Studies in Applied Finance

INVESTMENT THESIS FOR INTERNATIONAL BUSINESS MACHINES CORP. (NYSE: IBM)

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Investment Thesis for International Business Machines Corp.

By Shiv Krishnan

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Summary

The working paper is an in-depth financial analysis of International Business Machines (IBM). Our analysis examines the change in IBM's business from a traditional hardware and software services provider to a cognitive services and cloud platform company. This analysis is combined with our proprietary Discounted Cash Flow (P-DCF) model and a Monte-Carlo simulation. This results in distributions of probable free cash flows. In addition to these quantitative factors, we also examine compensation plans of IBM executives to assess the degree to which the executives' compensation incentives are aligned with the objective of creating shareholder value.

Company Name:	International Business Machines Corp.
Date:	10/5/16
Fiscal year ends (current period):	12/31/16
Current Price:	$159.55
52 week high (date):	$164.95
52 week low (date):	$116.90
Market Cap:	$152.5 Billion
Enterprise Value:	$178.2 Billion
Total Debt:	$36.1 Billion
Cash:	$10.6 Billion
Net Debt/Enterprise Value:	14.3%
Dividend:	3.5%
Diluted Shares Outstanding/Float:	955.8Million/ 873.8Million
Current P/E:	11.26x
2018 P/E (EPS):	10.73x ($13.52*)
2017 P/E (EPS):	11.33x ($12.74*)
2016 P/E (EPS):	11.81x ($12.21*)
2015 EPS:	$13.60
2014 EPS:	$15.59
2013 EPS:	$14.94

*Consensus Estimates as of time of this writing

Table of Contents

Executive Summary

International Business Machine Corp. (NYSE: IBM) is an integrated solutions company that leverages data to create value for clients. IBM is currently transitioning from a traditional hardware and software services to a cognitive services and cloud platform company. Upon inspection of the company we conclude that IBM's transition into cognitive and cloud computing is not fully discounted into the current valuation which warrants a multiple re-rating in the near future as these growth prospects come to fruition. We confirm this by implementing a Proprietary Discounted Cash Flow (DCF) model in conjunction with Monte Carlo simulations under different scenarios. We found that management compensation is aligned with our investment thesis, and that significant stakeholders in the company include famed value investor Warren Buffett, suggesting that there is a margin of safety buttressed by the healthy dividend and buyback program. Thus, we rate IBM a BUY with a probable free cash flow of $197.51.

Catalysts and Risks

- Inability to integrate acquisitions with Watson
- Entering the cloud and cognitive market too soon
- Difficulty balancing enterprise business with growing cloud business
- Highly dependent on skilled personnel to perform this transition. Loss of skilled personnel to competitors could highly impact their ability to complete projects for clients as well
- Relationships with critical suppliers
- Macro Risks – Downturn in Economic environment and inability of clients to make payments

Business Model

The company's business model is traditionally built on helping its clients become more innovative, efficient, and competitive. IBM is a leading diversified technology company with a broad range of offerings across IT hardware, software, and services segments. These skills are combined to provide integrated solutions and platforms to clients.

The business model is dynamic and is adapting to the changing industry and economic environment. They are currently transforming into a cognitive and cloud platform company. The company is driving this change through acquisitions to improve their cognitive computing platform (Watson, detailed more below) and divestments in their traditional business.   Thus, the company has outlined their future strategy in two initiatives below which contrast to the operating segments detailed in the next two sections.

Company Strategy

IBM has emerged as more than just a hardware, software, and services company. Today, IBM has transformed into a cognitive and cloud platform company as detailed through its two main initiatives below:

1.Cognitive
- IBM's cognitive business is a reflection of the seismic impact of cloud computing and data analytics on its clients.
- They have been developing a new generation of cognitive systems that can see and analyze massive amounts of data. This data has been previously invisible to computers and enterprises (i.e. unstructured data). Watson is the most important asset in this system.
- Nearly half of IBM's research spending is focused on analytics and cognitive to improve Watson's capabilities. For the past 5 years, IBM has put stress on improving Watson. This included dedicating $100 million to venture investments to support start-ups building cognitive apps through the Watson Developer Zone on Bluemix. IBM is also making Watson more widely available through the Watson Ecosystem, which has grown to more than 500 partners.
- In 2015, the Watson Health unit was formed, which is IBM's first business unit designed around a single industry. Watson Health will create cognitive solutions that can better help doctors diagnose and anticipate disease; it will recommend treatments that are tailored to individuals and it will assist researchers to predict and prevent the next generation of diseases.

2. Cloud Platform
Cloud is at the heart of the Technology Industry's digital revolution.
IBM's platform includes the following features:
- IBM Cloud's Infrastructure-as-a-Service offers bare metal, private cloud, and virtual server instances which enable it to cover many different workloads with unprecedented performance.
- Bluemix is IBM's Platform-as-a-Service, built on the open standards foundation of Cloud Foundry and powered by IBM Cloud's infrastructure. Bluemix offers cloud-based services, application program interfaces (APIs) and leading third-party services to developers in an integrated platform. With $1 billion of investment, Bluemix is now the largest Cloud Foundry development, has a significant number of services, and is onboarding thousands of developers per week.
- The Weather Company acquisition in January 2016, whose dynamic cloud data platform powers the fourth most-used daily mobile app in the United States, handles 26 billion inquiries to its cloud-based services each day. This high-volume cloud platform processes, analyzes, and distributes enormous data sets at scale in real time. It adds an important dimension to the company's cloud platform.
- IBM Cloud Marketplace brings together the company's extensive portfolio of cloud capabilities, providing a self-service, digital experience for developers, IT and business leaders. IBM has a significant number of Software-as-a-Service offerings and visitors to the Marketplace have access to an extensive and growing portfolio of cloud capabilities from IBM and qualified third-party vendor.

Business Segments

Despite the company's strategy centering on two main platforms, IBM operations are reported in five main segments detailed below. We believe that once cloud and cognitive computing grow to significant portions of operating results, restructuring the operating segments will be warranted.

1. *Global Technology Services:* provides IT infrastructure services, creates business value for clients through integrated services, and incorporates unique intellectual property within its global delivery model. By leveraging insights and experience drawn from IBM's global scale, skills, and technology, with applied innovation from IBM Research, clients gain access to leading-edge, high-quality services with improved productivity, flexibility, cost, and outcomes.

2. *Global Business Services (GBS):* has the mission to deliver predictable business outcomes to the company's clients across: Consulting and Systems Integration, Application Management Services, and Process Services. As clients transform themselves in response to market trends like big data, social, and mobile computing, GBS helps clients use these technologies to reinvent relationships with their customers and realize new standards of efficacy and efficiency in the internal processes, data, and applications that they use to run their businesses. In 2015, GBS announced the industry's first practice dedicated to cognitive business, Cognitive Business Solutions.

3. *Software:* consists primarily of middleware and operating systems software. Approximately 70 percent of external Software segment revenue is annuity based, coming from recurring license charges, software sold "as-a-Service", and ongoing post-contract support. The remaining revenue relates to one-time charge (OTC) arrangements in which clients pay one, up-front payment for a perpetual license. This sector is undergoing the most change due to high demand for Watson. The focus is centered around analytics, security, and commerce, utilizing its software assets to improve speed and agility in bringing integrated solutions to its clients and to help clients become cognitive enterprises.

4. *Systems Hardware:* provides clients with innovative infrastructure technologies to help meet the new requirements of hybrid cloud and cognitive workloads—from deploying advanced analytics, to moving to digital service delivery with the cloud, and securing mobile transaction processing.

5. *Global Financing:* facilitates IBM clients' acquisition of information technology systems, software, and services by providing financing solutions in the areas where the company has the expertise. The financing arrangements are predominantly for products or services that are critical to the end users' business operations. Financing has the benefit of both thorough knowledge of its client base and a clear insight into the products and services financed. These factors allow the business to effectively manage two of the major risks (credit and residual value) associated with financing while generating strong returns on equity.

We chose to model IBM through these revenue segments. Due to the company's current transitional phase and continual divestments and acquisitions, past revenue growth is not a reliable indicator of future growth given the transition of end-markets and different secular tailwinds. Instead we chose to look at guidance from management and understand how the change in business model would grow revenue into the new market segments. Indeed, this allows us to ascertain the fundamental value of the company assuming management can deliver on guidance. We find that the current valuation does not reflect the growth prospects of the company. Given the importance of Watson to IBM's transition into cloud and cognitive, we also consider Watson's growth drivers and potential end-markets in the following section to address idiosyncratic risks.

