EFFECT OF LAWSUITS ON STOCK PRICE COMPARED TO PRODUCT WITHDRAWAL: A FOCUS ON THE CONSEQUENCES OF VIOXX'S ADVERSE EFFECTS

by

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INTRODUCTION

Cox-2 inhibitor drugs have become major money makers for the pharmaceutical companies. With arthritis affecting millions of people across the country, these prescription drugs have given relief to these sufferers for several years now where other pain relievers, including over the counter drugs, had failed to do so.

Unfortunately, there is a risk associated with the use of pharmaceutical drugs since they are altering chemicals and functions in the body. Sometimes the negative side effects are known during the FDA trials and consumers are aware from the time their doctor prescribes the drug, or the drug never makes it to the market. Other times, it takes long term use to notice any problems the drug causes.

When these negative side effects are made known, it may be possible for the consumer to seek compensation from the manufacturer, usually in the form of lawsuits. These lawsuits can cost billions of dollars to the company from litigation costs, attorney's fees, and verdict awards. Most pharmaceutical companies are large enough to absorb these costs and are usually prepared for these costs since lawsuits happen often. Social concerns for people's health may make it necessary to completely remove a drug from the market to prevent future damage to consumers. If it is a popular drug like the Cox-2 inhibitors, the

revenues lost can be much greater than any lawsuit awards. Complete removal may not always be warranted. Sometimes additional warnings may be sufficient to ward off consumers who may be more susceptible to the negative side effects.

If a company must decide between product removal and additional future lawsuits, the stigma associated with civil lawsuits may sway a company towards product removal with the hopes of reducing the payouts that will most likely occur with the lawsuits. In the eyes of owners and investors this may not be the best decision, and a look at a company's stock prices surrounding these events will show this to be true. In the last few years, Merck, a major pharmaceutical company in the United States, both removed a blockbuster drug from the market and faced lawsuits which they both lost and won. The data will show that it was not in Merck's best interest to remove their Cox-2 inhibitor drug, Vioxx, from the market when they did.

CHAPTER II

STOCK PRICES

The essence of holding stock is different now than it was at its conception. Ideally one would buy stock in a company to obtain voting rights in the company and to be a part of the day to day decision making. When someone wants to open a business, they do not need to have the full amount of money required to buy all the capital to get started. By offering stock in the company, an entrepreneur can obtain the funds needed to start the business. This is by no means a one way street though. The investor will not aimlessly throw money into a company and hope that they will not lose every dollar they invested. In return for the use of their money, the investor will want an influence in the decisions made for the company to ensure that they get a good return on their investment.

The size of today's stock market does not really allow for every stock holder to actively participate in the decisions of a company. Occasionally a stock holder will receive a ballot advising them to make selections for a board of directors, but this is often the extent of their input. Investing in a company, for a large number of investors, is no longer about helping someone start a new company; it is about the increase in the initial dollar amount invested. Stock holders want to see high dividend payouts or an increase in the stock price so that when the time comes to trade in, they have more money than when they started.

With little control of their own, stock holders expect strategic leaders of the company to make the decisions with the benefit of the company in mind, further increasing the value of the company, and hence the value of the stock. The world has seen what happens when these decision makers forget the company and make decisions that benefit themselves. Enron and WorldCom executives both have been convicted in court for fraud that devastated the companies. People put their money—their future—into a company and expect the leaders in that company to make good financial decisions creating an increase in their initial investment.

Wise leaders know that the stock price is a common and readily available evaluation of the company and they should therefore evaluate every decision to determine how the investors will perceive changes in the company. If investors feel a bad decision is going to be made or has already been made, they will sell, causing the stock price to fall. This in turn could cause more people to sell for fear of taking a loss in profits. Alternatively, if a good decision is made, more investors will buy stock in the company. Additionally, those who already own the stock will hold on to their shares in anticipation of the new investors driving up the price of the stock and further increasing their profit. To account for these fluxes in the price, there are several factors that influence the stock price, and the leaders of a company must consider all the options when making any decision.

One of the major factors that influence a stock price is the company's future income or earnings potential. Any number of factors can influence a

company's future earnings, and after each financial quarter stock prices jump up and down based on whether the company met their expected earnings.

A major factor, especially in sectors like pharmaceuticals, is their research and development for new product lines. For a company to stay competitive in a global economy, it must be constantly reinventing itself by developing new products superior to those of its competitors. For pharmaceutical companies, the research and development phase takes years, and more time and money is spent on products that never reach a consumer's hand than those that are successful. Investors will look to see if a company is spending an adequate amount of money to develop these new blockbuster products that could send earnings skyward.

Current revenue is a well known influential factor. If a company is not making a profit, investors may feel less secure in its future and be less inclined to invest in it. There are exceptions for start up companies because some investors are willing to take a chance to catch a new company at a low price with the expectations that it could sky rocket and create a large profit for the investor. These kinds of companies are considered very risky investments, for there is always a chance a new company could fail before its capital is paid for.

A company's products will go through life stages. According to Philip Kotler in Marketing Management, a product will go through four stages. The introduction stage is just as the name suggests and little or no money is made here. Investors looking at a company with a product in this stage have a risky

decision to make. If the company is the first in the market to produce this product there is a good chance that, if it succeeds, it will be a long time money maker. Kotler states that out of twenty-five companies that were market leaders in 1923, nineteen of them were still leaders in 1983. Being the first to enter a developing market can also be very risky and investors will look to see what other products a company already has in case the new product fails. If a company has enough revenue coming in from other areas, it may be able to withstand a failure and therefore could be worth the risk to some investors.

The growth stage is an ideal stage for investors to take advantage of. In this phase, the company has established their new product and sales will enter a rapid climb. Revenues will increase as "promotion costs are spread over a larger volume" (Kotler 332). Investors will look to the company to make some strategy changes to keep their sales up after competitors enter the market. These changes are usually small; such as changing the styling of the product or adding new and improved models.

The maturity stage is indicated by a slowing of sales growth. Kotler divides this stage into three further stages: growth, stable, and decaying. The growth maturity stage is signified by a decline in the growth rate. The product is still increasing in sales, just not as quickly as it was in the growth stage. The stable maturity stage is identified by a saturation of the market with the product. The product is already in the hands of every consumer who wants it, and sales will only increase as the population increases or the product needs replacing by

the consumer. The decaying maturity stage is where the number of products sold begins to decline. Consumers are looking to newer and more innovative products to replace their old, out of date products. Because in some cases this stage can last for many years, investors will see the company as more of a steady investment, usually with low risk but smaller gains.

Finally, a product will enter the stage of decline. There are numerous reasons why sales will continuously decline. Kotel lists “technological advances, shifts in consumer tastes, and increased domestic and foreign competition” as a few. If a company does not have other products to sustain itself, investors will look to escape and take their profits elsewhere, or cut their losses if they stayed in too long.

