The Global Rise of Corporate Saving*

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Abstract

We document a pervasive shift in the sectoral composition of global saving during the last three decades. Whereas in the early 1980s most of global investment was funded by household saving, nowadays nearly two-thirds of global investment is funded by corporate saving. The shift in the sectoral composition of saving is not accompanied by changes in the sectoral composition of investment, implying an improvement in the corporate net lending position. We characterize the behavior of corporate saving using both national income accounts and firm-level data and clarify its relationship with the global decline in labor share, the accumulation of corporate cash stocks, and the greater propensity for equity buybacks. We develop a general equilibrium model with capital market imperfections to explore quantitatively the impact of changes in the cost of capital on the sectoral flow of funds. Declines in the real interest rate, the price of investment goods, and corporate income taxes generate increases in corporate profits and shifts in the supply of sectoral saving that are of similar magnitude to those observed in the data.

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1 Introduction

Apple Inc., as of 2015 the world's largest company by market capitalization, has generally invested at a rate of roughly 20 to 30 percent of its gross value added. Apple's flow of saving, by contrast, has risen from levels of 20 to 30 percent of gross value added in the late 1980s and 1990s to nearly 60 percent by 2013. Over this period, Apple's profits grew precipitously and dividends did not keep pace. Alongside this growth in Apple's saving rate, the company accumulated a massive stockpile of cash, has booked large amounts of operating income from subsidiaries all over the world, and has recently repurchased its equity.

What might have caused the increase in Apple's saving rate and how common is this increase among other corporations? Is this rise unique to U.S. corporations, to technology companies, or to large multinationals? How might it relate to changes in the cost of capital and corporate practices on liquidity, repurchases, and transfer pricing? What are the macroeconomic implications?

We start by constructing a dataset that allows us to characterize the behavior of global corporate saving at the macro and micro levels. We document a pervasive rise of the flow of corporate saving that is not concentrated in individual countries, industries, or types of firms. Using the national accounts of more than 60 countries, we show that global corporate saving has risen from below 10 percent of global GDP around 1980 to nearly 15 percent in the 2010s. This increase took place in the large majority of countries including all of the 10 largest economies.[1]

The increase in corporate saving is largely offset by a similar decline in household saving over the last three decades. We also document that the composition of investment spending across sectors was relatively stable over this period. The corporate sector transitioned from being a net borrower to being a net lender of funds to the rest of the global economy.

What, in an accounting sense, caused the rise of corporate saving? Given that taxes and interest payments on debt have remained essentially constant over time as shares of value added,

[1] As we elaborate below, the increase in corporate saving does not simply reflect increasing multinational activity because any cross-country reshuffling of profits and value added should cancel out at the global level.

the rise of corporate saving mirrors the increase in corporate (accounting) profits and the decline in the labor share documented previously for the global economy in Karabarbounis and Neiman (2014). Corporate saving reflects the part of profits that is retained by the firm rather than paid out as dividends. Since dividend payments have historically been "sticky" and did not increase as much as profits, corporate saving grew secularly.[2]

We next analyze the behavior of corporate saving in firm-level data. When aggregated at the global level, the firm-level data shows an increase in saving relative to value added similar to that found in the national accounts. We study the cross-section of firms and find, similarly to the national accounts data, that the increase in corporate saving reflects increases in firm profits and not other forces such as changes in dividends, interest payments, or tax payments. Surprisingly, we do not find evidence that trends in firm saving relate significantly to firm-level characteristics such as industry, size, and age.[3] Using decompositions of the trend in corporate saving into a component that captures changes within types of firms and a component that captures changes between types of firms, we show that increases in corporate saving within industry, age, and size account for the great majority of the global rise of corporate saving.

The increase in corporate saving exceeded that in corporate investment, which implies that corporations either accumulated financial assets net of debt liabilities or increased the value of their buybacks net of equity issuance, flows which have become increasingly important in corporate financial policy. The national accounts, reasonably in our view, treat equity buybacks as if they were negative equity issuances, but buybacks may alternatively be thought of as substitutes to dividends in transferring value to shareholders. Since equity buybacks are not removed from earnings when calculating corporate saving, one possibility is that the improvement in the corporate net lending position largely reflects an increase in share repurchases. We show in the

[2]The literature on the stickiness of dividends goes back to Lintner (1956) who discusses how managers aim to smooth dividend payments over time. Brav, Graham, Harvey, and Michaely (2005) provide more recent survey evidence on the stickiness of dividends. Fama and French (2001) have documented the pattern of disappearing dividends in the United States between the late 1970s and the late 1990s.

[3]This is an important finding in light of previous literature documenting that the pattern of disappearing dividends reflects a shift in the composition of firms toward smaller and less profitable firms with higher growth prospects (Fama and French, 2001).

firm-level data, however, that changes in equity buybacks net of issuance account for only a moderate part of the changes in firms' corporate net lending and saving behavior.

Alternatively, the excess supply of corporate saving over investment can be used to pay down debt, increase long-term assets, or increase cash holdings. Indeed, as highlighted by Bates, Kahle, and Stulz (2009) who emphasize precautionary motives and Foley, Hartzell, Titman, and Twite (2007) who emphasize repatriation taxes, cash holdings on firm balance sheets have risen markedly relative to assets. We document a positive relationship between trends in firms' flow of corporate saving and trends in firms' stock of cash holdings. Since the trends in the flow and stock of savings span several decades, these patterns cannot be entirely explained by short-term factors such as elevated uncertainty associated with the recent recession.

To understand the deeper forces leading to the global rise of corporate saving, we study a workhorse dynamic general equilibrium model with heterogeneous firms and capital market imperfections and quantify how observed changes in parameters affected the cost of capital and corporate saving, profits, financial policies, and investment. Our modeling is inspired by a literature at the intersection of corporate finance and macroeconomics, which incorporates collateral constraints, equity flotation costs, and different taxes on dividends and capital gains.[4] Given these imperfections, firms face a cost of capital that is higher than the cost that would arise in an undistorted economy and often prefer to finance operations from internal saving.

Given the pervasiveness of the rise of corporate saving across countries, industries, and types of firms, we parameterize the model to represent the global economy using a variety of external information on tax, financial, and technological parameters. We choose the remaining parameters to reproduce the global levels of corporate saving, labor share, dividends, and investment observed in the early years of our dataset as well as key moments in the firm-level data such as the stickiness of dividends. We compare this initial equilibrium to a new equilibrium that emerges when we subject our model economy to changes in several key parameter values that we estimate from the data.

[4]Important earlier contributions in this literature include Gomes (2001), Hennessy and Whited (2005), Riddick and Whited (2009), Gourio and Miao (2010), and Jermann and Quadrini (2012).

The model generates a decline in the cost of capital of roughly 3 percentage points. The decline in the cost of capital is associated with an increase in the corporate saving rate of equal magnitude to that documented in the data. Further, the corporate net lending position increases by over 6 percentage points relative to value added, nearly two-thirds of the increase observed in the data. Quantitatively, we find that important drivers of these changes are the global declines in the real interest rate, the price of investment goods, and corporate income taxes and the increase in markups. With an elasticity of substitution above one in production, the decline in the cost of capital leads to a decline in the labor share and an increase in corporate profits. Given the stability of dividends relative to GDP, this increase in profits leads to an increase in saving and an improvement in the net lending position of the corporate sector.

2 Corporate Saving in the National Accounts

We now describe the construction of our national income accounts dataset and review the national income accounting framework which relates corporate saving to the corporate labor share, profits, and dividends. We then document the widespread rise of corporate saving relative to GDP, corporate gross value added, and total saving over the past several decades.

2.1 National Accounts Data

We obtain annual data at the national and sector levels by combining information downloaded online or obtained digitally from the United Nations (UN) and Organization for Economic Co-operation and Development (OECD). Over time and across countries there are some differences in methodologies, but these data generally conform to System of National Accounts (SNA) standards. We refer the reader to Lequiller and Blades (2006) for the most detailed descriptions of how national accounts are constructed and harmonized to meet these standards.

We exclude countries that do not have raw data on corporate saving or gross fixed capital formation. The resulting dataset contains sector-level information on the income structure of 66 countries for various years between 1960 and 2013. The OECD data cover 30 member countries but offer more disaggregated items than the UN counterpart. All our analyses start on or after 1980, the earliest year for which we have at least eight countries (Finland, France, Germany, Italy, Japan, Netherlands, Norway, and the United States). The United Kingdom enters the sample in 1989 and China enters in 1992. By 2007, the sample consists of over 60 countries that account for more than 85 percent of global GDP.

2.2 National Accounts Structure and Identities

National accounts data include sector accounts that divide the economy into the corporate sector, the government sector, and the household and non-profit sector. For most economies, the corporate sector can be further disaggregated into financial and non-financial corporations and the household sector can be distinguished from the non-profit sector.[5] National accounts data also include industry accounts that divide activity according to the *International Standard Industrial Classification, Rev. 4* (SIC).

A set of accounting identities serve as the backbone for the national accounts.[6] The accounts are related as follows:

1. The *production account* captures the value of output produced in sectors, industries, and countries. The key identity is:

$$\text{Gross Output} = \text{Gross Value Added (GVA)} + \text{Intermediate Consumption.} \tag{1}$$

   The value of final production (i.e. production net of intermediates) constitutes gross value added, which is the first term on the right-hand-side of (1). Aggregated to the economy level, gross value added equals GDP less net taxes on products.[7]

[5] For countries with missing information on corporate sector gross value added, we impute their values by multiplying country GDP by the global corporate gross value added to GDP ratio. To impute the missing corporate labor share, we multiply the labor share found in the total economy by the global ratio of corporate labor share to total labor share. After imputing the corporate gross value added and labor compensation, we impute missing production taxes by subtracting gross operating surplus and labor compensation from gross value added.

[6] This set of identities is often referred to as the sequence of accounts, which begins with the production account, followed by the generation of income account, the distribution of income account, the capital account, and finally the financial account. Below, we omit discussion of the financial account as it plays no role in our analysis of national accounts data.

[7] The treatment of taxes net of subsidies on products (that includes items such as excise taxes, state and local

2. GVA is detailed in the *generation of income account* and equals the sum of income paid to capital, labor, and taxes:

$$\begin{aligned} \text{GVA} &= \text{Gross Operating Surplus (GOS)} + \text{Compensation to Labor} \\ &\quad + \text{Net Taxes on Production.} \end{aligned} \tag{2}$$

GOS captures the income available to corporations and other producing entities after paying for labor services and after subtracting taxes (and adding subsidies) associated with production.

3. The *distribution of income account* splits GOS into gross saving, dividends, and other payments to capital such as taxes on profits, interest payments, reinvested foreign earnings, and other transfers:

$$\begin{aligned} \text{GOS} &= \underbrace{\text{Gross Saving (GS)} + \text{Net Dividends}}_{\text{Accounting Profits}} + \text{Taxes on Profits} + \text{Interest} \\ &\quad - \text{Reinvested Earnings on Foreign Direct Investment} + \text{Other Transfers.} \end{aligned} \tag{3}$$

Net dividends equal dividends paid less dividends received from subsidiaries or partially-owned entities. Other transfers include social contributions and rental payments on land. In our analyses, we define (accounting) profits as the sum of gross saving and net dividends.

