LBNL-1005088

ERNEST ORLANDO LAWRENCE
BERKELEY NATIONAL LABORATORY

Commercial Discount Rate Estimation for Efficiency Standards Analysis

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April 13, 2016

This work was supported by the Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Building Technology, State, and Community Programs, of the U.S. Department of Energy under Contract No. DE-AC02-05CH11231.

Executive Summary

Underlying each of the Department of Energy's (DOE's) federal appliance and equipment standards are a set of complex analyses of the projected costs and benefits of regulation. Any new or amended standard must be designed to achieve significant additional energy conservation, provided that it is "technologically feasible and economically justified" (42 U.S.C. 6295(o)(2)(A)). A proposed standard is considered economically justified when its benefits exceed its burdens, as represented by the projected net present value of costs and benefits.

DOE performs multiple analyses to evaluate the balance of costs and benefits of commercial appliance and equipment efficiency standards, at the national and individual building or business level, each framed to capture different nuances of the complex impact of standards on the commercial end user population. The Life-Cycle Cost (LCC) analysis models the combined impact of appliance first cost and operating cost changes on a representative commercial building sample in order to identify the fraction of customers achieving LCC savings or incurring net cost at the considered efficiency levels.[1] Thus, the choice of commercial discount rate value(s) used to calculate the present value of energy cost savings within the Life-Cycle Cost model implicitly plays a key role in estimating the economic impact of potential standard levels.[2]

This report is intended to provide a more in-depth discussion of the commercial discount rate estimation process than can be readily included in standard rulemaking Technical Support Documents (TSDs), including details regarding:

- Discount rate estimation methods and rationale;
- Data sources used and data limitations;
- Discount rate distributions for use in standards analysis;
- Discount rate estimation methods and distributions specific to the small business subgroup analysis.

The report concludes by sketching plans for future updates to commercial discount rate distributions, in the face of uncertainty regarding data availability going forward.

[1] As a point of comparison, the National Impact Analysis (NIA) assesses the net present value to the nation as a whole, based on first cost, operating cost, and shipments changes induced by standards. This report focuses on the LCC.

[2] Note that a companion report on the consumer (i.e., residential) discount rate in the LCC is, or soon will be, available.

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1 Introduction

The Life-Cycle Cost (LCC) analysis of the Department of Energy's (DOE's) energy efficiency standard rulemaking process is used to estimate the combined impact of first cost and operating cost changes in a representative commercial building sample in order to identify the fraction of customers achieving LCC savings or incurring net cost, in monetary terms, at the considered efficiency levels.

The commercial discount rate is the rate at which future operating costs are discounted to establish their present value in the LCC analysis. The discount rate value is applied in the LCC to future year energy costs and non-energy operations and maintenance costs to calculate the estimated net life-cycle cost of products of various efficiency levels, and life-cycle cost savings as compared to the baseline for a representative sample of commercial end users. Thus, the choice of commercial discount rate value(s) used to calculate the present value of energy cost savings within the Life-Cycle Cost (LCC) model implicitly plays a key role in estimating the economic impact of potential standard levels.

DOE's method views the purchase of a higher efficiency appliance as an investment that yields a stream of value in the form of energy cost savings. DOE derived the discount rates for the LCC analysis by estimating the cost of capital for companies that purchase appliances and energy-consuming equipment. The weighted average cost of capital (WACC) is commonly used to estimate the present value of cash flows to be derived from a typical company project or investment. Most companies use both debt and equity capital to fund investments, so their cost of capital is the weighted average of the cost to the firm of equity and debt financing, as estimated from financial data for publicly traded firms in a given sector. We rely on the Capital Asset Pricing Model (CAPM) to estimate firms' costs of equity (Modigliani and Miller 1958).

Damodaran Online, the primary source of data for this analysis, is a widely used source of information about company debt and equity financing for most types of firms (Damodaran Online 2004-2013). Detailed sectors included in the Damondaran Online database were assigned to the following aggregate categories: Office; Food Sales; Health Care; Warehouse; Public Assembly; Food Service; Lodging; Retail - Mall; Retail - Other; Service; Industrial. State and local bonds rates were used to separately calculate discount rate distributions associated with the Education and Public Order & Safety sectors. These categories were chosen in order to map to the sectors defined in the commercial building sample used for the LCC analysis.

The structure of this report is as follows. The remaining subsections of the introduction provide an overview of discounting in the LCC and a brief review of the CAPM model as described in the literature. Section 2 discusses the data sources used in the analysis. Section 3 discusses the calculations used to derive discount rate distributions and presents summary results for the standard LCC analysis. Section 4 addresses the specific case of small businesses and their corresponding discount rate methodology and distributions. Section 5 lays out a rudimentary plan for future updates of this analysis. Two appendices are also provided: the first includes the full discount rate distributions by sector as used in the LCC; the second describes the process of identifying small businesses in the LCC building sample and presents the discount rate distributions by sector as used in the small business subgroup analysis.

1.1 Discounting in the Life-Cycle Cost Model

The LCC is used to predict how many and what type of businesses are likely to monetarily gain or lose under a proposed standard, based on a representative building sample drawn from the Commercial Building Energy Consumption Survey (CBECS). Broadly, the LCC addresses the questions: *how many commercial building owners benefit from the proposed standard, how many will be worse off, and to what degree?* A standard will have differential impacts on businesses depending on many factors, including: the size and type of commercial building; intensity of

product use; building age and weatherization. A proposed standard is expected to impact the number of commercial buildings that obtain a positive net present value via two primary factors: product energy efficiency (and thus energy consumption and cost) and final installed price.

At the individual commercial building level, the LCC addresses the question: *assuming that an appliance of the proposed efficiency level is installed, what is the net monetary impact of a proposed standard on the building's resident business?* The commercial discount rate of the LCC is used to estimate the value of future energy cost savings to businesses, predicated on the installation of a product of a given efficiency level.[3] It is applied to future-year energy costs and non-energy operations and maintenance costs in order to calculate the net present value of the appliance to a business at the time of installation. Because the time of installation defines the beginning of the analysis period, total installed cost is not discounted.

Unlike the shipments model, the LCC does not model a commercial consumer's purchase decision, so implicit discount rates are inappropriate for use in this stage of analysis. In the context of the LCC, many contributing components of the implicit discount rate are not relevant (e.g. transaction costs), as they are likely to influence a consumer's decision whether or not to purchase an appliance, but in the LCC, these factors are operationally sunk costs, which are rationally excluded from calculations valuing future costs and benefits associated with the appliance. This leaves the firm's required return on investment, as defined by weighted average cost of capital, itself incorporating the Capital Asset Pricing Model.

1.2 A Brief Review of CAPM in the Literature

Two seminal works in finance literature provided the impetus for cost of capital research and early formulations of CAPM: Modigliani and Miller (1958) and Markowitz (1952).[4] Modigliani and Miller (1958) state the basic problem as follows:

> *"What is the "cost of capital" to a firm in a world in which funds* [5] *are used to acquire assets whose yields are uncertain; and in which capital can be obtained by many different media, ranging from pure debt instruments... to pure equity issues? This question has vexed at least three classes of economists: (1) the corporation finance specialist concerned with the techniques of financing firms so as to ensure their survival and growth; (2) the managerial economist concerned with capital budgeting; and (3) the economic theorist concerned with explaining investment behavior..."*

Variants of what is now known as the Capital Asset Pricing Model were developed in the 1960s by several independent researchers (Sharpe 1964; Lintner 1965; Mossin 1966; Treynor 1999).[6] French (2003), Perold (2004), and Sullivan (2006) provide discussions of the history of CAPM as defined by these four researchers. Though differing somewhat in terminology, framing, and intent, these models were eventually demonstrated to be consistent with one another (Stone 1970), and can now be represented with the following simplified equation, the components of which are discussed in greater detail in section 3 :

[3] Note that this is a simplified description of the LCC process for the ease of discussing the concept of discounting. For a more detailed discussion of the LCC model, its inputs and assumptions, and the use of the household sample to estimate savings, please see the Technical Support Document for a recent rulemaking (http://energy.gov/eere/buildings/current-rulemakings-and-notices).

