MEMORANDUM

To: Professor Sury
From: The Average Joe's, LLC.
Aidan Cremins, Joe Morris, Peyton Lewis, and Amrit Sandhu
Re: Estimating Beta via SCL and Comparables Analysis
Date: October 27, 2022

Introduction

Our team decided to analyze Uber and come up with estimates of its equity β via two different methods: fitting a Security Characteristic Line (SCL), and gathering data on comparable companies. We chose to look at Uber because it has multiple lines of business, which made it more interesting to find comparable companies for each individual business segment. Moreover, since Uber is a relative pioneer in the ridesharing/food delivery space, we thought it would make for a more interesting and challenging analysis.

Methods & Procedure

SCL Analysis

The first stage of our analysis was to determine the time period and granularity of stock price data that we were going to get. In terms of time period, we were limited by the fact that Uber only had its IPO on May 10, 2019. Given that we couldn't go back very far historically, we settled on collecting data for the past two years. We were concerned that two years of monthly data wouldn't be enough data points to fit an informative regression model, so we opted to collect weekly data. We are also assuming that the risk-free rate is 0% because we are performing a historical SCL analysis. After making these decisions, we gathered the two year weekly returns for both UBER and SPY to represent the market. We then fit a regression model predicting Uber's risk premium from the market risk premium and performed statistical tests to determine the validity and confidence of our results.

Comparables Analysis

To begin our comparables company analysis, we had to first determine which business segments Uber operates in. We found this information on Uber's 10-K[1] and were unsurprised to see "Mobility" and "Delivery" listed. Interestingly, "Freight" was the third segment as Uber also has a significant shipping and logistics operation. We decided that sales would be the best metric to weight these segments and used the EV/Sales multiple from Aswath Damodaran's website[2] to appropriately adjust these weights.

[1] https://www.sec.gov/Archives/edgar/data/1543151/000154315122000008/uber-20211231.htm
[2] https://pages.stern.nyu.edu/~adamodar/

Our comparable company selection was driven first by Uber's 10-K, because they list what they view as primary competitors in each of their three main segments. For each segment, we included a few firms listed on the 10-K and then supplemented with our own comps. The "Freight" segment was the easiest to get comps for since it's a well-established business area with many competitors. We used FinViz[3] to help us find comps under the "Integrated Freight & Logistics" industry. Since there were so many options, we restricted our comps to be only U.S.-based companies with relatively large market caps. We say relatively large because we excluded UPS and FedEx since they're very large "pure play" freight companies, which Uber's smaller freight operation doesn't compare well to. We also excluded some more niche freight and logistics companies like Cryoport, Inc., which specializes in cold transport since Uber's freight business isn't that specialized.

In looking at comps for the "Mobility" segment, we had to get more creative. Uber is categorized as a "Software - Application" company on FinViz, as are companies like Salesforce, Intuit, and other non-related companies. Its ridesharing business proved to be too specific to find good comps on FinViz simply by using its sector category. Therefore, we simply started searching for competitors of Uber specifically related to its ridesharing business and found companies like Lyft, Via, Ola Cabs, etc.[4], though many of these companies weren't public. We also expanded our search to include electric scooter companies like Bird, because we thought their business model was similar enough. Another set of companies that we thought about adding were rental car companies such as Hertz. Ultimately, we decided against adding them because we felt that we were starting to get away from the "Mobility" segment's core purpose, which was quick ridesharing, not longer-term rentals.

We faced a similar challenge in finding comps for the "Delivery" segment. We were able to find some "pure play" comps like Doordash, Deliveroo, and Delivery Hero. Unfortunately, we had to eliminate some other possible pure plays like Grubhub (was recently delisted due to lack of demand) and Postmates (bought by Uber). Like with the "Mobility" segment, we had to creatively expand our scope of companies to look at. We settled on adding companies like Hello Fresh and Blue Apron, which deliver meal ingredients on a fixed schedule rather than cooked meals whenever desired as Uber Eats does.

