

The Global Rise of Corporate Saving

Online Appendix

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The Appendix consists of five sections. Section 1 describes the national accounts and firm-level data used in the paper. Section 2 supplements our analysis in the main text on firm characteristics and saving. Section 3 shows the robustness of our findings to an adjustment of the definition of corporate saving that excludes the value of equity buybacks net of issuances from corporate saving. Section 4 provides further detail on the role of multinational activity in aggregate and firm-level saving. Finally, Section 5 includes additional results, presents robustness checks, and discusses some of the details of the model.

1 Data Appendix

This section provides further details on the national accounts and firm-level data used in the paper.

1.1 National Accounts Data

The national accounts data described below and used to generate results in the paper can be downloaded from the authors' web pages.

1.1.1 Data Sources

The two primary sources of data for the national accounts are the United Nations (National Accounts Tables 4.1 through 4.9) and the Organization for Economic Co-operation and Development (National Accounts Tables 13 and 14A). For the United States, we use data from the Bureau of Economic Analysis Integrated Macroeconomic Accounts, which uses source data from the National Income and Product Accounts and conforms them to definitions used in the System of National Accounts. We convert all values from local currencies into U.S. dollars using data on each country's average annual exchange rate from the International Monetary Fund's International Financial Statistics (IFS).

1.1.2 Identities in the National Income Accounts

The national accounts have data for the corporate sector, the government sector, and the household and non-profits sector. Together these sectors form the total economy. We also provide data on the non-financial corporate sector which is the subset of the corporate sector that excludes financial firms.

A set of accounting identities serve as the backbone for the national accounts. Here, we repeat these identities from the main text and denote each item's official mnemonic used in the national accounts in underbraces. We use **bold** to denote variables that we provide in the publicly available dataset.

1. The production account.

$$\underbrace{\text{Gross Output}}_{P.1} = \underbrace{\text{Gross Value Added(GVA)}}_{B.1g} + \underbrace{\text{Intermediate Consumption}}_{P.2}.$$

Aggregated to the economy level, gross value added equals GDP less net taxes on products.¹

¹The treatment of taxes net of subsidies on products (that includes items such as excise taxes, state and local sales taxes, and taxes and duties on imports) in most countries differs from that in the U.S. NIPA tables. For instance, in many countries some subset of the taxes are not allocated to sectors. This means that while they contribute to overall GDP, they do not contribute to the gross value added of any sector.

2. The generation of income account.

$$\underbrace{\text{GVA}}_{B.1g} = \underbrace{\text{Gross Operating Surplus(GOS)}}_{B.2g+B.3g} + \underbrace{\text{Compensation to Labor}}_{D.1P} + \underbrace{\text{Net Taxes on Production}}_{D.29P-D.39R}.$$

3. The distribution of income account. Equation (2) in the main text is a rearranged version of original identities from the System of National Accounts. Here, we present the identities used in the System of National Accounts.

$$\underbrace{\text{GOS}}_{B.2g+B.3g} = \underbrace{\text{Gross Saving (GS)}}_{B.8g} + \underbrace{\text{Net Property Income Paid}}_{D.4P-D.4R} + \underbrace{\text{Current Taxes on Income}}_{D.5P} + \underbrace{\text{Social Transfers}}_{D.62P-D.61R} + \underbrace{\text{Other Transfers}}_{D.7P-D.7R}.$$

Net Property Income Paid can be further decomposed as follows:

$$\underbrace{\text{Net Property Income Paid}}_{D.4P-D.4R} = \underbrace{\text{Net Distributed Income (Dividends)}}_{D.42P+D.44P-D.42R-D.44R} - \underbrace{\text{Reinvested Earnings on Direct Foreign Investment}}_{D.43R-D.43P} + \underbrace{\text{Net Interest Paid}}_{D.41P-D.41R} + \underbrace{\text{Rents on Land}}_{D.45P-D.45R}.$$

This decomposition of Net Property Income Paid is unavailable in the UN data. Thus, when we aggregate dividends and interest at the global level, we use the OECD data which covers a smaller number of periods and is limited to member countries.

4. The capital account.

$$\underbrace{\text{GS}}_{B.8g} = \underbrace{\text{Net Lending}}_{B.9} + \underbrace{\text{Gross Fixed Capital Formation}}_{P.51} + \underbrace{\text{Changes in Inventories}}_{P.52} + \underbrace{\text{Changes in Other Non-Financial Produced Assets}}_{K.2} + \underbrace{\text{Net Capital Transfer}}_{D.9}.$$

In the paper we define the net lending position as the excess of gross saving over investment spending. This differs slightly from the identity above. However, because the remaining

items are small and stable over time, our measure of net lending position closely traces that in the national accounts.²

1.1.3 Dataset Variables

The dataset posted on the authors' web pages includes the following variables:

- Year
- Country
- Sector: Corporate (C), Non-Financial Corporate (NF), Households and Non-Profits (HH), Government (G), and Total Economy (TE).
- GDP: Gross Domestic Product. Only available for Total Economy. Source: UN.
- GVA: Gross Value Added. Not available for Total Economy. Source: UN.
- GS: Gross Saving. Source: UN.
- GOS: Gross Operating Surplus. Source: UN.
- GFCF: Gross Fixed Capital Formation. Source: UN.
- COMP: Compensation to Employees. Source: UN.
- ITAX: Current Taxes on Income. Source: UN.
- PTAX: Net Taxes on Production. Source: UN.
- NDIV: Net Distributed Income (Dividends). Source: OECD.
- NINT: Net Interest Paid. Source: OECD.
- REDFI: Reinvested Earnings from Direct Foreign Investment. Source: OECD.

