Understanding Crowd Funding: Cost of Capital and Factors for Success

By

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SUBMITTED TO THE SYSTEM DESIGN AND MANAGEMENT PROGRAM
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ABSTRACT

Since the advent of Web 2.0, crowd funding has played an increasingly important role as a means of financing for startup companies. Crowd funding is a particular means of financing where money is obtained from the public in exchange for equity or rewards. Currently, only accredited investors, including investment firms, pension funds and individuals with personal net worth of at least $1 million or earning at least $200,000 a year (US Securities and Exchange Commission, 2012) can invest in private companies and get equity in return. With the passing of the JOBS Act by President Barack Obama in April 2012, making investments in exchange for equity in private companies will soon be available to small investors.

This thesis examines the phenomenon of crowd funding through estimating the cost of capital for the crowd funded projects and the factors influencing their success. Data is obtained from a popular fund raising website, Kickstarter and analysis is carried out using regression. The results show that the probability of a successful fund raising campaign is rather low, at 43%. Setting a low funding target, entering a market that has fewer competing products and building up popular support through captivating design or meeting latent user needs is associated with a higher probability of fund raising success. In addition, though the median cost of capital is negative, the cost of capital exhibits a wide range and it may be more expensive to fund projects through crowd funding compared to debt financing, which has a much smaller spread of its cost of capital. As such, the results show that a lower the cost of capital is associated with a lower cost of goods sold, faster delivery of rewards and a high proportion of free capital, which may be obtained by encouraging donations or asking for a higher price premium for its products relative to retail price.

Thesis Supervisor: Andrey Malenko
Title: Assistant Professor of Finance

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I have also benefited greatly from sharing in the knowledge of my friends and peers here at the Massachusetts Institute of Technology (MIT), especially at the Sloan School of Management, with its numerous business focused talks and seminars organized primarily by students. It is through them that I was exposed to entrepreneurship and the emerging trend of crowd sourcing and crowd funding. My department, the System Design and Management Program, has also been very supportive throughout my academic journey to broaden my professional expertise.

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1 Introduction

1.1 Crowd Funding Overview

Crowd funding is defined as a form of investing by the non-professional public without the use of financial intermediaries such as banks or trust funds (Schwienbacher & Larralde, 2012). There has been many examples of crowd funding throughout the centuries – it has been used to finance publications, music concerts, music recordings, films, consumer goods and other pursuits [(Herner, 2011) (Wikipedia, 2013)]. Though the concept of crowd funding has been around for a long time, it only took off with the advent of Web 2.0, which enabled crowd funding to become more targeted and efficient (Ordanini, Miceli, Pizzetti, & Parasuraman, 2011).

Over the last few years, there had been a proliferation of crowd funding sites which provide platforms for projects to solicit crowd sourced funds from the public. Some of these sites include Indiegogo, Kickstarter and Fundable (Scharwath, 2012). Most of them are rewards based so as to get around current regulations that prohibit the public from investing in private companies in exchange for equity. Instead, the public pays for products that will only get delivered in the future. In this form of investment, the public makes a donation to the project in exchange for a reward, which ranges from non-tangible ones like an online mention and videos to tangible products such as T-shirt and custom designed products. These projects may be owned by individuals or by companies, usually startups, and these entrepreneurs usually pay a small fee to the crowd funding platforms to conduct their fund raising activity. For many platforms, if they fall short, they do not pay anything.

Thus, crowd funding appears to be a relatively cheap source of funding if one is successful. Also, the barrier to entry is low as anyone can put up a project to see crowd funding. Even though there is a risk of failure as popularity of a project with the public is difficult to predict, the financial cost of failure is low as project owners usually pay nothing to put up a project on a crowd funding platform. However, they do have to put in effort to develop marketing materials such as a prototype, marketing video and project website. These efforts, however, are not mandatory though they are associated with a higher probability of fund raising success (Lawton & Marom, 2013).

With the signing of the Jumpstart Our Business Startups (JOBS) Act in April 2012, it would soon be possible for the public to invest in small businesses in exchange for equity (Prive, 2012). Prior to this Act, only accredited investors (usually people who have at least $1 million net worth or earning at least $200,000 a year) and financial institutions such as venture capital funds could invest in private companies. Besides equity financing, the other alternative is loans from financial institutions or from friends and family. However, as of the writing of this thesis, the Securities and Exchange Commission (SEC) has yet to revise and implement rules pertaining to the spirit of this Act. As such, public investment in private companies in exchange for equity is still not yet possible.

1.2 Research Motivation

With the growing popularity of crowd funding, by understanding the advantages and disadvantages of crowd funding over traditional forms of entrepreneurial funding such as debt and venture capital, a small business can make a more informed decision on its choice of funding source. To do this, this research aims to answer the following questions through collection of data from online crowd funding platforms:

1. How does the cost of capital of successfully crowd-funded projects compare with traditional sources of funding?
2. What factors affect the probability of success in crowd funding? Are there any common drivers across different project types?

2 Literature Review

This chapter reviews the key concept of cost of capital used in this research. In addition, review of available resources for startups and privately held companies is also conducted for both crowd funding and traditional sources of funding. As crowd funding is primarily used by startups, entrepreneurs and small businesses for raising limited capital, raising funds through the issue of publicly traded equity is not comparable and hence not considered.

2.1 Finance Theory – Cost of Capital

The cost of capital is one of the fundamental tenets of finance theory – it is defined as the rate of return expected by the market to provide funding to an entity (Pratt & Grabowski, 2008). The entity is usually, but not limited to, a company – it can also be a project or an investment fund. In the case of a startup, the cost of capital will be the rate of return that the venture capital or angel capital investor expects from the company. For a unit trust fund, the cost of capital is the minimum rate of return that will entice the public to put their money in the fund – they will expect, at a minimum, that return from the fund under constant market conditions.

As for crowd funding, the cost of capital is the expected rate of return of the project by the group of individuals who have invested in it. This cannot be estimated directly as currently, crowd funding is only used in exchange for rewards in the United States. The United Kingdom has more progressive regulations permitting public investment in private companies and a popular website Crowd Cube has helped to enable such investments – companies seeking funding made their financials and other related data available on the platform for potential investors to peruse during a specified fund raising period, usually around two months (Crowd Cube, 2013). However, availability of past data is limited as Crowd Cube only makes data from a few demonstration cases available and it will be difficult to obtain data on unsuccessful cases publicly.

As such, regarding cost of capital estimation for crowd funding, it is best estimated from expected cost of the rewards as data is more readily available. This estimation is covered in section 3.4.1.

2.2 Sources of Traditional Funding

Companies traditionally turn to either debt and/or equity for financing. Debt financing and equity financing are very different and they have different costs of capital. For debt financing, creditors have claim on the cash flow of a company through the company's obligation on interest payment while equity investors lay claim to ownership of the company. At the moment, the only sources of equity financing available to startups and privately held companies are venture capital and angel investment. This section explores debt financing, venture capital investment and angel investment as suitable comparison with crowd funding.

2.2.1 Debt

At the point of research, crowd funding is being used for financing small projects and the target fund raising amount seldom exceeds $100,000. As such, this research focuses only on financing options that are viable comparisons with crowd funding. With this in mind, financing options used by large corporations such as issuing of bonds are not relevant as bond issuance needs credibility and an established market position for bond holders to have sufficient trust that the company will be able to meet its bond covenants. Also, micro-financing, which is a special case of debt financing, is not considered here. This is because micro-financing is usually meant to provide loans of small amounts to the poor, who usually have little or no credit history and limited assets. This is a different focus compared to crowd funding, which is meant for financing small projects by the public.

Thus, debt financing for small businesses is viable either through private loans from friends and family or through financial institutions using the U.S. Small Business Administration

(SBA) framework. For the former, the cost of capital is difficult to estimate as some people require implicit promises besides interest payments such as equity in the business and private favors. As such, due to uncertainties and difficulties in obtaining representative data, the option of private loans is omitted.

As for SBA loans, there are many types available, from short term loans to cover operational needs to long term loans for capital investments (U.S Small Business Administration, 2013). Among the various types of loans available, of interest to the research is the SBA Express loan, which provides a revolving line of credit up to $350,000 and the SBA 7(a) loan, which provides financing of up to $5 million. This is because short term credit is a more suitable comparison with crowd funding as the latter is usually used to provide capital for short term projects of less than a year since the means to raise funds are rewards. A summary of these loans and relevant terms and conditions is given in Table 1. The current prime rate is 3.25% (Bankrate.com, 2013).

In summary, the research compares SBA debt financing with crowd funding by assuming that the project could borrow on the SBA terms stated in Table 1 with consistent repayment until the expected date of delivering all its promised rewards.

Table 1
Summary of small businesses short term loans.

Program	Max Loan Amount	Guaranty	Guaranty Fees	Max Interest Rates	Qualification
7(a) Loan	$5 Million	85% for loans ≤ $150,000 75% for loans > $150,000	Up to 3.75% on guaranty portion of the loan	Up to prime + 4.25%	For profit small business with good credit rating, management and ability to repay
SBA Express	$350,000	50%		Up to 6.5%	Same as 7(a)

2.2.2 Venture Capital Investment

This source includes professionally run funds that invest in early stage startups in exchange for equity, with the purpose of earning large returns by undertaking substantial risks. For a venture capital fund, not all startups that it funds will become profitable – as such, these funds usually look for a startup company that has potential to grow exponentially such that when the venture capital fund exits several years after the initial investment, it would have made multiple times its initial investment.

Venture capital financing usually occurs in stages so as to reduce the cost of failures as the risk of loss decreases from stage to stage (Ruhnka & J.E., 1987). Money is provided to promising firms in exchange for equity and control of the firm and the fund aims to make money by exiting after several rounds of funding. The exit strategies vary – initial public offering (IPO), private equity sale to other investors, buyout by a larger firm or sale of a company's assets. An empirical study suggests that the returns are in multiple of the initial investment, with the average annualized log returns for investors at approximately 15% with a standard deviation of 89% (annualized arithmetic returns of 59% with standard deviation of 107%) (Cochrane, 2005). The standard deviation of the returns is much larger than the average market return. This is not surprising given the risky nature of venture capital investment – not all investments will give positive returns. In addition, the fees for venture capital fund administration add approximately 23% (mean value) of the total committed capital until the fund exits the investment (Metrick & Yasuda, 2010). This means that the expected annualized cost of capital if a company is venture capital funded should, depending on its valuation upon the fund's exit, be significantly more than 59%.

From the above description of venture capital, it appears that the early stage venture capital financing – the "start-up" or "seed" stage may be compared with crowd funding.

However, the early stage is but the first stage of many rounds of funding and it is very unlikely that the venture capital fund quits on a potentially successful or profitable firm after the first funding round by selling out its equity. As such, the cost of capital for just the early stage is difficult to measure.

In conclusion, venture capital investment differs from crowd funding in two major ways:

1. The nature of venture capital investment is staged over multiple years, compared to crowd funding's single stage funding.
2. Venture capital fund's goal is to sell out its share of the company after a few years but crowd funding is usually to fund just the initial stage of the company in return of products.

Thus, venture capital investment is not suitable as a comparison to crowd funding.

2.2.3 Angel Capital Investment

This source includes wealthy individuals or informal groups of such individuals who provide early stage funding to early stage startups for the same purpose as venture capital investment funds. The key difference between the two is that the angel investor makes the investment directly without going through a professionally run intermediary. Empirical evidence (Mason & Harrison, 2002) suggests that angel capital investment, like venture capital, is fraught with high risk of loss. In fact, not many of the investments make positive returns and these vary from less than 10% to more than 100% on exits.

The exit strategies of angel capital investment are similar to that of venture capital – buyouts, IPOs, sale of assets and private sale of equity to other investors. The empirical study mentioned earlier also determined the median investment holding period to be 4 years, which is much longer than crowd funding. As such, due to similar reasons with venture capital financing, angel capital investment is also unsuitable for a one-to-one comparison with crowd funding.

