Heterogeneous Tax Sensitivity of Firm-level Investments*

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Abstract

Firms are heterogeneous in size, productivity, ownership concentration, governance, financial structure and other dimensions. The paper introduces a stylized theoretical framework to account for such differences and to explain the heterogeneous tax sensitivity of firm-level investments. We econometrically test the theoretical predictions, taking account of selection of firms into different classes. We find important differences in the tax sensitivity of investment of small entrepreneurial and larger managerial firms in different financial regimes that are largely in line with theoretical results. In general, corporate taxes are more relevant than dividend taxes. Managerial firms are more sensitive to corporate taxation than entrepreneurial firms while dividend taxes are especially harmful for smaller managerial firms and cash-constrained entrepreneurial firms.

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1 Introduction

A salient feature of firm distributions is their heterogeneity along several dimensions. Firms differ by age and assets (young and mature), R&D intensity (innovative and less innovative), ownership structure (concentrated and dispersed), types of governance and other characteristics. Firm characteristics are related to specific agency problems and financial regimes. Young innovative firms tend to be entrepreneur centered with concentrated ownership, have large growth potential but little own assets and are, thus, often financially constrained. Financial constraints arise from moral hazard limiting the amount of earnings that can be pledged for repayment of external funds. Lacking the possibility of internal funding (due to limited own assets and current profits), they heavily rely on external funding and do not pay dividends. A firm's debt capacity and thereby the tightness of financial constraints on external financing depends on firm-specific factors (e.g., the availability of own funding and of collateral), country specific institutional factors (e.g., accounting standards, bankruptcy regulations, financial sector efficiency) and on country specific tax factors (e.g. personal income tax, including tax progressivity, and profit tax rates). These firms earn an excess return on capital and tend not to respond to user costs. Taxes affect investment not via the user cost of capital, but rather by their effect on pledgeable earnings. Medium sized companies with still relatively concentrated ownership have more own funds and larger earnings and have less problems in raising credit. The user cost of capital, reflecting both personal income (dividend) and profit taxes, should become a more important determinant of investment.

At some point the entrepreneur wishes to sell out to diversify her wealth and the firm may become public. Large firms are less dependent on external credit. Investment tends to be financed by retained earnings at the margin. Shareholders install an independent management and form a board to supervise the firm. The self-interest and independence of managers leads to a preference for retained earnings over dividend payouts and to partly inefficient investment associated with perks and other benefits in the interest of management. If funds are relatively scarce, firms refrain from paying dividends to maximize retained earnings which are partly diverted to inefficient projects serving the interest of management. Investment depends on dividend and corporate taxes and is also driven by institutional and corporate governance variables such as board composition, voting

rights and investor protection. If more internal funds are available, firms pay dividends. In large, dividend paying firms, investment depends on the user cost of capital while dividend payouts are driven by institutional and corporate governance variables.

Distinguishing these different types of firms is especially important when deriving policy implications: Being subject to regime specific agency problems, firms might react to a given tax schedule in different ways. So far, however, empirical research on the tax determinants of investment falls in three unintegrated groups. First, a large traditional literature does not specifically take account of financial frictions and problems of corporate governance and investigates mainly how investment depends on the user cost of capital. Hassett and Hubbard (2002) review the empirical literature and report estimates of investment elasticities with respect to the user cost in the range between -0.5 and -1.0. Auerbach and Hassett (2003) show how the effect of dividend and corporate taxes depend on the marginal source of funds.[1] In contrast, when firms are finance constrained, investment becomes sensitive to cash flow, own collateral and institutional country characteristics (see Hubbard, 1998, for an early survey). A second strand of the empirical literature emphasizes the prevalence of credit constraints. In general, young and small firms are more likely to be credit constrained than large firms (Beck et al., 2005; Aghion et al., 2007). Both entry and subsequent firm growth are limited by financial frictions (see Hubbard, 1998; Beck and Demirguc-Kunt, 2006; Aghion et al., 2007). Empirical research also finds that innovative firms tend to face tighter financing restrictions than non-innovative firms (Himmelberg and Petersen, 1994; Guiso, 1998; Hall and Lerner, 2010). Chirinko and Schaller (1995) and Hoshi, Kashyap and Scharfstein (1991) report elasticities of physical capital investment to cash flow around 0.4-0.5. Estimates for total working capital are significantly higher and vary between 0.8 to 1.3 (see Fazzari and Petersen, 1993; Calomiris and Hubbard, 1995; and Carpenter and Petersen, 2002). Ellul et al. (2015, 2010) find taxes to have a significant impact on investment and to importantly interact with institutional or firm specific characteristics that relate to credit constraints. Finally, a third strand of the literature discusses taxes and other determinants of investment and dividend payout behavior in large firms with a manager shareholder conflict. Chetty and Saez (2005, 2006, 2010) theoretically and empirically consider the effects of

