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Abstract

The sectoral composition of global saving changed dramatically 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. This shift in the sectoral composition of saving was 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 product and capital market imperfections to explore quantitatively the determination of the flow of funds across sectors. Changes including declines in the real interest rate, the price of investment, 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.

JEL-Codes: E21, E25, G32, G35.
Keywords: Corporate Saving, Profits, Labor Share, Cost of Capital.

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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 such an increase? 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, profits, and corporate practices on liquidity, repurchases, and transfer pricing? What are the macroeconomic implications?

We begin our analysis by constructing a dataset of sectoral saving and investment from the national accounts of more than 60 countries. Consistent with previous studies such as Poterba (1987), we measure corporate saving as undistributed corporate profits. We note that corporate saving is a flow measure, distinct from the stock of savings accumulated through cash or other financial assets, and equals physical investment plus net lending in the corporate sector. Corporate saving together with government and household saving equal national saving.

We document a pervasive shift in the composition of saving away from the household sector and toward the corporate sector. 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 most industries and in the large majority of countries, including all of the 10 largest economies. The composition of investment spending across sectors was relatively stable over this period. The corporate sector, therefore, 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, 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.[1]

We next study firm-level data and find, similarly to the national accounts data, that the increase in corporate saving in the cross-section of firms 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 size and age. Increases in corporate saving within industry, age, and size groups, rather than shifts in value added shares between these groups, account for the majority of the global rise of corporate saving.

Further, we consider the possibility that multinationals, with their ability to shift production, income, and tax liabilities across foreign business units, play a key role in the rise of corporate saving. The increase in corporate saving at the global level does not simply reflect the cross-country shifting of profits and value added by multinationals because this reshuffling should cancel out when aggregated across countries. Firms with significant income from foreign operations display higher saving rates than firms without foreign income and this difference mainly reflects higher shares of profits in value added rather than taxes or dividends. However, the share of firms with significant foreign income in total value added is stable over time and, therefore, level differences in saving rates across groups do not contribute to the overall rise of firm saving. These firms exhibit larger increases in their saving rates but this difference is also accounted for by their larger trend increase in profits rather than differential trends in dividend or tax payments.

The increase in corporate saving exceeded that in corporate investment, which implies that the corporate sector improved its net lending position. Among other possibilities, increased net lending can be associated with accumulation of cash, repayment of debt, or increasing equity

[1]The literature on the stickiness of dividends goes back to Lintner (1956). See Brav, Graham, Harvey, and Michaely (2005) and Fama and French (2001) for more recent evidence on sticky or declining dividends.

buybacks net of issuance.[2] We demonstrate in the cross section of firms that the balance sheet adjustment involved all three of these categories, though to an extent that varied over time. Increases in net lending were more likely to be stockpiled as cash starting in the early 2000s and were less likely to be used by firms to buy back their shares after the financial crisis.

To quantify how observed changes in parameters affect the cost of capital and corporate saving, profits, financial policies, and investment, we study a workhorse dynamic general equilibrium model with heterogeneous firms and product and capital market imperfections. Our modeling is inspired by a literature at the intersection of corporate finance and macroeconomics, which departs from the Modigliani and Miller (1958) and Miller and Modigliani (1961) irrelevance theorems by incorporating collateral constraints, equity flotation costs, and differential taxes on capital gains, interest, and dividends.[3] These imperfections imply that firms face a higher cost of capital than what would arise in an undistorted economy and often prefer to finance operations from internal saving.

We parameterize the model to represent the global economy in the early years of our sample. We compare this initial equilibrium to a new one that emerges when we subject the model to changes in several parameter values that we estimate from the data. The model generates a decline in the cost of capital of roughly 3 percentage points and an increase in the corporate saving rate of equal magnitude to that documented in the data. Quantitatively, we find that important drivers of this change are the global declines in the real interest rate, the price of investment goods, and corporate income taxes and the increase in markups. The mechanism is that, with an elasticity of substitution above one in production, the decline in the cost of capital and the increase in markups both lead 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 corporate saving. Further, firms have tax incentives to buy back more shares as saving increases and this lead to an improvement in the corporate net lending position.

[2]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 have risen markedly relative to assets.

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

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 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.[4] 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 that hold in the aggregate as well as at the sector or industry level serve as the backbone for the national accounts. In these accounts, the value of final production (i.e. production net of intermediate goods) is called gross value added (GVA). When aggregated to the economy level, GVA equals GDP less net taxes on products.[5] GVA is detailed in the *generation of income account* and equals the sum of income paid to capital, labor, and taxes:

$$\begin{aligned}\text{GVA} &= \text{Gross Operating Surplus (GOS)} + \text{Compensation to Labor} \\ &\quad + \text{Net Taxes on Production.} \end{aligned} \tag{1}$$

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.

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:

$$\begin{aligned}\text{GOS} &= \underbrace{\text{Gross Saving (GS)} + \text{Net Dividends}}_{\text{Accounting Profits}} + \text{Taxes on Profits} + \text{Interest} \\ &\quad - \text{Reinvested Earnings on Foreign Direct Investment} + \text{Other Transfers.} \end{aligned} \tag{2}$$

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

[4]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. The Appendix further discusses details such as when we use the UN or OECD data, how we treat outliers, and some country-specific adjustments.

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

analyses, we define (accounting) profits as the sum of gross saving and net dividends.

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

$$\begin{aligned} \text{GS} &= \text{Net Lending} + \text{Gross Fixed Capital Formation} + \text{Changes in Inventories} \\ &\quad + \text{Changes in Other Non-Financial Produced Assets.} \end{aligned} \tag{3}$$

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

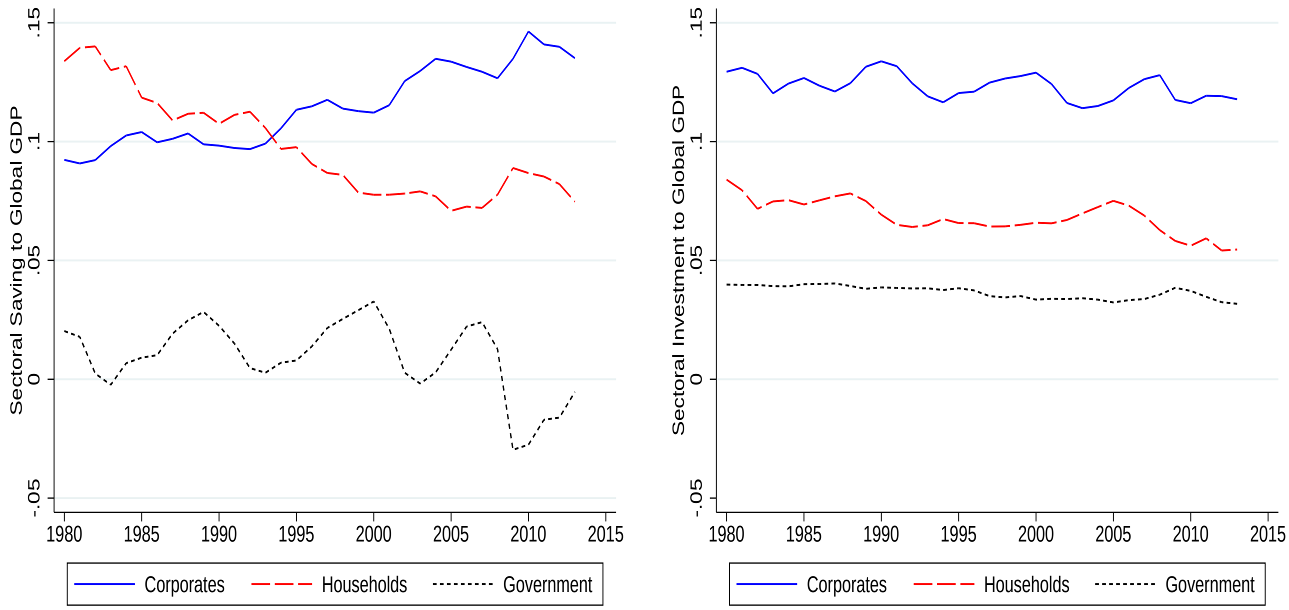
2.3 Sectoral Saving Trends

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 relative to GDP whereas saving by households has decreased by nearly 6 percentage points.[6]

