Guide to Calibration of Financial Policy Cost Function Parameters in the OLG Dynamic Scoring Model

May 24, 2016

Abstract

This will be the section in the dynamic scoring model handbook on calibrating the parameters affecting financial policy.

1 Calibrating the Financial Policy Parameters

Financial policy affects the firm's cost of capital, and thus marginal effective tax rate (METR) through its affect on the firm's nominal discount rate, $r_{C,m}$:

$$r_{C,m} = f_{C,m}\left[i(1-u_C)\right] + (1-f_{C,m})(E_{C,m}+\pi), \tag{1.1}$$

where $f_{C,m}$ is the fraction of investment financed by debt, i is the nominal market interest rate, u_C is the statutory tax rate at the business entity level, and E_C is the required real rate of return on firm equity (i.e., the rate savers could earn if they owned shares in other firms). The subscripts denote tax treatment, $C \in \{\text{Corporate}, \text{Noncorporate}\}$, and production industry, $m \in \{1, 2, ..., M\}$.

This guide explains the calibration of the $f_{C,m}$ parameters. Note that $u_{C,m}$, i, π and $E_{C,m}$ will be taken as given.

Note that our treatment of sector will correspond to the tax-treatment of the business entity. Therefore, we consider subchapter S corporations as non-corporate since they do not remit an entity level tax. See Table 1 for this breakdown. Note that these definitions are in contrast to the methodology used by BEA, where both subchapter C and subchapter S corporations fall into the "corporate" sector and partnership and proprietorships fall under the non-corporate grouping.

Table 1: Legal Form of Organization vs. Tax Treatment

Entity	Legal Form of Organization	Tax Treatment
C Corporation	Corporate	Corporate
S Corporation	Corporate	Non-corporate
Partnership	Non-corporate	n.a.
Share of partnership income attributable to corporate partners	n.a	Corporate
Share of partnership income attributable to individual partners	n.a.	Non-corporate
Sole Proprietorship	Non-corporate	Non-corporate

2 Measuring Debt by Industry

We measure total debt from the Financial Accounts of the United States. In particular, we use the following tables to capture debt, which we measure separately for corporate financial and nonfinancial businesss, noncorporate business, and household mortgage debt:

- B.100: Value of owner-occupied houses;
- L.103: Liabilities of nonfinancial corporations, by type of instrument;
- L.104: Liabilities of nonfinancial noncorporate business, by type of instrument;
- L.208: Total liabilities (financial corporations);
- L.223: Corporate equity outstanding, by sector (nonfinancial, financial);
- L.218: Home mortgages (households); and
- L.229: Proprietors equity in noncorporate business

To allocate debt across tax treatment, we use SOI Tax Stats Data (see the Depreciation Calibration Guide for details on the specific files to use). The Financial Account Data combine both S corporations and C corporations in the "corporation" definition. We thus use SOI data to identify the portion of debt and equity attributable to S corporations. Debt is assigned in proportion to interest deductions. Equity is assigned in proportion to the sum of capital stock, additional paid-in capital, and retained earnings minus treasury stock. The resulting S corporation amounts were subtracted from corporate totals (leaving the amount for C corporations) and added to noncorporate businesses. We do the same to allocate the noncorporate across sole proprietorships and partnerships. We further allocate the amount of debt and equity attributable to corporate partnerships using a similar method.

Specifically, we make the following calculations:

Let $debt_{corp}$ be the total amount of nonfinancial corporate debt reported in the Financial Accounts of the Untied States Table L.103, variable FL104122005. We then allocate this total across S-corporations and C-corporations and industry m as follows:

$$debt_{c,m} = debt_{corp} \frac{INTRST\_PD_{c,m}}{\sum_{S \in s,c} \sum_{m=1}^{M} INTRST\_PD_{S,m}} \tag{2.1}$$

Note that we exclude finance from the industries above since we have their debt and equity separately.

$$debt_{s,m} = debt_{corp} \frac{INTRST\_PD_{s,m}}{\sum_{S \in s,c} \sum_{m=1}^{M} INTRST\_PD_{S,m}} \tag{2.2}$$

Similarly, for equity. Let $X = CAP\_STCK + PD\_CAP\_SRPLS + RTND\_ERNGS\_APPR + COMP\_RTND\_ERNGS\_UNAPPR - CST\_TRSRY\_STCK$ and $equity_{corp}$ be total nonfinancial corporate equity from the Financial Accounts of the United States Table L.223, series LM103164103. For C-corps, we have:

$$equity_{c,m} = equity_{corp} \frac{X_{c,m}}{\sum_{S \in s,c} \sum_{m=1}^{M} X_{S,m}} \tag{2.3}$$

And for S-corps:

$$equity_{s,m} = equity_{corp} \frac{X_{s,m}}{\sum_{S \in s,c} \sum_{m=1}^{M} X_{S,m}} \tag{2.4}$$

For financial businesses, we use Table L.208, series FL794122005 for corporate debt and Table L.224 series LM793164105 for equity. Here we can split the financial business amount across subindustries in finance (to the extent the SOI data contain such detail) and between S corp and C corp. The methodology is the same as above, replacing the industry list with the list of finance subindustries and using the total equity and debt for financial businesses reported in the Financial Accounts.

