

The Economic Consequences of Accounting Fraud in Product Markets: Theory and Evidence from the US Telecommunications Industry*

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Abstract

This paper studies the effects of accounting fraud on the product market. The theory advanced in this paper relies on the intuition that a firm's financial statements and actions must be consistent with each other. If the financial statements portray the firm as a relatively efficient firm, then the firm must act accordingly, i.e., increase its market share and/or reduce its prices. Otherwise, the market would be able to identify the fraud. In such cases, the manager takes actions and makes pricing decisions, which are not optimal. Consequently, 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.

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1 Introduction

The existing literature, which studies the effects of 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 securities 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 take on additional 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.

In general, firms operate in and affect two major markets, financial markets and product markets. While the literature studies extensively the effects of fraud on financial markets, it neglects to study the effects on the product market. Therefore, the literature ignores the effects of fraud on competing firms and consumers. Consequently, the economic consequences of accounting fraud are understated. As Sadka (2004a, 2004b) indicates, financial reporting can significantly affect the product market and should not be ignored.¹ Since truthful financial reporting influences product markets, untruthful financial reporting is likely to have an impact as well.

This paper hypothesizes that when a firm engages in accounting fraud, it can affect the whole industry and as a result adversely affect social welfare. 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, in a competitive industry, if the firm portrays itself as the most efficient firm with the highest gross margins and lowest operating costs, it must be able to offer a lower price and/or increase its quantities (market share) compared to its competitors.² Otherwise, the fraud would be revealed to the market because lower costs should be reflected in lower prices and/or higher quantities (assuming no change in demand). When a firm has a competitive advantage, the market expects the firm to exploit it with the purpose of increasing its

¹See also Bushman and Smith (2001).

²It is also possible that the sales force would offer or the market would demand lower prices. In this case, managers did not initiate the adverse pricing and/or output choices, but they would be powerless to avoid them.

market share and profits. If the firm does not exploit its competitive advantage, the board and shareholders would be concerned and would inquire about the management actions. Such inquiries might reveal the fraud. Alternatively, an alert investor and/or the SEC or other regulatory agency might use the apparent inconsistency to uncover the fraud.

Since the fraudulent firm acts in a nonoptimal manner, accounting fraud is bound to affect the other firms in the industry. Unless the products of the fraudulent firm and other firms are totally independent, the pricing (output) of one product would affect the prices (output) of the other products. Therefore, 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 the firm is acting as if it is more efficient than it really is. The market price (quantity) would be lower (higher) than it will otherwise be. The price reduction and increase in the fraudulent firm's output would strain the other firms in the industry. In other words, accounting fraud can potentially bankrupt the entire industry, not to mention the fraudulent firm itself. The fraudulent firm is hurting³ because it is acting suboptimally and the rest of the industry suffers due to the resulting lower equilibrium price.

The analysis above hints of 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 where a firm capitalizes expenses.⁴ Eventually, these expenses would be realized in the future when the firm amortizes the capitalized expenses. Therefore, overall, there are no "real" cash flow effects on the firm. On the other hand, this paper advances the hypothesis that the fraud will force the firm to act in a nonoptimal manner (e.g., increase its output and lower its price). Therefore, the firm's profitability is affected. The effects of fraud on the firm are much more significant than the timing the firm chooses to recognize its expenses. Since investors expect profits to translate at some point into cash flows and dividends, the fraud will eventually be detected as it changes the firm's cash flows. Moreover, the fraud can bankrupt the firm: it might not have sufficient cash to pay off its debts, which would prompt the detection.

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

⁴The paper uses the WorldCom Inc. fraud to test the hypothesis. In this case, the firm capitalized expenses.

While the competing firms suffer from this "artificial" price decline, consumers enjoy a short-term gain. Prices fall and consumer surplus increases. Yet, this benefit is probably a short-term one. Since the fraud can bankrupt the entire industry, it might have long-term implications on productivity, prices and consumer surplus. The costs to consumers is especially high in cases where there are benefits to long-term relations with the firm. In this case, consumers would choose their supplier based on false information. In sum, while there are clear benefits in the short-term to consumers, it is unlikely that consumers are better off in the long-run.

The total social welfare implications of accounting fraud in the product market is simply the sum of the effects on industry profits and the effects on consumer welfare. Since firms are acting suboptimally, given their "true" costs, accounting fraud has adverse effects on social welfare (assuming price taking competition). Note that the welfare of consumers is increasing and the industry profits are decreasing (even though it is possible that the fraudulent firm is increasing its profits). 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 cost adds to the known costs of accounting fraud in financial markets (e.g., creating uncertainty in financial markets).

The hypothesis developed in this paper contributes to the understanding of the real effects of accounting and financial fraud.⁵ In terms of asset prices, fraud only has a distributional effect. While some investors benefit from the stock price incline, other investors bought the firm's securities at an unrealistically high price which fell when the fraud was discovered. However, there are no real cash flow effects.⁶ For instance, if an expense is capitalized fraudulently, it will eventually be depreciated and therefore would not affect cash flows or overall profits. In contrast, this paper demonstrates that capitalizing expenses can result in nonoptimal pricing, which would result in real effects on the firm, its industry and consumers.

This paper analyzes a recent episode to test the implications of the theory. Specifically, this paper explores the effects of the accounting irregularities in WorldCom Inc. (henceforth WC) on the telecommunication market in the US during the fraud period, 2000–2001.⁷ The WC case is a good case to test the hypothesis for several reasons. First, it is one of the largest frauds ever

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

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

⁷See, e.g., Sidak (2003).

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., Sprint⁸ 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.

The evidence is consistent with the analysis above. During this period, the total industry sales and the sales of each firm has declined due to declining demand. However, WC's sales do not decline as much. In fact, WC has 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. However, the restated results are very poor. The firm's true performance during this time period was much lower than the rest of the industry. After the fraud was discovered in 2002, WC's sales declined in 2003 by much more than the sales of its competitors. This result supports the hypothesis that WC, during 2000–2001, increased its market share by acting as if it were truly as efficient as its financial statements suggested. When the fraud was discovered, 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. Finally, Section 5 concludes the paper.