3 Data Collection

3.1 Data Collection Methodology

Past data on crowd funded products is readily available through Internet-based platforms such as Kickstarter and Indiegogo. There are a multitude of these platforms available. Out of these platforms, Kickstarter is chosen as it is one of the most established with over 35,000 projects funded (Kickstarter, 2013). Past project funding information is also easily available and searchable.

3.2 Selection of Data Set

3.2.1 Overview of Kickstarter Fund Raising Platform

Kickstarter is a fund raising platform for creative projects covering areas such as film, dance, game design and development, fashion and technology. It began operations on April 28 2009 and has since raised more than $450 million for over 35,000 projects (Kickstarter, 2013). On this platform, anyone can launch a project and the fund raising period is usually not more than 60 days (Yancey Strickler, 2011). Kickstarter is a rewards-based crowd-funding platform – this means that the public will make a pledge to a project in exchange for a reward. This reward can range from a simple thank you via email to a cutting edge technology product. If a project managed to meet or exceed its funding target during the stipulated fund raising period, Kickstarter will take 5% of the total raised amount as its fees. Also, there may be transaction fees involved, such as credit card or Paypal fees. However, if a project is unable to meet its funding target, the entire amount raised will be refunded to the backers and the project does not pay anything. Thus, Kickstarter provides a financially risk-free platform for anyone to raise funds for a project idea.

Compared to other online fund raising platforms, Kickstarter is much more established and is able to offer more data points. Its mode of operation is also simple and this makes cost of capital estimation much more straightforward. As such, Kickstarter is chosen as the primary source of data for this research.

3.2.2 Selection of Project Class

With over 3 years of data available, Kickstarter provides a rich set of data for analysis. Since cost of capital may differ between different project classes (e.g. cinema, dance, technology), this research is focused on estimating the cost of capital for companies/individuals that wanted to launch a technology product. Estimating the cost of capital requires knowledge of the commercial value of the product as well as its associated costs such as manufacturing, logistics and other administrative overheads. In this regard, obtaining and/or estimating the commercial value and cost of a technology product is simpler compared to intangibles such as a music album, film and dance. This is because for the latter, other factors such as popularity of the artist and the target market of the product may create significant bias in its production costs and commercial value.

3.2.3 Selection of Product Categories

The product categories were chosen at random to form a sample population of technology products that were seeking crowd-sourced funding. The selected categories and subcategories are given in Table 2 and this categorization is done by the author based on the description of the product on its fund raising website.

Table 2
Product categories and subcategories in the dataset.

S/N	Product Type	SubType	Examples
1	Camera		Sports action cameras, panorama cameras
2	Camera Accessory	Camera Control	Remote camera control, remote trigger
		Camera Support	Tripods, video stabilization systems
		Flash Accessory	Flash diffuser
		Lens Accessory	Special effects lens
		Others	Lens cap holder, balloon mapping kit
3	Custom Machine	3D Printer	Open Source 3D printer, preassembled 3D printer
		CNC Machine	Do-It-Yourself (DIY) CNC machine
4	Energy Efficiency		Power saving gadgets, smart light bulbs
5	Hobby Electronics		Add-on boards for Arduino-based processors, sensors for robot building hobbyists
6	Energy Generation and Storage		Solar powered chargers, next generation rechargeable batteries
7	Mobile Accessory	Cable Management	Cable winder, low profile charging cable
		Other Accessory	eWallet, attachment to turn phone into scanner
		Camera Attachment	Wide angle lens, zoom lens
		Protective Case	Phone case, skin, carrying case
		Mobile Dock	Charging station, docking station
		Mobile Entertainment	Game controller for smartphone, portable movie theater
		Portable Power	Portable battery pack, solar power charger
		Sound	Bluetooth speakers, sound amplifier
		Mobile Support	Phone tripod, phone/tablet stand
8	Mobility Enhancement		Powered skateboard, electric bicycle
9	Robotics		Educational kits, robotic kits for smartphones.
10	Watch		Watch kits for past generation iPod Nanos, custom built mechanical watches

3.2.4 Information Collected

The data collected was not meant to be exhaustive but to be of sufficient depth and quantity to be representative of a selected category. Keywords were used to search for projects in a particular category, for example, “iPhone” and “smartphone” for the mobile accessory product category, “camera” for the camera and camera accessory categories, and “energy” and “solar” for the energy storage and generation category.

For each data point, the following information was collected:

1. Name of project
2. Location of project
3. Product type
4. Product subtype (if applicable)
5. Funding target
6. Amount of money raised
7. Number of project supporters
8. End date of fund raising activity
9. Information on rewards, including:
    a. Description of reward
    b. Type of reward
    c. Number of supporters
    d. Minimum amount required for a particular reward level
    e. Expected delivery date
    f. Expected or actual retail cost of the reward if listed on Kickstarter or on the project website

The above information was obtained through the public Kickstarter website as well as through the project websites when available. Data collection was carried out over the course of approximately one month between Dec 2012 and Jan 2013. This collection period was deliberately kept to a minimum so that the collected data shows a snapshot of projects funded till the middle of January 2013. A total of 792 data points were collected across these product categories and summarized in Table 4 (see Chapter 4). Majority of the projects are attempts to at product commercialization while a handful of them are seeking funding for one-time do-it-yourself (DIY) efforts.

3.3 Key Research Assumptions

Even though Kickstarter has an extensive amount of information available for browsing on its website, there are gaps in the data collected and these gaps are filled using the assumptions given in this section. In addition, assumptions have to be made in order to process the data and analyze it for trends. All these assumptions are grouped as follows: pricing assumptions, costs assumptions and reward delivery assumptions.

3.3.1 Pricing Assumptions

The key assumptions have to do with pricing information. The data obtained has missing values primarily because it is difficult to value certain rewards, such as online mention of contribution, sending of thank you postcards, customized or personalized products that are pegged at a higher reward level and all inclusive "meet the founder" or "visit the factory" package. As a result, assumptions were made as to how much their retail price should be and these assumptions are classified as per Table 3.

For many of the projects, the total amount raised does not match the amount raised through the reward levels (i.e. multiply the number of supporters by the reward price). This discrepancy is likely due to one or more of the following reasons:

1. Some supporters give more than the minimum price stated for a reward level.
2. Some supporters paid more so as to purchase multiple quantities of the product.

Thus, for the purpose of this research, it is important to make the following set of assumptions:

- A supporter pays only the minimum amount stated for a reward level to support the project.

- The quantity of the product stated at a reward level is what the supporter wants to purchase.

Anecdotal evidence from the Kickstarter website suggests that project owners prefer to track different product colors using different reward levels, e.g. one reward level for the product in orange and another for the product in white. Extending this idea to tracking product quantity, project owners will similarly prefer to track required product quantity through the use of different reward levels, e.g having one reward level for one iPhone case and another reward level for two of the same iPhone cases. Thus, the set of assumptions stated above are reasonable. As a result, the excess funds raised are assumed to be donated to the project – supporters give the money to the project without requiring anything in return. This means that the money is essentially available to the project without cost, after deducting the fees charged by Kickstarter and credit card companies.

3.3.2 Costs Assumptions

The next set of assumptions deal with costs. The key assumption here is the cost of goods sold associated with each product. Unless otherwise stated in Table 3, this cost of goods sold is assumed to be 80% of the retail price. This assumption is reasonable because the scale in which most of these projects operate in is small; hence, operational cost savings from economy of scale is limited. In addition, their supply chains are unlikely to be highly optimized as these projects are either in their preliminary production phase or doing a one-time sale of products. In addition, a sensitivity study is carried out to ascertain the effect of this assumption on the analysis (see section 5.3).

If a project is successfully funded, Kickstarter takes 5% of the amount raised as its fees. In addition, payment processing fees can range from 3% to 5% of the total funds raised

(Kickstarter, 2013). These additional fees come from the usage of Amazon payment services on the US based Kickstarter website, and credit card processing and value added tax on the fees paid (for UK based projects). Choosing the lower bound for this fee will reduce the estimated cost of capital obtained from crowd-sourced funding and this may be overly optimistic. As such, this research assumes the worst case scenario of 5% for the payment processing fee.

3.3.3 Reward Delivery Assumptions

The next assumption deals with the expected product delivery date. Many of the projects deliver different promises at different times – for example, an online mention may be done almost immediately while a 3D printer might only be delivered six months from the end of the fund raising period. Supporters of a project may be influenced by this date – if the delivery is too far in the future, the public may expect a significant price discount to take the risk and support the project. Thus, getting an accurate picture of this expected delivery schedule is important for estimating the cost of capital. As such, whenever possible, the expected delivery date stated on the project website will be used because that will be the time when supporters expect to get their rewards. However, for projects that attempted to raise funds prior to October 2011, the expected delivery date information is not available. It is thus assumed that supporters for these projects were not particular about when the project would deliver their rewards as long as they were kept updated. As such, this expected delivery date is estimated from the project update section, which is used primarily by the project owners to update their supporters on the progress of the project.

In addition, the resolution of this expected delivery date is in months. Based on this assumption, if the end of a successful fund raising campaign is in April 2012 and supporters expect delivery of its reward in the same month, the expected delivery duration is considered to be 1 month.

Table 3
Summary of pricing assumptions.

Type	Cost to Project	Examples	Remarks
Non tangible items or items with little commercial value	$0	Online mentioning of names, customized thank you videos and graphics, personal thank you letters and other products that are not typically for sale	The products in this category have little commercial value. As such, it is fair to assume that they do not have a significant cost to the project.
Customized / Personalized / Limited Edition items	Same manufacturing cost as sister product	Serialized products, products with custom colors and engraved products	These products have the same functionality as their ordinary versions. Small scale customization does incur cost but it is likely to be insignificant.
No retail price is stated	Manufacturing cost is based on Kickstarter price	T-shirts, project merchandize such as custom bags and one of a kind product such as custom electronics board	Since no retail price is available, the assumption that the Kickstarter price is the retail price is valid.
Labor	$20 per hour	Taking supporter on factory tour, online meeting and coaching	Assumed to be similar to the wages of a young college graduate (O'Shaughnessy, 2012)
Dinner	$30 per head	Dinner with project team	Finances are usually tight for projects and there is usually little cash to spare on extravagance.
Party	$30 per head	Product launch party, funding completion party	Project is more likely to try to keep the cost of the party down than to splurge Kickstarter funds on the party.
Postcard	$1 each	Thank you postcards	Postcards cost money to purchase and the cost here is meant to cover both postcard and postage.
Prints	As per market price on Internet	5x7 photo print and 11x18 print	Even though the intellectual property of prints do have value, they are of no cost to the project as the project owns the rights to them. As such, the only cost to project is the cost of printing.
Commercial products included in the reward level	Product's own retail price	iPod nano and laptop computer	The project is likely to have purchased the item off the shelf and as such, it is safe to assume that its cost to the project is its retail price.
T-shirts given with other products and not priced	Manufacturing cost is based on retail price of $25 per T-shirt	Some projects give out T-shirts on certain reward levels as part of the reward	In the data set, most of the levels at which the T-shirt is the sole reward are priced at $25. As such, for consistency, T-shirts not priced explicitly will be priced at $25.
Travel	Air ticket based on current Internet prices, hotel assumed to be $200 per night	Flight to Stockholm to visit project team and hotel stay in the city coupled with factory tour	It is assumed that the projects will procure these services for the supporter unless otherwise stated.

3.4 Additional Computed Factors

This section describes the additional factors and metrics that are computed from the collected data set:

- Project cost of capital estimation
- Weighted average delivery time
- Days since Kickstarter launch
- Proportion of free capital
- Success Rate

3.4.1 Project Cost of Capital Estimation

The public who donates money to support a project can be seen as investors and their returns can be seen in the form of the rewards pegged at each level of financial commitment. There is no other investment return that these investors can expect to receive for this investment. As such, the expected gain from this investment is only in the difference between the expected value of the reward at the time of delivery and the amount paid for it. Thus, the net present value of the investment must be equivalent to zero when all the rewards have been delivered. As such, the estimated cost of this investment capital for the project should be equal to its internal rate of return:

$$NPV = -I_0 + \frac{R_1}{1 + CoC} + \frac{R_2}{(1 + CoC)^2} + \frac{R_3}{(1 + CoC)^3} + \cdots = 0 \qquad (1)$$

I_0 is the net investment amount because there are costs associated with using Kickstarter as a platform for fund raising (refer to section 3.3.2). As the project pays these costs immediately at the end of its successful fund raising period (i.e. period 0), I_0 is the net amount of investment available to the project.

