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3D SYSTEMS: AN IN-DEPTH LOOK INTO THE PAST, PRESENT, & FUTURE OF 3D PRINTING

by
John Lars Blackstone Ely

A thesis submitted to the faculty of The University of Mississippi in partial fulfillment of the requirements of the Sally McDonnell Barksdale Honors College

Oxford, MS
May 2016

Approved by

_____
Advisor: Professor Victoria Dickinson

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This thesis is dedicated to Lars and Cay Ely. Thanks to them, I know the true meanings of love and patience.

ACKNOWLEDGEMENTS

Thanks to Louisa Ely for being the loving little sister.

Thanks to Mary Allyn & Stephen Hedges for being my rock in Oxford.

Thanks to Miller Hedges for being the cool older brother.

Thanks to Bob Harper for his constant support and love for the Rebels.

Thanks to Tyler Williams for pushing me towards accounting and for guiding me along the way.

Thanks to Victoria Dickinson for actually getting me to write this thing.

This thesis revolves around the 3D printing industry. I focused my research on the company, 3D Systems. I investigated the various factors that are holding the company back and what it can do to overcome then. I concluded that 3D Systems needs to focus more on developing and marketing printers for the domestic market. I also found that the company must gain a stronger foothold in the Asian market if it wants to emerge as the leader of the industry.

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Chapter One

History

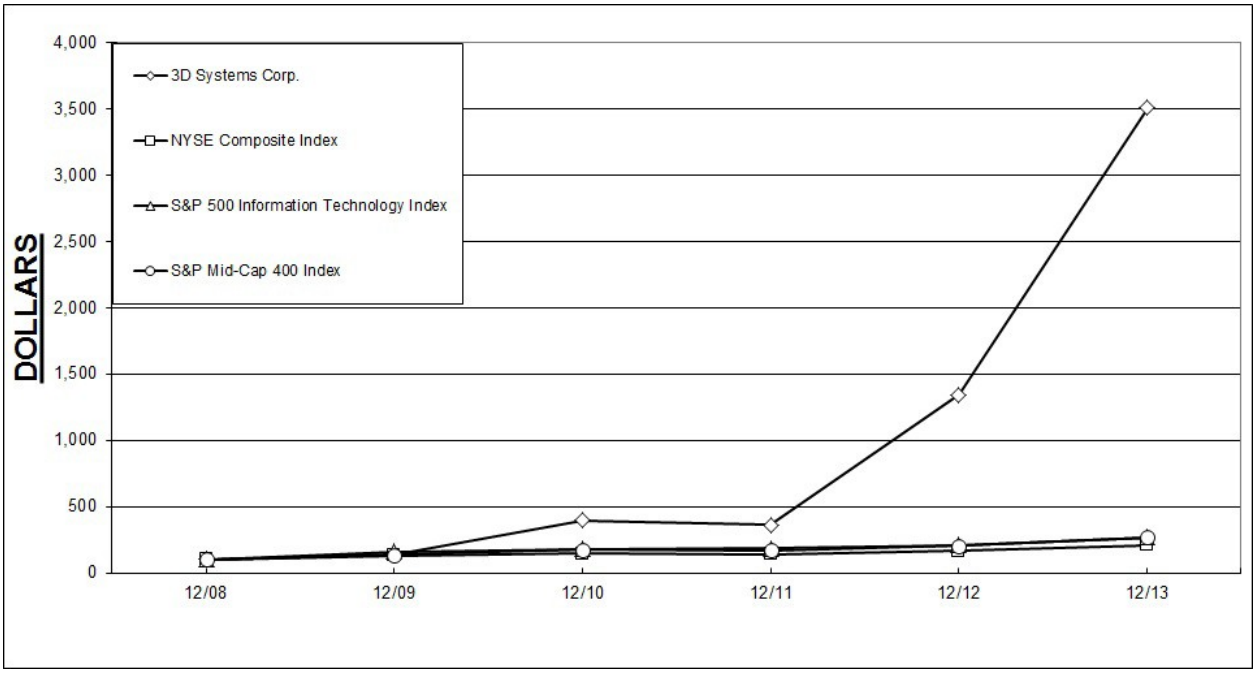
The printing press was invented by Johann Gutenberg in the mid-15th century and quickly revolutionized the world. With the advent of this device, books, music, and ideas could be spread in a way that had never been seen before. Entirely new ways of thinking emerged as a result of this invention. The American Revolution would not have been possible were it not for the printing press's ability to spread the revolutionary ideas throughout the colonies. This rapid increase in the supply of information set humanity on the path to the modern age. Now, more than five hundred years later, a different type of printer is set to revolutionize the world once again.

3D printing was invented in 1984 by Charles Hull, who later went on to found 3D Systems Corporation in 1986. Today, 3D Systems has its headquarters in Rock Hill, South Carolina and is one of the leading 3D printing companies in the world. Charles Hull discovered the process of stereolithography, which is the basis of 3D printing. Through stereolithography, an ultraviolet laser beam traces over a vat of liquid photopolymer that rests on a platform. A computer aided design (CAD) file is uploaded to a computer, which will instruct the laser what to make. The laser causes the resin to harden, and as the platform moves through the vat, a solid object is formed. Several other types of 3D printing have emerged in the past thirty years, but stereolithography is still widely used by 3D Systems. Today, the possibilities that 3D printing and 3D Systems bring are awe-inspiring. Plastics, metals, and consumables of all different types can now be used in 3D printing. 3D printers are being used to make parts for airplanes, prosthetics for amputees, components in space stations, clothing, food, and even houses and cars.

The world is entering an age where the only limitation to what we can create is our own imaginations. Additive manufacturing gives one the ability to quickly create complex objects at a fraction of the cost of traditional manufacturing. For instance, the Boeing Company has recently started using 3D printing to manufacture parts on their new jets. Previously, Boeing would shave its parts from one large block of titanium. This led to a significant amount of expensive material being wasted. Through 3D printing, Boeing has been able to manufacture customized plane parts with little to no waste. This has led to significant reduction in the company's manufacturing costs. Boeing's recent 787 Dreamliner had more than thirty parts that were made through 3D printing.

3D Systems currently sells printers ranging between $999 to around $1 million. While 3D systems is working to make their printers affordable to more people, a 3D printer is typically a sizeable purchase for any business. Therefore, any downturn in the economy will have a noticeable impact on the market. This was especially the case during the 2008 market crash and ensuing recession. A 3D printer is a large purchasing discussion for any size company and during 2008, many businesses were struggling to stay financially afloat. They were, therefore, not looking to purchase something as substantial as a 3D printer. The recession's effect on 3D Systems is evident in their income statement for 2008 where the company suffered a net loss of $6,154,000. From 2007 to 2008, cumulative total return on the company's stock dropped by nearly 50 percent. However, the company quickly rebounded in 2009 with a $1,066,000 net income. Since the 2008 crash, 3D Systems has seen a steady increase in both its net income and return on its stock. In 2013, the company posted an income of $44,107,000 and 3407% increase in the cumulative total return on its stock.

Five-Year Comparison of Cumulative Total Return on Common Stock



3D printers and the technology behind them captivate many people. However, 3D System's printers are primarily targeted towards professional services and manufacturers. These printers range in price from $20,000 to $1 million, which is far out of the price range of the traditional consumer. Still, 3D Systems has recently introduced several printers that are aimed towards the consumers that want to have a 3D printer in their home. The Cube 3 is the company's cheapest printer at $999 but can build the same complex objects as its higher priced models. 3D Systems has also listened to customers' desire for customization and responded by developing the Sense 3D Scanner. The device allows users to scan virtually anything and then have their personal 3D Printer make a plastic model of it. Not only are the models themselves accurate, but 3D Systems has developed color technology that enables the models to be photorealistic. Users can scan their own face and print a completely lifelike model of themselves. Since 2001, 3D

Systems has been surveying, identifying, and acquiring other smaller 3D printing companies that are coming up with innovative ideas that appeal to customers. For

instance, in May 2012, 3D systems acquired FreshFiber, an Amsterdam based company that allowed users to customize their iPhone cases through 3D printing. 3D Systems now has iPhone case manufacturing abilities in all its personal 3D printers. One month later, 3D Systems acquired My Robot Nation, which is a company that develops software that allows users to build their very own toy robots through an easy to use interface. By doing so, 3D Systems was responding to a growing desire that 3D printers be fun and accessible to all ages of users.

Avi Reichental, 3D Systems's CEO, believes that 2015 is the year that 3D printers become mainstream as we begin to see more of them in our day-to-day lives. Whereas previously 3D Systems had relied primarily on word-of-mouth, the company has placed much more emphasis on advertising. The company believes that it is critical for the general public to know how far 3D printing has come and the numerous applications it can have in their lives. From 2012 to 2013, advertising expenses rose from $3,972,000 to $6,010,000, a 51% increase. Much of 3D Systems' advertising is online through YouTube videos that showcase the technology behind their printers and how they can solve many business problems. The company's advertising campaign is also targeted

towards those who are simply interested in 3D printing and want to build things. 3D printing gives virtually anyone the ability to create complex and original objects. Anyone can be an artist through 3D printing and Reichental has claimed that, "3D printing will be the canvas of the 21st century." 3D Systems has also advertised through press releases and by showing off its technology at trade shows. The company recently drew buzz at the 2015 Consumer Electronics Show when it had one of its printers make an entirely edible pepperoni pizza in only a few minutes. The primary focus of the company's advertising campaign has been showing off the technology behind 3D printers and how they have a use in every business and home.

3D Systems operates in one core business line, which is the development, marketing, manufacturing, and selling of 3D printers, parts, and materials. The company is constantly developing new types of printers for various businesses. Its inventory is primarily targeted towards healthcare, professional services, production companies, and personal use. Many companies either cannot afford or do not find it practical to purchase a 3D printer. 3D Systems therefore offers companies the option to print their parts for them, which it calls its Quickparts service. A large portion of its revenue comes from Quickparts. The majority of its revenue comes from selling printers, followed by services and materials. In 2013, the company had revenue of $227,627,000 from selling printers. It made $157,368,00 and $128,405,000 from Quickparts and selling materials, respectively. This $513,400,000 in total revenue was a 45 percent increase from 2012.

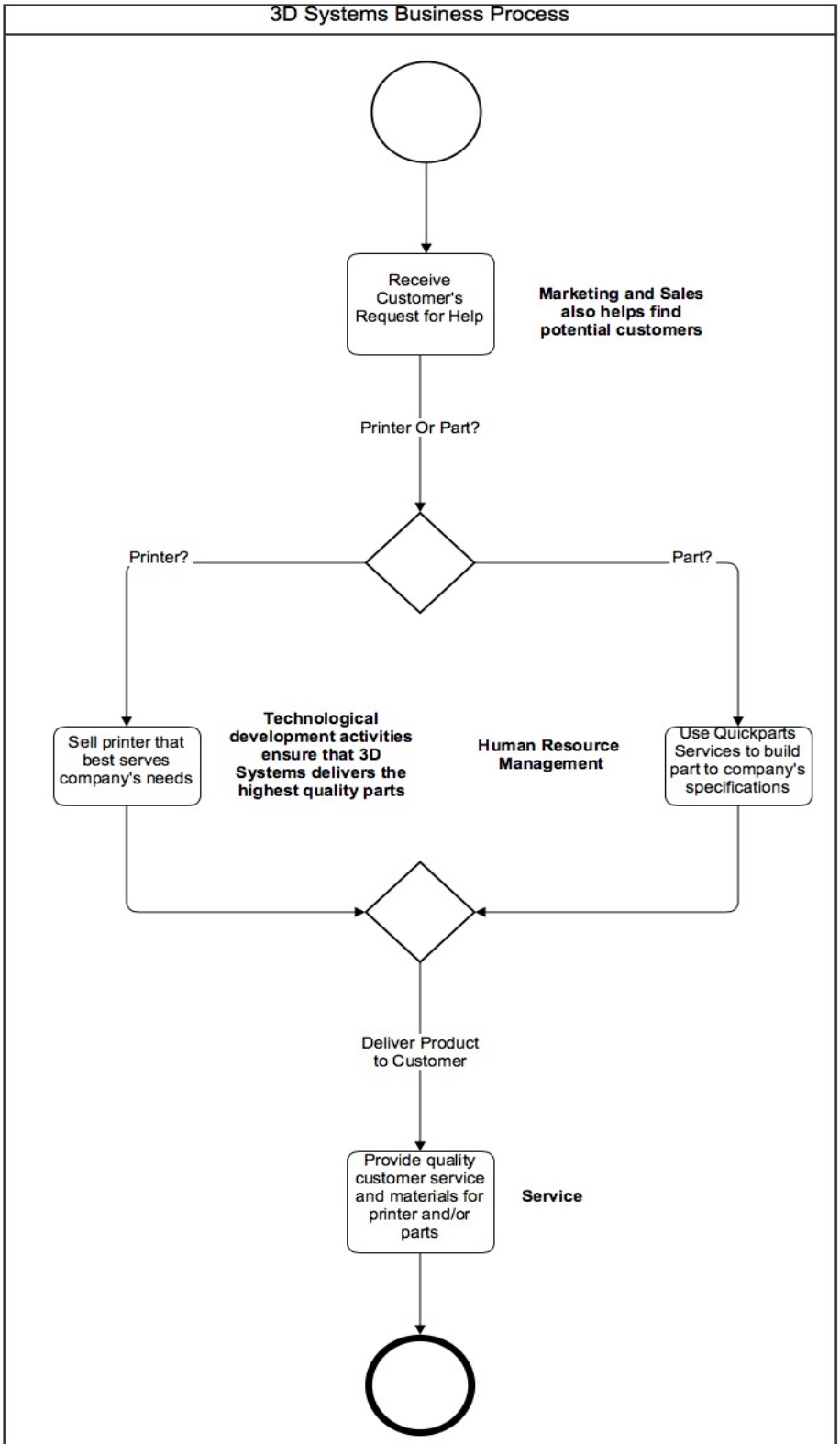
(in thousands)	2013	2012	2011
Printers and other products	$ 227,627	$ 126,798	$ 66,665
Materials	128,405	103,182	70,641
Services	157,368	123,653	93,117
Total revenue	$ 513,400	$ 353,633	$ 230,423

3D Systems' primarily streams revenue from the United States, however a growing portion of it comes from abroad. Of the $513,400,00 in revenue that was reported in 2013, 55 percent of it came from inside the United States. Germany, the rest of Europe, and the Asia Pacific region were responsible for 10 percent, 16 percent, and 19 percent.

(in thousands)	2013	2012
Assets:		
United States	$ 870,208	$ 501,157
Germany	38,685	24,264
Other Europe	120,562	86,494
Asia Pacific	68,401	65,527
Total	$ 1,097,856	$ 677,442

3D Systems is based in the United States, but it has facilities all over the world. The company has offices located in the United States, United Kingdom, France, Italy, Netherlands, Germany, Australia, China, Japan, India, Switzerland, South Korea, and

Mexico. The printers themselves are only developed and manufactured in the United States, France, and Switzerland. Many of its locations abroad only offer the company's Quickparts services, with the majority of revenue from printer sales coming from the Unites States, United Kingdom, France, Germany, and China. In 2013, 3D Systems had a gross profit of $267,594,000 and net income of $44,119,000. Their one business segment also reported total assets of $1,097,856,000 in 2013, which was a sharp increase from the $677,442,000 that was reported in 2012. 80 percent of its reported assets were in the United States, while three percent, 11 percent, and six percent were in Germany, the rest of Europe, and the Asia Pacific area, respectively.


3D Systems Business Process
Receive Customer's Request for Help
Marketing and Sales also helps find potential customers
Printer Or Part?
Printer?
Part?
Sell printer that best serves company's needs
Technological development activities ensure that 3D Systems delivers the highest quality parts
Human Resource Management
Use Quickparts Services to build part to company's specifications
Deliver Product to Customer
Provide quality customer service and materials for printer and/or parts
Service

Board of Directors

3D Systems Board of Directors is led by their CEO, Avi Reichental, who has been with the company since 2003. Before working at 3D Systems, Reichental served as the Vice President and General Manager of Sealed Air's shrink-packaging segment for five years. Sealed Air has yearly revenue of more than seven billion dollars, so Reichental gained experience leading a large and innovative company. Reichental's vision is for there to be a 3D printer in every home in the near future. He is clearly very passionate about the possibilities of 3D printing and what customers will want from it. Reichental has been very active in identifying 3D printing companies that consumers are attracted to and acquiring them. Reichental has done a strong job leading 3D Systems, as it has grown rapidly since his arrival. In recognition of his accomplishments, EY awarded Reichental the regional 2011 Entrepreneur of the Year Award.

Charles Hull, the founder of the 3D Systems, has served on the Board since 1993. He is also the company's Vice President and Chief Technology Officer. Having the inventor of 3D printing play an active role in your company is a huge advantage for 3D Systems. Hull provides insight and expertise on 3D printing that no one else can match. He has been very active in the technical aspects of the company and overseeing the development of its new printers. Hull was inducted into the National Inventors Hall of Fame and received the 2013 Innovation Award from *The Economist*.

It is important for a Board of Directors to have a financial and accounting perspective present. Daniel Van Riper provides this, as prior to working at 3D Systems, Van Riper served as a partner at KPMG for twenty-three years. He also served as Senior Vice President and Chief Financial Officer at Sealed Air, and director on Hubbell Inc.,

DOV Pharmaceutical Inc., and New Brunswick Scientific Company. Hubbell Inc. and DOV Pharmaceutical Inc. are manufacturers of electrical products and biotechnology equipment, which provided Van Riper with an understanding of the market in which 3D Systems operates. Van Riper's diverse experience and service on multiple boards of directors is invaluable to 3D Systems.

G. Walter Loewenbaum has served as the Chairman of the Board of Directors for 3D Systems since 1999. Loewenbaum also serves as the Chairman of the Board of Directors for Luminex Corporation, which manufacturers biological testing equipment. Next to Avi Reichental, Loewenbaum is the second largest shareholder of 3D Systems stock with 914,394 shares. He is also a major shareholder in Luminex Corporation with 875,214 shares owned. His experience as a large stakeholder and long period of service at 3D Systems provides him with a perspective on the best courses of action to benefit the stockholders.

Jim Kever has been on the Board at 3D Systems since 1996, which other than Charles Hull, is longer than any other member. Kever also serves on the boards for Tyson Foods Inc. and Luminex Corporation. He has a CPA and has worked in variety of different industries, spending a large portion of his career in healthcare services. A growing amount of 3D System's revenue is coming from selling printers to dentists and hospitals. Experts believe that as the technology improves, 3D printers could have a massive impact on healthcare. Scientists believe that we will soon be able to print working organs, which would revolutionize medicine. Kever's experience in healthcare provides the Board with a perspective on this growing market.

Karen Welke has served on the Board since 2008 and is its one female member. Welke worked at 3M Corporation for 27 years and served as the Vice President of the company's Medical Markets Group. She also served as a director in both France and Belgium for a combined total of seven years. Like Jim Kever, Welke provides a valuable perspective on the healthcare industry. Her experience working overseas is also very valuable, as many of 3D Systems' facilities are located in Europe. Karen Welke is the only source of diversity on 3D Systems' Board. The other nine members are all Caucasian and over the age of 50. The 3D printing industry is rapidly growing and evolving, so it is important to have younger, passionate minds from different cultures and backgrounds involved. Having such an undiversified Board of Directors only serves as a detriment to 3D Systems' goal of becoming the leading brand in 3D printing.

Kevin Moore works as the President and a director of The Clark Estates Inc., which is an investment firm. He also serves as a director for Bassett Healthcare Network, Aspect Holdings, The Clark Foundation, and the National Baseball Hall of Fame. He has served on the Board at 3D Systems since 1999. Moore brings a great deal of financial understanding to 3D Systems. His experience on so many different boards is valuable, as it provides the board with a perspective on how several different organizations operate. Moore's experience in the healthcare industry further helps 3D Systems develop a foothold in that rapidly emerging consumer base.

Peter Diamandis is the CEO and Chairman of the X Prize Foundation, which is a nonprofit organization that holds competitions to find the next great technological breakthrough that will benefit humanity. Diamandis attended MIT and Harvard Medical School and is very involved in the development of space exploration. He is the co-

founder of the Zero Gravity Corporation, Planetary Resources Inc., and Space Adventures Ltd. Due to its low costs and quickness, 3D printing is increasingly being used to make parts for space shuttles. 3D Systems recently manufactured a part for NASA's space shuttle, Endeavor. Diamandis provides a much better understanding of this growing customer base. His dedication towards innovation is also invaluable to 3D Systems, as staying ahead of the competition is critical in the 3D printing industry.

William Humes is the CFO of Ingram Micro Inc., which is the largest technology products distributor in the world. He previously worked at PricewaterhouseCoopers for nine years where he became a Senior Manager. Hume's experience leading a Fortune 100 technology company helps 3D Systems gain more of an understanding of the market and what steps it needs to take in order to continue to grow. Humes is responsible for managing Ingram Micro Inc.'s supply chain, which is critical to the success of any business and provides 3D Systems' with a better understanding of how to manage their suppliers.

William Curran is the final member of 3D Systems' Board of Directors and has been with the company since 2008. Curran has served important roles in the electronic and medical industry. He serves as a director for healthcare companies Profound Medical, Resonant Medical, and Ventracor. He also worked as the Chief Operating Officer for Philips Electronics and Philips Medical Systems. Curran's experience in operations and healthcare add further value to 3D Systems' Board. The company's stock has been highly volatile. In 2013, the price of its common stock ranged from $9.82 per share to $92.93 per share. The board should have a member who better understands the economics of the industry and is capable of helping 3D Systems keep it stock price stable.

Chapter Two

Mission and Strategy

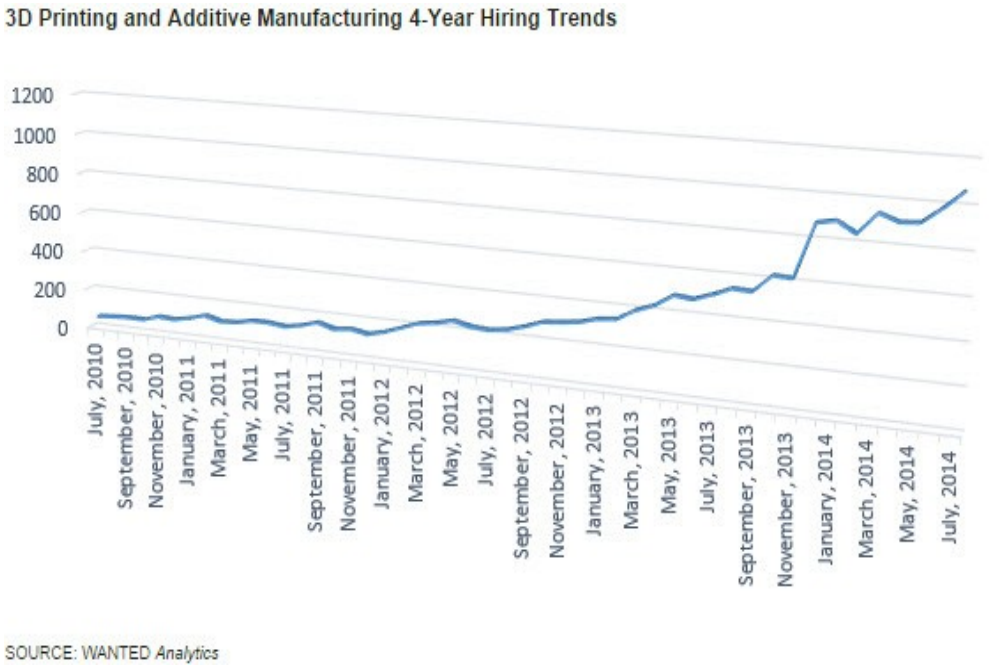
The stated mission of 3D Systems is to bring 3D printing into every home in the world. Increasing revenue has therefore been the primary goal of 3D Systems, and it has seen consistent success achieving this goal. Since 2006, the company has seen a yearly increase in both its revenue and gross profit. 3D Systems has seen such steady growth through its strategy of aggressive acquiring of smaller, innovative firms. The company has acquired more than fifty different companies in the past three years alone. 3D Systems chosen strategy is best classified as product differentiation. It is the company's desire to have a specific 3D printer that can solve any problem that a business or person might have. The inability to innovate is the primary threat to its strategy, which is why 3D Systems has spent an increasing amount of its revenue on research and development. The company spent $43,489,000 on research and development in 2013, an 87 percent increase from what it spent in 2012. Increased spending on advertising has also contributed to the growth in revenue.