[4] Markowitz (1952) is framed more specifically in terms of an investor's process of portfolio selection, but it shares the common thread with Modigliani and Miller (1958) and the subsequent CAPM papers of aiming to account for expected returns under varying degrees of uncertainty and risk.

[5] Analysts and researchers aiming to project the impacts of policies on firms represent additional classes of economists vexed by this question.

[6] Note that Treynor's work was completed in 1962, but not formally published until 1999.

$$k_{ei} = R_f + \beta_i \, ERP$$

Where:

k_{ei} =cost of equity of firm i,
R_f = expected return on risk-free assets,
β_i =risk coefficient of firm i, and
ERP =equity risk premium.

We recognize that CAPM is a fairly simple model used to represent a complex valuation process which varies from investor to investor and firm to firm. While potentially less accurate than more detailed models (i.e., arbitrage pricing, multifactor, discounted cash flow),[7] CAPM benefits from widespread familiarity and its comparatively simple data requirements. All potential substitute models and methodologies come with their own assortment of theoretical and practical weaknesses (i.e. assumptions and data requirements). For an informal yet in-depth discussion and critique of CAPM and its alternatives in discount rate estimation, see New York University's Aswath Damodaran's blog series on the topic.[8]

[7] Damodaran (2011) notes that while such models can outperform CAPM in terms of explaining past differences, there is little evidence of an improvement over CAPM for predictive purposes.

[8] http://aswathdamodaran.blogspot.com/2011/04/alternatives-to-capm-part-1-relative.html

2 Methodology

DOE's methodology for estimating commercial discount rates assumes that the purchase of a higher efficiency appliance can be viewed as an investment that yields returns in the form of a stream of energy cost savings. For the purpose of estimating the present value of any investment, the discount rate represents the opportunity cost, over the life of the investment, of selecting that particular investment over other available options. The discount rate is used to calculate the value, in today's dollars, of all future year earnings (i.e., energy cost savings) associated with the purchase of an appliance of a specific efficiency. This allows DOE to compare costs between different efficiency levels (Trial Standard Levels, TSLs).

Following this rationale, the commercial discount rate is estimated as the weighted average cost of capital, computed from a firm's cost of equity (i.e., expected interest rate on equity) and cost of debt (i.e., expected interest rate on debt), weighted by the firm's ratio of debt to equity, as recorded in the Damodaran Online dataset.

2.1 Cost of Equity

We estimate cost of equity using the capital asset pricing model (Ibbotson Associates 2009). CAPM assumes that the cost of equity (k_{ei}) for a particular company is proportional to the systematic risk faced by that company, where high risk is associated with a high cost of equity and low risk is associated with a low cost of equity. The risk facing a firm is in turn determined by several variables: the risk coefficient of the firm (β_i), the expected return on risk-free assets (R_f), and the equity risk premium (ERP).

We define the expected return on risk-free assets (R_f) as the yield on long-term U.S. Treasury bonds. Treasury bonds meet three key criteria of an ideal risk-free asset: 1) investors generally perceive Treasury bonds to carry little to no risk; 2) the time horizons of Treasury bonds are compatible with the efficiency standard analysis time frame and the expected longevity of regulated equipment; and 3) Treasury bonds are an appropriate measure for assets that produce a stream of payoffs (i.e., energy cost savings), rather than a lump sum payment at the end of a set term (Ibbotson Associates 2009).

The equity risk premium and firm β_i coefficient are intended to capture the impact of undertaking systematic risk on an investment's expected payoff. The ERP represents the difference between the expected stock market return and the risk-free rate; it is a measure of the additional return an investor expects to receive, on average, in compensation for investing in equities rather than risk-free assets (Ibbotson Associates 2009). The risk coefficient of the firm (β_i) indicates the risk associated with that particular firm relative to the price variability in the stock market; risk coefficient values are taken from the Damodaran Online data.

The cost of equity financing is estimated using the following equation, where the variables are defined as described above:[9]

$$k_{ei} = R_f + \beta_i ERP$$

Where:

k_{ei} =cost of equity of firm i,
R_f = expected return on risk-free assets,
β_i =risk coefficient of firm i, and
ERP =equity risk premium.

[9] Note that CAPM can be modified to account for systematic differences in the cost of equity relating to company size as estimated via market capitalization, described further in section 4 and appendix B.

Table 2.1: Risk-Free Rate and Equity Risk Premium, 2004-2013

Year	Risk-Free Rate (%)	ERP (%)
2004	7.10	3.25
2005	7.11	3.68
2006	7.10	3.49
2007	7.08	3.36
2008	7.01	2.40
2009	6.88	3.07
2010	6.74	3.23
2011	6.61	2.94
2012	6.41	3.99
2013	6.24	5.81

Several parameters of the cost of capital equations can vary substantially over time, and therefore the estimates can vary with the time period over which data is selected and the technical details of the data averaging method. For guidance on the time period for selecting and averaging data for key parameters and the averaging method, DOE used Federal Reserve methodologies for calculating these parameters. In its use of the CAPM, the Federal Reserve uses a forty-year period for calculating discount rate averages, utilizes the gross domestic product price deflator for estimating inflation, and considers the best method for determining the risk free rate as one where "the time horizon of the investor is matched with the term of the risk-free security" (Federal Reserve Board 2005).

By taking a forty-year geometric average of Federal Reserve data on annual nominal returns for 10-year Treasury bills, DOE estimated the following risk free rates for 2004 - 2013 (Table 2.1).(U.S. Office of Management and Budget (OMB) 2014). DOE also estimated the ERP by calculating the difference between risk free rate and stock market return for the same time period, as estimated using Damodaran Online data on the historical return to stocks (Damodaran Online 2013).[10]

2.2 Cost of Debt

The cost of debt financing (k_{di}) is the interest rate paid on money borrowed by a company. We estimate the cost of debt for a given firm by adding a risk adjustment factor (R_a) to the risk-free rate (R_f). This risk adjustment factor depends on the variability of stock returns represented by standard deviations in a firm's stock prices. So for firm i, the cost of debt financing is:

$$k_{di} = R_f + R_{ai}$$

Where:

k_{di} =cost of debt of firm i,
R_f = expected return on risk-free assets,
R_{ai} = risk adjustment factor to risk-free rate for firm i.

2.3 Weighted Average Cost of Capital

After estimating the cost of equity and cost of debt for each firm in the dataset, we calculate the WACC by firm using the following equation:

[10]Note that annual returns to investments are not independent from each other, and thus the geometric average is more informative than the arithmetic average.

Table 2.2: Weighted Average Cost of Capital by Sector

Sector	Sector #	Weighted Average Discount Rate (%)	Standard Deviation (%)
Office	2	6.04	1.05
Food Sales	6	5.52	0.72
Health Care	8	5.53	0.83
Warehouse	11	6.01	1.46
Public Assembly	13	6.31	1.13
Food Service	15	5.73	0.92
Lodging	18	6.99	1.85
Retail (Mall)	24	6.36	1.12
Retail (Other)	25	5.89	1.05
Service	26	6.25	1.04
Education	14	3.30	1.10
Other	91	6.02	1.09
Industrial	N/A	6.00	1.10

$$WACC_i = k_{ei} \times w_{ei} + k_{di} \times w_{di}$$

Where:

$WACC_i$= weighted average cost of capital for firm i,
k_{ei} =cost of equity of firm i,
w_{ei} =proportion of equity financing for firm i,
k_{di} =cost of debt of firm i,
w_{di} =proportion of debt financing for firm i.

By adjusting for the influence of inflation, DOE estimates the real weighted average cost of capital, or discount rate, for each company. We aggregate the individual firm real weighted average costs of capital to produce discount rate distributions for each of the sectors defined in section 3. Table 2.2 shows the average WACC values for the major sectors included in efficiency standards analysis.[11] While WACC values for any sector may trend higher or lower over substantial periods of time, these values represent a cost of capital that is averaged over major business cycles.