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, 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 household sector funded most of global investment, in modern times most

[6]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 constitute an important piece of the household sector.



(a) Sectoral Saving

(b) Sectoral Investment

Figure 1: Global Saving and Investment

Notes: The upper left panel plots sectoral saving over global GDP. The upper right panel plots sectoral investment over global GDP.

of global investment is funded by the corporate sector. Further, 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 is different than among non-financial corporations. Nonetheless, we find that saving of non-financial corporations relative to global GDP has exhibited a very similar trend as the whole corporate sector (see Appendix). 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.

The increase in corporate saving relative to GDP could in theory reflect either an increasing saving rate in the corporate sector or an increasing share of GDP produced by the corporate sector. In fact, the sectoral shares of global GDP have remained remarkably stable throughout

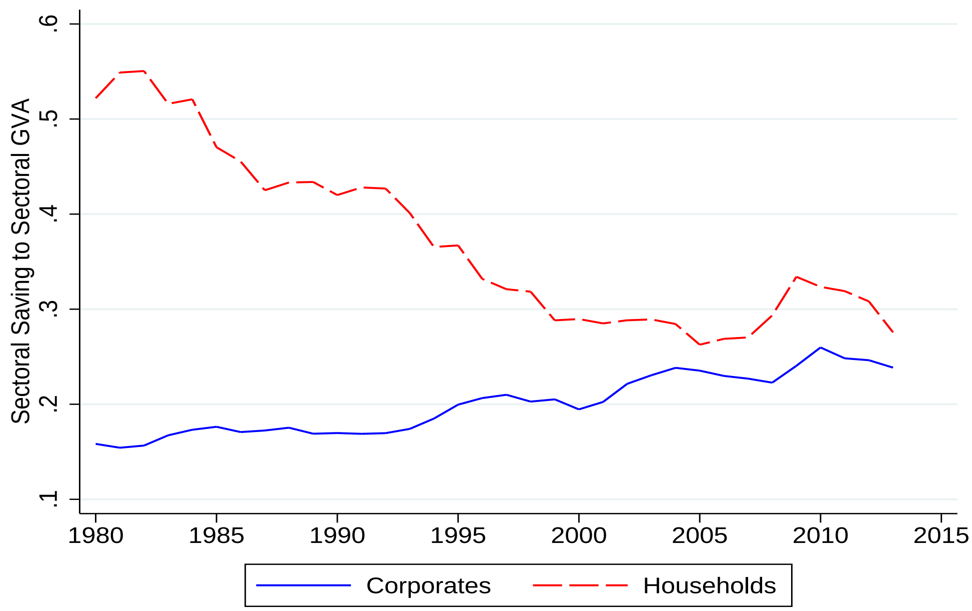


Figure 2: Sector Saving Rates

Notes: The figure plots sectoral saving rates, defined as sectoral saving over sectoral value added.

our sample.[7] It is not surprising, therefore, 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 2. In contrast, the household saving rate has declined markedly from roughly 50 to 30 percent.[8]

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 2 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 3 shows that the increase in corporate saving 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

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

[8] 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.

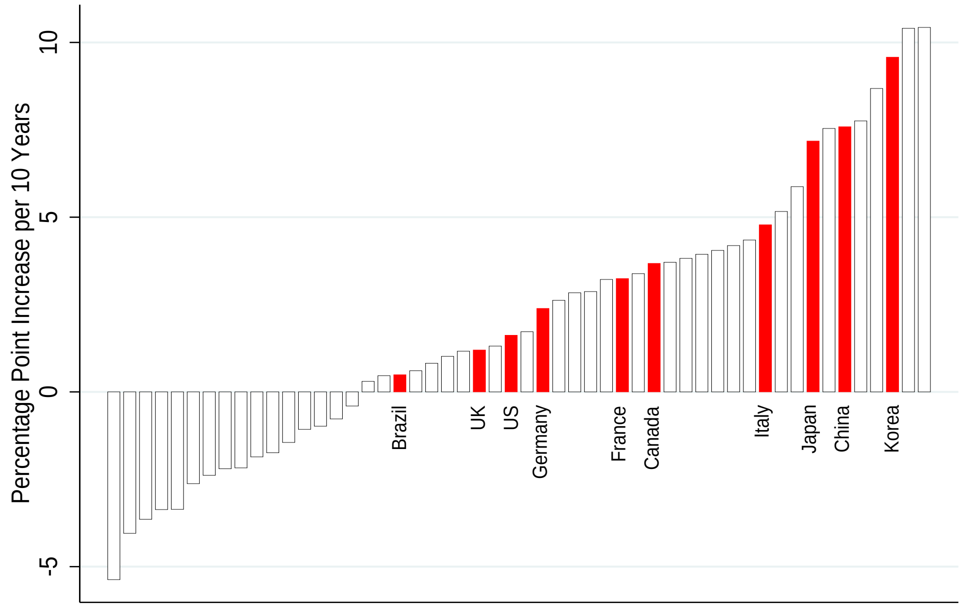


Figure 3: Trends in Corporate Saving Rates

Notes: The figure plots trends per 10 years in corporate saving rates by country.