[1]See Auerbach (2002) for a review of corporate financial policy and investment and Gordon and Dietz (2008) for tax explanations of dividend policies.

dividend and corporate taxes on investment and dividend behavior. Desai et al. (2007) show that corporate taxes interact with investment and rent diversion by managers.

This paper will outline a theoretical model that features relatively small entrepreneurial firms that are financially constrained, and large firms with dispersed ownership and manager shareholder tension. Depending on the level of own assets and ownership structure, firms respond in different ways to personal and firm level taxes and are affected by different types of institutional variables. These different characteristics lead to a heterogeneity of tax elasticities which could not be explained by taxation in a first-best world.

The paper will shed light on the heterogeneity of investment responses to effective (personal plus corporate plus dividend) income taxation empirically. We will make use of accounting information from a large dataset on individual firms. This dataset provides information on the profits, sales, financial assets and ownership structure of 46,268 firms in a set of 25 European countries. We will pursue an empirical approach which unifies two features: (i) estimating the flexible (regime specific) impact of taxes and costs of capital on firm-level investment, and (ii) the potential endogeneity of self-selection into different firm types. One merit of this approach will be to determine empirically the susceptibility of investments across different firms in terms of observable characteristics with special emphasis on different taxes.

The empirical analysis largely confirms theoretical predictions. In small entrepreneurial firms subject to credit rationing and managerial firms that are subject to a severe manager shareholder conflicts, investment depends positively and significantly on own funds. Corporate taxes negatively affect investment for all firms with the effect being most pronounced for non-dividend paying managerial firms. Dividend taxes seem to be less relevant for the investment decision in general. However, financially constrained entrepreneurial firms and non-dividend paying managerial firms are especially sensitive to these taxes.

The paper is organized as follows. Section 2 sets out a theoretical model to explain the heterogeneous tax sensitivity of investment in response to personal and corporate income taxes. Section 3 describes the data set and introduces the econometric methodology. Section 4 presents the main empirical findings, Sections 5 and 6 report on inference and robustness checks. Finally, Section 6 concludes.

2 The Model

Entrepreneurial firms are run by managing owners and may be financially constrained or unconstrained. Financial constraints root in the tension between the entrepreneur and external investors and could lead to underinvestment coupled with an excess return on capital. In contrast, large managerial firms are run by a professional manager and owned by external equity investors. So there is a manager shareholder conflict, potentially leading to overinvestment and below normal returns on investment.

Entrepreneurial firms have no independent board that protects shareholder interests and, therefore, have no access to external equity but are rather dependent on bank credit. External equity financing is associated with the entrepreneur 'going public' to raise funds on the stock market or selling out a substantial share to other investors.[2] To obtain the cross section, we may assume that entrepreneurs have a higher discount rate than investor owned firms (see Michelacci and Suarez, 2004), $r > i$, so that managerial firms have larger firm value, all else equal. On the other hand, selling out to investors requires to set up a board and hire a manager which reduces the value to owners. Given this trade-off, smaller firms with limited own assets remain entrepreneurial and larger ones choose a managerial structure with diversified ownership.