²Net capital transfer receivable include items such as buildings and equipment grants from general government to research facilities. Capital transfers payable includes contributions to local government for the construction of infrastructure.

1.2 Firm-Level Data

In this section we provide further details on the firm-level data used in our analysis.

1.2.1 Data Sample

Our sample consists of consolidated financial statement data of publicly listed firms from Compustat Global and Compustat North America. The word “consolidated” refers to the consolidation between parent and subsidiaries. By law, parent companies must submit consolidated statements. Non-consolidated statements, on the other hand, are typically not mandatory. We exclude non-consolidated statements to avoid double counting of firm activities. More specifically, we keep only observations that have value “C” for Compustat item *consol*.

We treat the financial statements at the end of each company’s fiscal year as if it reflected their activities during the corresponding calendar year. Compustat item *fyrr* denotes the month that corresponds to the company’s fiscal year end. We drop statements that are released outside of the month corresponding to the end of the firm’s fiscal year.³ We convert all local currency values to U.S. dollars using (calendar) annual average exchange rates.

We exclude financial firms (SIC codes 6000-6999) and other unclassified firms (SIC codes greater than or equal to 9000). Finally, we also exclude firms for which we cannot calculate a gross saving rate for at least 10 years.⁴

1.2.2 Aggregate Saving Rate in Firm-Level Data and National Accounts

The firm-level data classify activity across countries differently from the national accounts and include only publicly listed firms. Direct comparisons with GDP, therefore, are not particularly informative. Nonetheless, aggregated across all countries in 2013, firms in our sample contributed roughly 15.5 trillion U.S. dollars in gross value added, which represents roughly 60 percent of the global non-financial corporate sector GVA found in the national accounts.

³Occasionally, companies change their fiscal period during the calendar year, thus Compustat item *fyrr* changes accordingly. In these instances, there would be two statements during the calendar year, both of which are released in the month that corresponds to *fyrr*. We pick the later statement for that calendar year.

⁴Figure 6 in the main text and Figure 2 below includes some firms whose age is listed as below 10 years. In these cases the firms have been public for less than 10 years but provide sufficient information on their operations prior to their IPO, which we can use to calculate 10 years of saving rates.

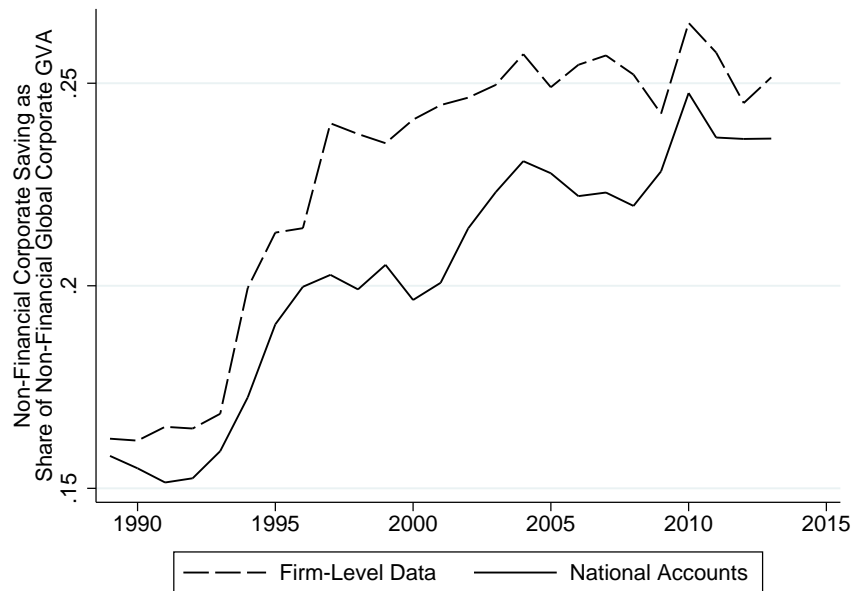


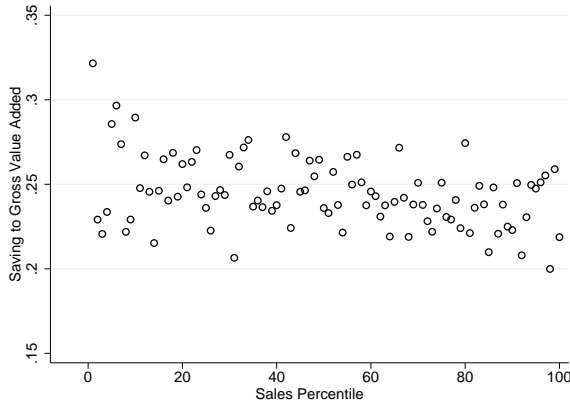
Figure 1: Global Non-Financial Corporate Saving: Firm-Level vs. National Accounts Data

Despite the differences between what is measured and reported in our macro and micro data, Figure 1 shows that the global (non-financial) saving rate aggregated up from the firm-level data tracks well the saving rate we measured from the national accounts.

