highly sensitive to the industry, the fraud, and the properties of accounting figures (see Section 4). The model also requires intent, i.e., the manager must willfully and knowingly engage in the fraudulent behavior. As such, this paper does not deal with general restatements, which might simply represent honest mistakes. Therefore, this paper does not empirically test the hypotheses in the paper. Instead, the paper utilizes a case study as an example for the implications of accounting fraud in product markets.

3 The Case of WorldCom Inc.

This section uses a specific US example from the telecommunication industry to illustrate the possible adverse effects of an accounting fraud on the product market.[18]

3.1 Data

This paper utilizes several data sources on the telecommunications industry and on the three firms, i.e., WC, Sprint, and ATT. The paper uses data from WRDS and EDGAR for the financial statements of these firms. The 2003/2004 Telecoms in the United States of America (Paul Budde Communication Pty Ltd) provides additional data on prices and quantities for the firms as well as more detailed segment information. The paper also utilizes company-level reports by the Paul Budde Communication Pty Ltd. The prices and quantities data are extracted from the Federal Communications Commission's (FCC) Study on Telephone Trends (2004).

3.2 Background

WC was a US-based international telecommunications service provider.[19] At the time of the scandal, WC's business segments included: data service, Internet-related services, commercial long-distance and local voice services, international communications services and designing and managing customers' communications systems. The data services included frame relay, ATMs and IP networks. The Internet services included high-speed connections, Web-site management, etc. The WC group included MCI, which provided wholesale data services, wireless messaging, dial-up Internet access and consumer long-distance and local voice services.

3.2.1 The Accounting Scandal

In June 2002, it became apparent that WC had overstated EBITDA by fraudulently capitalizing its expenses. This was the largest accounting scandal that had been committed in the US to date.[20] In

[18] WC has had other effects in financial markets, taxation, etc. (see United States Bankruptcy Court, Southern District of New York, In re: WorldCom Inc., et al., Debtors, Third and final report of Dick Thornburgh, Bankruptcy Court Examiner, January 26, 2004).

[19] Source: Paul Budde report on WorldCom.

[20] See Haywood, McMullen, and Wygal (2004).

July 2002, the company filed for Chapter 11 bankruptcy with debt of $41 billion.[21] In April 2003, the company changed its name to MCI and filed a reorganization plan. In May 2003, the company reached a settlement with the SEC. Currently, MCI is emerging from its bankruptcy. While it is not clear whether the government helped to bail out MCI, revenues from government contracts increased substantially during the post-fraud period.

The management perpetrated the fraud simply by transferring line costs – fees to telecom-network providers for use of their transmission networks – into capital accounts. This transfer of line costs into capital accounts allowed WC to meet analysts' expectations and to appear efficient by keeping high operating margins. For instance, in 2001 WC showed about 58% gross margins versus ATT's 51%. Moreover, the classification of line costs into capital accounts boosted operating cash flow. The capitalized expenses were included in investment activities and not in operating cash flows. In sum, the financial statements portrayed WC as one of the leading firms in the industry, and as one of the most efficient.

As discussed above, WC reduced its line costs by improperly releasing accruals and improperly capitalizing these expenses. Line costs are the costs of carrying data and/or voice transmission from one location to another. WC did not have its own lines and therefore had to pay telecom providers for the use of their lines. The firm created accrual liabilities in anticipation of future liabilities to telecom providers. WC reduced its line costs by (1) releasing accruals without any analysis of whether they needed to be released, (2) not releasing accruals during the period in which they were identified, and (3) Releasing accruals, established for other purposes, to offset line costs. During 1999 line costs were reduced by $500 million, and by $2,797 million during 2000.[22]

During 2000-2001, WC reduced its line costs by improperly capitalizing them. These expenses were not recorded in the income statement. They were recorded as assets and were slowly depreciated as they are used. During 2001-2002, WC reduced its line costs by about $3.5 billion. While there were other methods used by WC to reduce its line costs, most of the fraud was facilitated by capitalizing expenses and manipulating the accruals.

[21] The fraud was discovered by WC's audit panel during a routine internal audit.

[22] Source: The Report of Investigation by the Special Committee of the Board of Directors of WorldCom, Inc.

3.3 Empirical Evidence

This section explores the performances of the three major competitors in the telecommunications industry: WC, Sprint, and ATT. This section tests whether WC acted as if its costs were truly as low as their financial statements indicated. Specifically, this section compares market share and sales for the above firms during the period 2000–2001.

Figure 1 plots the annual sales growth for the three competitors. The figures support the hypothesis that WC was acting as if its costs were truly low. The annual sales growth of WC seemed the largest of all of the competitors during this time period. This result is quite surprising given that we know in hindsight that WC was struggling. Moreover, the reported operating income was very high. In conclusion, the figures seem to show that WC was doing very well. After the fraud was discovered in 2002, however, WC's market share began to decline. This decline continued in 2003.

Table 1 summarizes the effects on market share during the fraud period for ATT, Sprint, and WC. During the fraud period these three major competitors were losing market share to entrants and other smaller competitors (e.g., Qwest, IDT, and Global Crossing). ATT's market share declined from 40.4% in 1999 to 37.5% in 2001. Sprint, which had been steadily increasing its market share during the pre-fraud period, had lost its momentum and began loosing market share. Sprint's market share declined from 9.8% in 1999 to 9.3% in 2001. However, WC's market share declined only marginally, from 23.7% in 1999 to 23.5% in 2001.[23] In addition to effectively stable market share, the operating margins of WC also seemed to improve. Based on ATT's 2002 financial statements, ATT's EBITDA margins declined from 39% in 2000 to 28%. The reported margins for WC were 34% in 2000 and 27% in 2001 (these results are not tabulated). Therefore, compared to its major competitor WC seemed to be doing very well. However, the restated results showed losses for WC; the true margins were much lower than those of the pre-fraud period.

An analysis of the pre- and post-fraud periods suggests that WC was struggling due to inefficient pricing and/or quantity choices rather than an inefficient organization. In the post-fraud period, WC did not appear to engage in significant restructuring of the firm. Yet, even without a significant change in firm organization, the firm emerged from bankruptcy relatively swiftly. The analysis

[23] The market share is extracted from Table 59 of the 2003/2004 telecoms in the United States of America (Paul Budde Communication Pty Ltd).

above is consistent with the assumptions of the model and its implications; the loss to the firm during 2000 and 2001 does not seem to have been caused by inefficiencies in WC's operations. The fraudulent firm appears to have had the same organizational efficiency throughout the period. It also appears that the fraud caused the real adverse-profitability effect on WC.