[11] While this table provides average values and standard deviations, it is important to note that firm-level WACC within a sector are not necessarily normally distributed; thus, DOE prefers to use binned versions of the full distributions in subsequent analysis, rather than trying to fit coefficients of a specific distribution form.

3 Data Sources

This section provides information about the data sources used to estimate commercial discount rates, via a weighted average cost of capital incorporating the CAPM model, as described in 2.

Damodaran Online is a widely used source of information about company debt and equity financing for most types of firms, and was the primary source of data for this analysis (Damodaran Online 2004-2013). These datasets provide numerous annual financial details (e.g., market capitalization, stock price, total debt, tax rate, etc.) for approximately 5000-6000 companies and cover the period of $2004 - 2013$.[12]

To streamline the application of these data to the building samples used in efficiency standards analysis, detailed sectors by SIC code included in the Damondaran Online database were assigned to aggregate categories mapped to the following CBECS "Principal Building Activities": Office; Food Sales; Health Care; Warehouse; Public Assembly; Food Service; Lodging; Retail (Mall/Strip Mall); Retail (Other than Mall); Service. For the Education and Public Order & Safety sectors, the real interest rates on 20-year state and local bonds are applied (Table 3.1) (Board of Governors of the Federal Reserve System 2014; U.S. Office of Management and Budget (OMB) 2014).[13] Though not included in CBECS, Damodaran Online data also includes manufacturing, utilities, and similar industries that are aggregated into the Industrial sector (Table 3.1). Based on CBECS PBA, sector discount rates are matched to the appropriate building sample records.[14][15]

For each appliance and equipment efficiency standard under consideration, the analysis team will be able to map the commercial discount rate distributions by PBA (Table 3.1) to the building sample specific to their product. By product, the overall weighted average commercial discount rate will differ due to variation in the concentrations of types of appliances and equipment across sectors.

[12] Note that these data were available for download from Damodaran Online through early 2014, but can no longer be accessed. Damodaran Online now only provides aggregated sector-level data. These data sets could potentially be reconstructed through purchase from the original sources: Bloomberg, Morningstar, Capital IQ and Compustat.

[13] CBECS and Damodaran Online sector categories were mapped via NAICS and SIC codes. In response to frequently asked questions regarding CBECS, the Energy Information Administration provides a recommended mapping of its PBA codes to NAICS (https://www.eia.gov/consumption/commercial/faq.cfm#q8). Note that because CBECS PBAs are assigned based on the main activity that takes place in a building, this mapping to sectors will be imperfect. For example, a company categorized as sector 424: Nondurables Wholesalers could conceivably be mapped to three PBAs: Food Sales, Office, and Warehouse. In such cases, we rely on EIA's determination of most likely matches, as flagged in their PBA to NAICS "crosswalk." Because Damodaran Online provides sectors by SIC code, while PBAs are mapped to NAICS by EIA, it was necessary to compare NAICS and SIC to bridge between SIC and PBA (SIC: https://www.osha.gov/pls/imis/sicsearch; NAICS: http://www.census.gov/eos/www/naics/).

[14] Aggregated sectors are constructed from one or more CBECS PBAs; we continue to use the PBA number of one of these CBECS buildings types for identification purposes in our analysis (i.e., middle column). Numbers in parentheses in the rightmost column are the CBECS PBA codes for each individual CBECS sector.

[15] Note that the discount rates for the "Other" sector are the weighted average of all companies in the data set.

Table 3.1: Mapping of Sectors to CBECS Categories

Sector Name in DR Analysis	Primary CBECS PBA #	Applied to CBECS PBAs: (Sector Name and PBA number)
Office	2	Office (2)
Food Sales	6	Food Sales (6)
Health Care	8	Outpatient health care (8); Inpatient health care (16); Nursing (17); Laboratory (4)
Warehouse	11	Nonrefrigerated warehouse (5); Refrigerated warehouse (11)
Public Assembly	13	Public Assembly (13); Religious worship (12)
Food Service	15	Food Service (15)
Lodging	18	Lodging (18)
Retail (Mall)	24	Enclosed mall (24); Strip shopping mall (23)
Retail (Other)	25	Retail other than mall (25)
Service	26	Service (26)
Education	14	Education (14); Public order and safety (7)
Other	91	Other (91)
Industrial	N/A	N/A

It is important to note that some sectors cannot be addressed with Damodaran Online data, which only includes information on publicly-traded commercial companies. Commercial companies that are privately held are represented using their publicly-traded sectoral counterparts as proxies. Publicly-owned buildings, such as state-owned schools or government owned and occupied offices, must be addressed separately. Government buildings are assigned a discount rate from a distribution of state and local or federal bond rates, as appropriate.

If a very specific sector is needed but not included in Damodaran Online data (i.e., laundromats for the commercial clothes washers analysis) Ibbotson Associate's sector summary data can be used (Ibbotson Associates 2009). The "Industrial" sector (e.g., mining, manufacturing, utilities) is currently included as a single category; however, subsectors can be broken out as necessary for the few specifically industrial products covered by efficiency standards, such as distribution transformers or industrial pumps.

4 Small Business Subgroup

The life-cycle cost sub-group analysis is included in the efficiency standard evaluation process in order to determine if there are any specific groups of consumers who may be disproportionately affected by the proposed standard. In the case of commercial appliances and equipment, small businesses are one of the most common subgroups analyzed.

Even after accounting for systematic risk (β), CAPM underestimates the cost of equity for small firms; this phenomenon is known as the "size effect" (Ibbotson Associates 2009; Fama and French, 1992). To account for this size effect, a size premium can be incorporated into the CAPM equation to provide an alternative estimate of the small company cost of equity, and thus, the small company weighted average cost of capital.[16]

4.1 Modifying CAPM to Account for Characteristics of Small Businesses

The additional return associated with the firm size effect can be accounted for by adding a size premium to the CAPM calculation of the cost of equity for small firms:

$$k_{ei} = R_f + \beta_i \, ERP + S$$

Where:

k_{ei} =cost of equity of firm i,
R_f = expected return on risk-free assets,
β_i =risk coefficient of firm i,
ERP =equity risk premium, and
S =size premium.

For the small business subgroup analysis, size premia are taken from Ibbotson Associates' Stocks, Bonds, Bills, and Inflation Yearbook (Ibbotson Associates 2001 - 2013). Using the above modified CAPM equation, size premia are combined with Damodaran Online data to calculate revised discount rate distributions by sector that are specifically relevant to small businesses. Within the firm-level Damodaran Online dataset, small companies are identified by their market capitalization. Size premia and the definition of "small" companies vary over time, as shown in Table 4.1.

The real weighted average cost of capital is then estimated for each firm, using the cost of equity including a size premium, rather than the standard CAPM cost of equity.[17] Table 4.1 presents estimates of the discount rates for entire sectors, small companies specifically, and the small company discount rate premium (i.e., the difference between the small company discount rate and the average discount rate for each sector).

[16] Note that this section describes the process of estimating small company discount rates by sector. The process of mapping these rates to the appropriate items of the LCC building sample is provided separately in appendix B.

[17] As in section 2, the weighted average cost of capital is defined as a shared weighted average of the cost of equity and cost of debt for each firm.

Table 4.1: Size Premia and Decile Definitions

Year	Max. Market Capitalization (Decile 10, $million)	Max. Market Capitalization (Decile 10, $million)	Size Premium (Deciles 9,10 "Microcap", %)
2001	84.5	192.6	2.62
2002	141.5	314.0	3.53
2003	166.4	330.6	4.01
2004	262.7	505.4	4.02
2005	264.9	586.4	3.95
2006	314.4	626.9	3.88
2007	363.5	723.3	3.65
2008	218.5	456.3	3.74
2009	214.1	431.3	3.99
2010	235.6	477.5	4.07
2011	206.8	422.8	3.89
2012[18]	253.8	514.2	3.81

To estimate the impact of standards specifically on small businesses, the small company discount rates for each sector are input to the Life-Cycle Cost and Payback Period analysis instead of the sector average discount rates.