Another factor that will influence future income and earnings potential of a company is the market growth. If a particular market is expanding there is a greater capacity for growth of product sales. An investor will look for the company that is actively seeking to expand their availability to consumers in this market. On the other hand, if a market is shrinking, assuming that it is a market that is in demand and will not completely go away, an investor will look for the company that has a large enough market share to sustain itself and continue supplying the product to the limited number of consumers. An investor will look to see how a company’s sales growth compares with the growth of the entire market. According to Frost and Sullivan, if the company’s sales growth rate is greater than or equal to the market’s growth rate, this will show that the company

is truly competitive in its market, but if it is less than the market's growth rate, there could be future problems.

As implicated above, market share is also an important factor. When an investor is considering a company, the percentage of the market that company owns is important to its future. Not only does it insure that if the market shrinks, that the larger market share holders are more likely to endure, it is also likely that the larger companies will have the capabilities to expand in an upswing economy. The higher percentage of a market that a company commands, the more able it is to perform like a monopoly or an oligopoly with less competition and more freedom to set prices that allow for optimum revenues.

Finally, another important factor an investor must consider when analyzing a company's earnings potential is how many and who that company's competitors are, as well as its collaborators. Occasionally companies from different markets can work together using their specialties to improve one or both companies' products. An example of this is when General Motors and XM Satellite Radio collaborated to install XM ready stereos into General Motors' vehicles. This helped General Motors offer a more advanced model to their consumers and also helped the fledgling XM Radio get exposure to more consumers.

In addition to future income, another factor that influences a stock's price is a company's loss of income. Losses can come in a range of areas of the

company. Three examples of loss that are important to consider when investing in a company are loss of production, loss of a product, and lawsuits.

There are a couple of reasons why a company could experience a loss in production. First there could simply be a decrease in demand. Consumer preferences are constantly in a state of flux, and if a company cannot change with the consumer, the demand for their product could decrease dramatically resulting in a loss of revenue. Second, any interruption in the supply chain that helps produce a product can cause a temporary loss of production, affecting the company's bottom line. Gasoline shortages usually have a negative impact on shipping companies because their expenses increase quicker than they can increase the cost to the consumer.

A loss of a product can occur when a company chooses or is forced to stop making a product. A company may choose to stop making a product due to lack of sales. Even if a company is still able to sell hundreds or thousands of units of a product, if they are not making enough revenue from those sales to cover their cost basis, it is to their benefit to stop making the product. From a stock buyer's perspective, this situation would most likely not have much influence on someone's decision to buy that company's stock because their lack of revenues would have already been a major consideration. A company can also be forced to stop making a product due to either consumer or government standards. Recalls can have a huge impact on a company. According to the U.S. Consumer Product Safety Commission's 2005 Performance and

Accountability Report, there were almost 400 voluntary recalls resulting in almost 67 million units being recalled that year. If a company cannot simply fix the problem, then the product must be removed from the market or face the consequences of government fines and consumer lawsuits.

These lawsuits, or even the threat of lawsuits, can have an impact on a stock price. Simply put, if a lawsuit is decided against the company, their stock will usually go down; and when the company wins a lawsuit it will either not noticeably effect the price or it could go up. When a company is being sued, this affects the risk associated with that company. With settlements being as exuberant as they are in today's society, there is a constant risk associated with lawsuits until the verdict, and additionally the award if the jury decides against the company, is settled. There is a possibility that settlement caps like the one that the Texas legislature put into effect in September 2003 called Proposition 12, could lower the risk associated with lawsuits. With lawsuit caps on non-economic damages, which are usually the largest part of the awards, an investor could look at a company's revenues and determine if a company has the money to withstand a negative verdict.

Merck is a good example of a company that has had to persevere through many of the factors listed above. With their removal of one of the biggest money making drugs on the market, stock holders have been analyzing both Merck's future income and their losses.

CHAPTER III

BRIEF HISTORY OF VIOXX

To fully understand the series of events than led to Merck's removal of Vioxx from the market, a short summary is necessary because, even before its approval by the FDA for arthritis in 1999, the drug was being tested for several other uses. It was the results of these trials that created the red flag indicating that Vioxx had some previously unknown negative side effects.

In April 1998 the Mild Cognitive Impairment (MCI) trial was started to test Vioxx versus placebo for the prevention of Alzheimer's disease. In January 1999, the Vioxx Gastrointestinal Outcomes Research (VIGOR) trial was initiated which studied the effects of nonsteroidal anti-inflammatory drugs (NSAIDs), specifically Vioxx and naproxen, on upper gastrointestinal events. It was hypothesized that the blocking of the cyclooxygenase-1 enzyme is what caused upper gastrointestinal events among users of nonselective NSAID, such as naproxen. Since Vioxx is selective in blocking mostly the cyclooxygenase-2 enzyme, it was hypothesized that this would reduce upper gastrointestinal events.

Shortly after the FDA approved Vioxx, the Adenomatous Polyp Prevention on Vioxx (APPROVe) trial was initiated in February 2000. This trial used Vioxx versus a placebo to see if it was effective in preventing reoccurrences of colon polyps. In March of 2000, the preliminary results of the VIGOR study were

issued by Merck. By May these results were submitted to the New England Journal of Medicine and presented at Digestive Disease Week in San Diego. In June, Merck submitted its VIGOR data to the FDA.

As of March 2000, the MCI study did not show any difference in the rate of cardiovascular events between Vioxx and placebo; and, in April a second study was started to determine the effects of Vioxx in the treatment of Alzheimer's. A second interim analysis of the safety data was conducted, and again there was no difference in cardiovascular events between Vioxx and placebo. In May 2001, the second trial of Vioxx versus placebo for the treatment of Alzheimer's was stopped. The reason for the discontinuation of this study is still not publicly explained. Despite the abrupt stop of this trial, pooled data from the Alzheimer's study was presented at the European League Against Rheumatism (EULAR) in June of 2003. The data presented showed no excess cardiovascular events when Vioxx was compared with placebo.

In October 2001, Merck published in *Circulation* a pooled study that encompassed 28,000 patients in 23 studies. This group of data showed no excess cardiovascular events associated with Vioxx compared with both placebo and non-naproxen NSAIDs. An updated analysis of pooled data was also published in the *American Heart Journal* in October 2003, again showing similar data as published in *Circulation*.

In September 2001, Merck and Oxford signed a letter of intent for the Vioxx in Colorectal Cancer Therapy: definition of Optimal Therapy (VICTOR) trial

that would study the effects of Vioxx on colorectal cancer, and by April 2002, the first patient was enrolled. In March of 2003, the trial protocol was finalized on another trial, the Vioxx in Prostate Cancer (ViP) trial to study the effects that Vioxx had in decreasing the risk of prostate cancer. Neither of these studies would fully begin because by September 2004, the APPROVe External Data Safety Monitoring Board notified Merck of its recommendation that the APPROVe trial should be terminated due to findings of increased risk of cardiovascular incidents.