Demand

3D printers are considered luxury items, so there was a significant decrease in demand when the recession hit in 2008. However, demand for 3D Systems' products have increased as companies become more aware of the benefits of 3D printing and as the world's economy recovers from the recession. 3D printing technology has improved significantly since 2008, which has also contributed to the renewed interest in 3D printing. Through 2018, global demand for 3D printing is expected to rise by 500 percent. This growth in demand will push 3D printing to becoming a $16.2 billion dollar industry.

A significant source of this demand will be from the medical and dental markets. Plastic will remain the most popular material due to its wide use in prototyping. However, metal printing is expected to see significant growth over the next few years as the aerospace and aviation industry increasingly use it to manufacture parts. However, today many companies simply cannot afford to purchase a printer, which is why it has seen such a large increase in revenue from its Quickparts service. Customers are able to get the parts they need at a fraction of the cost of purchasing a printer. 3D Systems has been working to lower the cost of some of its printers to make them available to more small businesses.

3D Systems offers consultation with any business interested in purchasing a high-end printer. 3D Systems is then able to build a printer that fulfills that company's exact needs. The company builds all of its printers on-site in South Carolina, Virginia,



Massachusetts, and France. Due to their extreme complexity, 3D printers are expensive to build. While much of the production process is automated, labor is still needed to ensure a quality product. 3D Systems had 1,388 employees in 2013, which is 378 more than it

employed in 2012. This rise in labor led to a $16.8 million increase in salary costs for 2013. Wages are rising rapidly in the 3D printing industry and the average wage is expected to reach $66,819 by late 2015. 3D Systems has not ever had any problems with labor, but the demand for 3D printing skills has risen dramatically. With 3D Systems rapidly expanding, it might soon prove to be difficult to find enough qualified labor. Production costs accounted for 65 percent of the company's cost of sales in 2013. 3D Systems purchases and stores raw materials in large amounts, so that it never runs the risk of running low on inventory. The majority of materials that it purchases are stainless steel, chrome cobalt, and titanium. It doesn't purchase its raw materials from one supplier, but from several different ones spread across Europe and the United States. The company acquires its raw materials at market price, so it runs the risk of a change in market price severely impacting its production costs. This is especially the case with steel, which has been particularly volatile over the past several years.

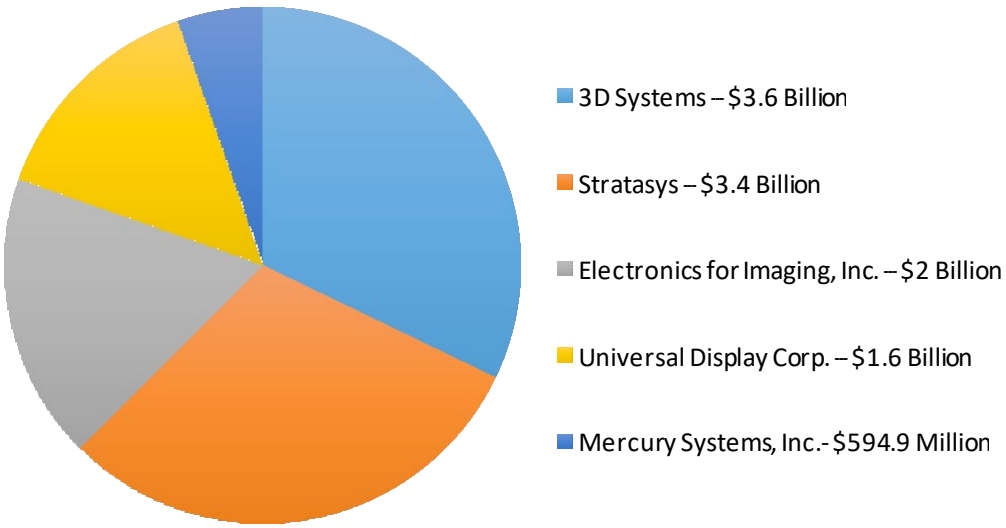
Competition

3D System faces competition from many smaller 3D printing companies, but Stratasys Ltd. is its biggest competitor by far. Stratasys is a Minnesota based 3D printing company that was founded in 1989. These two companies have emerged as the leaders in 3D printing, with no other companies even close. Whereas 3D Systems has focused a significant amount of attention on

small businesses and individual consumers, Stratasys has cornered the industrial sector. Stratasys reported revenues of $484,403,000 in 2013, a sharp 125 percent increase from 2012. Like 3D Systems, Stratasys has one business segment, which is the development and manufacturing of 3D printers. Stratasys offers a wide variety of printers that cater to various different industries such as dental, healthcare, aerospace, aviation, culinary, and automobile. 3D Systems was widely believed to be the sole leader in 3D printing until Stratasys acquired MakerBot Industries in June 2013 for $409 million. At the time of their acquisition, MakerBot was one of the more recognizable names in 3D printing. MakerBot specializes in consumer and desktop-based printers. Like 3D Systems, MakerBot offers three lower priced printers aimed towards individuals. By acquiring MakerBot, Stratasys entered the desktop market, which had long been dominated by 3D Systems' Cube 3. MakerBot is now a subsidiary of Stratasys and has helped Stratasys make great strides in the desktop market by posting $75 million in revenue in 2013. Stratasys took a giant leap forward in 2013, and the 3D printing community now sees the two companies as nearly equals.

However, 3D Systems is still viewed as the market leader due to its wider brand recognition, more consistent growth, and greater ability to innovate. In February 2015, 3D Systems' market capitalization was greater than all other companies in the computer

February 2015 Market Capitaliza5on



peripherals industry. Looking at the two company's website traffic also provides further evidence that 3D Systems is the market leader. Through 2014, not only did 3D Systems have 600,000 more visitors to its website, but its visitors stayed on its site twice as long as ones to Stratasys's did. While its acquisition of MakerBot helped Stratasys gain a strong foothold in the desktop market, 3D Systems is still considered to have the superior product. Its cheapest printer, the Cube 3, is only $999, which is $375 less than MakerBot's Replicator Mini. In addition to being cheaper, the Cube 3 is also believed to be user-friendlier and is one of the only 3D printers that is accessible to children. Families and individuals that are interested are in getting a 3D printer are much more likely to get the Cube 3, which will only help increase 3D Systems brand awareness. Both companies are growing exponentially, but for now, 3D Systems is the clear market leader.

Risks Abroad

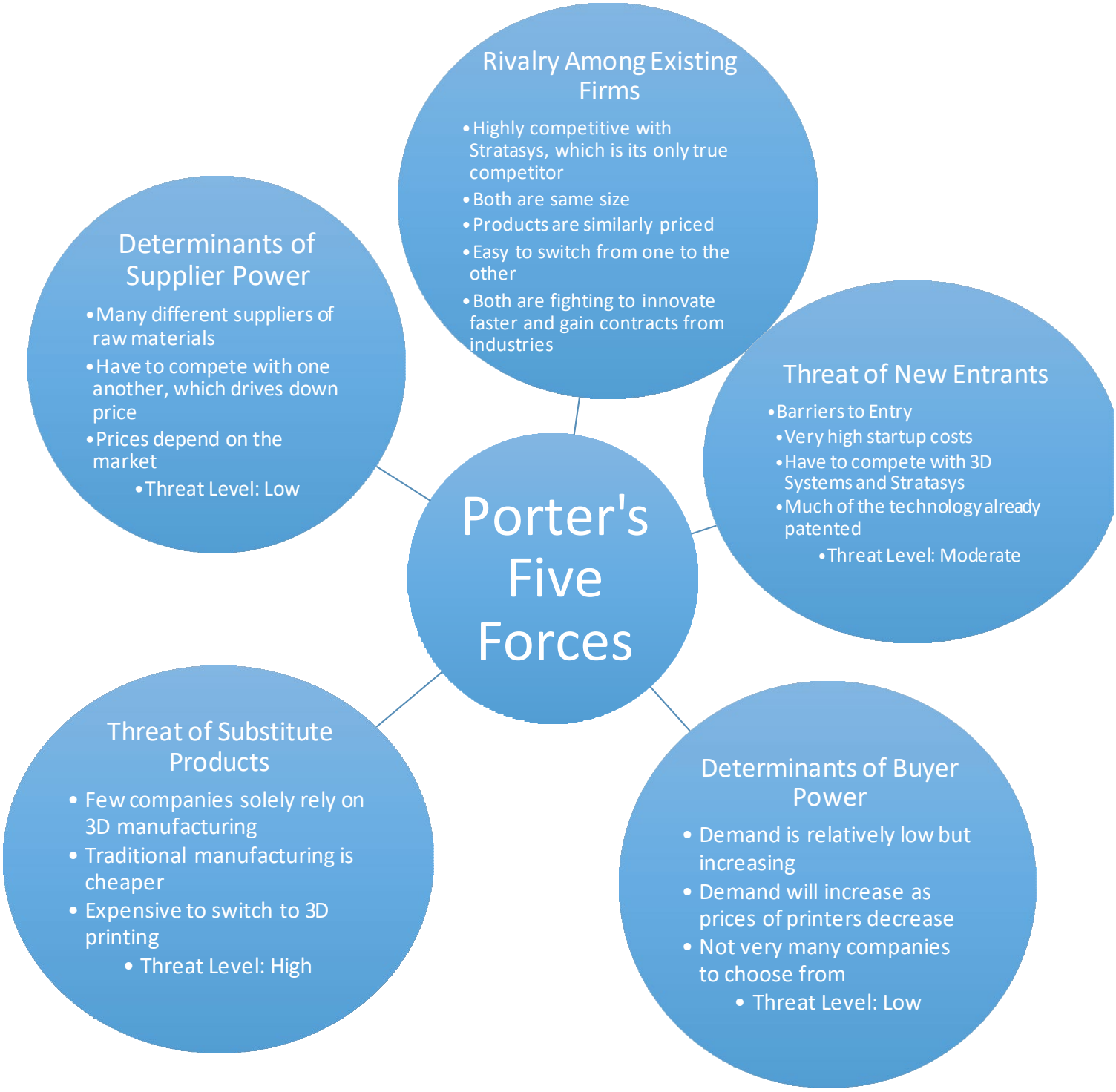
3D Systems is an international company with 44.5 percent of its business coming from outside of the United States. The company has offices in the United States, United Kingdom, France, Italy, Netherlands, Brazil, Germany, Australia, China, Japan, India, Switzerland, South Korea, and Mexico. However, it sells printers throughout the world via its website. Having such a significant portion of its business abroad brings on a substantial amount of risk. China has become increasingly attracted to 3D printing due to the technology's ability to mass-produce items. With a population nearing 1.5 billion, the country is

1

turning to 3D printing to help solve many of its emerging problems. In September 2015, a giant 3D printer was used to build ten houses in only 24 hours. The houses were built with recycled construction waste and only cost $5,000 a piece to make. This same printer was later used to make a 12,000 square foot mansion and an apartment complex. This amazing achievement in technology has excited the industry but should also concern 3D Systems. The printer used to build the houses was developed and produced by WinSun, a Shanghai based company. China is currently undergoing a technological boom with new companies such as ecommerce giant, Alibaba, bringing in $11.3 billion in revenue in 2014. This boom will result in a large increase in competition for technology companies in the United States. The country's current economic slowdown and advances in its own 3D printing technology may cause China to turn away from imported printers. This increased competition in China represents the biggest risk that 3D Systems faces abroad. What was once considered a booming market ripe for the taking may soon be very difficult for foreign businesses to enter. It is critical that 3D Systems gain a stronger foothold in the Chinese market, or it runs the risk of missing out on a massive opportunity. The 3D printer market in China is expected to quadruple over the next four years with revenues reaching $108,000,000 by 2018. 3D Systems already does business in China but needs to do significantly more if it wants to remain the leader in the industry.

3D Systems faces some risk in the rest of the countries in which it does business. South Korea's government has recently pledged to increase support for the country's 3D printing industry over the next ten years. Similar to the situation in China, this will eventually lead to increased competition in the area. South Korea currently only

represents less than three percent of the 3D printing market, so this increased competition should not affect 3D Systems very much. 3D Systems' has a relatively firm position in Mexico and South America. At 64,300 square feet, the company's facility in Mexico is its second largest. A significant portion of Quickparts orders are manufactured in this facility. In April 2014, 3D Systems acquired Robotec, which was the largest 3D printing company in South America. The Brazilian company has facilities through the continent, so its acquisition gave 3D Systems a substantial position in rapidly growing area. Inflation is always a risk when doing business, and experts predict that Brazil will see a significant rise in inflation during 2015. It remains to be seen how this downturn in the Brazilian economy will affect Robotec. However, 3D Systems does not believe that inflation will be a big problem in the other countries in which it operates. With so much of its business located outside of the United States, 3D Systems also runs the risk of currency exchange rates rising.


Porter's Five Forces
Rivalry Among Existing Firms
• Highly competitive with Stratasys, which is its only true competitor
• Both are same size
• Products are similarly priced
• Easy to switch from one to the other
• Both are fighting to innovate faster and gain contracts from industries
Determinants of Supplier Power
• Many different suppliers of raw materials
• Have to compete with one another, which drives down price
• Prices depend on the market
• Threat Level: Low
Threat of New Entrants
• Barriers to Entry
• Very high startup costs
• Have to compete with 3D Systems and Stratasys
• Much of the technology already patented
• Threat Level: Moderate
Threat of Substitute Products
• Few companies solely rely on 3D manufacturing
• Traditional manufacturing is cheaper
• Expensive to switch to 3D printing
• Threat Level: High
Determinants of Buyer Power
• Demand is relatively low but increasing
• Demand will increase as prices of printers decrease
• Not very many companies to choose from
• Threat Level: Low

Strengths

- Respected leader in 3D printing industry
- Consistent growth
- Strong research and development team
- Acquisition of multiple innovative, smaller firms

Weaknesses

- High cost to manufacture printers
- Small foothold in China
- High price level of printers

SWOT Analysis

Opportunities

- Rapidly growing market
- Increased usage by various industries such as aviation, aerospace, and automobile
- Growing demand in China

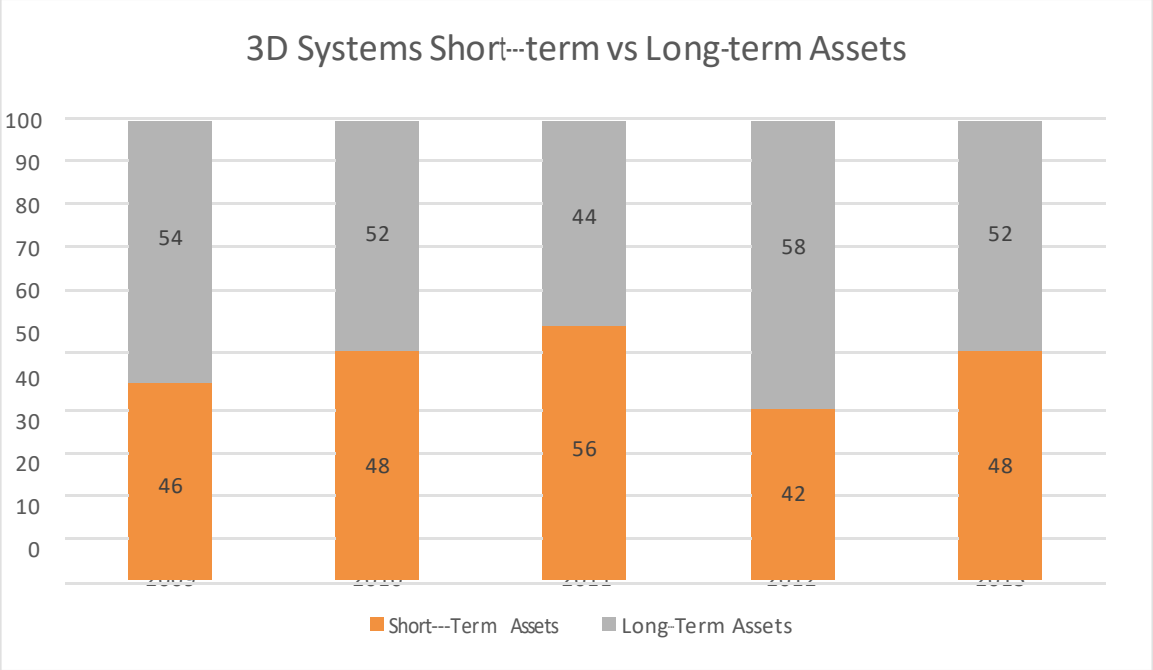
Threats

- Competition from Stratasys
- Potentially vulnerable to cyber-attack
- Traditional manufacturing methods

Chapter Three

Asset Composition

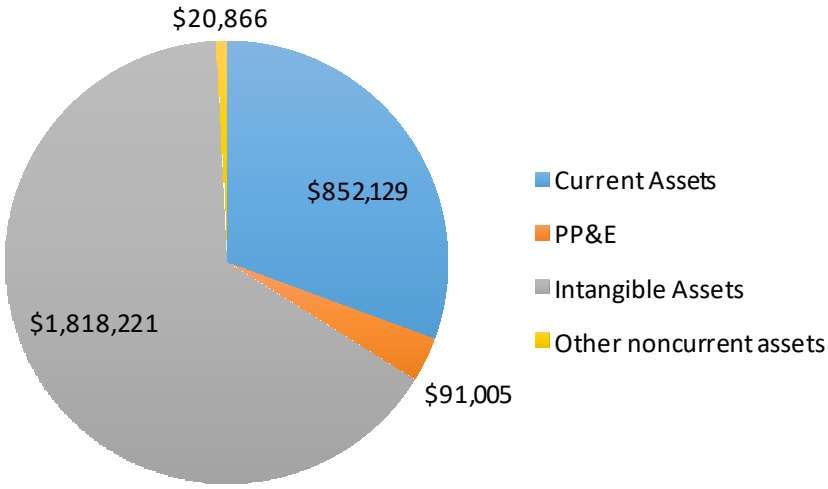
Current assets compose a significant portion of 3D Systems' assets. Cash and accounts receivable constitute 83 percent of the company's 2013 current assets. The rest of 3D Systems' assets consist of inventory, prepaid expenses, PP&E, goodwill, intangible assets, long-term deferred income taxes, and other assets. Account balances related to allowance for doubtful accounts, income taxes, inventory reserves, goodwill, and other intangible assets are found using some degree of estimation. Allowance for doubtful



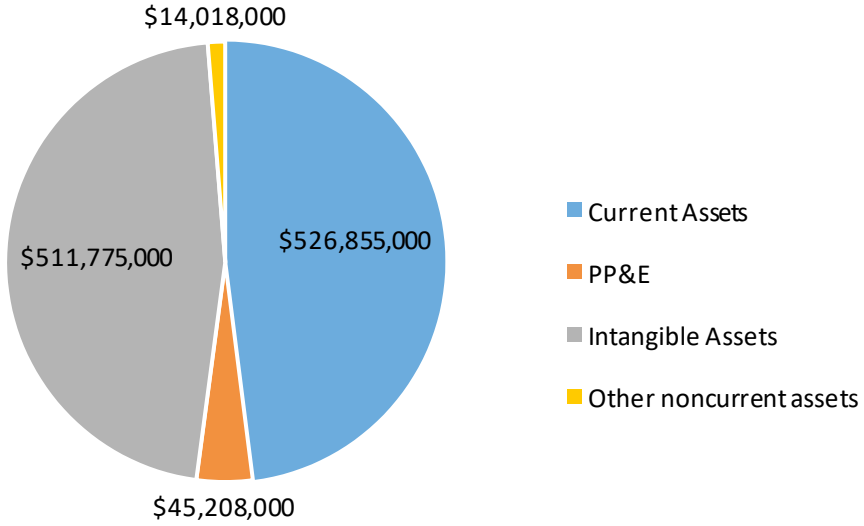
accounts is particularly hard to estimate, as it is more sensitive to the external environment. 3D Systems has little control over whether customers pay their bills or not. Research and development and patents are crucial in the 3D printing industry, which is part of the reason why intangible assets make up such a large portion of its total assets. Over the past few years, 3D Systems has seen a large increase in goodwill. This has arisen from the company's numerous acquisitions of other companies. 3D Systems' large supply

of current assets is critical, as it often needs to generate cash in order to fund its acquisition strategy and purchase smaller companies. The relation between long-term and short-term assets has not significantly changed since 2001, which was when the company began to aggressively take over smaller firms. 3D Systems' asset composition is somewhat similar to that of Stratasys, with both companies having a significant percentage of short-term assets. However, Stratasys has a much larger percentage of intangible assets.