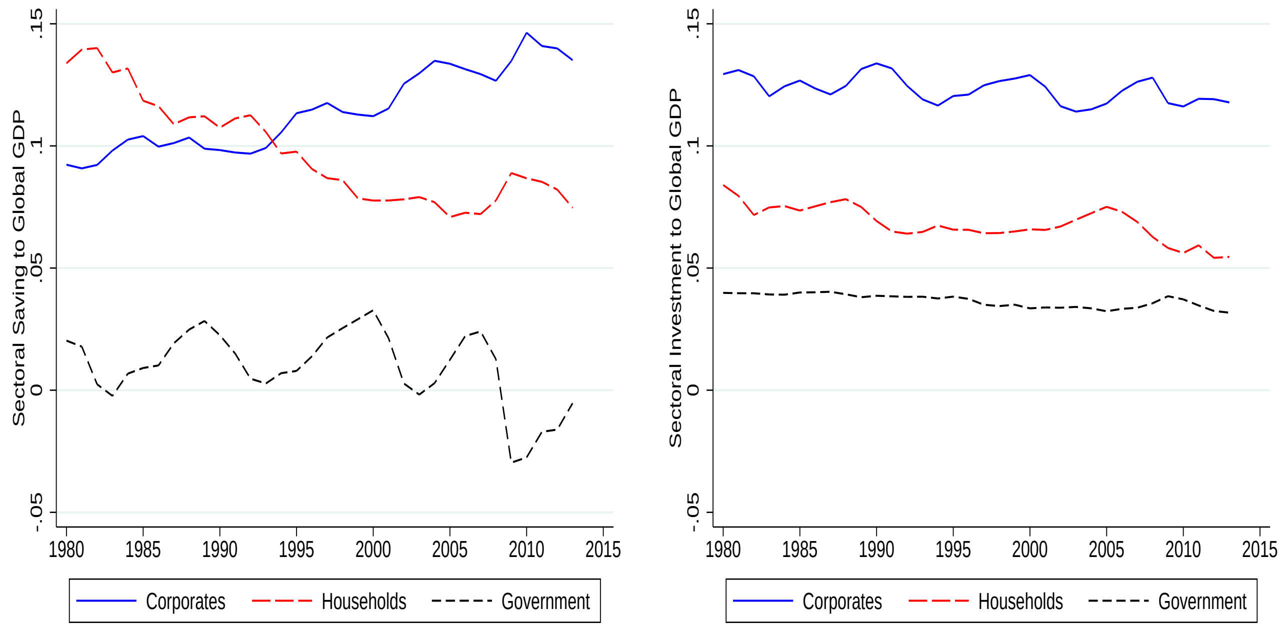
4. The *capital account* connects the flow of saving to the flow of investment as follows:

$$\begin{aligned} \text{GS} &= \text{Net Lending} + \text{Gross Fixed Capital Formation} + \text{Changes in Inventories} \\ &\quad + \text{Changes in Other Non-Financial Produced Assets.} \end{aligned} \tag{4}$$

The net lending position is defined as the excess of gross saving over investment spending.

In general, the identities (1) to (4) hold in the aggregate as well as at the sector or industry level. The Online Appendix further discusses details such as when we use the UN or OECD data, how we treat outliers, and some country-specific adjustments.

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.



(a) Sectoral Saving

(b) Sectoral Investment

Figure 1: Sectoral Saving and Investment Relative to Global GDP

2.3 Sectoral Saving Trends

Figure 1(a) plots the evolution of gross saving in each of the three sectors relative to global GDP since 1980. Government saving exhibits cyclical fluctuations but it has not exhibited secular trends relative to GDP. Households and corporations, however, exhibit striking trends. Saving by corporations has increased by nearly 5 percentage points of GDP whereas saving by households has decreased by nearly 6 percentage points.[8]

We generate these lines by pooling all countries with saving data for all three sectors and regressing the ratios of sector saving to GDP on time fixed effects. We weight the regressions by GDP, translated at market exchange rates, and we control for changes in the country composition of our unbalanced panel by absorbing country fixed effects. To benchmark the level of the lines,

[8] Most of our data adhere to SNA standards, which consider as corporations any entities that (i) aim to generate profit for their owners, (ii) are legally recognized as being separate entities from their owners, who have only a limited liability, and (iii) were created to engage in market production. Economic activities undertaken by households or unincorporated enterprises that are not separate legal entities with a full set of accounts to distinguish its business-related assets and liabilities from the personal assets and liabilities of its owners are considered part of the household sector. Implicit rental payments earned by homeowners constitutes an important piece of the household sector.

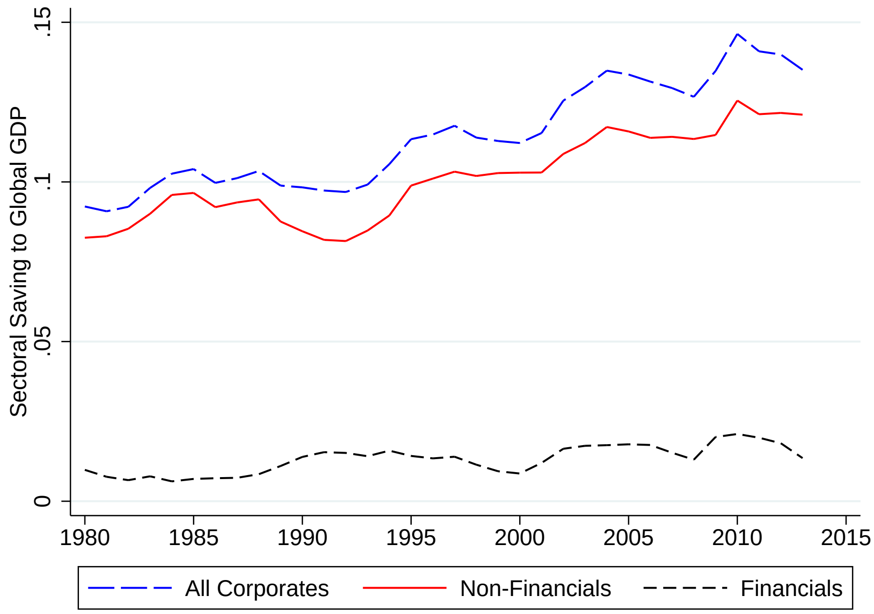


Figure 2: Saving in Non-Financial vs. Financial Corporations

we pool all available countries in our data in 2013 and calculate the appropriate global value. We then use the estimated time fixed effects to extrapolate that level backwards. All subsequent plots at the global level from the national accounts data are constructed equivalently.

For the world as a whole, gross saving must equal gross investment, but this need not be true at the sector level. Indeed, as Figure 1(b) shows, the sectoral composition of global investment has remained largely stable over time, in contrast to the sectoral composition of global saving. Whereas in 1980 the corporate sector funded most of its investment spending by borrowing from households, in modern times most of global investment is funded by the corporate sector. In fact, the corporate sector nowadays has become a net lender of funds in the global economy.

The corporate sector consists of both non-financial corporations and banks and other financial institutions. The importance of the financial sector has grown substantially in many countries around the world and the interpretation of saving and investment flows among banks may be less straightforward than among non-financial corporations. Nonetheless, as Figure 2 shows, the trend in the saving of non-financial corporations is very similar to the trend observed for the whole corporate sector. This is because the scale of saving in the financial corporate sector is only about one-tenth of that in the non-financial corporate sector.

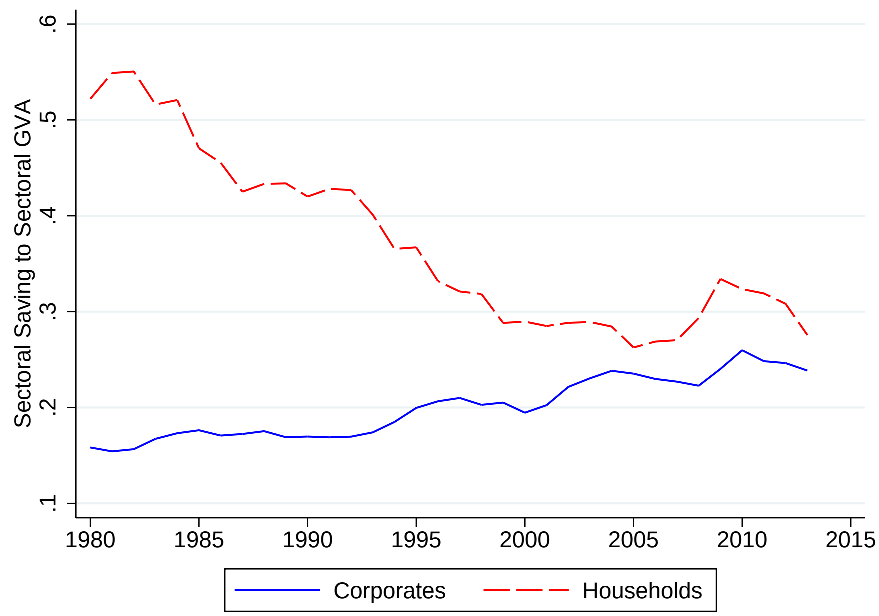


Figure 3: Sector Saving Rates

The increase in corporate saving relative to GDP could reflect either an increasing saving rate in the corporate sector or an increasing share of GDP produced by the corporate sector. The sectoral shares of global GDP have remained remarkably stable throughout our sample.[9] It is, therefore, not surprising that corporate saving relative to corporate gross value added ("the corporate saving rate") exhibits an upward trend of roughly 9 percentage points as shown in Figure 3. In contrast, the household saving rate has declined markedly from roughly 50 to 30 percent.[10]

Our estimates thus far have focused on global aggregates and, therefore, disproportionately capture trends in the largest economies. We now present evidence that the rise of corporate saving is a stylized fact characterizing regions and countries all around the world. First, we have repeated the exercise in Figure 3 separately for each continent. With the exception of Latin America and the Caribbean, corporate saving as a share of corporate gross value added has increased all around the world. Second, Figure 4 shows that the increase in corporate saving

[9]The corporate sector contributes between 59 and 62 percent of global GDP for each year in our sample.

[10]The household saving rate may seem high relative to measures constructed from household surveys. This, in large part, reflects that household saving here is expressed as a fraction of household gross value added rather than household income.