The results of the VIGOR data in March 2000 showed a "statistically significant difference" (Bertrand) in the risk of cardiovascular events for those taking Vioxx. All previous studies did not show significant differences, therefore, to account for this difference, Dr. François Bertrand, executive director of medical research at Merck Frosst, claims that key safety data was unblinded from the Alzheimer's studies and further analyzed. This data again showed no elevated risk of cardiovascular events when compared to placebo. Despite this, Bertrand says that "[b]ecause of a potential mechanism based reason to explain the higher CV risk in patients taking Vioxx…[w]e developed a prospective plan to analyze the cardiovascular event rates in three large, placebo-controlled studies."

This mechanism that Bertrand refers to was first identified in the FitzGerald study. The results were published in 2001 in the New England Journal of Medicine, and again discussed in 2004 in the same journal. The essence of the article is that NSAIDs inhibit the production of prostaglandin G/H

synthase, an enzyme that catalyzes the transformation of arachidonic acid to a range of lipid mediators, essentially lipoxygenases and cyclooxygenases. Cyclooxygenase-1 and Cyclooxygenase-2 are the forms of this enzyme that NSAIDs decrease. Both Cox-1 and Cox-2 produce chemicals that promote inflammation, but Cox-2 does so more potently than Cox-1. In addition to the pro-inflammatory effects created by the products of the Cox enzymes, these products also have some additional effects on the body. Cox-1 is protective to the stomach, which explains why Cox-1 inhibitors like aspirin cause gastrointestinal problems. The Cox-2 enzyme plays an important role in the production of prostacyclin, which reduces platelet aggregation. This could lead to excess clotting of the blood and hence the increases in myocardial infarctions in patients taking an NSAID which inhibits Cox-2.

There is much debate as to how early Merck was aware of the negative side effects caused by Vioxx. As the first few of many trials continue, new information is produced by the plaintiffs' lawyers attempting to prove how long Merck knew about the increased risk in myocardial infarctions, while Merck's lawyers attempt to show how their reaction to remove Vioxx from the market was quick and immediate following the publication of negative data.

CHAPTER IV

THE PHARMACEUTICAL INDUSTRY AND THE FDA

Vioxx is not the first drug to have been removed from the market, and most likely not the last. In 1980 a new NSAID was put on the market called zomepirac. It quickly rose in popularity, gaining eleven percent of the analgesic market within four months of its introduction (Ross-Degnan). Zomepirac is similar to Vioxx in that it quickly grew in market share and "maintained this level consistently throughout its market life" (Ross-Degnan 1940). For this reason, this study is a good one to use to compare the effects of zomepirac's withdrawal to the withdrawal of Vioxx.

Had Vioxx stayed on the market, the FDA would have added a black box warning to its prescription label as it did with Celebrex. This did happen with zomepirac when it was determined that it could cause an anaphylactic reaction in some patients. This warning caused little reduction in the prescriptions made by primary care physicians (1939). Due to hearings before the Food and Drug Administration and Congress that began in 1983, zomepirac was removed from the market in 1985. The flaw in the removal of this NSAID was that prescriptions of other drugs that "carried a risk of habituation and other adverse effects" increased (Clarke 179). Following the withdrawal of zomepirac, the prescriptions of propoxyphene increased 2.1% and barbiturates increased 2.7% which resulted in a loss of product safety (Ross-Degnan 1940).

This scenario could be applied to the Vioxx situation. With the removal of Vioxx, and Bextra's removal shortly after, if consumers specifically wanted a Cox-2 inhibitor, they were left with Celebrex, which also had undetermined adverse side effects. Otherwise consumers must return to the Cox-1 inhibitors and risk the gastrointestinal problems that they cause. These examples would imply that if the prescriptions of effective pharmaceuticals can be controlled for those at low risk and who need it the most, then it may be beneficial to leave the drug on the market and allow doctors to decide if their patient is a qualified candidate.

The problem with the above scenario is that patients and doctors are not always adequately informed of current warnings and adverse effects of pharmaceutical drugs. Many drugs have been taken off the market because the warnings given by the FDA were not heeded.

Terfenadine was an FDA-approved anti-histamine for the relief of allergic rhinitis symptoms. It was later determined that certain other drugs taken with terfenadine could inhibit the metabolism of the drug. This lead to increased levels of the unmetabolised parent drug that created serious cardiac abnormalities (Goldman 521). Changes were made to the labeling of terfenadine, listing specific concomitant drugs that should not be taken with it. Since a derivative of terfenadine, fexofenadine, had been approved for the same allergy relief with out the cardiotoxicity, the decision was made to remove terfenadine from the market. This was also done with the realization that even after FDA warning statements, labeling changes, and 'Dear Doctor' letters,

events of co-prescribing terfenadine with contraindicated drugs “have not been, and almost certainly cannot be, eliminated” (Goldman 522).

Goldman also reports on another pharmaceutical drug, cisapride. This drug was approved for adult nighttime heartburn. The risk of cardiac arrhythmias was quickly realized and prescription warnings were adjusted for those who could not relieve their heartburn first by lifestyle changes or other medications. Smalley et al. determined that the “FDA regulatory action demonstrated no material change in contraindicated use of cisapride” (Goldman 523). In all of the studies that were done on the effectiveness of the warnings, there seems to be disagreement on whether or not the warnings were successful. This is because, according to Goldman, at least two studies “reported significant decreases” of prescriptions written for cisapride and contraindicated drugs. This is countered by the idea that a desired standard of care had not been reached (Goldman 524). The manufacturer removed cisapride from the market in 2000. The FDA indicated that even though labeling changes had been made, the risks associated with the drug were unacceptable.

Bromfenac sodium was an NSAID that was approved for short term acute pain in 1997. Although bromfenac sodium was only approved for use of less than ten days, severe hepatitis and liver failure was found in patients who took the medication for more than one month. This situation is indicative of the difficulty the pharmaceutical companies have with making sure that their drugs are both prescribed correctly by doctors and taken correctly by patients. After

labeling changes, the FDA determined that these long term prescriptions were reduced by fifteen percent, but that prescriptions written for longer than ten days had not been eliminated (Goldman 524). Bromfenac sodium was finally removed from the market because of the inability to restrict its use to less than ten days and the availability of other medications that had larger safety margins.

These examples all show the difficulty in adequately warning both doctors and consumers of the negative side effects of medications that are not known at the time of release, as well as the inability of enforcing compliance with the warnings. While examples of non-compliance seem to be unending, there is an example of warnings and label changes being effective.