Watson

- IBM's biggest competitive advantage today is Watson. It is a question answering computer system that applies natural language processing, information retrieval, knowledge representation, automated reasoning, and machine learning techniques to the field of open domain question answering.
- Watson uses IBM's DeepQA software and Apache UIMA (Unstructured Information Management Architecture) framework. The system is work-optimized using massively parallel POWER7 processors and built on IBM's DeepQA technology to generate hypotheses, gather massive evidence, and analyze data.
- Watson can process 500 gigabytes (around 1 million books) per second . IBM expects to market the DeepQA Software to large corporations, with a price in the millions of dollars, reflecting the $1 million needed to acquire a server that meets the *minimum* system requirement to operate Watson. IBM expects the price to decrease substantially within a decade as the technology improves.
- Watson does have some limitations. It takes time to integrate Watson and its services into a company. It also takes significant effort to teach Watson in order to use it to its full potential (highly time intensive). Watson is also in English which limits the areas in which it can be used.

Current large scale applications of Watson are somewhat limited but highlight the potential addressable market and utility. Four examples include:

Healthcare: Watson will function as a clinical decision support system for use by medical professionals. Watson first parses the input to identify the most important pieces of information; then mines patient data to find facts relevant to the patient's medical and hereditary history; then examines available data sources to form and test hypotheses. Finally, it provides a list of individualized, confidence-scored recommendations.

Chatterbot: Watson is being used to provide conversation for children's data.

Jill Watson (TA): Watson is used to create a virtual TA to assist student's in an upper undergraduate level computer science class at Georgia Tech. Jill answered with 97% certainty an accurate answer, with the remainder answered by humans.

Weather Forecast: In August 2016, IBM announced it would be using Watson for weather forecasting. Specifically, the company announced they would use Watson to analyze data from over 200,000 Weather Underground personal weather stations, and data from other sources, as a part of project Deep Thunder.

Competitors to Watson

Given the large addressable market of cloud and cognitive computing, it comes as no surprise that there are a number of competitors in this space. We contend that Watson has not only a technological advantage, but a temporal one as well. Despite these advantages, the IT space has been known to have technological disruptions, which warrants consideration of the significant competitors of Watson below.

Microsoft Oxford:
Project Oxford is a set of machine learning offerings provided to developers as part of Microsoft Azure's (Microsoft's cloud service) portfolio. Oxford has 4 main components:
- *Face Recognition*: Automatically recognizes faces in photos, faces that look alike and verifies if 2 faces are the same.
- *Speech Processing*: Recognizes speech and translates it into text, and vice versa.
- *Visual Tools*: Can analyze visual content to look for inappropriate content, dominant color schemes, detect text in photos, sort photos by different metrics and edit photos down to a thumbnail for easy scanning
- *Language Understanding Intelligent Services (LUIS):* Invite only Beta offering, enables applications to understand what users mean when they say or type something using natural, everyday language

Out of the 4 applications above, LUIS is obviously the one which competes with Watson due to its Natural Processing Capabilities. However, Watson is much more applicable and has already been applied to multiple fields. Watson is also much more technologically advanced. That said, LUIS is a potential threat for the future.

Baidu Minwa:
Minwa helps Researchers overcome many problems associated with Deep Learning algorithms. The system allows researchers to work with better training data than most other deep learning projects. It works with larger and higher resolution images which improves recognition accuracy as well as classification accuracy Two main components:
- Deep Image: Baidu's Image recognition system. Performed best on ImageNet Classification Challenge but there some doubts over the results
- Deep Speech: Speech Recognition System which uses Deep Learning.

Minwa's Deep Speech capability seems to be Baidu's product which could potentially compete with Watson. The technology has not been released to market as a product for customers yet. Baidu is also very good at keeping projects secret but the belief is that the capabilities will be used for the companies search engine and Ad Software.

Salesforce Einstein:
Artificial Intelligence system built to power Salesforce's CRM platform. Delivers advanced AI capabilities to sales, services and marketing. It makes many business processes more efficient as you do not need prep data or manage models; additionally, it helps automate processes.
Einstein is the newest of the 4 products and does operate in the field of Artificial Intelligence but is currently being used for Salesforce's CRM business. It is being used to keep Salesforce's market share amongst clients and to help them compete and be cutting edge.

Google's DeepMind:
Unique in its technological capabilities, Google's DeepMind learns from experience and uses model-free reinforcement learning. It initially got famous due to the computer program AlphaGo which beat one of the highest ranked Go players (9th Dan) in the world – 4-1 in a 5 game match. Recently, DeepMind has started shifted its focus towards healthcare, albeit differently from how Watson is being applied. DeepMind is being used as an analysis tool for research versus IBM which helps Doctors mine through patient data and develop a list of individualized, confidence-scored recommendations based off of results from tests and symptoms noticed on patients.

With respect to the competitors, we can see that the big technology companies all have their own AI and deep learning software but they seem to be aimed at helping clients and consumers in different ways. Currently, IBM has the lion's share of the market due to their early entry and prior relationships with large companies, but there is a lot of competition not only from technology giants, but also from the growing startup market whose technology is under the wraps. An advantage to a larger corporation, like IBM, is that they are able to buy out small startup companies that may represent potential disruptors. However, this is a double-edged sword as IBM's competitors may also buy these companies, which could lead to fierce competition.

Historical Stock Price Performance

Over the past 5 years, IBM's revenue has declined 3.26% which we suspect would affect market sentiment.

To better understand the effect of revenue decline, we analyzed IBM's stock price with respect to the S&P500 index (SPX is generally a good tracker of the overall market condition).

Figure 1: Historical Stock Performance
IBM's daily historical price (white) and SPX index's daily historical price (green) over the past five years.
Source: Bloomberg terminal. Command: <GP>. Accessed: 10/05/2016

Despite the bull market over the past couple of years, negative revenue growth seems to have impacted IBM's stock price. Recently we have seen the price rebound, which is mainly due to investments from renowned investors such as Warren Buffett and positive future guidance. We believe that past revenue trends should not continue due to the fundamental shift in IBM's business. IBM is looking to move into the cognitive and cloud Industry and with Watson, is in a terrific position for exponential growth in the future.

To ensure that we are not too optimistic in our DCF projections in our model, we evaluated IBM's historical Long-Term Asset Turnover (LTAT) and Useful Life of their Long-Term Assets. Here, our projections fall in range/ slightly deviate from our historical values. The rationale behind LTAT is that companies cannot suddenly become extremely efficient with their assets.
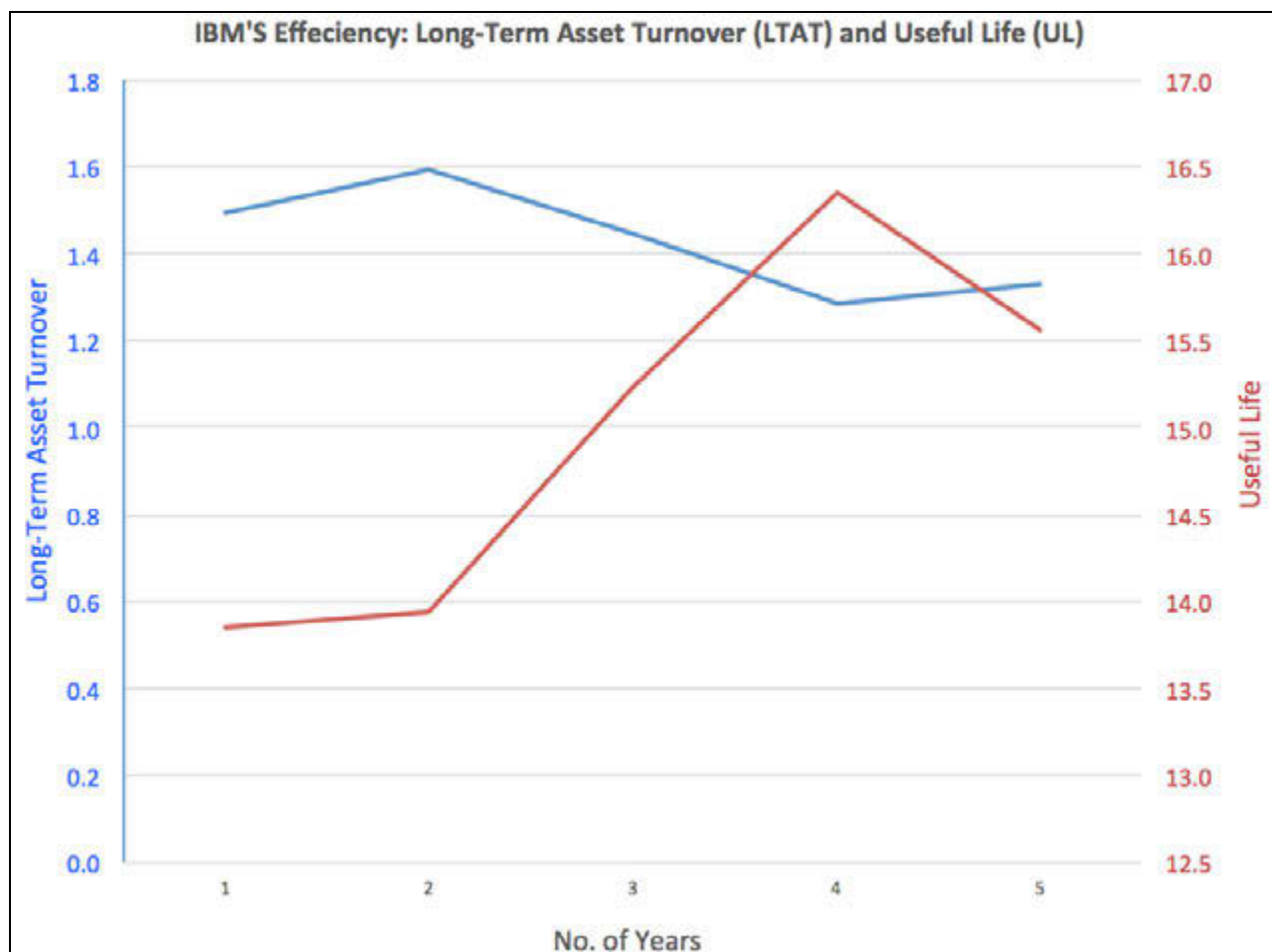
Figure 2: IBM's Long-Term Asset Turnover (LTAT) and Useful Life (UL)
Long-Term Asset Turnover (LTAT) is an indicator of Company Efficiency and is inversely related to Useful Life (UL). We see IBM becoming more efficient with their assets and we believe this will continue in the future due to the fundamental change in their business.
LTAT = Revenue/ Long-Term Assets Useful Life: Long-Term Assets/ D&A
Source: IBM's SEC 10-K filings

