Tax Competition

Is It a Source of the Corporate Savings Glut?

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Abstract

This paper examines the determinants of corporate savings in a cross-country panel setting. Specifically, it employs firm-level data covering more than 540,000 firm-year observations for 12 advanced and emerging market economies. Panel regression results suggest that reductions in statutory corporate income tax rates can explain one-third of the rise in corporate savings (defined as net financial assets) in 2003–17. This finding is supported by a propensity scores matching analysis of the effects of changes in corporate income tax rates.

Tax Competition: Is It a Source of the Corporate Savings Glut?[1]

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1. Introduction

The role of the corporate sector in the global flow of funds has changed substantially over the last three decades. The sector used to be considered a regular net borrower in the economy, needing to raise funds to engage in productive activities. However, with its accumulation of savings over the last three decades, the corporate sector has become a net lender of funds to the rest of the economy—a development that has been referred to as the "corporate saving glut" (Gruber and Kamin 2016). The corporate saving rate–the share of undistributed profits in gross value added–increased by 9 percentage points from 1980 to the mid-2010s, presenting a stark contrast to the decline in the household saving rate by 20 percentage points over this period (Chen, Karabarbounis, and Neiman 2017). There has also been mounting interest among policy makers in understanding cross-country differences in corporate saving, which have contributed to global payments imbalances. For example, research shows that cross-country differences in net saving rates of the corporate sector can explain over half of current account imbalances among advanced economies from 1995 to 2017 (International Monetary Fund 2019b).

However, few empirical studies have analyzed the cross-country and time-series determinants of corporate savings. Some studies of advanced economies have suggested that the increase in corporate savings can be explained by growing needs to finance investments in large intangible assets or R&D that allow technological innovation (Falato et al. 2018; Dao and Maggi 2018). Other studies, using firm-level panel regressions, have found no variables except the rise in corporate profits that help to explain changes in corporate savings (Chen, Karabarbounis, and Neiman 2017;

Saibene 2019).[4] Some studies report that variations in R&D investment needs and corporate profits are important in explaining within-country movements in corporate savings, yet, given common global trends in these factors, they are unlikely to have been key drivers of the persistent cross-country differences in corporate savings.[5]

In this paper, we analyze the determinants of time-series and cross-country variations in corporate savings, with a focus on corporate income taxes. The global average corporate tax rate has been consistently falling since 1980, in what has been referred to as an international tax competition, but the declines have varied from country to country (International Monetary Fund 2019a; Tax Foundation 2018). For example, Italy, Japan, and the United Kingdom have gradually reduced their statutory tax rates on corporate profits by over 10 percentage points over the last two decades; the United States did not reduce its rate until 2018, when it did so by 13 percentage points. Though there has been little published research exploring the empirical relationship between corporate tax rates and corporate savings, given the large volume of studies suggesting that corporate taxes influence firms' balance sheets—for example, through corporate leverage (Modigliani and Miller 1963; Faccio and Xu 2015; Fan, Titman, and Twite 2012) and firms' cash holdings (Riddick and Whited 2009)—corporate taxes may be expected to have significant effects on corporate savings.

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[4] Studies based on national samples from advanced economies attribute the rise in net lending/borrowing to increases in profits (International Monetary Fund 2006), the output gap (OECD 2006), and the weakness in investment (Gruber and Kamin 2016).

[5] Also, as documented frequently in the literature, R&D expenditure has been substantially larger in the United States than in other countries, while US corporate saving rates have been at the low end of the spectrum.

Our results indicate that changes in statutory corporate income tax rates, together with firm-level factors such as profitability and R&D spending, have contributed significantly to the increase in corporate savings in the past two decades: firms have tended to increase corporate savings following decreases in corporate tax rates. A fixed-effect regression model shows that the magnitude of the tax effects on corporate savings has been economically significant and comparable to the effects of other firm-level determinants. Thus, a one-standard-deviation decrease in corporate tax rates (7 percentage points) is associated with a 2.48 percentage points increase in corporate savings (defined as financial assets net of financial liabilities, as a percent of total assets), which is one-third of the increase in corporate savings observed over the sample period. Propensity score matching methodology confirms that, after controlling for firm- and country-specific factors, firms that experienced reductions in statutory corporate tax rates were likely to increase their savings in the following years.

Our study contributes to the literature on the determinants of corporate savings in three ways. First, this is one of the few empirical studies that directly analyze the cross-country and time-series determinants of corporate savings, which have implications for global imbalances,[6] though a number of studies have focused on determinants of corporate cash holdings, which are only part of corporate savings. Second, our empirical analysis incorporates two important channels through which corporate tax rate changes may influence corporate savings. One is a *deleveraging channel,* where firms reduce their reliance on debt (thus increasing their net savings) as corporate tax rate cuts reduce the benefits of tax deductions for interest payments. The other is an *asset*

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[6] Global imbalances refer not only to flow imbalances (global current account) but also stock imbalances (global disequilibria as measured in terms of countries' net foreign assets). After the GFC, stock imbalances kept increasing while a reduction was observed in flow imbalances (Alberola, Estrada, and Viani 2018).

reallocation channel where firms increase the share of financial assets on their balance sheets as lower corporate tax rates increase the post-tax rate of return on financial assets relative to fixed assets, which often do not generate immediate cash flows. The existing literature considers mainly the asset reallocation channel (Chen, Karabarbounis, and Neiman 2017; Dao and Maggi 2018). Lastly, while existing empirical research on corporate savings has concentrated on advanced economies (Saibene 2019; Dao and Maggi 2018; Gruber and Kamin 2016), we also look at several major emerging market economies, including Brazil, the Russian Federation, India, and China, which have played significant roles in the recent evolution of global payments imbalances.