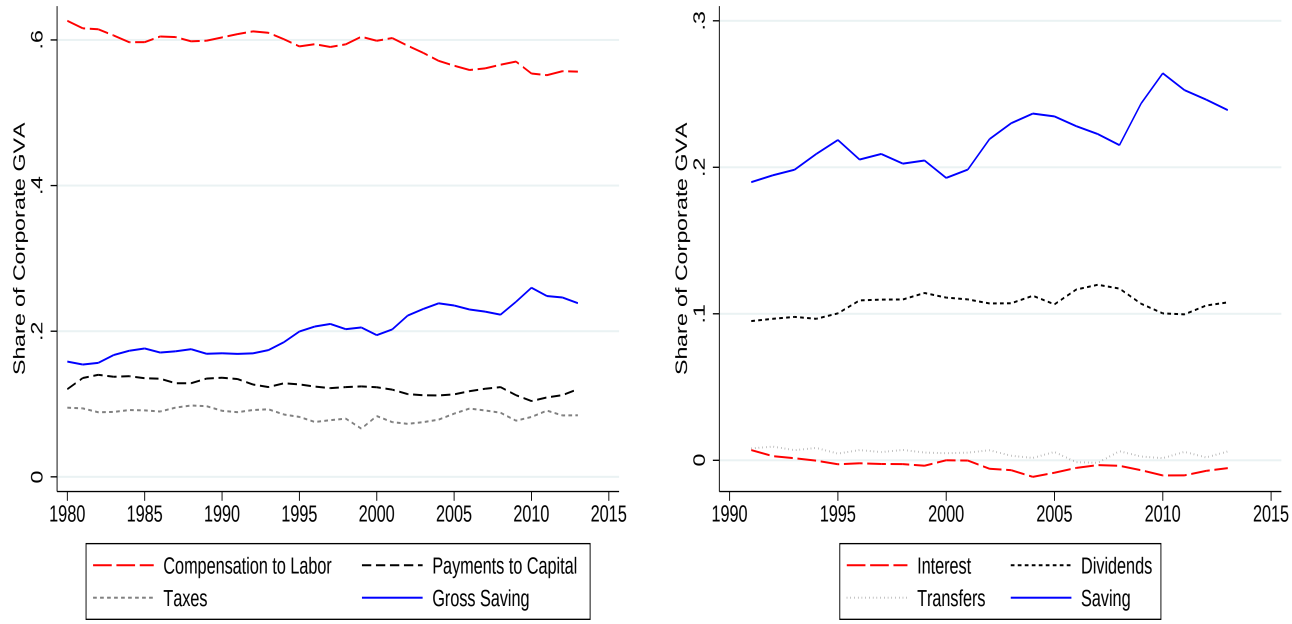
countries included, and all 10 of the world's largest economies (the shaded bars in the figure), have seen increases in their corporate saving rate.[9]

By construction, as the corporate saving rate increases, the share contributed by other components of gross value added must decrease. Substituting the definition of gross operating surplus from equation (2) into equation (1), and applying it to the corporate sector, we write a decomposition of corporate gross value added:

$$\begin{aligned}\text{Corporate GVA} \quad &= \quad \text{Corporate Compensation to Labor} + \text{ Corporate Taxes} \\ &\quad + \text{Corporate Payments to Capital} + \text{Corporate Gross Saving}, \qquad (4)\end{aligned}$$

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 investment, and other transfers. Equation (4) shows that an increase in the saving share of

[9]Our global results are consistent with other studies of various subsamples. Bacchetta and Benhima (2015) document 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 4: Decomposition of Increase in Corporate Saving

Notes: The left panel plots the four components of corporate gross value added at the global level. The right panel plots corporate saving along with dividends, taxes, and interest payments at the global level.

value added must be offset by declines in the share of payments either to labor, to creditors and owners, or to taxes.

Figure 4(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 4(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.

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. An important finding of our analysis is that much of this rise is accounted for by increasing saving rates within groups of firms and industries and does not simply reflect shifting market shares between groups with differing saving rate levels. Additionally, we discuss how multinational activity may have impacted the trend in corporate saving and we study the relationship between net lending and cash holdings, equity buybacks, and repayment of debt in the cross section of firms.

3.1 Firm-Level Data

We obtain consolidated financial statement data of publicly listed firms from Compustat Global and Compustat North America.[10] 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 such as Fama and French (2001) and DeAngelo, DeAngelo, and Skinner (2004), we exclude financial firms (SIC codes 6000-6999). 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

[10]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.

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 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:

$$\text{Operating Expenses}_{f,c,i,t} = \text{COGS}_{f,c,i,t} + \text{SG\&A}_{f,c,i,t}, \tag{5}$$

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:[11]

$$\begin{aligned} \text{Intermediate Consumption}_{f,c,i,t} \quad = \quad & \text{Operating Expenses}_{f,c,i,t} - \text{Depreciation}_{f,c,i,t} - \text{R\&D}_{f,c,i,t} \\ & \underbrace{- \text{ Staff Compensation}_{f,c,i,t} - \text{Production Taxes}_{f,c,i,t}}_{\text{Not Available in Compustat}}. \end{aligned} \tag{6}$$

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 (6) – 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

[11]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.

accounts data.[12] Specifically, for each country, 1-digit industry code, and year, we calculate:

$$\pi_{c,i,t} = \frac{\text{Intermediate Consumption}_{c,i,t}}{\text{Intermediate Consumption}_{c,i,t} + \text{Compensation}_{c,i,t} + \text{Other Production Taxes}_{c,i,t}}, \quad (7)$$

where the elements on the right hand side of equation (7) are readily available in the national accounts. Using $\pi_{c,i,t}$, we then impute gross value added for each firm f as:

$$\text{GVA}_{f,c,i,t} = \text{Sales}_{f,c,i,t} - \pi_{c,i,t} \times \left(\text{Operating Expenses}_{f,c,i,t} - \text{Depreciation}_{f,c,i,t} - \text{R\&D}_{f,c,i,t}\right), \quad (8)$$

where, other than $\pi_{c,i,t}$, all terms on the right hand side of equation (8) are directly available in the firm-level data.[13]

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:

$$\text{GOS}_{f,c,i,t} = \underbrace{\text{Sales}_{f,c,i,t} - \text{Operating Expenses}_{f,c,i,t} + \text{Depreciation}_{f,c,i,t}}_{\text{Operating Income Before Depreciation and Amortization}_{f,c,i,t}} + \text{R\&D}_{f,c,i,t}, \quad (9)$$

where the first three terms on the right-hand-side of equation (9), 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:[14]

$$\text{GS}_{f,c,i,t} = \text{GOS}_{f,c,i,t} - \text{Interest}_{f,c,i,t} - \text{Corporate Taxes}_{f,c,i,t} - \text{Dividends}_{f,c,i,t}, \quad (10)$$

[12] 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.

[13] Note from equation (6) that the term in parenthesis in equation (8) 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 (7).

[14] 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.

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.[15]

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 of gross value added, which represents roughly 60 percent of the global non-financial corporate gross value added found in the national accounts. Despite the differences between what is measured and reported in our macro and micro data, the global (non-financial) saving rate aggregated up from the firm-level data tracks well the saving rate we measured from the national accounts (see Appendix).

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 differing 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.[16] The third column presents the estimated

[15]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.

[16]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. Some of this difference reflects the fact that in the firm-level data we have value added contributed only by non-financial

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

Notes: The table presents summary statistics of the firm-level data.

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

Notes: The table presents trends (in percentage points per 10 years) in saving and net lending rates by industry.