Flucloxacillin was a popular anti-bacterial drug in Australia. It was being severely over prescribed and cases of cholestatic hepatitis and jaundice were reported. Warnings were updated but flucloxacillin prescriptions continued to increase. The Pharmaceutical Benefits Advisory Committee (PBAC) was concerned and instead of just warning about the side effects, they limited the scope of the medication and only allowed its use for serious staphylococcal infections. Soon a “striking decline in flucloxacillin dispensing rates was seen” (Goldman 528). It was determined that the success was due in part to multiple interventions from direct communication with the doctors to changes in the marketing of flucloxacillin.

Table 1 shows a summary of how and why these drugs’ warnings were adjusted and the results of those warnings.

Table 1: Summary of Results of Drug Warnings

Drug	Action Taken	Effect of Action Taken
Zomepirac	ineffective warning changes	removal caused increased prescriptions of other addictive drugs
Terfenadine	ineffective warning changes	newer derivative with less side effects replaced it in the market
Cisapride	ineffective warning changes	some reduction in prescriptions were seen by some studies but the overall risk were still too high
Bromfenac sodium	neglect in following 10 day prescription limit	longer than 10 day prescriptions were reduced but not eliminated
Flucloxacillin	use of the drug was limited to particular infections	direct communication to doctors showed dramatic decrease in non-recommended usage: no withdrawal made

The difficulty in controlling the effectiveness of new drug warnings involves several factors. First, the amount of information that doctors have to sift through to keep up to date can be overwhelming (Goldman 530). The publications come in multiple journals that are usually published weekly. The internet is filled with medical websites that attempt to keep up with new information, but as with anything on the internet, the reader must use discretion when choosing what to believe. Even if the search is limited to the FDA website the list of information can be daunting.

Usually doctors who have patients who experience an adverse effect to a medication must fill out multiple forms to file with the FDA. Rhode Island established a reporting project where doctors only had to fill out the simplest form that supplied the basic information and turn it in locally to the Department of Health in Providence. Officials there filled out the FDA paper work and submitted

it to the FDA. After the project was started in 1985 through its end in 1987, the reports made to the FDA via the Rhode Island health department “climbed dramatically, while the number of US reports remained relatively unchanged” (Scott 1787). The increase of reports to the FDA from Rhode Island during this time period was 17-fold.

In Australia and New Zealand, the government removed all medications that were made by Pan Pharmaceuticals, their largest manufacturer of complementary and alternative medicines. The study done by Eagle et al resulted in some astounding statistics from medicine users. They did analyze their statistics with some from the United States and found that both countries have consumers that similarly do not report all medications they take to their doctor. In the United States it is estimated at one-third and in New Zealand it is up to forty percent (Eagle 311).

Even when recalls are made, governments do not go door to door looking for recalled drugs previously bought by consumers. Eagle’s study found that 55% of those that responded to the study could not even remember the brands that had been recalled six months after the event occurred. Only 5.3% of the respondents said they accessed the internet to inform themselves of these recalls. Australia’s ACNielsen reported data that “79 per cent of people who were regular users of health supplements ignored the recall warnings and continued to take products that were specifically recalled” (Eagle 316). 87.5% of

regular users reported no difference in their usage of the recalled medications (317).

Clarke et al reported on the effectiveness of companies making decisions from “spontaneous reporting” (180). When adequate studies are not made on the negative side effects of a medication, “uncertainty remains about the causality and incidence of adverse effects for these products and the true benefit-risk balance may never be clearly defined” (180). They analyzed eleven drugs that had been removed from the market and if more “systematic reviews” had been done, only one of the medications had an “evidence of harm” (180). This is important because if a drug is unnecessarily removed from the market, further studies become “unfeasible and be seen as unethical” and the data for the medication will continue to be incomplete (180).

Through all these examples, it is safety that is the main reason for product withdrawals. The manufacturers and the government agencies that regulate pharmaceuticals have a duty, demonstrated by these recalls, to inform doctors, and therefore the patients, of any and all consequences there may be to taking medication. Many times the warnings are not listened to or are not adequately explained. In these situations, companies and sometimes the government have to step in and remove the product.

Merck essentially chose to bypass the choice of elevating the warnings associated with Vioxx. Whether the company managers feared that their warnings would not be listened to or that the costs associated with the warnings

would not be acceptable, they removed Vioxx while Pfizer left their Cox-2 inhibitor, Celebrex, on the market with extra warnings given by the FDA.

While human loss is the worst possible outcome to a product that has caused enough harm to be removed from the market, in all the cases listed above and those not mentioned, there is also a company that suffers losses. While these losses can in no way be quantitatively compared to a loss of a life, it is important to consider the financial outcome of a company that must remove a product from the market.

According to Boulding, et al, if the fault is known early on, companies can overspend in trying to go ahead or continue to market a defective product. While this is considerably dangerous in the pharmaceutical industry, the situation can still be analyzed assuming that that these side effects were acceptable risks, such as occasional nausea or headaches, which are commonly listed on most pharmaceutical advertisements.

This overspending can simply be faulted to human nature. Boulding suggests that managers in a company may continue to promote a product even if future success in getting a return on sunk costs is minimal. He refers to this situation as “good money chasing bad money”. The article finds that the hope of a good outcome is a manager’s only chance of a good future in a company because corporations do not reward bad outcomes. Therefore, admitting to a failed launch may seem worse than the reaching for the minimal chance of a long

term turn around, even though the financial loss associated with long term losses are significantly worse.

Jarrell and Peltzman attempt to quantify these financial losses to a manufacturer. Their analysis covered twenty six recall situations and the effects that the recall had on the both the company and the stock market. The final result was that the stock market seems to overestimate the cost to a company by assuming the demand of that company's other products will also decrease, as well as the demand for products of other companies in the same industry (524).

Essentially Jarrell and Peltzman show that the costs from stock market losses can exceed the costs to the company of the recall itself. This was shown by the example of the Dalkon Shield. The total loss to the company, A. H. Robins, was estimated to be about $150 million in 1985, although other estimates put it in the billions of dollars by the time all the cases were settled in the 1990's (centipedia.com). This loss to the manufacturer was estimated to be only one-third of the total stock value loss, but the company was bankrupted. The manufacturer losses included the cost of physically recalling and destroying the product, as well as all litigation costs.

While these losses to the manufacturer can be extraordinary, some companies, if large enough to absorb the costs, can survive. In 1982, Johnson and Johnson had to recall 22 million units of Extra Strength Tylenol. It was estimated at the time that they would spend $50 million recalling and destroying the defective units and an equal amount of money to rebuild consumer

confidence (518). Today Johnson and Johnson is still a thriving company and Tylenol is still one of the top over the counter pain relievers in the country.