R_1, R_2, $R_{3,\ldots}$ are computed as follows:

$$R_i = M_f \times Retail\ Price\ of\ Reward \qquad (2)$$

Where R_i is the estimated cost of rewards, M_f is the proportion of the retail price of the reward that is estimated to be its manufacturing and delivery cost, i.e. cost of goods sold. For this analysis, as per section 3.3.2, M_f is assumed to be 80% of the retail price.

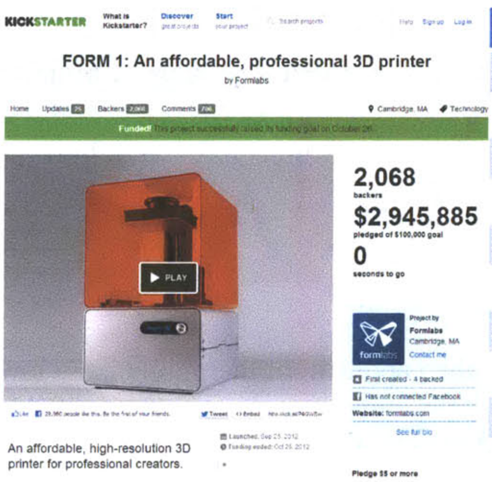
As mentioned in section 3.3.3, the data collected on expected delivery dates of projects has the resolution of one month. Thus, the estimated cost of capital of the project is a monthly rate based on the duration of the project.

The estimated cost of capital can be interpreted as follows:

- If it is negative, it means that the cost of obtaining the capital from the public is so low that the project actually makes money from its fund raising activity after considering the costs of delivering the promised rewards.
- If it is positive, it means that the project has to pay to obtain capital from the public on top of delivering the promised rewards.

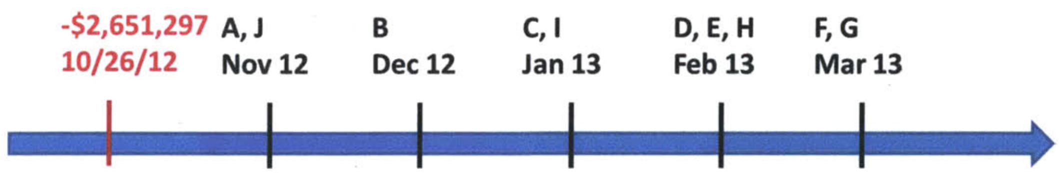
As an illustration, Figure 1(i) shows a description of one project from the collected data set. Figure 1(ii) summarizes all the rewards offered for supporters of the Form 1 3D printer. The estimated cost of each reward is computed from the reward price (Price) based on the assumptions in section 3.3 using equation (2). Figure 1(iii) places these cash flows on a timeline with the net initial investment in red (after deducting Kickstarter and payment processing fees) and the date shown being the end date of fund raising by the project. As explained above, since the expected delivery is given in terms of months, this end date of fund raising is rounded down to the beginning of October 2012 such that for rewards delivered within the same month, they are considered to be delivered in period 1 (i.e. one month after the fund raising end date). This ensures that the delay between the end of fund raising and the delivery of the reward can be taken into account for the cost of capital estimation.

Figure 1
Kickstarter project example illustration.



Reward	Price	Backers	Reward	Delivery Month	Estimated Cost
A	$5	276	Virtual model	Nov 12	$5
B	$29	149	T shirt	Dec 12	$29
C	$39	425	Gyrocube	Jan 13	$39
D	$2299	25	Product	Feb 13	$3,299
E	$2499	99	Product	Feb 13	$3,299
F	$2699	541	Product	Mar 13	$3,299
G	$2999	349	Product	Mar 13	$3,299
H	$5000	8	Collector's edition	Feb 13	$3,299
I	$8000	3	Collector's edtion + meet team	Jan 13	$8,000
J	$10,000	3	Product + dinner	Nov 13	$10,000

(i) (ii)



(iii)

(i) shows the Kickstarter webpage for a project (Formlabs, 2012); (ii) summarizes the various reward levels and their pricing; (iii) illustrates a timeline of the fund raise date and expected delivery of each reward level.

3.4.2 Weighted Average Delivery Time

The weighted average delivery time is defined as follows:

$$D_T = \sum_{i=1}^{n} i \times \frac{R_i}{R_{tot}} \tag{3}$$

D_T is the weighted average delivery time, R_i is the cost of the reward that is to be delivered i-th period (in months) from the end of fund raising date and R_{tot} is the total cost of all the rewards. Note that R_{tot} is the sum of the cost of all the rewards across all periods and it is not discounted. This metric provides the mean delivery time based on the portion of rewards that is expected to be delivered in the i-th period; as such, the discount rate need not be considered for the computation of this factor.

3.4.3 Relative End Fund Raising Date

Kickstarter was launched on April 28 2009. Using this day as day zero, this factor keeps track of the relative fund raising end date of a project so that the dates of different projects can be compared and analyzed for trends. For example, a project with a fund raising end date of June 21 2011 will be 784 days relative to the launch of the Kickstarter platform.

3.4.4 Proportion of Free Capital

The proportion of free capital describes how much money is given to a project without any expectation of a tangible reward. This metric is computed using the following equation:

$$Free\% = \frac{Amount\ Raised - Total\ Estimated\ Value\ of\ Rewards}{Amount\ Raised} \qquad (4)$$

The total estimated value of rewards is the total amount given by all the supporters in expectation of tangible rewards. This excludes donations or money given in exchange of intangibles such as online mentioning of names and thank you cards. In other words, this metric means how much money is donated to the project as a percentage of the total raised amount.

This metric can also be seen as the complex outcome of the popularity of a project and the price levels of rewards. In particular, one would expect a popular project to have more donations compared to an unpopular one, all else being equal. Also, if the price levels of a popular project is too high, those who wish to support the project would donate money instead of coming up with a significant sum to exchange for a reward so that they could contribute to the launch of the product (altruism).

3.4.5 Success Rate

There are two kinds of success rates that we are interested in – overall success rate and success rate within a product type or subtype. Regardless of which success rate is chosen, the computation is similar:

$$Success = \frac{Number\ of\ successful\ projects}{Total\ number\ of\ projects} \tag{5}$$

If equation (5) is used to compute success rate within a product type or subtype, the nominator used is the number of successful projects within the product type or subtype and the denominator is the total number of projects within the product type or subtype.

3.4.6 Debt Cost of Capital

The debt cost of capital is computed by finding the effective annual interest rate on the loan amount using the following equation:

$$EAR = \left(1 + \frac{APR}{12}\right)^{n} \tag{6}$$

Where EAR is the effective annual rate, APR is the stated annual percentage rate and n is the number of months of funding required. n is estimated from the furthest expected delivery month for all the rewards in a project. For example, if a project promises to deliver a reward in 2 months and another in 4 months, n will be equal to 4.

4 Analysis

For the analysis, we are interested in determining the factors which contribute significantly to:

(1) Whether the project gets funded (variable FUNDED).

(2) The magnitude of the estimated cost of capital for a successful project (variable ECOC).

(3) Success rate of a project type (variable SUCC).

Regression is used for this analysis. For a meaningful analysis, additional factors are computed from the collected data set and the definitions of these factors are given in section 3.4.

4.1 Overview of Data Set

The collected data set has 792 projects (data points), of which 344 are projects that managed to raise at least their targeted amount. This gives an overall success rate of 43%. Key statistics of the data set is given in Table 4 while Table 5 gives the statistics with product subtypes.

The spread of funding target and raised amount for each product type is given in Figure 2. The blue box is the spread of the funding targets for projects while the red box shows the spread of the total amount raised for projects for a particular product type. From the figure, the following is observed:

a) For the camera, custom machine, efficiency, energy, mobility and watch categories, projects which are successfully funded seem more likely to exceed their funding target by a large margin. This means that either much more supporters gave to these projects than expected or that each supporter gave more than what was required for the reward levels, i.e. money is donated to these projects. Regardless, it is implied that the successful projects in these categories tend to be popular with supporters, i.e. products with mass appeal.

b) Successful projects in the camera accessory, hobby electronics and robot categories appear to be usually funded close to their funding targets. This suggests that these products do not have the mass appeal of (a).

c) The mobile accessory category appears to be a difficult category for projects to raise funds:

   i. Supporters in this category appear to be very price conscious as the red box is below the blue box, suggesting that cheaper projects tend to have a higher probability of fund raising success.

   ii. There are also many outliers in column for the red box and this suggests that some of the products are wildly popular. This is because there are more outliers compared to the blue box, suggesting that some projects that got funded received much more than they had targeted.

Figure 3 shows the spread of the estimated cost of capital for projects in different product types. Watch is the only product type that shows a median positive cost of capital compared to the others – this suggests that projects in this category face higher funding cost and this cost could possibly be in terms of product discounts expected by supporters.

Figure 2
Box plot of spread of target amount against raised amount.

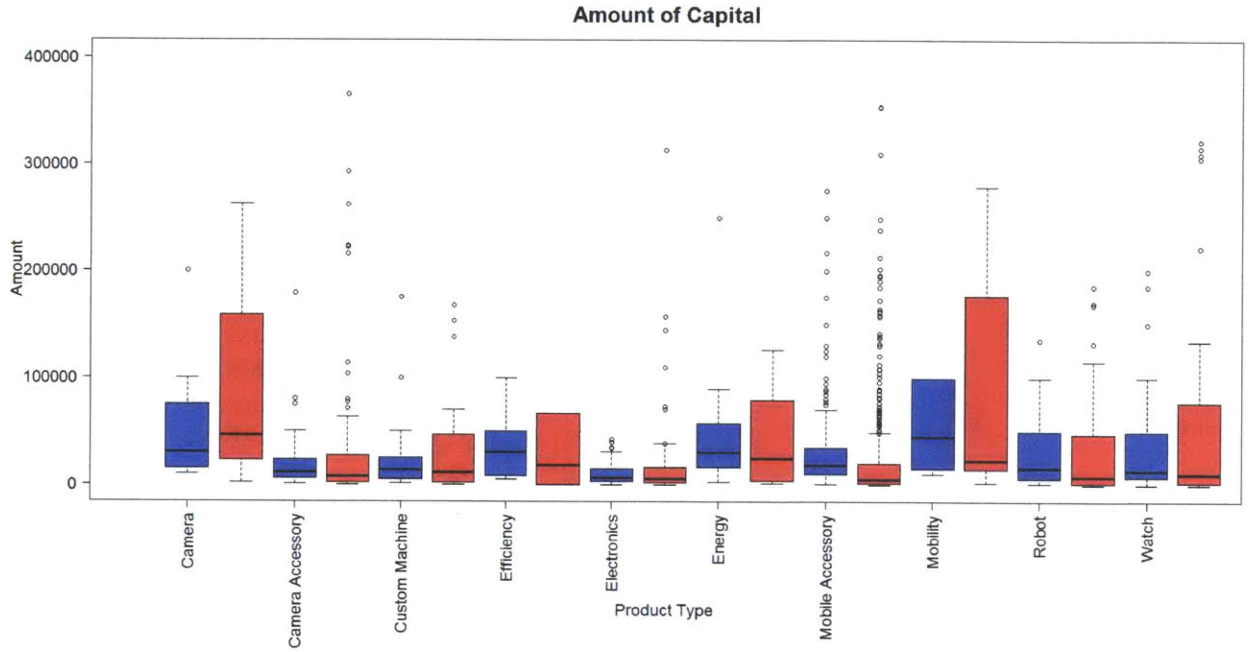


Figure 3
Box plot comparing estimated cost of capital spreads across product types.