The effects on prices in the industry is apparent in the pricing trends during the fraud period. The CPI of toll services declined. The interstate CPI declined by 11.2% and 4% in 2000 and 2001, respectively. The intrastate CPI declined by 6.0% and 2.9% in 2000 and 2001, respectively. Similar trends can be observed in the Average Revenue per Minute (ARPM) for interstate toll service calls. For all interstate and international switch services, the ARPM was stable in 1998 and 1999 at 0.14. However, during the fraud period, the ARPM declined to 0.12 and 0.10 in 2000 and 2001, respectively. For all interstate switched services the ARPM was stable at 0.11 for the period 1997–99. During the fraud period, however, the ARPM declined to 0.09 and 0.08 for 2000 and 2001, respectively. The ARPM in the international switched services was declining throughout the period 1993–2001, however, in 2001 it declined sharply from 0.53 in 2000 to 0.35 in 2001.[24]

The pricing in the industry seems to have taken a toll on the industry margins. Both ATT and Sprint experienced a decline in their operating margins during the fraud period. ATT's margins declined from 32% in 1999 to 30% in 2001. Sprint's operating margins declined from 30% in 1999 to 25% in 2001. In contrast, Canadian telecommunications companies did not experience a similar decline. In fact, ATT Canada was increasing its operating margins during the same time period, and Aliant kept a constant margin (38%) during the fraud period. The Canadian firms provide evidence that the effects on the industry margins were not part of an overall trend in telecommunications industries around the world. The US telecommunications industry was adversely affected by the "inefficient" pricing of WC.

3.3.1 Some Additional Anecdotal Evidence

There is much more anecdotal evidence beyond the data shown in Figure 1 and Table 1. A recent article in the Wall Street Journal[25] studying the effects of the fraud on ATT show that prior to

[24] The information is extracted from the 2003/2004 telecoms in the United States of America (Paul Budde Communication Pty Ltd).

[25] The *Wall Street Journal*, May 26, 2004, "Former chief tries to redeem the calls he made at AT&T", by Rebecca Blumestein and Peter Grant.

the discovery of the fraud, investors and analysts were concerned with the performance of ATT and its former CEO, C. Michael Armstrong. As Armstrong noted, *"ATT looked like it couldn't manage its business as well as WorldCom."* However, Armstrong points out that *"...in hindsight [WorldCom wasn't] executing at all. They were cheating, and we were executing better than any of them."*. These observations in the *Wall Street Journal* are predicted by the model in Section 2: WC was straining the industry.

The evidence and the analysis in this paper are consistent with the conclusions of Sidak (2003), who concludes that WC's fraudulent financial reports distorted the economic gains of acquiring new customers, and caused other firms to spend too much to do the same. Sidak also quotes William Esrey, the CEO of Sprint, saying that WC's fraud led the industry to "unsustainably" low prices. Sidak develops the hypothesis that WC's management engaged in a strategy of inefficiency in order to hurt its competitors, and manipulated the accounting numbers to avoid detection while exploiting the benefits. However, WC did not in fact benefit. The predatory strategy was not optimal for WC and the managers could have benefited even more had they simply manipulated the accounting profits. Therefore, in contrast to Sidak (2003), this paper develops the theory that the fraud caused the non-optimal strategy and not vice versa. The managers manipulated the accounting numbers to extract rents, and adopted a consistent strategy to avoid detection.

3.3.2 The Effects of Fraud on the Investment Decisions and Organization

Sadka (2004, 2005) hypothesizes and provides supporting evidence that competitors can use financial statements to extract the competitive advantage of a firm in the industry.[26] However, when a firm falsely reports a competitive advantage, the competing firms might mistakenly choose a non-profitable investment and/or non-optimal firm organization in response. Armstrong claims in the *Wall Street Journal* that the accounting fraud of WC made ATT make bad investment decisions, such as the cost-cutting initiatives that included discharging 20,000 employees. Moreover,

[26] This paper centers on pricing and output decisions. In contrast, a recent study by Kedia and Philippon (2005) explores the effects of fraud on investment decisions. Kedia and Philippon (2005) use a sample of accounting restatements to illustrate a distortion in investment decisions by the fraudulent firm. However, most restatements are not due to frauds. The model developed below requires fraudulent intent by managers and a desire to avoid detection. Moreover, pricing and output decisions and their effects on the firm and its competitors are sensitive to industry characteristics (e.g., the competitive-game Cournot/price taking) and to the nature of the fraud. Therefore, this paper utilizes a case study as an example of the possible adverse effects of fraud.

Mr. Armstrong added: "*I never got beat up for the [cable] strategy, but for breaking up the company. I would never have faced that decision had the WorldCom fraud not taken place.*" While in general learning from competitors can be socially beneficial, in the presence of untruthful financial reporting, it is clearly socially destructive.

Sidak (2003) reaches similar conclusions. Sidak states that the fraud caused over-investment in capacity and unreasonable expansions by WC's competitors. In this industry, these investments are sunk. Sidak quotes ATT, Sprint and The Eastern Management Group saying that relying on WC's financial statements and its growth projections,[27] caused the firm's competitors to make faulty investment decisions. This analysis contradicts the hypothesis that WC's managers chose a predatory strategy. A predatory strategy is supposed to reduce entry. However, the faulty projections given by the management and submitted to the FCC would increase entry, not reduce it.

3.4 The Restated (Real) WorldCom Performance

This section tests the following two empirical predictions of the model: that a fraudulent company's true performance is much worse than the industry's performance, and that the post-fraud performance (in terms of market share) is low. To test the first of these predictions, Figure 2 plots the restated operating income excluding depreciation and amortization. As shown in the figure, the actual performance of WC is very poor during the fraud period: in 2001 and 2002, the firm recorded a substantial loss. The low performance is expected since WC had not been choosing its actions and pricing decisions optimally. The operating performance is also much lower than the performance of ATT and Sprint, both of which were profitable. The 2000 – 2001 results might be overstating the extent of the poor performance due to goodwill and other asset write-offs, however, excluding these expenses still reveals a sharp decline in profitability for WC during the fraud period.