While the consumer is prone to blaming the manufacturers when things go wrong, the United States government has oversight in just about every industry that flourishes in the nation, with pharmaceuticals being no exception. The Food and Drug Administration has taken as much heat from these defective drugs as the manufacturers have; only the FDA cannot be sued or have decreased profit margins. The only gauge as to how a government agency is handling situations is through the public eye.

The FDA has taken an enormous amount of criticism during the last few years, not only due to the Vioxx situation. Both zomepirac and bromfenac sodium were approved by the FDA with full knowledge of their carcinogenic and hepatotoxicity properties, respectively (Noah 57). Both were approved because the FDA was looking for non-narcotic options for pain relief. Noah also suggests that the FDA is approving too many pain relievers, specifically NSAIDs, even when they "offer no particular advantage over existing, and typically less expensive, drugs in the class" (56). But it can also be argued that it is not the FDA's responsibility to reject a new drug just because there are others of the same class available. Noah suggests that this "comparative efficacy" is not for government to decide, but a decision to be made by doctors who know their patients.

There has been a lot of blame going around about the structure of the FDA and its inability to safely regulate drugs. David J. Graham, the whistle-blower in the Vioxx case, reported to the United States Senate that "the FDA, as currently configured, is incapable of protecting America against another Vioxx" (Okie 1063).

The authority a government agency has and how much funding it is given are essential to the effectiveness of the agency. In 1992, Congress passed the Prescription Drug User Fee Act (PDUFA) that was intended to encourage the FDA to pick up the pace in reviewing new drug applications. The U.S. General Accounting Office reported that the "PDUFA had forced the FDA to shift funds away from other activities, including post-marketing safety surveillance, and had contributed to increased workload, high turnover rates, and reduced training time for scientists and medical officers on review teams" (Okie 1064). When funds are not adequately spread out to the appropriate subsections of an agency, it discontinues functioning smoothly. This also resulted in a survey of FDA scientists by the Office of Inspector General of the Department of Health and Human Services that said eighteen percent of the scientists that responded felt they had been pressured to approve a drug that they were not certain was safe (Okie 1064). The same survey also reported that two-thirds of the respondents felt that the FDA could not monitor the safety of approved drugs once they were on the market (Zielinski 873).

The flaws with the FDA can be divided into two categories: flaws with the approval process and flaws with post-market safety. There is an inherent problem with the pharmaceutical testing scenario. Initially the drugs are tested by only several thousand people who meet specific requirements. These trials are, of course, run by the pharmaceutical companies and are therefore designed to demonstrate the drug's benefits (Zielinski 872). As with any statistical data, the more people that are tested, the more accurate the results are, and this amount of data is only available after the drug has been on the market for some time and been available to a more randomized population.

The approval time for new drugs has greatly decreased over the last few years. In 1993, the approval time for a drug was 14.9 months, while in 2003 it was only 6.7 months (Okie 1064). Since the PDUFA was implemented in 1992, it has allowed for a fast-track approval process, or the priority review, for companies that were willing to pay fees that were used to hire more reviewers. In return, the FDA was required to stick to specified timetables for approving the drug. More than half of the respondents to the survey mentioned above by the Department of Health and Human Services said that they were not given enough time to thoroughly review the scientific data before them (Okie 1064). While it is important to get useful new drugs out to the consumer as soon as possible, shortcuts allow more problems to go unnoticed with pharmaceutical drugs, and the lack of confidence the FDA's own employees have with the approval process shows this to be true.

Another problem in the approval process is the scientific data that is presented to the FDA. Many times the review teams must make decisions based on insufficient data. Okie reports that sometimes companies are allowed to submit what Dr. Jerry Avorn says are “pivotal studies that lasted only a few months, even for drugs that will be taken for a long time” (1065). As with Vioxx, the negative side effects were not established until the drug had been taken for longer than eighteen months. Short term trials cannot fully determine the effects a drug will have on the human body.

After a drug has been approved, it enters post-market surveillance. If a company uses the accelerated approval mentioned above, they are required by federal law to conduct post-market studies to ensure the safety of the newly approved drug. Okie reports that of over 1300 post-market studies that companies committed themselves to, sixty-five percent had not been started, and the FDA has never taken action on these companies by suspending or withdrawing the drug.

It is estimated that the FDA only receives reports of about ten percent of the actual number of adverse side effects that occur. This slows the system in not allowing authorities in the FDA and the manufacturers to know the whole story and therefore make a timely decision on what to do about the drug. Of the last fifteen drugs that were withdrawn, the average time it took from approval to withdrawal was 5.9 years (Zielinski 872). In a case like Vioxx, if 1.5 years are subtracted for the side effects to show up, consumers are left with approximately

4.5 years of the drug being left on the market. With a blockbuster drug, that equals millions of new consumers that would not have been exposed to the harmful side effects if the process of withdrawal had been more efficient.

Once an adverse side effect has been reported to the FDA, if they feel action is required by the manufacturer, the FDA only has the power to request that the company take recommended actions, but they have no legal power to enforce such requests. These requests can be anything from changing the label to restricted advertising. Long negotiations are usually a major factor. When the FDA wanted Merck to make their first label change to Vioxx, the negotiations took fourteen months (Zielinski 873).

There have been many suggestions made by congress members, government advisors, and independent medical advisors as to what needs to be done to ensure the FDA is functioning as it needs to. The FDA has initiated several steps on their own. One positive step is the FDA has asked the Institute of Medicine to study the FDA's safety monitoring procedures.

In 2005, the FDA set up a Drug Safety Oversight Board. Also, as part of a five-point plan for drug safety, the FDA began a search for a new director of the Office of Drug Safety which, in November 2004 had been vacant for more than a year (Kaufman). The FDA reported on January 27, 2005 that a new acting director had been found.

One action that the FDA has announced that would improve the dissemination of information about drug safety is a new Drug Watch webpage.

As of May 2006, this webpage, www.fda.gov/cder/drugsafety.htm, was still a list of intentions by the FDA.

Senator Charles Grassley (R-Iowa) and Senator Christopher Dodd (D-Conn) have introduced legislation that will create an independent office with the ability to police and remove drugs already on the market. This would solve the current flaw in the Office of Drug Safety, which is under the authority of the Office of New Drugs and has little authority after a drug is approved (Zielinski 873). As with most congressional bills, this one was referred to the Senate Committee on Health, Education, Labor, and Pensions almost a year ago, and it has yet to be recommended for a vote.

There are always some good intentions when government is concerned for public safety. Unfortunately quick action is an unlikely resource that governments cannot tap into. While most agree that changes need to be made in the pharmaceutical industry both industrially and regulatory, it will be years before changes are implemented, and even longer before the results of the changes will be noticed.