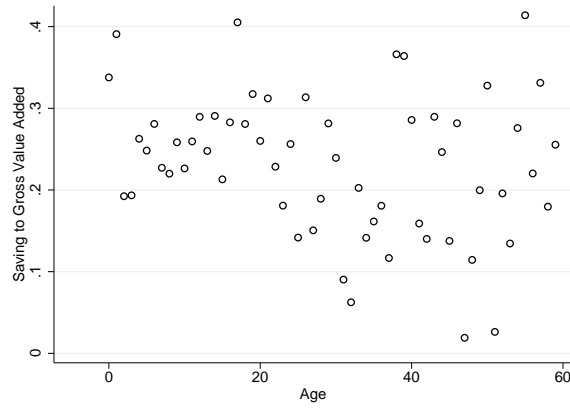
2 Size and Age Analyses Using Bins

In Section 3.4 of the main text, we present scatterplots relating each firm’s size and age to its corporate saving rate and the trend in its corporate saving rate. These relationships are generally either statistically or economically insignificant. Figure 2 in this Appendix presents equivalent scatterplots but where firms are aggregated into bins corresponding to the percentile of their average sales or their age. As in the text, we measure age with firm’s mean year in the sample minus the year of its IPO. We round age to the nearest digit such that the age bins are one year apart.

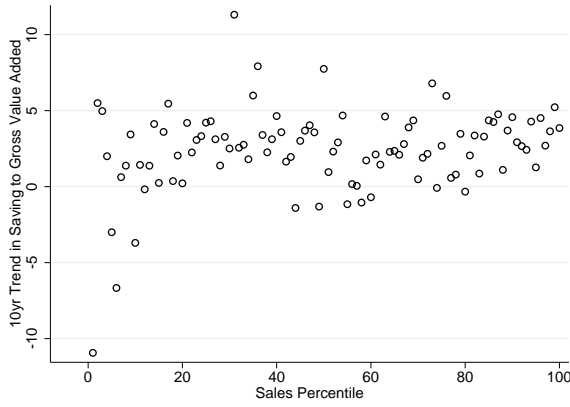
Whether measuring sales percentile or age, each firm only appears in one bin. To measure a firm’s sales percentile, we measure the firm’s sales in each year (relative to aggregate sales, to account for inflation) and take the average across years. We similarly assign each firm an age by averaging its age over all years it appears in the sample. We then calculate the saving



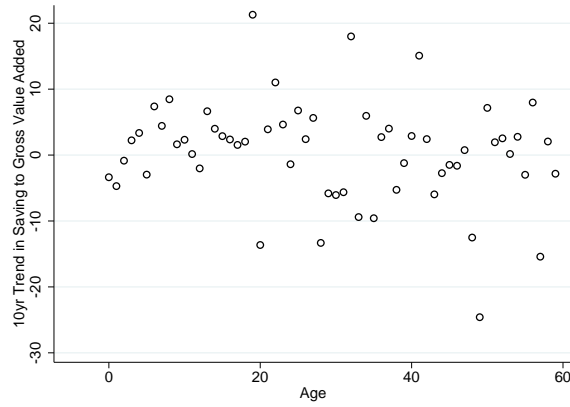
(a) Saving Rate Level and Sales, by Percentile Bin