2.1 Entrepreneurial Firms

We introduce a simple model of a manager owned entrepreneurial firm. Investment is possibly credit rationed. The firm invests I to generate net earnings $\theta f(I)$ where $f' > 0 > f''$. Investment is financed by own funds A and external debt B. Dividends in periods zero and one are D and D_1. Capital must earn a rate of return or interest equal to r. By subtracting opportunity costs of own funds $(1+r)A$, we define firm value as a surplus over own funds. Financial identities are

$$D = A + B - I - \tau \cdot T, \quad D_1 = \theta f(I) + I - (1+r)(B+A) - \tau \cdot T_1, \tag{1}$$

where τ is the tax rate and $T \equiv -eI$ and $T_1 \equiv \theta f(I) + eI - rB$ are tax bases. For simplicity, we do not model any current taxable earnings in period 0 so that T is negative.

[2] We do not equate 'going public' with stock market listing. Many medium sized firms remain unlisted but have several owners, establish a board of directors and hire a professional manager.

In period 1, we need to take account of disinvestment, leading to an extra tax τeI. Dividends thus amount to $D = A + B - (1 - e\tau) I$ and

$$D_1 = (1 - \tau) \theta f (I) + (1 - e\tau) I - (1 + (1 - \tau) r) B - (1 + r) A. \tag{2}$$

Beginning of period firm value (surplus) is the present value of dividends net of assets,

$$V^E = \max_{I,D} (1 - t_D) D + \frac{(1 - t_D) D_1}{1 + r} \quad s.t. \quad (2), \tag{3}$$

or $V^E = (1 - t_D) [(1 - \tau) (\theta f (I) - (1 - e\tau) rI) + \tau r (D - A)] / (1 + r)$.

First-Best: Optimality conditions are

$$\frac{dV^E}{dI} = \frac{(1 - t_D)(1 - \tau)[\theta f'(I) - (1 - e\tau) r]}{1 + r} = 0, \quad \frac{dV^E}{dD} = \frac{1 - t_D}{1 + r} \cdot \tau r > 0. \tag{4}$$

The firm invests until the marginal return is equal to the user cost,[3]

$$\theta f'(I) = (1 - e\tau) \cdot r \equiv u. \tag{5}$$

Raising dividends today reduces dividends tomorrow. In the absence of tax, the effect on net firm value is zero. If the firm pays more dividends, it must raise more external debt. Since interest on debt is deductible, repayment is tax subsidized tomorrow, leaving a net gain to the firm by shifting investment financing from retained earnings to external debt, $(1 - e\tau) I = (A - D) + B$. The firm raises dividends as much as possible by raising more debt which is limited to $B \leq (1 - e\tau) I$, or $D \leq A$.

Financing Constraint: We follow Ellul et al. (2010, 2015) for a simple way of modeling credit constraints. In period 1, investment and financing (I, B and D) are pre-determined. Suppose insiders can divert earnings $\phi' I$. Depending on the legal environment (investor protection, antidirector laws etc.), diversion is limited to $\phi' \in [0, \phi]$. If the entrepreneur is honest, she can promise external investors at most a repayment of $\theta f + I - \tau T_1 \geq (1 + r) B$. If the entrepreneur diverts funds, she reduces pledgeable earnings by $\phi' I$ and can get external funds to the extent that reported profits remain positive, $\pi_1 = \theta f + I - \tau T_1 - \phi' I - (1 + r) B \geq 0$. Given high earnings and a small cost of diversion, she never benefits from diverting minor amounts since total income $\pi_1 + \phi' I = \theta f + I - \tau T_1 - (1 + r) B$ (prior to getting a return on equity) is not affected.

[3]If interest on debt were not deductible, $T_1 = \theta f (I) + eI$, the user cost would be $u = \frac{1 - e\tau}{1 - \tau} \cdot r$ so that $u > r$ for any $e < 1$. Here, deductibility of interest on debt combined with deduction of investment costs subsidizes the user cost, $u < r$, as often happens in reality for 100% debt financing (at the margin).