With respect to Long-Term Asset Turnover (LTAT) our projection value was 1.34 compared to a historical average of 1.43. Our useful life was 13.25, which was lower than a historical average of 14.99. These results suggest that despite our optimistic growth assumptions, we are within the bounds of historical productivity, lending credence and validity to our forecasts.

With respect to costs, we noticed that management mentioned that there would be downward pressure in the future. In contrast, IBM is moving to an industry with a better margin structure. To make sure our projections were not too optimistic, we evaluated Potential Free Cash Flow Yield (PFCY – i.e. maximum free cash flow yield if working capital is zero and capital expenditures is equal to depreciation and amortization). Our average PFCFY was around 16.85% compared to a historical average of 9.66%. This is in line with our hypothesis that IBM should achieve much better margins moving forward, but does not deviate significantly from what we believe is realistically attainable for the company.

Model Assumptions

Our P-DCF models typically utilize historical statistics of growth and margins as a baseline for our projections. Historic long-term asset turns and useful life are also referenced as a litmus test for our model assumptions and projections to ensure we are not forecasting productivity that is unsustainable in the long-run as we project the company into the future. We can deviate from these historic averages if management provides material information that will impact their business or have reason to believe.

During the most recent earnings call (2nd quarter), management reminded us that they are still running their clients' most critical processes, and that this put them in a unique and terrific position to move into the future. Today, IBM is not only helping clients build infrastructure as they traditionally did in the past, but also helping them in their digital businesses and inject cognitive into everything they do. As such, we have modeled IBM's revenue based on this fundamental shift and our perspective on where the world is going.

Balance Sheet and Income Statements

Results are contained in Balance Sheet and Income Statement tab of accompanying spreadsheet.

To perform a fundamental change in business, IBM is using divestments and acquisitions.

In Table 1 below are IBM's Acquisitions and Divestures over the past year. Divestments are of capital-intensive parts of the business. In the recent past, we can see that IBM has divested parts of their businesses containing lots of PPE such as IBM's property in Sweden, IBM's share in Guangfa Bank Co., the 2D CAD system business and the Microelectronics business. These divestments look like they will not contribute towards the cloud and cognitive platform business. The divestment of the Microelectronics Business shows the desire to move away from IBM's traditional hardware business. Acquisitions are a lot of apps and ideas, which can be integrated into Watson. There are a lot of acquisitions in the medical and analytics fields. The best examples of these are acquisitions of the ATM services business from GS4 (use remote diagnostics technology to fix ATMs), Truven Health Analytics (cloud based healthcare data), investment in digital asset holdings (implementation of Distributed Ledger Technology to improve security, compliance and settlement speed while reducing costs) and Pathway genomics (personalized health and wellness information based on an individual's health history). These apps require data intensive computation and it is easy to see how Watson can be leveraged to bring added value to these acquisitions. We notice their style of divesting capital-intensive parts of their business from the drop in PPE on the balance sheet. At the same time we see goodwill increasing due to the large volume of idea based acquisitions for Watson Health.

Table 1: IBM's Acquisitions and Divestures over the past year

Action	Effective Date	Summary	Summary
Acquisition	12/31/16	Target: Promontory Financial Group LLC	Acquirer: IBM
Divestiture	12/31/16	Seller: IBM	Unit Sold: Office property/ Kista
Divestiture	12/31/16	Seller: IBM	Unit Sold: China Guangfa Bank Co Ltd
Divestiture	11/1/16	Seller: Fluid Inc.	Unit Sold: Expert Personal Shopper division
Acquisition	10/27/16	Target: Sanovi Technologies Inc	Acquirer: IBM
Acquisition	7/10/16	Target: ATM Service Business	Acquirer: GS4
Acquisition	6/27/16	Target: EZ Legacy Ltd	Acquirer: IBM
Divestiture	5/12/16	Seller: Riordan Lewis & Haden LLC	Unit Sold: Blue Wolf Group LLC
Divestiture	4/30/16	Seller: IBM	Unit Sold: 2D CAD System business
Acquisition	4/19/16	Target: Aperto AG	Acquirer: IBM
Divestiture	4/8/16	Target: Truven Health Analytics Inc	Acquirer: IBM
Acquisition	4/6/16	Target: Resilient Systems Inc	Acquirer: IBM
Acquisition	3/18/16	Target: Optevia Ltd	Acquirer: IBM
Divestiture	3/14/16	Seller: IBM	Unit Sold: IBM Microelectronics business
Acquisition	3/8/16	Target: ecx international AG	Acquirer: IBM
Divestiture	3/2/16	Seller: Telefonica SA	Unit Sold: Multiple Targets
Acquisition	2/24/16	Target: Resource/Ammirati	Acquirer: IBM
Divestiture	2/24/16	Seller: IBM	Unit Sold: Portfolio of compensation product offerings
Divestiture	2/23/16	Seller: Fairhaven Capital Management LLC	Unit Sold: Resilient Network Systems Inc/MA
Divestiture	2/22/16	Seller: IBM	Unit Sold: IBM WebSphere Voice Response solutions
Divestiture	2/10/16	Seller: IBM	Unit Sold: Toshiba Global Commerce Solutions Corporate Headquarters
Acquisition	2/2/16	Target: Digital Asset Holdings LLC	Acquirer: Multiple acquirers
Divestiture	1/29/16	Seller: Weather Group Television LLC	Unit Sold: Digital Assets/Weather Channel
Divestiture	1/29/16	Seller: IBM	Unit Sold: Toshiba Global Commerce Solutions Holdings Corp
Divestiture	1/25/16	Seller: IBM	Unit Sold: 100 patent assets
Acquisition	1/15/16	Target: IRIS Analytics GmbH	Acquirer: IBM
Divestiture	1/7/16	Seller: IBM	Unit Sold: Kenexa Compensation Inc
Acquisition	1/5/16	Target: Pathway Genomics Corp	Acquirer: Multiple acquirers
Divestiture	12/8/15	Seller: Multiple sellers	Unit Sold: Clearleap Inc
Acquisition	11/10/15	Target: Meteorix LLC	Acquirer: IBM