CHAPTER V

APPLICATION TO MERCK

Merck's current and future revenues were immediately reduced on September 30, 2004. According to Frost & Sullivan, Merck's 2003 revenues from Vioxx topped $3,814 million, making this one drug almost 17% of their yearly revenues that year, and future estimates had that value increasing to $5,374 by 2010. Their fourth quarter earnings report for 2005 shows a decrease in net revenues since the removal of Vioxx compared to the fourth quarter of 2004. Not only was this revenue depleted, but the company decided to stockpile additional funds to help pay for the inevitable lawsuits. According to Merck's 2004 financial statements, the company had reserved $675 million for future litigation solely for Vioxx, almost 3% of 2004's revenues. Additionally, according to their fourth quarter earnings report for 2005, they added another $295 million.

A company like Merck, and most other pharmaceutical companies, usually has many drugs on the market, and they range in their life cycle stages. This is how a company can stay afloat during a trying time like this. Even in losing one of their biggest money making drugs, Merck still has income from their other pharmaceuticals, and an investor will have to analyze their new adjusted earnings potential.

The pharmaceutical industry is a large industry with at least 152 companies as listed by TDAmeritrade. Merck is just a piece of this pie and

according to the U.S. Census Bureau, Merck's before tax net income is approximately 5% of the pharmaceutical industry's total receipts in 2002. Yahoo! Finance also lists Merck as one of only twenty-four major drug manufacturers, so it is safe to say that Merck has a large share in the pharmaceutical market.

The question to analyze here is whether the threat of lawsuits significantly affects the price of a stock when compared to the threat of a product withdrawal that will affect a company's revenue. Merck was not forced to remove Vioxx, and it is possible to find as many references that say that Vioxx could have been left on the market as those who say it was not removed soon enough. Pfizer made the decision to leave Celebrex, their Cox-2 inhibitor drug, on the market despite mixed reviews about its safety. They both face impending lawsuits, but Pfizer still has revenue from Celebrex while Merck faces lost revenues from both lost product and lawsuits.

Throughout the ongoing research process that occurred before its removal, the FDA knew about the results of the VIGOR trial, as well as other trials, that showed a statistical difference between Vioxx and the test drugs used, depending on the trial. Labeling was changed to include "detailed information about the increase in risk of cardiovascular events relative to naproxen, including heart attack" as well as "data from the ongoing placebo controlled Alzheimer's study at the 14 month time point which did not show an increase in CV risk" (Kweder), but no move was made by the FDA to force its removal from the United States market.

Dr. Sandra Kweder, M.D. also points out that at the time of the release of the results of the VIGOR trial, there was reason to question the significance of the results. In the statement she made to the United States Senate Committee on Finance referenced above, she points out that Vioxx was tested against naproxen instead of a placebo group because "untreated patients would have suffered and left the study" based on the severity of the pain associated with rheumatoid arthritis. This is significant because naproxen is considered to have "potent and sustained antiplatelet effects" (VIGOR presentation to FDA 104), so the result of Vioxx having higher cardiovascular events in this study only appeared that way due to the heart protective nature of naproxen. Additionally, Kweder says that low-dose aspirin was not allowed in the study due to the nature of its negative gastrointestinal effects. This could also have affected the results because aspirin is known to also have heart protective characteristics due to its thinning of the blood.

The risk assessment Merck finally had to make was based on the outcome of the APPROVe trial which showed that, when compared to placebo and after more that eighteen months of usage, the group of patients taking Vioxx had a significantly increased rate of cardiovascular events. The independent safety monitoring board recommended to Merck that the APPROVe trial be discontinued and, based on this suggestion and the evidence at hand, Merck removed Vioxx from the market. In doing so, it was initially estimated that the decision had cost Merck "about $9 billion in forgone profits and up to $5 billion in

future litigation costs" (Oberholzer-Gee 2147). Merck intends to battle each case individually, and has no intentions of settling at this point in time, so their litigations costs will be high, and the payout costs even higher. This is because when there have been medical injuries in malpractice lawsuits, 73% of those cases had decisions in favor of the plaintiffs (Studdert 2028).

If it can be projected that the FDA would have taken the same approach with Vioxx as it did with Celebrex, that a warning be added to the label limiting the use of Cox-2 inhibitor drugs in those at risk for heart attacks and strokes, then Vioxx could have been legitimately left on the market and Merck could have continued to incur profits from its sales, and for this reason, this paper intends to use stock prices to show the implications of withdrawals and lawsuits on companies that remove major products. If Vioxx had been a forced withdrawal, the point would be moot because Merck would not have had the potential of Vioxx's income as Pfizer does with Celebrex. One cannot fault Merck from removing Vioxx based on the examples given above since they could not be certain that doctors and patients would comply with any warning restrictions made on the label.

CHAPTER VI

METHODOLOGY

The resources used in the research of the paper were primarily from online news articles and journals. Due to the fact that the main event used for the topic of this paper was a current event, articles had to be analyzed as they were published. Several older articles were used to compare the withdrawal of other drugs to the Vioxx withdrawal. Of all the articles both listed in the reference section and those that were examined but not included in this paper, none that were found took the same stance of looking at major events in a company's life to determine the financial significance of the events on the stock price.

To determine the effect of both lawsuits and product withdrawals on Merck's stock price, the stock value was assessed at the closing of the markets the day before the event and at closing on the day of the event. The stock value was taken at closing on the day before to eliminate the effect that after market trading has on the opening price of the stock. For example, on September 30, 2004 Merck's stock dropped more than eleven dollars before the markets even opened that day. All closing values were the adjusted closing value that adjust for dividends and splits. The volumes of shares traded are also included to show the significance of the events to stock holders and how eager they were on negative news days to divest themselves of the stock and, on a positive news day, to invest in Merck. Volumes were only included in the one day stock

analysis because it was only on the day of the event that these numbers fluctuated to such a degree as to be of significant use in this analysis. On all other days analyzed, the volume prices returned to normal.

This analysis was extended to include longer time periods. The closing price for the stock was also analyzed at both ten trading days and twenty-eight trading days from each event to show the long term change the events cause on the stock. There were no overlaps of events so each data set for each time period is isolated to that event. Yahoo! Finance's historical prices page is the main source of the data used, as well as the Daily Stock Price Record: New York Stock Exchange, published quarterly by Standard & Poor's, for other companies used for comparison that are not currently traded.

Attempts were made to analyze the fluctuations of the stock prices of the companies that also had drugs withdrawals that this paper used to compare previous situations to the current Vioxx withdrawal. There were several roadblocks that presented themselves.