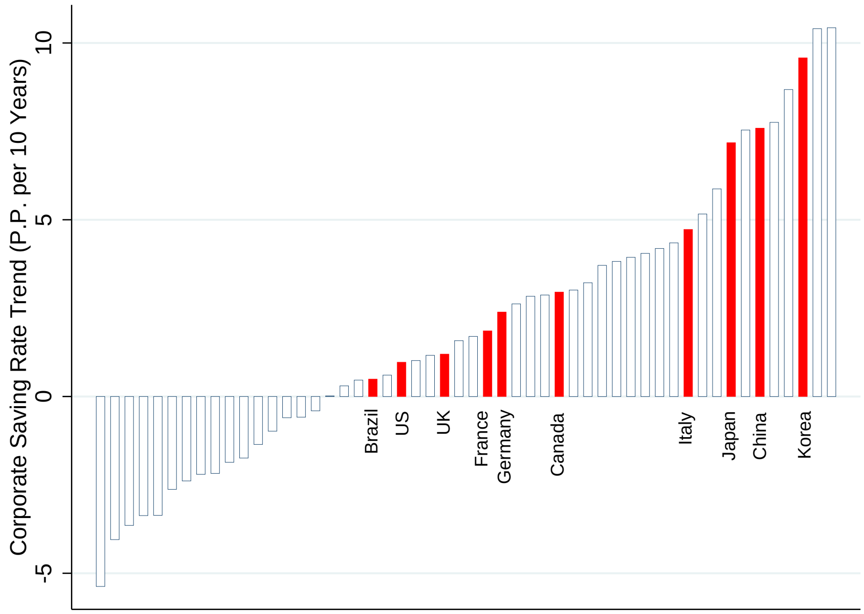


Figure 4: Estimated Trends in Corporate Saving Rates

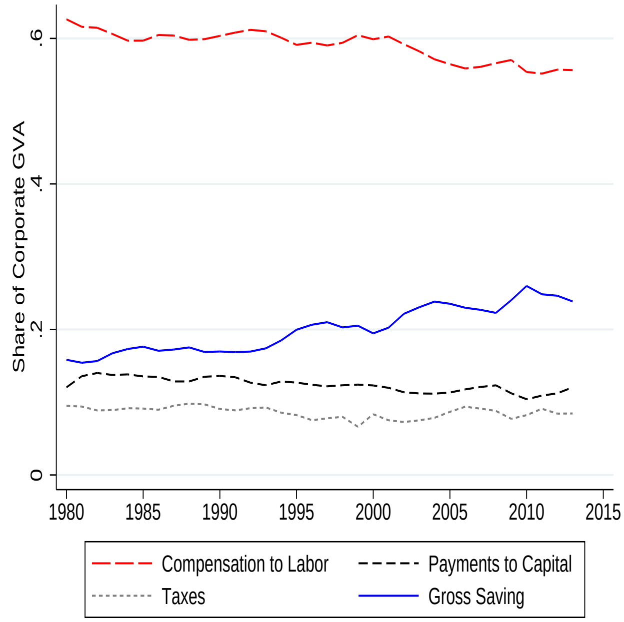
is present in a large majority of countries. The figure plots the linear trends per 10 years of the corporate saving rate in each country with at least 10 years of data. Over two-thirds of the 52 countries included, and all 10 of the world's largest economies, have seen increases in their corporate saving rate.[11]

As the corporate saving rate increases, the share contributed by other components of gross value added must decrease mechanically. Substituting the definition of gross operating surplus from equation (3) into equation (2), and applying it to the corporate sector, we write a decomposition of corporate gross value added:

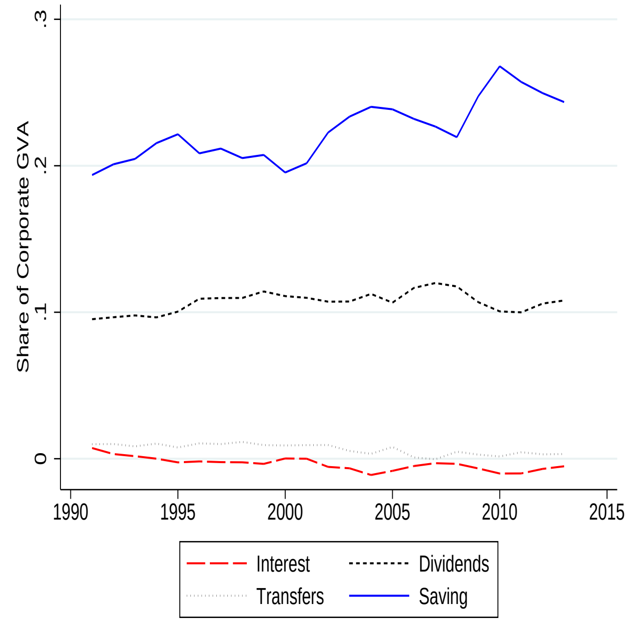
$$\begin{aligned}\text{Corporate GVA} &= \text{Corporate Compensation to Labor} + \text{Corporate Payments to Capital} \\ &\quad + \text{Corporate Taxes} + \text{Corporate Gross Saving}, \qquad (5)\end{aligned}$$

where we define taxes as the sum of net taxes on production and taxes on profits and define payments to capital as the sum of dividends, interest, reinvested earnings on foreign direct

[11] Our results for the world are consistent with several other studies that look at various subsamples. Bacchetta and Benhima (2015) have documented the increase in corporate saving for fast-growing emerging economies. Bayoumi, Tong, and Wei (2012) use listed firms to document the upward trend in China and selected other countries. Armenter and Hnatkovska (2014) use balanced sheet data and show the improvement in the net lending position of U.S. firms.



(a) GVA Components



(b) Saving, Dividends, and Interest

Figure 5: Decomposition of Increase in Corporate Saving

investment, and other transfers. Equation (5) shows that an increase in the saving share of value added must be offset by declines in the share of payments either to labor, to creditors and owners, or to taxes.

Figure 5(a) plots these four components of gross value added. The figure reveals that the rise of corporate saving mirrors the decline in the corporate labor share documented in Karabarbounis and Neiman (2014). Payments to capital and taxes have barely changed relative to gross value added since 1980. Our broader sample of data from the UN does not allow us to disaggregate payments to capital into its subcomponents, but we have separate information on dividends and interest payments for 30 countries in our OECD sample. In those countries, as shown in Figure 5(b), dividends are relatively stable at 10 percent of corporate gross value added. Interest payments and transfers are also stable at a share of close to zero. We conclude that forces causing the decline in the labor's share of income did not produce commensurate increases in tax, dividend, and interest payments, resulting in an increase in corporate saving.

2.4 The Impact of Multinational Production

The cross-country outsourcing or fragmentation of production by multinationals has steadily grown in importance in recent decades. Since a company's gross saving is always associated with its headquarters country, this dynamic might increase the corporate saving rate in the headquarters country because it preserves the numerator (gross saving) while lowering the denominator (gross value added). Further, such dissociation of the country where value added is recorded from the country where saving is recorded can be exacerbated by profit shifting behavior, where firms use intra-firm trade to realize as much of their global profits as possible in low tax jurisdictions.[12]

While such multinational activity might in theory be associated with changes in the corporate saving rate of a particular country, it is unlikely to underlie the rise of corporate saving at the global level. If outsourcing production or shifting profits causes an increase in the headquarters country because it reduces the scale of gross value added associated with each dollar of saving, then opposite increases of equal magnitude would be observed in the gross value added of the country where production occurred or profits were realized. At the global level, therefore, the effects of reshuffling profits and production across countries on corporate saving rates should cancel out.[13]

3 Corporate Saving at the Firm Level

In this section, we use firm-level data to study the cross-sectional patterns in the rise of corporate saving rates. We document how trends in corporate saving rates vary across industries and with

[12] There are multiple ways in which, for example, U.S. firms can shift profits to countries with lower tax rates (Clausing, 2011). One way is to outsource some production to wholly-owned subsidiaries operating in a low-tax locale and sell the output at a high transfer price back to the United States for local distribution. Another way, emphasized by Guvenen, Mataloni, Rassier, and Ruhl (2016), would be for the foreign subsidiary to "underpay" for an input provided by the U.S. parent. This may be more prevalent in IT-related industries where the input is the use of an intangible asset, such as a patent or design.

[13] Keightley (2013) emphasizes the disproportionate recording of U.S. profits in Bermuda, Ireland, Luxembourg, the Netherlands, and Switzerland. It is possible that our dataset – which has less than 10 years of data on Bermuda, Luxembourg, and Switzerland – disproportionately captures the headquarters countries, in which case this issue would not necessarily cancel out in our global analysis. But even among Ireland and the Netherlands, for which we have long time series, we observe large increases in corporate saving relative to corporate gross value added.

firm characteristics. An important finding of our analysis is that the majority of the increase in the global saving rate is accounted for by increasing saving rates within firms and industries and not shifts of market shares among groups with differing saving rate levels. Finally, we evaluate the extent to which the increasing trend in the flow of corporate saving is associated with trends in cash holdings or equity repurchases net of issuances.

3.1 Firm-Level Data

We obtain consolidated financial statement data of publicly listed firms from Compustat Global and Compustat North America.[14] 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. We convert all local currency values to U.S. dollars using annual average exchange rates.

There are three main differences between our national accounts dataset and our firm-level dataset. First, as with most analyses of firm-level financing decisions that focus on non-financial corporations (Fama and French, 2001; DeAngelo, DeAngelo, and Skinner, 2004), we exclude financial firms (SIC codes 6000-6999). As shown in Figure 2, excluding financial firms from the national accounting data does not change our inference about the global rise of corporate saving. We also exclude other unclassified firms (SIC codes greater than or equal to 9000) as well as firms for which we cannot calculate a gross saving rate for at least 10 years. Second, economic activities in the firm-level data are classified by the country of headquarters as opposed to the country of operation. For example, the production of a U.S. subsidiary operating in France would be captured in the consolidated statement of the U.S. parent and the subsidiary itself would not have any record included in our firm-level dataset. This differs from the treatment in the national accounts, where production, profits, and investment are all classified by the country of operation, as opposed to headquarters. A third difference with the national accounts is that the firm-level data includes only publicly listed firms.

We now describe key variables used in our firm-level analysis, many of which are unavailable

[14] 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.

in Compustat in raw format. First, gross value added is defined as gross output less intermediate consumption, but intermediate consumption is not available. To impute it, we start with operating expenses, which we calculate as the sum of the costs of goods sold (COGS) and selling, general, and administrative (SG&A) expenses, both of which are available as raw data:

$$\text{Operating Expenses}_{f,c,i,t} = \text{COGS}_{f,c,i,t} + \text{SG\&A}_{f,c,i,t}, \tag{6}$$

where f, c, i, and t index firms, countries, industries, and years, respectively. To obtain intermediate consumption, we would then need to subtract depreciation, research and development (R&D), staff compensation, and production taxes from operating expenses:[15]

$$\begin{aligned} \text{Intermediate Consumption}_{f,c,i,t} \quad = \quad & \text{Operating Expenses}_{f,c,i,t} - \text{Depreciation}_{f,c,i,t} - \text{R\&D}_{f,c,i,t} \\ & \underbrace{- \text{ Staff Compensation}_{f,c,i,t} - \text{Production Taxes}_{f,c,i,t}}_{\text{Not Available in Compustat}}. \end{aligned} \tag{7}$$

The difficulty is that, while we have firm-level data on operating expenses, depreciation, and R&D, data on staff compensation and production taxes – the last two terms of equation (7) – are generally not reported in Compustat.