Similarly, if the firm's actions were not optimal and it had produced too much, in the period following the discovery of the fraud, the firm would have to reduce its market share. Consistent with this hypothesis, the sales growth of the firms in the industry was -7%, -9%, and -15% for Sprint, ATT, and WC (named MCI during this period), respectively. Note that due to government assistance the decline in sales was much lower than what it otherwise would have been. For example,

[27] These projections were also filed with the FCC.

the General Services Administration (GSA), the Department of Defense, and other federal agencies supported MCI after it went bankrupt. In addition, after WC filed for bankruptcy, its revenues from various federal contracts grew by approximately $270 million. Without these government contracts, it is not clear whether WC (whose name changed to MCI after filing for bankruptcy) could have been revived as easily.

Bankruptcies are generally associated with declines in market share, however, in the general case, the bankrupt firm experiences a decline in market share prior to the Chapter 11 filing. In contrast, WC was increasing its market share prior to its declaration of bankruptcy. It was only after the fraud was discovered and WC filed for Chapter 11 that WC experienced a decline in market share. Moreover, the bankruptcy was not associated with a major restructuring of the business model of WC, but rather of its debt. This analysis implies that although the bankruptcy was one of the causes for the decline in market share, it does not seem to be the only reason for it. This decline is likely associated with the firm's choosing its proper (optimal) prices and output.

3.5 Estimating the Social Welfare Costs in the Interstate Toll Services

This section provides a crude estimate of the costs of accounting fraud. The results in Table 2 are not meant to capture the exact cost to the economy due to the WC fraud, but to illustrate the economic magnitude of the cost that such fraud can inflict on an industry. Moreover, this section can illustrate the magnitude of the effect on each of the market participants, i.e., consumers, competitors, and the fraudulent firm.

This paper utilizes FCC data to estimate the parameters of the demand curve and attempts to analyze the costs of fraud in the telecommunications industry. In order to estimate the demand parameters during the period 2000–2001, assume that during this period demand is constant and that price and quantity vary due to supply-curve variation. This assumption is plausible because the supply curve is expected to vary due to the lower reported costs. Also, prices fell and quantities increased, which is consistent with an increase in supply rather than a change in demand. If the demand declined (increased) prices should have declined (increased) and quantities should have declined (increased) as well, which did not occur: instead, prices declined and output increased. Therefore, even if the demand had changed, the change was fairly insignificant in comparison to the change in supply.

Since the marginal cost of a call is zero, the analysis would define quantities as households. This definition of quantity is consistent with the trend in the industry to offer calling packages with unlimited calls. According to the FCC's Study on Telephone Trends (2004) the average household expense on "telecommunications" in the years 2000 and 2001 are $P_{2000} = \$53$, $P_{2001} = \$51$. The report also includes the total generated revenues from end users for the years 2000, 2001: $P_{2000} \cdot Q_{2000} = \$172,292$ and $P_{2001} \cdot Q_{2001} = \$167,006$ (in millions). Thus, $Q_{2000} = 3251$ and $Q_{2001} = 3275$.[28] Use the following set of equations

$$Year \quad 2000: \qquad 53 = A - B \cdot 3251 \tag{6}$$

$$Year \quad 2001: \qquad 51 = A - B \cdot 3275 \tag{7}$$

to get $A \approx 313$ and $B \approx 0.08 \cdot 10^{-6}$. These estimates seem reasonable. The first household to use telecommunications services would probably be willing to pay up to \$300. Given the price in the economy and the number of households, B is expected to be very small.[29]

Apart from the demand parameter, the model requires two more additional variables, n (number of firms) and β, in order to assess the consequences in the product market. The Paul Budde Telecommunication in the United States of America report identifies 6 major competitors for WC: ATT, Sprint, Qwest, IDT, Global Crossing, and other small firms. Therefore, assume that $n = 6$. An estimate for β is more difficult to obtain. It is clear that the cost parameter is very small. First, the marginal cost of the first family is likely to be extremely low. The marginal cost is expected to rise with quantity due to customer retention costs and costs aimed at obtaining new subscribers. The costs of obtaining new subscribers is low for the first subscribers, however, when the number of subscribers and users is already high and many households are already subscribed, it is very costly to obtain an additional subscription. The data[30] suggest that $1 \cdot 10^{-4} \leq \beta \leq 10^{-7}$. For the illustration in Table 2, assume that $\beta = 0.00001$. The effects of the fraud on the product market are higher as β decreases.

[28] The prices and quantities data from the FCC is also consistent with the model. The prices in the industry fell and quantities increased.

[29] It is possible to use a more sophisticated method of estimating demand, but for the purposes of this study it is unneccesary.

[30] The prices and quantities data are from the FCC report.

Table 2 reports the calibrated numbers of Equations (2)–(5) for different values of α (the reported cost parameter of WC). The results are consistent with the empirical findings. When $\alpha = 1.75 \cdot 10^{-6}$, the cost of fraud to WC is estimated to be approximately \$49 billion, which is equal to its restated operating loss excluding depreciation for the year 2000. Yet, the effects of the fraud on the other firms in the industry does not seem very large. This result is also consistent with the empirical evidence, as ATT and Sprint do not seem to experience a sharp profitability decline during the fraud period. The short-term benefits to consumers do not seem very large either. The overall effect of fraud on the product market is on the other hand, very large. It is much stronger than the positive effect on consumer welfare. For instance, for $\alpha = 7 \cdot 10^{-6}$, WC is expected to lose \$49 billion, the competing firms are expected to lose about \$500 million, and consumers are expected to benefit about \$800 million, such that the overall negative effect of the fraud on social welfare is approximately \$49 billion. This cost is economically significant relative to the size and value of the industry. Note that these estimated costs are annual. The longer the fraud period, the higher the social cost.[31]

The high costs incurred by WC are due to the competition model and the quadratic cost function. WC was increasing its market share and quantities, q_1. At the same time, prices fell. Since the marginal cost function is increasing, $mc_1 = 2\beta q_1$,[32] WC is producing more at higher costs and selling at a lower price. On the other hand, its competitors are adjusting their quantities according to market prices and their own costs.