Stratasys Asset Composition

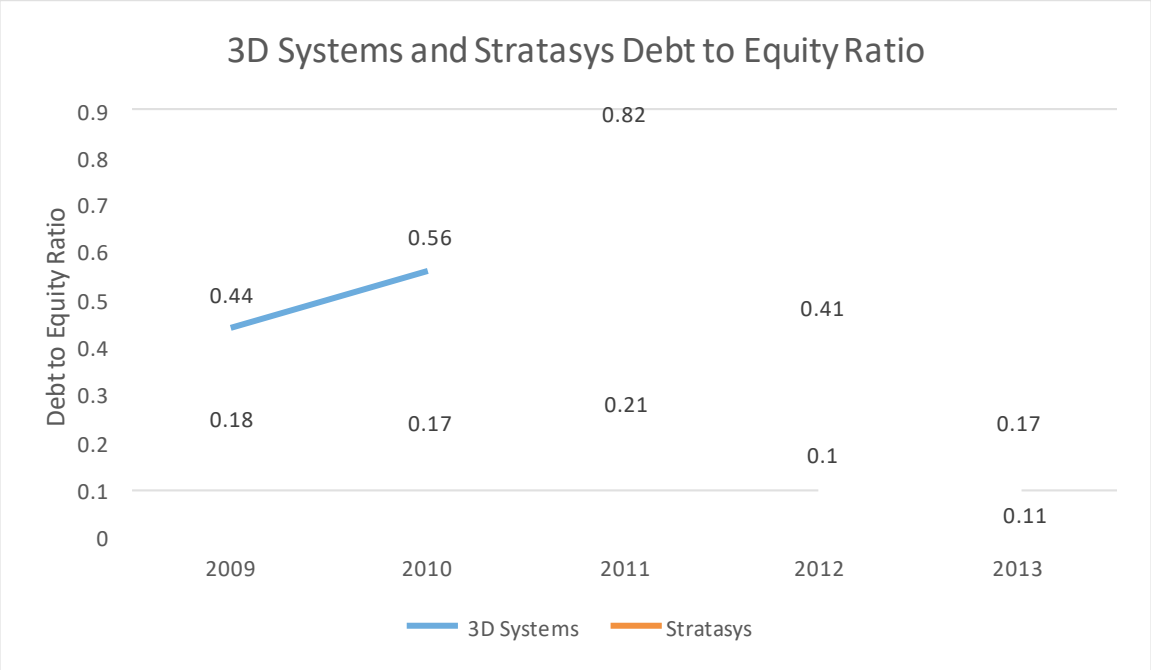


3D Systems Asset Composition



Debt to Equity and Liability Mix

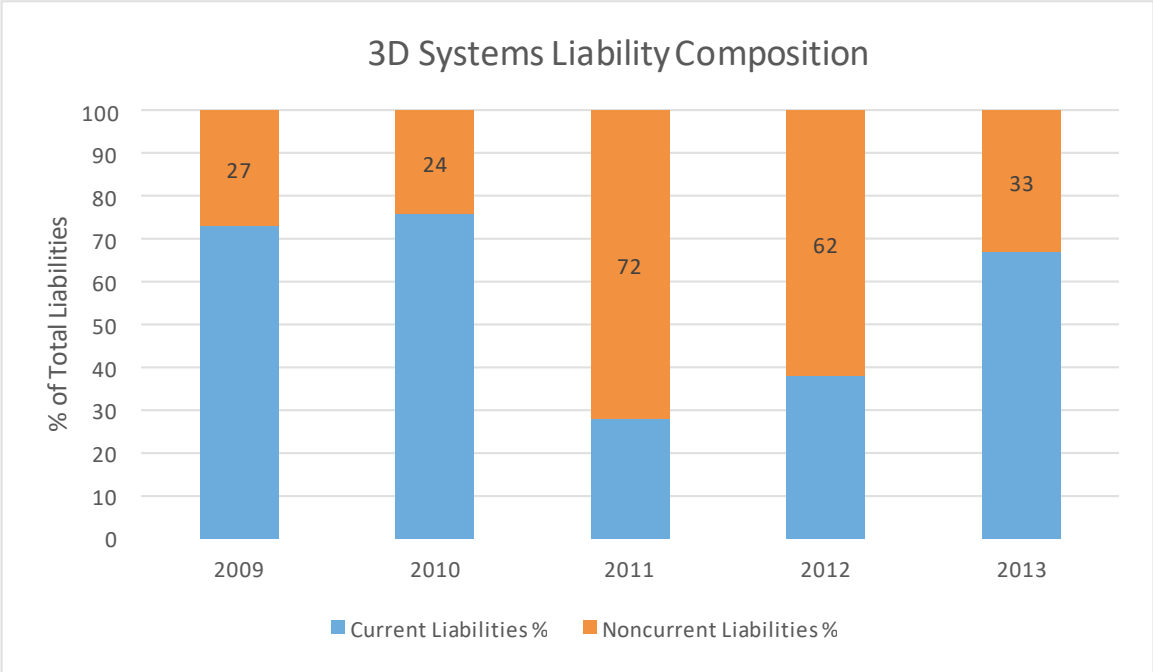
3D Systems is primarily financed through equity. In 2013, the company had $164,064,000 in total liabilities and $933,792,000 in total stockholders' equity. This debt to equity ratio has shifted widely over the past five years. However, since 2001, 3D Systems has turned significantly more towards equity to finance its business. By being an increasingly solvent company, 3D Systems is able to be much more financially flexible, which further helps its acquisition strategy. The company is becoming less risky as well, with very little of the company tied to any significant debt. Stratasys' debt to equity ratio



has been comparatively more stable over the past five years. Both companies have similar debt to equity ratios in 2013, with Stratasys having a 0.11 ratio and 3D Systems having a 0.17 ratio.

The strong majority of 3D Systems' liabilities are current liabilities, which composed 68 percent of total liabilities in 2013. Other than 2011 and 2012, this composition has been relatively stable. The sharp rise in noncurrent liabilities in 2011

was due to the issuance of a large number of senior convertible notes. This was also the cause for the sharp rise in the debt-to-equity ratio in 2011. Many of these notes were converted in 2012 and 2013, which led to a substantial increase in equity and decrease in long-term liabilities. By not having much long-term debt, 3D Systems avoids the risk that



comes along with it. With such a historically volatile stock price, the company is doing its best to become less risky.

Cash Flows

The Statement of Cash Flows shows that 3D Systems is a relatively financially healthy company. In 2013, the company had positive $25,184,000 from operating activities. This was a decrease from the $51,530,000 it generated in 2012. This sharp drop can mainly be attributed to a $24,438,000 increase in accounts receivable. 3D printers are a very expensive purchase, so it often takes 3D Systems a long time to collect from customers. The company had a negative $173,757,000 from investing activities in 2013, 93 percent of which is attributed to cash paid for acquisitions of other companies. The remaining 7 percent was spent on the purchase of property and equipment. Finally, 3D Systems generated $298,696,000 through financing activities in 2013, with 91 percent of this cash coming from the issuance of common stock. From 2012 to 2013, the company issued $165,187,000 worth of new common stock. With positive operating and financing activities, 3D Systems is currently in the growth stage of the life cycle. As the 3D

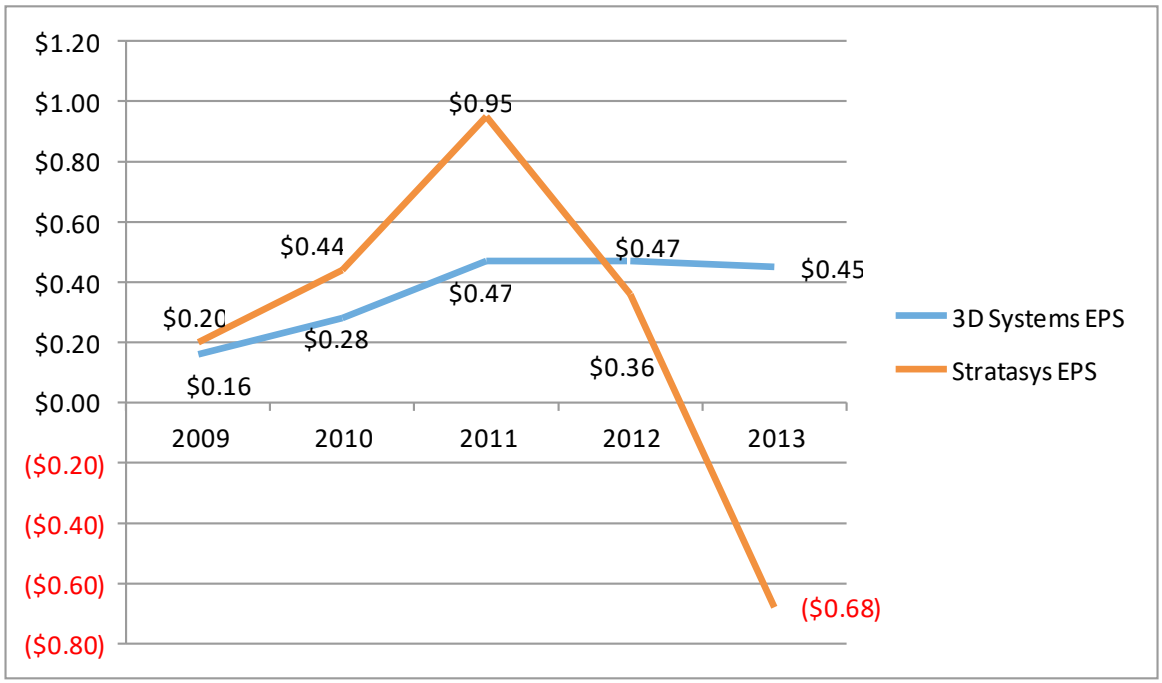
printing market rapidly grows, I expect cash from operating activities to begin to significantly rise and propel the company into the maturity stage.

Liquidity and Solvency Ratios

	2009	2010	2011	2012	2013
Current Ratio	2.1	1.7	4.4	3.8	4.8
Debt-to-Equity	0.44	0.56	0.82	0.41	0.17
Times Interest Earned	2.6	17.7	14.2	3.5	4.8

3D Systems current ratio has risen over the past two years, as the company has generated much more cash, while keeping its current liabilities relatively stable. The company needs a lot of working capital to fund its acquisition strategy, so the higher its current ratio the better. As discussed on pg. 3, 3D Systems' debt-to-equity ratio has dropped significantly since its 2011 issuance of convertible senior notes. Since 2011, $119,691,000 of the $131,107,00 notes that were issued have been converted into common stock. Times Interest Earned saw a large drop in 2012 due to a $14,836,000 increase in interest expense. Much of this interest was attributed to the 5.5 percent senior convertible notes. However, this ratio improved in 2013, as interest expense decreased by $437,000, while income from operations increased by $20,290,000.

Earnings Per Share

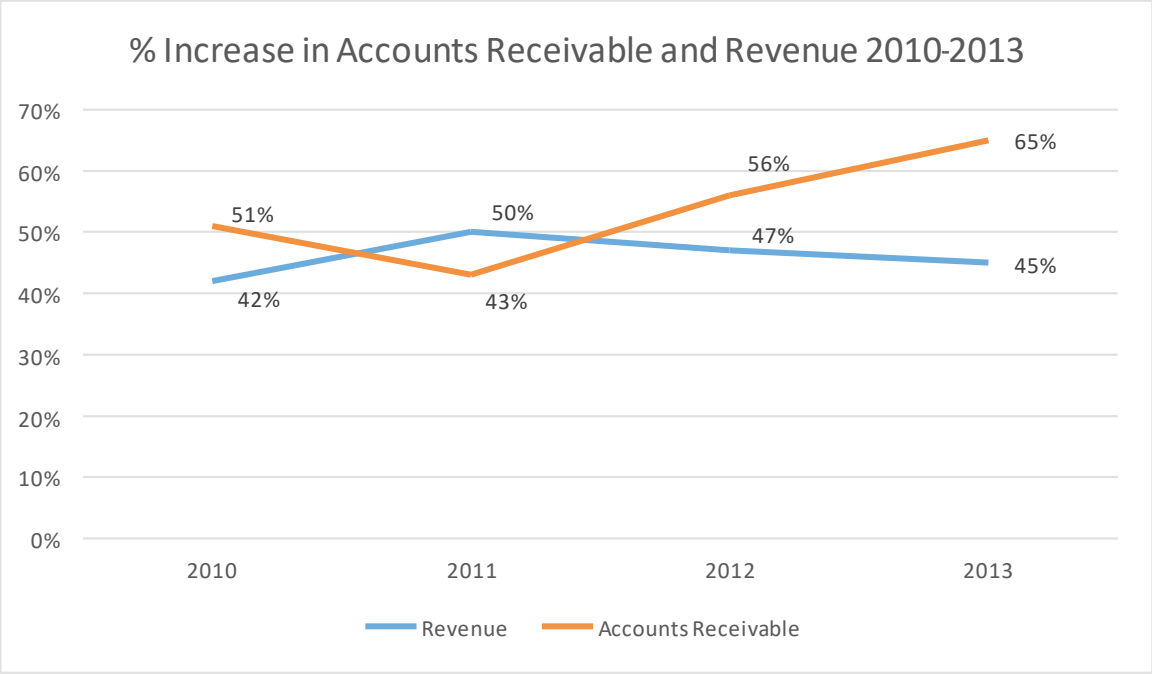


3D Systems has seen relatively stable growth in its earnings per share, as its net income has consistently improved over the past few years. The primary reason for the slight dip in earnings per share in 2013 was due to the fact that 17.6 million new shares of stock were issued, while net income only increased by $5.2 million. A large portion of this increase in common stock outstanding can be attributed to the fact that $69,115,000 worth of senior convertible notes were converted into stock during 2013. 44,000 new shares of stock were also issued during the year. This increase in common stock outstanding is the result of the company's managers funding its acquisition strategy.

Chapter Four

Accounts Receivable

3D Systems' only form of receivable is its accounts receivable, which was $132,121,000 in 2013. This was a 65 percent increase from the $79,869,000 that was posted in 2012. The company's desktop printers are sold for cash, but its more expensive printers are sold on credit. Established businesses with good credit generally purchase high-end 3D printers, so 3D Systems has little trouble collecting from most of its customers. With its numerous acquisitions and sharp rise in revenue, 3D Systems has seen steady growth in its accounts receivable. The percentage increase in accounts receivable has been faster than the percentage increase in revenue over the past couple

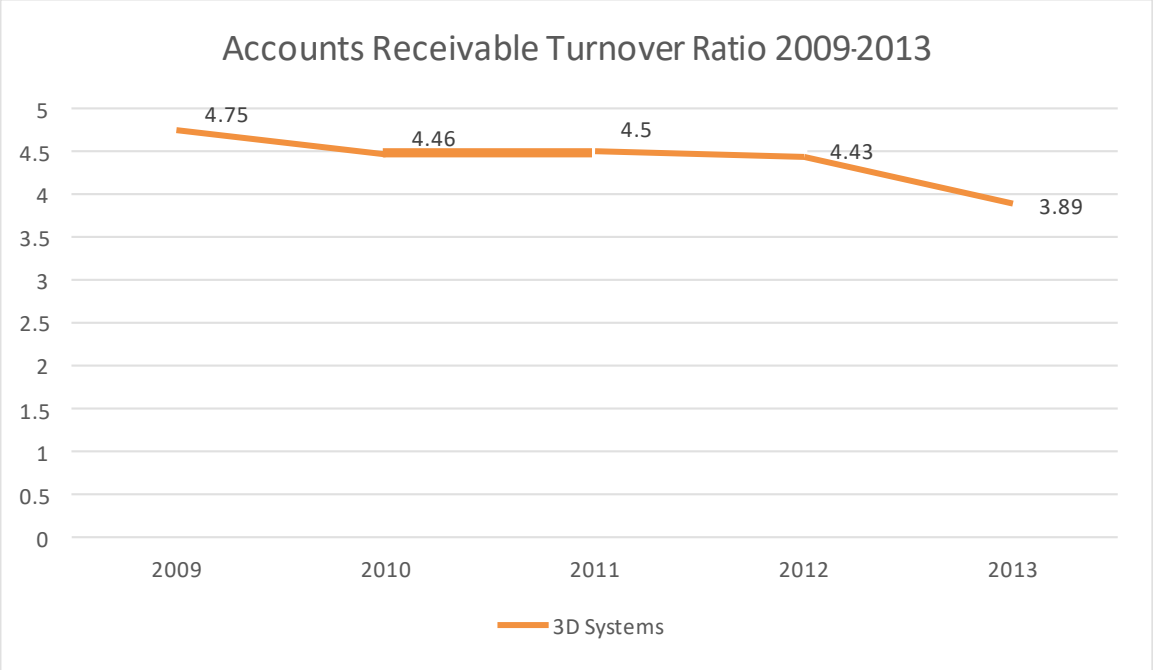


years. This is primarily due to 3D Systems relaxing its credit terms in effort to get more businesses to purchase its products. While the company strongly values the desktop market, it desperately needs to continue to expand into established industries if it wants to

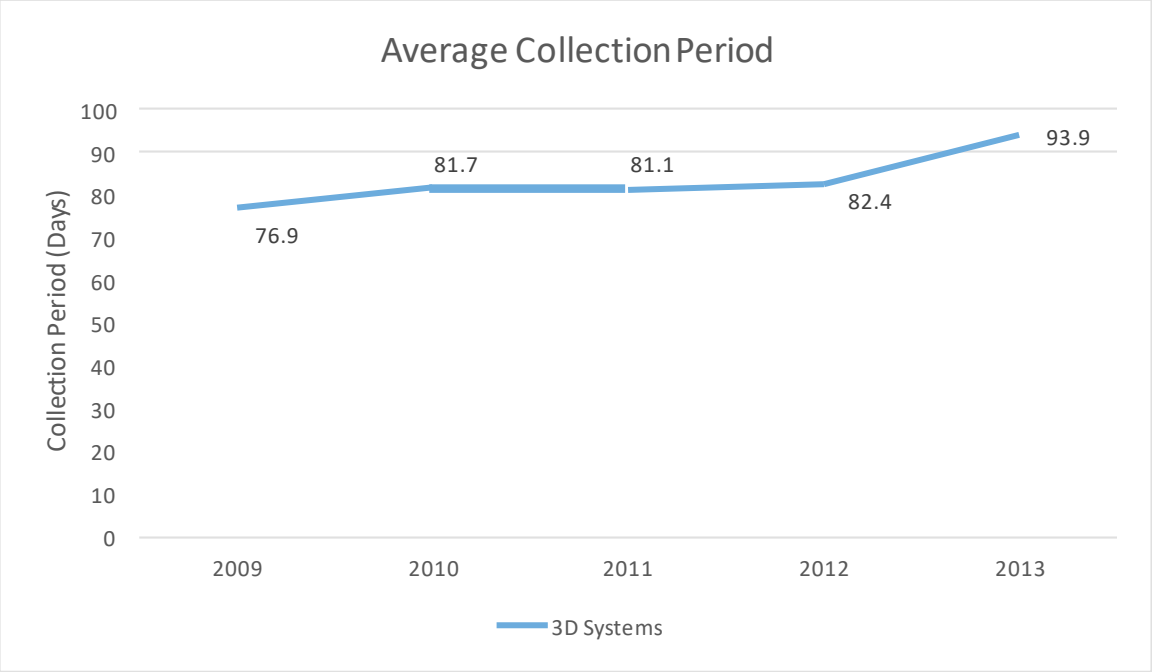
remain the leader in 3D printing. Relaxing its credit terms is helping the firm accomplish this.

Accounts Receivable Turnover and Average Collection Period

Due its relaxed credit terms, 3D System has made less frequent collections from its customers. Therefore, the company's Accounts Receivable Turnover Ratio has decreased over the past several years. This trend is an accurate reflection of 3D Systems' current growth strategy. The company has placed less emphasis on generating cash from operations and more emphasis on expanding its brand and entering more markets. This is also shown in the company's Average Collection Period, which has consistently increased over the past five years. While 3D Systems has been collecting from customers less frequently, its relaxed credit strategy has resulted in a significantly larger number of printers being sold. Many companies are still trying to recover from the 2008 Market Crash, so 3D Systems is also attempting to make it easier for these businesses to obtain a

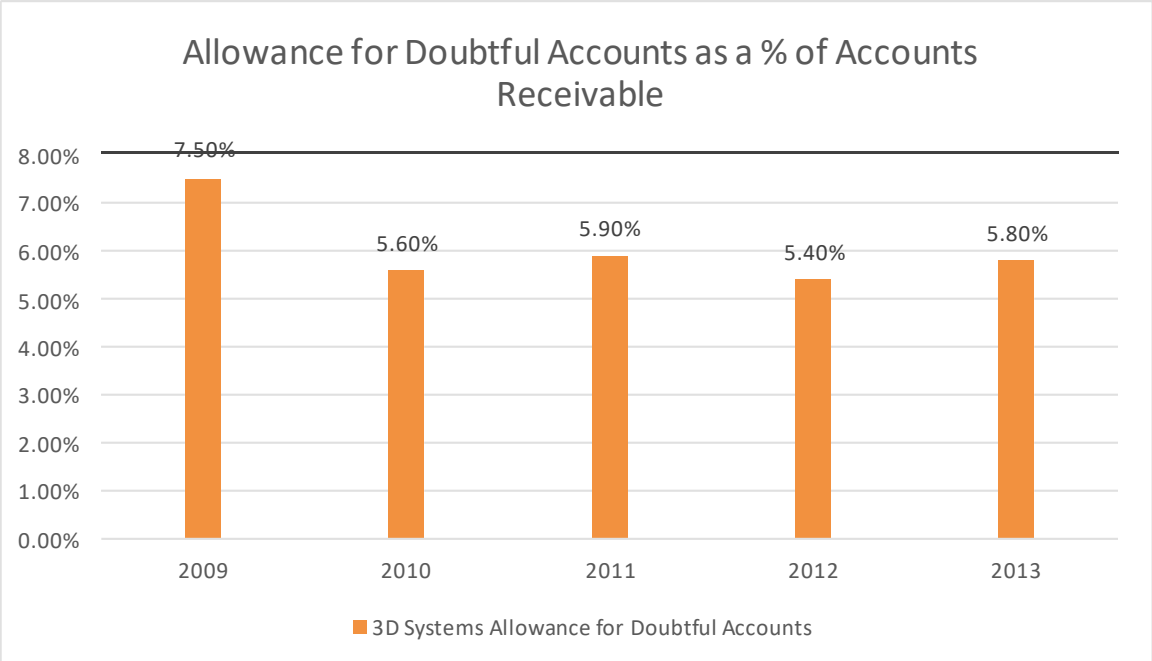


3D printer. The firm is generating sufficient cash through its financing activities, so collecting on accounts receivable is important but not imperative at this point in time.



Allowance for Doubtful Accounts

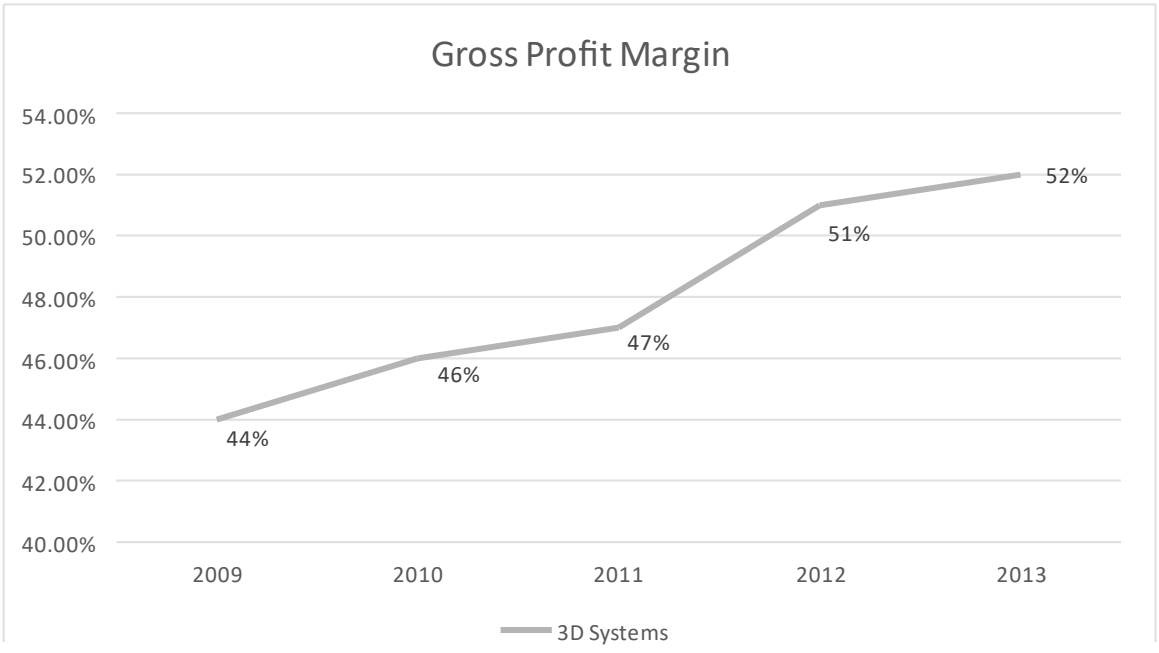
3D Systems works diligently to ensure that it has an accurate estimation of its Allowance for Doubtful Accounts. The company looks at every customer's account and determines if it will be able to collect on it. They look at whether or not the company will



soon be insolvent or if the company's account is more than ninety days past due. If either of these two has occurred, then 3D Systems will determine how much of the remaining balance will be recovered. Allowance for Doubtful accounts has increased over the past five years but has remained a marginally material percentage of Accounts Receivable. During 2013, Allowance for Doubtful Accounts increased by $3,816,000, which decreased the company's net income. With so many credit sales, it is very possible that 3D Systems purposefully understated its Allowance for Doubtful Accounts in order to increase its net income.