Source: Bloomberg Terminal. Command: <CACS>. Accessed: 10/05/2016

Moving on to liabilities, we see that IBM's total debt is $44.5 billion. Net debt to EV is 14.58%. Of the $44.5 billion $26.5 billion is in support of the financing business. Leverage on financing is 7:1. Their portfolio for financing is 52% investment grade. Their non-financing debt is $18 billion. Total non-financing debt to EV is just over 10%. Net non-financing debt (Total non-financing debt – cash) to EV is under 5%.
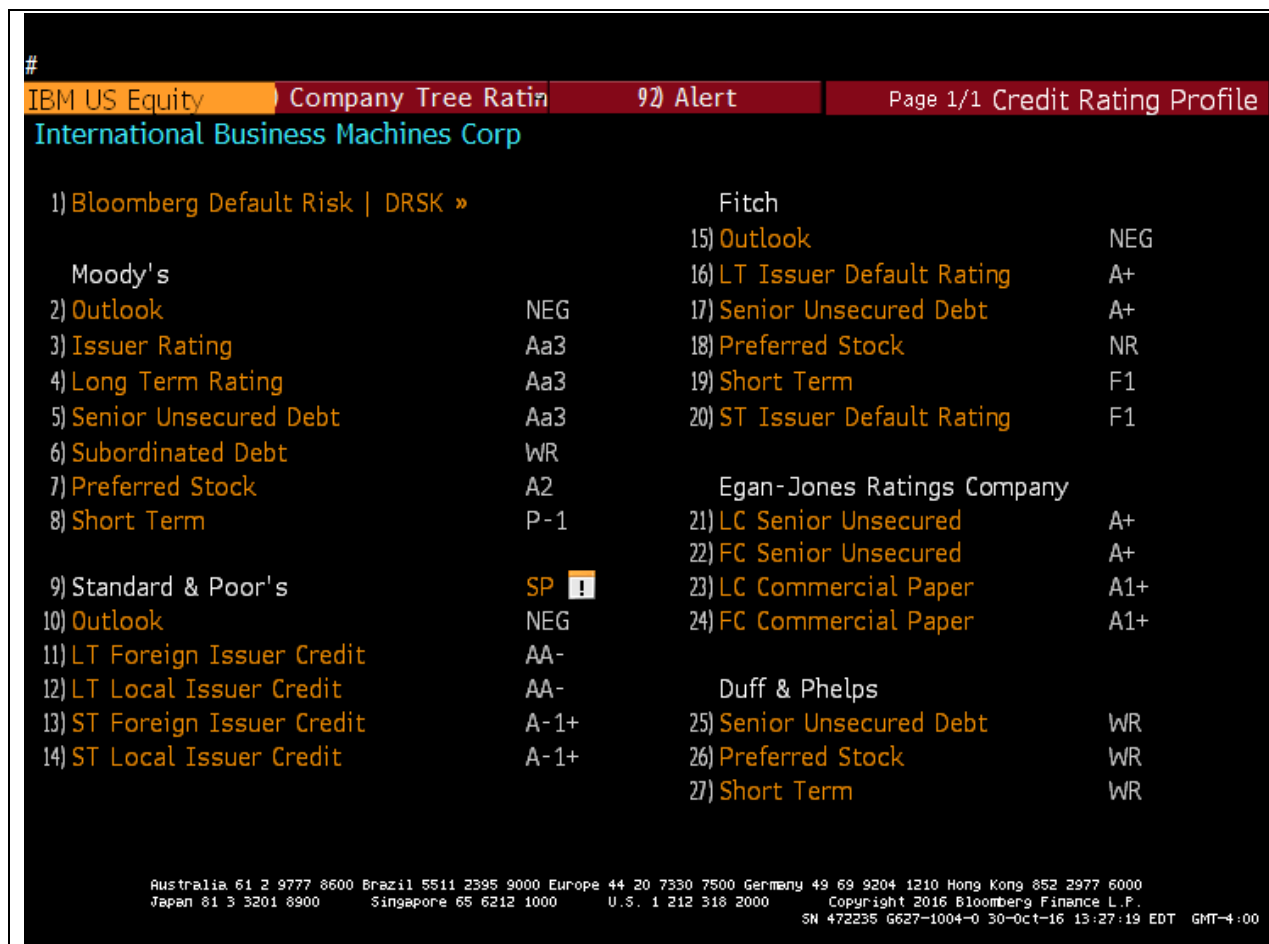

Figure 3: IBMs debt rating
Source: Bloomberg. Command: <CRPR>

We can see that the short-term debt is high grade and the long-term debt is upper medium grade to high grade. The outlook on debt is negative but we believe that is because the company is probably going to lever up. The increased debt will probably be for future acquisitions as the company changes its fundamental business.
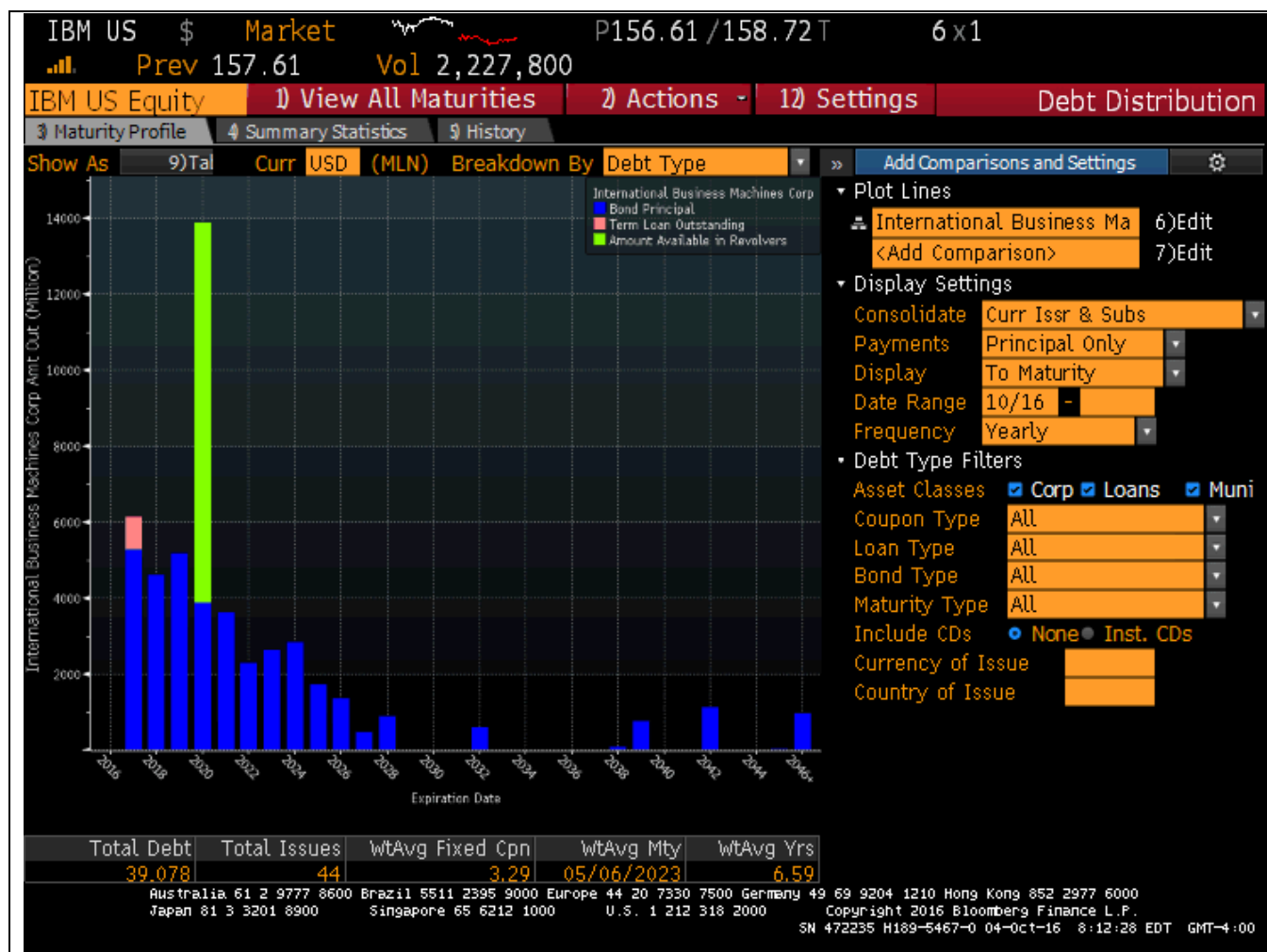
Figure 4: IBM's Debt Distribution
Source: Bloomberg Terminal. Command: <DDIS>. Accessed: 10/05/2016.

Most of IBMs debt is due in 2020. A lot of the debt is available in a revolver ($10 billion), which makes repayments easy. The weighted average maturity is 6.56 years.
We decided to look deeper into one of the IBM's bonds. We inspected a couple of IBM's bonds and found that they were all trading at a premium (details given in appendix A: debt analysis). Overall, we can conclude that IBM's debt looks healthy.

With respect to the income statement, we see that year over year growth in income is declining due to shift in businesses and loss of revenue from divestments. Management has not given any guidance for organic growth rates of revenue but we do believe that the company has moved towards occupying strategic positions in the Industry.

Value Drivers Tab

Values contained in the Value Drivers Tab of the accompanying spreadsheet
Due to the changing business structure, the historical revenue performance is not the best source for forecasting future revenues. We determined that it was important to understand the fundamental strategy of the company to project revenues. This along with guidance is the best

way to project revenue for IBM. With respect to costs, we felt that historical margins with downward pressure on costs seemed reasonable for our forecasts, which was indicated by management.

What stood out was IBM's change in working capital. The changing in working capital has fluctuated significantly in the past 5 years as can be appreciated by the standard deviation (22.49%). This variable contributes significantly to the uncertainty in our forecasts upon performing Monte-Carlo simulations.