First, through many acquisitions and mergers, the companies that produced and withdrew drugs many years ago are not the same companies listed on both national and world market exchanges. When this is the case, the original company must be established as well as their stock symbol at the time of interest and what country that company was traded in. For example, zomepirac was manufactured and withdrawn by McNeil Pharmaceuticals. All acknowledgements for zomepirac, whether good or bad, were accredited to

McNeil even though Johnson and Johnson bought McNeil in 1959. Large and diverse companies like Johnson and Johnson often keep the names of the companies they acquire and run them under such titles as “a division of Johnson and Johnson.” Janssen Pharmaceutica, the makers of cisapride, is also a division of Johnson and Johnson as of 1961. Wyeth-Ayerst, the manufacturers of bromfenac sodium, is a division of American Home Products Corporation. Finally, the search can come up short for Hoechst Marion Roussell, the makers of terfenadine. This company is not listed with any stock exchange that could be found. When the company’s full name is typed into either google.com or ask.com, there does not seem to be a home page for this company as there is for the others. Many of the websites are not in English and the translations the search engines offer are not successful. While Hoechst Marion Roussell seems to be their own company, now and at the time of the withdrawal of terfenadine, this could not be one hundred percent proven.

The second trial in locating historical stock data is knowing the exact ticker symbol for the company at the time in question. Yahoo! Finance requires that the ticker symbol be known for looking up historical stock prices. It does have a search to look up stock symbols for a company, but this search only works with currently listed companies. Some symbols can be found in searching the above mentioned search engines. The stock symbol for American Home Products Corporation (NYSE: AHP) was found by simply typing the company name into ask.com. As with much of the information found on the internet, the search

results can be misleading. An abbreviation for Hoechst Marion Roussell, HMR, was also found in the same method, but this turned out to be just a pharmaceutical shorthand for writing the full company name in spreadsheets and other forms.

The last obstacle in looking up historical information is knowing the exact date of the withdrawal. For two of the four drugs used in this paper, this was easy to find, as it was listed on several FDA documents. For the other two, zomepirac and terfenadine, the exact date was not given, even when listed in the same FDA documents that the dates for cisapride and bromfenac sodium were found. Internet search engines gave the same results. There could be a number of reasons for this: lack of communication from the company, phased withdrawals, or discontinuation of production, but not a full withdrawal of all previously manufactured products. These are just hypothetical suggestions and could not be substantiated at the time of this paper.

Another aspect of the stock analysis that would have been useful to compare are the effects of lawsuits on the above mentioned drug manufacturers stock prices. Searches for lawsuits of these products resulted in little information. A search for “bromfenac sodium lawsuits” produced a single page of results which is really rare with the internet being as full of information as it is. Searches for zomepirac and terfenadine also turned up few results. This could be due to the elapsed time that has occurred since the drugs were withdrawn. For cisapride, the Johnson and Johnson website had information of a settlement

agreement that was reached on February 5, 2004 in the class action lawsuit against Janssen Pharmaceutica. This date was used for analysis, even though there could be significant difference between lawsuit settlements and lawsuit verdicts.

CHAPTER VII

DATA AND RESULTS

A simple calculation of the percent change in Merck's stock value before and after specific events can show that traders were much more concerned with Merck's removal of Vioxx than they were about either of the first two trials on the days the verdicts were announced. Merck announced the removal of Vioxx on September 30, 2004. On August 19, 2005 a Texas jury voted in favor of the plaintiff in the trail of Ernst vs. Merck. A few months later on November 3, 2005, a New Jersey jury voted in favor of Merck in the trial of Humeston vs. Merck. The table below shows the results of the data collected.

Table 2a: Percent Change of Merck's Stock in One Day

Event	Date	Closing $Value_B$	Closing $Value_O$	$Volume_B$	$Volume_O$	Percent Change
Vioxx Withdrawal	30-Sep-04	$41.83	$30.63	4,889,500	145,015,504	-26.78%
Ernst vs. Merck	19-Aug-05	$29.30	$27.04	8,037,300	38,425,600	-7.71%
Humeston vs. Merck	3-Nov-05	$27.74	$28.79	9,633,200	38,110,500	3.79%

Subscript B refers to before event date, subscript O refers to on the event date.

When taking into account the absolute values of the percent change of the stock values, it is very clear that the change of the stock due to the withdrawal of Vioxx is considerably larger than the changes due to the trial verdicts. The increase in the trading volume indicates that these were all considered important events to the stock holders. The drastic volume change of more than 140 million

trades indicates that the withdrawal was a more noteworthy event than either of the trials. Although not included in the table, a quick calculation shows that the percent change of the volumes for the withdrawal is almost 3000% and only around 300% for each trial verdict.

To further analyze the data, a ten day and four week measure for long-term change was also used and is listed in Tables 3 and 4.

Table 2b: Percent Change of Merck's Stock in Ten Days

Event	Date	10-day	Closing $Value_B$	Closing $Value_{10}$	Percent Change
Vioxx Withdrawal	30-Sep-04	14-Oct-04	$41.83	$28.02	-33.01%
Ernst vs. Merck	19-Aug-05	2-Sep-05	$29.30	$28.16	-3.89%
Humeston vs. Merck	3-Nov-05	17-Nov-05	$27.74	$28.92	4.25%

Subscript B refers to before event date, subscript 10 refers to ten days from the event date.

Table 2c: Percent Change of Merck's Stock in Four Weeks

Event	Date	4-week	Closing $Value_B$	Closing $Value_{28}$	Percent Change
Vioxx Withdrawal	30-Sep-04	28-Oct-04	$41.83	$29.30	-29.95%
Ernst vs. Merck	19-Aug-05	16-Sep-05	$29.30	$28.22	-3.69%
Humeston vs. Merck	3-Nov-05	1-Dec-05	$27.74	$29.36	5.84%

Subscript B refers to before event date, subscript 28 refers to twenty-eight days from the event date.

As seen from the percent changes, the Vioxx withdrawal was still far more significant to the stock price than either of the trials.

To determine if Vioxx is a good example for proving a pattern that withdrawals have more influence on stock prices than lawsuits, the data below shows stock price changes for the other drugs used in this paper to compare with

Vioxx. Due to the restraints that are listed in the methodology section of this paper, the results here are limited to two drugs, cisapride and bromfenac sodium.

Table 3a: Percent Change in Johnson & Johnson for One Day

Event	Date	Closing $Value_B$	Closing $Value_O$	$Volume_B$	$Volume_O$	Percent Change
Cisapride Withdrawal	14-Jul-00	$43.26	$41.70	7,656,600	12,587,600	-3.61%
Settlement Announcement	5-Feb-04	$54.48	$54.50	9,449,000	7,138,300	0.04%

Subscript B refers to before event date, subscript O refers to on the event date.

Table 3b: Percent Change in Johnson & Johnson in Ten Days

Event	Date	10-day	Closing $Value_B$	Closing $Value_{10}$	Percent Change
Cisapride Withdrawal	14-Jul-00	28-Jul-00	$43.26	$42.54	-1.66%
Settlement Announced	5-Feb-04	20-Feb-04	$54.48	$53.29	-2.18%

Subscript B refers to before event date, subscript 10 refers to ten days from the event date.