If earnings are low and the firm is loaded with too much external funds, there might be a situation of $\theta f + I - \tau T_1 - (1+r) B > 0 > \theta f + I - \tau T_1 - \phi I - (1+r) B = \pi_1$. Since small amounts of diversion don't add to final wealth, she is clearly better off in diverting the maximum amount ϕI, reporting negative book earnings and declaring bankruptcy. Given limited liability, the entrepreneur is left with zero residual profit, but keeps diverted earnings ϕI. In this case, external investors recover only part of the promised repayment, $\theta f + I - \tau T_1 - \phi I < (1+r) B$. To prevent this scenario, they stop lending as soon as the no-diversion constraint becomes binding, $(1-\tau)\theta f(I) + (1-e\tau) I - (1 + (1-\tau) r) B \geq \phi I$. When access to external funds is limited, the firm is forced to cut dividends and keep retained earnings to economize on external funds, $B = (1-e\tau) I - (A - D)$. We also assume that the entrepreneur needs at least an amount $\bar{D}$ of current, after tax dividends for private needs. This leaves the no-diversion constraint [use $R \equiv 1 + (1-\tau) r$]

$$(1-\tau)[\theta f(I) - (1-e\tau) r I] \geq \phi I - R(A - D), \quad (1-t_D) D \geq \bar{D}. \tag{6}$$

We assume that access to external debt requires a minimum amount of self-financing:

Assumption 1 *With unconstrained investment, $\theta f'(I^*) = (1-e\tau) r$, the financing constraint is violated when retained earnings are zero, $(1-\tau)[\theta f(I^*) - (1-e\tau) r I^*] < \phi I^*$.*

Entrepreneurial firms may be in two regimes, see Appendix A for an analytical solution. Cash-poor firms are severely constrained and must cut dividends. The financing constraint in (6) binds even if the firm pledges a maximum of own funds by reducing dividends to $D = \bar{D}/(1-t_D)$. Investment is implicitly determined by (6) and depends on inside equity or the legal environment as measured by ϕ, and on determinants of pledgeable earnings, including tax payments,[4]

$$\begin{aligned} dI_c &= \frac{R}{k} \cdot dA - \frac{D}{1-t_D} \frac{R}{k} \cdot dt_D + \frac{(1-\tau) f}{k} \cdot d\theta - \frac{I}{k} \cdot d\phi \\ &: \quad -\frac{(1-\tau) B}{k} \cdot dr + \frac{(1-\tau) \tau r I}{k} \cdot de - \frac{T_1 + RT}{k} \cdot d\tau, \end{aligned} \tag{7}$$

where $k \equiv \phi - (1-\tau)(\theta f' - u) > 0$ and $R \equiv 1 + (1-\tau) r$.

Figure 1 illustrates how the financing constraint in (6) determines investment. Investment rises with own funds and declines with higher cost of capital, with deteriorating

[4]Write $[\theta f - (1-e\tau) r I - (1-\tau) e r I + r A] \cdot d\tau = (T_1 + RT) \cdot d\tau$ by using the definition of tax bases and $B = (1-e\tau) I - A + D$.

institutional quality (higher ϕ), and with a higher dividend tax. Cash-poor firms with little own funds are heavily constrained and cut dividends to preserve retained earnings for self-financing, $D = \bar{D}/(1 - t_D)$. A higher dividend tax thus requires larger gross dividends, thereby limiting retained earnings and reducing investment. Being constrained, firms are left with unexploited investments and earn an excess return.

Insert Figure 1 here

If a firm is endowed with relatively high own funds, it starts to pay larger dividends. It could invest at the first-best level, pay out dividends and raise external debt such that the financing constraint 'just binds', see the first inequality in (6). At that point, pushing for higher dividends would reduce retained earnings even further and restrict investment. Given the tax advantage of debt, this strategy is value increasing since a small cut in investment doesn't affect firm value while a small increase in debt financed dividends is strictly value increasing due to tax savings, see (4). Therefore, optimal investment is reduced below the first-best level and still earns an excess return, see the discussion of (A.3) and the illustration in Figure 1,

$$\theta f'(I_n) - (1 - e\tau) r = \frac{\tau}{1 - \tau} \frac{r\phi}{1 + r} > 0.$$