This is uncommon in such a large, well-established company except in periods of transition which IBM is going through. With respect to CAPEX, management indicates that they do not believe that CAPEX will grow in the coming years and should actually see CAPEX fall due to the change towards cognitive and cloud platforms. To be conservative, we chose to use historical averages.

Model Results
Values are contained in the P-DCF and MC tabs of the accompanying spreadsheet
Given our assumptions, our DCF model yields a probable cash flow of $197.51. Our assumptions may seem at odds with historical averages, but they are grounded on management guidance and changing industry trends. Our LTAT are within historical averages and do not grow exponentially over our projections supporting our conclusions. This shows us that we are not overestimating IBM's capability to generate revenue from its investments and assets. Our Potential Free Cash Flow Yields (PFCFYs) are slightly higher than historical averages but this is due to lower cost margins in the cognitive and cloud platform business compared to the current Hardware, Software and Services business.

The current stock is within the 45th percentile and indicates that the market has not accounted for these new possible earnings. We acknowledge today's stock price is near the median distributions. Indeed, the distribution is relatively wide and has large positive and negative values. This is most likely due to the 22.49% standard deviation in Change in Working Capital over the past five years. On further analysis using Figure 5 and Figure 6, dropping our Change in Working Capital Variance to 5% increases our certainty of the intrinsic price from 57% to 69%. If we do not float working capital (Figure 7) in the Monte-Carlo, our certainty now goes up to 72%.

To see how the market is currently valuing IBM and its peers, we decided to do comparable companies analysis.
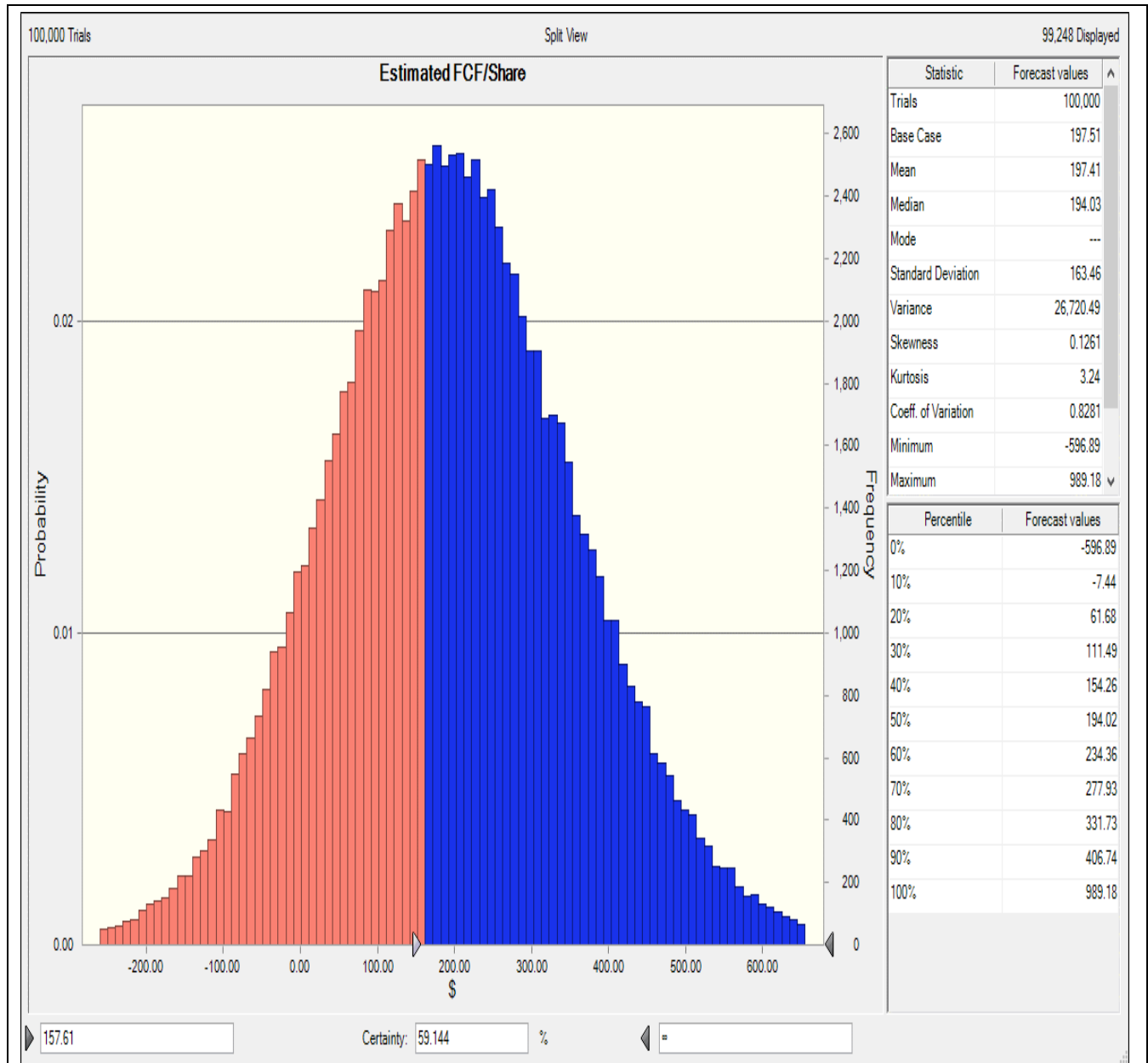
Figure 5: Monte-Carlo Simulation from IBM's P-DCF Model (High Working Capital Variance)