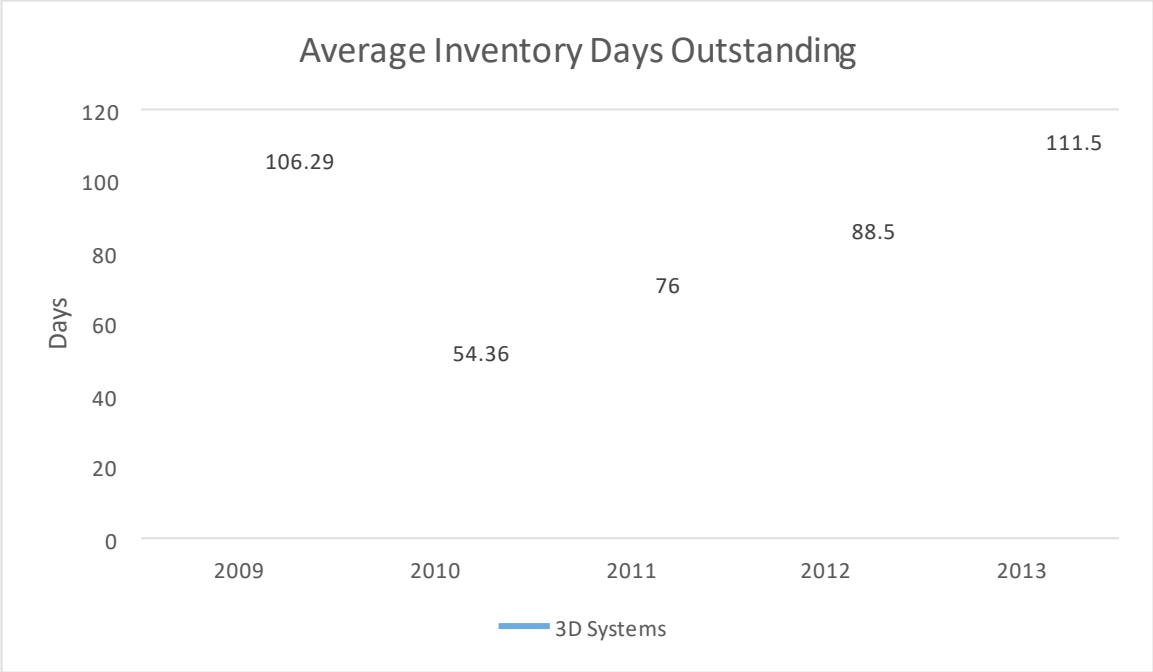
Inventories and Gross Profit Margin

3D System's only inventories are its printers and raw materials. The company uses the FIFO method to track and cost its inventory. The company uses historical experience and projected demand to determine how much inventory they need to have available at any given time. Inventory has remained relatively stable as a percentage of total assets. Inventory represented 6.8 percent of total assets in 2013, which was less than half a percent greater than 2012. This slight increase was primarily due to new product launches that occurred during the year. The company also maintained an inventory

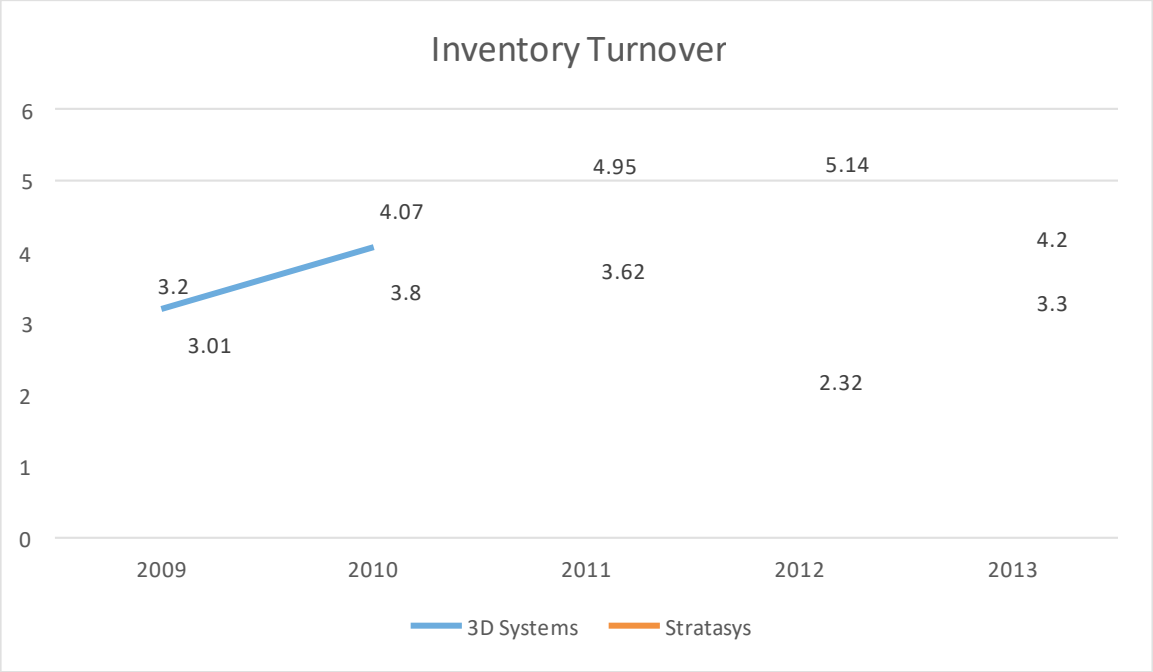


reserve of $4,300,000 in 2013. The majority of the inventory on hand are desktop printers and raw materials. 3D Systems often custom builds its high-end printers in order to fulfill the customer's specific needs. This is why raw materials constitutes such a large portion of inventory. 3D Systems has seen a steady increase in its Gross Profit Margin over the past five years. This trend indicates that the firm is in relatively strong financial health and is easily able to pay off its expenses. The company had a 52 percent Gross Profit Margin in 2013, which was 6 percent greater than the one posted by Stratasys.

Inventory Turnover and Average Inventory Days Outstanding



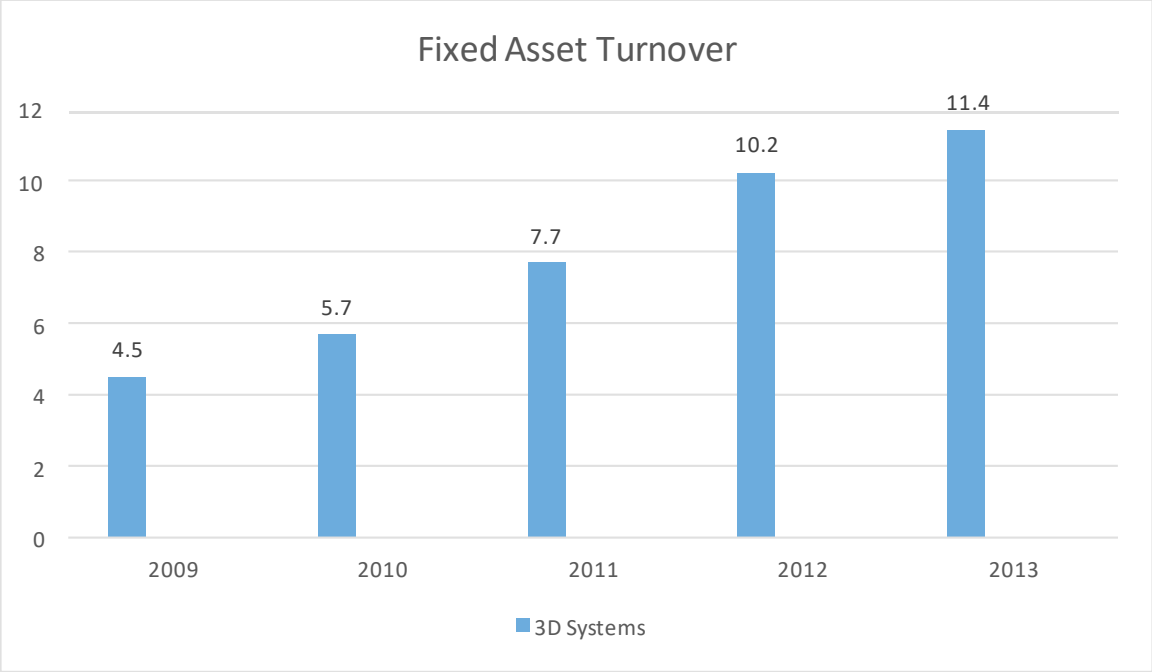
3D Systems' Inventory Turnover has fluctuated over the past five years. The ratio steadily increased from 2009 to 2012 but saw a slight dip in 2013. Turnover is low for



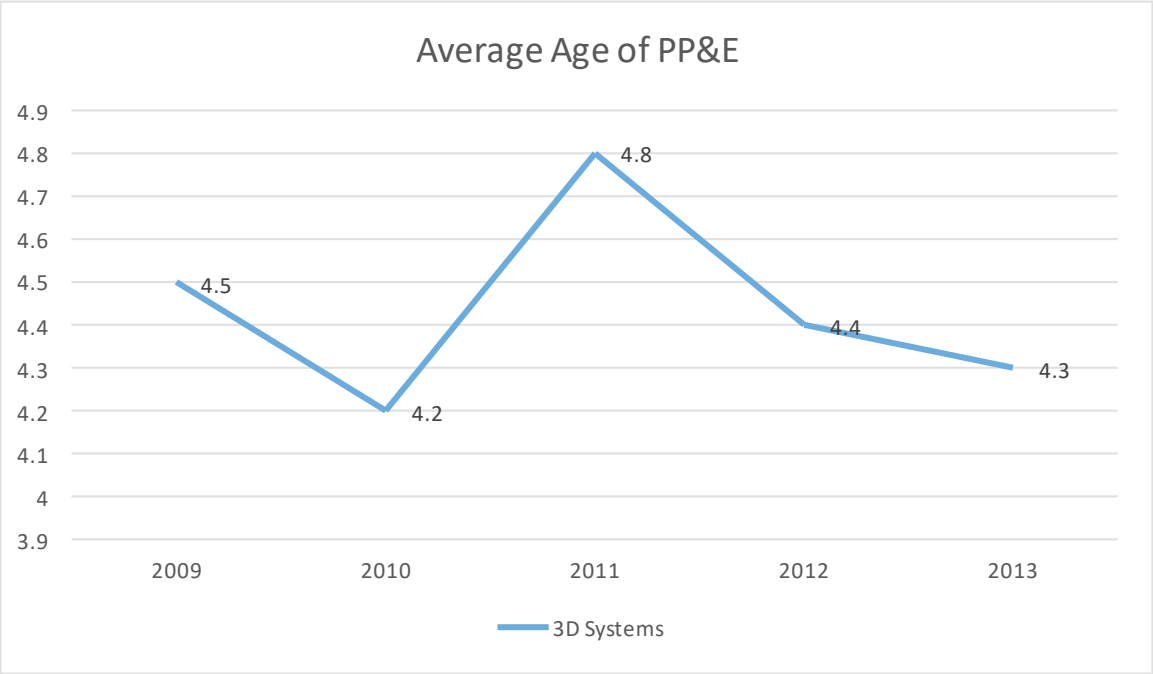
3D Systems due to the fact that the printers take time to produce and that the high-end printers are not sold very frequently. However, 3D Systems has a favorable Inventory Turnover when compared to Stratasys'. The company's Average Inventory Days Outstanding has also increased over the past several years but remains favorable when compared to Stratasys, which posted a 224 Average Inventory Days Outstanding in 2013. As the company turns more towards selling to businesses, its inventory has spent more time on the shelves. 3D Systems values its raw materials by the lower cost or market method. It could therefore manipulate its income by delaying write-downs on its raw materials. The raw materials used by 3D Systems can fluctuate dramatically in value, so 3D Systems could avoid significant losses by doing this.

Property, Plant, and Equipment

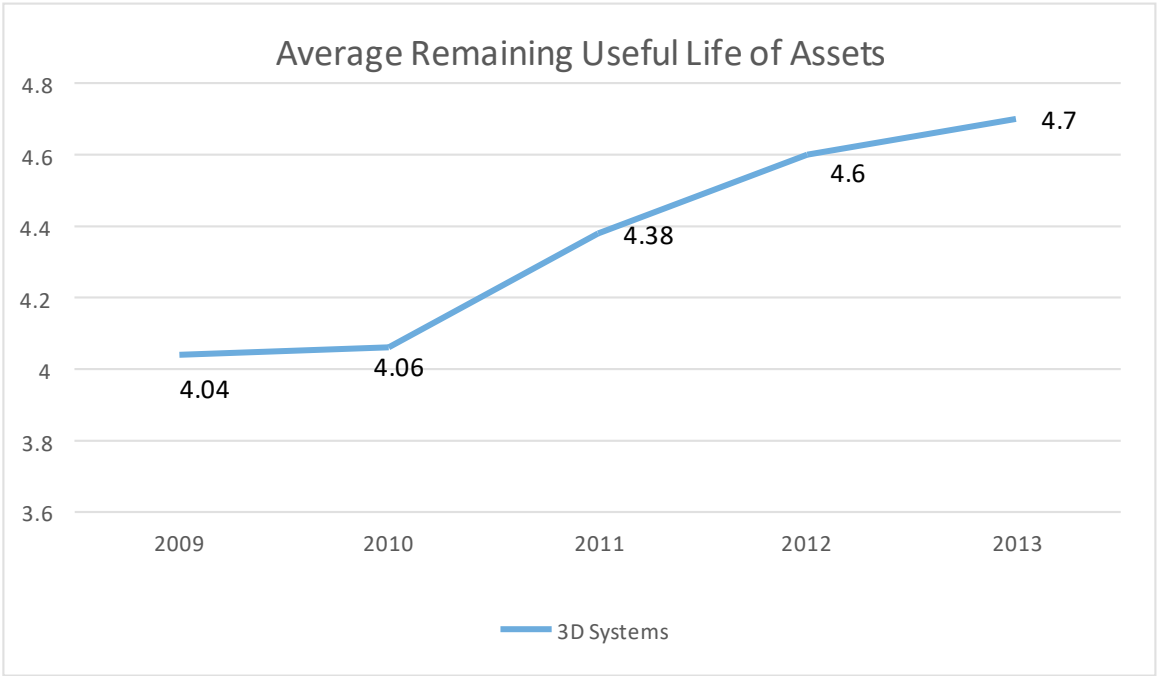
3D Systems has seen a 22.3 percent increase in its PP&E over the past year. This increase was primarily caused by the acquisition of new machinery equipment and leasehold improvements. The company uses the straight-line method to depreciate its assets. With its aggressive acquisitions of other companies, 3D Systems has seen a sharp rise in its total PP&E.



The company has a very substantial portion of its total assets in PP&E but has not seen a significant loss from impairment during the past five years. 3D Systems has become increasingly efficient with its PP&E, as its Fixed Asset Turnover Ratio has considerably increased over the past five years. Having the newest equipment is paramount in the 3D printing industry, so 3D Systems has worked to ensure that its assets do not deteriorate.



The average age of its assets has decreased over the past five years. The company has also seen an increase in the average remaining useful life of its assets. With PP&E constituting a significant portion of its total assets, 3D Systems could be using it to manipulate its net income. It could accomplish this by purposefully underestimating its depreciation expense. Increasing the estimated salvage value of its assets or its estimated



useful life would help achieve this result.

Chapter Five

Intercorporate Investments

Due to its aggressive acquisition strategy, 3D Systems has held many intercorporate investments over the past five years. Its primary reason for making these investments is to increase its asset base and enter new markets. The firm will wait for a new, innovative 3D printing company to emerge and then acquire it. From 2011 to 2013, 3D Systems acquired thirty-two different companies. By doing this, 3D Systems is able to bring in fresh minds and ideas, therefore being able to innovate faster than Stratasys. For example, in 2011 the company desired to further its expansion into the medical industry. It therefore acquired Bespoke Innovations, a San Francisco startup that specializes in printing personalized prosthetics. 3D Systems has seen significant growth through both its acquisitions and organically. The acquired businesses have helped 3D Systems improve its existing products, which has helped improve sales. The company's large number of acquisitions has resulted in a sharp increase in Goodwill. As seen on the above graph, the steep rise in Goodwill from 2011 to 2013 can be attributed to the large number of companies that it acquired during this period. 3D Systems has never reported any impairment on its Goodwill or any interest revenue. The company recognizes all of its holding gains and losses in the income statement as "interest and other expense, net". This account had a balance of $16.9 million, $17.3 million, and $2.5 million in 2013, 2012, and 2011, respectively. The sharp increase in 2012 was primarily attributed to a loss on the conversion of convertible notes. Unrealized and realized holding gains and

losses constituted little more than $150,000 of this account from 2011 to 2013. It should therefore not be included in forecasts of future earnings.

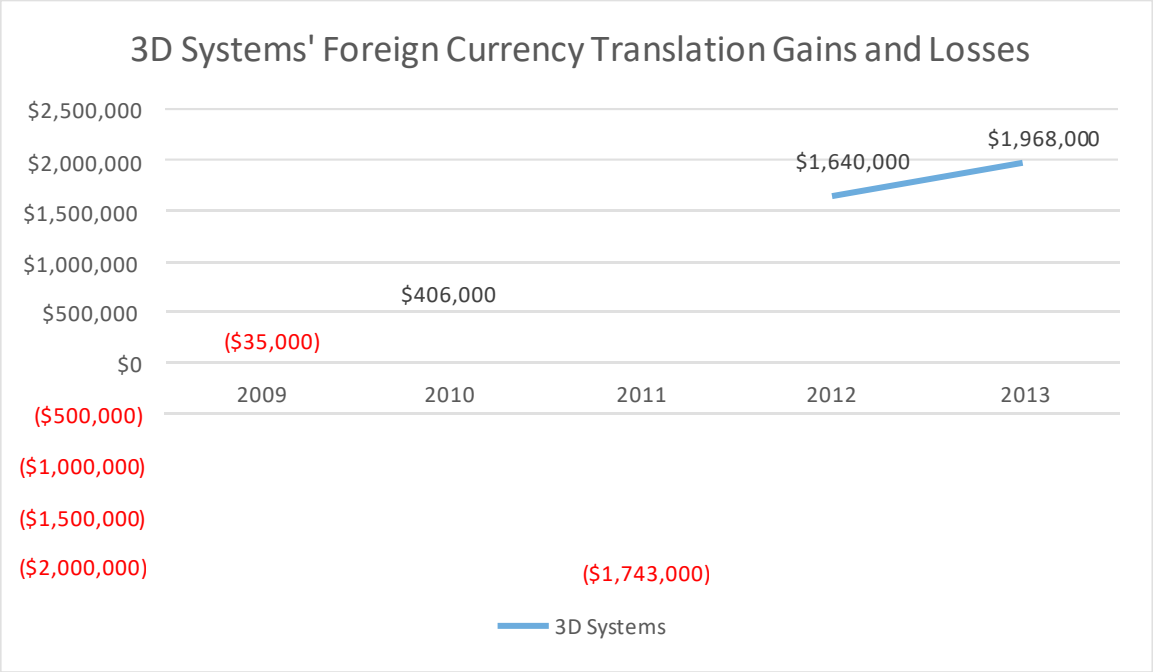
Restructuring Charges

3D Systems is a relatively new company that seen substantial growth in both revenue and market share. This growth has been especially substantial over the past five years. With the company doing so well, it therefore has not had to incur any substantial restructuring charges. The only restructuring expenses that it has incurred was $2.5 million in 2011 when it acquired Z Corp and Vidar. Z Corp was the then leader in multi-color inkjet printing, and Vidar was a leader in medical imaging technology. These acquisitions were two of 3D Systems' biggest, so some restructuring was needed to aid the integration process. Despite not having many restructuring charges so far, experts are predicting that 3D Systems will have to incur significant expenses in the near future.

Foreign Currency

Approximately 44.5 percent of the company's revenue comes from sales abroad. Most of this revenue is generated from its subsidiaries in foreign countries. Due to having such a significant presence overseas, 3D Systems has to deal with foreign currency translations. The currencies that 3D Systems has to translate include the Australian Dollar, British Pound, Euros, Japanese Yen, Swiss Franc, South Korean Won and Indian Rupee. At the end of each accounting period, the company uses each currency's respective exchange rate to determine each subsidiary's income and the value of its assets. Gains and losses from foreign currency translation have fluctuated over the past

five years. However, they have yet to have a very substantial impact on the company's

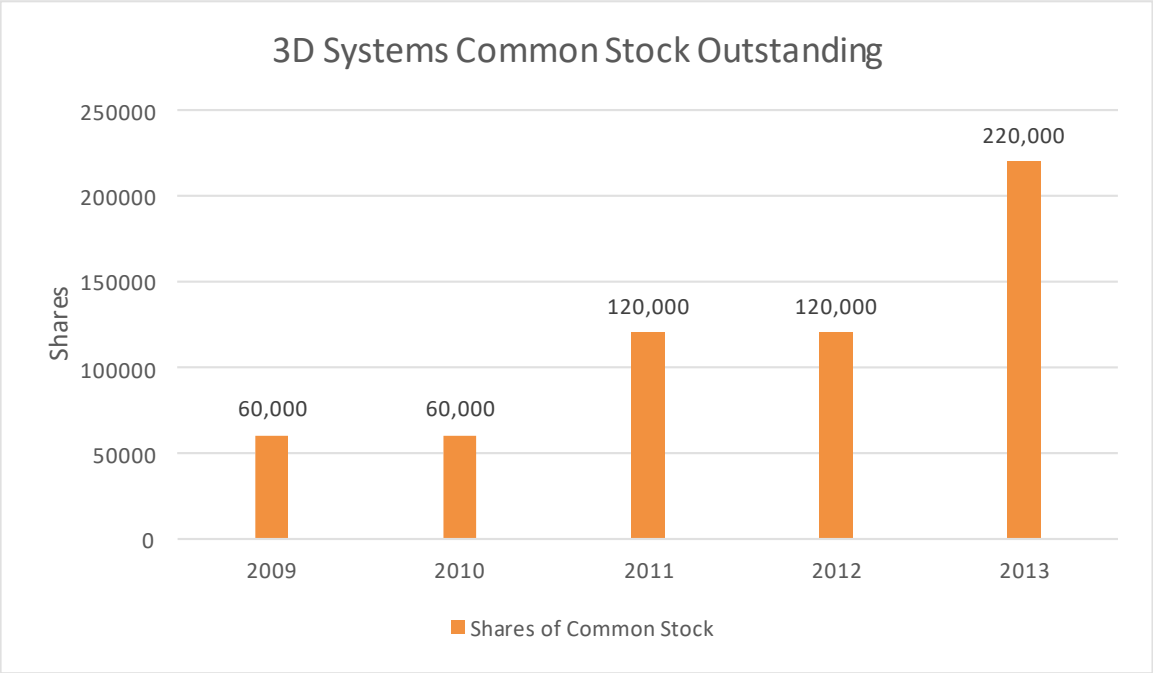


income. In 2013, exchange rates had the biggest impact in the Asia-Pacific region where foreign currency translation reduced revenue in the area by $4,311,000. A gain of $2,855,000 occurred in Europe during the same year as a result of foreign currency translation.