2. Theoretical Underpinnings

This section explains the theoretical underpinnings of our empirical analysis of how firm- and national-level factors affect the evolution of corporate savings. Although few studies have directly explored the determinants of corporate savings, there is an extensive literature on the determinants of firms' cash holdings (Almeida et al. 2014; Cruz, Kimura, and Sobreiro 2019) and leverage (Frank and Goyal 2008; Shyam-Sunder and Myers 1999), both of which carry implications for the behavior of corporate savings. These two strands of literature are based on two theoretical approaches: the Static Trade-off Model (STO model) and the Pecking-Order Hypothesis (POH).

The STO model focuses on channels through which key factors affect firms' choices regarding leverage and cash holdings. For example, a lower corporate tax rate will reduce the benefit of debt-related tax deductions and the cost of double taxation of interest earned on liquid assets (Falato et al. 2018), thus likely implying lower leverage, larger cash holdings, and larger savings.

Similarly, higher probability and cost of financial distress will increase both the cost of borrowing and the benefit of precautionary cash holdings, thus also tending to raise savings.

The POH assumes information asymmetries between a firm's insiders and outsiders, which imply that its capacity to generate funds determines its choice between internal and external financing, with capital market efficiency determining firms' choice between debt and equity financing.

Based on theoretical arguments, including these two frameworks, the composition of a firm's balance sheet may be expected to change in response to the following variables[7]:

Statutory tax rate on corporate income. On the basis of the STO model, we consider two channels through which the corporate tax rate could affect the benefits and costs of corporate savings. The first channel is the *deleveraging channel*, through which a corporate tax rate reduction would encourage firms to compress liabilities. Modigliani and Miller (1963) showed that tax deductibility of debt interest payments incentivizes firms to finance their activities more through debt than through equity, thus increasing corporate leverage. Their work has been supported by cross-country empirical evidence (Booth et al. 2001; Fan, Titman, and Twite 2012; Faccio and Xu 2015).

The second channel is the *asset reallocation channel*, through which lower tax rates would incentivize firms to allocate their resources more toward financial assets than fixed assets. Related to this effect is the argument, also found in the literature, that taxation of corporate income could reduce firms' cash holdings because the post-tax rate of return on cash is

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[7] These determinants of cash holdings, leverage, and corporate savings, with predicted signs and the results of previous theoretical and empirical studies are summarized in Table 1.

diminished by the taxation of interest on liquid assets (Riddick and Whited 2009). The presence of a tax cost of holding cash is also empirically supported by results obtained for US firms (Graham and Leary 2018). Based on the above arguments and findings, we can expect a negative relationship between corporate income tax rates and corporate savings, operating through both corporate leverage and asset reallocation channels.[8]

Profitability. The POH predicts that firms with higher capacity to generate internal funds will prefer internal funding to external borrowing, implying a positive association between corporate savings and profitability. Consistent with this, cross-country studies have found evidence of a negative relationship between profitability and leverage (Rajan and Zingales 1995; Booth et al. 2001).

Intangible assets and R&D. Investments in intangible assets, including R&D, tend to have less collateral value than investments in fixed assets. For this reason, the STO model predicts that firms with a relatively large proportion of assets in intangible form will have relatively large precautionary cash holdings, because of their smaller borrowing capacity. This has been supported by empirical studies (Hall and Lerner 2010). Accordingly, one would expect corporate savings to be negatively associated with tangibility and positively associated with R&D investment (Falato et al. 2018; Dao and Maggi 2018).

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[8] This negative relationship between corporate savings and corporate tax rates has also been identified by recent studies that deploy general equilibrium models. Thus, Chen, Karabarbounis, and Neiman's (2017) counterfactual exercise shows that the corporate sector would not have become a net lender in the global economy without the decline in corporate income tax rates. Armenter and Hnatkovska (2017) develop a dynamic equilibrium model—where firms are financially constrained and accumulate net savings because of a precautionary motive—and show that their model can match quantitatively the net lender position of the corporate sector in the United States in 2000–2007 when the cost of capital declined through dividend tax reduction.

Firm size. The POH models suggests a positive relationship between corporate savings and firm size, even though economies of scale in cash management (Miller and Orr 1966) should allow larger firms to hold less cash. Larger firms generally disclose more information to outsiders than smaller ones; they are thus likely to be subject to fewer asymmetric information problems, will tend to have more equity than debt, and hence lower leverage.

Earnings volatility. Since higher business risks are associated with a higher probability of financial distress, the STO model predicts a positive association between cash flow volatility and internal funding needs. Also, a volatile business environment will tend to constrain external borrowing capability, also suggesting a positive association between earnings volatility and corporate savings (Damodaran 2005).