Results

SCL Analysis Results

After running the SCL analysis on Uber's weekly returns for the past two years, we were able to generate the plot displayed in **Exhibit I** as well as the numerical results shown in **Exhibit II**. As can be seen, the equity beta generated was 1.6104. We performed hypothesis testing to see how significant the estimate was. Testing against the null hypothesis that the true coefficient was 1, we got a test statistic of 2.326, and since it's greater than 2, the estimated beta is significantly different from 1. This indicated that Uber's

[3] https://finviz.com/
[4] https://bstrategyhub.com/top-ubers-competitors/

equity beta was statistically significantly different from the market's beta of 1, showing that it bears more risk than a well diversified portfolio (i.e. the market portfolio).

We then also determined the 95% confidence interval for our beta estimate which was (1.0961, 2.1247). This 95% confidence interval was computed by taking the product of the critical t-value of 1.96 and the standard error of the Beta estimate of 0.262 and adding and subtracting it from the Beta estimate of 1.6104.

$$Confidence\ Interval = \beta \pm t_{critical} * Standard\ Error\ of\ \beta$$

The critical t value of 1.96 is used because in a normal distribution, 95% of the area under the curve is contained within 1.96 standard deviations on either side of the mean. We assume that with 105 observations, the student T distribution can be well approximated by the normal distribution. This interval, centered at the Beta estimate for Uber, indicates that if this process were repeated many times, 95% of the generated estimates for Uber's Beta would fall within this interval.
We could've gotten a tighter interval by having more data points in the regression (i.e. using daily instead of weekly data). This is a function of the sample size, because as sample size increases, the standard error of the Beta estimate decreases, and its corresponding confidence interval will tighten as well. The information about Uber's beta estimate and the corresponding confidence interval are also included in **Exhibit II**.

The last key step of this analysis was to assess its overall validity. We had to check whether our fitted regression line met the assumptions of linear regression: normality of residuals, homoscedasticity, no autocorrelation, no multicollinearity, and linearity. Through a series of plots and tests in our notebook, we found that all assumptions were indeed met. This means that we can feel more confident in our SCL estimate of Uber's beta.

Comparables Analysis Results

Using the comps that we gathered via the process outlined above, we performed the following computations to get our beta estimate. The first step was to unlever the comps' betas, and to determine which formula to use, we plotted both LTD over time and D/E over time to figure out which was more stable for all. Ultimately, we went with the constant D/E assumption because its unlevering formula allowed us to incorporate the beta of the debt, which we felt was important because several of our comps were penny stocks (which we defined as stocks with a price less than $5.00 as of 10/25/22) and thus likely to have risky debt. We ideally wanted to create some sort of ordinal system to establish the debt betas based on firm credit rating, but since the COMPUSTAT data ends in 2017, we set the debt betas for all seven penny stocks to 0.5 and assumed that the non-penny stocks had debt betas of 0. We then used the following formula (assuming a fixed D/E ratio) to unlever the comps' betas:

$$\beta_U = \frac{\beta_E}{1+\frac{D}{E}} + \frac{\beta_D(\frac{D}{E})}{1+\frac{D}{E}}$$

Next we adjusted our unlevered beta for cash adjustment. The comps' levered, unlevered, and cash adjusted betas can be found in **Exhibit III**.

We then averaged the cash adjusted betas for each of Uber's three segments. To take the average, we took the sales amount for the three segments and multiplied by the appropriate EV/Sales multiple from

Damodaran's website. The sales amount times the EV/Sales multiple yielded the implied Enterprise Value for each segment, which was used to get each segment's weight. We then took each segment's weight multiplied by the unlevered and cash adjusted beta from comps in that segment. The process of getting these weighted betas per segment is laid out in **Exhibit IV**.

Adding together these weighted beta components, we get the unlevered beta estimate. We then add back in the Uber's cash amount since we took out cash from the comp betas. Lastly, we relevered the beta with the following formula (assuming a fixed D/E ratio):

$$\beta_L = \beta_U (1 + \frac{D}{E}) - \beta_D (\frac{D}{E})$$

This yielded an estimated beta of 1.5749 via this comparable company analysis. Uber's unlevered beta estimate, cash adjusted beta, and re-levered final beta estimate are all included in **Exhibit V**.