Figure 2 plots the figures from Table 2 along with the actual and restated results for each of the competitors. In particular, the counterfactuals are based on $\alpha = 1.75 * 10^{-6}$ and $\alpha = 3 * 10^{-6}$ for 2000 and 2001, respectively. The added profitability to competitors from Table 1 is allocated to ATT and Sprint based on their relative profitability. The figure illustrates the hypothesized market equilibrium had no fraud occurred. The actual results of ATT and Sprint are consistent throughout the period of 1999–2002. Their results are consistent with the trend in Table 2. It seems that the effects on competitors are insignificant compared to the effects on the fraudulent firm.[33]

[31] While this analysis might be overstating the costs of fraud due to asset write-offs made by WC in 2000 and 2001, the inferences do not change if these expenses are excluded. The goal of this illustration is to point out the relative impact on the different market participants (consumers, competitors, and the fraudulent firm) and not to estimate precisely the cost of fraud.

[32] While WC reported α as its marginal cost parameter, its true cost was β.

[33] This result is specific to the competitive model and cannot be generalized.

3.6 Can Alternative Hypotheses Explain the Results?

The WC case has been studied by others as well (e.g., Sidak (2003)). This paper differs from previous work in terms of its interpretation. In order to provide more support for the model, it is necessary to explore some additional alternative explanations.

An obvious alternative interpretation of the results is that the management of WC simply chose a bad strategy and production process and covered for their incompetence by falsifying the financial statements. However, there are several strong arguments against this theory. First, the management knew the true performance. Therefore, they could have simply changed their strategy or production process. Note that the fraud occurred over several periods. It is possible that the managers first chose a poor strategy and when the poor results were apparent, falsified the financial statements to avoid showing the poor results. But in this case one would expect the management, which would now be aware of the flaws in their strategy, to change their strategy. Yet, WC's management did not change its strategy, which they knew to be faulty. Moreover, granting that management was willing to falsify the financial statements, they would have been even better off by choosing a better production process or strategy and falsifying the reports so as to show even better performance. So even if poor strategy had generated the fraud, at some point the fraud made the poor strategy persist. The second drawback to this alternative interpretation is that it is inconsistent with WC's true performance and actions. Specifically, if WC were truly less efficient than its competitors, then it should have reduced its market share and/or increased prices. In fact, however, WC increased its market share and reduced prices.

A second possible interpretation for the results is that WC chose a strategy meant to hurt its competition (e.g., Sidak (2003)). This hypothesis is not consistent with the data. It seems that WC was doing itself more damage than it was to any of its competitors. While WC's true operating performance was very poor, the rest of the industry did not seem to be as strongly affected. In addition, the goal of such a strategy would be to deter entry (promote exit), but WC was providing the FCC with faulty optimistic growth projections that caused over-investment and entry in the industry. If the goal of WC was to deter entry, their growth projections would have been overly pessimistic rather than optimistic.

The third alternative interpretation is that WC was pricing low so as to attract consumers in the short-run. This hypothesis is also not consistent with industry trends. First, if such a strategy

was good for WC, it should have been good for all the firms in the industry. However, other firms in the industry did not choose such a strategy. Moreover, this strategy would only work if consumers faced high switching costs. Otherwise, the increase in subscribers would be short-lived and subscribers would change providers when prices adjusted back to their equilibrium level. The effect of WC's bankruptcy and fraud discovery on the market share of WC suggests that consumers did not face high switching costs. Therefore, it is difficult to justify such a strategy. In general, if the managers truly believed their chosen strategy was optimal for the firm in the long-run, it is difficult to imagine the use of fraud to conceal poor short-run performance.

The analysis above suggests that it is difficult to justify WC's actions as a strategy chosen by the management to better the firm. In addition, the specifics of the case also suggest that the strategy was more likely meant to benefit its managers than its stakeholders. WC's CEO received loans totalling over $400 million during the fraud period. By November 2000, the CEO should have known that he would not be able to repay the loans, yet he sought and accepted new loans. In addition, the rate on these loans was far below the commercial rate, and in 2002, he provided misleading documents to the compensation committee suggesting he had sufficient assets to cover the loans. These actions constituted a breach of the CEO's duties of loyalty and good faith.

In sum, the only apparent difference between the fraud period and the pre- and post-fraud period is the fraud. WC was performing well (relative to its industry) in both the pre- and post-fraud period. The firm did not seem to change its firm organization or production process during that period. In fact, after the fraud was discovered and WC filed for bankruptcy, it did not change its firm organization or production process. Therefore, it is unlikely that WC's results are due to inefficient firm organization. Moreover, since WC did not improve its productivity, it is not otherwise clear why it reduced its prices and increased its market share.

4 Generalizability and Additional Considerations

4.1 Generalizability

This paper concentrates on a specific case in US history to study the effects of accounting fraud on the product market. As in any such case study, there is a concern regarding the generalizability of the results to other cases. While this study is specific, its major results can be generalized to other

cases i.e., accounting fraud has a significant impact on the product market if the following three conditions hold:

1. *Economically Significant Fraud*: The fraud must be economically significant. Hence, the analysis does not apply to any earnings management but rather to significant frauds. If the firm's management decides to shift income from one period to the other, the managed amount must be significant enough so that the firm appears to be more or less efficient than it really is. Financial reporting provides a noisy measure of the firm's cost function. Since accounting measures are noisy, the market discounts the information. Therefore, to change the market perception of the firm's efficiency the fraud must be sufficiently large. To illustrate this point more formally, assume that the firm's cost parameter, α, is distributed normally, $\alpha \sim N\left(\beta, \sigma_\alpha^2\right)$. Also assume that financial reporting, denoted as y, provides a noisy measure of the cost parameter, i.e., $y = \alpha + \varepsilon$, where $\varepsilon \sim N\left(0, \sigma_\varepsilon^2\right)$ and ε is independent of α. Thus, the conditional expectation of α given y, is

$$E\left(\alpha|y\right) = \beta + \frac{\sigma_\alpha^2}{\sigma_\alpha^2 + \sigma_\varepsilon^2}\left(y - \beta\right) \tag{8}$$

   The model in the paper requires the manager to act as if her firm is more efficient than it is, because otherwise the market would be able to detect the fraud. However, when $(y - \beta)$ is small, the market would not change its priors about the firm's cost parameter. In such cases, the manager can act optimally and still avoid detection.