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:

$$\Delta\left(\frac{\mathrm{GS}_t}{\mathrm{GVA}_t}\right) = \underbrace{\frac{1}{2}\sum_i \left(\omega_{i,t} + \omega_{i,t-1}\right)\Delta\left(\frac{\mathrm{GS}_{i,t}}{\mathrm{GVA}_{i,t}}\right)}_{\text{Within-Group Component}} + \underbrace{\frac{1}{2}\sum_i \left(\frac{\mathrm{GS}_{i,t}}{\mathrm{GVA}_{i,t}} + \frac{\mathrm{GS}_{i,t-1}}{\mathrm{GVA}_{i,t-1}}\right)\Delta\omega_{i,t}}_{\text{Between-Group Component}}, \tag{11}$$

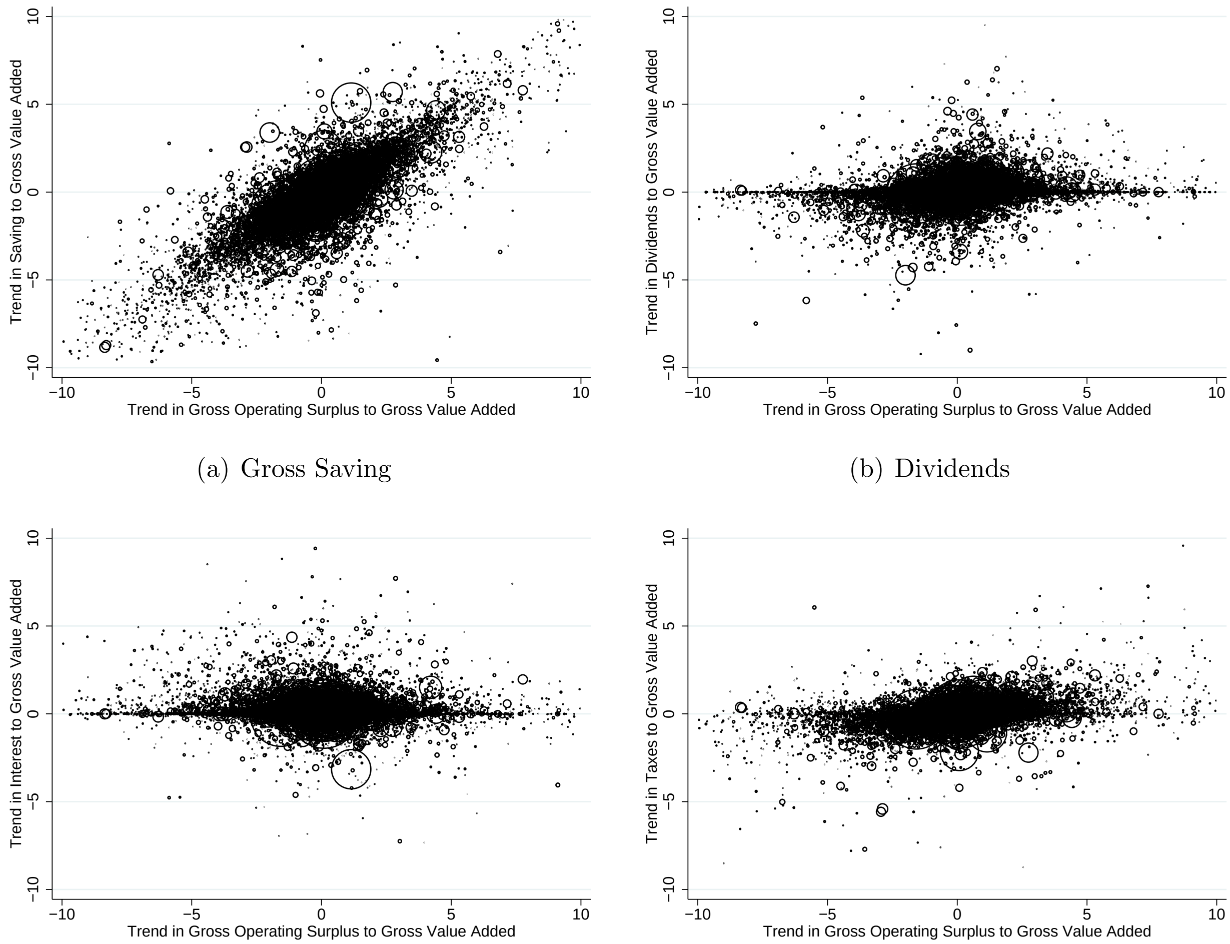
where $\Delta x_t = x_t - x_{t-1}$ and $\omega_{i,t}$ denotes the share of group i in total gross value added in period t. Here, we use the industries in Table 2 to define the groups, so that the first component in equation (11) reflects changes within industries over time holding constant their share 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 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 most 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 share and the increase in corporate profits because dividends,

corporations and so we exclude the contribution to GDP from sectors like finance, government, and households (including implied rental income). An additional difference may reflect the greater propensity for manufacturers to be publicly listed and, therefore, included in our firm-level dataset.



(a) Gross Saving

(b) Dividends

(c) Interest

(d) Taxes

Figure 5: Firm's Profit (GOS) and Saving Trends

Notes: Each panel represents a scatter of firm-level trends in gross operating surplus to gross value added against trends in the four components that constitute gross operating surplus (saving, dividends, interest, taxes).

interest payments, and taxes are relatively constant over time as shares 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 5 plot the percentage points 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 5(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.[17] Weighting with gross value added, the slope coefficient for Figure 5(a) is 0.74, suggesting that every dollar increase in gross operating surplus in the cross section of firms is associated with an increase of 74 cents in corporate gross saving. From the other three categories, only the regression with taxes produces a meaningfully positive coefficient (it equals 0.16). When we do not weight our regressions with gross value added, we generally obtain similar results.

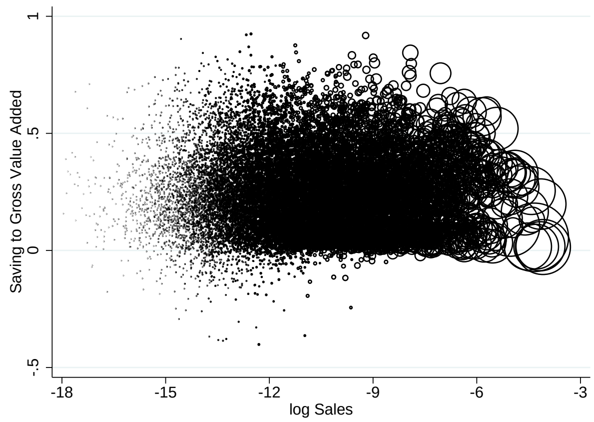
3.4 Corporate Saving in the Cross Section of Firms

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 of corporate saving reflects changes within particular types of firms or changes across firms with different characteristics and levels of saving.

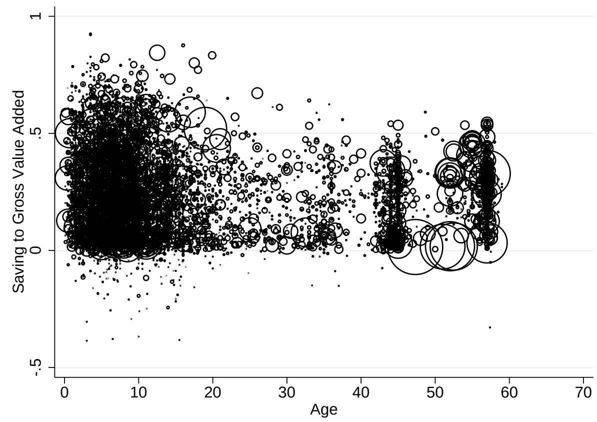
The rise of corporate saving could reflect compositional changes over time if the average propensity to save varies with firm characteristics. The upper panels of Figure 6 present scatter-plots of the average saving rate against log firm size (measured as the average share of the firm in aggregate sales) and firm age (measured as the firm's mean year in the sample minus the year of its IPO). The regression coefficient (weighted by gross value added) corresponding to Figure 6(a) is 0.0006 with a standard error of 0.003, controlling for country and industry fixed effects.[18] 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 0.04 percentage point higher saving rate. The regression coefficient (weighted by gross value added) corresponding to Figure 6(b) is -0.0003 with a standard error of 0.0002, controlling for country and industry 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

[17] In these and later regressions of firm-level data, we winsorize all variables at the top and bottom 1 percent.