Stock Splits

Due to the fact that it is a growing company, 3D Systems has never repurchased any of its common stock or issued any cash dividends to stockholders. The company is rapidly expanding and needs as much cash as possible. Therefore, it is reinvesting any earnings back into the company. The Board of Directors has given no indication as to when it may begin to issue dividends. The company has executed a couple of stock splits over the past five years, which has dramatically increased the number of its shares

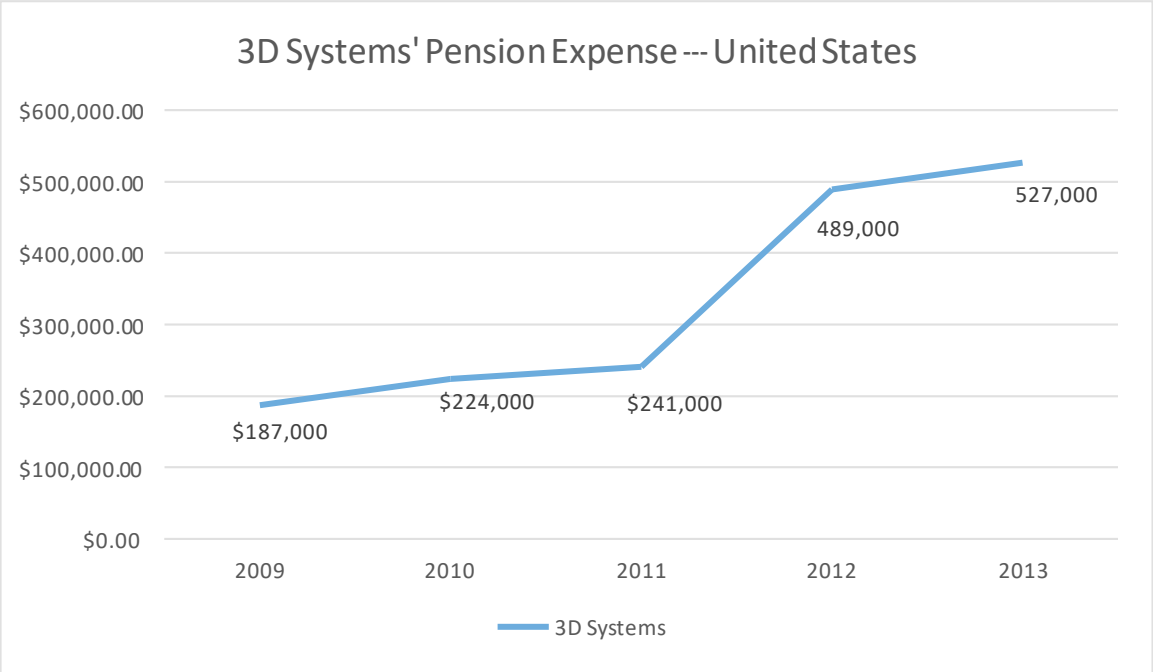
outstanding. 3D Systems executed a three-for-two split in 2013 and two-for-one split in 2011. These splits had a large impact on the amount of common stock outstanding. 3D



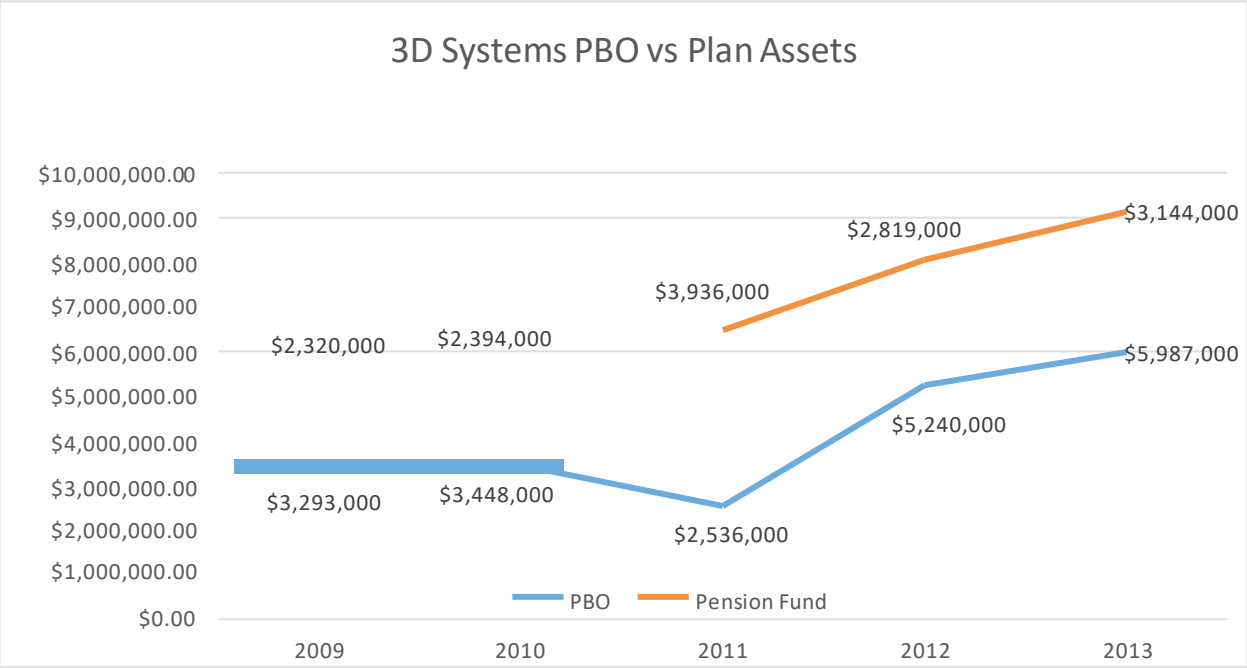
Systems did this in order to make its stock more liquid and therefore increase its number of investors. The stock splits and the conversion of senior convertible notes have also played a large part in 3D Systems' volatile stock price.

Pensions

3D Systems sponsors a 401k plan that covers all employees inside of the United States. The company matches 50 percent to 300 percent of all employee contributions to the plan and has also made several contributions on its own accord. The company's pension expense has steadily risen over the past five years. This is to be expected, as the company's rapid growth has led to it employing a much larger workforce. The company also offers a retirement plan to its international workforce. This is a defined benefit plan and, the company maintains insurance contracts that issue annuities in order to help pay for it. The present value of those contracts in 2013 was $3,144,000, while the company only had to pay $122,000 in benefits to its international workforce. 3D Systems' workforce is relatively young, so it has yet to have to make any significant benefit payments to its employees. However, the company's international retirement plan is



currently underfunded. The present value of the annuity contract is significantly below the company's projected benefit obligation.



Chapter Six

Balance Sheet

Current Assets	**Current liabilities:**
Cash and cash equivalents	Current portion of capitalized lease obligations
Accounts receivable, net of allowance for doubtful accounts	Accounts payable
Inventories, net	Accrued and other liabilities
Prepaid expenses and other current assets	Customer deposits
Current deferred income taxes	Deferred revenue
Restricted cash	Total current liabilities
Total current assets	Long-term portion of capitalized lease obligations
Property and equipment, net	Convertible senior notes, net
Intangible assets, net	Deferred income tax liability
Goodwill	Other liabilities
Long term deferred income taxes	Total liabilities
Other assets, net	Commitments and Contingencies
Total assets	**Stockholders' equity:**
	Common stock,
	Additional paid-in capital
	Treasury stock, at cost
	Accumulated earnings
	Accumulated other comprehensive income
	Total 3D Systems Corporation stockholders' equity
	Noncontrolling interest
	Total stockholders' equity
	Total liabilities and stockholders' equity

	Non-Operating
	Operating

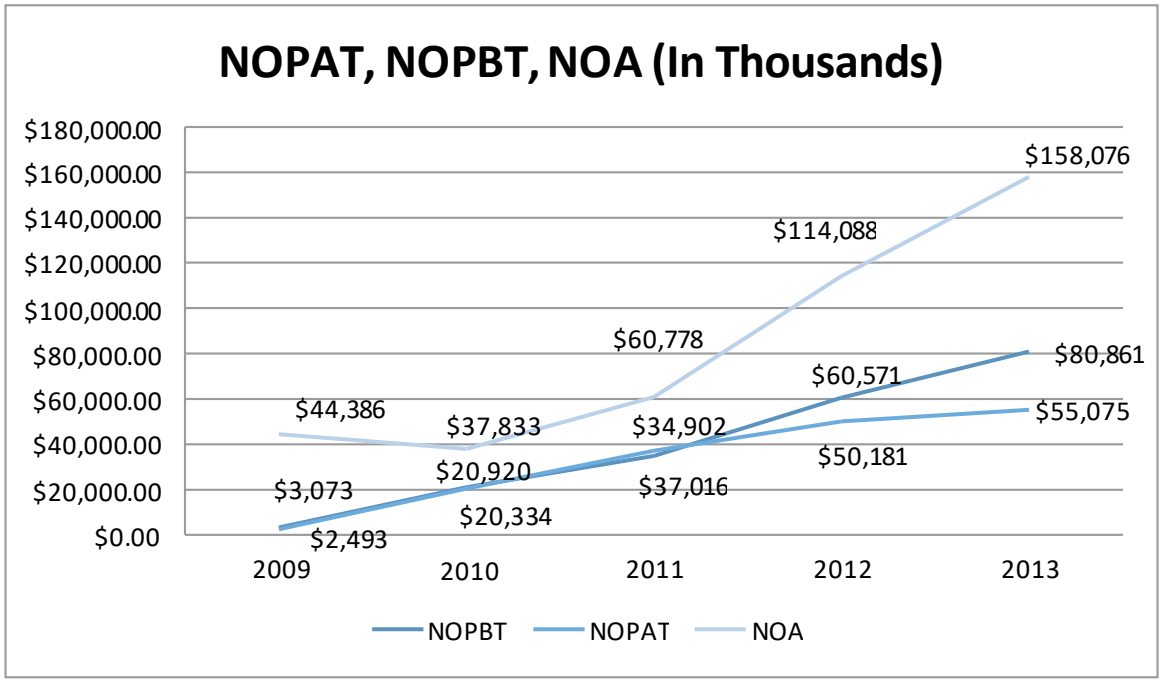
Income Statement

Revenue:
Products
Services
Total revenue
Cost of sales:
Products
Services
Total cost of sales
Gross profit
Operating expenses:
Selling, general and administrative
Research and development
Total operating expenses
Income from operations
Interest and other expense, net
Income before income taxes
Provision for (benefit of) income taxes
Net income
Net (income) attributable to noncontrolling interest
Net income attributable to 3D Systems Corporation

Tax Rates

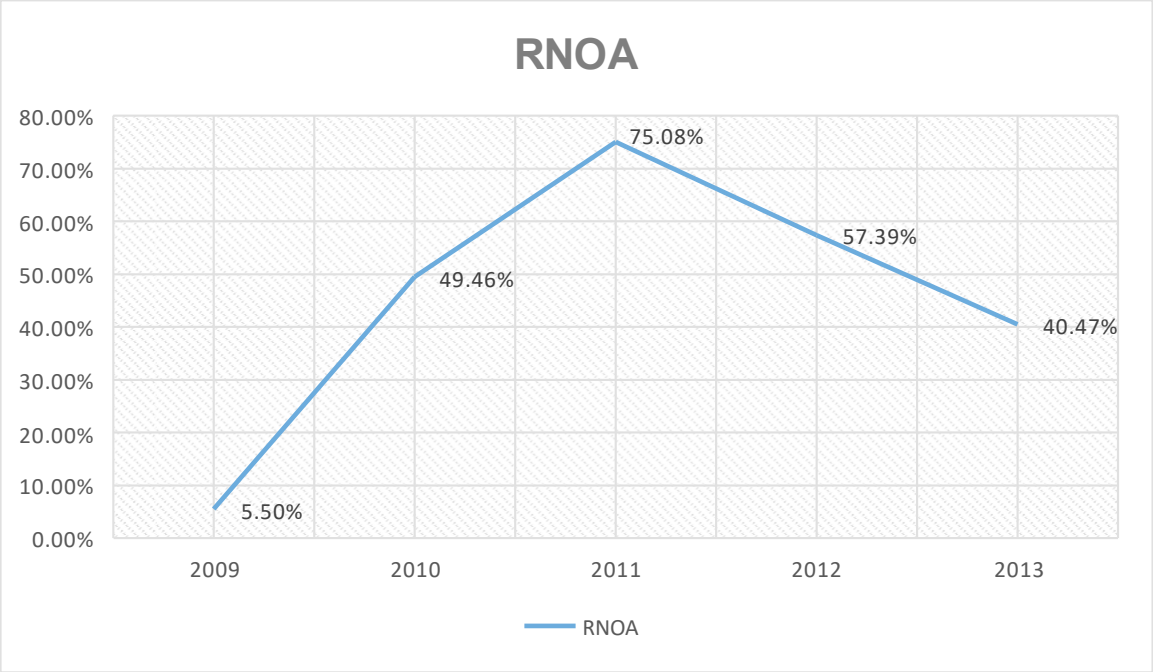
	2013	2012	2011	2010	2009
Federal Tax Rate	35%	35%	35%	35%	35%
Statutory State Tax Rate	2.4%	2.3%	1.3%	2.8%	(1.4%)

NOPAT, NOPBT, NOA



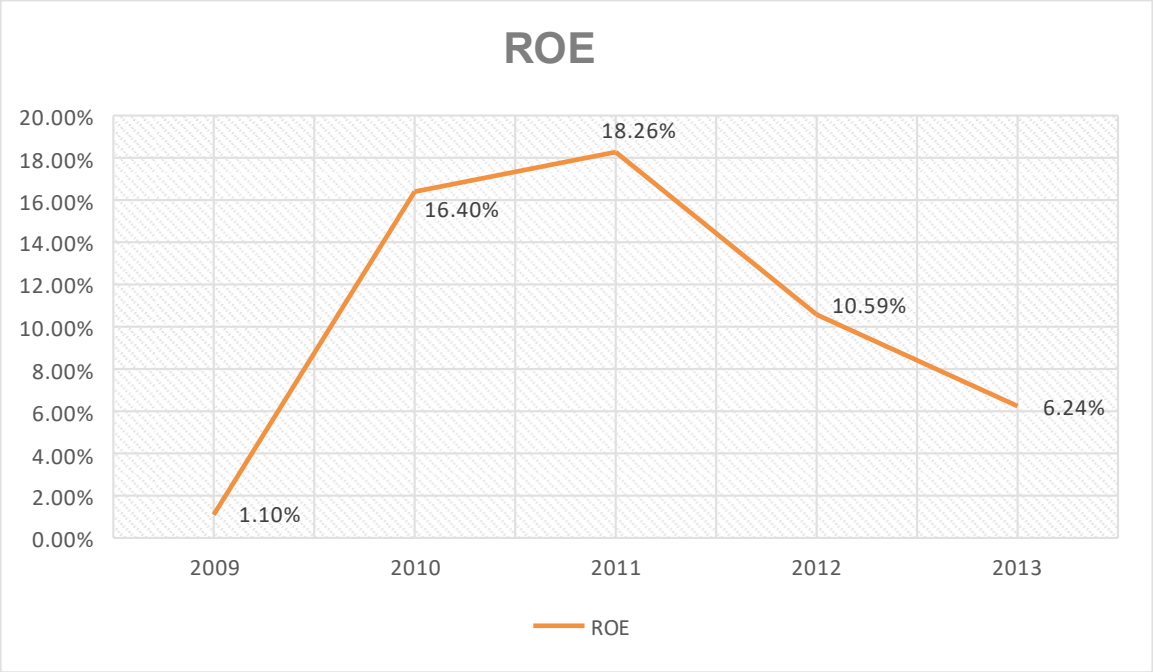
NOPAT, NOPBT, and NOA have all significantly increased over the past five years. Net Operating Assets has more than doubled since 2011. This is due to 3D Systems' acquisition of several medium sized companies during this period, which greatly increased its Property, Plant, & Equipment, Inventory, and Receivables. NOA should continue on this trend for the foreseeable future, as the company continues its aggressive acquisition strategy. NOPAT leveled off slightly in 2012, as there was a sizeable increase in tax on operating profit.

RNOA

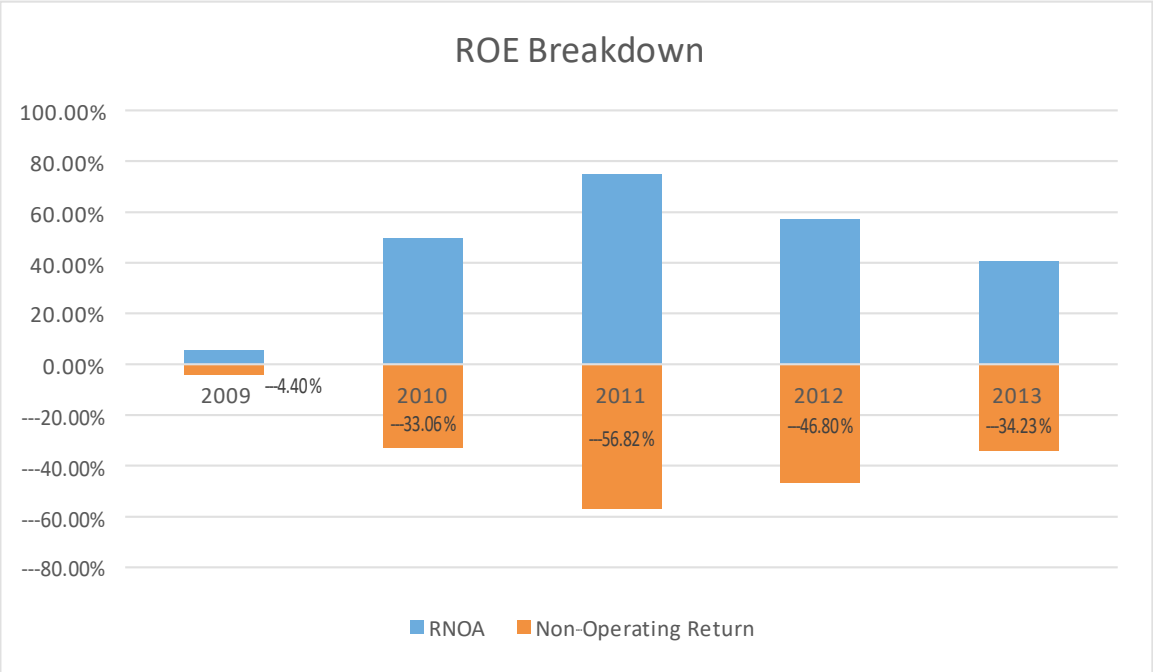


3D Systems' RNOA saw a sharp increase from 2009 to 2011 but has steadily declined since then. This correlates with the increase in NOA that occurred during the same period. NOPAT has increased at a slower rate than NOA. This is due to the fact that the company's large increase in assets has not translated to an equal sized increase in profit.

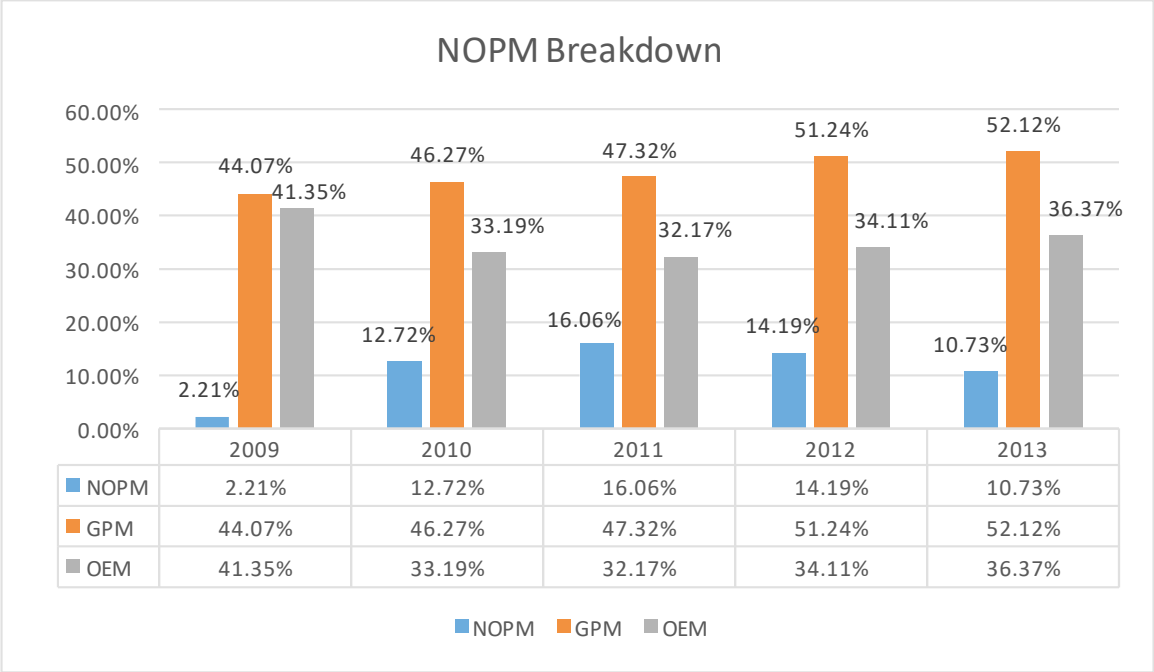
ROE



3D Systems' ROE spiked from 2009 to 2011 but has steadily decreased since 2011. This downturn was largely the result of the two-for-one stock split that was issued in May 2011. Net income has not increased at the same rate as Stockholders' Equity. The company is still in the growth stage and issuing stock to finance the company, so this decline in ROE is not surprising. The three-for-two stock split that was issued in February 2013 led to ROE decreasing even further. Currently, 3D printing is a rapidly growing industry with people all over becoming aware of how this technology can change the world. However, this global awareness has not yet translated to a boom in sales. When this boom happens, 3D Systems' ROE should increase substantially.