2 The Model

The model aims at identifying 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, these inefficient allocations could come about due to fraudulent management's desire to avoid detection. The management's actions should be consistent with the financial statements, or else the fraud would be detected immediately and the management would be penalized. What follows describes the model setup and some of its key assumptions.

⁸Sprint FON, excluding its wireless PCS services unit.

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.¹⁰ 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 observe the true realization. Since the paper is concentrated on the effects of false disclosure, assume that Firm 1 draws β as its marginal cost.¹¹

Assumption 1: If the manager chooses to disclose falsely, she must commit to it for T periods. This assumption is made to ensure the relation with accounting practices. Any sudden change in accounting practice and recognition would alert the market about the inappropriate disclosure 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 is completely amortized and there are 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 . If the manager is caught, he will be fired and penalized with a constant exogenous amount k .¹² Later the model identifies a level of the penalty, which would eliminate the incentives for false disclosure. This assumption is valid only when there are no clear indications of false reporting (e.g., discrepancies

⁹The price taking competition was chosen to reflect the price war in the telecommunications industry during that period.

¹⁰This paper assumes that managers' incentives to increase their compensation (at the expense of shareholders) generate the incentives for untruthful disclosure. In contrast, Shleifer (2004) develops the theory that market pressure induces fraudulent reporting.

¹¹The 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.

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

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 might be less profitable. 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 publicly available information source to competitors and owners is the firm's financial disclosure. The later assumption is given for simplicity; it only affects the quantity choices in the first period.

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 much of their compensation is a function of their reported outcome.¹³ In this paper, the manager is assumed for simplicity to have no time preference.

At this point, it is important to note that while this model is a general one, there are some aspects of it that reflect the WorldCom case specifically. For instance, the price taking competition is meant to reflect the telecommunications industry during that time period. In addition, the fraud choice, i.e., reporting a lower cost than the actual, is assumed in this model to reflect 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 would 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 $\pi_{i,t}^F$ denote the true 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. Let $\pi_{i,t}^D$ and $\pi_{i,t}^{DF}$ 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

¹³Since 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.

fraud, respectively. Note, that $\pi_{i,t} = \pi_{i,t}^D$ for all i , and $\pi_{i,t}^F = \pi_{i,t}^{DF}$ for all $i \neq 1$. Finally, denote consumer surplus and social welfare as cs_t and sw_t . Since the reported profits, the 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 (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 relies 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. This result holds for any (weakly) increasing cost function, when the competitive game, prices and output are observable.

This is an important implication of the theory. The consequences of accounting fraud in product markets are a result of enforcement. Take away enforcement and fraud will have no consequences in the product market. To sustain a viable financial system it is necessary to have financial reports and that accounting rules be enforced. Therefore, the effects of fraud are one of the costs associated with the reporting requirement of financial markets and their enforcement. The enforcement makes financial statements credible and forces fraudulent management to act accordingly 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' perception 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 is consistent with its reported cost. Therefore, the competing firms 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. ■

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 would hold 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 would reflect the actual lower profits of previous periods. Hence, the true cost function during these periods would be revealed. ■

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

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:*

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

Proof. See Appendix. ■

This result shows that, in equilibrium with $k < k^*$, a manager can choose to disclose untruthfully. 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 the model. Generally, including higher discount factors would result in higher k^* and higher risk aversion would result in lower k^* .¹⁴

¹⁴Managers may also derive utility from obeying the law, that is from not reporting falsely. This will lower, k^* ,

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, although it would result in suboptimal allocations. These inefficient quantity choices would 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 $\Delta\pi_1 = \pi_1^F - \pi_1$,*

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

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

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

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

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

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

$$\Delta sw = \Delta\pi_1 + n \cdot \Delta\pi_2 + \Delta cs \quad (5)$$

Equation (5) summarizes the social cost of accounting fraud with respect to the product market. The suboptimal quantity choices would affect industry profits. Moreover, Firm 1's untruthful

possibly all the way down to zero.

disclosure and inefficient quantity choices would affect the entire market, including consumers, which will be affected by price variations.

Proposition 2 *Firm 1 has lower true profits when its manager 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.¹⁵ 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 separately 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 is simply the sum of the above implications.

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).

¹⁵It 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 would result in a benefit to Firm 1. This paper chose price taking competition to be consistent with the telecommunications industry.

Therefore, since the fraud equilibrium varies from this first best equilibrium, fraud has an overall negative effect on social welfare. ■

2.2 Testable Implications

The model above provides some empirical predictions on the effects of accounting fraud on the product market. First, the model predicts that the fraudulent firm would perform according to its reported productivity – i.e., if the firm states in its financial reports that it has very low costs (compared to its competitors), then the firm should be increasing its market share. 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 (compared to its competitors). Second, since the firm was acting suboptimally during the fraud period, after the fraud is discovered it will reduce its market share. Finally, the true firm’s performance (the restated performance) is 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 remains constant, the model has more empirical implications. The model predicts that the quantities in the industry would increase and that prices would fall. Since demand and supply rarely remain constant through time, it is unlikely that these implications can easily be tested.

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.¹⁶

3.1 Data

This paper utilizes several data sources on the telecommunications industry and the three firms, i.e., WC, Sprint, and ATT. The paper uses data from WRDS and EDGAR for the financial statements

¹⁶WC 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).

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 and a 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). This report is available online at http://www.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/trend504.pdf.

3.2 Background

WC was a US-based international telecommunications service provider.¹⁷ 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, the market found out that WC had overstated EBITDA by fraudulently capitalizing its expenses (about \$10 billion) – the largest accounting scandal committed in the US to date.¹⁸ In July 2002, the company filed for Chapter 11 bankruptcy with debt of \$41 billion.¹⁹ 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, the revenues from government contracts have increased substantially during the post-fraud period.

The management perpetrated the fraud simply by transferring line costs – fees to telecommunication 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, WC showed about 58% gross margins versus 51%

¹⁷Source: Paul Budde report on WorldCom.

¹⁸See Haywood, McMullen, and Wygal (2004).

¹⁹The fraud was discovered by WC's audit panel (a routine internal audit).

by ATT in 2001. Moreover, the classification of line costs into capital accounts boosted operating cash flow. The capitalized expenses were included in investment activities and not 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 firms.