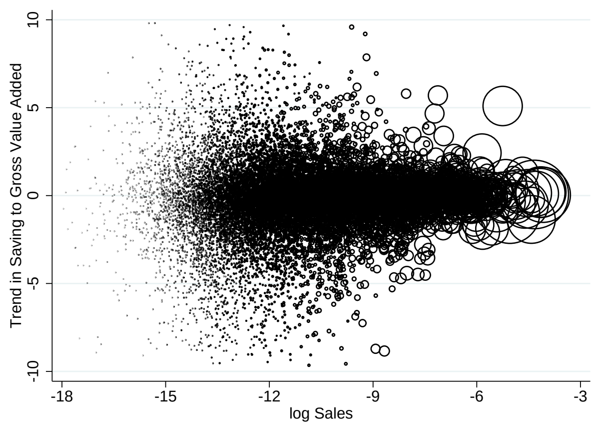
[18] We cluster the standard errors at the country level in all regressions in that use averages or trends of firm-level variables.



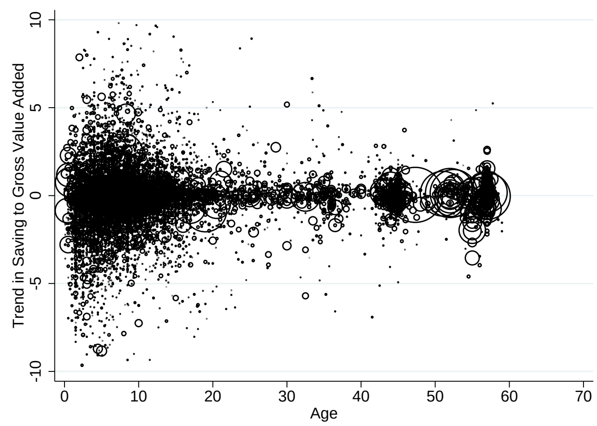
(a) Saving Rate Level and Log Sales



(b) Saving Rate Level and Firm Age



(c) Saving Rate Trend and Log Sales



(d) Saving Rate Trend and Firm Age

Figure 6: Saving Rate and Firm Characteristics

Notes: The upper panels plot saving rates against firm log average sales (left panel) and firm age (right panel). The lower panels plot trends in saving rates against firm log average sales (left panel) and firm age (right panel). Each firm's sales are normalized by aggregate sales in that year to account for inflation over the years in our dataset. Each firm's age is calculated as their last year in the dataset minus their year of incorporation.

save does not vary significantly with firm size and age.

We use the decomposition in equation (11) to quantify the extent to which changes in the corporate saving rate reflect changes within or between groups 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.[19] In

[19]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

Notes: The table presents results from the within-between decomposition presented in equation (11) for groups of firms i defined by quartiles of age, quartiles of size, or the union of them.

columns 1 and 2, we present the decomposition of the cumulative change from the beginning to the end of the sample. 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 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 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 within components.

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. The lower panels of Figure 6 present scatterplots that relate the trend in saving over value added for each firm per 10 years to log firm size and age. As we see in these scatters, there is no clear pattern that relates the trend in saving to either size or age.[20]

[20]The regression coefficient (weighted by gross value added) corresponding to Figure 6(c) is -0.107 with a standard error of 0.137, controlling for country and industry 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 0.07 percentage point lower trend in their saving rate per 10 years. The equivalent regression coefficient corresponding to Figure 6(d) is -0.03 with a standard error of 0.01, implying that firms that are 10 years older have a 0.03 percentage point lower trend in their

Taken together, the results in Sections 3.2 to 3.4 suggest that the growth in corporate saving is not primarily driven by basic characteristics such as firm size or age and is not specific to a small number of industries. Much like our conclusion from analysis of the national accounts, these firm-level data 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 or industries, or changes in the corporate financial practices of particular firms or countries.[21]

3.5 The Impact of Multinational Production

The operations of multinationals across countries have grown in importance in recent decades. Since a company's gross saving is associated with its headquarters country, moving production to foreign subsidiaries might increase the corporate saving rate in the headquarters country because it preserves the numerator (gross saving) while lowering the denominator (gross value added). If shifting of production or profits reduces the gross value added associated with each dollar of saving in the headquarters country, then the opposite increase of equal magnitude would be observed in the country where production occurred or where profits were realized. To the extent that our country coverage is sufficiently broad, the effects of reshuffling profits and production across countries on corporate saving rates should cancel out in our data at the global level.[22] The Appendix presents a stylized example that illustrates this logic.

Multinationals might also impact trends in corporate saving given they might have a different propensity to pay taxes and issue dividends. Levin and McCain (2013) and Clausing (2011) detail, for example, how multinationals use transfer pricing and various accounting rules to realize

saving rate per 10 years. The Appendix additionally presents versions of Figure 6 plotting aggregated bins of firms, rather than individual firms, which largely corroborate these conclusions.

[21] This finding is interesting in light of previous research 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).

[22] 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 the reshuffling of profits would not necessarily cancel out at the global level. But even among Ireland and the Netherlands, for which we have long time series, we observe large increases in their corporate saving rates.

as much of their global profits as possible in low tax jurisdictions.[23] Further, multinationals may pay less dividends to avoid paying the resulting tax on repatriated foreign earnings.

To study these issues, we first need to distinguish multinationals from other firms in our dataset. While multinational status is not directly observable in our data, our analysis distinguishes between firms that have less than one percent of their income earned outside their headquarters country (roughly 50 percent of the firms in our data) and those earning greater than one percent of their income abroad. Firms with a higher fraction of foreign income have the greatest ability and interest in shifting income across countries to avoid taxes. We perform our analysis only in the U.S. data as we cannot construct the foreign income variable for other countries.

Firms in the group with more than one percent of their income earned abroad display a saving rate that is roughly 4 to 6 percentage points higher than firms with less than one percent of their income earned abroad. Surprisingly, this difference mainly reflects a higher share of gross operating surplus in value added – likely reflecting lower labor shares – rather than differences in taxes or dividends.[24] Because the value added share of each group of firms is essentially constant since the beginning of the sample, shifts of economic activity between these groups do not contribute to changes in the aggregate firm saving rate.

Firms with more than one percent of their income earned abroad also experienced a larger trend increase in their saving rates. This difference, however, resulted primarily from faster growth in their gross operating surpluses. We do not find that firms with greater foreign income had significantly lower growth in taxes or dividends relative to gross value added or gross operating surplus. This finding is consistent with our previous conclusion that the rise of firm saving reflects the decline in the labor share and the rise of corporate profits.

[23] Guvenen, Mataloni, Rassier, and Ruhl (2016) emphasize the possibility that foreign subsidiaries "underpay" for inputs provided by U.S. parents. This phenomenon may be most prevalent when the input is an intangible asset such as a patent.

[24] These results are presented in the Appendix and control for firm size, firm age, and industry fixed effects. We note that the saving rates of the two groups of firms are different at conventional significance levels only when we do not weight the regressions.