Table 3c: Percent Change in Johnson & Johnson in Four Weeks

Event	Date	4-week	Closing $Value_B$	Closing $Value_{28}$	Percent Change
Cisapride Withdrawal	14-Jul-00	11-Aug-00	$43.26	$44.44	2.73%
Settlement Announced	5-Feb-04	4-Mar-04	$54.48	$53.03	-2.66%

Subscript B refers to before event date, subscript 28 refers to twenty-eight days from the event date.

The data for Johnson and Johnson shows a small decrease in stock value on the day of the withdrawal of Janssen's cisapride. While the increase in volume for July 14, 2000 also corresponds with what happened with Merck on the day Vioxx was withdrawn, a comparison of a decrease in the stock price of 1.66% versus 26.78% is drastically different. While the end results are similar, a diverse company like Johnson and Johnson will not be as affected by a single

product withdrawal as Merck was, as the small changes show. Also, cisapride was only 3.4% of Johnson and Johnson's 1999 annual income, compared to Vioxx being 17% of Merck's, indicating that the loss of income from cisapride did not have as much of a financial impact as Vioxx did to Merck. This is also shown by the quick recovery Johnson and Johnson made in four weeks. During this time, their stock had increased past the point it was at on the day before the withdrawal. The announcement of the class action lawsuit settlement seems to have no effect on the stock price for one day. This could be because the settlement was far removed from the event of the withdrawal, almost four years.

Data for American Home Products Corporation was also obtained to determine the effect of the withdrawal of bromfenac sodium on the company's stock price. This data was found in the Daily Stock Price Record for the New York Stock Exchange.

Table 4a: Percent Change in American Home Products Corp. for One Day

Event	Date	Closing $Value_B$	Closing $Value_O$	$Volume_B$	$Volume_O$	Percent Change
Bromfenac Na Withdrawal	22-Jun-98	$52.13	$51.06	2,571,900	2,264,200	-2.05%

Subscript B refers to before event date, subscript O refers to on the event date.

Table 4b: Percent Change in American Home Products Corp. in Ten Days

Event	Date	10-day	Closing $Value_B$	Closing $Value_{10}$	Percent Change
Bromfenac Na Withdrawal	22-Jun-98	6-Jul-98	$52.13	$51.63	-0.96%

Subscript B refers to before event date, subscript 10 refers to ten days from the event date.

Table 4c: Percent Change in American Home Products Corp. in Four Weeks

Event	Date	4-week	Closing Value$_B$	Closing Value$_{28}$	Percent Change
Bromfenac Na Withdrawal	22-Jun-98	20-Jul-98	$52.13	$52.81	1.30%

Subscript B refers to before event date, subscript 28 refers to twenty-eight days from the event date.

This data again shows a decrease in the stock price with the withdrawal of their drug bromfenac Sodium, and like Johnson and Johnson, American Home Products Corporation recovered their original stock value within four weeks. For this company, this could be attributed to the small volume of bromfenac sodium that was in use at the time of withdrawal compared to Merck's Vioxx which had become a best selling drug. But, at the same time, there was still a measurable decrease in the stock value on the day of the withdrawal, further showing that a withdrawal of a profitable product will cause investors to sell the stock due to a lack of confidence in the future value of the company.

CHAPTER VIII

CONCLUSION

This analysis shows that a withdrawal of a product will negatively affect the stock value of a company, as shown with all three companies above, but without further lawsuit information, each company cannot be analyzed to show which is more significant. With Merck and all the publicity that surrounded the company, the information was readily available. The closest withdrawal that has occurred to Vioxx was Pfizer's removal of Bextra. While it carried a smaller risk of myocardial infarctions than Vioxx did, it caused some patients to develop Stevens Johnson Syndrome. The lawsuits have not been decided in court or settled by Pfizer, so further analysis of this situation would add to the data collected here and, either prove the theory of this paper that product withdrawals cause more negative financial impact to a company's value than the loss due to lawsuits or prove that situation with Vioxx is unique.

Such a large drop in stock value was not demonstrated through the examples used for this paper, so future cases should be analyzed to determine if Vioxx was an anomaly or if it is the start of a future trend with companies who withdraw a blockbuster drug. The fact that Vioxx was such a large part of Merck's financial income may have a lot to do with the impact it cause. It targeted such a large population with arthritis afflicting 1 in 3 Americans, and only two other competitors of the same NSAID category, Celebrex and Bextra.

If Merck and its stock holders can be used as a standard for other companies, then the result is that events that result in lost product will more greatly affect a company than a lawsuit whose verdict is against the company. Given the opportunity, a company should risk additional future lawsuits rather than risk lost revenues due to product loss. This is only ethical if, in the case of a pharmaceutical company, the drug in question is not excessively dangerous. In such a case, the FDA would request the removal of the drug instead of additional warnings that must be included in the labeling.

Settlements may also have a different effect on stock prices than ongoing litigation due to the fact that a settlement gives an investor a finite amount of money that the company is losing. This could help the investor realize the immediate financial situation of the company; rather than with litigation where only estimates are given and each lawsuit carries its own risk of financial loss for the company. This would explain the loss in stock value when Merck loses a case and why Johnson and Johnson actually had a small increase on the day they announced their settlement.

To further prove this theory, more research could be done on other companies that have lost product due to voluntary removal as well as forced removal. It would also be useful to compare the data to companies that have left a questionable drug on the market, like Pfizer's Celebrex.

A limitation on the data is that the decrease in value on the withdrawal date is two-fold. The removal of Vioxx was both a loss of future revenue and

admittance by Merck that their drug was harmful to its users. The latter could have reduced the significance of the changes in stock value around the lawsuits because the loss due to negative verdicts would have been included in a stock holder's decision to sell stock on September 30, 2004 based on this admittance.

Finally, the results of this paper should bring up new and continuing debate on policies of drug safety, both with drug manufacturers and the government overseers that regulate this industry. While the FDA seems to be attempting to change its structure to better regulate drugs that are already approved, it will take further compliance with the manufacturers to ensure that they continue to monitor the safety of their products. Congress will also have to take action since they are the law makers that ensure that federal agencies are doing their job.

Without further policy changes, new drugs will continue to flow onto the market that may have great benefits, but if they are not carefully analyzed before and after their release, they will cause needless harm to more people. Longer analysis is needed before a long term drug reaches the market, as well as easier information accumulation for negative side effects that do occur. Until these problems are solved, manufacturers will continue to feel the weight of unnecessary lawsuits and remain fearful of the repercussions that occur from producing a useful drug, causing them to unreasonably withdrawal a product like Vioxx that was safe for many consumers and a source of significant relief from their constant state of pain.

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