The small company discount rate premium is the difference between the weighted average cost of capital for decile 9-10 companies in a sector and that of the full sample of commercial firms in the sector. Relying only on the original CAPM model (without size premium modifier) would lead to underestimation of discount rates for small companies by approximately 1-3%, depending on the sector in question.

Table 4.2: Comparison of Small Business and Full Commercial Sample: Weighted Average Cost of Capital by Sector

Sector	Sector #	All Company WACC (%)	Small Company WACC (%)	Small Company Avg. DR Premium (%)
Office	2	6.04	7.15	1.11
Food Sales	6	5.52	7.30	1.78
Health Care	8	5.53	8.56	3.03
Warehouse	11	6.01	9.10	3.09
Public Assembly	13	6.31	7.30	0.99
Food Service	15	5.73	8.21	2.47
Lodging	18	6.99	7.74	0.75
Retail (Mall)	24	6.36	8.17	1.81
Retail (Other)	25	5.89	8.35	2.45
Service	26	6.25	7.61	1.36
Other	91	6.02	7.78	1.76
Industrial	N/A	6.00	8.45	2.45

5 Discussion: Planning for Future Updates

In the near term, the discount rate distributions presented in this report (based on 2004-2013 firm betas, stock value deviations, and debt to equity ratios; risk-free rates from 40-year geometric average returns for 10-year Treasury bill; equity risk premia calculated from difference in 40-yr geometric average of risk-free rate and stock market return; size premia from 1926-2012) can be expected to reasonably represent the financial environment of U.S. firms in the period covered in the LCC analysis. However, over time it is likely that these distributions and their underlying data will become outdated. Unless detailed company-level financial data again becomes available from Damodaran Online (or another publicly available source), we will need to consider alternative data sources and methods to estimate commercial discount rates for efficiency standards analysis.

Two promising options include using Damodaran Online's sector level cost of capital data or Ibbotson Associates' cost of capital by SIC code.[19][20] However, both of these data sources are quite aggregated, and as such, they are less suited to constructing discount rate distributions and to performing the small business discount rate estimation. Damodaran Online sector data is expected to continue to be updated annually and publicly available for the foreseeable future. It has the additional advantage of sharing sector naming conventions with the detailed firm-level data for which we have already determined mapping to CBECS Principal Building Activities. Ibbotson Associates' data is available at a somewhat more disaggregated level as compared to Damodaran Online sector data (reported for major SIC codes and small versus large companies comparison). However, Ibbotson Associates data would need to be purchased each year and do not allow for the construction of discount rate distributions as currently applied in the LCC.

Due to cost considerations and data granularity, the discount rate distributions calculated from firm-level Damodaran Online data should continue to be applied in upcoming analyses at least through 2018.[21]

[19] http://pages.stern.nyu.edu/~adamodar/ (Data => Current Data => Costs of Capital by Industry; Data => Archived Data => Costs of Capital by Industry)

[20] Note that a third option could be to attempt to build our own version of Damodaran's firm-level data set by purchasing data from the underlying data sources, listed at Damodaran Online as: Bloomberg, Morningstar, Capital IQ and Compustat. This option is likely to costly and complicated.

[21] This date is approximately 5 years after the data period concludes. While the economic and policy environment surrounding U.S. commercial and industrial business may alter in the next five years, it is important to consider that the 2004-2013 period included in the commercial discount rate distributions already incorporates impacts of a relatively strong economy slipping into recession and subsequently beginning recovery.

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A Discount Rate Distributions by Sector

Table A.1: Office (2) Discount Rate Distribution

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%	2.8%	0.0%	0.0%	2	1,842
5	3-4%	3.5%	1.2%	0.3%	139	289,000
6	4-5%	4.8%	25.0%	15.2%	2878	14,859,826
7	5-6%	5.6%	41.8%	43.9%	4802	42,839,263
8	6-7%	6.4%	19.5%	27.6%	2244	26,939,795
9	7-8%	7.5%	7.2%	7.0%	831	6,864,589
10	8-9%	8.5%	3.2%	3.8%	364	3,675,384
11	9-10%	9.4%	1.4%	1.8%	161	1,771,330
12	10-11%	10.3%	0.4%	0.2%	50	191,759
13	11-12%	11.4%	0.1%	0.1%	10	83,939
14	12-13%	12.3%	0.0%	0.0%	4	8,903
15	13-14%	13.7%	0.1%	0.1%	7	63,273
Weighted Average:			**5.86%**	**6.04%**		

Table A.2: Food Sales (6) Discount Rate Distribution

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%					
5	3-4%					
6	4-5%	4.8%	31.0%	26.3%	61	290,345
7	5-6%	5.5%	54.3%	59.3%	107	654,495
8	6-7%	6.6%	12.7%	11.3%	25	124,883
9	7-8%	7.7%	1.0%	1.2%	2	13,203
10	8-9%	8.2%	0.5%	1.9%	1	20,836
11	9-10%	9.4%	0.5%	0.0%	1	346
12	10-11%					
13	11-12%					
14	12-13%					
15	13-14%					
Weighted Average:			**5.48%**	**5.52%**		

Table A.3: Health Care (8) Discount Rate Distribution

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%	3.0%	0.1%	0.0%	2	23
5	3-4%	3.3%	1.9%	0.2%	43	14,409
6	4-5%	4.8%	20.2%	29.6%	459	2,547,064
7	5-6%	5.5%	49.9%	52.2%	1136	4,495,187
8	6-7%	6.3%	19.1%	9.6%	435	828,726
9	7-8%	7.5%	6.0%	7.0%	137	598,175
10	8-9%	8.4%	1.8%	1.3%	41	109,671
11	9-10%	9.4%	0.8%	0.1%	18	6,563
12	10-11%	10.4%	0.1%	0.0%	3	1,947
13	11-12%	11.1%	0.0%	0.0%	1	3,188
14	12-13%	12.7%	0.0%	0.0%	1	1,100
15	13-14%					
Weighted Average:			**5.67%**	**5.53%**		

Table A.4: Warehouse (11) Discount Rate Distribution

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%					
5	3-4%	3.6%	1.0%	0.0%	3	46
6	4-5%	4.7%	16.9%	33.1%	53	276,556
7	5-6%	5.5%	33.8%	31.9%	106	266,499
8	6-7%	6.4%	22.0%	10.7%	69	89,110
9	7-8%	7.3%	14.6%	10.0%	46	83,849
10	8-9%	8.6%	6.4%	9.3%	20	77,803
11	9-10%	9.6%	4.8%	4.9%	15	40,971
12	10-11%	10.5%	0.3%	0.0%	1	59
13	11-12%	11.7%	0.3%	0.1%	1	706
14	12-13%					
15	13-14%					
Weighted Average:			**6.24%**	**6.01%**		

Table A.5: Public Assembly (13) Discount Rate Distribution

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%	2.9%	0.1%	0.0%	1	1,627
5	3-4%	3.5%	0.8%	0.4%	11	33,322
6	4-5%	4.8%	19.0%	10.9%	248	949,484
7	5-6%	5.6%	40.2%	33.2%	524	2,904,006
8	6-7%	6.4%	26.3%	35.0%	343	3,060,165
9	7-8%	7.5%	8.2%	9.8%	107	861,404
10	8-9%	8.4%	3.4%	8.9%	44	779,801
11	9-10%	9.2%	1.2%	1.1%	16	97,422
12	10-11%	10.2%	0.7%	0.2%	9	14,142
13	11-12%	11.5%	0.1%	0.5%	1	40,882
14	12-13%	12.5%	0.1%	0.1%	1	4,783
15	13-14%					
Weighted Average:			**5.99%**	**6.31%**		

Table A.6: Education (14) Discount Rate Distribution

Bin	Bin Range	Rates	Distribution (Year Count Weighted)	Year Count (#)
1	<0%			
2	0-1%			
3	1-2%	1.5%	12.9%	4
4	2-3%	2.8%	25.8%	8
5	3-4%	3.5%	45.2%	14
6	4-5%	4.1%	6.5%	2
7	5-6%	5.1%	6.5%	2
8	6-7%	6.3%	3.2%	1
9	7-8%			
10	8-9%			
11	9-10%			
12	10-11%			
13	11-12%			
14	12-13%			
15	13-14%			
Weighted Average:			**3.30%**	