These are the results from 100,000 Monte-Carlo simulations of IBM's P-DCF model. The plot is the probability versus the possible discounted free cash flow per share. The blue portion of the figure indicates possible free cash flow levels that are above today's stock price. The pink portion denotes values below today's stock price.
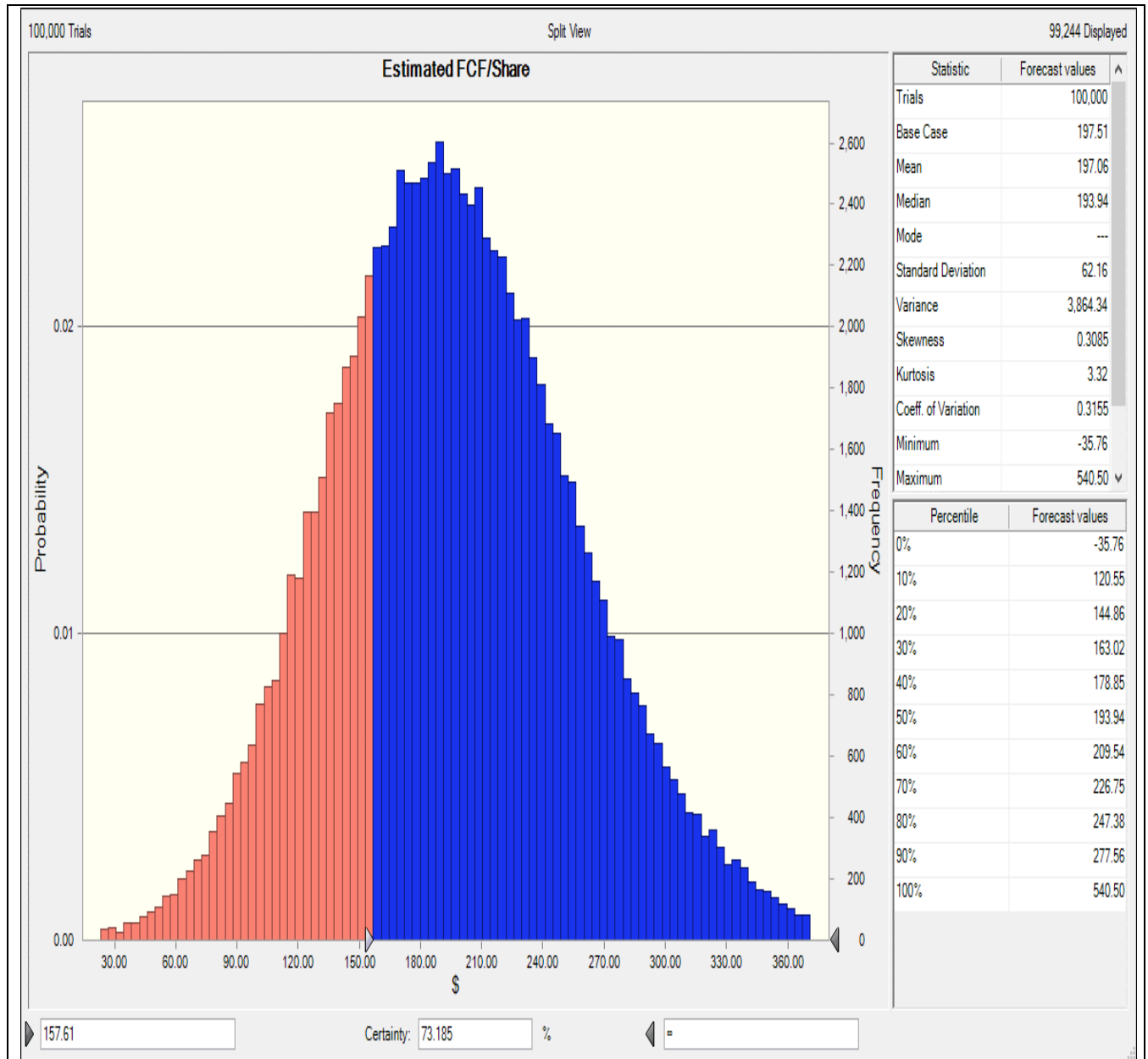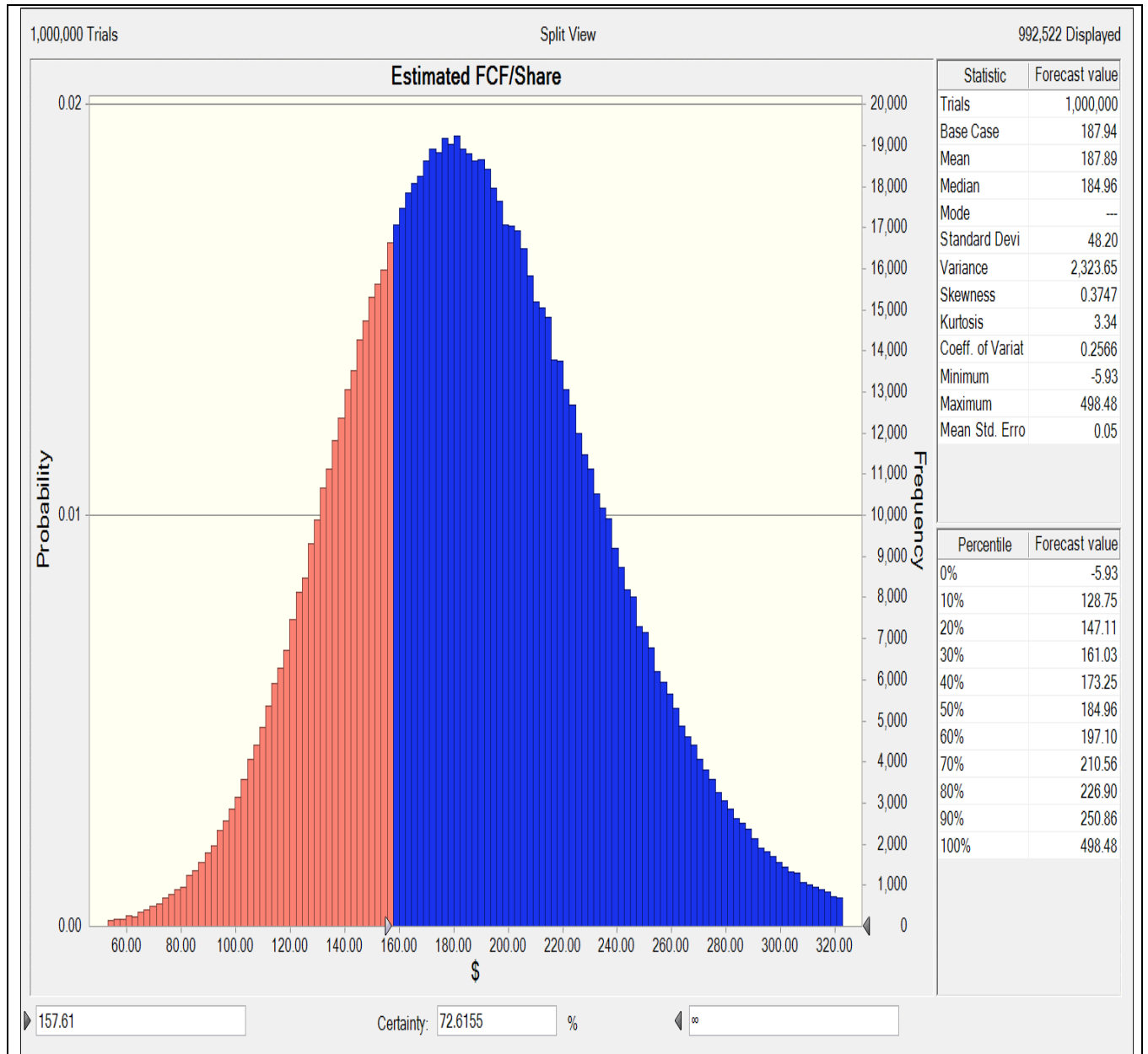
The working capital variance is 22.49%

Figure 6: Monte-Carlo Simulation from IBM's P-DCF Model (Low Working Capital Variance)
These are the results from 100,000 Monte-Carlo simulations of IBM's P-DCF model. The plot is the probability versus the discounted cash flow per share. The blue portion of the figure indicates the possible free cash flow levels that are above today's stock price. The pink portion denotes values below today's stock price.
The working capital variance is 5%

1,000,000 Trials	Split View	992,522 Displayed

Estimated FCF/Share

Statistic	Forecast value
Trials	1,000,000
Base Case	187.94
Mean	187.89
Median	184.96
Mode	---
Standard Devi	48.20
Variance	2,323.65
Skewness	0.3747
Kurtosis	3.34
Coeff. of Variat	0.2566
Minimum	-5.93
Maximum	498.48
Mean Std. Erro	0.05

Percentile	Forecast value
0%	-5.93
10%	128.75
20%	147.11
30%	161.03
40%	173.25
50%	184.96
60%	197.10
70%	210.56
80%	226.90
90%	250.86
100%	498.48

157.61   Certainty: 72.6155 %   ∞

Figure 7: Monte-Carlo Simulation from IBM's P-DCF Model (No Working Capital Variance)
These are the results from 100,000 Monte-Carlo simulations of IBM's P-DCF model. The plot is the probability versus the discounted cash flow per share. The blue portion of the figure indicates the possible free cash flow levels that are above today's stock price. The pink portion denotes values below today's stock price.
The working capital Variance is 0%

Comparable Analysis

Values are contained in the Comps tab of the accompanying spreadsheet

We reviewed ratios of the following peer companies that we believed were comparable in their products' future growth prospects and fundamental businesses, including:

Accenture
Amazon
AT&T
Cisco Systems
Google
Intel
Microsoft
Oracle
Salesforce

As a part of the analysis, we calculated and analyzed each company's ratio of current stock price to LTM earnings, current stock price to FY2017E earnings and current stock price to LTM free cash flow.

All of these calculations were done using data available from Bloomberg.

Table 2: IBM's comparable ratios

Name	P/E		Price to Free Cash Flow
	LTM	**FY2017E**	**LTM**
Mean	20.49x	27.01x	20.95x
Median	17.48x	19.55x	17.53x
Min	14.73x	12.2x	12.44x
Max	29.50x	79.42x	42.74x
IBM	11.09x	10.92x	9.73x

Source: Bloomberg Terminal

All of these calculations were done using data available from Bloomberg. Values excluding IBM, except where noted. P/E values calculated without Amazon.

Using a multiple range of 17.48x to 20.49x for LTM P/E, 19.55x to 27.01x for FY2017E P/E and 17.53x to 20.95x for Price to Free Cash Flow, we get a stock price range of $214.48 to $329.01.

It is very important to note that IBM's multiples are much lower than any of its comparable companies. This is because the market is looking at IBM as a **hardware company** instead of as a **software company** – cognitive and cloud analytics. This means higher future revenues and better margins as well for IBM.

Table 3: IBM's comparable ratios

Name	Revenue Growth	Gross Margin
	LTM	LTM
Mean	10.58%	57.79%
Median	7.19%	61.59%
Min	-1.60%	29.53%
Max	29.01%	80.09%
IBM	-0.28%	48.38%

Source: Bloomberg Terminal

We can see how the comparables have much higher margins and better revenue growth. We believe that after this transition period, IBM will be given a higher multiple due to having better margins and higher revenue growth moving into the future.

Our analysis thus far indicates that IBM may provide return upon investment, however, to assess whether management compensation is aligned with our thesis and forecast, we analyzed compensation plans provided for executives.

Proxy Findings

Management Compensation

Given that management plays such an important role in performing IBM's transition, we conducted a compensation analysis to see if management is obligated, or incentivized, to generate shareholder returns aligned with our Investment Thesis. IBM's CEO and Chairman of the Board is Virginia M. Rometty. Mrs. Rometty, 58, has held this position since late 2012 prior to which she was Senior Vice President and Group Executive of sales, marketing and strategy. She has been at IBM since 1981.