Investment opportunities. Whether the occurrence of new investment opportunities will increase corporate savings is theoretically ambiguous, so it is not surprising that the evidence on this is mixed. Because a cash shortage could force a firm to forego profitable investment opportunities, firms foreseeing such opportunities may be expected to hold more liquid assets. The implications of investment opportunities for leverage, however, are ambiguous. Since rapidly growing firms would likely lose more of their value if they went into distress than more stable, established firms, the STO model predicts that they will be less inclined to borrow, indicating a negative relationship between leverage and growth. However, the POT model predicts that firms making more investments will accumulate more debt, so that growth opportunities and leverage will be positively related.

Government leverage. If government deficit financing tends to crowd out corporate debt financing through competition for investor funds, a negative association may be expected between government and private leverage. This association is empirically supported by a study based on data for the United States (Graham, Leary, and Roberts 2015).

Financial Market Efficiency. Financial market development should reduce the cost of raising capital on the market, thus decreasing reliance on corporate debt and increasing corporate savings (Demirgüç-Kunt and Maksimovic 1999; de Jong, Kabir, and Nguyen 2008). But the relationship between financial market efficiency and cash holdings is unclear. In countries with better developed financial markets, firms can more easily raise funds when needed so that they should not need to hold large amounts of cash. Past studies have discussed the implication that firms in countries lagging in financial development may be expected to hold more cash (Damodaran 2005). However, more recent studies—(Kalcheva and Lins 2007; Lins, Servaes, and Tufano 2010; Pinkowitz, Stulz, and Williamson 2016)—have found the opposite result, or mixed results, so that the evidence on the effect of capital market development on corporate savings is mixed.

Quality of governance. The quality of a country's governance and institutions may also affect corporate savings. A greater risk of expropriation will discourage firms from investing in assets that can be more easily expropriated. Thus, this will tend to reduce cash holdings by firms in countries with high corruption (Pinkowitz, Stulz, and Williamson 2016; Smith 2016). Also to limit expropriation, firms in countries with weaker governance will tend to use more debt (Fan, Titman, and Twite 2012; Smith 2016). Therefore, we would expect a negative association between the quality of institutions and corporate savings.

3. Data and Summary Statistics

Data construction

We constructed a panel data set for both publicly listed and private firms from 2003 to 2017 from the Orbis database provided by Bureau van Dijk. Our sample size is larger than in previously published research which covers only publicly traded firms included in the Compustat or Worldscope data bases. Following Armenter and Hnatkovska (2017), we define corporate savings as the corporate sector's net financial position, that is, its financial assets net of liabilities. We restrict our sample to firms with more than 250 employees—consistent with the EU's definition of large enterprises—and that have at least 100 observations each year and non-missing corporate savings observations for at least six of the 15 years in the sample period. After imposing these restrictions, the sample consists of more than 64,000 firms in 12 economies, with a total of 540,000 firm-year observations.

The benefit of defining corporate savings as financial net worth are twofold. First, changes in aggregated financial net worth from firms' financial statements correspond conceptually to, and are statistically closely associated with, the corporate sector's net borrowing or lending in the System of National Accounts (SNA), thus allowing us to derive macroeconomic implications on national and global payments imbalances. By contrast, changes in such variables as cash holdings, the values of fixed and financial assets, debt, and retained earnings, neither correspond conceptually nor are closely related statistically to SNA-based net lending/borrowing in the

corporate sector.[9] Second, this specification allows us to capture the two channels suggested by theory distinguished above—the deleveraging channel and the asset reallocation channel—through which the tax system may affect firms' decisions on corporate savings.

Stylized facts

For each country in the sample, the evolution of the statutory corporate income tax rate and annual means of key company variables are shown for 2003-17 in Figures 1-4. Corporate income tax rates fell in most countries in our sample. Corporate savings and cash holdings increased in most cases, while debt fell in most advanced economies, including those where corporate tax rates declined significantly, but rose in most EMDEs.

Although statutory corporate income tax rates declined over the sample period in all countries except Turkey and the United States, the declines differed widely in magnitude among the countries (Figure 1). In Italy, Japan, and the United Kingdom, there were large declines of more than 10 percentage points, while in France, India and Russia, there were only small declines.

Corporate savings show broadly increasing trends over the sample period, especially after the global financial crisis (GFC), in most advanced economies, including Germany, Italy, Japan, the Republic of Korea, and the United Kingdom, where corporate tax rates declined significantly. On the other hand, corporate savings were relatively flat in France and declined in the United States, where large declines in corporate income tax rates did not occur. These observations are largely in line with earlier research that documents the historical development of SNA-based net

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[9] When SNA-based net lending/borrowing was regressed on country means of firm-level variables with country- and year-fixed-effects, the coefficient for corporate savings is 0.186 (with a standard deviation of 0.088) relative to 0.010 (with a standard deviation of 0.239) for cash holdings, 0.150 (with a standard deviation of 0.230) for other financial assets, and -0.188 (with a standard deviation of 0.155) for retained earnings.

lending/borrowing of the non-financial corporate sector in advanced economies (Gruber and Kamin 2016; Dao and Maggi 2018). In the EMDEs, corporate savings followed flat or increasing trends except in Turkey, where the corporate income tax rate remained unchanged. In some cases, fluctuations in savings are observed around the GFC.

Figure 3 shows the evolution of cash holdings in each country; the patterns are generally similar to those for corporate savings. In most advanced economies—Germany, Italy, Japan, Korea, and the United Kingdom—cash holdings trended upwards over the sample period, but they were mostly flat in France and fell slightly in the United States, while remaining the highest among the sample countries (Pinkowitz, Stulz, and Williamson 2016). In most of the EMDEs in the sample, cash holdings trended upwards, with large jumps in China and India, especially after the GFC.