Our approach is to impute intermediate consumption at the firm level using information on a firm's operating expenses and the relationship between operating expenses and intermediate consumption found in industry-level data from national accounts. We begin by approximating the share of intermediate consumption in operating expenses net of depreciation and R&D in country c, industry i, and year t, $\pi_{c,i,t}$, using the industry-level information in the national accounts data.[16] Specifically, for each country, 1-digit industry code, and year, we calculate:

$$\pi_{c,i,t} = \frac{\text{Intermediate Consumption}_{c,i,t}}{\text{Intermediate Consumption}_{c,i,t} + \text{Compensation}_{c,i,t} + \text{Other Production Taxes}_{c,i,t}}, \tag{8}$$

[15] The national accounts definition of intermediate consumption includes the products and non-labor services consumed in the production process, such as produced inputs, rental payments for structures and equipment, purchases of office supplies, usage of water and electricity, advertisement costs, overhead costs, market research cost, and administrative costs. Intermediate consumption excludes depreciation, research and development expenses, compensation to labor, and taxes levied during the production process.

[16] Note that the national accounts data are available by industry or by institutional sector, but not by both. These data therefore pool corporate and non-corporate economic activity within each sector.

where the elements on the right hand side of equation (8) are readily available in the national accounts. Using $\pi_{c,i,t}$, we then impute gross value added for each firm f as:

$$\text{GVA}_{f,c,i,t} = \text{Sales}_{f,c,i,t} - \pi_{c,i,t} \times \left(\text{Operating Expenses}_{f,c,i,t} - \text{Depreciation}_{f,c,i,t} - \text{R\&D}_{f,c,i,t}\right), \tag{9}$$

where, other than $\pi_{c,i,t}$, all terms on the right hand side of equation (9) are directly available in the firm-level data.[17]

Gross operating surplus equals gross value added less compensation and production taxes. Because operating expenses equal intermediate consumption plus depreciation, R&D, staff compensation, and production taxes, we can write GOS as sales less operating expenses plus depreciation and R&D:

$$\text{GOS}_{f,c,i,t} = \underbrace{\text{Sales}_{f,c,i,t} - \text{Operating Expenses}_{f,c,i,t} + \text{Depreciation}_{f,c,i,t}}_{\text{Operating Income Before Depreciation and Amortization}_{f,c,i,t}} + \text{R\&D}_{f,c,i,t}, \tag{10}$$

where operating income before depreciation and amortization (OIBDA) is generally provided in our firm-level data. This item is almost always equivalent to earnings before interest taxes depreciation and amortization (EBITDA). Thus, we use firm-level data on EBITDA whenever OIBDA is not available.

Gross saving at the firm level is calculated by removing interest, dividends, and corporate taxes from our measure of GOS:[18]

$$\text{GS}_{f,c,i,t} = \text{GOS}_{f,c,i,t} - \text{Interest}_{f,c,i,t} - \text{Corporate Taxes}_{f,c,i,t} - \text{Dividends}_{f,c,i,t}, \tag{11}$$

where interest, corporate taxes, and dividends are items available in our firm-level data. Finally, we measure gross fixed capital formation as the acquisition less sale and disposals of property, plant, and equipment, plus R&D expenditure.[19]

[17]Note from equation (7) that the term in parenthesis in equation (9) equals intermediate consumption plus staff compensation plus production taxes. These are the fields in Compustat that best correspond to the national accounts fields used in the denominator of equation (8).

[18]To exactly match the concept of gross saving in the national accounts, we would need to also remove some other transfers such as social contributions or reinvested earnings on foreign direct investment. Unfortunately, these items are not available within the consolidated financial statements.

[19]We ignore changes in the value of inventories in our firm-level measure of investment. While plausibly important over short horizons, this is unlikely to impact our results which focus on long-term trends.

Table 1: Summary of Firm-Level Data

Country	**Gross Value Added in 2013 ($Billions, USD)**	**Number of Firms**	**Earliest Year**
United States	4772.5	3232	1989
Japan	2843.2	2385	1989
China	994.6	1279	1995
United Kingdom	853.7	978	1989
France	808.6	447	1989
Germany	716.3	428	1994
Korea	360.2	360	1995
Russia	328.9	73	1996
India	279.3	1870	1995
Brazil	266.2	202	1992
Netherlands	260.4	109	1991
Switzerland	255.7	163	1991
Taiwan	232.5	1112	1994
Australia	218.5	359	1991
Italy	174.3	149	1994
Canada	169.6	414	1989
Hong Kong	166.8	503	1992
Spain	164.9	56	1994
Sweden	155.4	204	1994
Mexico	138.4	80	1994
South Africa	114.7	162	1992
Thailand	94.4	334	1993
Norway	92.3	91	1993
Singapore	87.4	368	1995
Chile	79.1	118	1994

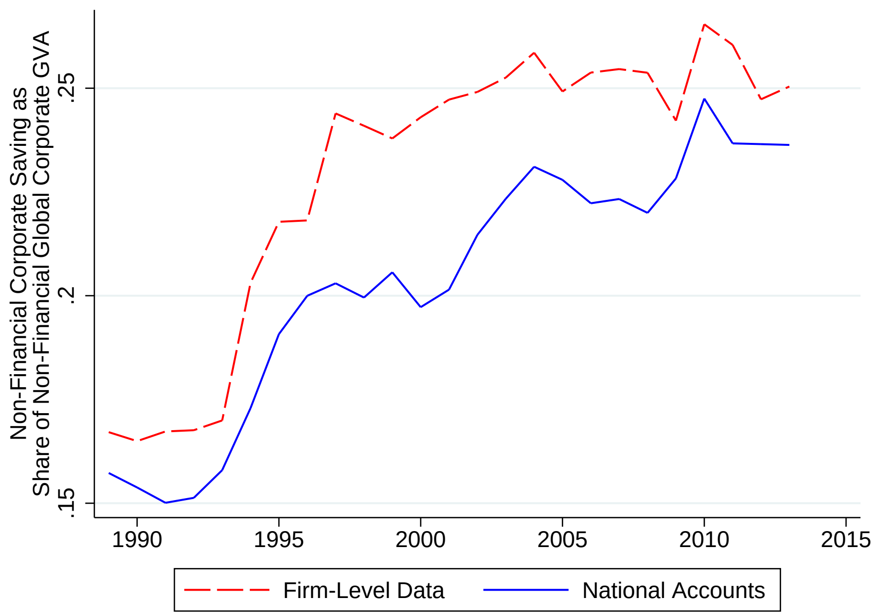


Figure 6: Global Non-Financial Corporate Saving in the Firm-Level and National Accounts Data

Table 1 provides an overview of the resulting firm-level dataset. We rank countries by their aggregated gross value added recorded in the dataset and present statistics for the largest 25 countries. We reiterate that these 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. Despite the differences between what is measured and reported in our macro and micro data, Figure 6 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.

3.2 Corporate Saving in the Cross Section of Industries

Is the rise of corporate saving primarily concentrated in specific industries or is it broad-based? Is the rise caused by growth in the saving rate within industries or does it reflect the changing size of industries with higher levels of saving rates? To answer these questions, we begin by aggregating saving, net lending, and value added from the firm-level data up to the country and industry level. For each industry, we then regress the saving rate and the net lending rate on a linear time trend, absorbing country fixed effects. We weight these regressions with countries' gross value added in that industry to obtain a representative global trend for each industry.

We present our results in Table 2. The first column presents the average share of an industry's value added in global value added. Adding up all shares (other than the manufacturing subsectors) yields 100 percent of global value added.[20] The third column presents the estimated trend in the saving rate, expressed in percentage point changes per 10 years, along with its standard error. Most industries experienced statistically significant increases in their corporate saving rate. The exceptions, Information and Communications, Transportation, and Utilities, only represent a total of 14.5 percent of value added in our data. The fourth column shows that a clear majority of industries also experienced improvements in their net lending positions.

We use a standard within-between decomposition to quantify the extent to which the changes in the corporate saving rate reflect changes within or between industries. Denoting groups of firms by $i = 1, ..., I$, we decompose changes in the aggregate saving rate into these components as follows:

$$\Delta\left(\frac{\mathrm{GS}_t}{\mathrm{GVA}_t}\right) = \underbrace{\frac{1}{2}\sum_i \left(\omega_{i,t} + \omega_{i,t-1}\right)\Delta\left(\frac{\mathrm{GS}_{i,t}}{\mathrm{GVA}_{i,t}}\right)}_{\text{Within-Group Component}} + \underbrace{\frac{1}{2}\sum_i \left(\frac{\mathrm{GS}_{i,t}}{\mathrm{GVA}_{i,t}} + \frac{\mathrm{GS}_{i,t-1}}{\mathrm{GVA}_{i,t-1}}\right)\Delta\omega_{i,t}}_{\text{Between-Group Component}}, \quad (12)$$

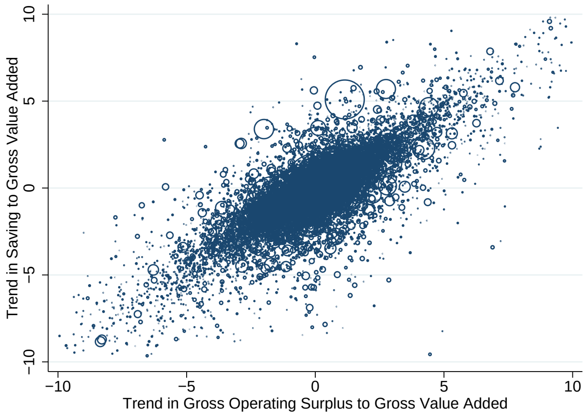
where $\Delta x_t = x_t - x_{t-1}$ and $\omega_{i,t}$ denotes the share of group i in total gross value added in period t. Here, we use the industries in Table 2 to define the groups, so that the first component in equation (12) reflects changes within industries over time holding constant their share of economic activity and the second component reflects changes between industries as their share of economic activity changes over time.

Applying this decomposition to the change in our full sample from 1989 to 2013, we find that 7.6 of the 8.7 percentage points increase in the global corporate saving rate is accounted

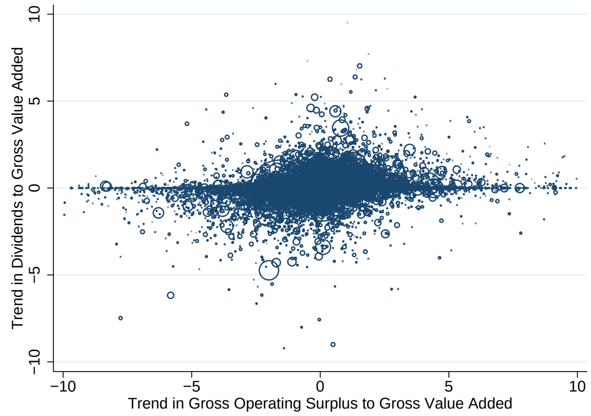
[20]The 44 percent of global value added accounted for by manufacturing in 2013 in our firm-level data exceeds estimates of manufacturing's share of global GDP, which are closer to 17 percent according to the World Bank. The bulk of this difference reflects the fact that in the firm-level data we have value added contributed only by non-financial corporations which is a bit more than half of global GDP. An additional difference may reflect the greater propensity for manufacturers to be publicly listed and, therefore, included in our firm-level dataset.