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 portrayed. Specifically, the section compares sales, sales growth, and operating income for the above firms, during the period of 2000–2001.

Figure 1 plot the annual sales and operating income excluding depreciation for the three competitors. (Figure 1 does not report the operating income growth in 2002 because the annual operating income of 2002 is the restated number.) 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 competitors during this time period. This result is quite surprising given the hindsight that WC was struggling. Moreover, the reported operating income was very high. In conclusion, it seems that WC was doing very well.

Figure 2 shows the sales growth from 2000 to 2001 in the major sectors that these companies compete in.²⁰ Apart from the long-distance voice services sector, WC had increased its market share and had the highest sales growth. WC had a very strong sales growth in the other voice services while the other firms faced declining sales. WC also had the largest sales growth in the data services segment. During this period, Sprint was the only other firm with sales increase in the data services. However, the sales increase was not as strong as that of WC. In the local voice services, ATT and WC seemed to be competing strongly on market share. Both had very similar sales growth.

Figure 3 reports the log quantities growth for the three firms in the long-distance toll services. Using the Consumer Price Index (CPI) for the service and the sales growth, it is possible to calculate the quantities growth, $\Delta q \equiv \Delta sales - \Delta CPI$. The results are consistent with the predictions of the model. Assuming that prices are similar between competitors, WC seemed to have the strongest

²⁰Figures 3 and 4 are based on the Paul Budde Telecomms report.

growth in quantities in the industry during the fraud period.

During the fraud period these three major competitors (WC, ATT, and Sprint) 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's market share declined from 9.8% in 1999 to 9.3% in 2001. However, WC did not seem to lose market share. Its market share declined from 23.7% in 1999 to 23.5% in 2001.²¹

An analysis of the pre-fraud period and the post-fraud period suggests that WC was struggling due to inefficient pricing and/or quantity choices rather than an inefficient organization. In 2000, excluding restructuring charges made by ATT, both ATT and WC have approximately similar operating margins (approximately 20%). Moreover, in the post-fraud period, WC does not seem to engage in significant restructuring of the firm. Yet, the firm emerged from bankruptcy relatively swiftly, without a significant apparent change in the firm organization. The analysis 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 be caused by inefficiencies in WC's operations. The fraudulent firm appears to have the same organizational efficiency as its competitors. 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 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 of 1993–2001. However, in 2001 the ARPM declined sharply from 0.53 in 2000 to 0.35 in 2001.²²

The pricing in the industry seems to have taken a toll on the industry margins. Both ATT and

²¹The market share is extracted from Table 59 of the 2003/2004 telecoms in the United States of America (Paul Budde Communication Pty Ltd).

²²The information is extracted from the 2003/2004 telecoms in the United States of America (Paul Budde Communication Pty Ltd).

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 operating margins declined from 30% in 1999 to 25% in 2001. In contrast, Canadian telecommunications companies did not experience a similar decline in margins. For instance, ATT Canada was increasing its operating margins during the same time period. Also, Aliant kept a constant margins (38%) during the fraud period. The Canadian firms provide evidence that the effects on the industry margins are 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

Apart from the data in Figures 1–4, there is much more anecdotal evidence. For instance, the 2003/2004 Telecoms in the United States of America report is also puzzled by the trends in the telecommunications market. In the USA long-distance calling market, the report makes the following observation: *"One of the most interesting trends of the past few years has been the introduction of so-called 'all you can eat' plans, such as ATT \$19.95 per month for unlimited interLATA calls to any other ATT consumer and MCI's (previously WorldCom's) 'Neighborhood' plan which allows unlimited local and long-distance calling from \$49.99 and \$59.99 per month, depending on the subscriber's location. The company now has over 2 million subscribers to this service."* Notice that during this time period WC was very competitive in its pricing and output.

In a recent article in the Wall Street Journal,²³ the authors study the effects of the fraud on ATT. Prior to the discovery of the fraud investors and analysts were concerned with the performance of ATT and its former CEO, C. Michael Armstrong. For instance, *"On Wall Street many investors blame Mr. Armstrong for billions of dollars in lost market value at one of America's iconic corporations."* The article further suggests that ATT was burdened by a price war with WorldCom: *"ATT core business was showing signs of trouble as well, as WorldCom and other upstarts started a price war to get customers."* As a summary, Mr. Armstrong said, *"Suddenly, ATT looked like it couldn't manage its business as well as WorldCom. But in hindsight they weren'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 – WorldCom was straining the

²³The Wall Street Journal, May 26, 2004, Former chief tries to redeem the calls he made at AT&T, by Rebecca Blumstein and Peter Grant.

industry.

The evidence and the analysis in the paper are consistent with the conclusions of Sidak (2003). Sidak concludes that WorldCom's fraud probably caused other firms in the industry to spend too much on acquiring new consumers. The financial reports of WorldCom distorted the economic gains of acquiring new customers and caused other firms to spend too much. Sidak also quotes William Esrey, the CEO of Sprint, saying that WorldCom's fraud led the industry to "unsustainably" low prices. Sidak develops the hypothesis that WorldCom's management engaged in an inefficient strategy to hurt its competitors and manipulated the accounting numbers to avoid detection while exploiting the benefits. However, WorldCom did not benefit. The predatory strategy was not optimal for WorldCom and the managers could have benefited even more if they had not chosen this strategy and simply manipulated the accounting profits. Therefore, this paper develops the theory that the fraud caused the nonoptimal 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 (2004a, b) hypothesizes and provides supporting evidence that competitors can use financial statements to extract the competitive advantage of a firm in the industry. However, when a firm falsely reports a competitive advantage, the competing firms might mistakenly choose a non-profitable investment and/or nonoptimal firm organization. Both the article in the *Wall Street Journal* and Armstrong claim that the accounting fraud of WC made ATT make bad investment decisions: *"Indeed, many of his moves were prompted by competition with WorldCom. Mr. Armstrong cut \$7.5 billion in costs and more than 20,000 employees to try to match his rival's fraudulent profit margins. And in the spring of 2000 a price war with WorldCom forced ATT to revise revenue estimates to the year downward. To Wall Street, ATT looked like a lumbering giant that couldn't act as nimbly as its brash new competitors. The company lost \$20 billion to \$30 billion in market value that it never recovered."* Moreover, 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."* ATT actions are consistent with the hypothesis advanced in Sadka (2004a, b). It seems that competitors use financial statement analysis to draw inferences on their competitive disadvantages and ways to improve their organizational efficiency. While in general,