(b) Saving Rate Level and Age, by Age Bin



(c) Saving Rate Trend and Sales, by Percentile Bin

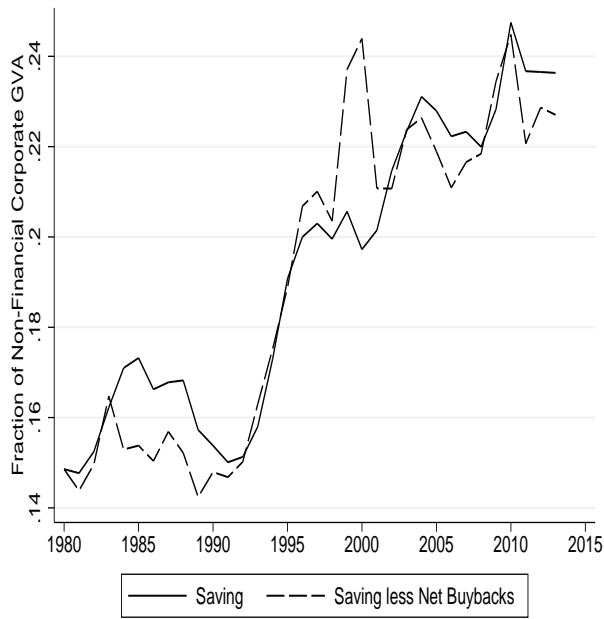


(d) Saving Rate Trend and Age, by Age Bin

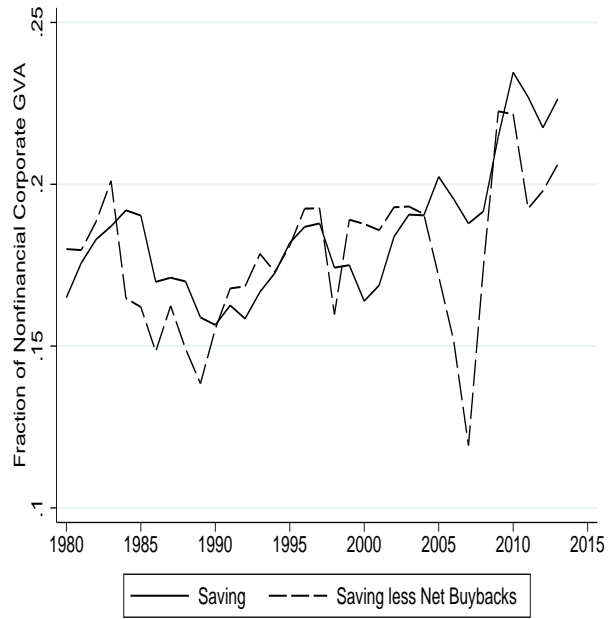
Figure 2: Saving Rate and Firm Characteristics, Analysis of Bins

rate for each bin and each year by summing saving for all firms in that bin and dividing that total by the sum of the gross value added of all firms in that bin and year. Figures 2(a) and 2(b) report the average across years of the saving rate for each bin, while Figures 2(c) and 2(d) report the trend over years of the saving rate for each bin.

The plots in the top row of the figure demonstrate there is no clear relationship even among these aggregated groups between size and corporate saving rates and between age and corporate saving rates. For example, the saving rate of the largest bin is below that of the smallest, but the saving rate of the second largest is above that of the second smallest. Whereas the size bins by construction have an equal number of firms in them, this is not true for the age plots. Some age bins have a small number of firms and, therefore, they exhibit more volatility. Nonetheless, there is also no clear relationship of saving rates and age. Regressions fitted to the data in



(a) Global Non-Financial Corporate



(b) U.S. Non-Financial Corporate

Figure 3: Corporate Saving Rates and Net Equity Buybacks

Figures 2(a) and 2(b) do not generate economically significant coefficients.

The lower row of plots similarly rejects the idea that there is an important relationship between size or age and growth in corporate saving rates. If one eliminates the datapoint corresponding to the smallest percentile in Figure 2(c), a clear outlier, the estimated regression coefficient becomes insignificant. While Figure 2(d) suggests that older age bins generally have a lower trend in their saving rate, the noise in the plot and the poor explanatory power of a linear regression makes clear that this relationship cannot explain a meaningful share of the behavior of the aggregate saving rate.

3 Adjustment for Value of Net Equity Buybacks

In Figure 3 we plot the non-financial corporate saving rate when we subtract the value of equity buybacks net of issuances from non-financial corporate saving. Specifically, we add to gross saving (SNA item B.8g) the net incurrence of equity liabilities (SNA item F.5L). After this adjustment we follow the same procedure described in the main text to regenerate the saving rate at the global level (left panel) and separately for the United States (right panel).

As the figures show, the adjustment makes a small difference for the evolution of the saving rate at the global level. While for the United States this adjustment reduces somewhat the increase, we still find a significant rise in the saving rate.⁵

4 Multinational Firms

This section of the appendix supplements Section 3.5 in the main text. We first describe in detail the impact of multinational activity on corporate saving as measured in national accounts. Then, we present cross-sectional regressions of levels and trends of saving, as well as of its components, on a dummy that captures a significant share of income earned abroad.

4.1 Multinational Activity and Saving in the National Accounts

Most items in the national accounts such as GDP, gross value added, and gross fixed capital formation, are attributed to the country where production and operation of economic activity takes place. By contrast, the retained earnings of a foreign subsidiary are attributed to the saving of the country of headquarters through an item called Reinvested Earnings on Direct Foreign Investment (SNA Item D.43). The following quote describes the scope of the aforementioned item, extracted from page 212 of Lequiller and Blades (2006), paragraphs 7.137 and 7.138:

“...retained earnings of a foreign direct investment enterprise (are) treated as if they were distributed and remitted to foreign direct investors in proportion to their ownership of the equity of the enterprise and then reinvested by them by means of additions to equity in the financial account. The imputed remittance of these retained earnings is classified in the SNA as a form of distributed income that is separate from, and additional to, any actual payments of dividends or withdrawals of income from quasi-corporations.”

⁵In these figures we report results for the non-financial corporate sector only. We stress that for the corporate sector as a whole the adjusted saving rate series exhibits a larger trend increase than the series without the adjustment. We choose to focus on the non-financial corporate sector because the item net incurrence of equity liabilities (SNA item F.5L) includes investment fund shares. This sub-category is a significant fraction of the item for financial firms, thus making the adjusted series very volatile.

Table 1: Impact of Multinational Activity on Saving: An Example

U.S. Headquartered Company Earns \$1 Produced in:	United States	Foreign Country	
		No	Yes
Repatriates \$1 Back to U.S.?	–		
	(1)	(2)	(3)
United States			
(A) GDP, GVA, and GOS	1	0	0
(B) Saving	1	1	1
(C) Reinvested Earnings	0	-1	0
(D) Net Dividends	0	0	-1
Foreign Country			
(E) GDP, GVA, and GOS	0	1	1
(F) Saving	0	0	0
(G) Reinvested Earnings	0	1	0
(H) Net Dividends	0	0	1

Therefore, by construct, foreign subsidiaries do not contribute to aggregate gross saving of the country in which they produce and operate. Retained earnings of a foreign subsidiary are recorded as a positive transfer to the parent and contribute to the corporate saving of the country of headquarters.