Table 2: Industry Trends

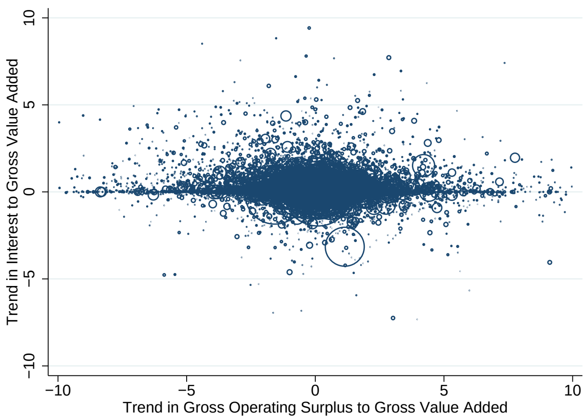
Industry	Value Added Share		Saving Rate	Net Lending Rate
			(p.p. per 10 years)	
Agriculture and Mining	3.77		3.20 (0.16)	-1.00 (0.50)
Construction	2.82		0.41 (0.10)	0.70 (0.17)
Information and Communications	6.79		-3.40 (0.19)	1.80 (0.44)
Total Manufacturing	44.43		1.95 (0.04)	1.49 (0.11)
Manufacturing Subsectors:				
Chemical, Petro, and Coal		14.31	1.01 (0.08)	0.24 (0.21)
Electronics and Electrical		7.43	2.79 (0.05)	4.53 (0.14)
Transportation Equipment		7.06	1.94 (0.12)	0.60 (0.25)
Rubber, Plastic, Glass, Metal		6.67	0.77 (0.09)	0.30 (0.18)
Other Manufacturing		8.96	2.12 (0.03)	1.78 (0.08)
Services	7.23		2.43 (0.07)	4.44 (0.08)
Transportation	3.79		-1.83 (0.08)	-1.65 (0.14)
Utilities	3.95		-6.06 (0.11)	-9.14 (0.35)
Wholesale/Retail Trade	27.21		0.60 (0.02)	0.96 (0.03)



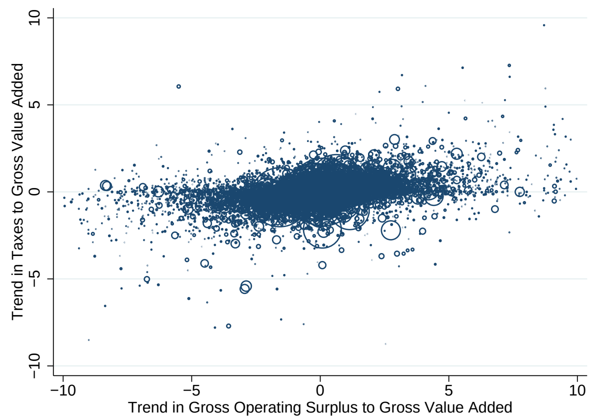
(a) Gross Saving



(b) Dividends



(c) Interest



(d) Taxes

Figure 7: Firm's Profit (GOS) and Saving Trends

for by the within-industry component. For the United States, we actually find that the between component is negative. Taken together with our result that the increase in corporate saving is observed in the majority of countries, we conclude that the increase is pervasive across types of economic activity and does not reflect long-term structural changes at the industry or global level.

3.3 Accounting for the Rise of Saving Using Firm-Level Data

In Section 2.3 we used national income accounts data to argue that the trend in corporate saving reflects the decline in the labor shares and the increase in corporate profits because dividends, interest payments, and taxes are relatively constant over time as a share of corporate gross value added. We now use the firm-level data to explore whether these relationships also hold in the cross section of firms.

The four panels in Figure 7 plot the percentage point trend per 10 years in firm gross operating surplus against the trends in the four main categories that constitute it. Each hollow circle is plotted with a size corresponding to a firm's average gross value added over the sample period. In Figure 7(a), we observe that there is a strong cross-sectional relationship between trends in the saving rate and trends in the gross operating surplus relative to value added. The other three panels show that trends in dividend, interest, and tax payments are weakly correlated with trends in the gross operating surplus.

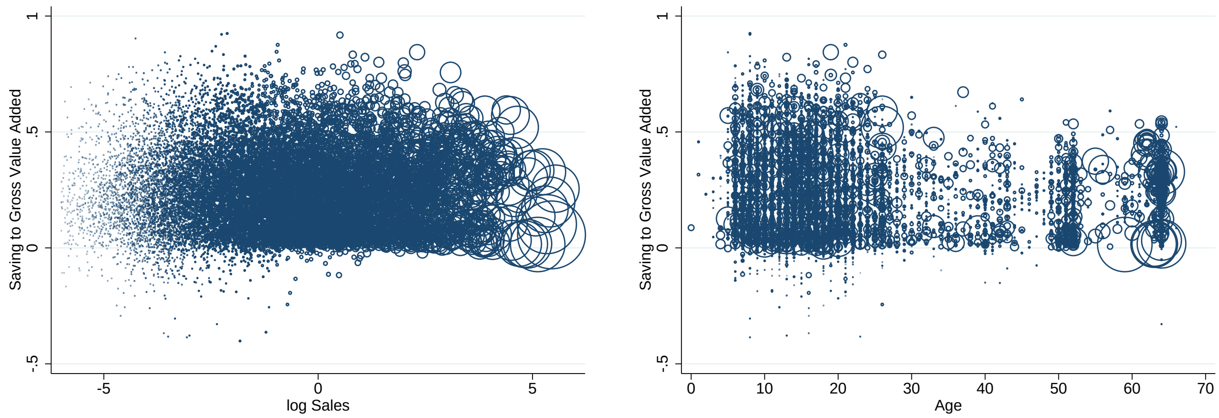
To quantify these relationships we regress each variable plotted in the y-axis on the trend in gross operating surplus relative to gross value added, controlling for country and industry fixed effects.[21] Without weights, the slope coefficient for Figure 7(a) is 0.81, suggesting that every dollar increase in gross operating surplus in the cross section of firms is associated with an increase of 81 cents in corporate gross saving. From the other three categories, only the regression with taxes produces a meaningfully positive coefficient (it equals 0.14). When we weight our regressions with gross value added, we generally obtain similar results.

3.4 Corporate Saving in the Cross Section of Firms

Is growth in firm saving most prevalent among large or small firms? Is it driven by young and rapidly growing firms or by older firms? In this section we assess the extent to which the rise in corporate saving reflects within-firm changes over time, changes within particular types of firms, or changes across firms with different characteristics and levels of saving.

The rise of corporate saving could reflect compositional changes over time if the average propensity to save varies with firm characteristics. Figure 8 presents scatterplots of the average saving rate against firm size (as measured by average log sales) and firm age (as measured by the firm's last year in the sample minus year of IPO). The regression coefficient (weighted by gross value added) corresponding to Figure 8(a) is 0.0003 with a standard error of 0.003, controlling for

[21] In these and later regressions that use firm-level data we winsorize all variables at the top and bottom 1 percent.



(a) Log Sales

(b) Firm Age

Figure 8: Saving Rate and Firm Characteristics

country, industry, and year fixed effects.[22] This estimate implies that firms with twice the value of another firm's sales (i.e. an increase of 0.69 log points) have roughly a 0.02 percentage point higher saving rate. The regression coefficient (weighted by gross value added) corresponding to Figure 8(b) is -0.0003 with a standard error of 0.0002, controlling for country, industry, and year fixed effects. This means that firms that are 10 years older have a 0.3 percentage point lower saving rate. We conclude that the average propensity to save does not vary significantly with firm size and age.

We use the decomposition in equation (12) to quantify the extent to which changes in the corporate saving rate reflect changes within group of firms or changes between group of firms. In Table 3 we present decompositions in which groups $i = 1, ..., I$ are defined either by the quartile of a firm in the age distribution or the quartile of a firm in the size distribution or the union of the two.[23] In columns 1 and 2, we present the decomposition of the cumulative change from the beginning to the end of the sample. We see that essentially all of the increase in the corporate saving rate is due to the within-group component, irrespective of whether groups are defined by the quartiles of size or age or both. In columns 3 and 4, we perform the decomposition

[22]We cluster the standard errors at the country level in all regressions in that use averages or trends of firm-level variables.

[23]In this decomposition we focus only on firms that have information on age. We group firms into size and age groups depending on the quartile that their size or age belongs to in each year.

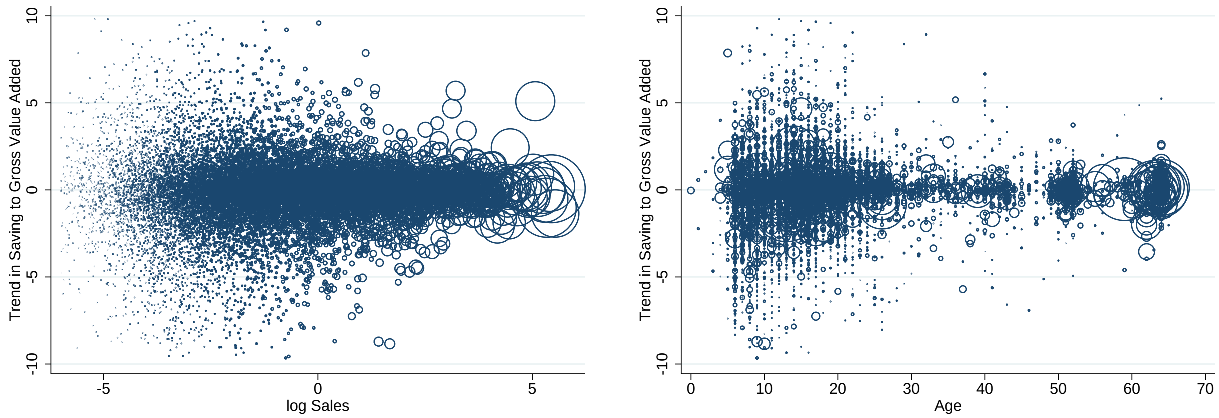
Table 3: Within-Between Decompositions of Changes in Saving Rate

	Saving to Gross Value Added (p.p.)			
	Beginning to End (1989-2013)		**Cumulative Annual Changes**	
	Within	Between	Within	Between
	(1)	(2)	(3)	(4)
Size	12.11	0.29	12.10	0.29
Age	10.17	2.23	7.61	4.79
Size and Age	10.39	2.01	7.38	5.01

annually and then cumulate the changes from the beginning to the end of the sample. We find that the change in the corporate saving rate is entirely because of the within-size component. While we observe that some of the increase in the corporate saving rate is due to the between age and between age and size components, again the majority of the increase is accounted for by increases in the corporate saving rate within firms belonging to age groups.