Table A.7: Food Service (15) Discount Rate Distribution

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%					
5	3-4%	3.7%	0.8%	0.0%	4	175
6	4-5%	4.8%	16.1%	24.3%	78	445,229
7	5-6%	5.5%	45.8%	44.9%	222	821,578
8	6-7%	6.3%	26.0%	20.8%	126	380,018
9	7-8%	7.2%	6.6%	4.9%	32	89,616
10	8-9%	8.4%	3.7%	4.9%	18	90,035
11	9-10%	9.3%	0.8%	0.2%	4	3,866
12	10-11%					
13	11-12%	11.8%	0.2%	0.0%	1	528
14	12-13%					
15	13-14%					
Weighted Average:			**5.84%**	**5.73%**		

Table A.8: Lodging (18) Discount Rate Distribution

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%					
5	3-4%	3.8%	0.9%	0.0%	4	412
6	4-5%	4.8%	17.1%	12.3%	75	207,046
7	5-6%	5.7%	35.5%	24.2%	156	408,986
8	6-7%	6.5%	30.1%	29.1%	132	491,011
9	7-8%	7.5%	8.4%	10.5%	37	177,713
10	8-9%	8.5%	4.6%	9.2%	20	155,529
11	9-10%	9.3%	1.6%	4.9%	7	82,374
12	10-11%	10.8%	1.4%	5.4%	6	91,959
13	11-12%	11.9%	0.5%	4.3%	2	73,322
14	12-13%					
15	13-14%					
Weighted Average:			**6.21%**	**6.99%**		

Table A.9: Retail - Mall (24) Discount Rate Distribution

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%					
5	3-4%	3.1%	0.5%	0.2%	4	3,241
6	4-5%	4.9%	18.1%	9.6%	144	150,998
7	5-6%	5.5%	36.5%	29.0%	291	454,649
8	6-7%	6.5%	30.5%	40.6%	243	637,795
9	7-8%	7.3%	10.3%	12.6%	82	197,925
10	8-9%	8.4%	2.6%	4.2%	21	66,564
11	9-10%	9.5%	1.0%	2.2%	8	34,492
12	10-11%	10.4%	0.4%	1.5%	3	23,944
13	11-12%	12.9%	0.1%	0.0%	1	43
14	12-13%					
15	13-14%					
Weighted Average:			**6.02%**	**6.36%**		

Table A.10: Retail - Other (25) Discount Rate Distribution

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%					
5	3-4%	3.9%	0.4%	0.0%	3	1,093
6	4-5%	4.8%	14.9%	20.7%	116	1,606,491
7	5-6%	5.6%	39.2%	45.4%	306	3,528,128
8	6-7%	6.4%	26.9%	22.1%	210	1,714,479
9	7-8%	7.4%	11.1%	6.6%	87	513,688
10	8-9%	8.5%	4.4%	1.8%	34	136,471
11	9-10%	9.2%	2.2%	3.2%	17	248,650
12	10-11%	10.3%	0.6%	0.2%	5	15,446
13	11-12%	11.3%	0.3%	0.0%	2	1,661
14	12-13%	14.3%	0.1%	0.0%	1	264
15	13-14%					
Weighted Average:			**6.14%**	**5.89%**		

Table A.11: Service (26) Discount Rate Distribution

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%					
5	3-4%	3.8%	0.8%	0.0%	13	259
6	4-5%	4.8%	19.2%	9.1%	305	183,304
7	5-6%	5.6%	42.5%	38.3%	676	772,626
8	6-7%	6.4%	25.8%	33.3%	411	673,013
9	7-8%	7.5%	7.1%	11.8%	113	238,894
10	8-9%	8.3%	3.5%	5.3%	55	107,829
11	9-10%	9.3%	0.8%	1.6%	13	32,623
12	10-11%	10.3%	0.2%	0.5%	3	11,072
13	11-12%	11.4%	0.1%	0.0%	1	22
14	12-13%	12.1%	0.1%	0.0%	1	289
15	13-14%					
Weighted Average:			**5.91%**	**6.25%**		

Table A.12: Other (91) Discount Rate Distribution

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%	2.9%	0.0%	0.0%	16	3,854
5	3-4%	3.4%	1.2%	0.2%	478	608,811
6	4-5%	4.8%	19.3%	17.0%	7723	45,040,196
7	5-6%	5.6%	39.7%	42.4%	15860	112,221,685
8	6-7%	6.4%	23.8%	25.6%	9522	67,682,404
9	7-8%	7.4%	9.1%	8.5%	3628	22,597,352
10	8-9%	8.4%	4.1%	3.9%	1628	10,419,740
11	9-10%	9.4%	1.8%	1.7%	716	4,622,795
12	10-11%	10.4%	0.6%	0.4%	256	948,416
13	11-12%	11.5%	0.2%	0.1%	64	270,802
14	12-13%	12.4%	0.1%	0.0%	25	33,282
15	13-14%	13.5%	0.1%	0.0%	23	95,590
Weighted Average:			**6.00%**	**6.01%**		

Table A.13: Industrial Discount Rate Distribution

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%	2.9%	0.1%	0.0%	11	363
5	3-4%	3.4%	1.3%	0.2%	254	266,855
6	4-5%	4.8%	16.3%	17.7%	3306	23,523,854
7	5-6%	5.5%	37.2%	41.5%	7534	55,076,269
8	6-7%	6.4%	26.1%	24.7%	5284	32,743,410
9	7-8%	7.4%	10.6%	9.8%	2154	12,958,295
10	8-9%	8.4%	5.0%	3.9%	1010	5,199,818
11	9-10%	9.4%	2.3%	1.7%	456	2,304,158
12	10-11%	10.4%	0.9%	0.5%	176	598,089
13	11-12%	11.3%	0.2%	0.1%	45	66,554
14	12-13%	12.4%	0.1%	0.0%	17	18,163
15	13-14%	13.3%	0.1%	0.0%	15	32,053
Weighted Average:			**6.11%**	**6.00%**		

B Additional Small Business Discount Rate Information

This appendix provides additional information on discount rates used in the small business subgroup analysis. The first subsection describes the process of identifying small businesses in the LCC building sample. The second subsection provides the full small business discount rate distributions by sector.

B.1 Mapping to Small Businesses in the LCC Building Sample

In order to evaluate the life-cycle cost implications of higher small business discount rates, buildings likely to contain small businesses must be identified from the LCC building sample. To identify such buildings, Small Business Administration (SBA) size standards are used to define which business entities are considered to be small. The SBA establishes size standards for types of economic activity, or industry, under the North American Industry Classification System (NAICS).[22][23]

In previous efficiency standards analysis, industries occupying the following CBECS building types have been considered in the small business subgroup: public assembly, health care, lodging, food services, office, retail, and warehouses. For each of these building types, DOE selected and assigned specific representative economic activities from the NAICS industry definitions, as summarized in Table B.1.

[22] Title 13, Code of Federal Regulations, Chapter I-Small Business Administration, Part 121-Small Business Administration, Subpart A-Size Eligibility Provisions and Standards.

[23] Note that SBA size standards are expressed in terms of company dollars per year of revenue while CBECS allows for the identification of number of employees per building.