We then calculate the fraction of investment financed with debt for those under the corporate income tax as: $f_{C,m} = \frac{debt_{c,m}}{equity_{cm} + debt_{c,m}}$.

For the corporate financial services industry, we use Table L.208 series FL794122005 for debt and Table L.223 series LM793164105 for equity.

Noncorporate, nonfinancial debt totals come from Table L.104, series FL114123005. For non-corporate debt, we can divide between partnerships and sole props by industry using

$$debt_{NC,m} = debt_{noncorp} \frac{INTRST\_PD_{NC,m}}{\sum_{NC \in p,sp} \sum_{m=1}^{M} INTRST\_PD_{NC,m}} \tag{2.5}$$

Note that we do have partnerships and sole proprietorships in the tax data that are financial firms. I don't know where this debt is in the Financial Accounts. Because of this, let's exclude the finance industry from the above calculation.

Noncorporate equity total comes from Table L.229, series FL152090205. Not quite sure how to separate equity. We can see partners capital accounts for partnerships, but for sole props we don't have a good measure of the equity of proprietors. Let's just allocate across industry in the same way for each. And since we don't really need to separate partnership and sole prop equity (we'll just care about "non-corporate". Do this as:

$$equity_{p+sp,m} = equity_{noncorp} \frac{PCA_{p,m}}{sum_{m=1}^{M} PCA_{p,m}} \tag{2.6}$$

Where $PCA_{p,m}$ are the "partnership capital accounts" for partnerships in industry m. $equity_{p+sp,m}$ denotes the total amount of equity for partnerships and sole proprietorships in industry m. We then find total non-corp equity for industry m as $equity_{NC,m} = equity_{p+sp,m} + equitys, m$. Note that one will need to be careful about the industry detail that varies across the data for corporations and that for sole props and partnerships.

We then calculate the fraction of investment financed with debt for the non-corporate businesses by industry as: $f_{NC,m} = \frac{debt_{NC,m}}{equity_{NC,m} + debt_{NC,m}}$. The exception here are financial, noncorporate businesses (see issue above with debt for these businesses). Because of this limitation, let's use $f_{NC,finance} = f_{s,finance}$ (i.e. w use S-corp financials policy and apply it to all non-corporate financial businesses).

2.1 Owner-Occupied Housing

Financial Accounts Data: B B.101: Value of owner-occupied houses, series LM155035015; B L.218: Home mortgages (households), series FL153165105

For purposes of an analysis of effective tax rates, home- owner debt consists entirely of home mortgages: $9,490.8 billion, according to the Financial Accounts report. The total value of owner-occupied housing was $17,576.3 billion, in 2012 and the average share financed by debt was 54 percent. As with the corporate and noncorporate sectors, CBO assumed that the marginal investment in owner- occupied housing, f_h, is funded with the same share of debt.

Of course, individual homeowners typically have their highest debt share at the time of purchase. The share of debt is gradually reduced as the mortgage is paid off and as the home appreciates in value. Refinancing interrupts the process, but the trend is still toward a lower share of debt over time. The methodology of effective tax rates, however, is concerned with the debt share over the life of an investment, not with the variation within those years. From that perspective, the average share of debt among all homeowners is a better guide to the debt share of a marginal investment than is the debt share at the time a home is purchased.

3 A Note on Industry Classifications

For our computational model, we would like to model the industries outlined in Table 2. These are mostly at the 2-digit NAICS classification level, with some exceptions for industries that may face special tax treatment. The data sources do not all share the same level of industry detail. For example, the BEA Detailed Fixed Asset Tables report fixed assets by asset type and by industry, where industry categories are generally at the 3-digit NAICS level. IRS data is generally reported at the 2-digit NAICS level, with some items being available at finer levels of aggregation and others at more coarse levels. BEA's Standard Fixed Asset Tables report fixed asset by industry, but only at a very coarse level.

When moving across these data sources, we try to retain the finest level of detail with regard to industry classification. In cases where we cannot, we apply the most detailed industry information we can across the sub-classifications. However, to maintain notational consistency, we refer to the industry with the subscript m, even if the industry category level differs.

Table 2: Production Industries

#	NAICS Code	Industry
1	11	Agriculture, Forestry, Fishing and Hunting
2	211	Oil and Gas Extraction
3	212 and 213	Mining and Support Activities for Mining
4	22	Utilities
5	23	Construction
6	32411	Petroleum Refineries
7	336	Transportation Equipment Manufacturing
8	3391	Medical Equipment and Supplies Manufacturing
9	Other codes in 31-33	Manufacturing
10	42	Wholesale Trade
11	44-45	Retail Trade
12	48-49	Transportation and Warehousing
13	51	Information
14	52	Finance and Insurance
15	53	Real Estate and Rental and Leasing
16	54	Professional, Scientific, and Technical Services
17	55	Management of Companies and Enterprises
18	56	Administrative and Support and Waste Management and Remediation Services
19	61	Educational Services
20	62	Health Care and Social Assistance
21	71	Arts, Entertainment, and Recreation
22	72	Accommodation and Food Services
23	81	Other Services (except Public Administration)
24	92	Public Administration