Given the salience of the within components to the growth in corporate saving rates, we conclude this section by asking if this growth is heterogeneous in age or size at the firm level. Figure 9 presents scatterplots that relate the trend in saving over value added for each firm per 10 years to log sales (averaged over the sample period) and the age of the firm (as measured by the firm's last year in the sample minus year of incorporation). As we see in these scatters, there is no clear pattern that relates the trend in saving to either size or age. Rather, the trend in saving is observed across all types of firms.[24]

[24] The regression coefficient (weighted by gross value added) corresponding to Figure 9(a) is 0.05 with a standard error of 0.17, controlling for country, industry, and year fixed effects. This estimate implies that firms with twice the value of another firm's sales (i.e. an increase of 0.69 log points) have roughly a 0.03 percentage point higher trend in their saving rate per 10 years. The regression coefficient (weighted by gross value added) corresponding to Figure 9(b) is -0.029 with a standard error of 0.013, controlling for country, industry, and year fixed effects. This means firms that are 10 years older have a 0.3 percentage point lower trend in their saving rate per 10 years. These relationships are either statistically insignificant or economically small.



(a) Log Sales

(b) Firm Age

Figure 9: Trend in Saving Rate and Firm Characteristics

Taken together, the results in Sections 3.2, 3.3, and 3.4 suggest that the growth in corporate saving is not driven by basic characteristics such as industry, firm size, or firm age. Much like our conclusion from analysis of the national accounts, these firm-level data also paint a picture of a global and pervasive phenomenon. It is unlikely to reflect structural changes such as the decline in manufacturing, idiosyncratic changes in the market power of particular firms and industries, or changes in the corporate financial practices in particular firms or countries.

3.5 How Was Corporate Saving Used?

An increase in corporate saving can be used for a combination of investment expenditures, accumulation of financial assets net of debt liabilities (what we refer to as "net financial assets") or increases in the value of equity buybacks net of equity issuance (what we refer to as "net buybacks"). As we documented in both the national accounts and the firm-level data, the difference between corporate saving and investment increased over time. Some authors, such as Gruber and Kamin (2015), actually suggest that changes in buyback behavior can explain a significant fraction of the increase in corporate saving.[25] Others, including Bates, Kahle, and

[25] We clarify that the national accounts treat equity buybacks as if they were negative issuances. Such a treatment is reasonable because it implies no changes in corporate saving were a firm to simultaneously issue and then repurchase the same value of shares. Aggregating net buybacks with dividends would be economically meaningful if the two were perfect substitutes. However, capital gains from repurchases are often taxed differentially from dividends and tax authorities may put limits to buybacks. Additionally, equity issuance is costly and its cost is

Table 4: Uses of Saving and Net Lending: Buybacks and Cash Accumulation

	Net Buybacks		**Cash Holdings**	
	(1)	(2)	(3)	(4)
(A) Saving	0.158	0.182	0.453	0.532
	(0.061)	(0.085)	(0.034)	(0.045)
(B) Net Lending	0.254	0.268	0.079	0.004
	(0.060)	(0.067)	(0.052)	(0.038)
GVA Weighted	Yes	No	Yes	No
Observations	18,023	18,023	18,023	18,023

Stulz (2009) and Foley, Hartzell, Titman, and Twite (2007), have emphasized the accumulation of cash on corporate balance sheets, which is one particular type of financial asset.[26] In this section, we provide evidence that links trends in saving and trends in the net lending position of firms to trends in net buybacks and trends in cash accumulation.

Table 4 reports results from eight regressions estimated on data from the cross section of firms. All regressions include country and industry fixed effects. The first two columns consider regressions where the left-hand-side variable is the trend in the ratio of net buybacks to gross value added and the right-hand-side variable is either the trend in the saving rate (row A) or the trend in net lending relative to value added (row B). Column 1, where we weight the regression with gross value added, shows that firms experiencing a one percentage point higher trend increase in the saving rate increased their net buybacks by an additional 0.158 percentage point relative to value added. When we do not weight the regression in column 2, we estimate

likely to vary cyclically (Eisfeldt and Muir, 2016).

[26]Falato, Kadyrzhanova, and Sim (2013) argue that the secular trend in U.S. corporate cash holdings reflects the rising importance of intangible capital as an input of production. If intangible capital is more difficult to pledge as collateral, firms reduce the cost of financing externally their intangible capital accumulation by increasing their cash holdings.

a coefficient of 0.182. In row B we document that firms experiencing a one percentage point higher trend increase in the net lending rate increased their net buybacks by 0.254 (when we weight) or 0.268 (when we do not weight) additional percentage point relative to value added.

Columns 3 and 4 report results from regressions of the trend in cash on saving and net lending. Since cash is a stock variable, these regressions consider trends in the levels of cash, saving, and net lending, but with all variables divided by the firm's average gross value added to create a scale-independent measure. Row A demonstrates that roughly 45 cents (when we weight) or 53 cents (when we do not weight) of each dollar of trend increase in saving was accumulated in cash. Row B shows that dollar changes in the net lending position of firms are positively associated with changes in cash accumulation but the relationship is not statistically significant.

We emphasize that there is no reason that such long-term relationships between firm's flow of saving, flow of net lending, equity repurchases, and cash accumulation need to exist. For example, the increased flow of saving can be used to hold illiquid or other non-cash assets or to pay down debt. The policy literature in particular has covered the large stockpiles of corporate cash holdings as reflecting, for example, increases in uncertainty especially after the global recession of 2008-2009.[27] By contrast, the relationships we uncover concern trends that span several decades. Therefore, we argue that these relationships should be studied in the context of the secular rise of corporate saving over the past decades.

4 Corporate Saving and Capital Market Imperfections

In this section we develop a model with capital market imperfections that allows us to quantify how changes in parameters affect the cost of capital, the flow of funds between corporations and households, and other key macroeconomic aggregates. We use moments from our firm-level data to inform heterogeneity in firm technologies and in frictions influencing corporate financial

[27] Warsh (2006) emphasizes the growing significance of foreign operations of U.S. multinationals and uncertainty even before the 2008-2009 recession. Carney (2012) stresses the elevated levels of uncertainty following the 2008-2009 recession. Within the macroeconomics literature, the decision to increase corporate cash holdings in response to uncertainty shocks has been recently examined by Alfaro, Bloom, and Lin (2016).

policy. Given the pervasiveness of the rise of corporate saving across countries, industries, and types of firms, we calibrate our model to represent the integrated global economy around 1980, as characterized in our analysis of national accounts data. We subject the model to changes in objects for which global common trends are likely to exist, such as the real interest rate, price of investment goods, markups, and other aspects of firms' cost of capital, and then assess the extent to which the model reproduces the evolution of corporate saving, profits, financial policies, and investment as seen in the world.

4.1 Description of the Model

We consider an infinite horizon, $t = 0, 1, 2, ...$, general equilibrium model with no aggregate uncertainty. Model periods denote years. The economy is populated by identical households, a government, and heterogeneous firms denoted by $i = 1, ..., N$. Firms supply differentiated varieties of a final good and face idiosyncratic productivity shocks.

We introduce several imperfections in the capital market that intermediates funds between households and firms. Firms' issuance of debt is limited by a collateral constraint. Households can inject equity flows to firms but these flows are subject to flotation costs. Dividend payments from firms to households are taxed and, therefore, firms prefer to return value to shareholders with capital gains resulting from equity buybacks. Further, corporate income is taxed and firms face costs to adjust their capital stock. Capital market imperfections create a wedge between the equilibrium cost of capital and cost of capital that would arise in an undistorted economy. In the presence of these imperfections, firms often prefer to use internal saving to finance their operations.

Growth. Our quantitative results focus on comparisons across different balanced growth paths of the model economy. Along any given balanced growth path, the economy is growing at a constant exogenous rate g given by the growth rate of the population. Denoting initial labor by L_0, population in period t is $\tilde{L}_t = (1 + g)^t L_0$. In what follows, we write the model directly in terms of stationary variables that are detrended by their respective growth rates. Thus, if $\tilde{x}_t$ is a variable growing at a rate $g_x = \{0, g\}$ along the balanced growth path, the detrended variable x_t is defined as $x_t = \tilde{x}_t/(1 + g_x)^t$.

Households. Households choose consumption C_t, bonds B_{t+1}, and shares s_{it+1} to maximize the objective function $\sum_{t=0}^{\infty} \beta^t \log(C_t)$. Households supply labor inelastically. Normalizing the price of consumption to one in each period, the budget constraint is given by:

$$C_t + \sum_i v_{it} s_{it+1} + (1+g)B_{t+1} = w_t L + (1+r_t)B_t + \sum_i \left((1-\tau_t^d)d_{it} - e_{it} + v_{it}\right) s_{it} + T_t^h, \quad (13)$$

where v_{it} denotes the (ex-dividend) price of a share of firm i, w_t denotes the wage per unit of L, r_t denotes the (risk-free) real interest rate, τ_t^d is the tax rate on dividend income, d_{it} denotes dividend distributions from firms to households, e_{it} denotes the value of net equity flows from the household to firms, and T_t^h denotes lump-sum transfers from the government to the household.

We note that e_{it} denotes the value of net equity issuance which equals the difference between the value of equity issuance and the value of share repurchases. The value of net equity issuance e_{it} enters with a negative sign in the right hand side of the budget constraint because issuance dilutes equity and reduces capital gains. For simplicity, capital gains inclusive of the impact of dilution and repurchases, $v_{it+1} - v_{it} - e_{it}$, are not taxed and, therefore, τ_t^d should be understood as a function of the gap between taxes on dividends and capital gains.

Final good. Producers of the final good are competitive and produce aggregate output Y_t by combining intermediate goods y_{it} according to a CES function:

$$Y_t = \left(\sum_i y_{it}^{\frac{\varepsilon}{\varepsilon-1}}\right)^{\frac{\varepsilon}{\varepsilon-1}}, \quad (14)$$

where $\varepsilon > 1$ is the elasticity of substitution between varieties. Denoting by p_{it} the price of variety i and by P_t the price of output, the profit maximization problem of the final goods producer yields the demand functions $y_{it} = \left(\frac{p_{it}}{P_t}\right)^{-\varepsilon} Y_t$.

Final output is used for consumption, investment, and resource costs related to the adjustment of capital and the issuance of equity. Producers of the consumption good transform one unit of final output Y_t into one unit of consumption C_t. Our normalization of the price of consumption to one implies $P_t = \left(\sum_i p_{it}^{1-\varepsilon}\right)^{\frac{1}{1-\varepsilon}} = 1$. Producers of the investment good transform one unit of final output Y_t into $1/\xi_t$ units of investment X_t, where ξ_t denotes the price of investment relative to consumption. Resource costs RC_t equal the sum of resource costs related to the adjustment of the capital stock and the issuance of equity and are denominated in terms of final output. The goods market clearing condition is given by $Y_t = C_t + \xi_t X_t + \mathrm{RC}_t$.