these actions 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 overinvestment 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,²⁴ the firm's competitors made 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 projection 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, stating that the true performance is much worse than the industry's performance, and that the post-fraud performance is low. To test the first of these predictions, Figure 4 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 is not choosing its actions and pricing decisions optimally. The operating performance is also much lower than that of other market participants, i.e., ATT and Sprint (they are 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 produced too much, in the period following the discovery of the fraud, the firm must 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 the decline in sales is much lower than what it otherwise would be, due to government assistance. For example, the General Services Administration (GSA), the Department of Defense, and other federal agencies supported MCI after it went bankrupt. In addition, after MCI (it was named WC when it filed for bankruptcy) filed for bankruptcy, its revenues from various federal contracts grew by approximately \$270 million. In

²⁴These projections were also filed with the FCC.

May, the National Oceanic & Atmospheric Administration signed a seven-year contract with MCI to provide satellite data communications. In April, the Defense Information Systems Agency signed a ten-year, \$450 million contract with MCI to provide it with a defense research and engineering network.²⁵ Without these government contracts, it is not clear whether WC could have easily been revived.

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, and not only after the filing. However, in contrast, WC was increasing its market share prior to its declared 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 Tables 1 and 2 are not meant to capture the exact cost to the economy due to the WC fraud. These results are meant 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 time period 2000–2001, assume that during this period demand is constant and the 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 and there does not seem to be any significant demand variation in telecommunications during this period (most of the decline in demand seems to have occurred by 1999). Even with demand fluctuations, it is likely to assume that most of the variation in prices and quantities is based on changes in the supply curve during

²⁵Source: Paul Budde MCI report.

that period.

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 $Q_{2001} = 3275$.²⁶ Use the following set of equations

$$\text{Year } 2000 : \quad 53 = A - B \cdot 3251 \quad (6)$$

$$\text{Year } 2001 : \quad 51 = A - B \cdot 3275 \quad (7)$$

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.

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 of 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 data²⁷ suggests that $1 \cdot 10^{-4} \leq \beta \leq 10^{-7}$. For the illustration in Tables 1 and 2, assume that $\beta = 0.00001$. The effects of the fraud on the product market are higher as β decreases.

²⁶The prices and quantities data from the FCC is also consistent with the model. The prices in the industry fell and quantities increased.

²⁷The prices and quantities data is from the FCC report.

Table 1 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 as well. The overall effect of fraud on the product market is 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 and consumers are expected to benefit by about \$500 million and \$800 million, respectively, such that the overall negative effect of the fraud on social welfare is approximately \$49 billion. This cost is economically significant relative to the industry. Note that these estimated costs are annual. The longer the fraud period, the higher the social cost.²⁸

Figure 4 plots the figures from Table 1 along with the actual and restated results for each of the competitors. In particular, the counterfactuals are based on $\alpha = 1.75 \cdot 10^{-6}$ and $\alpha = 3 \cdot 10^{-6}$ 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 if no fraud had 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 1. It seems that the effects on competitors are insignificant compared to the effects on the fraudulent firm.²⁹

Table 1 and the model ignore the adverse effects of accounting fraud on the investment decisions and the firm organizations of the fraudulent firm’s competitors. As pointed out earlier, the CEO of ATT claims he made a few wrong choices because he was attempting to "copy" the performance of WC. To illustrate the adverse effects of such nonoptimal decisions, assume that the most efficient feasible production process yields the following cost function $C_i(q_i) = \beta \cdot q_i^2$. Also, assume that if the competing firms undertake actions to change their production process, their cost function

²⁸While 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.

²⁹This result is specific to the competitive model and cannot be generalized.

will increase to $C_i(q_i) = \gamma \cdot q_i^2$, where $\gamma = \beta + (\beta - \alpha)$. This assumption states that the more pronounced is the fraud and the more other firms attempt to copy it, the more likely they would fail in their attempt to copy and the cost to their firm would increase.

Table 2 repeats the analysis under the new assumptions above. In this case, the cost to the fraudulent firm decreases because its competitors are becoming less efficient. However, the cost to its competitors is very large (e.g., \$3 billion when $\alpha = 7 \cdot 10^{-6}$). Moreover, since it is not clear whether prices fall, consumer surplus may not increase at all, as shown in Table 2. For $\alpha = 7 \cdot 10^{-6}$, consumers are worse off by about \$100 million. These results are not apparent in the data. It seems that ATT and Sprint did not incur a significant decline in productivity during the same time period. However, this result does not suggest that these firms did not waste resources attempting to learn about and adopt the "superior" organization of WC. In fact, there is significant amount of anecdotal evidence in support of inefficient over investments in the telecommunications industry during the fraud period.

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, this interpretation has several caveats. First, the management knew the true performance. Therefore, they could have simply changed their strategy or production process. Moreover, if management was willing to falsify the financial statements, they would have been even better to choose a better production process or strategy and still falsify the reports to show unusually high performance. The second caveat of this alternative interpretation is that it is inconsistent with WC's true performance and actions. Specifically, if WC was truly less efficient than its competitors, then it should have reduced its market share and/or increased prices. Conversely, WC increased its market share and reduced prices.

Another interpretation for the results is that WC chose a strategy to hurt its competition. This hypothesis does not seem to be consistent with the data. It seems that WC was hurting more than

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 sum, the only 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 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 i.e., accounting fraud has a significant impact on the product market to other cases 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 high. To illustrate this point more formally, assume that the firm's cost parameter, α , is distributed normally, $\alpha \sim N(\beta, \sigma_\alpha^2)$. Also assume that financial reporting, denoted as y , provides a noisy measure of the cost parameter, i.e., $y = \alpha + \varepsilon$, where $\varepsilon \sim N(0, \sigma_\varepsilon^2)$ and ε is independent of α . Thus,

the conditional expectation of α given y , is

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

The model in the paper requires the manager to act as if her firm is more efficient than it is, because otherwise the market will 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 the 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. In terms of Equation (7), this analysis is equivalent to assuming that $\sigma_\varepsilon^2 \rightarrow \infty$. In this case, accounting signals do not provide information about α .
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 it is more efficient than it is without changing the way it acts. 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 they choose to take.