3.6 How Was the Increase in Corporate Net Lending Used?

An increase in the flow of corporate saving can be used for a combination of expenditures in physical investment, accumulation of cash and other financial assets, repayment of debt obligations, or increases in equity buybacks net of issuances. Our analysis documents that the difference between corporate saving and investment increased over time. In this section, we provide evidence that links trends in the net lending position of firms to trends in their net buybacks, debt repayment, and cash accumulation.

We first clarify that national accounts treat equity buybacks as if they were negative issuances. Therefore, the value of equity buybacks net of issuances is part of corporate saving and net lending. Such a treatment is reasonable in our view 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.[25] In the Appendix we show that subtracting the value of net equity buybacks from corporate saving does not affect significantly the evolution of the global corporate saving rate shown in Figure 2. This result is consistent with Gruber and Kamin (2016) who also document a small trend in net buybacks as a share of GDP among OECD economies.

Table 4 reports results from regressions in the firm-level data that link trends in the net lending position of firms to trends in their net buybacks, debt repayment, and cash accumulation.[26] 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 the trend in net lending relative to value added. For the full sample between 1989 and 2013, presented in row A, we find that firms experiencing a

[25]However, capital gains from repurchases are often taxed differentially from dividends and tax authorities may put limits on buybacks. Additionally, equity issuance is costly and its cost is likely to vary cyclically (Eisfeldt and Muir, 2016).

[26]Net buybacks are defined as value of equity buybacks net of equity issuance (corresponding to variables "PRSTKC" - "SSTK"). Net repayment of debt is defined as repayment of long term debt minus issuance of long term debt and changes in current debt (corresponding to "DLTR" - "DLTIS" - "DLCCH"). Cash accumulation is defined as cash assets and short-term investments (corresponding to "CHE"). Data limitations preclude us from a full decomposition of net lending, so various other balance sheet items including the accumulation of other financial assets are subsumed in a residual category.

Table 4: Uses Net Lending: Buybacks, Debt Repayment, and Cash Accumulation

	Net Buybacks of Equity		**Net Repayment of Debt**		**Change in Cash Holdings**	
	(1)	(2)	(3)	(4)	(5)	(6)
(A) Full Sample	0.267	0.277	0.397	0.343	0.322	0.057
	(0.064)	(0.071)	(0.051)	(0.048)	(0.142)	(0.054)
(B) 1989 to 2000	0.174	0.326	0.516	0.346	0.053	-0.075
	(0.098)	(0.075)	(0.149)	(0.067)	(0.074)	(0.028)
(C) 2001 to 2013	0.130	0.129	0.346	0.337	0.312	0.050
	(0.029)	(0.026)	(0.067)	(0.051)	(0.127)	(0.049)
(D) 1989 to 2006	0.275	0.292	0.481	0.393	0.172	-0.042
	(0.090)	(0.076)	(0.050)	(0.050)	(0.063)	(0.058)
(E) 2007 to 2013	0.098	0.074	0.446	0.435	0.218	0.050
	(0.028)	(0.018)	(0.082)	(0.051)	(0.053)	(0.031)
GVA Weighted	Yes	No	Yes	No	Yes	No

Notes: Columns 1 and 2 present estimated coefficients and their standard errors from firm-level regressions of the trend in the net buyback to value added ratio on the trend in the net lending to value added ratio. Columns 3 and 4 present estimated coefficients and their standard errors from firm-level regressions of the trend in the net repayment of debt to value added ratio on the trend in the net lending to value added ratio. Columns 5 and 6 present estimated coefficients and their standard errors from firm-level regressions of the trend in cash standardized by mean value added on the trend in net lending standardized by mean value added. All standard errors are clustered by country.

one percentage point higher trend increase in their net lending rate increased their net buybacks by 0.267 (when we weight) or 0.277 (when we do not weight) additional percentage point relative to value added.

Columns 3 and 4 show that firms experiencing a one percentage point higher trend increase in their net lending rate increased their net repayment of debt by 0.397 (when we weight) or 0.343 (when we do not weight) additional percentage point relative to value added. Columns 5 and 6 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 and net lending but with all variables divided by the firm's average gross value added to create a scale-independent measure. We find that roughly 32 cents (when we weight) or 6 cents (when we do not weight) of each dollar of trend increase in net lending was accumulated in cash.[27]

Rows B through E of Table 4 document how these relationships between net lending and buybacks, repayment of debt, and accumulation of cash evolve during subperiods of our sample. Rows B and C repeat these regressions in the early (1989 to 2000) and later (2001 to 2013) years of the sample and rows D and E repeat the regressions before (1989 to 2006) and after the financial crisis (2007 to 2013). We find that the propensity of firms to increase their buybacks in response to net lending fell markedly during and after the financial crisis relative to the decades prior. Net lending only led to the accumulation of cash starting in the 2000s. Discussion in the policy literature of the large corporate cash stockpiles often emphasize increases in uncertainty, especially after the global recession of 2008-2009. These results indeed suggest there was a change in corporate preference for liquidity, though they suggest the change predates the recent crisis.[28]

4 Corporate Saving and Capital Market Imperfections

In this section we develop a general equilibrium 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 calibrate our model to represent the global economy around 1980. Given the pervasiveness of the rise of corporate saving across countries, industries, and types of firms, we subject the model to parameter changes that represent common global trends, such as changes in the real interest rate,

[27] Bates, Kahle, and Stulz (2009) and Foley, Hartzell, Titman, and Twite (2007) have emphasized the accumulation of cash on corporate balance sheets. 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.

[28] 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).

price of investment goods, markups, and other aspects of firms' cost of capital. We 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 model with periods $t = 0, 1, 2, ...$ and no aggregate uncertainty. Model periods denote years. The economy is populated by identical households, a government, and heterogeneous firms $i = 1, ..., N$ that supply differentiated varieties of a final good and face idiosyncratic productivity shocks.

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 $\tilde{L}_0$, the population in period $t > 0$ is $\tilde{L}_t = (1+g)^t \tilde{L}_0$. 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:

$$C_t + \sum_i v_{it} s_{it+1} + (1 + g)B_{t+1} = w_t L + (1 + r_t)B_t + \sum_i \left((1 - \tau_t^d)d_{it} - e_{it} + v_{it}\right) s_{it} + T_t^h, \quad (12)$$

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.

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 perfectly competitive and produce aggregate output Y_t by combining intermediate goods y_{it} according to a CES function $Y_t = \left(\sum_i y_{it}^{\frac{\varepsilon}{\varepsilon-1}}\right)^{\frac{\varepsilon}{\varepsilon-1}}$, 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 $y_{it} = (p_{it}/P_t)^{-\varepsilon} Y_t$. Intermediate goods are monopolistically competitive and, therefore, there are economic profits in equilibrium equal to a fraction $s_\pi = 1/\varepsilon$ of total income in the economy.