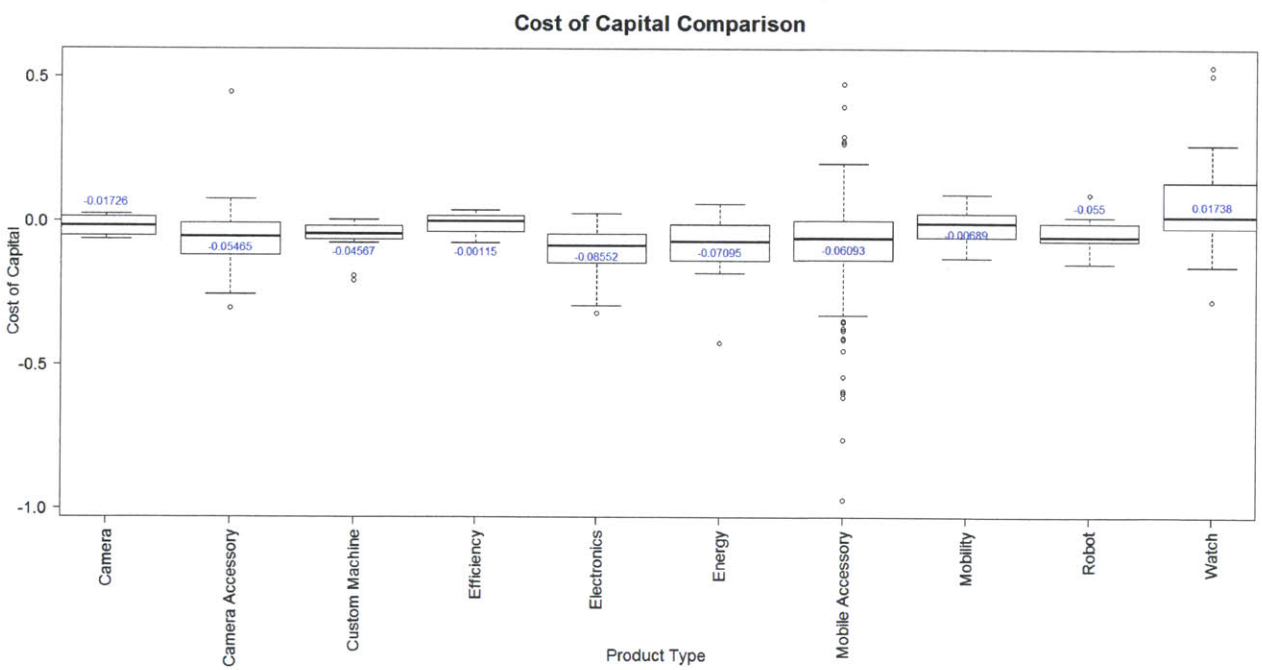


Table 4
Key statistics of data set with product types.

Product Type	Success Rate	Count	Supporters	ECoC	Free%	Target Funding	Raised Amount	Delivery Time
Camera	62.50%	8	504.63 (965.24)	-1.18% (3.08%)	8.29% (7.58%)	56,312.50 (64,968.64)	125,703.63 (190,396.41)	3.72 (1.18)
Camera Accessory	48.53%	68	399.60 (890.99)	-2.51% (8.89%)	12.53% (11.96%)	26,363.22 (57,545.71)	44,766.54 (93,731.52)	3.18 (2.09)
Custom Machine	47.50%	40	183.20 (421.93)	-2.55% (4.72%)	8.13% (11.69%)	34,348.75 (81,725.11)	131,833.85 (481,158.31)	4.65 (2.29)
Efficiency	50.00%	6	1,651.33 (3,720.13)	-0.67% (3.79%)	15.91% (15.43%)	37,166.67 (35,073.73)	236,489.50 (528,829.63)	5.30 (0.53)
Electronics	61.54%	65	294.83 (789.52)	-6.31% (8.33%)	14.19% (14.28%)	10,589.40 (10,515.04)	22,141.40 (48,322.18)	3.17 (0.98)
Energy	66.67%	15	370.33 (410.50)	-6.27% (12.24%)	10.73% (9.37%)	50,655.73 (61,293.04)	44,160.53 (45,824.09)	3.03 (1.57)
Mobile Accessory	37.09%	515	405.41 (1,044.45)	-3.02% (11.25%)	17.59% (16.87%)	33,348.08 (59,576.88)	32,287.23 (106,761.86)	3.06 (1.75)
Mobility	70.00%	10	244.50 (342.43)	-1.07% (6.24%)	10.43% (7.49%)	55,199.90 (41,000.69)	112,645.80 (155,095.84)	4.79 (3.31)
Robot	48.28%	29	248.55 (335.92)	-2.00% (4.41%)	12.16% (17.37%)	34,074.48 (36,225.59)	42,610.07 (59,550.67)	4.26 (1.71)
Watch	61.11%	36	2,628.14 (11,593.16)	3.70% (14.85%)	11.92% (10.81%)	39,575.00 (55,394.18)	368,320.24 (1,706,238.02)	4.42 (2.98)

In the table, Product Type is the associated category of the product, Success Rate is the percentage of projects that were able to raise funding successfully, Count is the total number of projects associated to a product type, Supporters is the number of financial contributors to the project, ECoC is the estimated cost of capital (computed as per section 3.4.1), Free% is the percentage of funds raised that is not tied to a tangible reward (free money computed as per section 3.4.4) and the delivery time is the time from end of fund raising to the expected month of reward delivery (computed as per section 3.4.3). The numbers given in the Supporters, ECoC, Free%, Target Funding, Raised Amount and Delivery Time are the mean of the projects associated with each product type and the numbers in parentheses are their standard deviations.

Table 5
Key statistics of data set with product subtypes.

Product Type	Product SubType	Success Rate	Count	Supporters	ECoC	Free%	Planned Amount	Raised Amount	Delivery Time
Camera	Camera	62.50%	8	504.63 (965.24)	-1.18% (3.08%)	8.29% (7.58%)	56,312.50 (64,968.64)	125,703.63 (190,396.41)	3.72 (1.18)
Camera Accessory	Camera Accessory	80.00%	5	362.00 (245.58)	-12.03% (12.78%)	13.78% (8.70%)	8,200.00 (6,889.48)	13,933.40 (12,108.23)	2.54 (1.72)
Camera Accessory	Camera Control	50.00%	8	745.00 (1,235.61)	-1.00% (4.59%)	7.00% (2.91%)	25,625.00 (22,721.53)	56,414.88 (76,741.06)	5.39 (4.49)
Camera Accessory	Camera Support	43.75%	48	381.50 (930.38)	-1.99% (9.19%)	14.18% (14.16%)	31,358.33 (67,204.45)	51,454.21 (106,072.37)	2.87 (1.43)
Camera Accessory	Flash Accessory	66.67%	3	177.67 (66.52)	0.19% (0.95%)	10.71% (2.94%)	6,666.33 (2,886.17)	7,716.33 (961.89)	2.00 (0.00)
Camera Accessory	Lens Accessory	50.00%	4	139.50 (239.26)	-2.02% (2.53%)	5.58% (4.25%)	5,375.00 (478.71)	7,547.00 (11,015.74)	4.47 (0.67)
Custom Machine	3D printer	50.00%	24	236.96 (534.84)	-2.38% (4.56%)	6.38% (10.29%)	50,433.33 (103,032.05)	209,308.29 (613,704.46)	4.08 (1.97)
Custom Machine	CNC Machine	43.75%	16	102.56 (112.63)	-2.81% (5.09%)	11.14% (14.09%)	10,221.88 (7,298.61)	15,622.19 (20,525.04)	5.63 (2.63)
Efficiency	Efficiency	50.00%	6	1,651.33 (3,720.13)	-0.67% (3.79%)	15.91% (15.43%)	37,166.67 (35,073.73)	236,489.50 (528,829.63)	5.30 (0.53)
Electronics	Electronics	61.54%	65	294.83 (789.52)	-6.31% (8.33%)	14.19% (14.28%)	10,589.40 (10,515.04)	22,141.40 (48,322.18)	3.17 (0.98)
Energy	Energy	66.67%	15	370.33 (410.50)	-6.27% (12.24%)	10.73% (9.37%)	50,655.73 (61,293.04)	44,160.53 (45,824.09)	3.03 (1.57)
Mobile Accessory	Cable Management	70.59%	17	1,422.47 (1,556.42)	-5.42% (19.19%)	19.97% (21.68%)	23,361.76 (19,128.82)	52,650.00 (61,858.63)	3.18 (1.15)
Mobile Accessory	Mobile Accessory	56.14%	57	799.14 (1,119.59)	-3.21% (12.17%)	10.81% (9.42%)	45,427.63 (74,670.10)	73,164.37 (141,479.44)	3.49 (2.01)
Mobile Accessory	Mobile Cam	47.06%	17	309.29 (366.15)	-1.97% (6.02%)	18.68% (17.51%)	42,617.65 (43,535.02)	23,414.82 (30,772.74)	2.72 (1.04)
Mobile Accessory	Mobile Case	28.95%	190	154.87 (403.32)	-3.26% (12.16%)	20.06% (20.16%)	25,804.08 (33,883.28)	14,045.41 (54,932.52)	2.39 (1.22)
Mobile	Mobile Dock	34.04%	47	546.72	-2.49%	18.37%	64,297.87	58,285.72	2.87

Accessory				(1,863.53)	(6.97%)	(15.07%)	(143,999.19)	(217,672.72)	(0.94)
Mobile Accessory	Mobile Entertainment	46.67%	15	414.00 (724.85)	-7.62% (17.06%)	33.28% (24.52%)	29,426.60 (22,338.45)	29,446.33 (37,825.32)	4.56 (3.39)
Mobile Accessory	Mobile Power	60.00%	15	834.93 (1,413.07)	-1.00% (5.54%)	13.09% (13.10%)	44,200.00 (35,725.04)	84,156.07 (115,248.45)	4.04 (1.43)
Mobile Accessory	Mobile Sound	45.16%	31	469.87 (978.46)	-3.92% (12.63%)	8.83% (5.13%)	25,016.13 (29,907.21)	51,239.77 (168,963.80)	3.43 (1.46)
Mobile Accessory	Mobile Support	30.16%	126	360.12 (1,104.50)	-2.05% (9.01%)	19.80% (14.94%)	29,036.20 (37,911.63)	19,554.97 (68,020.65)	3.15 (2.15)
Mobility	Mobility	70.00%	10	244.50 (342.43)	-1.07% (6.24%)	10.43% (7.49%)	55,199.90 (41,000.69)	112,645.80 (155,095.84)	4.79 (3.31)
Robot	Robot	48.28%	29	248.55 (335.92)	-2.00% (4.41%)	12.16% (17.37%)	34,074.48 (36,225.59)	42,610.07 (59,550.67)	4.26 (1.71)
Watch	Watch	61.11%	36	2,628.14 (11,593.16)	3.70% (14.85%)	11.92% (10.81%)	39,575.00 (55,394.18)	368,320.24 (1,706,238.02)	4.42 (2.98)

The descriptions of the columns are as per Table 4, with the addition of the product subtype, which is the subtype associated with the product. This gives the product type segregation more resolution.

4.2 Analysis Methodology

Regression analyses are used for this project[1] – multivariate linear regression and limited dependent variable regression models. Multivariate regression methods are chosen because it is likely that the three explained variables in question, FUNDED, ECOC and FSUCC, are dependent on more than one explanatory variables. In addition, the data set does not include all the possible factors such as product appeal, need and willingness to pay and this may reduce the goodness of fit of the model. The information on regression in this section is based on a popular econometrics textbook. For further information and derivation, please refer to Wooldridge's Introductory Econometrics: A Modern Approach, 2009 edition (Wooldridge, 2009).