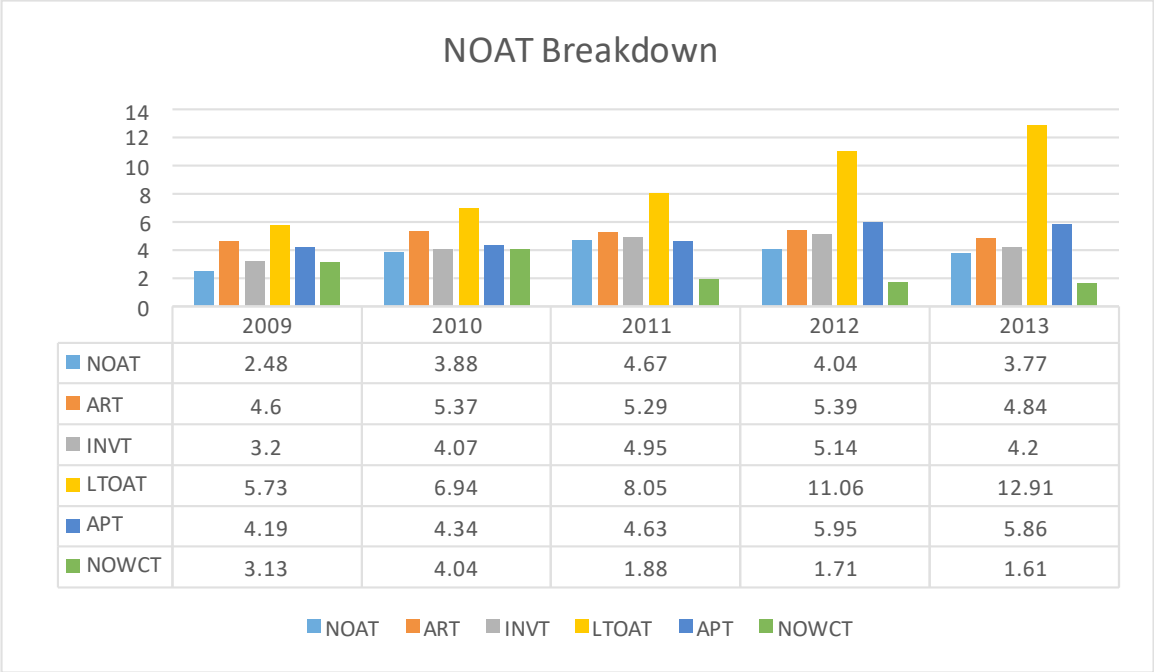


While Operating Return has decreased since 2011, its Non-Operating Return has increased, although it is still negative. 3D Systems made several risky acquisitions in 2011, which caused the increase in non-operating return. The company's aggressive acquisition strategy should only lead to an increase in this trend.



	2009	2010	2011	2012	2013
NOPM	2.21%	12.72%	16.06%	14.19%	10.73%
GPM	44.07%	46.27%	47.32%	51.24%	52.12%
OEM	41.35%	33.19%	32.17%	34.11%	36.37%

Like the previously discussed ratios, Net Operating Profit Margin also saw an increase from 2009 to 2011 and a decrease from 2011 to 2013. The NOPM shows how much operating profit the company is making. The decrease in NOPM was due to the fact that while revenues have grown exponentially over the past several years, operating profit after tax has not grown as significantly. For example, revenue increased by $130 million from 2012 to 2013, while NOPAT only increased by $5 million. The two components of NOPM, Operating Expense Margin and Gross Profit Margin, both increased over the past three years.

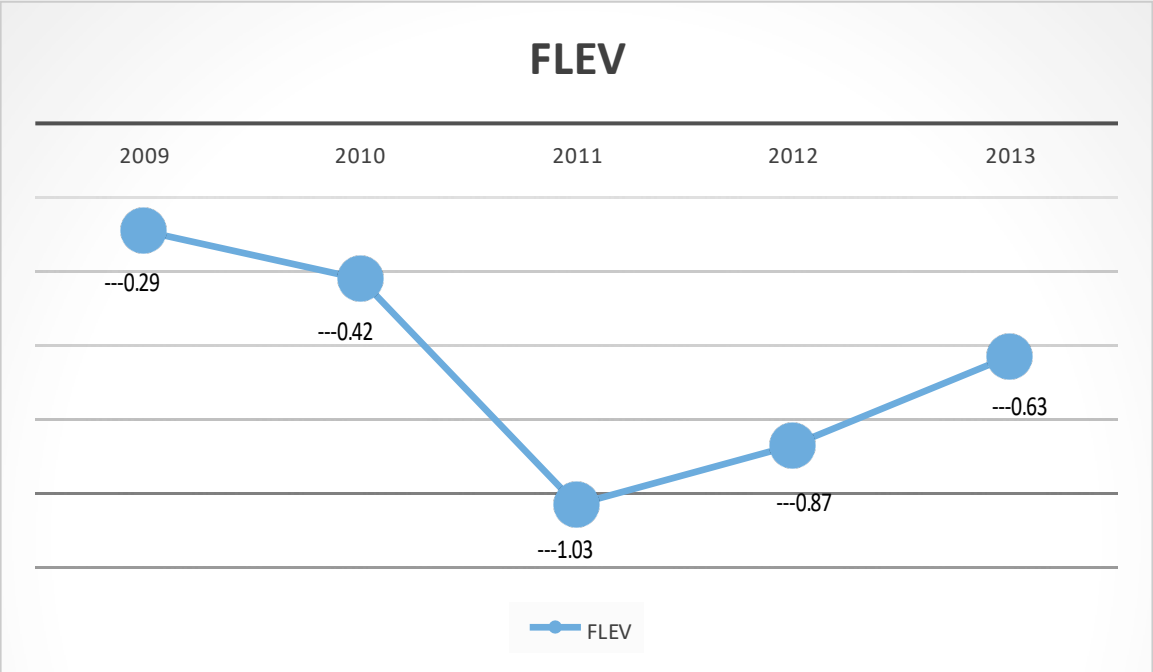


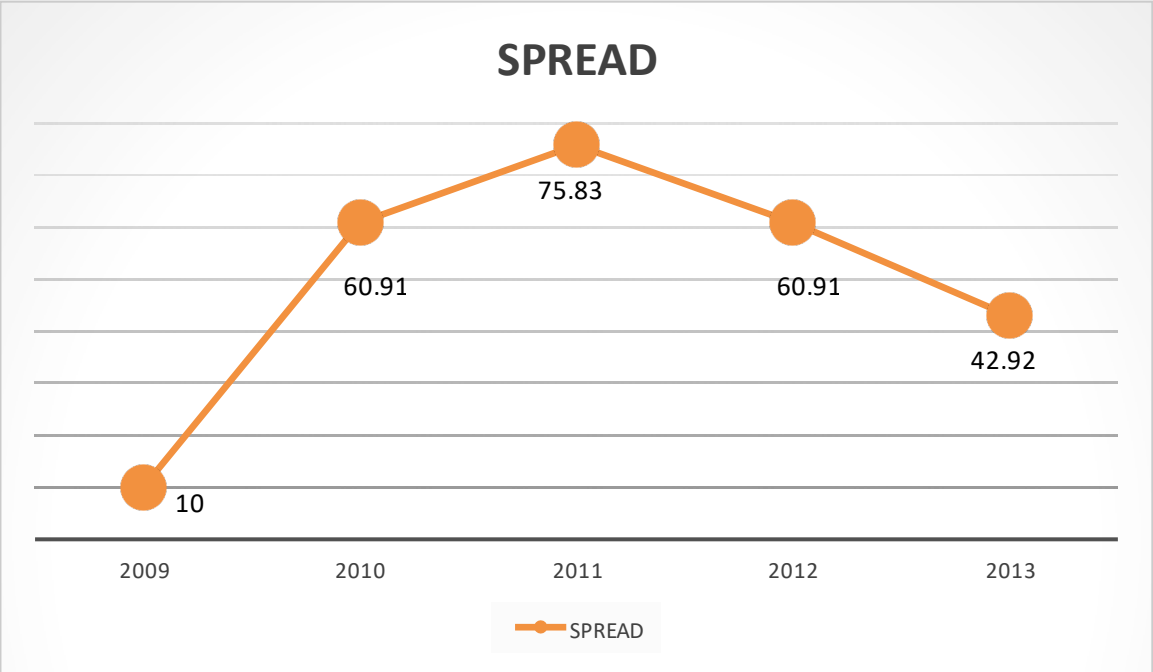
	2009	2010	2011	2012	2013
NOAT	2.48	3.88	4.67	4.04	3.77
ART	4.6	5.37	5.29	5.39	4.84
INVT	3.2	4.07	4.95	5.14	4.2
LTOAT	5.73	6.94	8.05	11.06	12.91
APT	4.19	4.34	4.63	5.95	5.86
NOWCT	3.13	4.04	1.88	1.71	1.61

Net Operating Asset Turnover follows a similar trend as the previously discussed measurements. 3D Systems' net operating assets are relatively productive and brought in $3.77 of sales for every dollar invested in them. This is especially favorable when compared to the median average of $1.4 for all publicly traded companies. 3D Systems is

greatly increasing its assets each year, but more importantly, it is utilizing them effectively.

FLEV & SPREAD

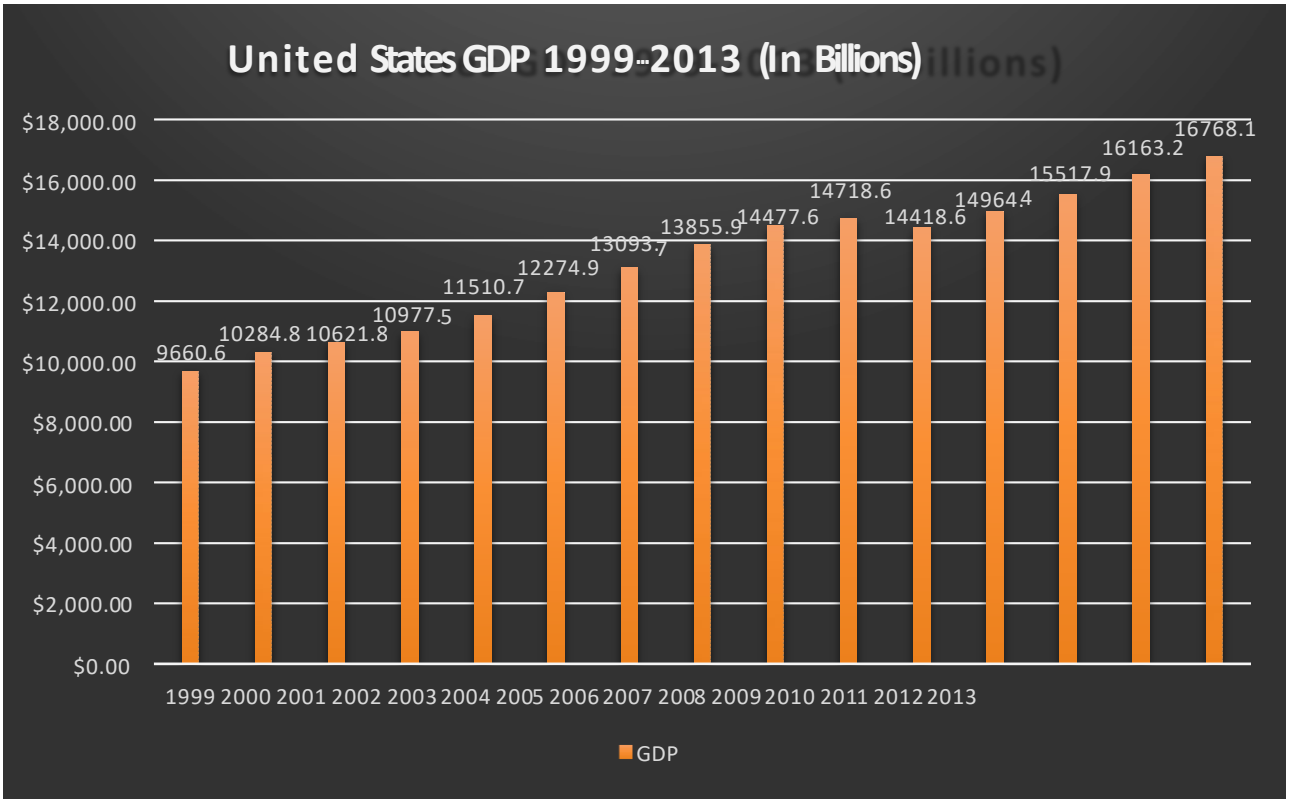




FLEV and SPREAD are negatively correlated with one another. FLEV has seen a steady increase since 2011, as there has been a downward spike in the company's net non-operating obligations. In contrast, SPREAD has steadily decreased since 2011. This has been mainly due to the decrease in RNOA. These statistics help confirm the strategy choice that was identified in Chapter Two. 3D Systems has seen a massive rise in its net operating assets, which confirms that it is using a product differentiation strategy. The company is trying to have a many different type of printers as possible.

Chapter Seven

GDP

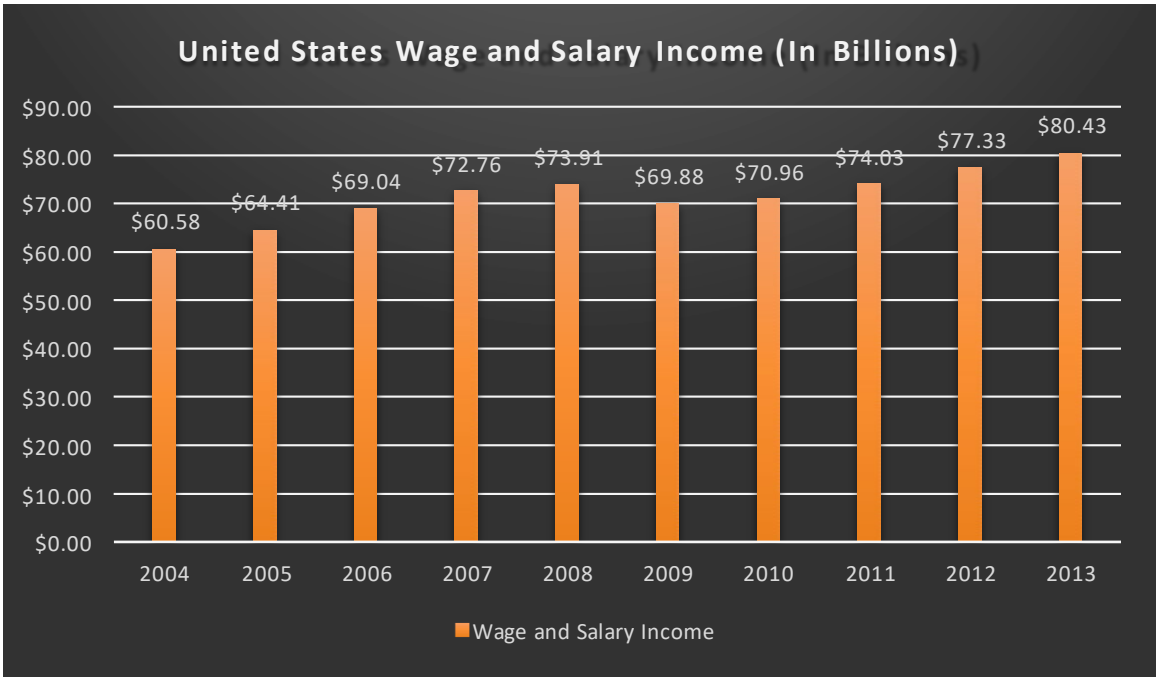


As has been discussed in prior chapters, 3D printers are luxury items and are particularly sensitive to changes in the economy. This is the case in the United States and abroad. Printers are primarily purchased when the economy is doing well, and 3D Systems' revenue growth over the past fifteen years matches well with the above graph. Just as the U.S. Gross Domestic Product saw a dip in 2009, so did 3D Systems' revenue. The country's GDP has recovered since then and the 3D printing industry has followed the same upward trend.

Retail Sales

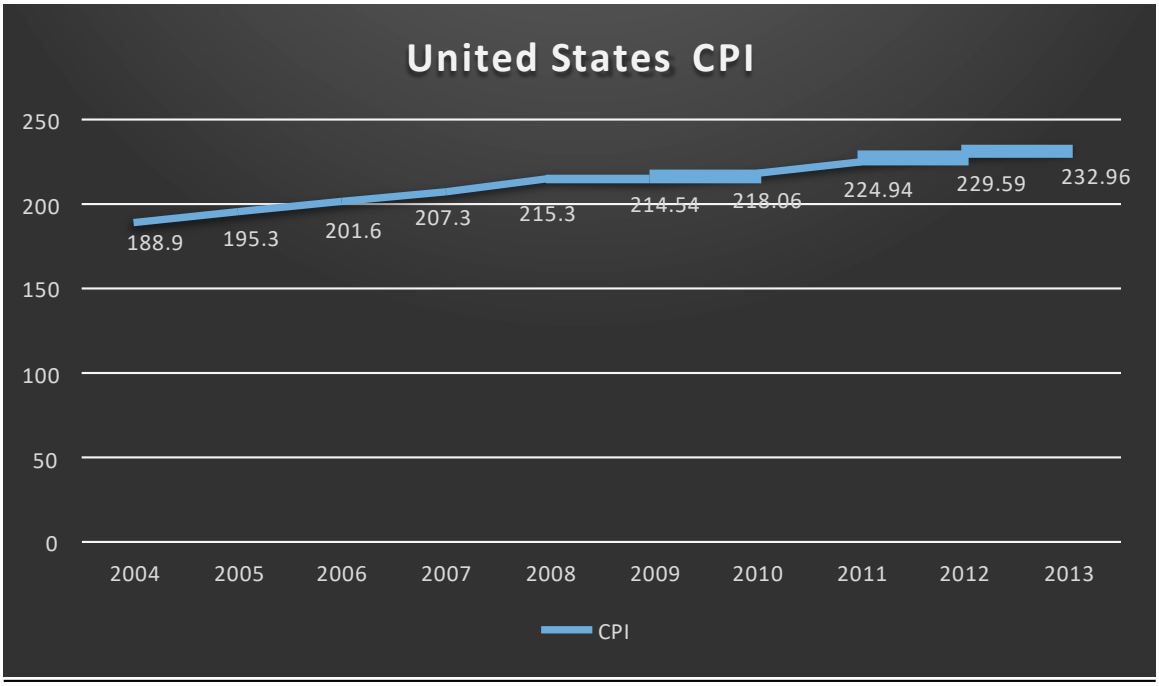
3D Systems is a retail company, so retail sales have a strong impact on the company's performance. Other than a drop in 2008 due to the market crash, total retail sales in the United States has steadily increased over the past ten years. As was the case with GDP, this growth mirrors the growth that 3D Systems' revenue has seen. Retail Sales is a timely indicator of how the economy is performing. It is useful to 3D Systems, because it provides them with an up to date look at consumer spending trends. This is especially helpful, as the company is currently attempting to increase its sales to the individual consumer. Using this information, the company can determine whether it needs to increase or decrease production and advertising of its desktop printers.

Wage & Salary Income



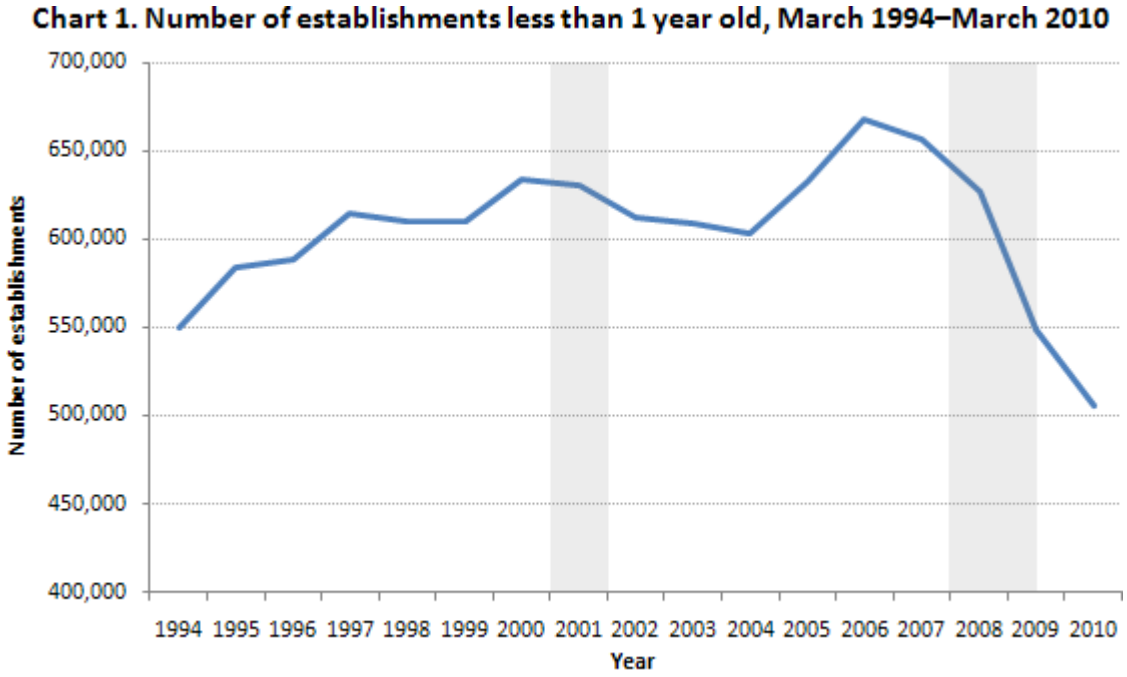
As discussed earlier in this chapter, 3D printers remain a luxury item and are primarily sold to businesses or individuals with a sufficient amount of disposable income. A household that is struggling is not going to spend $1,000 and up for a 3D printer. Therefore, 3D Systems' success is strongly tied to the level of income that citizens are receiving. Other than the dip in 2009, income rates have steadily increased. 3D Systems hopes that this figure continues to trend upwards, as a well-paid consumer base will greatly aid its key goal of entering the desktop marketplace. Well-paying businesses will also have the capital available to purchase the company's more high-end printers.

Consumer Price Index



The Consumer Price Index shows changes in the cost of living. The CPI is used to identify the occurrence of inflation or deflation. The CPI in the United States has steadily risen over the past ten years, as can be seen in the above graph. The graph on the previous page showed that wages have risen in accordance with CPI. 3D printers are currently not essential items. Therefore, 3D Systems hopes that average wages increase at a greater rate than CPI, as it will give consumers an increase in their disposable income. It is 3D Systems' hope that advancements in 3D printing technology will eventually make a 3D printer an essential item. This is why innovation is so important to the industry.