Table B.1: NAICS Industry Size Data Assignment to CBECS Building Type

Building Type	NAICS Industry	
	Code	Industry Title
Assembly	711	Performing arts spectator sports & related industries;
	712	Museums, historical sites, & similar institutions;
	713	Amusement, gambling, & recreation industries
Food Service	722	Food services & drinking places
Lodging	721	Accommodation
Office	5222	Non-depository credit intermediation;
	523	Securities intermediation & related activities;
	5242	Agencies, brokerages & other insurance related activities;
	531	Real estate Rental & leasing services;
	533	Lessors of intangible assets except copyrighted works;
	541	Professional, scientific, & technical services
Health Care	621	Ambulatory health care services;
	622	Hospitals
Retail	441	Motor vehicle & parts dealers;
	442	Furniture & home furnishings stores;
	443	Electronics & appliance stores;
	444	Building material & garden equipment & supplies dealers;
	445	Food & beverage stores;
	446	Health & personal care stores;
	447	Gasoline stations;
	448	Clothing & clothing accessories stores;
	451	Sporting goods, hobby, book and music stores;
	452	General merchandise stores;
	453	Miscellaneous store retailers
Warehouse	423	Merchant wholesalers, durable goods;
	424	Merchant wholesalers, nondurable goods

The SBA defines a small business by either its annual receipts (i.e., revenues) or its number of employees. Though the exact definition differs across industries, businesses are generally defined to be small if annual receipts are $6 million or less. Businesses located in warehouses are considered to be small if they employ 100 or fewer people.

DOE draws its LCC analysis building sample from CBECS, which provides the number of workers employed, but not the annual revenues for each of the records in its building sample. Thus, DOE needed to correlate annual revenues with the number of workers to identify the sub-group of small businesses in the building sample. Because some individual CBECS building records could represent businesses that are part of much larger firms, the small business sub-group identified in this way could possibly over-represent the actual number of small businesses. However, the results from the analysis provide an adequate indication of whether the small business sub-group would be disproportionally advantaged or disadvantaged by a proposed standard.

The Establishment and Firm Size data series from the U.S. Census Bureau 2007 Economic Census were used to define the relationship between annual revenues and the number of workers for each of the relevant business activities (U.S. Census Bureau 2007). The Census data series provide annual receipts, the number of paid employees, and the number of establishments by categories of establishments. Establishment categories are based on a range of annual receipts (e.g., establishments with receipts of $1 million to less than $2.5 million). Within each establishment category, an average value for annual receipts was determined by dividing the annual receipts by the number of establishments. Similar calculations produce an average number of paid employees

for each establishment category.

Table A.2 provides a listing of establishment categories for Lodging (NAICS code 72, and subcodes) in the Economic Census. The primary data in Table A.2 are drawn directly from the Accommodation Establishment and Firm Size data series. The derived data in the right-hand columns (average receipts and average number of employees) are calculated from the Census data. Note that the upper limit of what is generally considered a small business ($6 million annual receipts) falls within the establishment category of $5 million to $9.99 million.

Table B.2: Example of Establishment Categories (NAICS 72)

Primary Data (2007 Census, NAICS 72)				Derived Data	
Size by Sales Value	# Firms	Total Sales ($1000)	Number of Employees	Average Sales ($)	Average Employees
Establishments with sales less than $10,000	1,813	10,299	1,871	5,681	1
Establishments with sales of $10,000 to $24,999	5,578	93,379	6,906	16,741	1
Establishments with sales of $25,000 to $50,000	10,709	403,792	18,798	37,706	2
Establishments with sales of $50,000 to $99,999	28,387	2,158,713	74,652	76,046	3
Establishments with sales of $100,000 to $249,999	94,395	16,230,362	434,330	171,941	5
Establishments with sales of $250,000 to $499,999	107,938	39,226,439	970,993	363,416	9
Establishments with sales of $500,000 to $999,999	118,564	85,439,795	2,013,459	720,622	17
Establishments with sales of $1,000,000 to $2,499,999	114,048	173,798,712	3,748,465	1,523,908	33
Establishments with sales of $2,500,000 to $4,999,999	28,535	94,993,873	1,853,487	3,329,030	65
Establishments with sales of $5,000,000 to $9,999,999	6,172	40,934,803	627,594	6,632,340	102
Establishments with sales of $10,000,000 or more	3,466	133,267,583	1,286,875	38,449,966	371

By deriving the average receipts and numbers of employees for the establishment categories within each of the NAICS industries listed in Table B.2, we create a data set from which to estimate the relationship between sales (revenues) and number of employees (workers) for buildings in these sectors (Figures B.1 - B.6).

Figure B.1: Assembly: Relationship between Number of Employees and Value of Sales

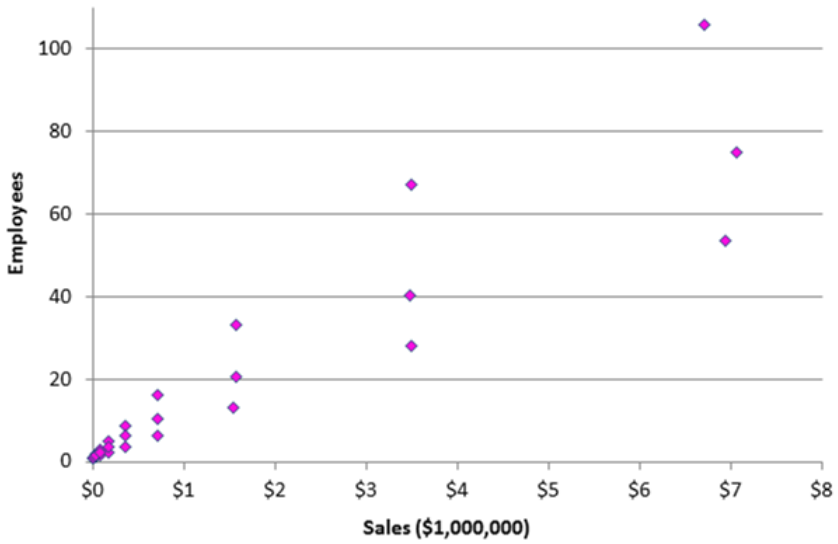


Figure B.2: Health Care: Relationship between Number of Employees and Value of Sales

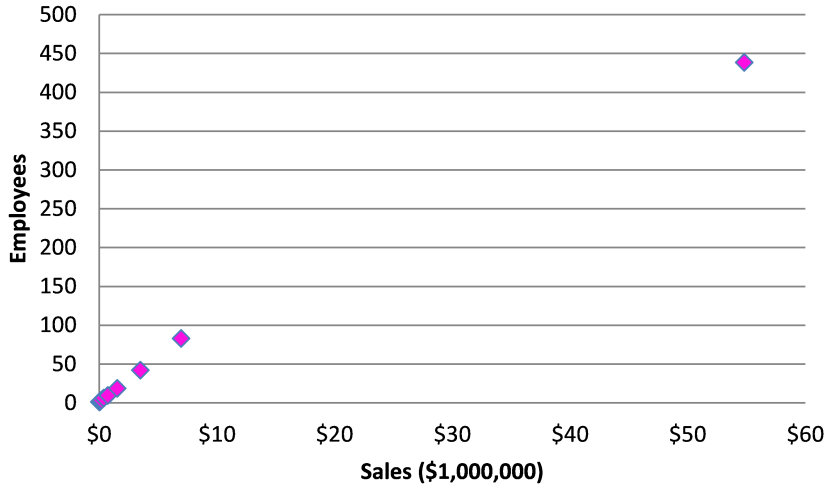


Figure B.3: Food Service: Relationship between Number of Employees and Value of Sales