On the other hand, the incentives to commit fraud are lower for managers of monopolies. Unless the costs are higher than the demand for the first unit, denoted as A in the model, the firm can always make a profit (ignoring fixed costs). In such cases, the managers have a lower incentive to commit fraud. The conditions above imply that it is more likely that frauds will occur in industries where the output/pricing response is expected to be lower (assuming the incentives to commit fraud are the same for all industries).

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 $\xi \sim N(0, \sigma_\xi^2)$, 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 firms 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

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

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

4.2.2 The Role of Auditors

The model does not take into consideration the role of auditors although public financial statements are audited each year. However, the models implicitly includes auditors, internal auditors,³⁰ and other market participants, such as the SEC, that enforce truthful disclosure.³¹ The basic model assumes that the manager has a probability λ_2 of getting caught in each period. Skillful auditing can increase this probability and reduce the number of frauds perpetrated in the market. On the other hand, when the auditors are involved in the fraud, as in the case of Enron, the probability

³⁰The WC fraud was first discovered by an internal auditor.

³¹These participants can also include arbitrageurs and other active investors that follow the firm.

of getting caught is very low, and the expected benefit of fraud is higher. Therefore, auditors play an important role in the model in preventing fraud.

4.2.3 The Type of 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 instance, in Cournot, the fraudulent firm actually benefits from the fraud at the expense of its competitors.

In this paper, the model assumes that the price competition was not related to the fraud. However, accounting fraud can also change the competitive game. For instance, if WC was trying to prove that it was truly more efficient, it might have chosen a bullish pricing strategy. This strategy might have created a scenario in which the way the firms compete changed. The fraud might have pushed the industry away from a Cournot quantity equilibrium into price taking competition. The effects of accounting fraud would be much more pronounced in such cases. It is also possible to show that in some cases competitors might choose price taking competition to challenge the fraudulent firm and test whether it is truly more efficient. Since price taking competition strains the fraudulent firm, it might result in a more prompt discovery of the fraud.

4.2.4 Who Generates the Effects on the Product Market?

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. These employees are acting optimally given their beliefs about the firm's productivity and cost structure. Alternatively, the market can observe the high margins and consumers will allocate themselves to the more efficient firm, while driving down the price. These considerations do not affect the implication for the product market. But if the managers do not anticipate this behavior, they may not take it into account when they choose whether to commit to fraud in the first period.

4.2.5 ATT Sues MCI for Racketeering

Recently, in 2003, ATT sued MCI for routing long-distance calls through Canada, forcing ATT to pay the costly fees that MCI should have paid.³² It is important to note that even assuming these charges are just, this lawsuit cannot explain the ability of MCI to compete with ATT. First, it appears that the alleged conspiracy began in mid-2001. The fraud, however, began in 2000. WC appears to have been productive well before these alleged illegal routing began. Second, the size of the lawsuit is not significant enough to explain WC's actions. It seems that the lawsuit is for about \$10 million³³, while WC's reported operating income was around \$13 billion.

4.2.6 WorldCom's Faulty Projections

Alongside an accounting fraud, WC also provided faulty Internet traffic projections. WC was a major player in that market and submitted those reports to regulators as well. Therefore, its competitors believed they could rely on these projections.³⁴ These projections have likely caused much of the overinvestment in the telecommunications industry during this time period. On the other hand, it probably did not affect the low prices in the industry. In addition, these projections raise doubts about the motives of the managers to use predatory strategy to deter entry. These projections imply high future demand, which might increase short-term entry and investment in the industry.

As in the case of the accounting fraud, the fact that these projections were submitted to the FCC created much of their effects on competitors. The submission to the FCC increases the credibility of these projections. Along with the financial statements, the faulty projections that appeared credible created the vast overinvestment in the industry. It is unlikely that the effects would be similar if faulty projections had not been submitted to the FCC.

³²Source: RedNova news article available online at: <http://www.rednova.com/news/stories/3/2003/09/03/story101.html>

³³See USA Today, AT&T sues MCI, adds new charges to call-routing complaint (2003). Available online at: http://www.usatoday.com/money/industries/telecom/2003-09-02-telecom-racketeering_x.htm

³⁴See Sidak (2003).

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 intuition 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, i.e., WorldCom. The evidence is consistent with the implications of the model. It appears as if WC is not acting 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, presented in the paper, shows that these costs can be economically significant and can have a serious adverse effect on the market. It is important to note that the effects of fraud can vary significantly depending on the type of competition, strategic behaviors and technology and in some cases it can perhaps be socially beneficial.

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

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

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 $q_2^F \equiv q_3^F = \dots = q_n^F = P/2\beta$, 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

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

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

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

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

Proof of Proposition 2.

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

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

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

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

$$2\alpha\beta X^2 - \beta^2 X^2 - \alpha^2 X^2 - 2\alpha B(\beta - \alpha)X - B^2(\beta - \alpha)^2 \vee 0 \quad (20)$$

Rearrange the equation above to get

$$-[(\beta - \alpha)X - B(\beta - \alpha)]^2 - 2BX(\beta - \alpha)\beta \vee 0 \quad (21)$$

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

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

The reported profits of the firm is

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

and

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

Multiply both sides by the denominators

$$A^2\alpha\beta^2 (2\beta^2 + B\beta(n+1))^2 \vee A^2\beta^3 (2\alpha\beta + B\beta + nB\alpha)^2 \quad (25)$$

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

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

Rearranging the above equation yields

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

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

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

■

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

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

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

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

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

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

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.a.