Level of New Business Startups



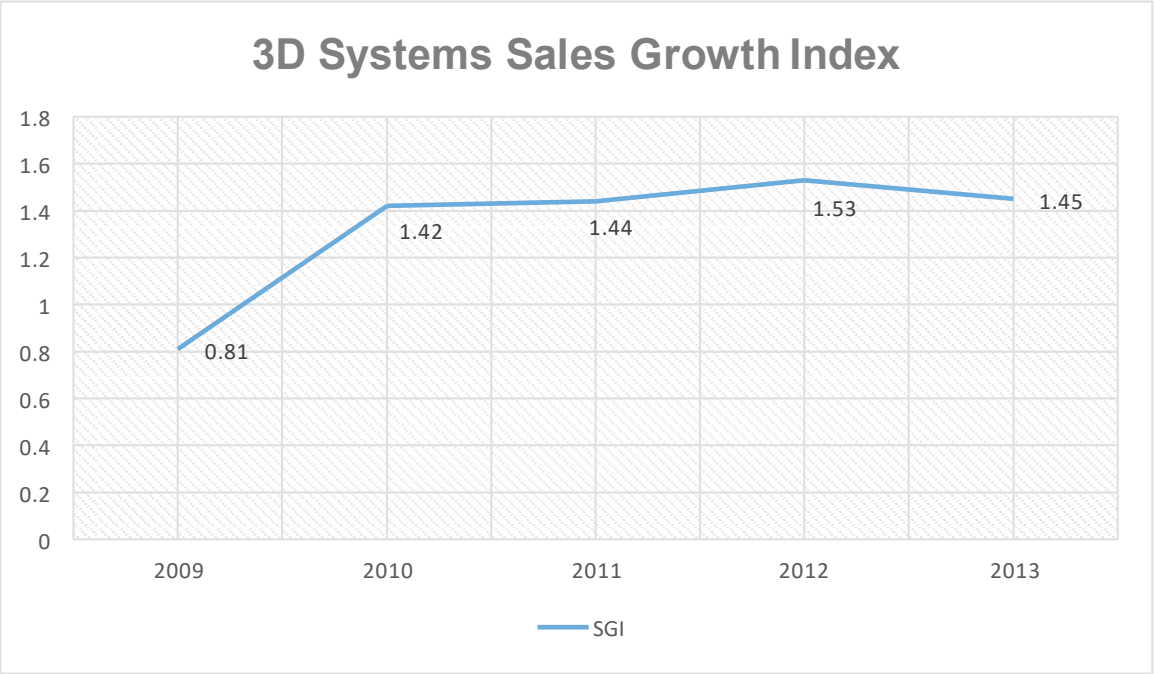
Source: U.S. Bureau of Labor Statistics

New businesses are critical to the 3D printing industry. New companies bring new ideas and innovation, which are the lifeblood of the industry. A lack of new companies results in stagnation and decline. This is one of the driving factors behind 3D Systems' aggressive acquisition strategy. The company has a multitude of brilliant minds on its Board of Directors, but they all realize that in order to be successful, it constantly needs to be searching for that next great idea. Apple Inc. was once a small business in a California garage, and the next revolution in 3D printing could have very similar roots. Today, small businesses are responsible for 43 percent of high-tech employment. As the above graph shows, new business startups sporadically increased from 1994 to 2010. However, the 2008 crash resulted in 150,000 less startups. Many of the businesses that were started during this time did not last longer than six months. As the economy has

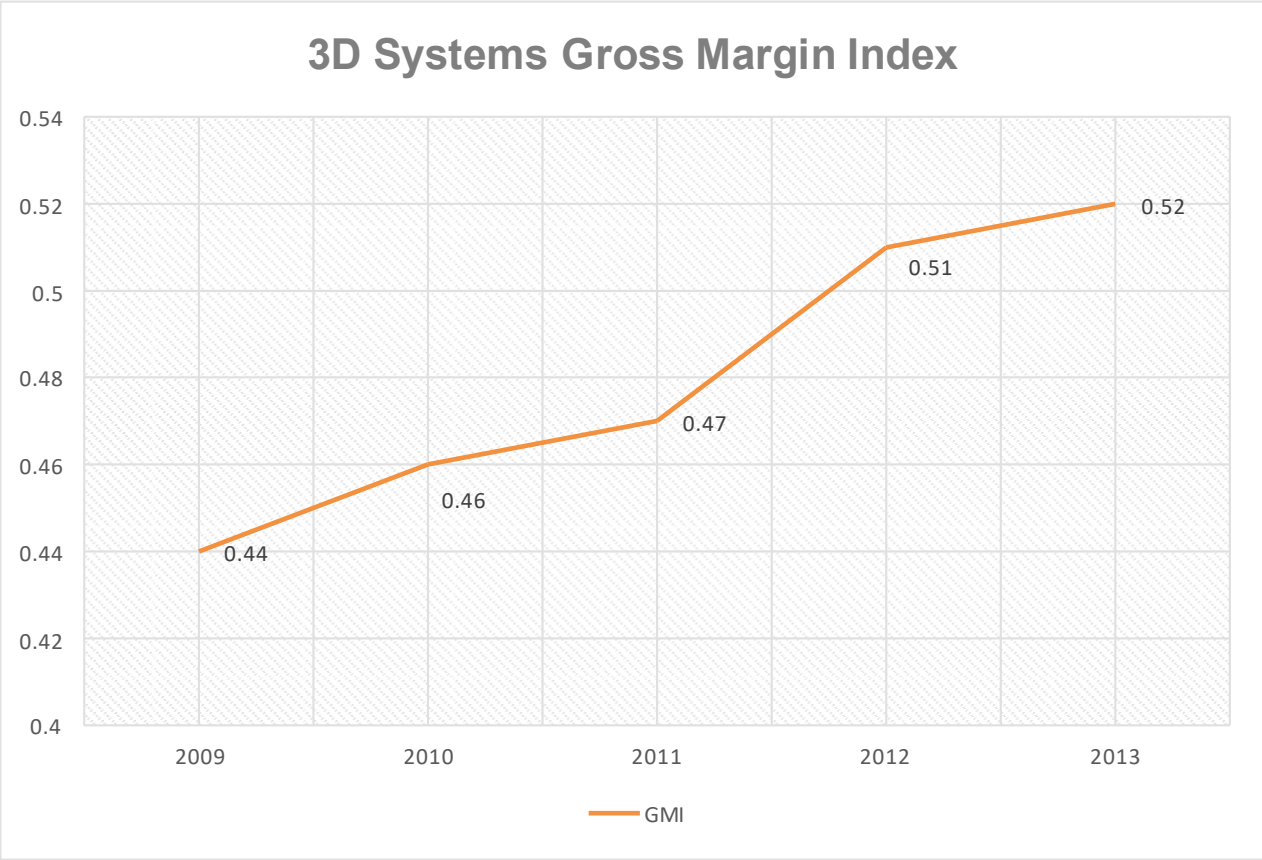
slowly recovered, so has the number of new businesses. In 2013, there were 543,000 new startups, which is a good sign for both the economy and 3D Systems.

Revenue Recognition

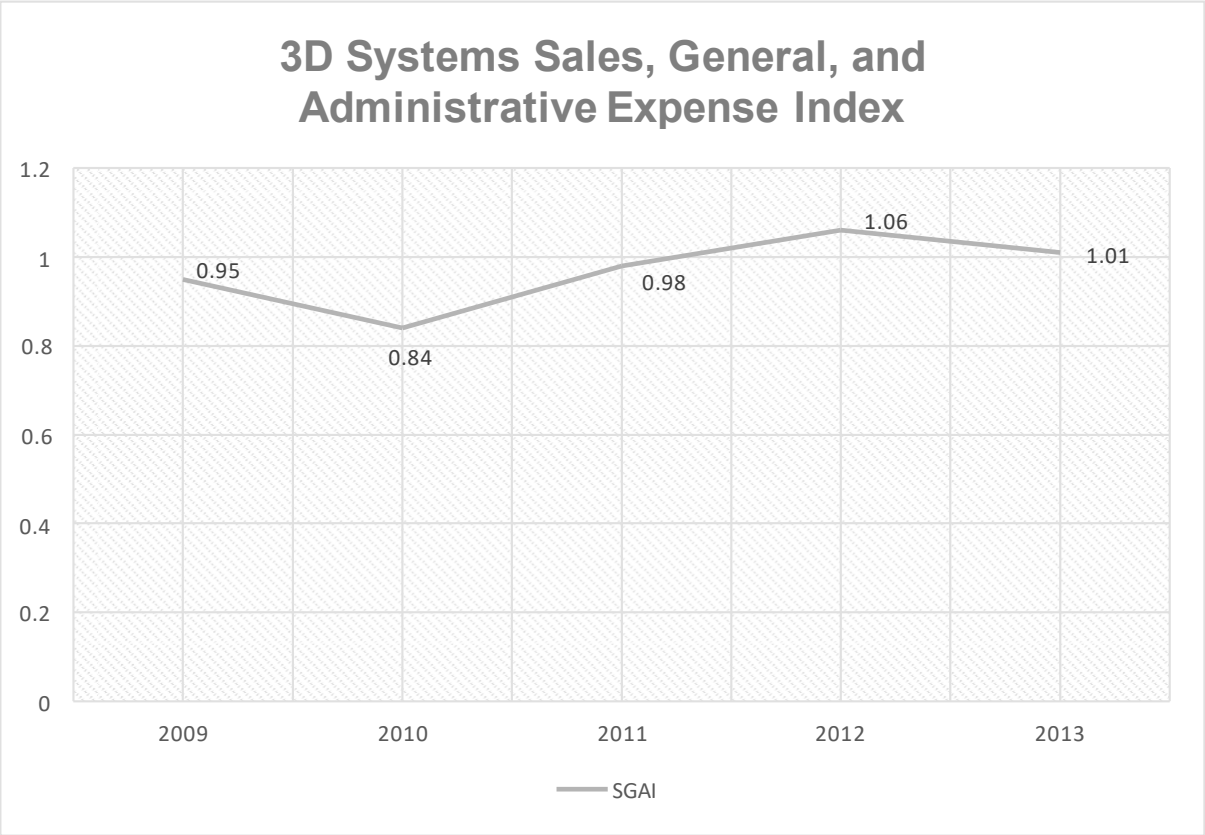
3D Systems' revenue comes from the sale of its products, printers, and services. It therefore recognizes revenue when there is sufficient evidence that a sale has taken place and services have been rendered. Many of the company's orders involve multiple products or parts. To help it allocate revenue to multiple deliverables, 3D Systems uses the best-estimated selling price or "BESP". The company determines BESP by considering factors such as geography, internal costs, gross margin objectives, the competitive landscape, and the market condition. 3D Systems sells its products through its sales force and resellers. When selling products to resellers, the company recognizes revenue when the reseller has economic substance and the products have been delivered. When selling through its direct sales force, 3D Systems separates revenues by printers, parts, and services. It then allocates revenue based on their respective fair values and recognizes revenue when products are shipped. 3D Systems extends credit to customers based on their respective financial condition and requires payment within sixty days after the products have been shipped.



3D Systems' Sales Growth Index has steadily risen since a spike is 2010. The large increase from 2009 to 2010 is not alarming, as it indicates the company's recovery from the recession.

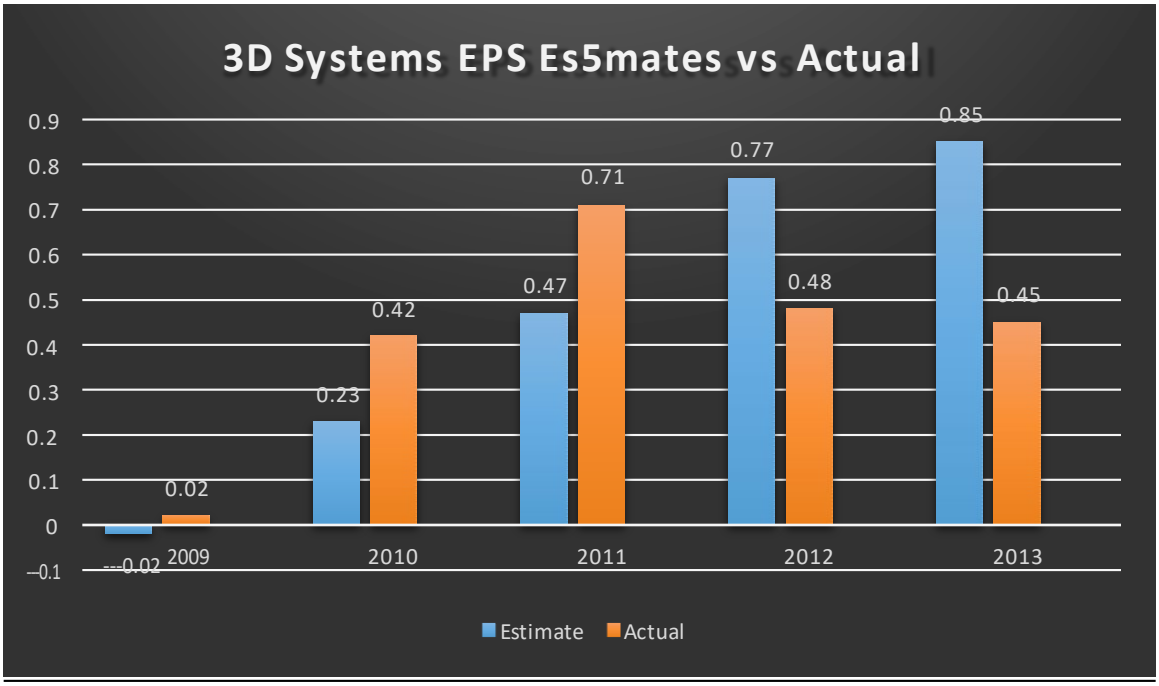


The company's Gross Margin Index has steadily grown over the past five years but has remained below one. This is indicative of the company retaining a higher percentage of its revenue as gross profit.



3D Systems' Sales, General, and Administrative Expense has been relatively stable over the past five years. However, sales have increased faster than expenses over the past two years. This is due to the large spike in revenue that occurred in 2012 and 2013, as a result of several recently acquired companies.

Earnings Estimates



3D Systems has experienced a great deal of volatility with its Earnings per Share over the past five years. The company rebounded from the 2008 crash faster than analysts predicted. 3D Systems experienced exponential growth from 2009 to 2012, which caused many analysts to overestimate its EPS. It could not sustain this growth and therefore fell short of analysts' forecasts for 2012 and 2013. The company issued a two-for-one stock split and $150 million in senior convertible notes in 2011. The stock split and the conversions of the notes were the primary reasons behind the decrease in 3D Systems' EPS. As long as the company continues to issue stock to finance its operations, its earnings per share will continue to be volatile and more difficult for analysts to predict.

Earnings Management

3D Systems' current main goal is to continue to grow the company and expand its presence into various industries. Therefore, management is not overly concerned with its

EPS at this point in time. However, the company will begin to care more about its earnings in the near future. 3D Systems has had years of strong growth and success, and years that were not as successful as the company had hoped. During these down years, it would be advantageous for management to skew earnings upward. In contrast, if the company is experiencing success but anticipates a downturn in the future, then management would want to shift some of its earnings to the following year. 3D Systems has a significant portion of raw materials in its inventory. These materials' value is highly dependent on the market. The company values its raw materials at lower of cost or market. By using more optimistic market values, 3D Systems could reduce inventory write-downs and as a result, earnings. In order to increase earnings, management could incentivize customers to pay for their orders prior to the year's end.

Chapter Eight

Operating Leases

3D Systems leases some of its facilities and equipment with non-cancelable operating leases. The company's biggest lease is its own headquarters and development facility in Rock Hill, South Carolina. Operating leases need to be capitalized, as they are currently not reported on the balance sheet. The first step is determining the discount rate which can be seen in the table below. The company's IRR came to be 94 percent. This is indicative of a high rate of return, which is not surprising considering 3D Systems is a relatively new company.

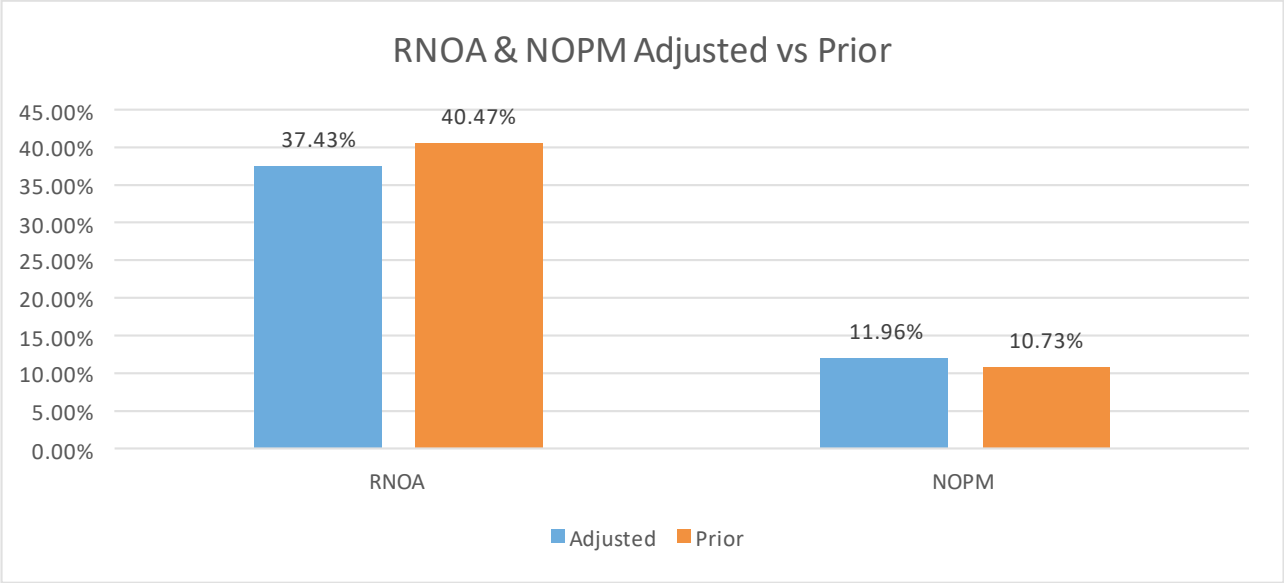
Discount Rate (In millions)	
PV of future minimum capital lease payments	-696
2014	709
2015	691
2016	718
2017	715
IRR	94%

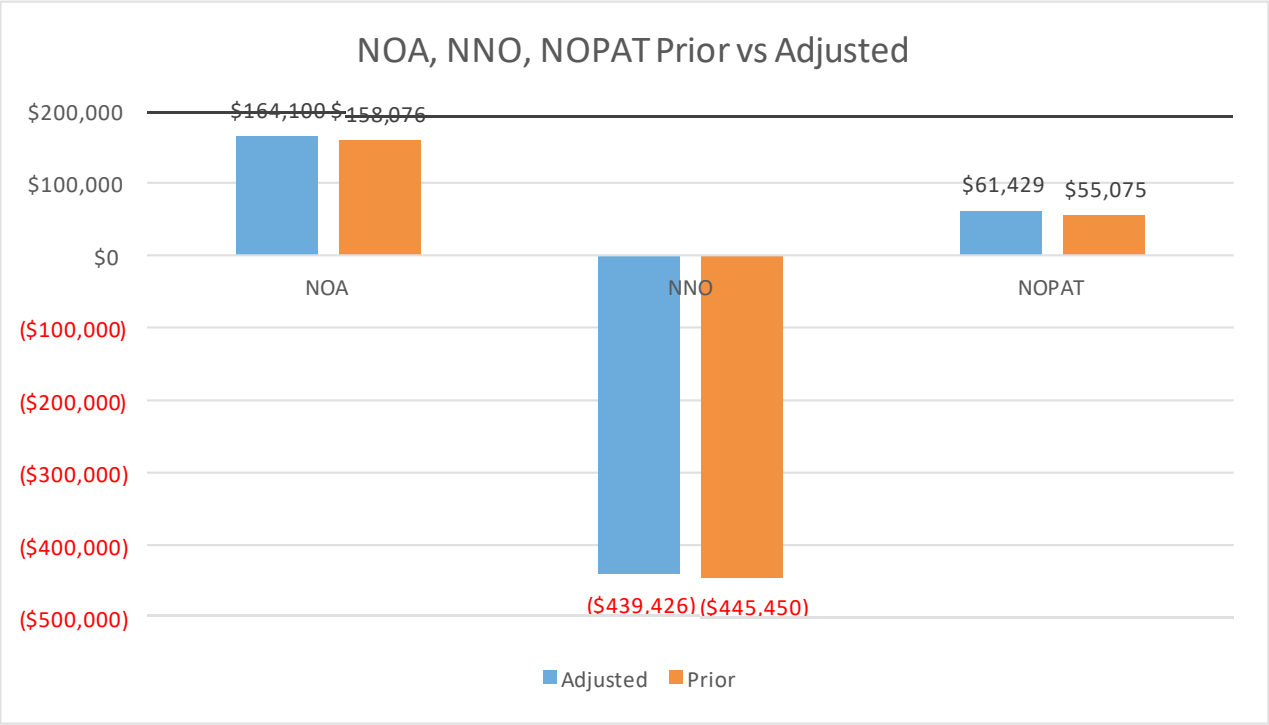
The second step is determining the present value of future operating lease payments. This was accomplished by discounting the operating leases through the discount factor, which is based upon the IRR rate.

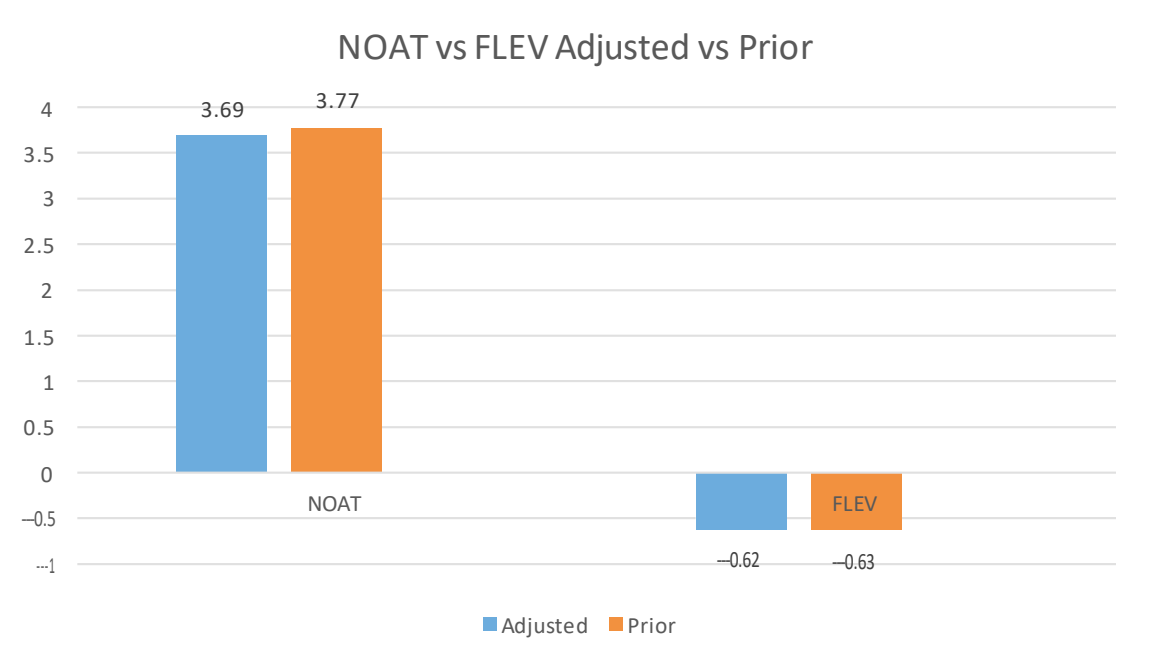
PV of Operating Lease Payments			
Year	Operating Lease Payment	Discount Factor	Present Value
1	$6756	0.514675068	$3477
2	$5615	0.264890425	$1487
3	$4416	0.136332497	$602
4	$3452	0.070166937	$242
5	$2890	0.036113173	$104
Thereafter	$2890	0.038293621	$111

			$6024

More than $6 million in lease payments were not recorded on the balance sheet. The adjustment for these lease payments resulted in a change to all of the ratios that were calculated in Chapter 6.




NOA, NNO, NOPAT Prior vs Adjusted
$200,000
$100,000
$0
($100,000)
($200,000)
($300,000)
($400,000)
($500,000)
$164,100
$158,076
$61,429
$55,075
NOA
NNO
NOPAT
($439,426)
($445,450)
Adjusted
Prior


NOAT vs FLEV Adjusted vs Prior
4
3.5
3
2.5
2
1.5
1
0.5
0
–0.5
–1
3.69
3.77
NOAT
–0.62
–0.63
FLEV
Adjusted
Prior

Net Operating Asset Turnover was higher prior to the adjustment. Turnover has gone down, as there are more assets to turnover. All of the ratios, RNOA in particular, look more favorable prior to the adjustment. Managers prefer to structure lease contracts as operating leases, as rent expense is less than what depreciation expense would have been if they were structured as capital leases. This results in a higher net income during the earlier years of the lease. 3D Systems is still a rapidly growing company, so it is very advantageous for them to continue to implement operating leases. This will keep profits high and shareholders happy.