2. *Financial Statements Are Informative*: The second condition requires financial statements to provide information about the firm's cost function and/or productivity. For instance, without segment reporting, it is very difficult to draw inferences about a firm's productivity in supplying any one of its products. The firm can "allocate" the fraudulent information among the different segments and generate a significant accounting fraud using a large number of small frauds.[34] In terms of Equation (7), this analysis is equivalent to assuming that $\sigma_\varepsilon^2 \to \infty$. In this case, accounting signals do not provide information about α.

[34] The information content of financial statements also depends on the firm's ability to differentiate its products (see third condition). In such cases, it is more difficult to observe the demand for the differentiated product and draw inferences from market shares. The information in financial statements also depends on the firm's ability to bundle products and services making it more difficult to identify the cost structure underlying pricing decisions.

The informativeness of financial statements depends on whether the information contained in them refers to marginal cost or average cost. The model assumes that the market can observe the marginal cost. There are some cases in which the average cost and marginal cost are the same (e.g., fixed marginal cost with no fixed cost) and other cases where it is sufficient to observe changes to the average cost to infer changes in the marginal cost. The important condition regarding the available information is that market participants should be able to observe changes (or changes relative to competitors) to the cost variable used in pricing decisions.

3. *Competition*: The third condition requires the fraudulent firm to be part of a competitive industry. The demand for other products cannot be independent of the price and output of the fraudulent firm. This requirement is necessary because the demand curve is not stationary over time and is not easily observable. A monopoly can claim to be more efficient than it is without changing the way it behaves. It can simply claim that the demand curve shifted in a way that forced it to make its output/price decisions. Since the demand curve is not easily observable and it varies over time, the management can justify almost any action it chooses to take. In this case the model will hold only if the demand is observable because only then can the market infer the optimal prices and output.

4.2 Additional Considerations

4.2.1 Allowing Managers to Avoid Detection

Assumption 2 in the paper generates the result that accounting fraud is always detected. It is possible to relax this assumption to reach a different equilibrium in which the managers might not be caught. In particular, assume that at period $T+1$, the market receives a noisy signal about the true profitability of the firm. Let $\Pi^F = \sum_{t=1}^{T} \pi_{1,t}^{DF}$ and $\Pi = \sum_{t=1}^{T} \pi_{1,t}$. In addition, let $D = \Pi + \xi$, where $\xi \sim N\left(0, \sigma_\xi^2\right)$, denote the signal of the firm's true profits. For instance, D can be some form of cash flow measure. Assume that the probability of discovering the fraud at period $T+1$, λ_{T+1}, is a decreasing function of D, i.e., $\partial\lambda_{T+1}/\partial D < 0$. Intuitively, this assumption means that when investors observe a high signal of true profitability, they become less suspicious of the firm's profits. In other words, a higher signal reduces the concern that the managers have overstated the profits.

These assumptions would not affect the implications of the theory regarding the effects of fraud on product markets. However, the incentives to commit fraud are affected by the possibility of not getting caught. Given the assumptions above, the manager might avoid being penalized. Therefore, in order to prevent fraud it is necessary to increase the penalty. Specifically, the minimum penalty necessary to prevent fraud, k^{**}, is given by

$$k^{**} = \frac{\rho\left[\pi_1^{DF}\left(\sum_{t=1}^{T}(1-\lambda_2)^t\right) - T\pi_1^D\right]}{\sum_{t=1}^{T}(1-\lambda_2)^{t-1}\lambda_2 + (1-\lambda_2)^T\lambda_{T+1}} \tag{9}$$

Since $0 < \lambda_{T+1} < 1$, $k^{**} > k^*$.

4.2.2 Quantity Competition

This paper follows the case of WC. Since the market was engaged in what seems to be a "price war" during the fraud period, the paper chose the price-taking competition as an appropriate competition model. In fact, the results are consistent with the chosen model in that the fraudulent firm is worse off and its competitors do not seem to incur such high costs. However, the effects of financial fraud varies with respect to the competitive game. For example, in Cournot, the fraudulent firm may actually benefit from the fraud at the expense of its competitors.

Sadka (2006) develops the model presented in this paper with two major differences in the assumptions. First, the model assumes a Cournot (quantity) competition instead of price-taking competition. Second, for simplicity, the model assumes that the marginal cost is constant, i.e., $C_i(q_i) = \beta \cdot q_i$. In the case of fraud, the firm reports a lower marginal cost. For brevity, I will only discuss the key differences between the model under Cournot competition compared to price-taking competition.

As in the case with price-taking competition, the quantity decision made by the firm engaging in fraud must be consistent with its reports, because one can infer the marginal cost from the quantity choice. Accordingly, the model indicates that prices decline when the firm reports lower profits. Therefore, consumer welfare increases and competitors' profits decline due to the lower prices. However, unlike the case of price-taking where lowering prices means lowering the price below marginal cost, in a Cournot model, lowering the price does not necessarily suggest that the price will be below the marginal cost of the firm committing fraud. Therefore, the profits of the fraud firm can increase compared to the case where the firm does not commit fraud (which increases

the incentives for fraud). The intuition of this result is similar to that of the instability of collusion. When competitors collude, it is commonly beneficial to one of the competitors to increase her output assuming other competitors do not change their output. The same intuition applies in the case of Cournot. Since the price is above the marginal cost, a small increase in the output of one firm will not change prices significantly[35] and will increase the profits of the firm that increased its output.

5 Conclusion

This paper develops the theory that financial accounting fraud might result in a significant effect on the product market in which the fraudulent firm competes. Based on the supposition that the firm's actions and its financial statements must be consistent, the model shows that fraud will affect the true profitability of the fraudulent firm, the industry profits, consumer surplus, and social welfare. The paper illustrates that in the case of price-taking competition, profitability falls, consumer surplus rises (in the short term), and social welfare decreases. The signs of the effects are dependent on the cost structure, the demand curve, and the competitive game. This paper tests the implications of the theory described above using a US-based example, WorldCom. The evidence is consistent with the implications of the model. It appears as if WC did not act according to its "true" productivity.

This paper deviates from the traditional concerns that arise in the presence of accounting fraud, such as corporate governance problems and other costs in financial markets. This paper takes a different perspective on the effects of fraud. While this effect is not expected to be equivalent in all cases (depending on the industry), it is an important aspect to study. An illustration of the possible cost of fraud as presented in the paper shows that the effects of fraud on the industry can be economically significant and can have a serious adverse effect on the market.