Since the financing constraint becomes binding only for tax reasons while the firm would be unconstrained in the absence of tax, we call this regime 'tax-constrained' as opposed to 'cash-constrained'. Investment of a tax constrained entrepreneurial firm changes by

$$\begin{aligned} dI_n &= -\frac{\tau r}{(1 - \tau)(1 + r)} \frac{1}{-\theta f''} \cdot d\phi - \left[1 - e\tau + \frac{\tau\phi}{(1 - \tau)(1 + r)^2}\right] \frac{1}{-\theta f''} \cdot dr \qquad (8) \\ &: \quad + \frac{f'}{-\theta f''} \cdot d\theta - \left[\frac{1}{(1 - \tau)^2} \frac{\phi}{1 + r} - e\right] \frac{r}{-\theta f''} \cdot d\tau + \frac{\tau r}{-\theta f''} \cdot de. \end{aligned}$$

Results are as expected. A constant dividend tax rate has no impact any more since it doesn't constrain the firm's choice between present and future dividends. A higher corporate tax rate reduces investment because it makes firms to pay out even more dividends today to exploit the larger tax advantage of debt, accepting a somewhat smaller level of investment due to diminishing internal funds. A slight ambiguity remains since a larger tax rate magnifies the value of the investment tax credit which in itself strengthens cash flow and investment. This effect is unimportant if the tax credit is small ($e \to 0$).

Insert Figure 2 here

Firm Value: Firms differ in own funds A. Given low own funds, the *financing constraint binds* even if dividends are cut to $D = \bar{D}/(1-t_D)$ to strengthen retained earnings, implying an external debt of $B = (1-e\tau)I - A + D$. Investment follows from (6) and depends on A. Noting (2), firm value rises with own funds, at least for small taxes ($\tau \to 0$),

$$\frac{dV_c^E}{dA} = (1-t_D)\frac{(1-\tau)(\theta f' - u)\frac{dI}{dA} - \tau r}{1+r}, \quad \frac{dV_n^E}{dA} = 0. \tag{9}$$

When own funds are larger, investment I_n is *tax-constrained* and is independent of A, see (8). Given interest deductibility of debt, the firm wants to raise as much external debt as possible. Given I_n, the financing constraint yields the minimum level of retained earnings, $R(A-D) = \phi I_n - (1-\tau)(\theta f(I_n) - uI_n)$, and thereby the maximum level of external debt, $B = (1-e\tau)I_n - (A-D)$. Hence, both investment and external debt, I_n and B, are independent of A so that current dividends $D = A + B - (1-e\tau)I_n$ rise one to one with own funds while period 1 dividends decline in proportion to $1+r$. The net discounted effect is zero. The firm's surplus is not affected by larger own funds.

Clearly, a cash-poor firm is *cash-constrained* so that more own funds boost investment and add to firm value in proportion to the excess return. The effect eventually disappears when investment and dividend pay-out are exclusively driven by the tax advantage of debt. Figure 2 illustrates. There is a cutoff value A_c such that firms with $A < A_c$ are cash-constrained and do not pay dividends while richer firms with more own funds $A > A_c$ are constrained only for tax reasons and pay dividends. Figures 2 and 3 compare entrepreneurial and managerial firms and display how firm values and investment change with assets.

Insert Figure 3 here

2.2 Managerial Firms

We assume that entrepreneurial firms have no access to external equity. Their marginal source of finance is debt. Once the entrepreneur has largely exhausted excess returns (cash-rich firm), she wants to sell out by going public. The firm becomes managerial, subject to a new agency problem. Since enough own funds are available, the marginal source of finance is retained earnings, as in the new view on dividend taxation. We thus

exclude further investment financing with new equity in addition to the acquisition of A. Firms do not pay dividends, not because of a shortage of own funds but rather because of manager's overinvestment in perks and pet projects.