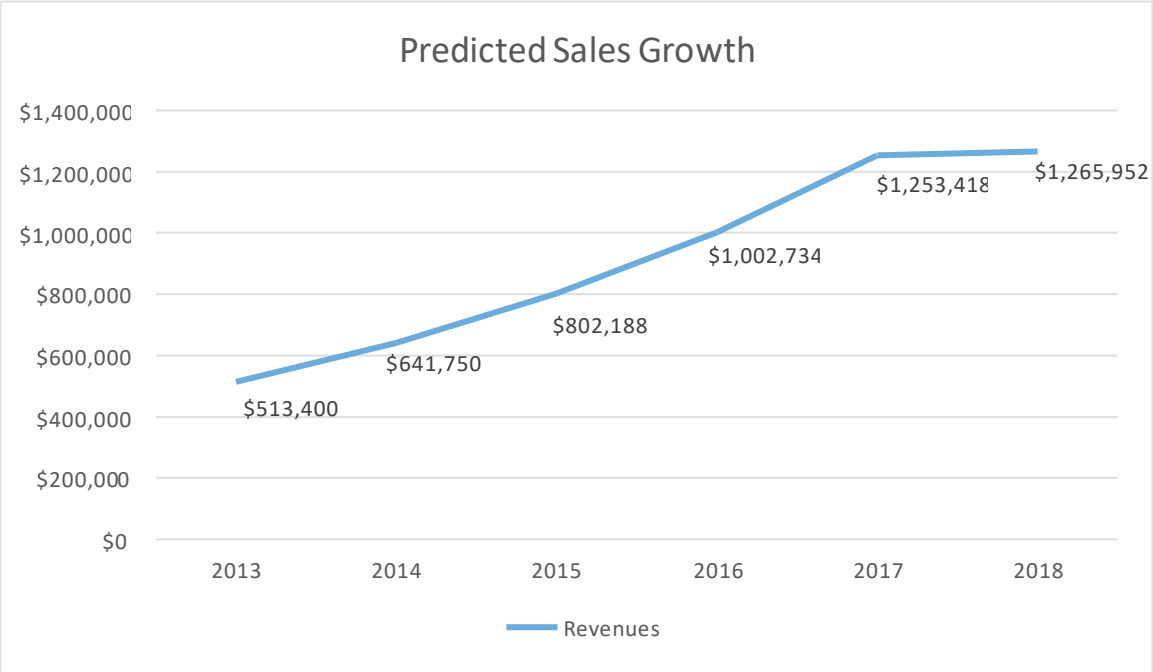
WACC

Cost of Equity	
Beta	1.13
Risk Free Rate	2.5%
Equity Spread	6%
Cost of Equity	9.28%

Cost of Debt	
Weighted Average Effective Interest Rate on Debts	9.51%
Effective Tax Rate	31.1%
Cost of Debt	6.55%

WACC	
Stockholders' Equity	933,792
Total Debt	18,693
Equity Weight	98%
Debt Weight	2%
WACC	9.2%

I split WACC into two groups: Cost of Equity and Cost of Debt. The company's Beta was 1.13, which I found on Yahoo Finance. The Risk-Free Rate and the Equity Spread were 2.5 percent and 6 percent, respectively. I calculated the Cost of Equity to be 9.28%. The weighted average effective interest rate and effective tax rate were on the company's 10-K. Using these percentages, I found Cost of Debt to be 6.55%. I calculated the Equity Weight by dividing 3D Systems' 2013 Stockholders' Equity by the sum of its 2013 Stockholders' Equity and its total debt. The Debt Weight was calculated by subtracting the Equity Weight from one. I then calculated the weighted average cost of capital, which was 9.2%.



3D Systems has experienced exponential growth over the last five years. Its revenue growth from 2011 to 2012 was more than 55%. From 2012 to 3013, this percentage dropped to 38%. While I expect the company to continue to experience steady growth, I predicted that it would slow down to an average of 25% per year. I used this percent to calculate the sales growth over the next five years. In 2018, I used 1% to calculate revenue, as this was the terminal year.

DCF Model

	2013	2014	2015	2016	2017	2018
Sales Growth	45%	25%	25%	25%	25%	1%
FCFF	$55,697	$69,621	$87,027	$108,783	$135,979	$137,339
Discount Factor		0.91575092	0.83859974	0.76794848	0.70324952	
PV of FCFF		$63,756	$72,980	$83,540	$95,627	
Cum PV of FCFF	$315,903					
PV of Terminal	$1,674,863					

Total Firm Value	$1,990,767					
Firm value – NNO	$439,426					
Firm equity value	$2,430,193					
Shares outstanding	111,210					
Stock Value per Share	$21.85					
Trading Price 12/31/13	$92.93					

There are two ways to perform a stock evaluation: DCF and ROPI. DCF is more widely used but is not practical for 3D Systems. This is due to the fact that 3D Systems reports negative FCFF. As long as the company continues to rapidly grow, this will continue to be the case. 3D Systems has a large number of plan assets which are treated as cash outflows even though they create shareholder value. The DCF model resulted in the stock value being $21.85. The trading price of the company's stock on December 31, 2013 was $92.93. This shows that the company's stock was highly overvalued at the time. This was the highest the company's stock has ever been. The stock dropped significantly over the past year and is currently trading at around $25.

ROPI Model

	2013	2014	2015	2016	2017	Terminal Period
Sales Growth	45%	25%	25%	25%	25%	1
NOPM	0.1196					
NOAT	3.69					
						5
Sales	$513,400	$641,750	$802,188	$1,002,734	$1,253,418	$1,265,90
NOPAT	$61,403	$76,753	$95,942	$119,927	$149,909	$151,47
NOA	$139,133	$173,916	$217,395	$271,744	$339,680	$343,0
Residual Income		1	2	3	4	5
Required Return		$12,800	$16,000	$20,000	$25,000	$31,25
ROPI		$63,953	$79,941	$99,927	$124,908	$120,1

PV of Horizon ROPI		$58,565	$67,039	$76,739	$87,842	
Cum PV of Horizon ROPI	$290,184					
PV of terminal ROPI	$1,465,334					
Total firm value	$1,755,518					
Less NNO	-$445,450					
Firm equity value	$2,200,968					
Shares outstanding	111,210					
Stock value per share	$19.79					
Trading Price 12/31/13	$92.93					

ROPI is slightly better than DCF to evaluate 3D Systems' stock but is still not perfect. ROPI is not ideal for knowledge-based industries, and 3D Systems is this type of industry. The company has a lot of research and development costs which ROPI does not account for. ROPI is better, as it looks at plan assets and because it does not account for FCFF. ROPI evaluated 3D Systems' stock at $19.79. The stock was still highly overvalued at this time. As previously stated, this number dropped soon after.

Chapter Nine

Assets

	Existence or Occurrence	Completeness	Rights and Obligations	Valuation or Allocation	Presentation and Disclosure
Cash and Cash Equivalents	Cash account value should be equal to bank account value.	Amount of cash received should equal amount in transaction.	Company has possession to cash, so they have the right to it.	Cash is valued in US dollars.	Classification: Current Asset Footnotes: All disclosures have been adequately disclosed.
Accounts Receivable	Should total all transactions that have occurred but not yet been paid.	All transactions have been accurately recorded; Should total receivable transactions total minus cash received in payment	The company has shipped the product and therefore has right to be paid.	Valued by determining allowance for doubtful accounts on a specific account basis.	Classification: Current Asset Footnotes: Net of allowance for doubtful accounts.
Inventories	Physical inventory of all products on hand and raw materials at fair market value.	All inventory transactions have been accurately recorded. All shipped products not liable to return to company	Company has title of all products and raw materials inventory. Can do what it wishes with it.	Inventory is valued according to FIFO at lower of cost or net realizable value. Correct estimation of inventory obsolescence.	Classification: Current Asset Footnotes: Evaluation method and inventory reserves have both been disclosed.
Prepaid Expenses and Other Current Assets	Value of all prepaid expenses during the period	Value of expenses have been correctly calculated. Prior period's prepaid expenses have not been	Company has already paid for expenses and has right to receive benefit from them.	Expenses valued at the value of amount paid for.	Classification: Current Asset Footnotes: All disclosures adequately disclosed.

		included in value			
PP&E	Value of all property, plant, and equipment that company has acquired.	All PP&E transactions have been properly recorded. Depreciation not overstated in order to increase earnings.	Company has ownership to all of the property, plant, and equipment included in amount.	PP&E is carried at cost and depreciated on a straight-line basis. PP&E is correctly calculated	Classification: Long-term asset Footnotes: Depreciation method and amortization method of lease improvements disclosed
Intangible Assets & Goodwill	Calculated value of all intangible assets and Goodwill. Goodwill has been correctly estimated.	Fair value of goodwill, licenses, patents, technology, trademarks, etc. is correctly computed. All are regularly tested for impairments	Company has right to all goodwill from its acquisitions. Has ownership of all patents, trademarks, and developed technology	Goodwill from acquisitions allocated based on geographic area. Tested for impairment	Classification: Long-term asset Footnotes: Method of testing for impairment and assigning goodwill based on geographic area

Liabilities

Accounts Payable	Consists of total amount owed during the current period. All transactions during the period have been recognized.	All Accounts Payable transactions have been properly recoded. All accounts that have been paid are not included in total.	Company is obligated to pay its debts. It is responsible to pay amount due within certain period of time.	Accounts Payable is valued according to dollar amount owed to vendor.	Classification: Current Liability Footnotes: All disclosures have been adequately disclosed.
Deferred Revenue	Account is the total amount of	Amount of deferred revenue	Company is obligated to fulfill the	Deferred Revenue is recognized	Classification: Current Liability

	revenue that has been unearned from a contract.	should equal value have stipulated in warranty of each printer sold.	requirements of the warranty included in each printer's sale.	ratable on a straight-line basis. The computation is mathematically correct.	Footnotes: Method of recognizing deferred revenue
Convertible Senior Notes	Total amount of senior notes that have been issued	All transactions involving the notes have been accurately recorded. Converted notes are not included in calculation.	Company is obligated to convert all notes to stock if the holder wishes to.	Notes are valued according to fair value. Fair value measured according to quoted prices for similar notes in active markets.	Classification: Long-term liability Footnotes: Proper method to determine fair value by looking at market.

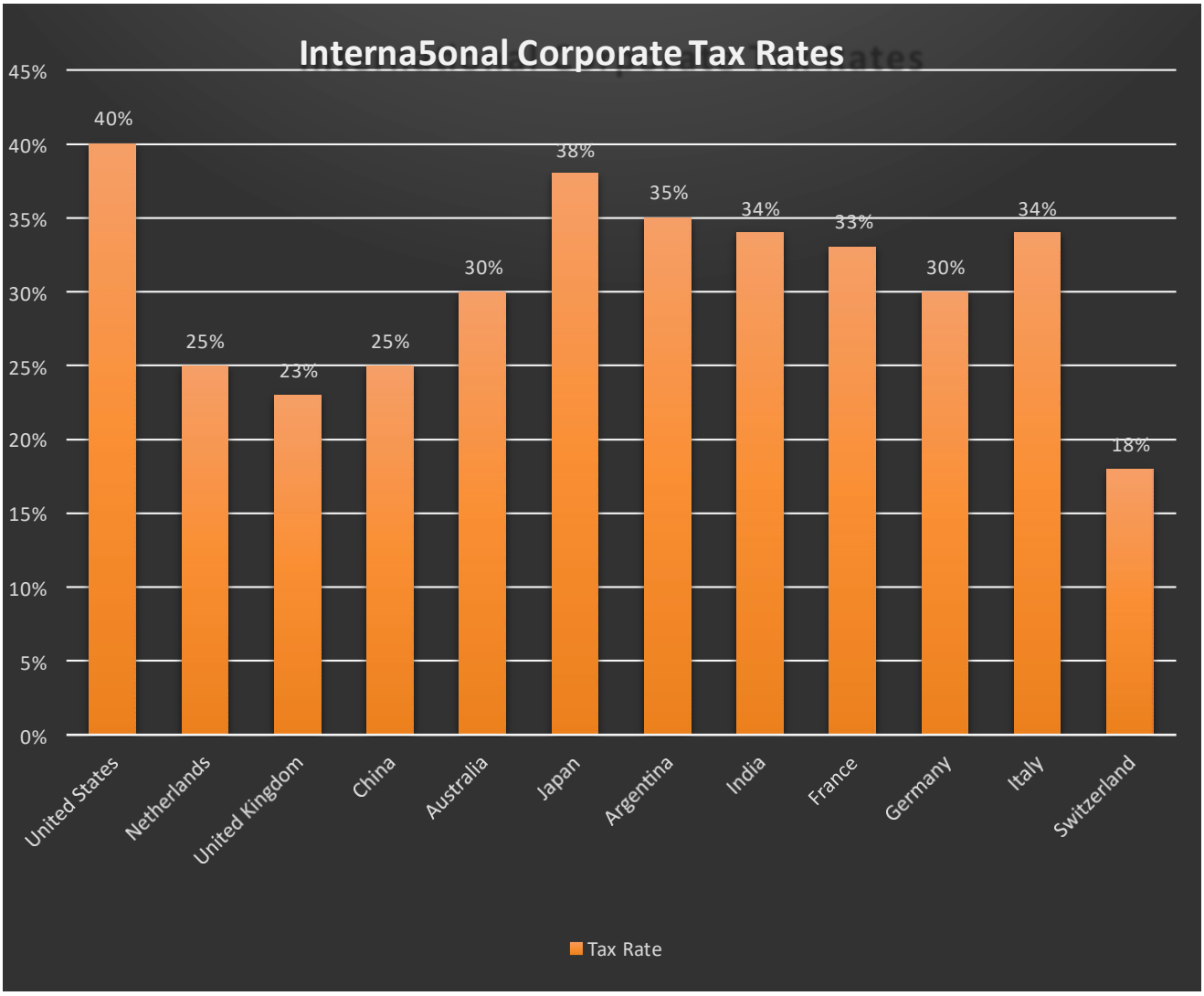
Audit Risk and Controls

3D Systems faces a significant amount of audit risk with its assets. Two main areas of audit risk are found in the company's Inventories and its Goodwill and Intangible Assets. Fraud is most likely to occur when pressure, opportunity, and rationalization are present. More than 46 percent of the company's assets are found in its intangible assets and goodwill. 3D Systems' acquisition of dozens of smaller companies has left it with more than $370 million in Goodwill. Its numerous patents, trademarks, acquired technology, and licenses have given it more than $140 million in intangible assets. These two large figures present the opportunity for management to commit fraud. The values in Goodwill and Intangible assets are calculated using estimates. The company has methods in place to ensure that these estimated values are accurate as possible. However, management could theoretically overestimate the amount of Goodwill from an

acquisition or the value of a patent. This would overstate the value of the company's assets and be more appealing to its shareholders. Goodwill is the difference between that amount paid for a company and its fair market value. A test that would address these risk concerns would be to recalculate the fair market value of all acquired companies during the year and subtract the amount that 3D Systems respectively paid for them. The auditor would then compare this amount to the amount that 3D Systems recorded in the books for Goodwill. An internal control that would alleviate some of the auditors' concern would be to institute a segregation of duties. In this case, it would be best to not have the same employee be responsible for both calculating Goodwill and recording it in the company's books.

3D printers are incredibly valuable, and the company's higher-end printers sell for up to $1 million. Therefore, there is a significant amount of risk with its inventory. More than $75 million of the company's assets is found in its inventories. There is the risk that a factory worker simply steals a printer. There is also the risk that management steals or hides a printer and claims that it has been sold. Doing this with only one high-end printer would have a material impact on the financial statements. An auditor could test for any potential fraud in this case by doing a physical count of all printers on hand and comparing that count to the number of printers manufactured and sold. An internal control that would help alleviate some of this risk would be the implementation of physical controls such as an increase in security cameras, locks, and guards at all inventory warehouses.

Corporate Tax Rates



The current federal tax rate in the United States is 35 percent. The above graph shows 40 percent, as it includes the average state and local income tax for all fifty states. As can be seen in the graph, 3D Systems pays a higher tax rate in the United States then it does in every other country in which it operates. In 2013, the company paid $20 million in income taxes. One might suggest that company move the bulk of its operations away from the United States in order to avoid paying such a high tax rate. However, the United States is currently responsible for 55 percent of 3D Systems' total revenue. It would be a

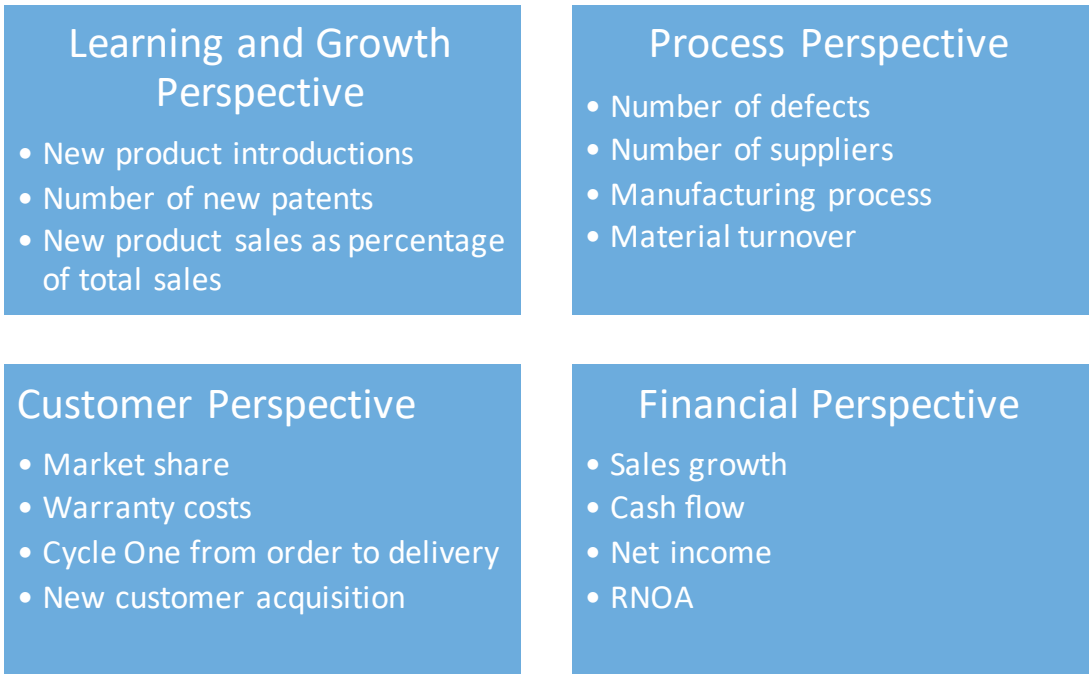
mistake to turn away from the country that is primarily driving the growth of the 3D printing industry. It would be unwise for 3D Systems to move its operations into countries such as Japan, Italy, Argentina, India, France, and Germany, as there is a relatively minor difference between their corporate tax rates and the United States'. The only countries I would suggest the company possibly move to would be the United Kingdom or Switzerland, as their tax rates are significantly lower. However, with the company currently in the growth stage, I believe that it should maintain its presence in the United States before considering moving.

Tax Credits and Recommendation

The main tax credit that 3D Systems benefits from is the Federal Research and Development Tax Credit, which allows a credit of up to 13 percent on any spending on new technology, research, and improvements. Research and development costs are one of 3D Systems main expenses, so this credit is very important to its business. Innovation is the key to success in the industry, and this credit helps alleviate some of the costs associated with it. 3D Systems takes advantage of this credit, as it had $12.4 million in tax credits in 2013. In order to avoid paying a significant portion of the tax that it pays on its inventory; the company should dramatically cut down on the number of finished printers that it keeps in storage. Instead, 3D Systems should begin to custom build all of its printers to order. The company currently does this for its higher end printers but should consider doing it for all of its printers. Instead of paying taxes on a large inventory of expensive printers, the company would only have to pay taxes on its supply of raw materials. The company would be able to expense its inventory as it is sold.

Chapter Ten

Balanced Scorecard



Recommendation #1

One of 3D Systems' main objectives is to expand its presence in the desktop market. Avi Reichental has stated that the company's main goal is to bring 3D printing into every home in the world. The company has made great strides in accomplishing this by introducing its line of cheaper printers aimed towards the individual customer. However, these printers have proven to still be too pricey for many potential buyers. Many small businesses and households are still feeling the effects of the recession, so a $1,000 3D printer is still not a very pertinent purchase. If the company wants to make the public more aware of the possibilities of 3D printing and truly grow this industry, then it must make its printers more affordable to the average consumer. Ten years ago, the cheapest desktop printer was a little more than $10,000, but 3D Systems still has a way

to go. I recommend that the company work to develop a very simple printer that it can sell for less than $500. The printer would only have to be able to build small models but still be able to effectively show off the technology behind 3D printing. The company should aggressively market this printer to families with children. By doing this, 3D Systems will greatly spread awareness of its company and the possible things that can be achieved through 3D printing. If more people become interested in the 3D printing industry, then more people are going to want to invest in 3D Systems. This will help raise what has been a very unstable stock price.

Recommendation #2

As discussed earlier in Chapter 2, 3D Systems must gain a stronger foothold in China if it wants to remain the leader in the 3D printing. With a population of nearly 1.4 billion, China is looking for ways to mass produce food and housing for its citizens. 3D printing is able to provide both of these and as a result, the market there is set to explode. Analysts predict the Chinese 3D printing market to have a 34 percent growth rate over the next five years. 3D Systems simply has to acquire several companies in the country if it wants to take advantage of this growing market. The company recently took a step in the right direction by acquiring Easyway Design and Manufacture Co. of China. These two acquisitions created 3D Systems China and allows the company greater access to the area. If the company continues to acquire other Chinese 3D printing companies, then it will see rapid growth in both its revenues and stock price.

Recommendation #3

My final recommendation for 3D Systems is for the company to open up several small stores in major U.S. cities. These stores would sell the company's more modestly priced printers while also showcasing some of its more high-end printers. Employees would give live demonstrations of the printers' capabilities, so people would be able to walk in and see the possibilities that the technology brings. The stores' primary item would be the printer that was discussed in Recommendation #1. Currently, the only places people can see a 3D printer in action is at certain technology expos and universities. These stores will go a long way in spreading the 3D Systems brand and showcasing its printers. Establishing a small store in a mall generally costs around $100,000, which should not be an overly significant expense for 3D Systems. The company would need to aggressively advertise these new store locations in their respective cities. 3D Systems' advertising costs in 2013 were a little over $6 million. If the company wishes to succeed in its goal of having a 3D printer in every home, then it needs to be able to better show the world its printers and what they can do. More interest in the company's product will lead to more investors. This will result in an increase in 3D Systems' stock price.

BIBLIOGRAPHY

"3D Systems Board of Directors." *3D Systems*. Web. 13 May 2016. <http://www.3dsystems.com/investor/board-of-directors>.

"3D Systems Corporation." *Yahoo! Finance*. Web.

"3D Systems Form 10-K." *3D Systems*. 5 Oct. 2014. Web.

Chan, Emily. "Your next Home Could Be a Click Away as Construction Company Unveils 3D Printed Villas That Can Be 'built' in under 3 Hours." *Mail Online*. Associated Newspapers, 2015. Web. <http://www.dailymail.co.uk/news/peoplesdaily/article-3155972/Your-home-click-away-construction-company-unveils-3D-printed-villas-built-3-hours.html>.

"The 3D Printing Solutions Company." *3D Printing Solutions*. Stratasys, Mar. 2015. Web.