Most of the advanced economies in the sample show largely flat or decreasing corporate debt, except that in the United States corporate debt increased after the GFC (Figure 4). The declines in corporate debt contribute to the increases in corporate savings by our definition. In the EMDEs, corporate debt increased over the sample period, in Russia before the GFC but in China, Indonesia and Turkey after it. Only in India are upward trends apparent before and after the GFC.

4. Identification Strategy

In the main exercises, we identify the impact of changes in corporate tax rates on corporate savings by regressing corporate savings on the corporate tax rate, along with firm and country control variables. We assume that the effects are the same for each firm to focus on the overall effects of changes in the tax rates. We also include year dummies to eliminate spurious

correlations arising from common macroeconomic factors in both taxes and balance-sheet structure.

We also employ a propensity score matching procedure to clarify the causal relationship between the tax system and corporate savings. This procedure identifies two sets of control samples of firms (called matching peers) that differ in whether they experienced corporate tax changes but whose characteristics are otherwise similar. Changes in corporate savings after a tax rate change should then differ between the two sets of firms only if the tax change affected corporate savings.

5. Results

Table 4 reports the regression results. To clarify the two channels through which corporate income tax changes affect corporate savings, we report the regression results for equations in which cash holdings and corporate debt are the dependent variables as well as for those for corporate savings.

The firm-level variables as well as the national macroeconomic and institutional environment indicators used as covariates for the estimation are mostly variables identified as potential determinants of firms' cash holdings and financial structures in the literature discussed earlier. We use the real GDP growth rate as a proxy for economywide investment opportunities.

The results confirm the theoretical prediction that the statutory corporate income tax rate is negatively associated with corporate savings. The results also show the significance of both the deleveraging channel and the asset reallocation channel. The statutory corporate income tax rate is positively associated with corporate debt, and negatively associated with firms' cash holdings. The results indicate that a one-standard-deviation reduction in the statutory tax rate (by 7

percent points) is associated with an immediate 1.31 percentage point increase in corporate savings as a percentage of total corporate assets. Since lagged corporate savings have a coefficient of 0.471, the long-term effect of a 7 percentage points reduction in the tax rate is an increase in corporate savings of 1.31/(1-0.471)= 2.48 percentage points. Considering the increase in the sample mean of corporate savings from 8.7 percent to 15.7 percent of total assets over the sample period, the implication is that the reduction in statutory tax rates had economically significant effects on corporate savings. These results were found to be robust in that including other variables representing the macroeconomic and institutional environment (equation (2)) did not change materially the magnitude or statistical significance of the coefficient.

The results also show statistically significant coefficients of firm-level variables as determinants of corporate savings, with signs as theoretically predicted, but the implied economic significance of these influences, in each case, is limited. Profitability, R&D spending, and cash flow volatility are positively associated with corporate savings, while the tangibility of assets and firm size are negatively associated, in line with the predictions discussed in the previous section. Equations (3) –(6) indicate that these variables influence firms' savings decisions through both cash holding and debt channels, except for R&D spending and cash flow volatility, whose coefficients in the equations for cash holdings have a negative sign. With regard to the economic significance of the influences implied by the estimated coefficients, consider R&D expenditure: a one-standard-deviation increase (of 0.01 percent point) is associated with only a 0.33 percentage point immediate increase in corporate savings and a 0.63 percentage point increase in the long term. Similarly, for cash flow volatility, a one-standard-deviation increase (of 0.062 percent point) is

associated with only a 0.04 percentage point immediate increase in corporate savings and a 0.08 percentage point increase in the long term.[10]

Propensity Score Matching

Table 5 compares the changes in corporate savings, cash holdings, and debt (relative to the year-end prior to the tax reform) of firms in the countries that experienced a tax reform to those in the countries without a tax reform. The firms are matched based on the propensity that a firm experiences a tax reform in a given year, which is estimated as a function of firms' characteristics and country-level variables seen in column (2) of Table 4 (except statutory corporate income tax rates). We report differences in the changes in these three variables between two sets of firms in the year of the tax reform as well as the differences in the cumulative changes in the variables as of 1, 2, and 3 years after the tax reform. The results in Table 5 indicate that after controlling for observable firm characteristics and country-level variables, the firms in the countries that experienced a reduction in corporate tax rates increased corporate savings significantly more than the firms that did not experience a tax reform. This suggests that the observed changes in corporate savings were affected by corporate income tax rate changes and were not due only to observed firm or country characteristics.

6. Conclusion

Despite mounting interest in a global corporate savings glut, few empirical studies have explored the cross-country and time-series determinants of corporate savings. Based on a large sample of

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[10] Based on a sample from advanced economies, (Dao and Maggi 2018) found that higher net lending was associated with higher R&D intensity, but they do not report the economic significance of the effect.

firm-level data covering both advanced economies and EMDEs, our panel regression found that the declines in statutory corporate income tax rates that occurred in the period 2000-17 can explain a considerable portion of the rise in corporate savings. R&D spending appears to have had significant but limited effects on corporate savings, contrary to past studies that identified R&D as a key driver of corporate savings. Additionally, a propensity scores matching analysis shows that the reductions in statutory corporate tax rates contributed significantly to the increases in corporate savings.