We now present a stylized example to further clarify these concepts and discuss the impact of cross-country reshuffling of value added and profits on saving rates at the country and world levels. Table 1 illustrates how gross value added (GVA), gross operating surplus (GOS), and saving are impacted depending on whether a U.S. headquartered firm earns one dollar of income domestically or abroad through a foreign subsidiary and whether or not the foreign income is repatriated.

Column 1 considers a first case in which the company produces in the United States and retains the value of its earnings (rather than pays it out as a dividend). Here, as shown in row A, U.S. GDP, GVA, and GOS take the value of one dollar, as does corporate saving shown in row B. Since in this simple case nothing happens involving the rest of the world, rows E to H are all equal to zero.

Column 2 considers a second case where the foreign subsidiary produces the good but does not repatriate the earnings back to the U.S. parent. As shown in rows A and E, in this case, the dollar of GDP, GVA, and GOS is now associated with the foreign country and not with the United States. Whether there is repatriation or not does not influence where saving are attributed to. Therefore, as with the first case, rows B and F show that saving in this case equals one in the United States and zero in the foreign country.

How can the United States in this case have positive saving without any GOS or GDP? The entry called “reinvested earnings” takes a negative value in the United States and a positive value abroad, ensuring that saving, reinvested earnings, and dividends, equal (in this simplified example) GDP in both countries.

Finally, column 3 considers the case where the foreign subsidiary produces the good but repatriates the earnings back to the U.S. parent. Here, GDP and saving are identical relative to column 2, but the United States receives a negative value of net dividends instead of a negative value of reinvested earnings, while the reverse happens abroad.

Note that in these simple cases, the reshuffling of production activity from United States to a foreign country impacts saving rates (i.e. saving relative to GDP) in each country, but has no impact on the global saving rate. Further, the extent to which this is the case is not a function of whether the firm repatriates earnings or not.

4.2 Multinational Firms and Saving in the Cross Section

Here we present the cross-sectional regressions discussed in the text. We distinguish between firms with less than 1 percent (on average) of their income earned outside their headquarters

Table 2: Estimates of Dummy for Firms With > 1 Percent of Income Earned Abroad

	Share of	Weights	Saving	Dividends	Taxes	Interest	GOS
Levels	GVA	No	6.23	-0.66	0.42	-1.33	4.77
			(1.79)	(0.29)	(0.27)	(0.46)	(1.64)
	GVA	GVA	3.84	-0.61	0.68	-0.83	3.07
			(2.79)	(0.47)	(0.22)	(0.75)	(2.71)
	GOS	No	8.93	-2.44	0.10	-5.91	NA
			(1.59)	(0.93)	(0.90)	(1.22)	NA
GOS	GOS	7.37	-3.29	0.39	-4.42	NA	
		(2.69)	(1.28)	(1.51)	(2.55)	NA	
Trend	GVA	No	0.30	-0.01	0.00	-0.04	0.26
			(0.07)	(0.04)	(0.04)	(0.03)	(0.11)
	GVA	GVA	0.34	0.05	0.03	-0.04	0.39
			(0.09)	(0.04)	(0.08)	(0.04)	(0.12)
	GOS	No	0.13	-0.02	0.46	-0.67	NA
			(0.48)	(0.20)	(0.16)	(0.32)	NA
GOS	GOS	-0.57	0.01	0.69	-0.69	NA	
		(0.94)	(0.38)	(1.02)	(0.36)	NA	

country with those earning greater than 1 percent.⁶

Table 2 presents estimated coefficients and standard errors from regressions of the level

⁶More precisely, for each firm, we take the average over time of the ratio between Compustat items PIFO (Foreign Pre-tax Income) and PI (Pre-tax Income) and separate firms based on whether the absolute value of this number is less than or greater than 1 percent. Because PIFO is only available for firms in the Compustat North America sample, we include only U.S. headquartered firms in this analysis. Using these criteria, we find that roughly half of the firms are classified as having a “higher fraction of foreign income” and they account for roughly three-quarters of total gross value added.

and trend in saving as a share of gross value added (GVA) on the dummy for firms with a higher fraction of foreign income, controlling for size, age, and industry fixed effects. The table repeats the same regressions when saving is expressed as a share of gross operating surplus (GOS). It also shows results for various subcomponents of saving. Standard errors are denoted in parentheses.

5 Model Appendix

In this section we include additional results, present robustness checks, and discuss some of the details of the model.

5.1 Binding Collateral Constraint

In the text we assumed that the collateral constraint $b_{it+1} \leq \theta \xi_{t+1} k_{it+1}$ always binds. Here we give a justification of this assumption.

Let q_{it} denote the value of a unit of flow of funds in period t . There are four regions of the parameter space defined by whether firms issue equity (in which case $q_{it} = 1/(1 - \lambda) > 1$) or not (in which case $q_{it} = 1$) and whether or not firms expect to issue equity in the next period with positive probability ($\mathbb{E}_t q_{it} > 1$ or $\mathbb{E}_t q_{it} = 1$). Except for the case in which firms do not issue equity in the current period and expect to issue equity in the next period with positive probability ($q_{it} = 1$ and $\mathbb{E}_t q_{it} > 1$), firms find it optimal to take on as much debt as possible and the collateral constraint always binds. In the case of $q_{it} = 1$ and $\mathbb{E}_t q_{it} > 1$, the collateral constraint binds depending on a condition that compares the benefits of the tax shield on debt (parameterized by the tax rate τ_t^c) to the equity flotation costs (parameterized by λ).