4.2.1 Multivariate Linear Regression

4.2.1.1 Overview

Multivariate linear regression involves attempting to find a line of best fit to the available data:

$$y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \cdots + u \tag{7}$$

where y is the explained variable, α is the intercept, β_1, β_2,... are the coefficients of the explanatory variables x_1, x_2,... and u is the noise associated with measurement data. Since we will never be able to get the actual value of y as that will require infinite amount of data x_1, x_2,..., by using the method of Ordinary Least Squares Estimates (OLS), we can estimate equation 5-5:

$$\hat{y} = \hat{\alpha} + \widehat{\beta_1} x_1 + \widehat{\beta_2} x_2 + \cdots \tag{8}$$

[1] For processing, both Microsoft Excel and R statistics packages are used. Excel is used primarily for linear regression as the data set is collected using the spreadsheet software. R is more suited for limited dependent variable model regression and it is used for that purpose. The input to the regression functions in R is created by using Excel to output the data points using the comma separated values (CSV) format.

where ŷ is the estimate of y (fitted values), $\hat{\alpha}$ is the estimate of α, and $\widehat{\beta_1}, \widehat{\beta_2}$,... are the estimates of β_1, β_2,... The residual is the difference between the fitted value and the actual observed value and the goodness-of-fit is ascertained by the R-squared of the regression, which is also known as the coefficient of determination:

$$R^2 = \frac{SSE}{SST} = 1 - \frac{SSR}{SST} \quad (9)$$

SST is the total sum of squares, SSE is the explained sum of squares and SSR is the residual sum of squares. These values, including R^2, are usually computed by statistics packages. A high value of R^2 indicates that the regression model is a good fit to the data set.

4.2.1.2 Interpretation of Results

The goodness-of-fit is computed from equation (9). The significance of a factor is considered using a 2-tail t-test with the null hypothesis that the factor in question does not contribute to the multivariate linear regression model:

$$H_0: \beta_j = 0 \quad (10)$$

In equation (10), j refers to any of the explanatory variables in the regression model. The rejection rule, using t-statistic is:

$$H_1: \left| t_{\widehat{\beta_j}} \right| > c \quad (11)$$

where c is the level of significance (usually at 5% level or smaller). This computation is usually done by the statistics package.

4.2.2 Limited Dependent Variable Models

4.2.2.1 Overview

The multivariate linear regression model works well for continuous explained variables; however, it is unable to handle limited dependent variables, which are discrete variables that can only take on certain values. For this analysis, the variable FUNDED is a special case of the limited dependent variable – it only takes on values of zero and one. As such, either the logit regression model or the probit regression model can be used.

The logit model uses the following logistic function for regression:

$$F(z) = \frac{e^z}{(1 + e^z)} \tag{12}$$

The profit model, on the other hand, uses a standard cumulative distribution function:

$$F(z) = \int_{-\infty}^{z} f(t)dt \tag{13}$$

Regardless of the model used, the function is always a cumulative distribution function that gives a value between zero and one for all real z. In addition, the generic form of the regression model used to describe the result is as follows:

$$P(y = 1|x) = F(\alpha + \beta_1 x_1 + \beta_2 x_2 + \cdots) \tag{14}$$

For both logit and probit models, the method of maximum likelihood estimation (MLE) is used to obtain the estimator for the limited dependent variable and the coefficients of the explanatory variables. The Wald test, similar to the t test used in the linear regression model, is then used to test the significance of the each factor. All these are done using the statistics packages on a computer.

4.2.2.2 Goodness-Of-Fit

For either probit or logit models, there is no ideal method to compute goodness-of-fit. For this research, the Akaike Information Criterion (AIC) is used as it is the default method used by R, a statistics package chosen for this research. The AIC is defined by (Akaike, 1974):

$$\begin{aligned} AIC = (-2)\log(maximum\ likelihood) \\ + 2(number\ of\ independently\ adjusted\ parameters) \end{aligned} \tag{15}$$

It is an estimate of the maximum likelihood of the regression model, which has already been computed. As such, it is easy to compute. However, by itself, AIC does not have much meaning but used comparatively (e.g. comparing the results of logit regression and probit regression), it can identify the model that is a better fit to the data set (smaller number means a better fit).

4.3 Data Selection and Transformation

4.3.1 Data Selection

The following variables are used for the analysis:

1. Product type
2. Product subtype (if applicable)
3. Funding target
4. Amount of money raised
5. Number of project supporters
6. End date of fund raising activity
7. Estimated cost of capital (computed based on section 3.4.1)
8. Weight average delivery time (computed based on section 3.4.2)
9. Relative end fund raising date (computed based on section 3.4.3)
10. Proportion of free capital (computed based on section 3.4.4)

With the exception of variables (1) and (2), the rest of the data are continuous variables and no special transformation is required prior to regression analysis. Variables (1) and (2) are categorical variables; thus, they have to be transformed appropriately prior to analysis.

4.3.2 Data Transformation

Categorical data is transformed to dummy variables prior to processing (Shmueli, Patel, & Bruce, 2010). This is done by setting (n-1) binary variables for n categories. For example, if there are 10 product types, there will be 9 mutually exclusive binary variables, with a one indicating that the project belongs to a product type. The 10th product type is represented by defining it to be not represented by any of the 9 variables, i.e. the values of the 9 variables are equal to zero. This is known also as the base or the reference case.

For the purpose of this analysis, the base case is chosen to be the energy efficiency product type. This is because this product type has a success rate of 50.0% (see Table 4), which makes the analysis meaningful as if any of the product type is positive or negative significant, it would mean that the product type has a higher or lower chance of success respectively.

4.4 Results

The results of each of the following explained variables are given in this section:

(1) Whether the project gets funded (variable FUNDED). This variable is computed based on whether the amount of money raised is more than the funding target.

(2) The magnitude of the estimated cost of capital for a successful project (variable ECOC). This variable is computed as per section 3.4.1.

(3) Success rate of a project type (variable FSUCC). This variable is computed as per section 3.4.5.

To perform regression on each of them, explanatory variables are selected from the data set based on whether the variables may logically explain the trend shown by the explained variable. For example, the name of the project and its location are unlikely to play any significant role in influencing the outcome of the explained variable. Also, explanatory variables must be computed independent of the explained variable. For example, ECOC is computed only when FUNDED is true, i.e. ECOC will have a strong correlation to FUNDED as its computation is dependent on FUNDED. As such, ECOC should not be used as an explanatory variable for FUNDED. The reverse is also true.

4.4.1 Regression on FUNDED Variable

This aim of this regression is to identify factors that influence whether a project will successfully meet its funding target. FUNDED variable is a special case of the limited dependent variable – it is a binary variable that indicates whether a project is funded (value of one) or not (value of zero). As such, the regression method of choice is either probit or logit. Both methods are explored and the best fit model is selected based on its AIC value.

The following variables are used for this regression analysis. Product subtypes are ignored as having too many variables may dilute the effects of other variables that may be more significant. In addition, variables that are computed only when a project is successfully funded (such as estimated cost of capital and proportion of free capital) are also dropped from the analysis as they would not be able to explain why a project was not funded.

1. Funding target
2. Number of project supporters
3. Relative end fund raising date
4. Product type (split into 9 different binary variables):
    a. Camera
    b. Camera accessory
    c. Custom machine
    d. Hobby electronics
    e. Energy generation and storage
    f. Mobile accessory
    g. Mobility enhancement
    h. Robotics
    i. Watch

j. Energy efficiency (base case, not represented by any of the dummy categorical variables)

4.4.1.1 *Probit and Logit Regression Models Results*

Table 6 shows the results of the probit and logit regression on FUNDED using product types as part of the explanatory variables. The AIC of the logit regression model is lower than that of the probit model (462.74 against 488.28). In addition, the logit model is easier to interpret compared to the probit model. As such, the logit model is chosen for the interpretation of factors influencing the explained variable, FUNDED.

At 5% significance level, the significant factors are the target funding (PLANNED), number of supporters (BACKER) and the mobility enhancement product type (MOB).

Table 6
Results summary of probit and logit regressions on FUNDED variable.

Dependent Variable	Probit Estimate	Logit Estimate
Continuous Variables		
Funding target	**-0.0000490 (0.00000509)*****	**-0.000105 (-0.0000114)*****
Number of supporters	**0.00862 (0.000728)*****	**0.0194 (0.00177)*****
Relative end fund raising date	**0.000661 (0.000318)****	0.000986 (0.000581)*
Discrete Variables		
Camera	0.8924 (0.9026)	1.584 (1.681)
Camera accessory	-0.2579 (0.7092)	-0.4337 (1.314)
Custom machine	0.1983 (0.7182)	0.2948 (1.33)
Hobby electronics	0.1163 (0.7046)	0.1435 (1.305)
Energy generation and storage	0.7348 (0.9085)	1.352 (1.699)
Mobile accessory	-0.6186 (0.6832)	-1.085 (1.271)
Mobility enhancement	**2.598 (1.060)****	**5.311 (2.197)****

Robotics	0.2956 (0.7581)	0.4552 (1.397)
Watch	0.3218 (0.7309)	0.4583 (1.348)
Constant term	-0.901 (0.760)	-1.428 (1.411)
Null deviance	1084.25 (791 degrees of freedom)	1084.25 (791 degrees of freedom)
Residual deviance	462.28 (779 degrees of freedom)	436.74 (779 degrees of freedom)
AIC	488.28	462.74
N of observations	792	792

The table summarizes the results of multivariate regression of various parameters using both logit and probit regression models. Data for all of the parameters are obtained empirically. For the discrete variables, the base case is a project with a product aimed at improving energy efficiency. The estimate for each of these discrete variables indicates how the probability of the project obtaining funding change if the product belongs to the particular product type instead of the base case. *, ** and *** indicate the statistical significance of the variable at 10%, 5% and 1% levels respectively. The variables that are significant at 5% significance level are in bold.

4.4.1.2 Interpretation of Coefficients

The logistic equation is given as follows:

$$logit(p) = ln\left(\frac{p}{1-p}\right) = \ln(odds(p)) = \alpha + \beta_1 x_1 + \beta_2 x_2 + \cdots \tag{16}$$

Where p is the probability of the project raising sufficient funds to meet its target, i.e. P(FUNDED = 1). By taking the exponential of equation (16):

$$odds(p) = e^{(\alpha+\beta_1 x_1+\beta_2 x_2+\cdots)} \tag{17}$$

Thus, each of the coefficients can be interpreted as the change in odds ratio due to a unit change in the associated continuous explanatory variable. For product type dummy variables, these odds ratios can be seen as odds ratios between different product types, i.e. the change in odds for a product type compared to the base product type. Also, since exponential coefficients are always positive and $e^0 = 1$, therefore, if the odds ratio is less than 1, there is a negative relationship between the odds ratio and the FUNDED variable. Similarly, if the odds ratio is more than 1, there is a positive relationship.

The exponential coefficients are summarized in Table 7.

Table 7
Estimated change in odds and confidence intervals at 5% significance level.

Explanatory Variable	Exponential Coefficient	Lower 95% Confidence	Upper 95% Confidence
Continuous variables	0.2398	0.0105	3.2961
Target funding	**0.9999**	**0.9999**	**0.9999**
Number of project supporters	**1.0195**	**1.0162**	**1.0233**
Relative end fund raising date	1.0001	0.9987	1.0021
Discrete variables			
Camera	4.8728	0.2107	177.8808
Camera accessory	0.6481	0.0560	12.5364
Custom machine	1.3423	0.1128	26.7157
Hobby electronics	1.1543	0.1017	22.0914
Energy generation and storage	3.8660	0.1540	143.7247
Mobile accessory	0.3378	0.0320	6.1158
Mobility enhancement	**202.4940**	**3.8636**	**18146.66**
Robotics	1.5765	0.1150	34.7287
Watch	1.5814	0.1279	32.3417

For the table above, the significant variables (at 5% significance level) are in bold. They are identified from Table 6.