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Figure 1: Race to the bottom: statutory corporate tax rates

Variable definitions are shown in Table 2.
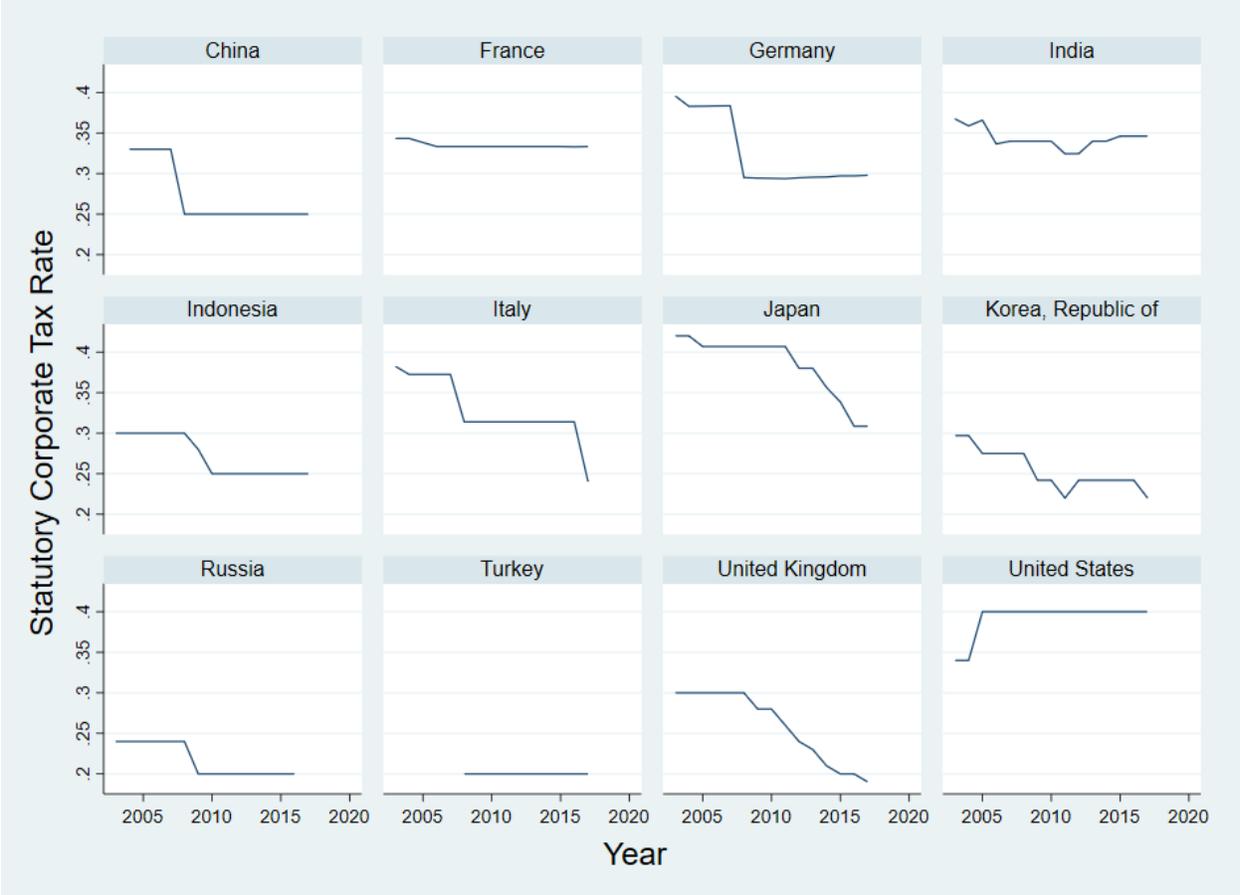
Figure 2: Corporate savings (net financial assets) in percent of total assets (book value)

Variable definitions are shown in Table 2.

Figure 3: Corporate cash holdings in percent of total assets (book value)