Appendix

Proof of Proposition 1. In order to show that there exists a unique k^* such that if the penalty was higher the manager would choose not to commit fraud, we must first determine the expected

[35] The competing firms will lower their output, which will limit the impact on the price.

benefits of committing fraud. Since we assume a zero discount rate, the expected benefits are simply the sum of the period-specific expected benefits beyond truthful reporting as follows

$$\begin{array}{lll} Period & 1 & \rho \cdot \pi_1^{DF} (1-\lambda_2) - \lambda_2 \cdot k - \rho \cdot \pi_1^D \\ Period & 2 & \rho \cdot \pi_1^{DF} (1-\lambda_2)^2 - (1-\lambda_2) \lambda_2 \cdot k - \rho \cdot \pi_1^D \\ . & . & . \\ . & . & . \\ Period & T & \rho \cdot \pi_1^{DF} (1-\lambda_2)^T - (1-\lambda_2)^{T-1} \lambda_2 \cdot k - \rho \cdot \pi_1^D \\ Period & T+1 & -(1-\lambda_2)^T k \end{array} \tag{10}$$

The overall expected benefits of accounting fraud is

$$\rho \left[\pi_1^{DF} \left(\sum_{t=1}^{T} (1-\lambda_2)^t \right) - T\pi_1^D \right] - k \left(\sum_{t=1}^{T} (1-\lambda_2)^{t-1} \lambda_2 \right) - (1-\lambda_2)^T k \tag{11}$$

to get k^* set the equation above to zero and solve for k. ■

Proof of Lemma 3. Each firm solves the following maximization schedule

$$max_{q_i} \quad P \cdot q_i - C_i (q_i) \tag{12}$$

Use the first order conditions and solving for q_i to get

$$q_i = \frac{P}{2\gamma} \tag{13}$$

Thus, $q_1^F = P/2\alpha$ and $q_2^F \equiv q_3^F = ... = q_n^F = P/2\beta$, where the superscript F denotes the scenario in which the manager of Firm 1 chooses to commit fraud. These results imply that $\pi_1^D = P^2/4\alpha$ and $\pi_2 = P^2/4\beta$. Use the linear demand curve, $P = A - BQ$, and $Q = q_1 + n \cdot q_2$, to get

$$P^F = \frac{2A\alpha\beta}{(2\alpha\beta + B\beta + nB\alpha)} \tag{14}$$

substitute for P and q_i in the profit function to get

$$\pi_1^F = \frac{(2\alpha - \beta) A^2\beta^2}{(2\alpha\beta + B\beta + nB\alpha)^2} \tag{15}$$

and

$$\pi_2^F \equiv \pi_3^F = ... = \pi_n^F = \frac{A^2\alpha^2\beta}{(2\alpha\beta + B\beta + nB\alpha)^2} \tag{16}$$

The consumer surplus, cs, in the economy is given by $(A-P) \cdot Q/2$. Substitute for P and Q to get

$$cs^F = \frac{A^2 B (\beta + n\alpha)^2}{2 (2\alpha\beta + B\beta + nB\alpha)^2} \tag{17}$$

To get cs, P, π_1, and π_2 substitute α with β in equations 13–16. ■

Proof of Proposition 2.

$$\Delta\pi_1 = \frac{(2\alpha-\beta)A^2\beta^2}{(2\alpha\beta+B\beta+nB\alpha)^2} - \frac{A^2\beta^3}{\left(2\beta^2+B\beta(n+1)\right)^2} \vee 0 \tag{18}$$

divide Equation (17) by $A^2\beta^2$, rearrange the denominator of the first argument, π_1^F, and take β out of the parenthesis in the denominator of the second argument to get

$$\frac{(2\alpha-\beta)}{(\alpha(2\beta+B(n+1))+B(\beta-\alpha))^2} - \frac{1}{\beta(2\beta+B(n+1))^2} \vee 0 \tag{19}$$

Let, $X \equiv \left(2\beta^2+B\beta(n+1)\right)$. Multiply the equation above by the two denominators (both of which are positive) to get

$$2\alpha\beta X^2 - \beta^2X^2 - \alpha^2X^2 - 2\alpha B(\beta-\alpha)X - B^2(\beta-\alpha)^2 \vee 0 \tag{20}$$

Rearrange the equation above to get

$$-\left[(\beta-\alpha)X - B(\beta-\alpha)\right]^2 - 2BX(\beta-\alpha)\beta \vee 0 \tag{21}$$

divide by $(\beta-\alpha)^2$

$$-X^2 - B^2 + 2BX\left(\frac{\beta}{\beta-\alpha}\right) < -(X-B)^2 < 0 \tag{22}$$

The reported profits of the firm is

$$\pi_1^{DF} = \frac{A^2\alpha\beta^2}{(2\alpha\beta+B\beta+nB\alpha)^2} \tag{23}$$

and

$$\pi_1^{DF} = \frac{A^2\alpha\beta^2}{(2\alpha\beta+B\beta+nB\alpha)^2} \vee \frac{A^2\beta^3}{\left(2\beta^2+B\beta(n+1)\right)^2} = \pi_1 \tag{24}$$

Multiply both sides by the denominators

$$A^2\alpha\beta^2\left(2\beta^2+B\beta(n+1)\right)^2 \vee A^2\beta^3(2\alpha\beta+B\beta+nB\alpha)^2 \tag{25}$$

rearrange the equation above and divide by $A^2\beta^2$ to get

$$4\alpha\beta^4 + 4\alpha\beta^3B(n+1) + \alpha\beta^2B^2(n+1)^2 \vee 4\alpha^2\beta^3 + 4\alpha\beta^3B\left(n\frac{\alpha}{\beta}+1\right) + \alpha\beta^2B^2\left(n\frac{\alpha}{\beta}+1\right)^2 \tag{26}$$

Rearranging the above equation yields

$$4\alpha\beta^3(\beta-\alpha) + 4\alpha\beta^2Bn(\beta-\alpha) + \alpha\beta B^2n^2(\beta-\alpha) + \beta^2B^2(\beta-\alpha) \vee 0 \tag{27}$$

Since $\alpha < \beta$ and $n > \beta/\alpha$, the right hand side is larger than the left-hand side, i.e., $\pi_1^{DF} > \pi_1$.