4.4.1.3 Analysis of Regression on FUNDED Results

The results of the logistic regression indicate the following:

- Increasing target funding decreases the likelihood of success in crowd sourced funding. A project is 0.9999 times as likely to be funded if its target funding increases by $1.
- Increasing the number of supporters increases the likelihood of fund raising success. A project is 1.02 times as likely to be funded if its number of supporters increases by 1.
- If the project has a product in mobility enhancement, its likelihood of obtaining crowd funding is improved compared to having a product in the energy efficiency category, i.e. the project 202.5 times more likely to be funded than a project with a product in energy efficiency.

Projects with lower funding targets are more likely to be successful at raising funds – this is probably because a smaller funding target is easier to meet, requires less supporters and the price of individual reward levels may be lower. However, the change in the odds of a successful funding by increasing or decreasing the target funding by a dollar is very small and this suggests that only significant changes in funding target (in the range of thousands of dollars) will the chance of success be reasonably affected.

As expected, the number of supporters correlates positively to the probability of fund raising success. This suggests that popularity of a project is a factor in fund raising success. However, an increase in the number of supporters does not change the odds by much and this is probably because projects with smaller funding targets do not need many supporters to reach the funding target.

Interestingly, projects in the mobility product category are more likely to be successfully funded compared to the base case of projects with products in the energy efficiency category (50% chance of being funded, all else being equal). There can be many reasons for this, such as lack of competition, fulfillment of a consumer need or it could be the current fashion fad. However, there is insufficient data to identify reasons contributing to the high likelihood of a successful fund raising for projects in the mobility product category.

4.4.2 Regression on ECOC Variable

4.4.2.1 Results of Regression on ECOC

The regression of the ECOC explained variable is done using ordinary least squares (OLS) estimation in Microsoft Excel. The data set used is a subset of the complete data set – only projects that have successfully raised funds are considered. This is because the purpose of this regression is to identify the factors that influence the magnitude of the estimated cost of capital, which is only computed for projects that have obtained funding. The independent variables used on this regression are:

1. Target funding
2. Total amount of funds raised

3. Number of supporters
4. Proportion of free capital
5. Weighted average delivery time as defined in section 3.4.2.
6. Relative end fund raising date
7. Product type (split into 9 different binary variables):
    a. Camera
    b. Camera accessory
    c. Custom machine
    d. Hobby electronics
    e. Energy generation and storage
    f. Mobile accessory
    g. Mobility
    h. Robotics
    i. Watch
    j. Energy efficiency (reference case)

Product type (and subtype) division is made arbitrarily based on personal assessment of the kind of product that is developed for each project. As such, the variables may have limited usefulness in identifying underlying factors influencing ECOC due to personal bias. Also, there is limited number of observations (total 344) and it is good practice to keep the number of independent variables as small as possible. As such, product type is chosen over product subtypes (more variables) to limit this impact.

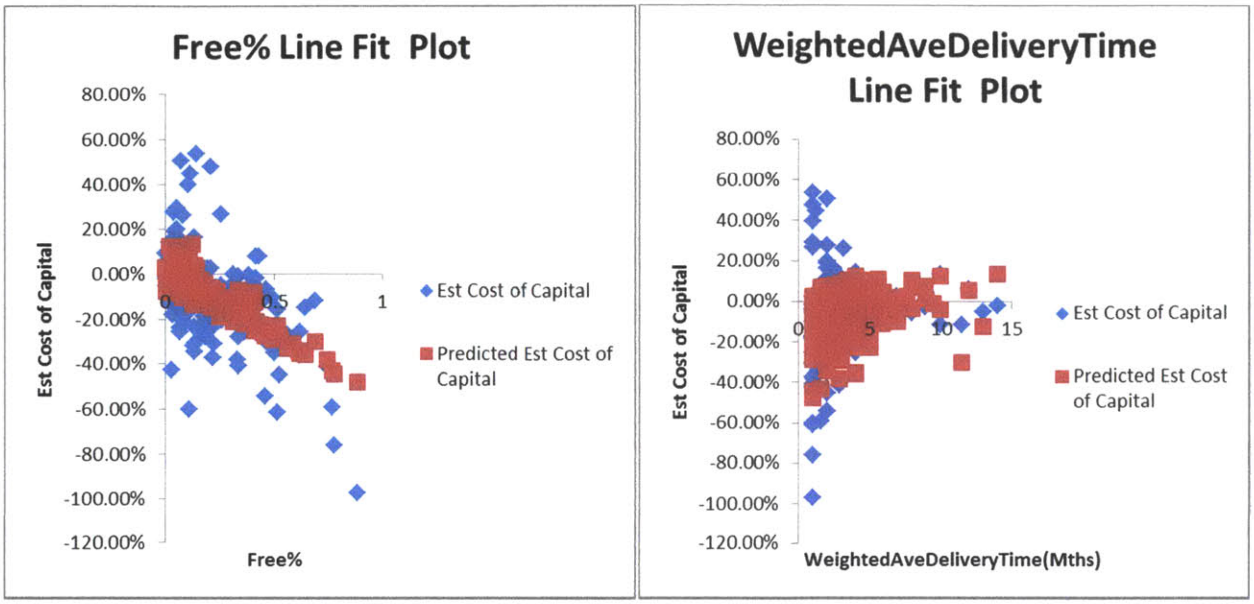
The result of this regression is summarized in Table 8 and the line fit plots of the two significant factors are given in Figure 4.

Table 8
Results of Ordinary Least Squares linear regression for ECOC variable.

Dependent Variable	Coefficient Estimate	Lower 95% Confidence	Upper 95% Confidence
Continuous			
Target Funding	0.0000001003 (0.0000002356)	-0.0000003631	0.0000005637
Total Amount Raised	-0.00000004136 (0.00000003641)	-0.0000001130	0.0000000303
Number of supporters	0.000005022 (0.000005341)	-0.000005485	0.00001553
Proportion of free capital	**-0.5480 (0.04510)*** **	**-0.6367**	**-0.4593**
Weighted average delivery time in months	**0.009550 (0.003881)** **	**0.001915**	**0.01718**
Relative End Fund Raising Date	0.00006536 (0.00003772)*	-0.000008841	0.0001396
Discrete			
Camera	-0.03160 (0.09080)	-0.2102	0.1470
Camera accessory	-0.02467 (0.07572)	-0.1736	0.1243
Custom machine	-0.05151 (0.07848)	-0.2059	0.1029
Hobby electronics	-0.06690 (0.07538)	-0.2152	0.0814
Energy generation and storage	-0.07479 (0.08255)	-0.2372	0.0876
Mobile accessory	-0.02843 (0.07299)	-0.1720	0.1152
Mobility enhancement	-0.01373 (0.08591)	-0.1827	0.1553
Robotics	-0.02736 (0.0.07937)	-0.1835	0.1288
Watch	0.07487 (0.07665)	-0.0759	0.2257
Constant term	-0.06141 (0.09013)	-0.2387	0.1159
R^2	0.3774		
N of observations	344		

This table summarizes the results of the multivariate linear regression on the estimated cost of capital dependent variable. Each of the discrete variables indicate how the estimated cost of capital will change if the product of the project belongs to a type other than energy efficiency. *, ** and *** indicate the statistical significance of the variable at 10%, 5% and 1% levels respectively.

Figure 4
Plot surveying accuracy of regression prediction on ECOC.



The variables chosen are the two significant variables identified using linear regression and their predicted values for the estimated cost of capital are plotted against actual data. The actual data is given in blue while the predicted data is shown in red. The Free% is the proportion of free capital and it is computed as per section 3.4.4. WeightedAveDeliveryTime is the weighted average delivery time in months and it is computed based on section 3.4.2.

4.4.2.2 Analysis of Regression on ECOC

From the data, the fit of the model (R^2) is 0.377, which indicates that the model fit is poor. This suggests that the data set had not sufficiently captured all the significant variables needed to explain the key factors that influence the estimated cost of capital. The line fit plots in Figure 4 confirms this observation but they also show that the lines of best fit (in red) follow the general trends of the data points. Still, this regression analysis is valuable in providing insights into some of the factors that are associated with a lower cost of capital for a successfully funded project. From the results obtained, the following is observed:

- The higher the proportion of free capital, the lower the cost of capital. In particular when this proportion increases by 1%, ECOC decreases by 0.548%. This is expected as the higher the proportion of free capital, the lower the total value of the rewards to be delivered and hence, the lower the cost of capital for the project.

- The longer it takes to deliver the bulk of the rewards (Weighted Average Delivery Time), the higher the cost of capital – when the weighted average increases by 1, the cost of capital increases by 0.955%.

The observation of increasing cost of capital due to longer delivery time is counter-intuitive – if a reward takes longer to deliver, it should cost the project less to deliver this product based on the time value of money. However, from the supporters' perspective, the longer it takes for the project to deliver the reward, the more discount supporters expect as they will be locking their money in without any returns (in the form of rewards) for a longer period of time. Increasing discounts increases the estimated cost of capital and thus, the cost of capital rises with increasing time taken to deliver the bulk of the rewards.

4.4.3 Regression on FSUCC Variable

4.4.3.1 Results of Regression on FSUCC

For this analysis, product subtype is used instead of product type as there are more observations available. Even so, as there are only 23 observations, the number of independent variables that can be analyzed has to be limited. With this in mind, the following variables are chosen:

- Number of projects in a subtype. Section 4.4.1.3 suggests that competition between projects in the same product category contributes to the probability of a project being successful. By regressing success rates across different product categories with the number of projects with products in particular subtypes, it will be clear if competition between projects plays a significant role in determining a project's chance of funding success.
- Mean funding target. Section 4.4.1.3 also suggests that a lower funding target increases the chance of being funded. By performing regression on the mean funding target of the

projects within a product subtype, the result will show whether this relationship holds true across different product types or only within a particular product type.

The result of this analysis is given in Table 9.

Table 9
Results of Ordinary Least Squares linear regression for FSUCC explained variable.

Dependent Variable	Coefficient Estimate	Lower 95% Confidence	Upper 95% Confidence
Number of projects	**-0.001836 (0.0005296)*** **	**-0.002941**	**-0.0007315**
Mean Target Funding	-0.0000007689 (0.000001355)	-0.000003594	0.000002057
Constant term	**0.6201 (0.05331)*** **	**0.5089**	**0.7313**
R^2	0.3799		
N of observations	23		

4.4.3.2 Analysis of Regression on FSUCC

The fit of the model is low with its R^2 value at 0.3799, suggesting that the model has not included other significant factors. However, due to the limitation of available data points, adding more independent variables to the model is not advisable because the model may be over-fitted given limited data points. From the results of the regression, the following is observed:

- The constant term is significant. This suggests that for a project in a new category that has no other projects, its chance of success is about 62.0%.
- The lower the number of projects within a product type, the higher the chance of a successful fund raising. This means that competition between projects decreases the chance of a successful funding campaign. Specifically, an increase in 1 project leads to a 0.184% drop in success rate.
- The mean target funding is not a significant variable. This suggests that it is not necessarily true that a lower target funding will increase the chance of success at fund raising across product types. This is reasonable considering that different product types have different perceived value and they are not interchangeable; however, within a

product type, a customer can choose a cheaper product as a replacement for a more expensive one.

Interestingly, all else being equal, a project within any product category has, on the average, more than 60% chance of being successful in raising funds. However, it should be noted that the above model fit is poor. As such, one would expect the actual chance of success to be lower, probably closer to 43% (see section 4.1).

The above observation indicates that the number of projects is a significant factor in determining if a project within a product category will be funded. This shows that competition plays a role in determining funding success. Surprisingly, projects with lower funding targets do not always get funded – the mean target funding is not significant across different product categories.

5 Discussion

5.1 Implications of results

From the results of the regression analysis obtained in the previous chapter, the following factors are associated with a higher probability of success at crowd funding:

- Low funding target. A lower funding target can increase a project's chance of success at fund raising.
- Low level of competition. A project in a product category that has lower number of competing projects tends to have a higher probability of fund raising success.
- Popularity of product. A popular product is appealing and it can possibly increase the number of eventual supporters, hence contributing to a higher probability of success at fund raising.