Variable definitions are shown in Table 2.
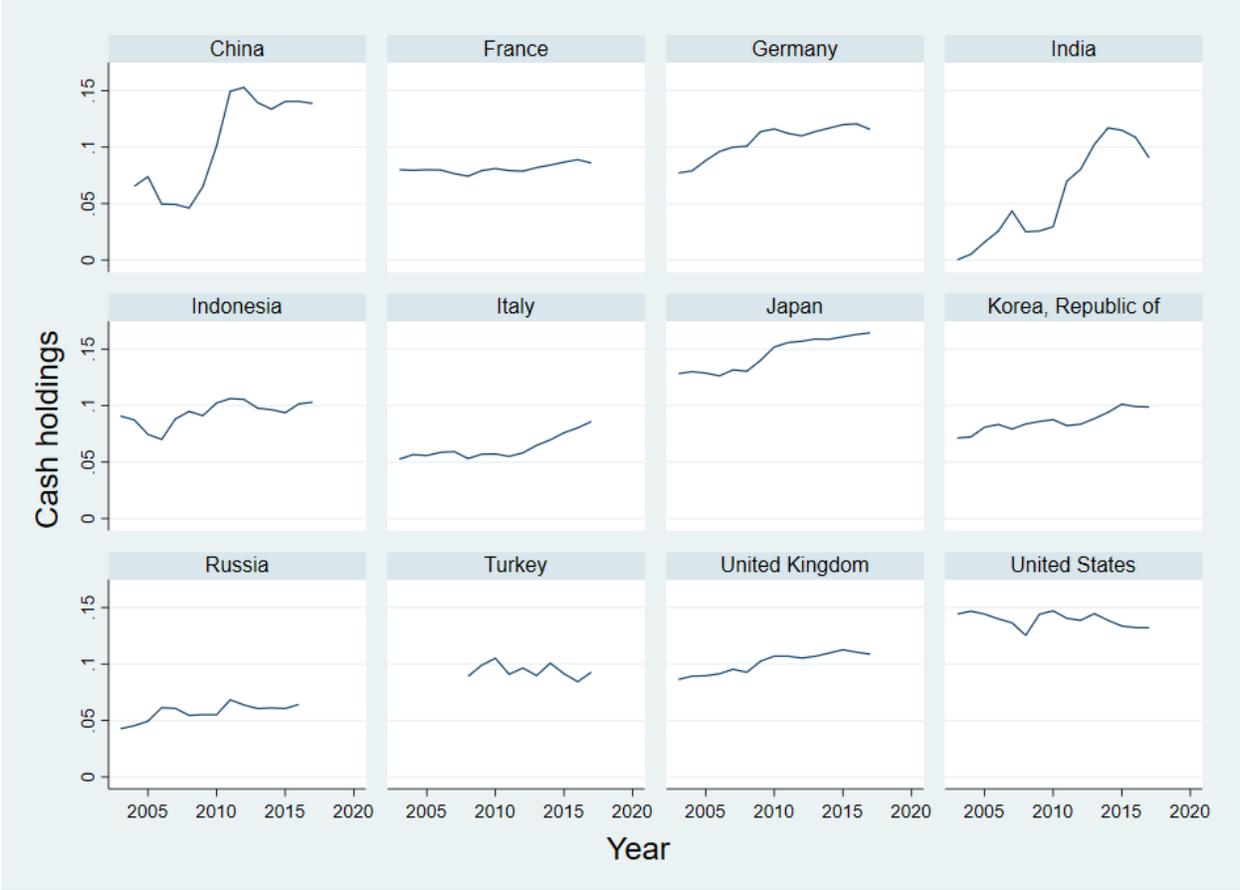
Figure 4: Corporate debt in percent of total assets (book value)

Variable definitions are shown in Table 2.
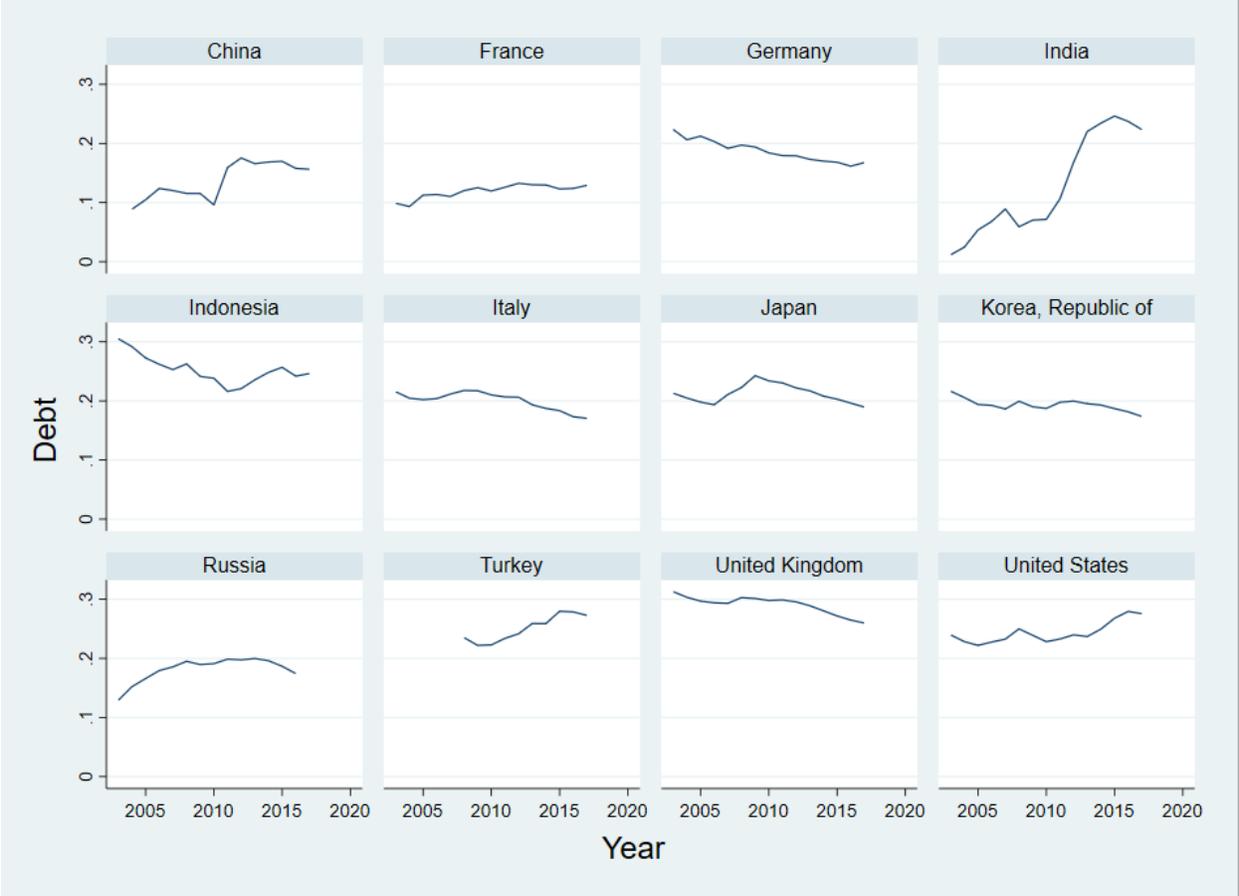
Table 1: Theoretical Prediction