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. Our analysis focuses on balanced growth paths with no aggregate uncertainty and, therefore, firms apply the household's stochastic discount factor in a balanced growth path to value streams of payoffs. Following Auerbach (1979), Poterba and Summers (1985), and Gourio and Miao (2010, 2011), 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:

$$\max_{\{d_{it}, e_{it}, b_{it+1}, x_{it}, \ell_{it}, p_{it}\}_{t=0}^{\infty}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left\{(1 - \tau_t^d) d_{it} - e_{it}\right\}, \tag{13}$$

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 firms and are perceived by firms as creating value for shareholders.[29]

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

$$d_{it} = \kappa \left(p_{it} y_{it}\right)^{\kappa_r} \left(\xi_t k_{it}\right)^{\kappa_k}. \tag{14}$$

In equation (14), $p_{it} y_{it}$ 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 productivity is not directly observed 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, the elasticities κ_r and κ_k are disciplined from firm-level data on dividends, revenues, and fixed assets.

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 $\mathrm{EC}_{it} = \lambda e_{it} \mathbb{I}\left(e_{it} \geq 0\right)$, 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:

$$y_{it} = \exp\left(A_{it}\right) \left(\alpha k_{it}^{\frac{\sigma-1}{\sigma}} + (1-\alpha)\ell_{it}^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}, \tag{15}$$

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,

[29] As we discussed in Section 3.6, the increase in net lending only partially reflected an increase in 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.

$y_{it} = \exp(A_{it})\, k_{it}^{\alpha} \ell_{it}^{1-\alpha}$. Productivity A_{it} is the only exogenous stochastic process that firms face. It follows an AR(1) process in logs:

$$A_{it} = -\frac{\sigma_A^2}{2(1+\rho_A)} + \rho_A A_{it-1} + \sigma_A u_{it} \text{ with } u_{it} \sim \mathbb{N}(0,1), \tag{16}$$

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:

$$b_{it+1} \leq \theta \xi_{t+1} k_{it+1}, \tag{17}$$

where $\theta \geq 0$ denotes the leverage parameter. Interest payments on debt are tax deductible and, therefore, firms prefer to issue debt rather than equity. For this reason, we assume that the collateral constraint always binds (see Appendix for more details).

Firms own the capital stock and augment it by purchasing investment goods. The law of motion for capital is given by $(1+g)k_{it+1} = (1-\delta)k_{it} + x_{it}$. Firms face convex adjustment costs $\mathrm{CC}_{it} = \psi\left(k_{it+1} - k_{it}\right)^2 / \left(2k_{it}\right)$ to change their capital stock.

Defining operating profits as $\pi_{it} = p_{it} y_{it} - w_t \ell_{it}$, the flow of funds constraint of the firm is given by:[30]

$$d_{it} + \left(1+\tau_t^x\right) \xi_t x_{it} + (1+r_t) b_{it} + \mathrm{RC}_{it} = (1-\tau_t^c)\pi_{it} + \tau_t^c \left(\delta \xi_t k_{it} + r_t b_{it}\right) + \tau_t^f + (1+g) b_{it+1} + e_{it}, \tag{18}$$

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

Equilibrium. An equilibrium for this economy is defined as a sequence of prices and quantities such that households and firms maximize their values, the government budget constraint holds,

[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.

and goods, labor, and capital markets clear (see Appendix for a more detailed description). We define a stationary equilibrium as an equilibrium in which all (detrended) aggregate variables are constant and the distribution of firms across states (k_{it}, A_{it}) is stationary over time.

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

$$S_t^f = (1-\tau_t^c)(Y_t - w_t L) + \tau_t^c(\delta\xi_t K_t + r_t B_t) + T_t^f - \tau_t^x \xi_t X_t - \mathrm{RC}_t - r_t B_t - D_t + g B_{t+1}. \quad (19)$$

Using the 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:

$$S_t^f = B_t - B_{t+1} - E_t + \xi_t X_t. \quad (20)$$

Parameterization. Our strategy is to choose parameters in order to match statistics in the early years of our sample, which we treat as being generated from an initial balanced growth path of our model. To parameterize the model, we use a variety of aggregate statistics from our national accounts dataset and other sources and moments estimated from our firm-level data that inform heterogeneity in firm technologies and in frictions influencing corporate financial policy. We present details of the parameterization in the Appendix. Here we summarize our choice of the most important parameters for our results.[31]

The elasticity of substitution between capital and labor is set equal to $\sigma = 1.25$, 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 set the growth rate to $g = 0.023$, consistent with data from the World Bank, and set the discount factor β so that the model generates a real interest rate equal to $r = (1+g)/\beta - 1 = 0.043$. This value equals the world real interest rate estimated by King and Low (2014) in the first year of their sample (1985) using data on ten-year inflation-protected government bonds. Tax rates are obtained from the OECD tax databases.

[31] Parameters values not discussed in the text are: $\alpha = 0.292$, $\delta = 0.074$, $\xi = 1$, $s_\pi = 0.05$, $\theta = 1.7$, $\lambda = 0.028$, $\tau^d = 0.17$, $\tau^c = 0.48$, $\tau^x = 0.117$, $\chi = 0.037$, $\kappa = 0.17$, $\psi = 5.5$, $\rho_A = 0.8$, and $\sigma_A = 0.48$.

Table 5: Model Results

Start of Sample	$\frac{S^f}{Y}$	$\frac{wL}{Y}$	$\frac{D}{Y}$	$\frac{I}{Y}$	$\frac{S^f-I}{Y}$	R
1. Data	0.162	0.612	0.101	0.215	-0.053	
2. Model	0.162	0.612	0.101	0.215	-0.053	0.153
End of Sample (Δ)	$\frac{S^f}{Y}$	$\frac{wL}{Y}$	$\frac{D}{Y}$	$\frac{I}{Y}$	$\frac{S^f-I}{Y}$	R
3. Data	0.085	-0.054	0.005	-0.006	0.091	
4. Model	0.081	-0.054	-0.001	0.019	0.062	-0.031
Counterfactuals (Δ)	$\frac{S^f}{Y}$	$\frac{wL}{Y}$	$\frac{D}{Y}$	$\frac{I}{Y}$	$\frac{S^f-I}{Y}$	R
5. No ξ	0.057	-0.029	-0.003	-0.005	0.062	0.005
6. No τ^c	0.048	-0.045	0.001	0.006	0.042	-0.028
7. No r	-0.015	-0.026	-0.005	-0.051	0.036	0.007
8. No s_π	0.055	-0.026	-0.002	0.001	0.054	-0.027

Notes: The variables S^f, wL, D, and I denote corporate saving, compensation to labor, dividends, and the investment expenditure and are expressed as a share of corporate value added Y. For all variables the data entries in the beginning of the sample (row 1) refer to world averages between 1980-1984 with the exception of dividends that refer to world averages between 1990-1994. The data entries in the end of the sample (row 3) refer to world averages between 2009-2013. The variable R denotes the equilibrium cost of capital defined in equation (22).

The elasticities κ_r and κ_k in the dividend policy function are estimated from the following regression applied to our firm-level dataset:

$$\log\left(\text{Dividends}\right)_{ict} = b_i + b_c + b_t + \kappa_r \log\left(\text{Sales}\right)_{ict} + \kappa_k \log\left(\text{Book Value of Capital}\right)_{ict} + u_{ict}, \quad (21)$$

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. As shown below, these firm-level estimates imply a significant rigidity of dividends at the aggregate level.