Besides being successful at raising funds, the project should aim to keep its cost of capital down so that excess funds can be used for other purposes, such as manufacturing more of the products for retail, improving on the product or developing new product lines. From the results of the regression, a lower cost of capital is associated with:

- Faster delivery of rewards. Supporters appear to be more willing to pay more rewards that are delivered faster.
- High proportion of free capital. To do so, project owners can try to make the product more appealing for supporters to pay more. This can be done through design or product functionality. However, care must be taken to ensure that price of the reward appears reasonable and of sufficient value to supporters.

5.2 Comparison of Cost of Capital with Debt Financing

From section 2.2, out of the traditional sources of business financing, debt financing is the only source that can be suitably compared to crowd funding. Figure 5 compares the estimated cost of capital for each product type with debt financing. In computing the cost of debt financing, it is assumed that the financing is meant to cover short term operating costs such that it is directly comparable to Kickstarter fund raising, which, by its money for rewards structure, caters more for raising short term funds than for long term capital. As such, for the purpose of this comparison, each project is assumed to borrow its funding target from the financial institution and repay the loan by the latest expected delivery month promised to their Kickstarter project supporters.

From the results, it shows that though debt financing may be more expensive with a higher median, it has a much lower spread and is thus more predictable compared to the use of crowd funding mechanism. However, debt financing may not always be available. To be eligible for financing, a company has to provide securities for loan (e.g. assets), faces restrictions on how the capital can be used and they have to show good credit rating. All these restrictions make it difficult for startups to use debt financing as a vehicle for fund raising as they usually start off without much assets and proof of steady income (refer to section 2.2.1). Venture capital and angel investments can be used to get such first stage funding but the chances of success is notoriously low due to limited availability and the high payback expected by such funds, which take on enormous amount of risks by investing in early stage companies.

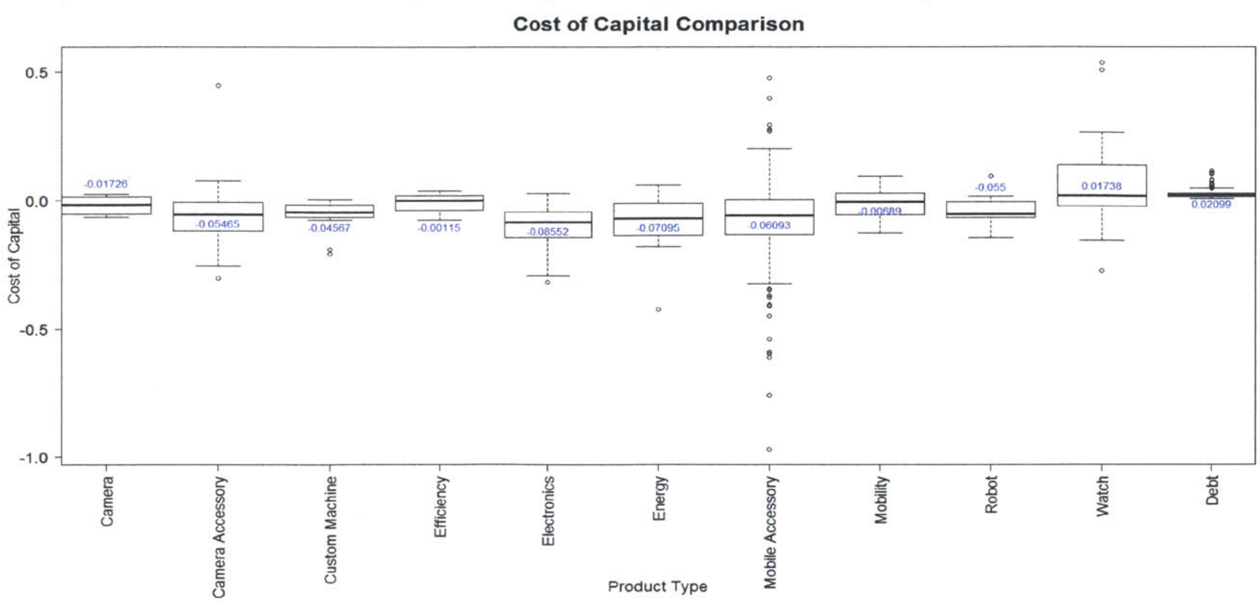
The key advantage of crowd funding lies in its low cost of capital – Figure 5 shows that the median cost of capital for crowd funding across project types is negative. In addition, crowd funding provides affordable marketing – a popular project may be highlighted in the staff picks section and in technology blogs such as Mashable and Engadget without added cost. Though each successful project has to pay a fee to use the crowd funding platform, the fee is a percentage of the raised amount and is usually paid only when the project has successfully secured sufficient funds. As such, putting up a project for crowd funding is of little financial risk to a company.

By marketing a product through crowd funding, a company is also getting feedback on the potential popularity of the product – if there are sufficient supporters for the project such that it reaches its funding target successfully, chances are that the product may be popular when retailed online and/or in brick and mortar stores. In addition, crowd funding is not just about passive marketing – it encourages the development of a "community" around the product of which they are both investors and buyers of the product. This group can also be tapped to provide suggestions on how to improve the product, being its early adopters (Lawton & Marom, 2013). Examples of projects that have made a successful switch from crowd funding to retail include the Capture Camera Clip System, Glif tripod stand for iPhone and B-Squares modular solar project kit. However, making the transition from Kickstarter to retail is not assured – the product must be able to generate sustained interest and that may be difficult to gauge just from crowd funding success as this success can be due to many reasons besides desirability and popularity (Pieri, 2013).

Crowd funding's advantage in online marketing and reach is also a major pitfall – sufficient details on the design and workings of the product has to be revealed to the public to convince potential supporters that the product is real and is able to function as described. Such information lay prey to well-funded competitors who might be able to copy the product idea and push out their versions to the marketplace before the original product makes it to the retail channels. Such intellectual property can possibly be protected using patents but filing takes time and is usually prohibitively expensive for those seeking the raise funds from the public. Thus, the project must be careful to balance between revealing sufficient information to persuade the public that the product is able to meet their needs while keeping crucial implementation information from potential competitors before the product is ready to be launched on the retail channels.

From the data set, some projects are able to deliver the rewards within one to two months after the fund raising date. Faster reward delivery, besides its association with a lower cost of capital, can also circumvent the above pitfall by reducing the time that competitors are able to respond to a product launch. There are risks involved in such a move – being able to move so quickly means that the projects may need to secure manufacturing contracts prior to the end of the fund raising. As a result, even if the fund raising attempt fails, the project may still have to meet its contractual obligations for the manufacture. This is potentially costly as the project will have to find other sources of funding, which may be more expensive. There is evidence of this in the data set – quite a few of the projects proceeded with marketing and selling their products online despite failing to raise sufficient funds through Kickstarter and it is quite plausible that this is because they had committed to manufacturing prior to completing fund raising.

Figure 5
Comparison of estimated cost of capital across product types with debt financing.



5.3 Sensitivity Analysis

Of the assumptions described in section 3.3, the one with the most impact on the results is cost of goods sold (COGS) assumption. At 80%, it is rather high and is a conservative estimate of the direct costs for the manufacturing of the products in all the reward levels. In this section, sensitivity analysis of this assumption is carried out with the intention of highlighting changes in the analysis as COGS is adjusted from 40% to 80% of the retail price of each reward level at 10% intervals. Details of this sensitivity testing are described in Table 10, Table 11, Table 12 and Figure 6.

From the data, the following points are observed:

- Whether a project gets funded is influenced by its funding target and number of supporters. The magnitude of COGS does not dilute the influence of either factor. In fact, changes to COGS are not associated with the probability of fund raising success.
- Estimated cost of capital varies strongly with cost of goods sold – the higher the COGS, the higher the cost of capital. This is expected because manufacturing cost of the product is directly correlated to the cost of capital.
- When COGS is high, projects with mobility products are more likely to succeed compared to projects with energy efficiency products.
- The influence of proportion of free capital on the estimated cost of capital decreases as COGS decreases.
- As COGS decreases, the weighted average delivery time has a bigger positive influence on the estimated cost of capital.
- As COGS decreases, model fit for the estimated cost of capital variable becomes better.

The sensitivity analysis shows that COGS and the estimated cost of capital are positively correlated – the higher the COGS, the higher the estimated cost of capital (see Figure 6). COGS is also positively correlated with the influence of the proportion of free capital on the cost of capital. This is logical as lower COGS decreases overall costs, which reduces how much the amount of free capital (which is fixed) contributes to reducing the cost of capital. Furthermore, the influence of weighted average delivery time increases with decreasing COGS and this is probably because lower manufacturing costs makes the price discount paid for longer delivery time more prominent.

The above analysis also shows that projects with mobility products have significant higher chance of successful fund raising compared to those with energy efficiency products regardless of the manufacturing costs involved. This is expected given that from Table 4, projects with the mobility product type have the highest chance of success. However, they do not have the lowest mean target funding among the product types and this suggests that there are other reasons why mobility projects are so successful. One of these reasons can be competition – the mobility product type does have one of the lowest numbers of competing projects and section 4.4.3 has shown that competition matters in determining whether projects are successful in their fund raising attempts. In addition, I postulate that this product category has more appeal compared to the others because the product can potentially make transportation, which is a necessary activity (together with food, water and shelter), easier and better for people. As such, this product fills a gap in customer needs that currently has no viable competition (besides bicycles, which require manual input), motor vehicles (high purchase price, maintenance and operating costs) and public transportation (which may be inefficient or lacking coverage in some areas).

The observation that the estimated cost of capital linear regression model fit better as COGS decreases suggests that COGS is a major factor influencing the estimated cost of capital, especially at higher COGS levels. In fact, this result suggests that if the manufacturing cost is high, this cost will overshadow the effect of other factors on the cost of capital, which is reasonable as manufacturing cost is usually the most significant variable in determining the cost of a project that is geared heavily towards delivering tangible rewards to supporters.

Interestingly, the COGS variable does not influence the probability of a project getting funded, which indicates that the probability of success in fund raising is not determined by COGS. This can possibly be due to the supporters' inability to know how much it costs to make a particular product because of information asymmetry. A project is not required to disclose how much it costs to make the product, though the public can compare the price of the reward with competing products to determine if the reward is reasonably priced. Anecdotal evidence from the data set shows that some of the project owners support this – on their fund raising webpage, they claim how competing products are more expensive than theirs given the same functionality. Thus, it appears that the supporter is more concerned with the retail cost of the product and its perceived value than the actual cost of the product to the manufacturer, which is influenced by factors in addition to COGS. Some of these factors include the manufacturer's profit margin, logistics cost and other administrative overheads.

In summary, the above observations reinforce the analysis summarized in section 5.1. In addition, COGS is another significant factor that affects cost of capital. As such, projects could lower its cost of capital by reducing its COGS as a percentage of the product's retail price by charging a premium (e.g. by promising shorter delivery time, creating a highly popular product etc) or through economy of scale.

Table 10
Changes to coefficient estimates for fund raising success as COGS changes.