Category	Specific Variable	Cash holdings	Leverage	Corporate savings
Institutional characteristics	Corporate Tax Rate	+	-	+
	Capital Market Efficiency	+/-	-	+/-
	Governance institutions quality	-	+	-
	Investment opportunities	+	+/-	+/-
Macroeconomic environment	Government leverage	+/-	-	+/-
	Aggregate Investment opportunities	+	+/-	+/-
Firm-level characteristics	Profitability	+	-	+
	Tangibility	-	+	-
	R&D	+	-	+
	Firm size	+	-	+
	Earning volatility	+	-	+

"+" means that cash holdings, leverage, or corporate savings increases with the factor, "-" means that that cash holdings, leverage, or corporate savings decreases with the factor, and "+/-" means that both positive and negative relationships between leverage and the factor are possible theoretically

Table 2: Sample statistics and definitions

	Mean	SD	Min	Max	Definition and Sources
Corporate Savings	0.093	0.327	-1.710	0.999	Financial assets net of liability divided by book value of total assets: (OCAS+OFAS-LOAN-LTDB)/TOAS. OCAS (other current assets) includes CASH (cash and equivalents). 1% tails are trimmed. Orbis, Bureau van Dijk.
Cash Holdings	0.096	0.119	0.000	0.948	Cash divided by book value of total assets: CASH/TOAS. 1% tails are trimmed. Orbis, Bureau van Dijk.
Debt	0.207	0.222	0.000	1.945	Debt divided by book value of total assets: (LTDB+LOAN)/TOAS. 1% tails are trimmed. Orbis, Bureau van Dijk.
Corporate Tax Rate	0.284	0.069	0.190	0.420	Statutory tax rate of corporate income. KPMG.
Financial Market Efficiency (FME)	0.764	0.260	0.188	1.000	Global Financial Development Database, World Bank.
World Governance Indicator (WGI)	0.561	0.952	-0.912	1.582	World Governance Indicator Project, World Bank.
Public Debt	0.736	0.643	0.075	2.363	General government gross debt to GDP.
Real GDP Growth	0.022	0.034	-0.081	0.133	Real GDP Growth rate. WDI, World Bank.
Profitability	0.040	0.097	-1.140	1.141	ROA, pre-tax profit and Loss divided by book value of total assets: PL/TOAS. 1% tails are trimmed. Orbis, Bureau van Dijk.
R&D	0.003	0.014	0.000	0.381	Research and Development spending divided by book value of total assets: RD/TOAS. Assuming zero if missing. 1% tails are trimmed. Orbis, Bureau van Dijk.
R&D non-zero indicator	0.111	0.314	0.000	1.000	Dummy variable equals to one in which a firm spends Research and Development. Orbis, Bureau van Dijk.
Tangibility	0.288	0.225	0.000	0.956	Tangible Fixed Assets divided by book value of total assets: TFAS/TOAS. 1% tails are trimmed. Orbis, Bureau van Dijk.
Sales Growth	0.031	0.268	-14.057	19.846	Annual growth of sales: log(TURN(t))-log(TURN(t-1)). Assuming zero if missing. 1% tails are trimmed. Orbis, Bureau van Dijk.
Firm Size	6.677	1.031	5.525	12.367	The natural logarithm of Number of Employee: log(EMPL). 1% tails are trimmed. Orbis, Bureau van Dijk.
Cash Flow Volatility	0.056	0.062	0.002	1.412	The standard deviation of industry cash flow divided by book value of total assets (Bates, Kahle, and Stulz 2009). Standard deviation of cash flow to book assets is computed for every firm-year using data over the previous ten years. A minimum of 6 years is required to calculate. We then average these cash flow standard deviations over NAICS 2-digit industries and each year. 1% tails are trimmed. Orbis, Bureau van Dijk.

Table 3: Sample Statistics

Valuable definitions are shown in Table 2.