Comparison of Methods

In the end, we got an estimated β_E of 1.6104 via the SCL regression analysis and an estimated β_E of about 1.5749 from the comparable companies analysis. We were quite surprised as to how close these two estimates were especially regarding the difficult nature in finding appropriate comps. The estimate β_E of 1.5749 from the comps analysis was indeed well within the 95% confidence interval of (1.0961, 2.1247) that we got when doing our regression analysis (though this interval is quite large and not all that informative). A logical next step would be to blend these two estimates to get a single estimated β_E. Such an approach would be particularly important if the two estimates were significantly different from one another. The weight placed on the estimated β_E from SCL in the blended β_E would depend on how confident one is that the past performance of the company in question is reflective of expected future performance. Additionally, the weight placed on the estimated β_E from comps analysis in the blended β_E would depend on how confident one is that appropriate comps were gathered.

Exhibits

Exhibit (i) : SCL Plot
Exhibit (ii) : SCL Beta Analysis: Summary
Exhibit (iii) : Comparables Analysis: Unlevered Cash Adjusted Betas
Exhibit (iv) : Comparables Analysis: Segment Overview
Exhibit (v) : Final Comparison between Methods

The exhibits are attached below.

Lessons Learned & Future Actions

One of the major lessons that we learned via this project is that comps analysis can get difficult very quickly. Since we were analyzing Uber, which largely pioneered and continues to dominate the market for

two of its three major segments, “Mobility” and “Delivery”, there weren’t that many similar companies that we could find. Thus, we had to stretch to include companies that were operating with similar, though not identical, business models. It was challenging to determine how far we should stretch to find these comps. Another difficulty that we encountered was what to set β_D to be. We recognized that several of our comps were not investment-grade as they were penny stocks that had dropped significantly in price over the past few years. Clearly, these were struggling companies that would have some sort of risk attached to their debt. We knew from prior classes that β_D typically ranges between 0.3 to 0.5. However, we didn’t have a strong mechanism to assign a β_D within this range to each comp with risky debt. We ultimately just assigned a β_D of 0.5 to every comp with risky debt, which is definitely something we would want to improve upon in the future.

For any future business needs or inquiries, please reach out to our team.

Thank you,
The Average Joe’s, LLC.
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Exhibit I: SCL Plot