For the last part of the proposition, note that

$$\pi_1^{DF} = \frac{A^2\alpha\beta^2}{(2\alpha\beta + B\beta + nB\alpha)^2} > \frac{(2\alpha - \beta)\, A^2\beta^2}{(2\alpha\beta + B\beta + nB\alpha)^2} = \frac{(\alpha - (\beta - \alpha))\, A^2\beta^2}{(2\alpha\beta + B\beta + nB\alpha)^2} = \pi_1^F \tag{28}$$

■

Proof of Proposition 3. First, note that $\Delta cs > 0 \; iff \;\; P^F < P$. Start from Equation (3)

$$\frac{A^2\alpha^2\beta}{(2\alpha\beta + B\beta + nB\alpha)^2} \vee \frac{A^2\beta^3}{\left(2\beta^2 + B\beta\,(n+1)\right)^2} \tag{29}$$

multiply by 4β, and take the square root of both sides (both the right-hand side and the left-hand side are positive) to get

$$P^F = \frac{2A\alpha\beta}{(2\alpha\beta + B\beta + nB\alpha)} \vee \frac{2A\beta^2}{\left(2\beta^2 + B\beta\,(n+1)\right)} = P \tag{30}$$

divide by $2A\beta$, and take β out of the parenthesis in the denominator of the right-hand side to get

$$\frac{\alpha}{(2\alpha\beta + B\beta + nB\alpha)} \vee \frac{1}{(2\beta + B\,(n+1))} \tag{31}$$

Multiply both sides by the two denominators to get

$$2\alpha\beta + nB\alpha + B\alpha \vee 2\alpha\beta + B\beta + nB\alpha \tag{32}$$

and thus,

$$0 < B\,(\beta - \alpha) \tag{33}$$

■

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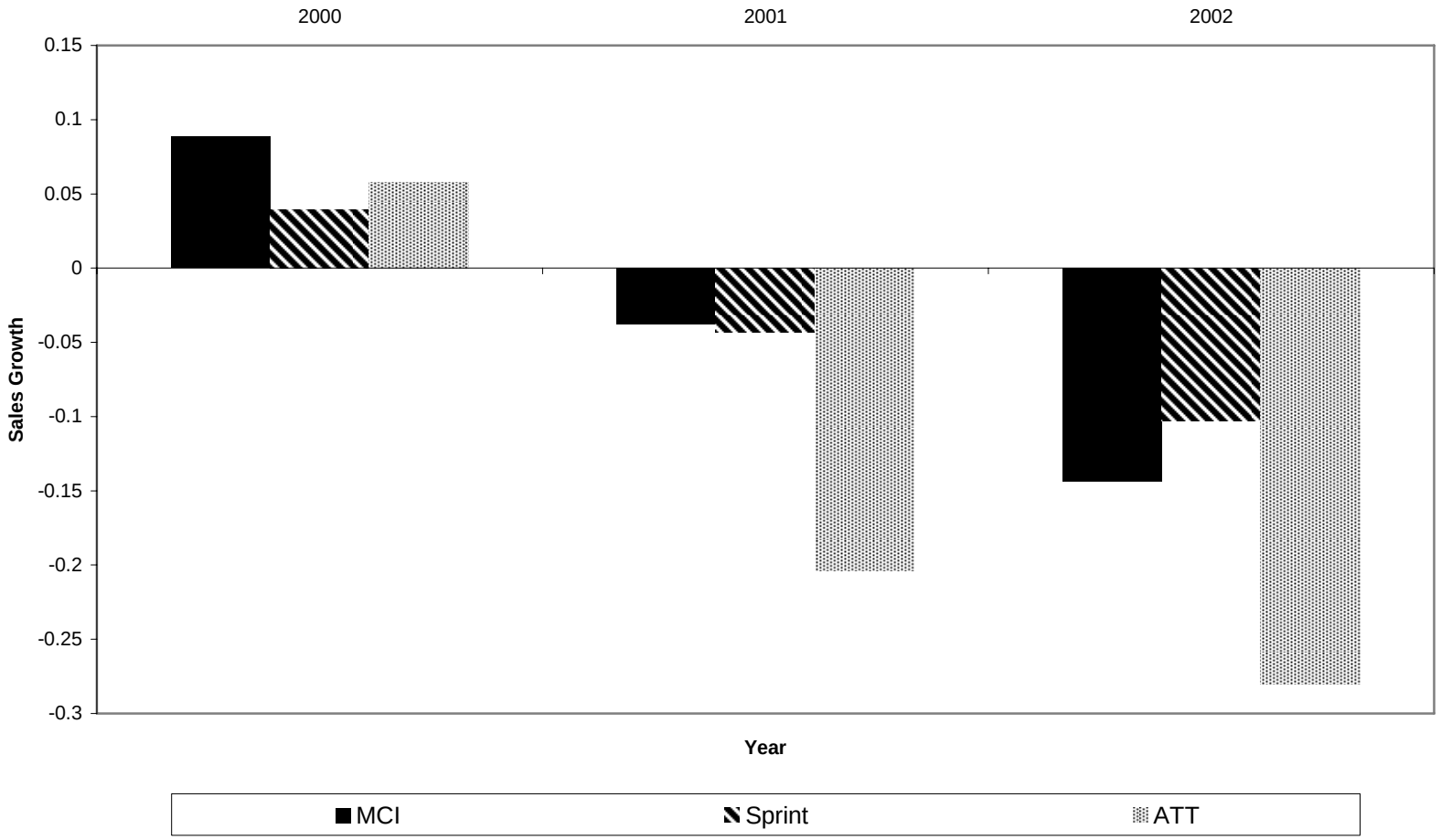

Figure 1: Annual Performance of MCI, Sprint and ATT. The figure plots the annual sales growth for these firms for the period 2000-2002.