Corporations producing intermediate goods. Corporations are owned by households. We focus on the analysis of balanced growth paths with no aggregate uncertainty and, therefore, firms apply the household's stochastic discount factor in a balanced growth path to value steams of payoffs. Following Auerbach (1979), Poterba and Summers (1985), and Gourio and Miao (2010, 2011), corporations make investment and debt and equity financing decisions to maximize shareholder wealth via dividend payments and equity repurchases.

Each firm chooses dividends d_{it}, equity e_{it}, debt b_{it+1}, investment x_{it}, labor ℓ_{it}, and the price of its variety p_{it} to maximize discounted net payments to shareholders:

$$\max_{\{d_{it},e_{it},b_{it+1},x_{it},\ell_{it},p_{it}\}_{t=0}^{\infty}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left\{(1-\tau_t^d)d_{it} - e_{it}\right\}, \tag{15}$$

where $(1-\tau_t^d)d_{it} - e_{it}$ denotes after-tax dividends and the value of equity repurchases less equity injections. While for concreteness we call negative values of e_{it} equity repurchases, we think of $e_{it} < 0$ more broadly as capturing all pre-dividend distributions or transactions that affect the net lending position of the corporate sector and are perceived by firms as creating value for shareholders.[28]

Whenever $\tau_t^d > 0$, reductions in e_{it} are the preferred means of transferring resources to shareholders. We sidestep the issue of why firms prefer to pay dividends rather than create capital gains to shareholders by assuming that, for institutional reasons, firm dividends are

[28]As we discussed in Section 3.5, the increase in corporate saving did not fully reflect a substitution of dividends for equity repurchases net of issuance. In a stationary state of our model, bond positions do not change and the net lending position of the corporate sector depends only on e_{it}. We therefore interpret changes in e_{it} broadly to include other unmodeled factors that lead shareholders to value changes in the firm's net lending position.

equal to a target level of dividends that depends on revenues and the value of fixed assets:

$$d_{it} = \kappa \left(p_{it} y_{it}\right)^{\kappa_r} \left(\xi_t k_{it}\right)^{\kappa_k}. \tag{16}$$

In equation (16), $p_{it}y_{it}$ denotes firm's revenues and $\xi_t k_{it}$ denotes the value of fixed capital. We choose to model dividends as a function of variables that are sufficient statistics for a firm's state vector (productivity and capital). Because we do not observe productivity directly in the firm-level data, we use revenues as a proxy and treat the data and the model similar in that respect. In our quantitative application, we discipline the elasticities κ_r and κ_k using firm-level data on dividends, revenues, and fixed assets. We discipline the shifter κ of the dividend function with the level of dividends relative to gross value added observed in the aggregate data.

Following Gomes (2001) and Hennessy and Whited (2005), equity financing is costly because of asymmetric information or transaction costs. Specifically, for each unit of new equity raised in period t, only $(1-\lambda)e_{it}$ units actually augment the firm's funds, where $\lambda \in [0,1]$. Flotation costs are given by $\text{EC}_{it} = \lambda e_{it} \mathbb{I}\left(e_{it} \geq 0\right)$, where $\mathbb{I}_t$ is an indicator taking the value of one when firms issue equity. Firms can buy back their shares ($e_{it} < 0$) without costs.

Firms operate a CES production function:

$$y_{it} = \exp\left(A_{it}\right) \left(\alpha k_{it}^{\frac{\sigma-1}{\sigma}} + (1-\alpha)\ell_{it}^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}, \tag{17}$$

where σ denotes the elasticity of substitution between capital and labor and α denotes a distribution parameter. In the limiting case of $\sigma \to 1$, the production function becomes Cobb-Douglas, $y_{it} = \exp\left(A_{it}\right) k_{it}^{\alpha} \ell_{it}^{1-\alpha}$.

Productivity A_{it} is the only exogenous stochastic process that firms face. It follows an AR(1) process in logs:

$$A_{it} = -\frac{\sigma_A^2}{2(1+\rho_A)} + \rho_A A_{it-1} + \sigma_A u_{it} \text{ with } u_{it} \sim \mathbb{N}(0,1), \tag{18}$$

where ρ_A denotes the persistence of the productivity process and σ_A denotes the standard deviation of productivity shocks.

Firms issue debt that, as in Kiyotaki and Moore (1997), is limited by a collateral constraint:

$$b_{it+1} \leq \theta \xi_{t+1} k_{it+1}, \tag{19}$$

where $\theta \geq 0$ denotes the leverage parameter. Interest payments on debt are tax deductible and, therefore, firms prefer to issue debt than equity. This implies that the borrowing constraint always binds.[29]

Firms own the capital stock and augment it by purchasing investment goods. The law of motion for capital is given by:

$$(1+g)k_{it+1} = (1-\delta)k_{it} + x_{it}. \tag{20}$$

Firms face convex adjustment costs $\text{CC}_{it} = \frac{\psi(k_{it+1}-k_{it})^2}{2k_{it}}$ to change their capital stock.

Before presenting firm's flow of funds, it is useful to define (operating) profits as:[30]

$$\pi_{it}(k_{it}, A_{it}; Y_t, w_t) = p_{it}y_{it} - w_t\ell_{it} = Y_t^{\frac{1}{\epsilon}}\left(y(k_{it}, A_{it})\right)^{\frac{\varepsilon-1}{\varepsilon}} - w_t\ell(k_{it}, A_{it}). \tag{21}$$

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.

The flow of funds constraint of the firm is given by:

$$d_{it}+(1+\tau_t^x)\,\xi_t x_{it}+(1+r_t)b_{it}+\text{RC}_{it} = (1-\tau_t^c)\pi_{it}+\tau_t^c\left(\delta\xi_t k_{it}+r_t b_{it}\right)+\tau_t^f+(1+g)b_{it+1}+e_{it}, \tag{22}$$

where τ_t^x is the tax rate on investment spending, $\text{RC}_{it} = \text{CC}_{it} + \text{EC}_{it}$, τ_t^c is the corporate tax rate, and τ_t^f is a lump sum transfer from the government. We note that depreciation and interest payments, $\delta\xi_t k_{it} + r_t b_{it}$, are deducted from firm earnings in calculating taxes. We specify firm lump sum transfers as $\tau_{it}^f = \chi Y_t/N$, so that they always represent a constant fraction χ of total output. We denote by $T_t^f = \sum_i \tau_{it}^f = \chi Y_t$ total firm lump sum transfers.

[29]More precisely, 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 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. 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). In our baseline parameterization we find that this condition is not satisfied for less than 0.1 percent of firms. To economize on state variables in the firm's dynamic programming problem, we thus assume that the borrowing constraint (19) always binds.

[30]The difference between the term "operating profits" used here and "accounting profits" used in the empirical sections is that our notion of operating profits, equivalent to earnings before interest and taxes in the firm-level data, does not remove interest and taxes.

Equilibrium. We define an equilibrium for this 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 $\{\tau_t^c, \tau_t^x, \tau_t^d, T_t^h, T_t^f\}$. First, households maximize their value function subject to the budget constraint (13). Second, firms maximize their value function subject to the dividend policy function in equation (16), the production function in equation (17), the demand function $y_{it} = p_{it}^{-\varepsilon} Y_t$, the stochastic process for productivity in equation (18), the collateral constraint (19), the capital accumulation equation (20), and the budget constraint (22). Third, all markets clear and the government balances its budget:

1. Goods market:

$$Y_t = C_t + \xi_t X_t + \text{RC}_t. \tag{23}$$

2. Labor market:

$$L = \sum_i \ell_{it}. \tag{24}$$

3. Capital markets:

$$s_{it} = 1,\ X_t = \sum_i x_{it},\ D_t = \sum_i d_{it},\ E_t = \sum_i e_{it}, \text{ and } B_t = \sum_i b_{it}. \tag{25}$$

4. Government budget constraint:

$$T_t^h + T_t^f = \tau_t^c \left(Y_t - w_t L - \delta \xi_t K_t - r_t B_t\right) + \tau_t^d D_t + \tau_t^x \xi_t X_t. \tag{26}$$

We define a stationary equilibrium for this economy as an equilibrium in which all (detrended) aggregates variables are constant and the distribution of firms across states (k_{it}, A_{it}) is stationary over time.

Saving Flows. Total domestic saving equals investment spending, $S_t = Y_t - C_t - \text{RC}_t = \xi_t X_t$, and can be decomposed into household and firm saving, $S_t = S_t^h + S_t^f$:

$$S_t^h = w_t L + r_t B_t + (1 - \tau_t^d) D_t + T_t^h - g B_{t+1} - C_t, \tag{27}$$

$$S_t^f = (1-\tau_t^c)(Y_t - w_t L) + \tau_t^c(\delta\xi_t K_t + r_t B_t) + T_t^f - \tau_t^x \xi_t X_t - \mathrm{RC}_t - r_t B_t - D_t + gB_{t+1}. \quad (28)$$

Combining these equations with the aggregated flow of funds of firms, we show that the three uses of corporate saving are reductions in debt, reductions in equity issuance, and investment spending:

$$S_t^f = B_t - B_{t+1} - E_t + \xi_t X_t. \quad (29)$$

Similar to our quantitative application below that considers economies along their balanced growth paths, we now derive the corporate saving rate in a stationary environment. Dropping time subscripts to denote (detrended) variables that are constant in a balanced growth path, we can write the corporate saving rate as:

$$\frac{S^f}{Y} = 1 - \underbrace{\frac{wL}{Y}}_{\text{labor share}} - \underbrace{\frac{D}{Y}}_{\text{dividends}} - \underbrace{\left[\tau^c\left(1 - \frac{wL + \delta\xi K}{Y}\right) + \frac{\tau^x \xi X + \mathrm{RC} - T^f + ((1-\tau^c)r - g)B}{Y}\right]}_{\text{taxes and other payments to capital}}. \quad (30)$$

The corporate saving rate decreases with the labor share, with the dividend rate, with net taxes, and with other payments to capital.

4.2 Parameterization of the Model

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.[31] The first panel of Table 5 lists externally calibrated parameters that we choose prior to solving the model.[32] We set the growth rate to $g = 0.023$, which is World Bank's estimate of real GDP growth rate for the world between 1980 and 1984. Given g, we set the discount factor to $\beta = 0.981$ so that

[31] 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 iterate 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.

[32] For convenience, Table 5 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 5: 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 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 (19) 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.[33] For the equity flotation cost, we follow Gomes (2001) who estimates that the marginal cost of issuing equity is $\lambda = 0.028$.[34]

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

[34] Eisfeldt 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 and on average equals 2.4 percent.

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:

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

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 5 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.

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.

4.3 Quantifying the Increase in Corporate Saving in the Model

Table 6 summarizes our results from the calibrated economy. The first row lists values for the corporate saving rate S^f/Y, the labor share $s_L = wL/Y$, the dividend to output ratio D/Y, and the investment rate I/Y corresponding to the initial balanced growth path of our model economy. These values match exactly those in the early years of our data. For each row we always show two set of results in columns. The first set of columns show results for our baseline model with an elasticity of substitution between capital and labor equal to $\sigma = 1.25$. The second set of columns show results with a Cobb-Douglas production function (where $\sigma = 1$) that is calibrated to match the same statistics.