	Savings	Cash	Debt	Tax rate	FME	WGI	Public Debt	Real GDP	Profit.	R&D	R&D dummy	Tan-gibility	Sales Growth	Size	CF Vol.
China	0.175	0.120	0.145	0.263	1.000	-0.509	0.360	0.085	0.059	0.004	0.241	0.284	0.140	7.318	0.043
France	0.207	0.079	0.112	0.336	0.787	1.214	0.772	0.013	0.028	0.000	0.030	0.177	0.054	6.690	0.047
Germany	0.131	0.116	0.191	0.311	0.905	1.488	0.727	0.014	0.040	0.001	0.041	0.338	0.025	6.700	0.063
India	0.112	0.104	0.238	0.339	0.591	-0.251	0.698	0.069	0.065	0.003	0.433	0.320	0.081	8.182	0.051
Indonesia	0.020	0.104	0.283	0.268	0.321	-0.431	0.301	0.053	0.041	0.000	0.085	0.380	0.070	7.426	0.077
Italy	0.060	0.062	0.202	0.325	1.000	0.560	1.168	-0.001	0.012	0.000	0.000	0.235	0.038	6.540	0.034
Japan	0.152	0.149	0.204	0.375	0.994	1.277	2.126	0.008	0.026	0.003	0.223	0.296	0.027	6.674	0.028
Korea, Rep.	0.165	0.085	0.193	0.254	1.000	0.758	0.319	0.035	0.046	0.006	0.465	0.319	0.069	6.475	0.056
Russian Federation	0.035	0.057	0.190	0.212	0.440	-0.735	0.126	0.025	0.049	0.000	0.000	0.288	0.000	6.212	0.054
Turkey	0.043	0.095	0.251	0.200	1.000	-0.180	0.325	0.058	0.041	0.003	0.503	0.306	0.008	7.353	0.056
United Kingdom	0.081	0.102	0.287	0.258	0.689	1.429	0.669	0.016	0.044	0.001	0.070	0.286	0.004	6.713	0.090
United States	0.029	0.137	0.236	0.389	1.000	1.268	0.847	0.020	0.026	0.025	0.435	0.299	0.071	8.152	0.067
Total	0.095	0.097	0.207	0.284	0.764	0.567	0.748	0.022	0.040	0.003	0.113	0.287	0.030	6.684	0.056

Table 4: Determinants of Corporate Savings, Cash Holdings, and Debt

Dependent variable	Savings	Savings	Cash	Cash	Debt	Debt
	(1)	(2)	(3)	(4)	(5)	(6)
Institutional characteristics						
Corporate Tax Rate	-0.195***	-0.190***	-0.067***	-0.057***	0.1094***	0.117***
	(0.011)	(0.012)	(0.006)	(0.006)	(0.009)	(0.009)
Financial Market Efficiency		-0.014***		0.005***		0.004**
		(0.002)		(0.001)		(0.002)
World Governance Indicator		-0.025***		0.0019		-0.001
		(0.005)		(0.002)		(0.003)
Macroeconomic environment						
Public Debt		0.064***		0.009***		-0.015***
		(0.003)		(0.001)		(0.002)
Real GDP Growth		-0.0071		0.032***		0.051***
		(0.014)		(0.006)		(0.010)
Firm-level characteristics						
Savings (t-1)	0.475***	0.471***				
	(0.003)	(0.003)				
Cash (t-1)			0.391***	0.386***		
			(0.003)	(0.003)		
Debt (t-1)					0.485***	0.482***
					(0.003)	(0.003)
Profitability	0.322***	0.317***	0.0661***	0.065***	-0.277***	-0.276***
	(0.005)	(0.005)	(0.002)	(0.002)	(0.004)	(0.004)
R&D	0.256***	0.238***	-0.0341	-0.039	-0.368***	-0.363***
	(0.055)	(0.056)	(0.034)	(0.035)	(0.039)	(0.039)
R&D, non-zero dummy	-0.007***	-0.011***	0.0133***	0.012***	0.009***	0.009***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Tangibility	-0.471***	-0.475***	-0.103***	-0.103***	0.023***	0.023***
	(0.005)	(0.005)	(0.002)	(0.002)	(0.003)	(0.003)
Sales growth	-0.020***	-0.020***	-0.002***	-0.002***	0.000	0.000
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
Firm size	-0.036***	-0.037***	-0.002***	-0.002***	0.010***	0.011***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Cash flow volatility	0.013**	0.006	-0.004***	-0.006**	-0.013**	-0.011*
	(0.006)	(0.006)	(0.003)	(0.003)	(0.006)	(0.006)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	548,174	541,793	548,174	541,793	548,174	541,793
Number of firms	64,042	64,005	64,042	64,005	64,042	64,005
Adjusted R^2	0.3919	0.3930	0.3904	0.1902	0.1932	0.2054

(Note) The dependent variables are corporate savings (column (1) and (2)), cash holdings ((3) and (4)), and outstanding debt ((5) and (6)) to total assets. Variable definitions are in Table 2. The number in parentheses are robust standard errors. ***, **, * next to a number indicate statistical significance at 1, 5 and 10 percent, respectively.

Table 5: Corporate Savings: Changes after Tax Reduction—Propensity Score Matching Results

Year	Savings		Cash		Debt	
	Diff.	*p*-value of Diff.	Diff.	*p*-value of Diff.	Diff.	*p*-value of Diff.
Reduction year	0.0085	0.00	0.0010	0.35	-0.0042	0.02
1 year later	0.0162	0.00	0.0048	0.01	-0.0086	0.00
2 years later	0.0092	0.01	0.0068	0.00	-0.0097	0.00
3 years later	0.0130	0.00	0.0043	0.13	-0.0072	0.01

The average change in corporate savings in the tax reduction and matching samples, as well as the difference between the two. The *p*-values are based on two tailed t-tests. The control firms are matched by variables in column (2) of Table 4 except for corporate tax rate. The matching process follows the propensity score matching procedure proposed by (Rosenbaum and Rubin 1983).