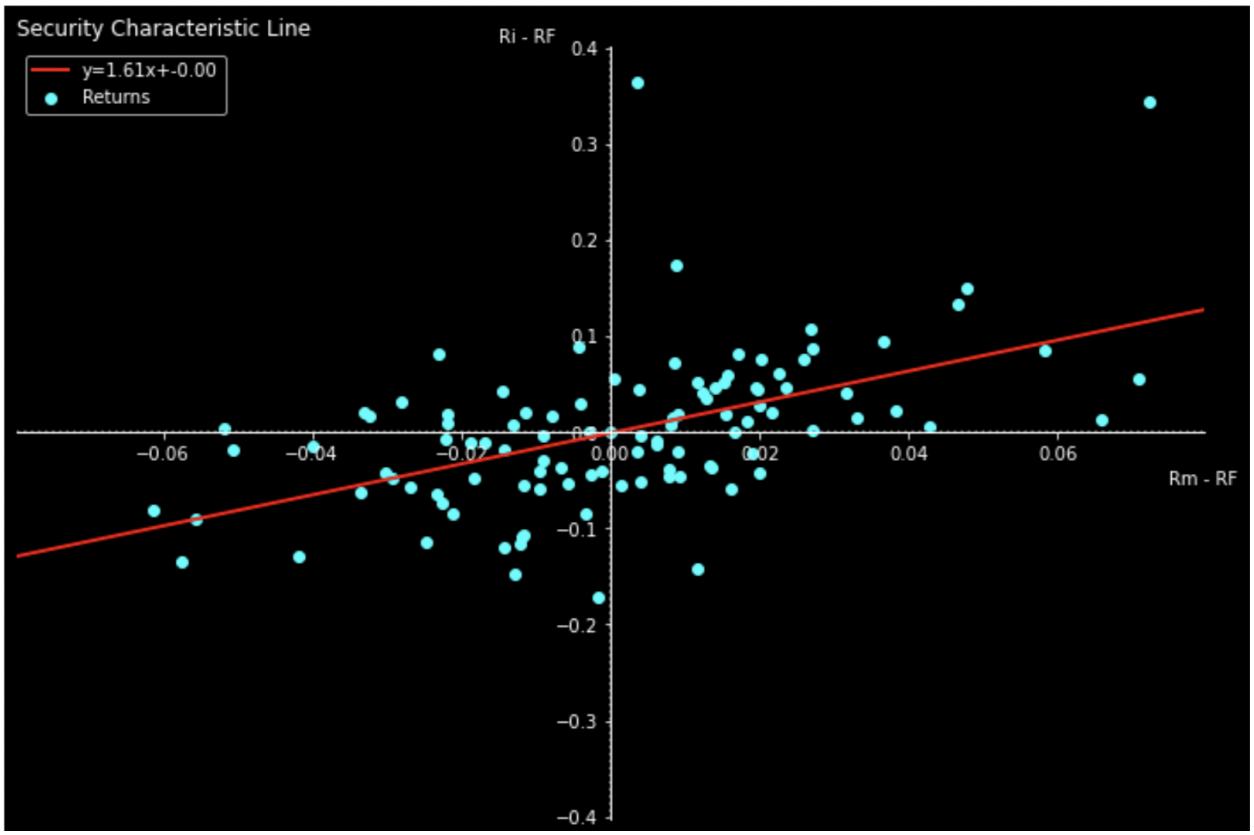

Exhibit II: SCL Beta Analysis: Summary

Uber's Equity Beta	T-Statistic (H0: Beta = 1)	95% Confidence Interval
1.6014	2.3264	(1.0961, 2.1247)

Exhibit III: Comparables Analysis: Unlevered Cash Adjusted Betas

Firm	Segment	Levered Beta	Unlevered Beta	Cash Adj. Unlevered Beta
DoorDash, Inc.	Delivery	1.7325	1.7201	1.8542
Deliveroo PLC	Delivery	0.5703	0.5686	0.7710
Delivery Hero SE	Delivery	1.4112	0.4765	0.6739
HelloFresh SE	Delivery	0.8133	0.7724	0.8920
Blue Apron Holdings, Inc.	Delivery	1.1522	1.0057	1.4385
CH Robinson Worldwide, Inc.	Freight	0.8034	0.7188	0.7309
XPO Logistics, Inc.	Freight	1.4059	0.9498	0.9690
Deutsche Post AG	Freight	1.0036	0.7758	0.8036
GXO Logistics, Inc.	Freight	1.6351	1.3374	1.3733
J.B. Hunt Transport Services, Inc.	Freight	0.9787	0.9323	0.9472
Hub Group, Inc.	Freight	0.9442	0.8800	0.9274
Landstar System, Inc.	Freight	0.7210	0.7130	0.7402
Lyft, Inc.	Mobility	1.7576	1.6806	1.7336
DIDI Global, Inc.	Mobility	2.4587	2.4286	3.8948
Grab Holdings Inc.	Mobility	1.2933	1.2367	1.7394
Bird Global, Inc.	Mobility	0.7755	0.7755	0.8563
Helbiz Inc.	Mobility	1.4203	1.3308	1.5019
Niu Technologies	Mobility	1.4304	1.4288	1.7116

Exhibit IV: Comparables Analysis: Segment Overview

Segment	EV/Sales Multiplier	Revenue (Millions)	Implied Enterprise Value (Millions)	Segment Weight	Average Segment Beta	Weighted Beta
Delivery	12.84	$ 8,632.00	$ 110,834.90	0.5450	1.1259	0.6137
Freight	1.52	$ 2,132.00	$ 3,240.64	0.0159	0.9274	0.0148
Mobility	12.84	$ 6,953.00	$ 89,276.52	0.4390	1.9063	0.8369

Exhibit V: Final Comparison between Methods

Uber's Equity Beta (SCL)	Uber's Unlevered Equity Beta (Comps)	Uber's Cash Adj. Unlevered Beta (Comps)	Uber's Re-Levered Equity Beta (Comps)
1.6014	1.4654	1.3875	1.5749