IBM's Compensation is divided into the following segments:
1. Current Year Performance
   a. Annual Incentive
2. Long-term Incentive plan
   a. Performance Share Units
   b. Annual Stock Based Grants
3. Retention
   a. Stock- Based Grants and Cash Awards
   b. Supplemental Executive Retention Plan (stopped in 2007)
4. Pension and Savings Plan
   a. Pension Plans (stopped in 2007)
   b. Savings Plans
   c. Deferred Savings Plans
5. Other Compensation
   a. Perquisites and other Benefits

As passive investors, we want Executives to act like owners. To this line, the Chairman and CEO and all Senior Executives are required to own IBM shares or equivalents with three times their individual total target cash compensation within 5 years of hire or promotion. Unlike the majority of Fortune 100 companies that establish guidelines based on a multiple of base salary, IBM uses a multiple of base salary and an annual target incentive.

Outlined below is a description of the specific metrics and weightings for the Annual Incentive and Performance Share Unit Programs:

Annual Incentive Programs:
IBM sets business objectives at the beginning of each year as approved by the Board of Directors. Performance against business objectives determine the actual total funding pool for the year which can vary from 0% - 200% of total target incentives for all executives.

Metrics and weighting for this year have been listed below:

Table 4: IBM's Executive Annual Incentive Program

Financial Metric	2015 and 2016 Weighting in Overall Score
Operating Net Income	40%
Strategic Imperatives Revenue	20%
Operating Cash Flow	40%

Source: IBM 2015 proxy (DEF 14A)

Adjustments are made to targets for extraordinary events such as large divestures and acquisitions.

We think Strategic Imperatives Revenue is an excellent metric due to the IBM's goals to generate revenue from newer technology and their fundamental business shift. This perfectly correlates to our investment thesis.

Performance Share Unit Program (PSU)

The targets for the PSUs are set at the beginning of each three-year performance period, taking into account IBM's financial model and annual budget as approved by the board, including the impact of the share buyback program on operating EPS. For PSUs and beyond, the Committee has determined that the actual operating EPS results will be adjusted to remove the impact of any change from the budgeted share count, including share repurchase transactions. The score is calculated on the basis of the following predetermined, with the following weights:

Table 5: IBM's Executive Performance Share Unit Program

Financial Metric	2015 and 2016 Weighting in Overall Score
Operating Earnings per Share	70%
Free Cash Flow	30%

Source: IBM 2015 proxy (DEF 14A)

The scoring of PSUs also takes into account extraordinary investments. For example, in 2015, operating EPS reflected the impact of the Microelectronics divesture.
Number of PSUs is adjusted up or down based on the approved actual performance from 0% to 150%.

Free Cash Flow and Operating Earnings per Share are two metrics, which we as value investors really care about. We want to see growth in these two metrics especially over the long run, as that would increase the stock price and give us a better return on our investments.

Benchmark Group (same for 2016 and 2015)

Table 6: List of IBM's Peer

Accenture	EMC	Oracle
Amazon	ExxonMobil	PepsiCo
Apple	Ford	Pfizer
AT&T	General Electric	United Technologies
Boeing	Google	UPS
Caterpillar	Hewlett-Packard	Verizon
Chevron	Intel	Xerox
Cisco Systems	Johnson & Johnson	
Dow Chemical	Microsoft	

Source: IBM 2015 proxy (DEF 14A)

Owing to the size and scope of their business overall, their Chairman and CEO and corporate function heads are generally compared to the 75th percentile of the benchmark group, because IBMs revenues are near this reference point.

We think the benchmark group has some exceptional companies such as Intel, Microsoft, AT&T, and Cisco System amongst others. There are though some companies in the group, which do not really make sense such as Dow Chemicals, Ford and Pfizer. The only reason to have them in the peer group could be size.

That being said, the comparison is to the 75th percentile and we believe that is fair.

Institutional Holders

As value investors, we felt it was it was crucial to look at the Institutional holders of IBM. It is important to see if the largest holders would push to bring about changes similar to what we desired as value investors. We noticed that Berkshire Hathaway was the major shareholder. Other top holders, were Vanguard Group, Blackrock and State Street Corp.

Figure 8: IBM's Institutional and Insider Holders
It is reassuring to see Warren Buffett as the largest shareholder.
Source: Bloomberg Terminal. Command: <OWN>. Accessed: 10/04/2016

Warren Buffett (CEO: Berkshire Hathaway) believes that the IBM is fundamentally undervalued and indicated in May 2016 that he plans to buy more of the stock over the next 12 to 24 months.

We believe that this makes IBM even more attractive given that Buffett does not traditionally invest in technology companies as well as his knack for finding the right companies to invest in. In addition, IBM's dividends and ongoing share buyback program make them a very attractive as well.

Dividend Program
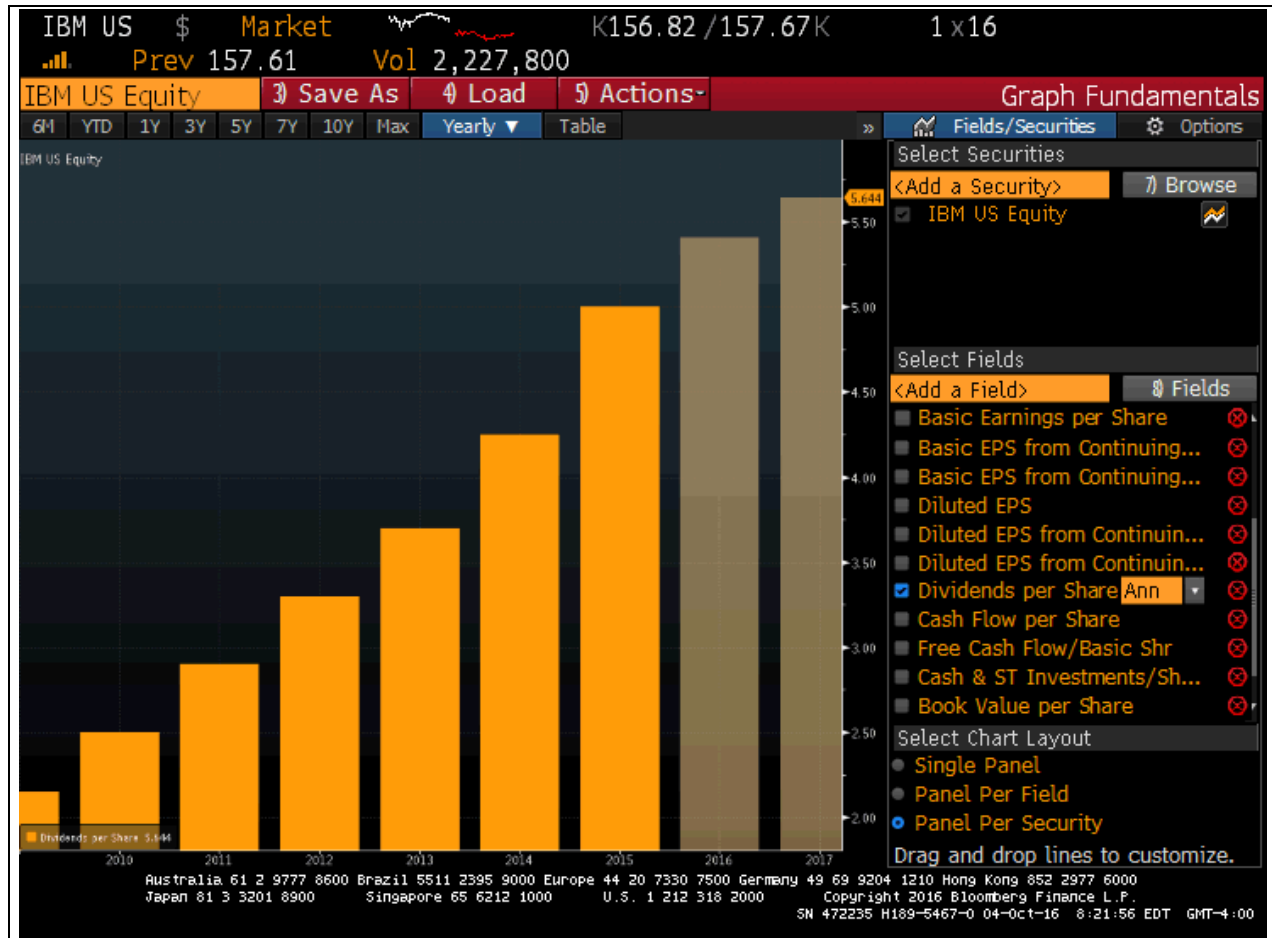
Figure 9: IBM's Annual Dividends per Share over the past 5 years
Source: Bloomberg terminal. Command: <GF>. Accessed: 10/04/2018

IBM has been consistently raising dividend over the past couple of years. This indicates that the company is confident about future prospects. IBM as a company traditionally does not hoard cash and pays out dividends to shareholders. Management has indicated further growth in the future.

Share Buyback Program

Figure 10: IBM's Shares Outstanding over the past 5 year
Source: Bloomberg Terminal. Command: <GF>. Accessed: 10/04/2018.