To economize on state variables in the firm's dynamic programming problem, we assume that the borrowing constraint always binds. We check for the accuracy of our assumption by calculating the multiplier on the borrowing constraint:

$$\mu_{it} = (1 + g)q_{it} - \beta (1 + (1 - \tau_{t+1}^c)r_{t+1}) \mathbb{E}_t q_{it+1}. \quad (1)$$

In our baseline parameterization we find that $\mu_{it} < 0$ and so the collateral constraint should not have been binding for less than 0.5 percent of the firms in our simulated sample.

5.2 Equilibrium

We define an equilibrium for our model economy as a sequence of aggregate prices $\{r_t, w_t, P_t\}$, a sequence of aggregate variables $\{Y_t, C_t, B_t\}$, and a sequence of firm prices and quantities $\{d_{it}, e_{it}, b_{it}, x_{it}, k_{it}, \ell_{it}, p_{it}, y_{it}, v_{it}, s_{it}\}$ that satisfy three requirements given a sequence of exogenous government policies $\{\tau_t^c, \tau_t^x, \tau_t^d, T_t^h, T_t^f\}$.

1. Households maximize their value:

$$\max_{C_t, B_{t+1}, s_{it+1}} \sum_{t=0}^{\infty} \beta^t \log(C_t), \quad (2)$$

subject to the budget constraint:

$$C_t + \sum_i v_{it} s_{it+1} + (1+g)B_{t+1} = w_t L + (1+r_t)B_t + \sum_i ((1-\tau_t^d)d_{it} - e_{it} + v_{it}) s_{it} + T_t^h. \quad (3)$$

2. Firms maximize their value function:

$$\max_{\{d_{it}, e_{it}, b_{it+1}, x_{it}, \ell_{it}, p_{it}\}_{t=0}^{\infty}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \{(1-\tau_t^d)d_{it} - e_{it}\}, \quad (4)$$

subject to the dividend policy function:

$$d_{it} = \kappa (p_{it} y_{it})^{\kappa_r} (\xi_t k_{it})^{\kappa_k}, \quad (5)$$

the production function:

$$y_{it} = \exp(A_{it}) \left(\alpha k_{it}^{\frac{\sigma-1}{\sigma}} + (1-\alpha) \ell_{it}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \quad (6)$$

the demand function:

$$y_{it} = p_{it}^{-\varepsilon} Y_t, \quad (7)$$

the stochastic process for productivity:

$$A_{it} = -\frac{\sigma_A^2}{2(1 + \rho_A)} + \rho_A A_{it-1} + \sigma_A u_{it} \text{ with } u_{it} \sim \mathbb{N}(0, 1), \quad (8)$$

the collateral constraint:

$$b_{it+1} \leq \theta \xi_{t+1} k_{it+1}, \quad (9)$$

the capital accumulation equation:

$$(1 + g)k_{it+1} = (1 - \delta)k_{it} + x_{it}, \quad (10)$$

and the budget constraint:

$$d_{it} + (1 + \tau_t^x) \xi_t x_{it} + (1 + r_t) b_{it} + \text{RC}_{it} = (1 - \tau_t^c) \pi_{it} + \tau_t^c (\delta \xi_t k_{it} + r_t b_{it}) + \tau_t^f + (1 + g) b_{it+1} + e_{it}, \quad (11)$$

where operating profits π_{it} are given by:

$$\pi_{it}(k_{it}, A_{it}; Y_t, w_t) = p_{it} y_{it} - w_t \ell_{it} = Y_t^{\frac{1}{\varepsilon}} (y(k_{it}, A_{it}))^{\frac{\varepsilon-1}{\varepsilon}} - w_t \ell(k_{it}, A_{it}). \quad (12)$$

In firm profits we have substituted firms' optimal price setting and labor demand. Therefore, we can express π_{it} solely as a function of the firm's capital stock, its productivity, and the aggregate variables Y_t and w_t .

3. All markets clear and the government balances its budget:

(a) Goods market:

$$Y_t = C_t + \xi_t X_t + \text{RC}_t. \quad (13)$$

(b) Labor market:

$$L = \sum_i \ell_{it}. \quad (14)$$

(c) Capital markets:

$$s_{it} = 1, X_t = \sum_i x_{it}, D_t = \sum_i d_{it}, E_t = \sum_i e_{it}, \text{ and } B_t = \sum_i b_{it}. \quad (15)$$

(d) Government budget constraint:

$$T_t^h + T_t^f = \tau_t^c (Y_t - w_t L - \delta \xi_t K_t - r_t B_t) + \tau_t^d D_t + \tau_t^x \xi_t X_t. \quad (16)$$

We define a stationary equilibrium as an equilibrium in which all (detrended) aggregate variables are constant and the distribution of firms across states (k_{it}, A_{it}) is stationary over time. We solve for the stationary equilibrium of the model with fixed point iteration. Firm decisions depend on two unknown aggregates, the wage w and output Y . With an elasticity of substitution in production different from one, the relationship between these two aggregates depends on the distribution of firm output. We, therefore, need to loop over both variables. We begin our algorithm by guessing values of w and Y . Given these values, we solve for firm optimal policy functions with value function iteration defined over a grid of 500 points for capital and 15 points for productivity. Next, we simulate a panel of 60,000 firms for 500 years and derive the implied aggregate labor demand and aggregate output supply in the last 50 years of the panel. If at the guessed w and Y , the labor and goods markets clear, then we stop the process. Otherwise, we update our guesses for w and Y and continue until labor and goods markets clearing is achieved. We finally check that the distribution of (k, A) across firms is stable over the last 50 years of the sample path.