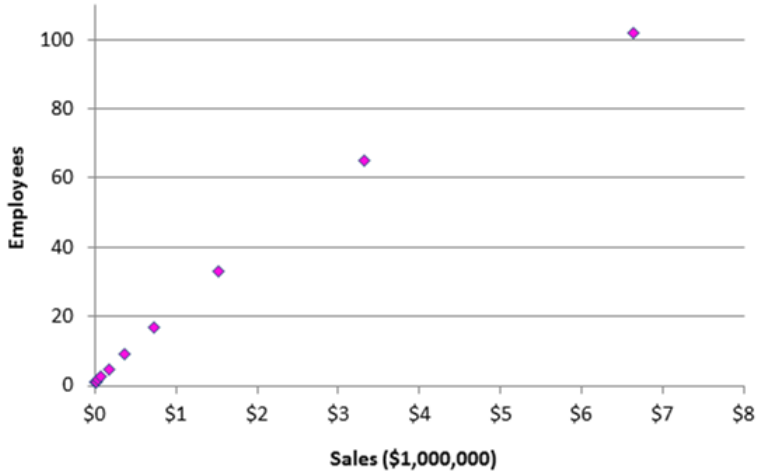


Figure B.4: Lodging: Relationship between Number of Employees and Value of Sales

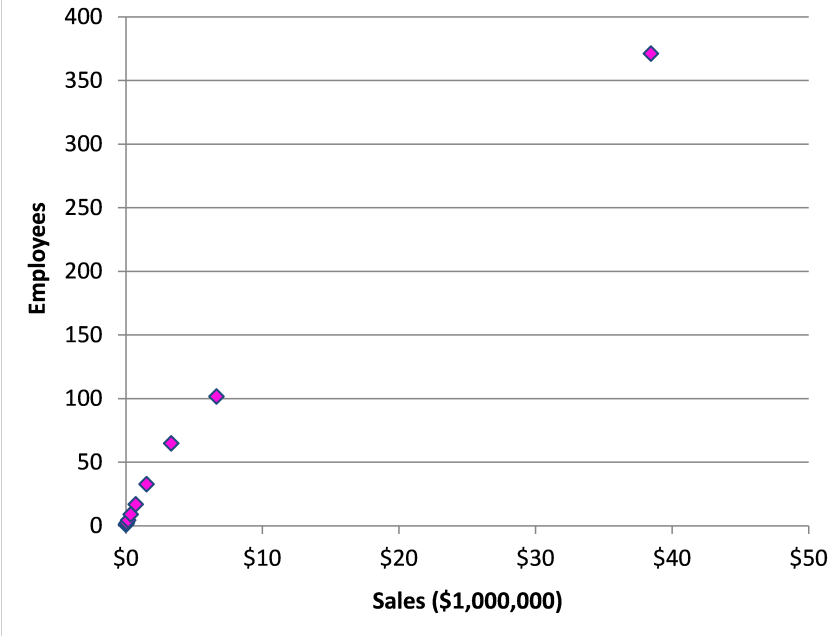


Figure B.5: Office: Relationship between Number of Employees and Value of Sales

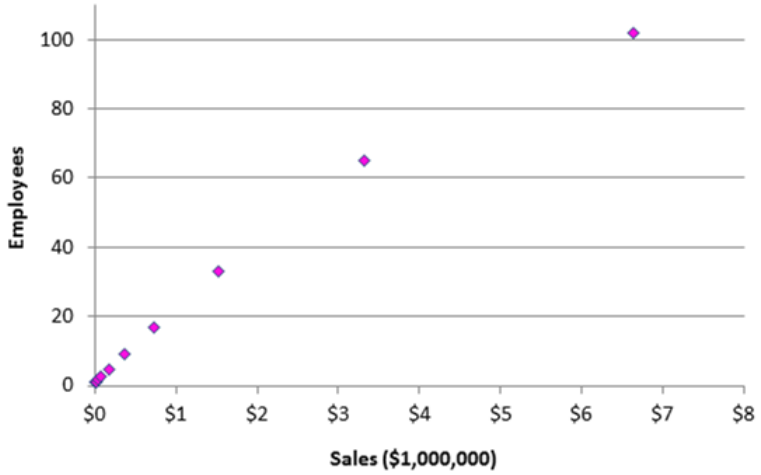
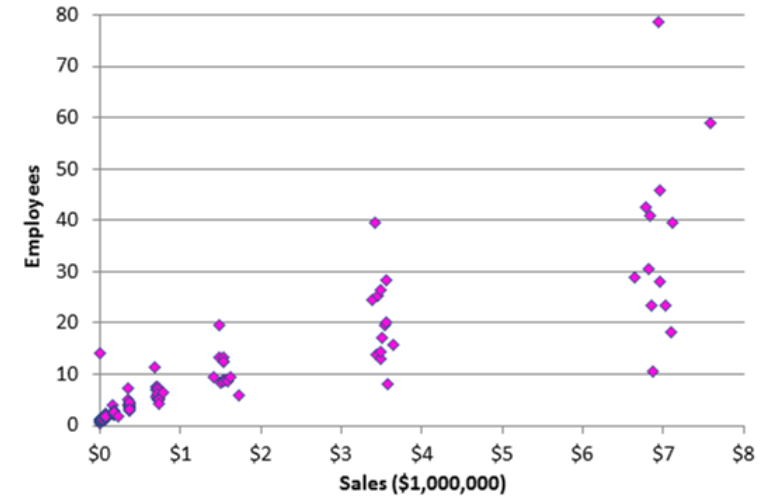


Figure B.6: Retail: Relationship between Number of Employees and Value of Sales



The relationship between annual value of sales and number of employees for each building type through linear regression of the data in Figures B.1 - B.6. Based on the regression parameters, we then estimated the number of employees for each of the building types associated with annual sales at the upper limit of the SBA definition of a small business (Table B.3).

Table B.3: Maximum Number of Employees in Small Business by Sector

Sector	Maximum Number of Employees
Assembly	70
Health Care	85
Lodging	113
Food Service	98
Office	28
Retail	32
Warehouse	100

Using the maximum employee number from Table B.3, DOE was able to identify from its building sample which buildings could potentially be occupied by small businesses. It is important to reiterate that this methodology is likely to overestimate the proportion of the total building sample composed of small businesses, as any small building will be flagged as a small business, even if it is in fact part of a major chain. However, of primary interest are the average firm-level impacts, and the results from the analysis provide an adequate indication of any differential impact on the small business sub-group following a proposed standard.

B.2 Small Business Discount Rate Distributions by Sector

Table B.4: Office (2) Discount Rate Distribution (Small Businesses)

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%					
5	3-4%					
6	4-5%	4.9%	1.4%	4.1%	99	97,461
7	5-6%	5.7%	8.8%	36.0%	608	849,465
8	6-7%	6.5%	21.0%	16.5%	1452	390,221
9	7-8%	7.5%	25.2%	14.9%	1740	351,055
10	8-9%	8.5%	19.6%	11.5%	1357	270,255
11	9-10%	9.5%	12.4%	8.7%	860	204,522
12	10-11%	10.4%	6.4%	5.3%	442	124,888
13	11-12%	11.5%	2.9%	1.7%	198	40,575
14	12-13%	12.5%	1.4%	0.8%	94	18,822
15	13-14%	13.8%	0.9%	0.5%	60	12,173
Weighted Average:			**7.96%**	**7.15%**		

Table B.5: Food Sales (6) Discount Rate Distribution (Small Businesses)

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%					
5	3-4%					
6	4-5%	4.9%	1.3%	3.0%	1	1,184
7	5-6%	5.6%	11.7%	9.3%	9	3,605
8	6-7%	6.5%	19.5%	30.7%	15	11,938
9	7-8%	7.2%	20.8%	21.9%	16	8,516
10	8-9%	8.5%	41.6%	31.9%	32	12,410
11	9-10%	9.7%	2.6%	1.2%	2	472
12	10-11%	10.4%	1.3%	1.0%	1	390
13	11-12%		0.0%	0.0%		
14	12-13%	12.2%	1.3%	0.9%	1	346
15	13-14%					
Weighted Average:			**7.56%**	**7.30%**		

Table B.6: Health Care (8) Discount Rate Distribution (Small Businesses)

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%					
5	3-4%					
6	4-5%	4.9%	1.5%	2.0%	21	4,016
7	5-6%	5.4%	4.5%	3.2%	62	6,457
8	6-7%	6.6%	12.3%	11.9%	168	23,607
9	7-8%	7.5%	18.7%	13.7%	256	27,214
10	8-9%	8.5%	29.1%	29.6%	398	58,989
11	9-10%	9.5%	21.3%	24.4%	291	48,525
12	10-11%	10.4%	7.8%	9.7%	107	19,249
13	11-12%	11.4%	2.9%	3.4%	39	6,770
14	12-13%	12.5%	1.5%	1.7%	20	3,448
15	13-14%	13.7%	0.4%	0.4%	6	730
Weighted Average:			**8.39%**	**8.56%**		

Table B.7: Warehouse (11) Discount Rate Distribution (Small Businesses)