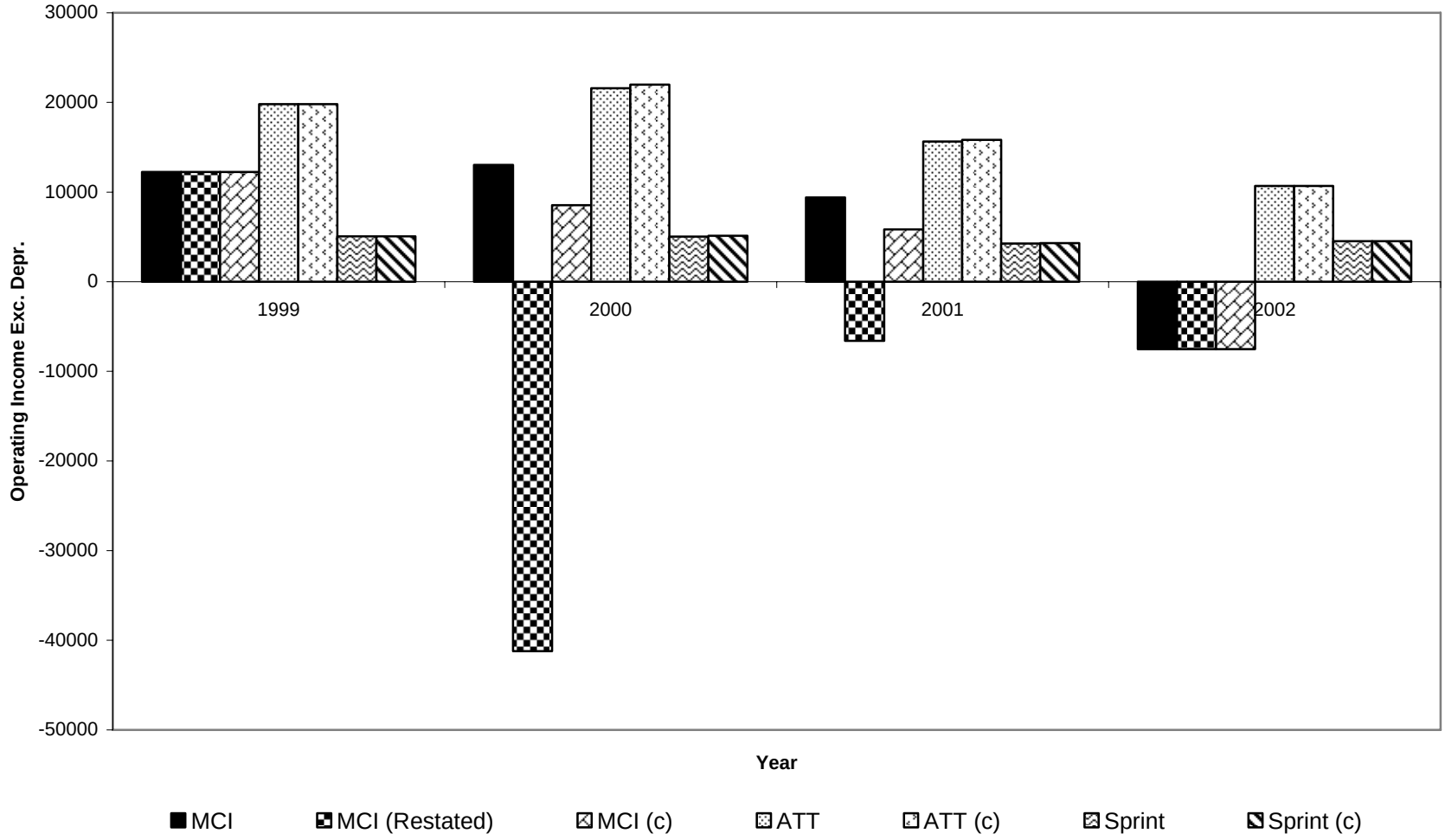

Figure 2: Operating Income Ecxl. Depr. for MCI, Sprint and ATT. The figure plots the annual operating income for these companies for the period beginning in 1999 and ending in 2002. It includes both the reported MCI results and the restated results. The "c"s in the parenthesis represent hypothesized counterfactual based on Table 1, assuming α=0.00000175 and α=0.000003 for 2000 and 2001, respectively.

Table 1- Market Shares

The table reports the market shares and growth in market share for WC, ATT and Sprint for the period 1998-2001. The data is extracted from the 2003/2004 Telecoms in United States of America (Paul Budde Communication Pty Ltd, 2003).

Share of total toll service revenues - long-distance					
Year		1998	1999	2000	2001
WorldCom	Market Share	21.1%	21.7%	20.8%	21.4%
	Growth in market Share	-	2.8%	-4.1%	2.9%
ATT	Market Share	38.7%	36.9%	35.2%	34.2%
	Growth in market Share	-	-4.7%	-4.6%	-2.8%
Sprint	Market Share	7.6%	9.0%	8.4%	8.5%
	Growth in market Share	-	18.4%	-6.7%	1.2%

Share of total toll service revenues - long-distance and International					
Year		1998	1999	2000	2001
WorldCom	Market Share	23.5%	23.7%	22.4%	23.5%
	Growth in market Share	-	0.9%	-5.5%	4.9%
ATT	Market Share	43.1%	40.4%	37.8%	37.5%
	Growth in market Share	-	-6.3%	-6.4%	-0.8%
Sprint	Market Share	8.5%	9.8%	9.0%	9.3%
	Growth in market Share	-	15.3%	-8.2%	3.3%

Table 2- Measuring the Effects of Accounting Fraud

The table reports the estimates of Equations (2) – (5) in millions, as a function of α where $A \approx 313$, $B \approx 0.08 \cdot 10^{-6}$, $n=6$, and $\beta = 0.00001$.

α	The Cost to Fraud Firm	The Cost to Competitors	Consumer Surplus	Economic Surplus
0.000009	-$31	-$12	$14	-$28
0.000008	-$149	-$27	$32	-$144
0.000007	-$432	-$46	$56	-$423
0.000006	-$1,037	-$72	$88	-$1,021
0.000005	-$2,318	-$108	$134	-$2,291
0.000004	-$5,181	-$161	$208	-$5,134
0.000003	-$12,434	-$249	$339	-$12,344
0.000002	-$36,025	-$423	$633	-$35,814
0.0000019	-$40,833	-$450	$684	-$40,600
0.0000018	-$46,517	-$480	$741	-$46,256
0.0000017	-$53,291	-$514	$806	-$52,998
0.0000016	-$61,439	-$551	$882	-$61,109
0.0000015	-$71,344	-$594	$970	-$70,968
0.0000014	-$83,526	-$642	$1,073	-$83,095
0.0000013	-$98,714	-$697	$1,197	-$98,214