IBM has had a share buyback program. It still has to buyback $3.9 billion in their buyback authorization program, which should create value for shareholders. Management may also believe that their stock is fundamentally undervalued and is trying to create a mean reversion via payout methods.

Conclusions

IBM is emerging as more than a hardware, software and services company and is transforming into a cognitive and cloud platform company. We believe IBM occupies a unique position in the technology industry with a long-standing strategic IT relationship with global corporations. IBM has been running most critical process for its clients and has the ability to leverage its product suite to add further value to customers.

Our DCF model implies stock price is $197.51 providing significant upside over the current market price of $157.61.On a peer group evaluation, IBM is extremely well positioned and valued much lower than its peers. IBM's LTM P/E ratio is 11.09x compared to a median of 17.48x for the comparables, FY2017E is 10.92x compared to a median of 19.55x for the Hence, we rate International Business Machines (NYSE: IBM) as a BUY.

Appendix A: Debt Analysis

We inspected three different notes for IBM.

1. 5.7% 09/14/17 note
We inspected IBM's 5.7% for 3 million due on 02/12/24. A description of the bond is in Figure 11 below.

Figure 11: Description of IBM's corporate bond, maturing 09/14/17 with 5.7% coupon
Source: Bloomberg Terminal. Command: DES

The bond appears liquid, which means it is probably fairly priced.
After looking into trades, we saw that the bond was trading at a premium - around 104 cents to the dollar

2. 3.6255 02/12/24 note
We inspected IBM's 3.625% for 2 million due on 02/12/24. A description of the bond is in Figure 12 below.

Figure 12: Description of IBM's corporate bond, maturing 02/12/24 with 3.625% coupon
Source: Bloomberg Terminal. Command: DES

The bond appears liquid so it is most likely fairly priced.
After looking into the trades for this note, we found that the 3.625% 02/12/24 note was trading at a premium – around 108 cents to the dollar.

3. 4% 06/20/42 Note

We inspected IBM's 4% for 1.11 million due on 06/20/42. A description of the bond is in Figure 13 below.

Figure 13: Description of IBM's corporate bond, maturing 06/20/42 with 5.7% coupon
Source: Bloomberg Terminal. Command: DES

The bond appears liquid so it is most likely fairly priced.
After looking into the trades for this note, we found that the 4% 06/20/42 note was trading at a premium – around 104 cents to the dollar.

We can hence conclude IBM's debt is healthy.

Appendix B: Supply Chain

IBM has an extensive integrated supply chain, procuring materials and services globally. In 2015, the company also managed approximately $24 billion in procurement spending for its clients through the Global Process Services organization. The supply, manufacturing and logistics operations are seamlessly integrated and have optimized inventories over time. Simplifying and streamlining internal processes has improved sales force productivity and

operational effectiveness and efficiency. Supply chain resiliency enables IBM to reduce its risk during marketplace changes.
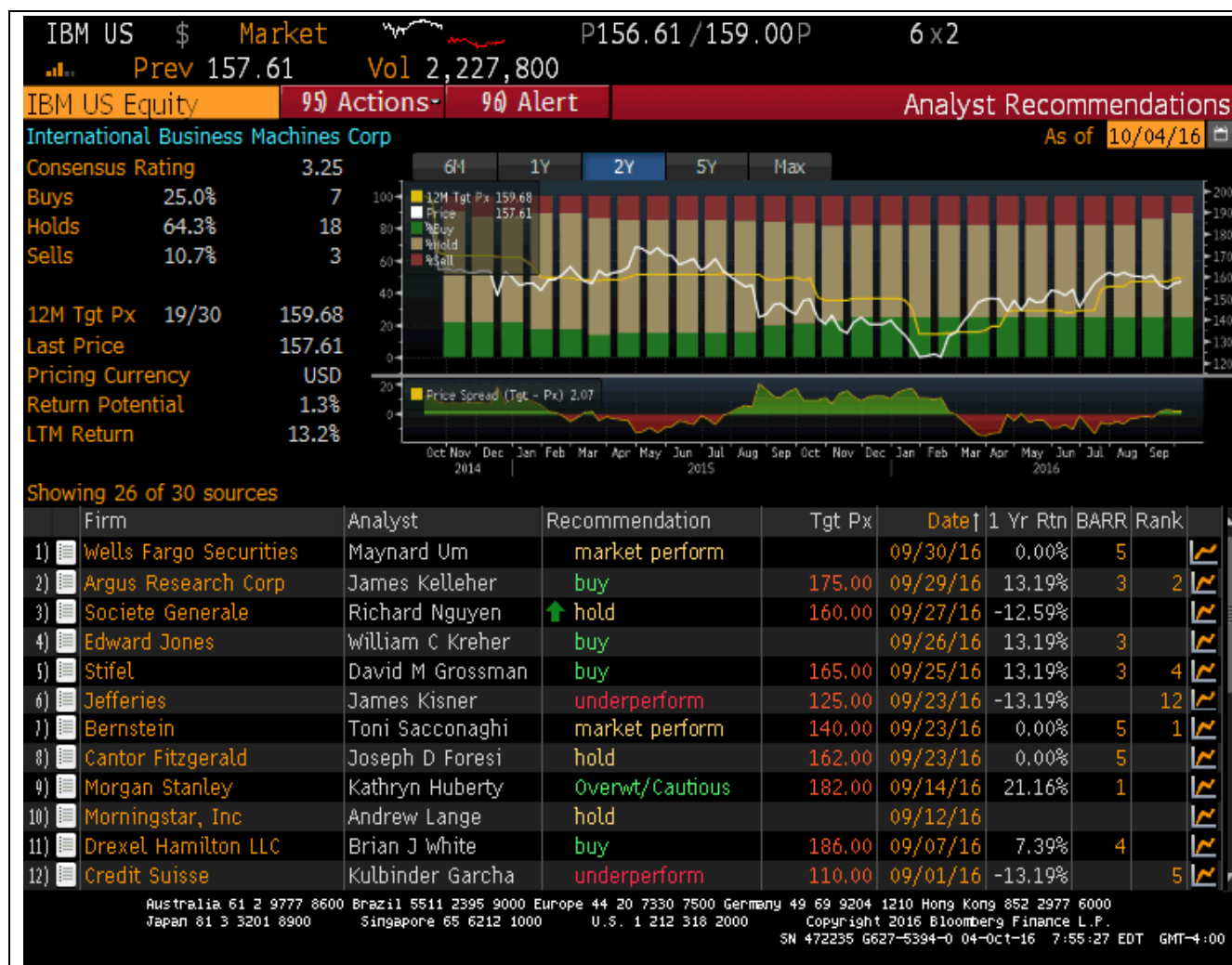
Appendix C: Analyst Recommendations

Figure 14: Analysts Recommendation for IBM from a Bloomberg Terminal
As of 10/04/2016, 7 analysts had rated IBM as a buy, 12 analysts had rated IBM as a hold and 3 have rated IBM as a sell. The average 12M Target price is $159.68.
Source: Bloomberg Terminal. Command: <ANR>. Accessed: 10/05/2016

We see that the target price has followed the actual price and is up from the bottom in February 2016. This recent increase may show the market sentiment changing for the future and represents a favorable opportunity in investing in IBM.

Appendix D: Differing Definitions between P-DCFs and the Traditional DCF

- **Working Capital = Current Assets – Current Liabilities – Cash & Cash Equivalents**
  Reason: The reason for this is because we do not treat cash as an asset. By definition, an asset has to generate cash and has to be a use of cash. It does not make sense to argue that cash is a use of itself. Additionally, the amount of cash on the balance sheet can be a capital allocation decision by management. As a result, we do not wish to conflate management's capital allocation strategy with working capital.

- **Capital Expenditures = (Long-Term Assets) $_t$ - (Long-Term Assets) $_{t-1}$ + D&A$_t$**
  Reason: We treat D&A as a cash expense. This is done because all the depreciable assets will have to be replaced one day. Once, that day comes, the replacement of each asset will require cash, which will be a cost against Free Cash Flow.

- **Discount Rate: 10% (in place of WACC)**
  Reason: By definition, WACC is the opportunity cost of capital of the firm, which is very different from the Investor's cost of capital. We should use a discount rate that reflects the Investor's cost of capital, such as the average return of the S&P500, which happens to be 10%.

- **Terminal Value = [Free Cash Flow$_{10}$ * (1 + r)]/(r – g) - Long-Term Debt]/(1+r)^{10}**
  Reason: We elect to use a perpetual growth model instead of a terminal multiple. Our formula is an extension of the Gordon Growth Model, except the face value of the company's long-term debt is subtracted from the expression to achieve a terminal value. We believe dealing with a firm's debt in year 10 is the most reasonable approach. Since, we assume the company pays its debt off in year 10, we assume Interest Expense in Year 10 to be 0.