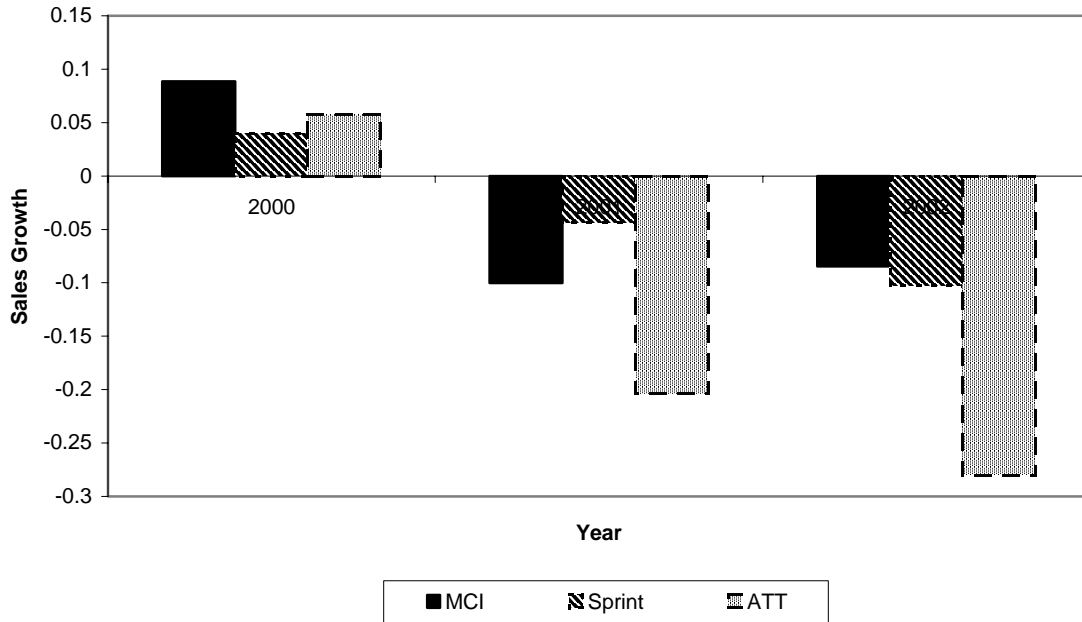


Figure 1.b.

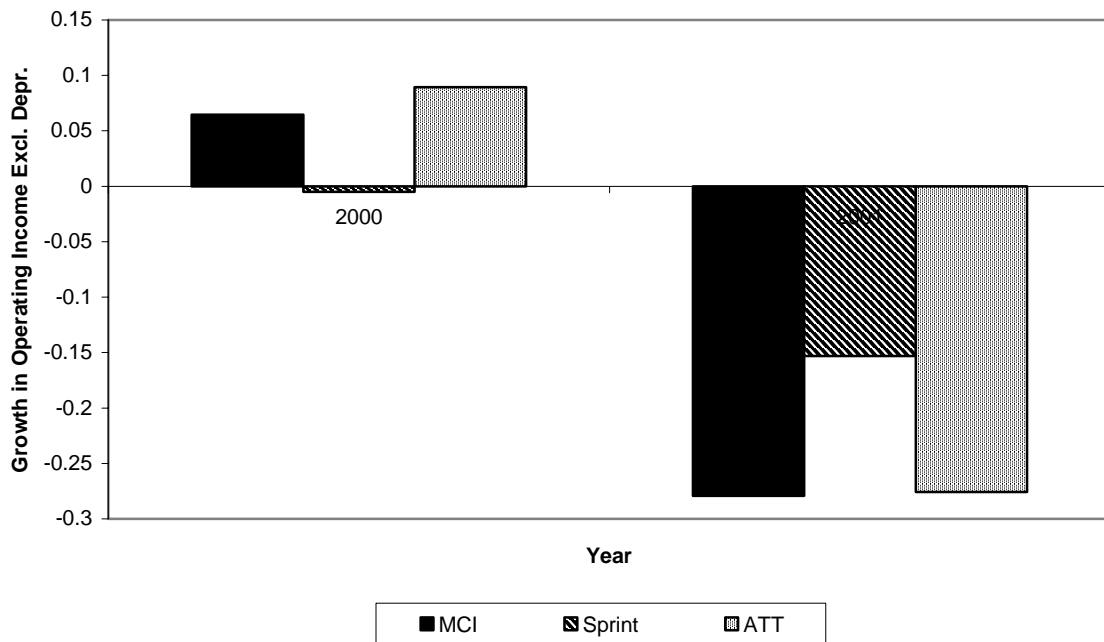


Figure 1. Annual Performance of MCI, Sprint and ATT. Figure 2.a. plots the annual sales growth for these firms for the period 2000-2002. Figure 2.b. plots the growth in operating income excluding depreciation for the period 2000-2001.