5.3 Parameterization

We parameterize the model to match world aggregate statistics in the early part of our sample, which we treat as being generated from an initial balanced growth path. The first panel of Table 3 lists externally calibrated parameters that we choose prior to solving the model.⁷ We set the growth rate to $g = 0.023$, which is World Bank's estimate of real GDP growth rate for

⁷For convenience, Table 3 lists as "parameters" the real interest rate r and the profit share s_π because for these two variables there is a one-to-one mapping with deeper parameters as discussed below.

Table 3: Parameters

Externally Calibrated											
g	r	σ	δ	ξ	s_π	θ	λ	τ^d	τ^c	κ_r	κ_k
0.023	0.043	1.25	0.074	1.00	0.05	1.70	0.028	0.17	0.48	0.63	0.05
Internally Calibrated											
α	κ	χ	τ^x	ψ	ρ_A	σ_A					
0.292	0.17	0.037	0.117	5.50	0.80	0.48					

the world between 1980 and 1984. Given g , we set the discount factor to $\beta = 0.981$ so that the model generates a real interest rate equal to $r = (1 + g)/\beta - 1 = 0.043$. This value equals the world real interest rate estimated by King and Low (2014) in the first year of their sample (1985) using data on ten-year inflation-protected government bonds.

The elasticity of substitution between capital and labor is set equal to $\sigma = 1.25$, which is the value estimated in Karabarbounis and Neiman (2014) from cross-country covariation in trends in the labor share and the relative price of investment goods. We calculate the depreciation rate $\delta = 0.074$ using data on the values of depreciation and the capital stock from U.S. National Accounts for the corporate sector between 1980 and 1984. We normalize the initial relative price of investment goods to $\xi = 1$. We choose an elasticity of substitution between varieties $\varepsilon = 20$ so that (economic) profits are a fraction $s_\pi = 1/\varepsilon = 0.05$ of gross value added, a value slightly above the estimate of Basu and Fernald (1997) for the U.S. economy.

We set the leverage parameter in the borrowing constraint (9) equal to $\theta = 1.70$, which is the average ratio of firm debt liabilities to the (book value) of undepreciated capital in our firm-level data.⁸ For the equity flotation cost, we follow Gomes (2001) who estimates that the marginal cost of issuing equity is $\lambda = 0.028$.⁹

⁸This ratio is relatively stable over time for the world aggregate and somewhat increasing in the United States.

⁹Eisfeldt and Muir (2016) estimate the cost of external finance over time using the observed variation in the cross-sectional relationship between external finance issuance and liquidity accumulation. Their estimated cost of external finance exhibits substantial business cycle variation but it does not show systematic trends over time

Denoting the tax rate on dividends as τ^D and the tax rate on capital gains as τ^G , the tax penalty on dividends relative to repurchases is given by $\frac{1-\tau^D}{1-\tau^G}$. Our framework does not explicitly include capital gains taxes, however, and so this penalty is captured in the model by the factor $1 - \tau^d$. Using the Dividend Tax database of OECD, we estimate τ^D to average roughly 0.55 between 1981 and 1984. Becker, Jacob, and Jacob (2013) estimate that the average difference between taxes on dividends and taxes on capital gains across OECD countries is roughly 9 percent. So we set $\tau^d = 1 - \frac{1-0.55}{1-0.46} = 0.17$. We set $\tau^c = 0.48$, which equals the average corporate income tax rate between 1981 and 1984 in the OECD Corporate Income Tax Rate database.

Finally, we estimate the elasticities κ_r and κ_k in the dividend policy function using our firm-level dataset. We run a regression:

$$\log(\text{Dividends})_{ict} = b_i + b_c + b_t + \kappa_r \log(\text{Sales})_{ict} + \kappa_k \log(\text{Book Value of Capital})_{ict} + u_{ict},$$

where b_i , b_c , and b_t denote firm, country, and time fixed effects. We obtain values of $\kappa_r = 0.63$ and $\kappa_k = 0.05$ with standard errors (clustered at the firm level) of around 0.01 in both cases.

The second panel of Table 3 lists seven internally calibrated parameters that we choose to match seven targets in the initial stationary equilibrium. While parameters affect all moments simultaneously, here we loosely associate parameters with moments for which these parameters are particularly informative. The first four parameters are largely pinned down by moments in our national accounts data whereas the last three come from moments in our firm-level data.