Dependent Variable	Coefficient Estimate When Cost of Goods Sold Is 80%	70%	60%	50%	40%
Continuous Variables					
Funding target	**-0.000105 (-0.0000114)*****	**-0.000105 (0.0000114)*****	**-0.000105 (0.0000114)*****	**-0.000105 (0.0000114)*****	**-0.000105 (0.0000114)*****
Number of supporters	**0.0194 (0.00177)*****	**0.0194 (0.00177)*****	**0.0194 (0.00177)*****	**0.0194 (0.00177)*****	**0.0194 (0.00177)*****
Relative end fund raising date	0.000986 (0.000581)*	0.000986 (0.000581)*	0.000986 (0.000581)*	0.000986 (0.000581)*	0.000986 (0.000581)*
Discrete Variables					
Camera	1.584 (1.681)	1.584 (1.681)	1.584 (1.681)	1.584 (1.681)	1.584 (1.681)
Camera accessory	-0.4337 (1.314)	-0.4337 (1.314)	-0.4337 (1.314)	-0.4337 (1.314)	-0.4337 (1.314)
Custom machine	0.2948 (1.33)	0.2948 (1.33)	0.2948 (1.33)	0.2948 (1.33)	0.2948 (1.33)
Hobby electronics	0.1435 (1.305)	0.1435 (1.305)	0.1435 (1.305)	0.1435 (1.305)	0.1435 (1.305)
Energy generation and storage	1.352 (1.699)	1.352 (1.699)	1.352 (1.699)	1.352 (1.699)	1.352 (1.699)
Mobile accessory	-1.085 (1.271)	-1.085 (1.271)	-1.085 (1.271)	-1.085 (1.271)	-1.085 (1.271)
Mobility enhancement	**5.311 (2.197)****	**5.311 (2.197)****	**5.311 (2.197)****	**5.311 (2.197)****	**5.311 (2.197)****
Robotics	0.4552 (1.397)	0.4552 (1.397)	0.4552 (1.397)	0.4552 (1.397)	0.4552 (1.397)
Watch	0.4583 (1.348)	0.4583 (1.348)	0.4583 (1.348)	0.4583 (1.348)	0.4583 (1.348)
Constant term	-1.428 (1.411)	-1.428 (1.411)	-1.428 (1.411)	-1.428 (1.411)	-1.428 (1.411)
Null deviance (791 degrees of freedom)	1084.25	1084.25	1084.25	1084.25	1084.25
Residual deviance (779 degrees of freedom)	436.74	436.74	436.74	436.74	436.74
AIC	462.74	462.74	462.74	462.74	462.74
N of observations	792	792	792	792	792

The table summarizes the results of multivariate regression of various parameters using the logit regression model for COGS ranging from 40% to 80%. For the discrete variables, the base case is a project with a product aimed at improving energy efficiency. The estimate for each of these discrete variables indicates how the log-odds of the project obtaining funding change if the product belongs to the particular product type instead of the base case. *, ** and *** indicate the statistical significance of the variable at 10%, 5% and 1% levels respectively. The variables that are significant at 5% significance level are in bold.

Table 11
Changes to coefficient estimates for cost of capital estimation as COGS changes.

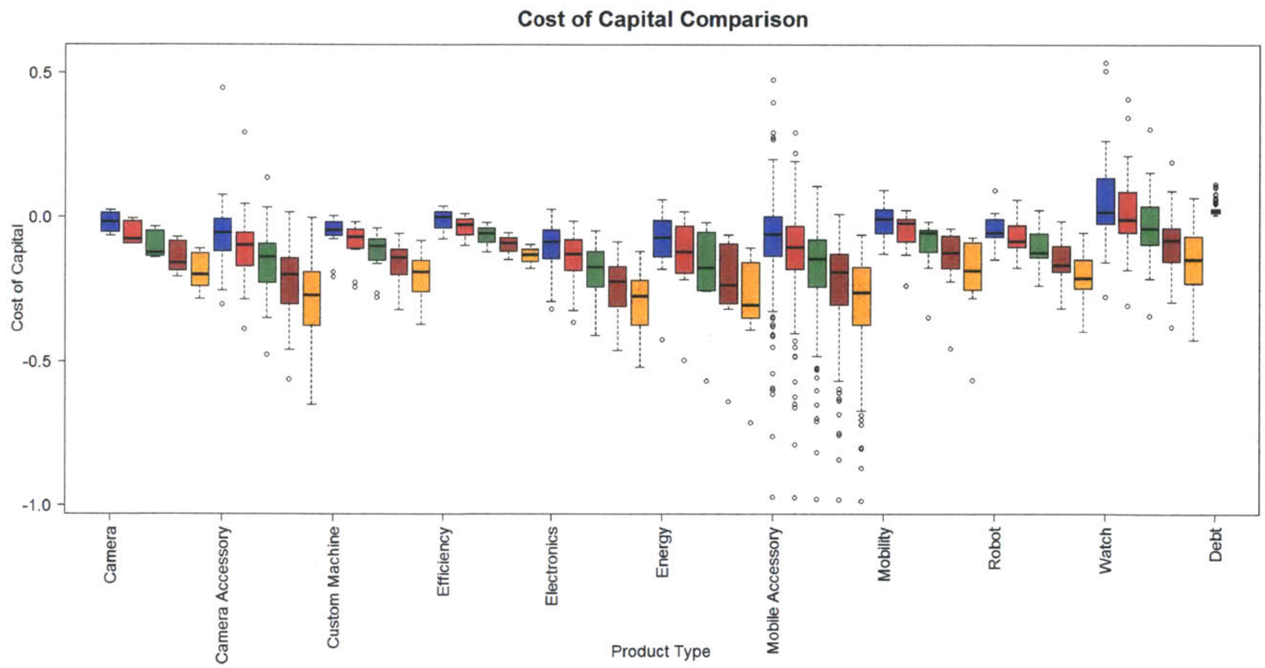
Dependent Variable	Coefficient Estimate When Cost of Goods Sold Is 80%	70%	60%	50%	40%
Continuous					
Target Funding	0.0000001 (0.00000024)	0.00000021 (0.0000002)	0.000000317 (0.0000002)	**0.000000421 (0.0000002)****	**0.000000521 (0.0000002)*****
Total Amount Raised	-0.000000041 (0.000000036)	-0.000000042 (0.00000003)	-0.000000042 (0.00000003)	-0.0000000421 (0.00000003)	-0.0000000412 (0.000000029)
Number of supporters	0.000005 (0.0000053)	0.0000052 (0.0000049)	0.00000538 (0.00000462)	0.00000547 (0.0000044)	0.00000546 (0.00000425)
Proportion of free capital	**-0.5480 (0.04510)*****	**-0.5145 (0.04167)*****	**-0.4789 (0.03903)*****	**-0.4406 (0.03714)*****	**-0.3985 (0.03586)*****
Weighted average delivery time in months	**0.009550 (0.003881)****	**0.01879 (0.003585)*****	**0.02810 (0.003358)*****	**0.03748 (0.003195)*****	**0.04690 (0.003084)*****
Relative End Fund Raising Date	0.00006536 (0.00003772)*	0.0000644 (0.0000348)*	0.0000629 (0.0000326)*	0.0000607 (0.000031)*	0.00005770 (0.00003)*
Discrete					
Camera	-0.03160 (0.09080)	-0.02432 (0.08389)	-0.01713 (0.07857)	-0.01004 (0.07478)	-0.003044 (0.07220)
Camera accessory	-0.02467 (0.07572)	-0.02688 (0.06996)	-0.02924 (0.06552)	-0.03174 (0.06236)	-0.03439 (0.06021)
Custom machine	-0.05151 (0.07848)	-0.04492 (0.07251)	-0.03862 (0.06791)	-0.03271 (0.06463)	-0.02728 (0.06240)
Hobby electronics	-0.06690 (0.07538)	-0.05557 (0.06965)	-0.04487 (0.06523)	-0.03494 (0.06208)	-0.02603 (0.05994)
Energy generation and storage	-0.07479 (0.08255)	-0.06901 (0.07627)	-0.06359 (0.07143)	-0.05858 (0.06798)	-0.05410 (0.06564)
Mobile accessory	-0.02843 (0.07299)	-0.02883 (0.06744)	-0.02941 (0.06316)	-0.0302 (0.0601)	-0.03120 (0.05803)
Mobility enhancement	-0.01373 (0.08591)	-0.02466 (0.07937)	-0.03540 (0.07434)	-0.04586 (0.07075)	-0.05586 (0.06831)
Robotics	-0.02736 (0.0.07937)	-0.02179 (0.07333)	-0.01633 (0.06868)	-0.01094 (0.06536	-0.005577 (0.06311)
Watch	0.07487 (0.07665)	0.06469 (0.07082)	0.05404 (0.06633)	0.04284 (0.06312)	0.03096 (0.0609)
Constant term	-0.06141 (0.09013)	-0.1463 (0.08327)*	**-0.2343 (0.07799)*****	**-0.326 (0.07422)*****	**-0.4229 (0.07166)*****
R^2	0.3774	0.4265	0.4875	0.5527	0.6155
N of observations	344	344	344	344	344

This table summarizes the results of the multivariate linear regression on the estimated cost of capital for COGS ranging from 40% to 80%. Each of the discrete variables indicate how the estimated cost of capital will change if the product of the project belongs to a type other than energy efficiency. *, ** and *** indicate the statistical significance of the variable at 10%, 5% and 1% levels respectively. The variables that are significant at 5% significance level are in bold.

Table 12
Mean estimated cost of capital by product type and COGS.

	Mean Estimated Cost of Capital (%) when COGS is				
Product Type	**80%**	**70%**	**60%**	**50%**	**40%**
Camera	-1.18	-3.50	-6.03	-8.84	-12.02
Camera Accessory	-2.51	-5.05	-7.75	-10.65	-13.83
Custom Machine	-2.55	-4.04	-5.69	-7.54	-9.68
Efficiency	-0.67	-1.91	-3.30	-4.89	-6.77
Electronics	-6.31	-8.76	-11.44	-14.41	-17.78
Energy	-6.27	-9.28	-12.52	-16.07	-20.02
Mobile Accessory	-3.02	-4.84	-6.79	-8.89	-11.20
Mobility	-1.07	-4.20	-7.53	-11.12	-15.08
Robotics	-2.00	-3.64	-5.44	-7.44	-9.71
Watch	3.70	0.86	-2.20	-5.54	-9.27

Figure 6
Comparison of cost of capital estimation by product type and COGS.



The legend for the graph is as follows – blue: COGS = 80%; red: COGS = 70%; green: COGS = 60%; brown: COGS = 50%; orange: COGS = 40%.

6 Conclusion

The only traditional source of funding that can be compared with crowd funding is debt financing. Through data gathered from Internet sources, this research has shown that though crowd funding can be potentially cheaper than debt, funding is not assured. However, its entry barrier is low – anyone can put up a project to canvass for funds while debt finance has requirements such as credit rating, proof of ability to finance the loan and loan guarantee. In addition, crowd funding platforms are well frequented and popular project can receive a marketing boost from technology blogs and the official Kickstarter blog. Good marketing, however, is a double edged sword – designs and ideas may be copied by competitors and it is essential that the project moves as quickly as it can to get its product out to the market.

The sensitivity study suggests that COGS has much influence on the cost of capital because lower manufacturing costs means that more money is available for other costs or investment opportunities. In addition, it appears that when COGS is high, its effect becomes disproportionately large compared to other factors and model fit suffers.

Surprisingly, sensitivity analysis reveals that the probability of a project getting funded is independent of how much the product cost to manufacture. This is likely to be due to information asymmetry as the public has no way of knowing how much it costs to make the product except by comparing it with competing products, which may all be highly marked up. In addition, projects focused on mobility products tend to do better than others and this is likely because there are fewer competitors in this space and this product type may have better mass appeal as it fills a customer need that has no other viable options at the moment.

In conclusion, based on the factors associated with a successful, low cost of capital crowd funded project, projects can follow the following rules when planning its fund raising effort:

- Do not be greedy. Set the funding target low to increase one's chance of success.

- Choose a product that has fewer competing projects.
- Build up popular support for the project, either through snazzy product design or ensuring that the product meets user needs. This can get additional supporters onboard and increase the amount of funds raised. Supporters may also be willing to donate to the project, which may lower cost of capital.
- A popular project also has a higher chance of getting free marketing through mentions on technology blogs and on the official Kickstarter blog.
- The information on Kickstarter is public information and the project owners should take care not to reveal sensitive information that may give its competitors an advantage.
- Deliver the rewards as quickly as possible so that the public is less likely to require a discount before supporting the project and this lowers the cost of capital. In addition, delivering the rewards quickly can help to maintain first mover advantage over competitors.

Raising money through crowd funding is just the beginning for a company – many other factors determine if the product will be able to bring in sufficient retail sales to be truly successful.

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