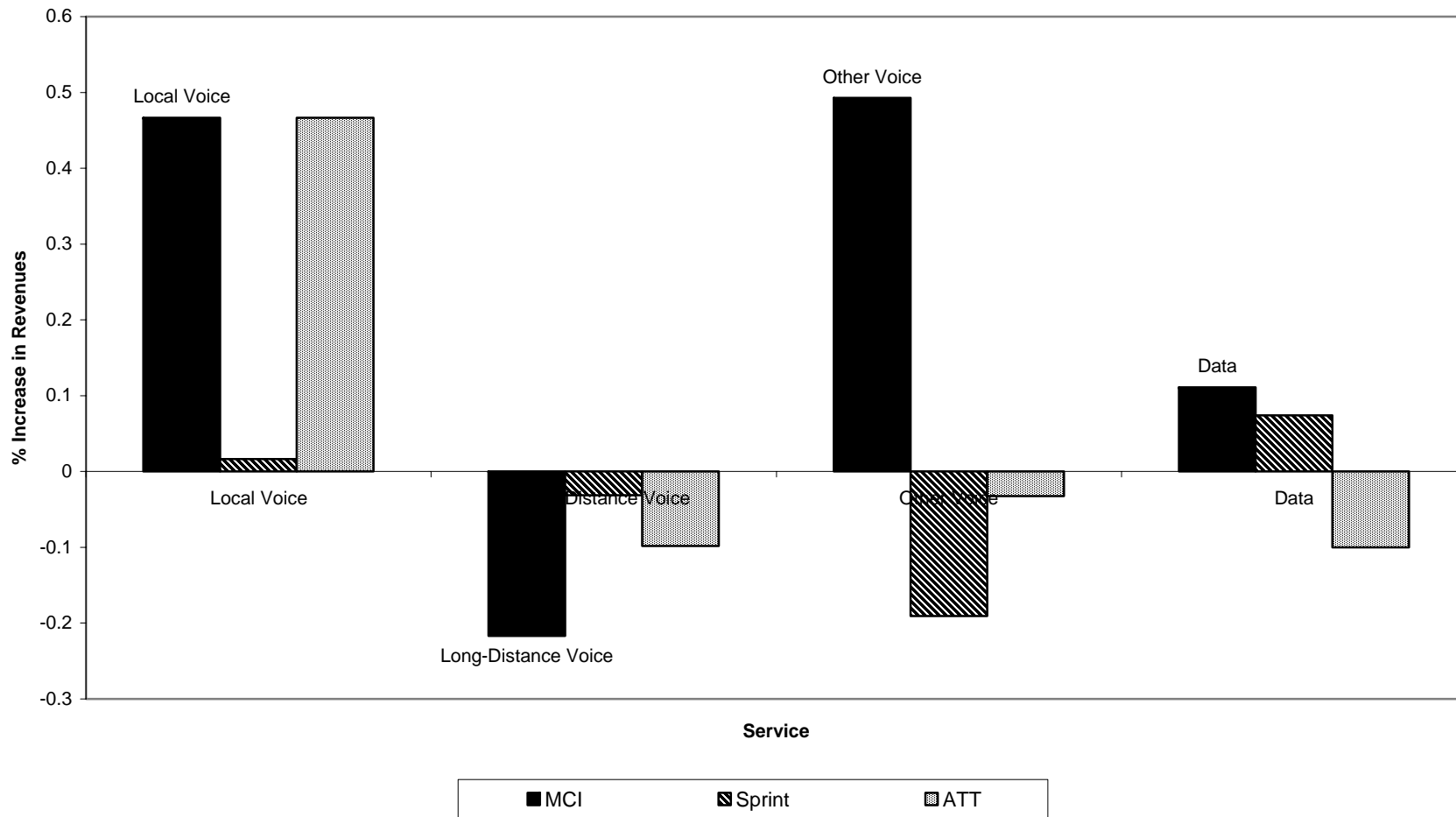


Figure 2. Increase in Revenues by Segment for MCI, Sprint and ATT. The figure plots the increase in sales for these firms for 2001 compared to 2000, by segment.

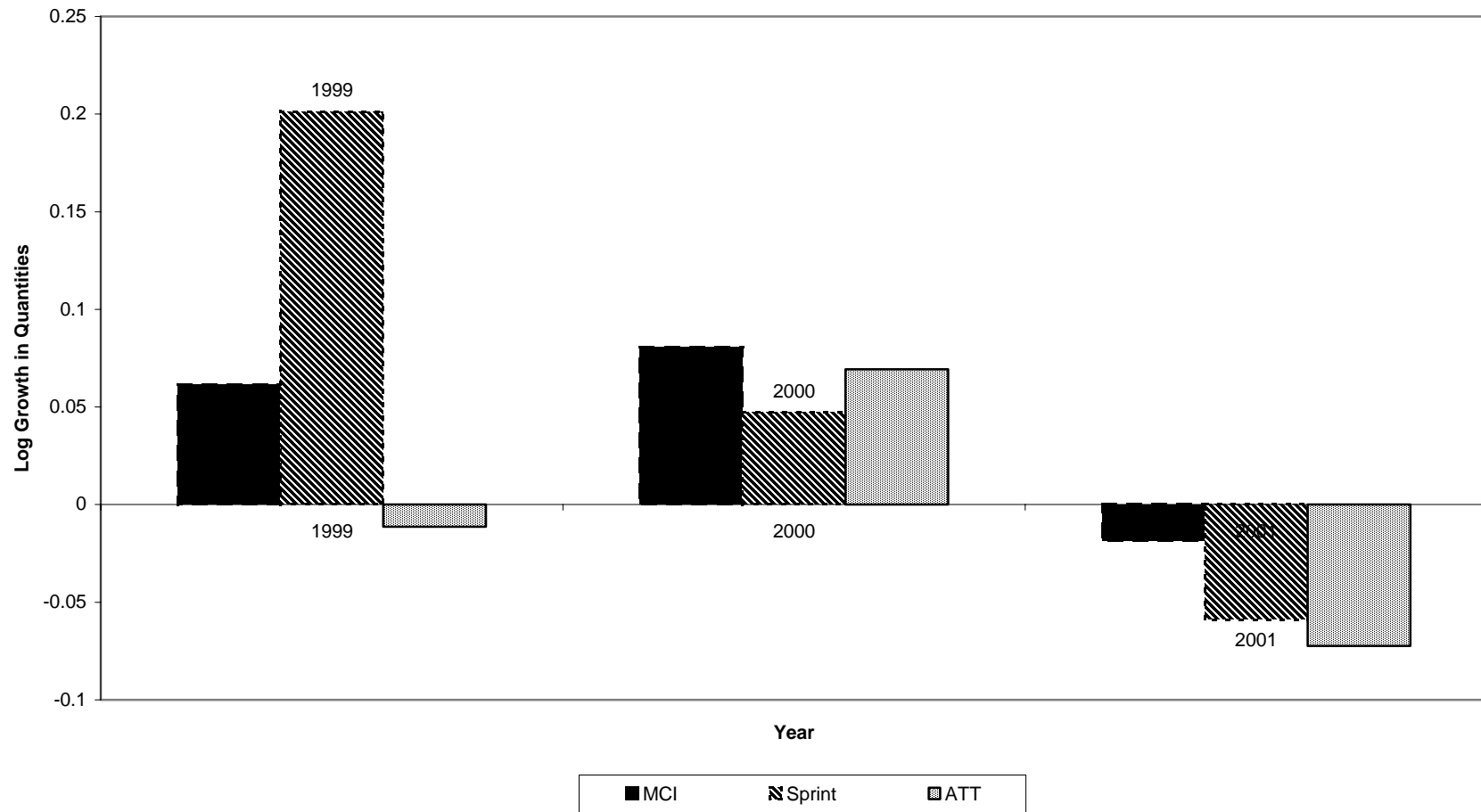


Figure 3. Increase in sales quantities for MCI, Sprint and ATT. The figure plots the increase in sales quantities for these firms for the period beginning 1999 and ending at 2001. The log growth in quantities is estimated using log sales growth and the log consumer price index.