4.2 Quantifying the Increase in Corporate Saving in the Model

Table 5 summarizes our results. Row 1 lists values for the corporate saving rate S^f/Y, the labor share $s_L = wL/Y$, the dividend to output ratio D/Y, the investment rate I/Y, and the corporate net lending position $(S^f - I)/Y$ in the early years of our sample (generally 1980-1984). Row 2 lists the corresponding values generated by the initial balanced growth path of our economy. By construction, our model is calibrated to match exactly the data along these statistics in the early years of our sample. Along with these statistics, the table presents the model's equilibrium aggregate cost of capital defined by:

$$R = \frac{(1 - s_L - s_\pi)Y}{K}. \tag{22}$$

The initial cost of capital equals 0.153 and reflects a combination of technological parameters, interest rates, taxes, and financial frictions. Defining the "frictionless" cost of capital as $\xi(r+\delta) = 0.117$, capital market imperfections in our model lead to an (aggregate) capital wedge of 3.6 percentage points (or 30 percent).

Row 3 summarizes changes in aggregate variables for the global economy between the initial (generally 1980-1984) and final years 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. We set $\xi = 0.8$ to capture the 20 percent decline in the relative price of investment goods over the past three decades, documented in Karabarbounis and Neiman (2014). We calculate a decline in the corporate income tax rate τ^c from 0.48 to 0.25 and in the world interest rate r from 0.043 to 0.009. We estimate an increase in the depreciation rate δ from 0.074 to 0.093. We use the updated series from McDaniel (2007) to estimate an increase in investment tax rates τ^x of roughly 26 percent from 0.117 to 0.148. 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 calculate increased values for s_π (from 0.050 to 0.062) and χ (from 0.037 to 0.059) so that the model 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 4 of Table 5 contains the main result of our analysis. The model generates a roughly 3 percentage points 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.

To understand the mechanism driving this behavior, we use equation (19) to derive the corporate saving rate in a stationary environment (dropping time subscripts denotes detrended variables that are constant in a balanced growth path):

$$\frac{S^f}{Y} = 1 - \underbrace{\frac{wL}{Y}}_{\text{Labor Share}} - \underbrace{\frac{D}{Y}}_{\text{Dividends}} - \underbrace{\left[\tau^c\left(1 - \frac{wL + \delta\xi K}{Y}\right) + \frac{\tau^x \xi X + \mathrm{RC} - T^f + ((1-\tau^c)r - g)\,B}{Y}\right]}_{\text{Taxes and Other Payments to Capital}}. \tag{23}$$

The decomposition in equation (23) 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 $\exp(A)$:

$$\frac{wL}{Y} = \left(\frac{1}{\mu}\right)\left(1 - \alpha^\sigma\left(\frac{\exp(A)}{\mu R}\right)^{\sigma-1}\right). \tag{24}$$

Equation (24) 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 4, 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 (14) we see that the dividend to output ratio for a representative firm with revenues Y is given by:

$$\frac{D}{Y} = \kappa \left(\frac{\xi K}{Y}\right)^{\kappa_k} \left(\frac{1}{Y}\right)^{1-\kappa_r-\kappa_k}. \tag{25}$$

Our estimates of $\kappa_k = 0.05$ and $\kappa_r = 0.63$ from our firm-level data imply 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 3.6, 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.[32]

In the data, the net lending position of the corporate sector, which equals the difference between saving and investment, improved by 9.1 percentage points relative to value added between the earlier and the later years of the sample. As column 4 shows, the model also generates a significant improvement in the net lending position of the corporate sector 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 generates an increase in the investment rate whereas in the data this rate in fact slightly decreased.

The improvement in the corporate net lending position has direct implications about household saving behavior. In our closed economy, meant to represent the world, 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 relative to GDP of about 6 percentage points, a similar magnitude to the actual decline shown in Figure 1(a).

[32]We use equations (24) and (25) to give intuitions for key mechanisms in our model as would apply to a representative firm. Our model, however, has significant firm heterogeneity which is driven by the firm-level productivity process as we estimate in the Appendix. The aggregate response in our environment as reported in Table 5, therefore, additionally reflects compositional changes across firms.

Rows 5 to 8 in the third panel of Table 5 conduct a series of counterfactual exercises to quantify separately the role of individual parameter changes. Here, we focus on the parameter changes that are quantitatively the most important and present in the Appendix additional counterfactual exercises. 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 4 gives the independent impact of the excluded change.

In row 5, we remove the decline in the price of investment goods ξ. This causes the cost of capital to increase by 0.5 percentage point rather than to decline by 3.1 percentage points as in row 4. 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.

In row 6, we remove the decline in the corporate income tax rate τ^c and find a significant change in corporate saving. Without the decline in τ^c, the net lending position of the corporate sector would not have become positive. Similarly to the decline in ξ, the decline in τ^c affects corporate saving through its impact on the cost of capital and the labor share. Quantitatively, however, we find that the impact of τ^c on the cost of capital is much smaller than the impact of ξ. The decline in τ^c differs from the decline in ξ because it increases corporate saving directly through the third term in the decomposition (23). The term $\tau^c \left[1 - \left(wL + \delta\xi K\right)/Y\right]$ captures the lowering of taxes on corporate profits.

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. Similarly to the decline in ξ, the decline in r leads to a large decline in cost of capital and impacts the corporate saving rate through the decline in the labor share of income. The decline in r, additionally, affects corporate saving through its impact on the third term in the decomposition (23). The term $\left[(1-\tau^c)r - g\right] B/Y$ characterizes the impact of the debt to output ratio on the corporate saving rate in a balanced growth path as a function of interest payments (net of taxes) and growth. The decline in r lowers interest payments and, therefore, contributes to an increase in the corporate saving rate.[33]

Finally, in row 8 we report that without the increase in the profit share s_π, corporate saving would have increased by less than in our baseline model. Equation (24) shows the direct impact of higher markups on the decline in the labor share. We find that, without the increase in markups, the labor share would have only exhibited about half of its decline.

The Appendix compares our model with CES production ($\sigma = 1.25$) to a similarly calibrated model but with Cobb-Douglas production ($\sigma = 1$). The main difference is that the rise of corporate saving and investment in the Cobb-Douglas 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 (24), 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 an increase in the corporate saving rate, it does so without matching the significant decline in the labor share of income observed in the data.[34]

To summarize, our model generates an increase in corporate saving above corporate investment in response to a reduction in the cost of capital (including declines in the real interest rate, price of investment goods, and corporate income taxes) and other changes such as higher markups and slower growth. A fraction of the rise of corporate saving in the model is used to transfer wealth to shareholders via endogenous substitution between dividends and net buybacks. These dynamics are of similar magnitude to what we documented in our empirical analyses.

5 Conclusion

In the last three decades, the sectoral composition of global saving has shifted. Whereas in the early 1980s most of investment spending at the global level was funded by saving supplied by

[33]Across balanced growth paths, the term $(1 - \tau^c)\, r - g$ increases when we allow for simultaneous changes in r, τ^c, and g. The Appendix additionally gives results when we remove the r and g changes.

[34]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.

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 was 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 product and 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.[35] 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 forces that simultaneously affect households and firms.

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[35]Beginning with Bernanke (2005), the literature on the global saving glut has emphasized the downward pressure on real interest rates brought by an increase in desired saving. Our results additionally highlight that the decline in the real interest rate is associated with a shift in the supply of saving from households to corporations.

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