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%					
5	3-4%					
6	4-5%	5.0%	3.1%	4.4%	5	1,317
7	5-6%	5.4%	6.9%	5.4%	11	1,594
8	6-7%	6.4%	6.9%	4.9%	11	1,452
9	7-8%	7.4%	13.8%	14.1%	22	4,178
10	8-9%	8.6%	19.4%	18.4%	31	5,450
11	9-10%	9.6%	20.6%	18.5%	33	5,484
12	10-11%	10.4%	12.5%	14.8%	20	4,394
13	11-12%	11.3%	9.4%	10.6%	15	3,153
14	12-13%	12.4%	4.4%	5.6%	7	1,660
15	13-14%	13.3%	3.1%	3.3%	5	991
Weighted Average:			**8.95%**	**9.10%**		

Table B.8: Public Assembly (13) Discount Rate Distribution (Small Businesses)

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%					
5	3-4%					
6	4-5%	4.9%	4.8%	7.1%	32	18,207
7	5-6%	5.6%	12.8%	21.0%	86	53,463
8	6-7%	6.4%	18.0%	20.6%	121	52,504
9	7-8%	7.5%	21.2%	17.6%	143	44,807
10	8-9%	8.4%	21.8%	16.2%	147	41,262
11	9-10%	9.4%	11.9%	9.4%	80	23,874
12	10-11%	10.3%	5.8%	4.8%	39	12,324
13	11-12%	11.5%	1.9%	2.2%	13	5,680
14	12-13%	12.3%	1.3%	0.9%	9	2,289
15	13-14%	13.6%	0.4%	0.3%	3	702
Weighted Average:			**7.69%**	**7.30%**		

Table B.9: Food Service (15) Discount Rate Distribution (Small Businesses)

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%					
5	3-4%					
6	4-5%	4.9%	1.5%	2.4%	4	1,400
7	5-6%	5.7%	7.7%	9.1%	21	5,198
8	6-7%	6.6%	12.2%	13.8%	33	7,903
9	7-8%	7.5%	22.9%	22.3%	62	12,719
10	8-9%	8.5%	26.6%	21.2%	72	12,096
11	9-10%	9.5%	14.4%	17.2%	39	9,852
12	10-11%	10.5%	10.0%	10.0%	27	5,728
13	11-12%	11.5%	2.2%	1.8%	6	1,041
14	12-13%	12.3%	1.8%	1.2%	5	662
15	13-14%	15.1%	0.7%	1.0%	2	553
Weighted Average:			**8.30%**	**8.21%**		

Table B.10: Lodging (18) Discount Rate Distribution (Small Businesses)

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%	<0%				
2	0-1%	0-1%				
3	1-2%	1-2%				
4	2-3%	2-3%				
5	3-4%	3-4%				
6	4-5%	4-5%	4.9%	3.1%	0.6%	7
7	5-6%	5-6%	5.4%	9.7%	9.0%	22
8	6-7%	6-7%	6.5%	18.5%	35.7%	42
9	7-8%	7-8%	7.5%	19.8%	19.8%	45
10	8-9%	8-9%	8.4%	24.2%	16.3%	55
11	9-10%	9-10%	9.6%	12.3%	5.4%	28
12	10-11%	10-11%	10.4%	6.6%	4.8%	15
13	11-12%	11-12%	11.4%	3.1%	4.7%	7
14	12-13%	12-13%	12.6%	1.3%	2.7%	3
15	13-14%	13-14%	14.2%	1.3%	1.0%	3
Weighted Average:			**7.99%**	**7.74%**		

Table B.11: Retail - Mall (24) Discount Rate Distribution (Small Businesses)

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%					
5	3-4%					
6	4-5%	4.9%	2.8%	4.0%	13	4,090
7	5-6%	5.6%	9.3%	8.3%	43	8,408
8	6-7%	6.6%	15.6%	17.7%	72	17,934
9	7-8%	7.5%	20.0%	18.4%	92	18,692
10	8-9%	8.5%	19.5%	16.1%	90	16,367
11	9-10%	9.5%	16.1%	17.8%	74	18,090
12	10-11%	10.4%	11.1%	11.2%	51	11,382
13	11-12%	11.4%	4.6%	5.8%	21	5,856
14	12-13%	12.2%	0.9%	0.7%	4	710
15	13-14%	16.6%	0.2%	0.0%	1	43
Weighted Average:			**8.18%**	**8.17%**		

Table B.12: Retail - Other (25) Discount Rate Distribution (Small Businesses)

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%					
5	3-4%					
6	4-5%	5.0%	2.6%	2.5%	7	2,149
7	5-6%	5.6%	5.1%	6.6%	14	5,763
8	6-7%	6.4%	17.9%	21.2%	49	18,470
9	7-8%	7.4%	26.0%	25.2%	71	21,902
10	8-9%	8.4%	14.7%	12.2%	40	10,648
11	9-10%	9.4%	13.9%	10.3%	38	8,953
12	10-11%	10.6%	9.9%	7.5%	27	6,496
13	11-12%	11.5%	4.4%	5.1%	12	4,406
14	12-13%	12.6%	3.3%	6.6%	9	5,755
15	13-14%	15.0%	2.2%	2.9%	6	2,503
Weighted Average:			**8.33%**	**8.35%**		

Table B.13: Service (26) Discount Rate Distribution (Small Businesses)

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%					
5	3-4%					
6	4-5%	4.9%	1.9%	1.0%	18	3,068
7	5-6%	5.6%	9.6%	13.6%	92	39,768
8	6-7%	6.5%	19.7%	28.9%	190	84,690
9	7-8%	7.5%	22.4%	20.1%	216	58,783
10	8-9%	8.5%	21.8%	16.4%	210	48,109
11	9-10%	9.5%	14.2%	11.2%	137	32,690
12	10-11%	10.4%	6.9%	6.0%	66	17,605
13	11-12%	11.5%	2.3%	1.4%	22	4,248
14	12-13%	12.5%	0.9%	0.8%	9	2,412
15	13-14%	13.9%	0.3%	0.6%	3	1,626
Weighted Average:			**7.93%**	**7.63%**		

Table B.14: Other (91) Discount Rate Distribution (Small Businesses)

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%					
5	3-4%					
6	4-5%	4.9%	1.8%	3.5%	399	193,339
7	5-6%	5.6%	7.4%	20.9%	1641	1,153,617
8	6-7%	6.5%	15.6%	16.8%	3449	927,457
9	7-8%	7.5%	21.1%	16.3%	4644	898,628
10	8-9%	8.5%	21.4%	15.4%	4722	847,285
11	9-10%	9.5%	16.4%	13.0%	3626	718,599
12	10-11%	10.4%	8.9%	7.9%	1962	433,297
13	11-12%	11.5%	4.0%	3.4%	886	188,470
14	12-13%	12.5%	2.0%	1.7%	445	91,213
15	13-14%	13.9%	1.2%	1.0%	275	56,098
Weighted Average:			**8.30%**	**67.78%**		

Table B.15: Industrial Discount Rate Distribution (Small Businesses)

Bin	Bin Range	Rates	Distribution (Firm Value Weighted)	Distribution (Company Count Weighted)	Company Count (#)	Firm Value ($ million)
1	<0%					
2	0-1%					
3	1-2%					
4	2-3%					
5	3-4%					
6	4-5%	4.9%	1.8%	3.0%	192	60,052
7	5-6%	5.6%	6.3%	8.6%	673	174,348
8	6-7%	6.5%	12.2%	14.6%	1296	296,670
9	7-8%	7.5%	18.6%	16.7%	1981	338,535
10	8-9%	8.5%	21.5%	17.9%	2290	361,614
11	9-10%	9.5%	19.2%	17.9%	2044	362,772
12	10-11%	10.5%	10.9%	11.3%	1167	227,860
13	11-12%	11.5%	5.2%	5.6%	553	113,845
14	12-13%	12.5%	2.7%	2.6%	284	53,443
15	13-14%	13.8%	1.7%	1.8%	186	36,181
Weighted Average:			**8.58%**	**8.45%**		