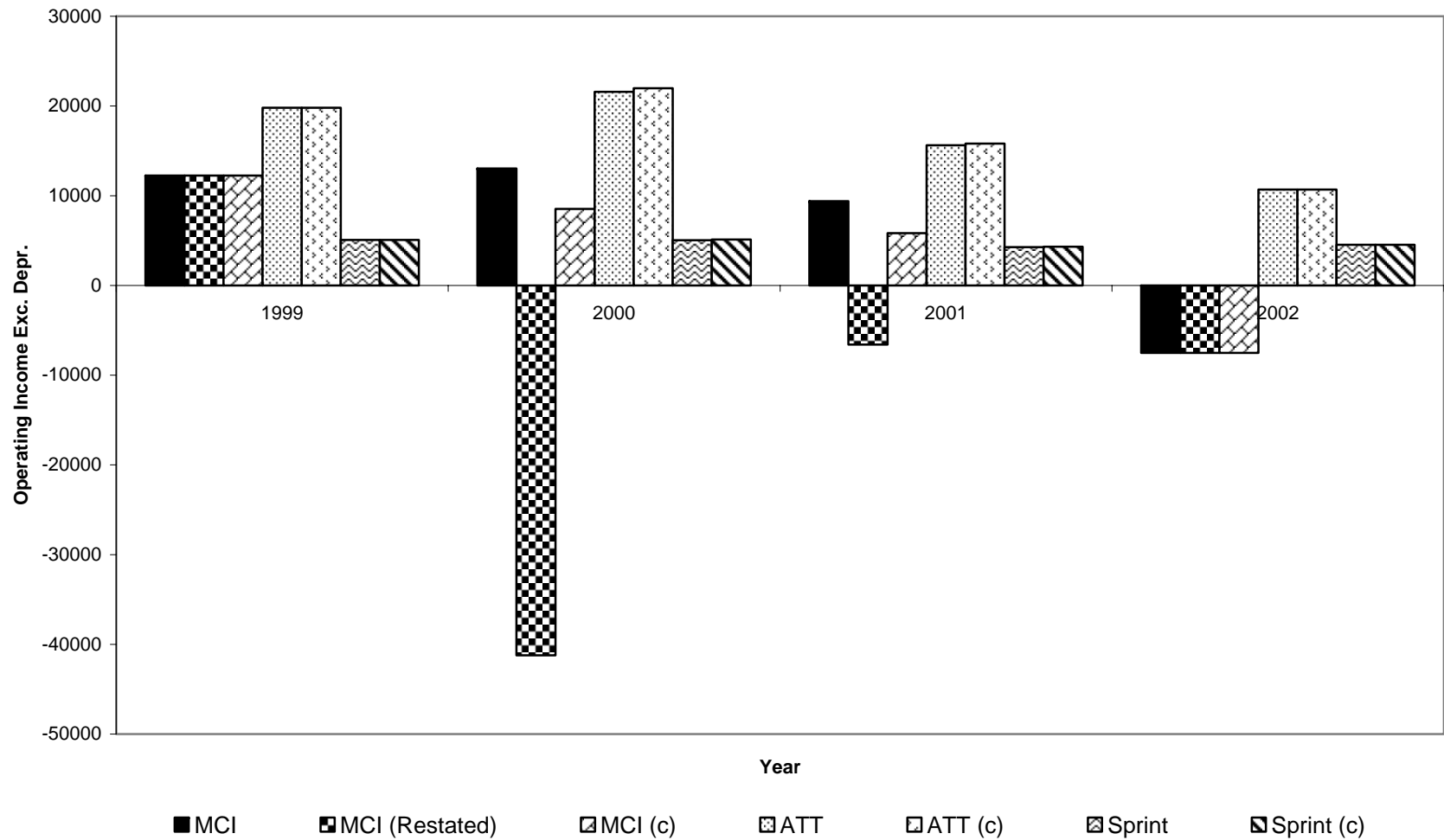


Figure 4. Operating Income Excl. Depr. for MCI, Sprint and ATT. The figure plots the annual operating income for these companies for the period beginning at 1999 and ending at 2002. It includes both the reported MCI results and the restated results. The “c” in the parenthesis represent hypothesized counterfactual based on Table 1, assuming $\alpha=0.00000175$ and $\alpha=0.000003$ for 2000 and 2001, respectively.

Table 1- 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

Table 2- Measuring the Effects of Accounting Fraud When the Productivity of Competitors Declines

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 $\beta = 0.00001$, and $\gamma = \beta + (\beta - \alpha)$.

α	The Cost to Fraud Firm	The Cost to Competitors	Consumer Surplus	Economic Surplus
0.000009	-\$21	-\$1,221	-\$53	-\$1,295
0.000008	-\$132	-\$2,250	-\$90	-\$2,472
0.000007	-\$412	-\$3,129	-\$113	-\$3,654
0.000006	-\$1,019	-\$3,892	-\$123	-\$5,034
0.000005	-\$2,318	-\$4,563	-\$118	-\$6,998
0.000004	-\$5,232	-\$5,164	-\$90	-\$10,485
0.000003	-\$12,629	-\$5,717	-\$17	-\$18,363
0.000002	-\$36,724	-\$6,260	\$183	-\$42,801
0.000001	-\$179,152	-\$6,925	\$1,077	-\$185,001
0.0000009	-\$224,239	-\$7,019	\$1,327	-\$229,932
0.0000008	-\$287,072	-\$7,126	\$1,664	-\$292,533
0.0000007	-\$378,074	-\$7,250	\$2,137	-\$383,187
0.0000006	-\$516,522	-\$7,400	\$2,831	-\$521,091
0.0000005	-\$741,312	-\$7,590	\$3,918	-\$744,983
0.0000004	-\$1,140,720	-\$7,845	\$5,782	-\$1,142,783