Along with these statistics, we present the model's equilibrium aggregate cost of capital defined by:

$$R = \frac{(1 - s_L - s_\pi)Y}{K}. \tag{31}$$

Table 6: Results

	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

The initial cost of capital equals 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).[35]

Row 2 summarizes changes in aggregate variables for the global economy between the early

[35]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 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.

(generally 1980-1984) and the end of our sample (2009-2013). As discussed in Section 2.3, the global corporate saving rate increased by 8.5 percentage points and the labor share declined by 5.4 percentage points. Dividends and investment spending remained roughly constant relative to gross value added.

Our goal is to compare aggregates measured at the end of our data with those generated along a new balanced growth path that differs from the initial one due to the following changes:

$$(\xi, \tau^c, \tau^x, r, g, \delta, s_\pi, \chi) = (0.80, 0.25, 1.26\bar{\tau}^x, 0.009, 0, 0.093, 0.062, \bar{\chi} + 0.022)\,, \tag{32}$$

where $\bar{\tau}^x$ and $\bar{\chi}$ denote the values of τ^x and χ in the initial stationary equilibrium. We set $\xi = 0.8$ to capture the 20 percent decline in the relative price of investment goods over the past three decades from Karabarbounis and Neiman (2014). We calculate final values for the corporate income tax rate $\tau^c = 0.25$, the world interest rate $r = 0.009$, and the corporate sector depreciation rate $\delta = 0.093$ from the same sources used to calculate their initial values but using data for 2009 to 2013. We use the updates series between 2009 and 2013 from McDaniel (2007) to estimate an increase in investment tax rates of roughly 26 percent, $\tau^x = 1.26\bar{\tau}^x$. We set the growth rate to zero percent to mimic the slowdown of world economic activity in the aftermath of the Great Recession. Finally, we increase the values for s_π and χ by 0.012 and 0.022 relative to their initial values so that the model with $\sigma = 1.25$ generates the observed decline in the labor share and stability of taxes as a share of corporate value added documented previously in the data.

Row 3 of Table 6 contains the main result of our analysis for the CES model. We find that the model generates a roughly 3 percentage point decline in the cost of capital. Along with this decline, the corporate saving rate increases and the labor share decreases by magnitudes that are close to the changes observed in the data.

What is the mechanism driving this behavior? The decomposition in equation (30) shows that the corporate saving rate decreases with the labor share, with the dividend rate, with net taxes, and with other payments to capital. We begin our analysis by deriving an equation for the labor share of income for a representative firm with revenues Y that faces a cost of capital

R, markups μ, and technology $\exp(A)$:

$$\frac{wL}{Y} = \left(\frac{1}{\mu}\right)\left(1 - \alpha^{\sigma}\left(\frac{\exp(A)}{\mu R}\right)^{\sigma-1}\right). \tag{33}$$

Equation (33) shows that, with an elasticity of substitution in production $\sigma > 1$, the decline in the cost of capital induces firms to substitute away from labor and toward capital to such a degree that the share of income accruing to labor declines. Given the stability of payments to taxes, the decline in the labor share implies an increase in the share of profits. This leads to an increase in the corporate saving rate as long as dividends relative to value added do not increase by the same amount.

Indeed, as shown in the third column of Row 3, the stability of dividends relative to gross value added in our model is quantitatively consistent with the behavior of dividends in the data. From the dividend policy function in equation (16) we see that the dividend to output ratio for a representative firm with revenues Y is given by:

$$\frac{D}{Y} = \kappa\left(\frac{\xi K}{Y}\right)^{\kappa_k}\left(\frac{1}{Y}\right)^{1-\kappa_r-\kappa_k}. \tag{34}$$

We estimated $\kappa_k = 0.05$ and $\kappa_r = 0.63$ in our firm-level data, which implies that the dividend to output ratio is increasing in the capital-output ratio and decreasing in output. Following the decline in the cost of capital, both the capital-output ratio and output increase, leading to a relatively stable D/Y. As discussed in Section 3.5, the decision by firms how to allocate profits among dividends, financial assets, and net buybacks is critical to the behavior of corporate saving. This specification of the dividend process, estimated from cross-sectional variation in our firm-level data, plays an important role in determining this allocation in our model.

Row 3 of Table 6 also shows the case of Cobb-Douglas production function that features $\sigma = 1$. The main difference with the CES model is that the rise of corporate saving and investment in that model is smaller. With a lower elasticity of substitution in production, firms in the Cobb-Douglas world substitute less from labor to capital than in the CES model in response to the decline in the cost of capital. As shown in equation (33), with $\sigma = 1$ the labor share of costs is always constant and the labor share of income declines only to the extent that markups increase. Therefore, while the Cobb-Douglas model is also able to generate a significant increase in the corporate saving rate, it does so without matching the significant decline in the labor share of income observed in the data.[36]

The CES model generates a significant improvement in the net lending position of the corporate sector which equals the difference between saving and investment. In the data, the net lending position of the corporate sector improved by 9.1 percentage points relative to value added between the earlier and the later part of the sample. In the CES model, the net lending position of the corporate sector improves by 6.2 percentage points relative to value added. The difference between the model and the data is mostly explained by the behavior of the corporate investment rate. The model with CES predicts an increase in the investment rate whereas in the data this rate in fact slightly decreased. The Cobb-Douglas model also implies an improvement in the corporate net lending position of 6.5 percentage points relative to value added.[37]

The improvement in the corporate net lending position has direct implications about household saving behavior. In our closed economy total saving equal investment. Abstracting from the government sector and from investment in housing, any change in the corporate net lending position relative to GDP implies an equal and opposite movement in household saving as a share of GDP. Our model, therefore, implies a decline in household saving to GDP of about 6 percentage points which is of similar magnitude to that shown in Figure 1(a).

Rows 4 to 10 in the third panel of Table 6 conduct a series of counterfactual exercises to quantify separately the role of each change in the parameters. In each exercise, we revert one of the parameters back to its initial value and keep the others at their final values. Comparing the results in these rows with those in row 3 gives the independent impact of the excluded change.

In row 4, we remove the decline in the price of investment goods ξ. This causes the cost

[36]The Cobb-Douglas model would generate a decline in the labor share similar to the data if, alternatively, we introduce a much larger increase in the profit share from a level of 5 to 13.4 percent of value added. This change generates a 13 percentage points increase in the corporate saving rate, but counterfactually implies a 4 percentage points decrease in dividends relative to output.

[37]In both models the cost of capital R declines but the wedge between R and the frictionless cost of capital $\xi(r+\delta)$ increases from 3.6 to 4 percentage points. Therefore, the increase in saving and the improvement in the net lending position reflect firms' response to the lower cost of capital, which exacerbates the impact of imperfections in the capital market.

of capital to increase by 0.5 percentage point rather than to decline by 3.1 percentage points as in row 3. Since $\sigma > 1$, the decline in the cost of capital significantly lowers the labor share, increases corporate saving, and increases corporate investment. Removing the decline in the price of investment goods mutes or reverses these changes. With a Cobb-Douglas production function, the labor share is constant and changes in the price of investment goods do not play an important role for the increase in corporate saving.

In row 5, we remove the decline in the corporate income tax rate τ^c. We find a significant change in corporate saving and, to a smaller extent, in corporate investment. As the decomposition in equation (30) shows, the decline in corporate income taxes contributes to an increase in corporate saving beyond any changes in the labor share or dividends. Without the decline in τ^c, the net lending position of the corporate sector would not have shifted from negative to positive. Next, in row 6, we remove the increase in investment taxes τ^x. As expected, the rise of investment taxes tends to lower corporate investment and saving. The decline is, however, relatively small.

In row 7, we show that removing the decline in the real interest rate r leads to very large effects on all variables of interest. The cost of capital rises by 0.6 percentage point and both the corporate saving and investment rate fall significantly. The net lending position in this case rises by far less than in row 3, implying that firms responded to the decline in r in part by increasing their net buybacks of shares. In row 8, we continue to remove the decline in r and additionally remove the decline in the growth rate of the economy g.[38] In the absence of the decline in the growth rate, corporate saving and investment would increase relative to the case with only r excluded, though both rates remain well below their values in row 3. In row 9, we remove the increase in the depreciation rate. We find that increased depreciation rate contributed to a lowering of corporate saving and to a lowering of investment. Because depreciation affects investment by more, the increase in depreciation is associated with higher corporate net lending.

[38]We cannot remove the change in g without removing at the same time the change in r because $\beta < 1$ requires that $r > g$ along any equilibrium.

Finally, in row 10 we report that without the increase in the profit share s_π, saving and investment would have increased by less than in our baseline with all changes. We also find that the labor share would have only exhibited about half of its decline. Removing the same sized increase in s_π has a much larger impact in the CES model than in the Cobb-Douglas model. With $\sigma > 1$, the increase in markups and the decline in the cost of capital interact quantitatively in a significant way.

To summarize, our model with a CES production function generates an increase in corporate saving above corporate investment in response to a reduction in the cost of capital and other changes including markups and growth. This implies that a fraction of the rise of corporate saving was used to transfer wealth to shareholders via endogenous substitution between dividends and net buybacks. From the components of the cost of capital, the declines in the real interest rate, price of investment goods, and corporate income taxes are quantitatively the most important. A model with Cobb-Douglas production would not generate significant movements in the labor share of costs and implies a smaller increase in the corporate saving rate.

5 Conclusion

We document a large shift in the sectoral composition of global saving during the last three decades. Whereas in the early 1980s most of investment spending at the global level was funded by saving supplied by the household sector, by the 2010s nearly two-thirds of investment spending at the global level was funded by saving supplied by the corporate sector. The shift in the supply of saving is not accompanied by changes in the composition of investment across sectors. Therefore, the corporate sector has now become a net lender of funds in the global economy.

Using national accounts and firm-level data, we show that the global rise of corporate saving is not concentrated in particular types of countries, industries, or firms. Rather, it reflects the pervasive increase in the share of corporate profits that mirrors the global decline in the labor share. Given that dividend payments and investment did not increase much as a share of value added, firms used part of the increased flow of saving to repurchase their shares and part of it to accumulate cash and other types of financial assets.

Through the lens of a calibrated general equilibrium model with capital market imperfections and heterogeneous firms, we demonstrate that changes in the cost of capital are important for understanding the evolution of the sectoral flow of funds. We find that the observed declines in the real interest rate, the price of investment goods, and corporate income taxes generate increases in corporate profits and shifts in the supply of sectoral saving that are of similar magnitude to those observed in the data. Based on this result, we argue that models trying to understand the evolution of global saving and investment – whether generated from the household sector or the corporate sector – need to take into account frictions in the sectoral flow of funds and the general equilibrium that affect simultaneously households and firms.[39]

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