1. We choose $\alpha = 0.292$ in the production function to generate a labor share of 0.612, which is the average value in the global corporate sector between 1980 and 1984.
2. We choose $\kappa = 0.17$ in the dividend policy function to generate a ratio of aggregate dividends to value added equal to 0.101, which is the value found in our data from 1990-1994 (the first years when dividends are included).
3. We choose the fraction of output rebated as lump sum transfers to the firms $\chi = 0.037$ to generate a corporate saving rate of 0.162, which is the average value in our data between 1980 and 1984.

and on average equals 2.4 percent.

4. We choose the tax rate on investment spending $\tau^x = 0.117$ to generate a firm investment rate of 0.215, which is the average value in our data between 1980 and 1984.
5. We choose the capital adjustment cost parameter $\psi = 5.5$ to generate a firm-level elasticity of investment with respect to revenues equal to 0.36. This elasticity is estimated from a regression of log investment on log revenues, controlling for log capital and firm, year, and country fixed effects.
6. We choose the persistence of the productivity process $\rho_A = 0.80$ so that the model generates an autocorrelation coefficient for log revenues equal to 0.79. This value is estimated from a regression of log revenues on lagged log revenues and firm, year, and country fixed effects.
7. We choose the standard deviation of productivity shocks $\sigma_A = 0.48$ so that the model generates a standard deviation of log revenues equal to 1.79, which is the average standard deviation in our data across countries and time.

The equilibrium aggregate cost of capital is defined by:

$$R = \frac{(1 - s_L - s_\pi)Y}{K}. \quad (17)$$

The initial cost of capital equals in our model is 0.153 and reflects a combination of technological parameters, interest rates, taxes, and financial frictions. If we define the “frictionless” cost of capital as $\xi(r + \delta) = 0.117$, we see that capital market imperfections in our model lead to an (aggregate) capital wedge of 3.6 percentage points (or 30 percent). In addition to creating an aggregate wedge, capital market imperfections also imply heterogeneity in the extent to which each firm’s cost of capital differs from the frictionless benchmark.

Almeida, Campello, and Weisbach (2004) argue that the sensitivity of cash saving to cash flow shocks is a useful measure of the degree of financial constraints that firms face. Our model generates a positive sensitivity of firm saving s^f and the firm saving rate s^f/y with respect to variations in profitability π , holding constant firm productivity A . We find that the sensitivity of saving s^f is higher and the sensitivity of the saving rate s^f/y is lower in the new equilibrium

Table 4: Results with CES and Cobb-Douglas Production Functions

	CES ($\sigma = 1.25$)					Cobb-Douglas ($\sigma = 1$)				
Start of Sample	$\frac{S^f}{Y}$	$\frac{wL}{Y}$	$\frac{D}{Y}$	$\frac{I}{Y}$	R	$\frac{S^f}{Y}$	$\frac{wL}{Y}$	$\frac{D}{Y}$	$\frac{I}{Y}$	R
1. Model	0.162	0.612	0.101	0.215	0.153	0.162	0.612	0.101	0.215	0.152
End of Sample (Δ)	$\frac{S^f}{Y}$	$\frac{wL}{Y}$	$\frac{D}{Y}$	$\frac{I}{Y}$	R	$\frac{S^f}{Y}$	$\frac{wL}{Y}$	$\frac{D}{Y}$	$\frac{I}{Y}$	R
2. Data	0.085	-0.054	0.005	-0.006		0.085	-0.054	0.005	-0.006	
3. Model	0.081	-0.054	-0.001	0.019	-0.031	0.054	-0.008	-0.007	-0.011	-0.030
Counterfactual (Δ)	$\frac{S^f}{Y}$	$\frac{wL}{Y}$	$\frac{D}{Y}$	$\frac{I}{Y}$	R	$\frac{S^f}{Y}$	$\frac{wL}{Y}$	$\frac{D}{Y}$	$\frac{I}{Y}$	R
4. No ξ	0.057	-0.029	-0.003	-0.005	0.005	0.048	-0.008	-0.006	-0.017	0.004
5. No τ^c	0.048	-0.045	0.001	0.006	-0.028	0.027	-0.008	-0.004	-0.021	-0.024
6. No τ^x	0.092	-0.058	-0.001	0.032	-0.037	0.062	-0.008	-0.007	-0.003	-0.036
7. No r	-0.015	-0.026	-0.005	-0.051	0.007	-0.020	-0.008	-0.007	-0.058	0.006
8. No r and g	0.045	-0.026	-0.005	-0.011	0.008	0.038	-0.008	-0.008	-0.022	0.008
9. No δ	0.096	-0.080	0.001	0.041	-0.059	0.053	-0.008	-0.007	-0.012	-0.055
10. No s_π	0.055	-0.026	-0.002	0.001	-0.027	0.041	0.000	-0.005	-0.014	-0.027

of the model economy characterized by a lower cost of capital R . However, as Riddick and Whited (2009) emphasize, these sensitivities could also reflect many other forces. Profits in our model are only a function of capital and productivity and we do not have other independent shocks to cash flows. Conditional on their productivity, firms with higher capital stocks in our model issue less equity and therefore save more on average.

5.4 CES ($\sigma = 1.25$) vs. Cobb-Douglas ($\sigma = 1$) Production Function

Table 4 presents our baseline results under a CES production function with an elasticity of substitution equal to $\sigma = 1.25$ along with the results generated by a similarly calibrated economy but with a Cobb-Douglas production function that features $\sigma = 1$.

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