2.2.1 Agency Model

In large firms (high A), entrepreneurs divest and sell out to external investors who require a lower return on their diversified portfolio, $i < r$, but are passive owners and must hire a manager (possibly the founding entrepreneur). It is now the manager who can divert a part J of the firm's funds, instead of productively investing it. In total, she spends $I + J$ where J does not add to the firm's earnings $\theta f(I)$. After spending on investment, managers use the remaining funds to pay out dividends. Abstracting from new equity issues, the marginal source of finance is retained earnings, leading to the first period financial identity $(1 - e\tau)(J + I) = A - D$. In the second period

$$D_1 = (1 - \tau)\theta f(I) + (1 - e\tau)(I + J) - (1 + i)A. \tag{10}$$

Defining firm value as a surplus net of opportunity costs, we must subtract $(1 + i)A$ before dividends are shared with managers and other stakeholders. Using financial identities, the present value of dividends is $V = (1 - t_D)[D + D_1/(1 + i)]$, or

$$V = (1 - t_D)\left[D + \frac{(1 - \tau)\theta f(I) + A - D - (1 + i)A}{1 + i}\right], \tag{11}$$

which yields $V = (1 - t_D)[(1 - \tau)\theta f(I) - (1 - e\tau)i(I + J)]/(1 + i)$.

Managers decide on investment and dividend policy. Part J of total investment spending doesn't add to earnings but yields private benefits $g(J)$ to the manager. Active shareholders sit on the board, provide oversight and control and set executive compensation (dividend share α) to realign manager and shareholder interests. Firm value is divided among managers and shareholders,

$$V^M = \alpha \cdot V + \frac{g(J)}{(1 + i)q} - B^M, \quad V^B = (1 - \alpha) \cdot V + B^M, \quad V^* = V + \frac{g(J)}{(1 + i)q}. \tag{12}$$

Active owners (board members) acquire the firm and cede a share α to managers, possibly against a payment B^M. The board thus keeps a residual share of $1 - \alpha$. Private benefits from less productive investment J are reduced by tighter monitoring by board members

and higher institutional quality relating to investor protection, antidirector rights, accounting standards etc. Given that our focus is on investment decisions, we refrain from endogenizing board monitoring. In our simplified framework, parameter q thus captures the effects of monitoring and institutional quality.

2.2.2 First Best

Suppose shareholders can observe private benefits (institutional quality $q \to \infty$). Maximizing the joint surplus V^* thus yields

$$\begin{aligned} \frac{dV^*}{dI} &= \frac{1-t_D}{1+i}(1-\tau)\left[\theta f'(I) - \frac{1-e\tau}{1-\tau} i\right] = 0, \\ \frac{dV^*}{dJ} &= -\frac{1-t_D}{1+i}(1-\tau)\theta f'(I) + \frac{g'(J)}{(1+i)q} \leq 0. \end{aligned} \tag{13}$$

The first condition yields I and the second implies J. As long as $g'(0)$ is finite, $q \to \infty$ implies $J \to 0$ and residual dividends $D = A - (1-e\tau) I$. In the first-best, there is no diversion of funds. Investment exclusively depends on the user cost of capital.

If managers are not wealth constrained, the first-best can be implemented by selling the firm to them (set $\alpha = 1$) at a price that extracts their surplus, $B^M = V + \frac{g(J)}{(1+i)q}$, giving a value $V^B = B^M$ to board members. Managers maximize $V + \frac{g(J)}{(1+i)q}$ and choose investments as in (13), leading to $J = 0$ for $q \to \infty$ as before. Since all surplus is extracted from managers by the price B^M, board members get the entire surplus equal to

$$V^B = V = (1-t_D)\frac{(1-\tau)\theta f(I) - (1-e\tau) iI}{1+i}. \tag{14}$$

Comparing (3) and (14), a managerial firm – in the absence of tax – is larger and has greater value in the first-best than an entrepreneurial firm since $i < r$ implies $V^E < V^B$. They would be exactly equal if $i = r$. With taxes, there is a countervailing effect. Entrepreneurial firms are favored since interest on external debt is deductible while opportunity costs of equity (internal finance) are not.

2.2.3 Investment and Dividend Policy

To discourage unproductive investments that is directed towards private benefits, managers are offered a share α to boost incentives for value maximization. We assume

that managers are wealth constrained, $B^M = 0$, leaving them with rents at the expense of board members. Total rent consists of monetary income and private benefits, $V^M = \alpha V + \frac{g(J)}{(1+i)q}$, where V is stated in (11). Given a contract α, the manager maximizes rent by setting investment and dividends subject to $J = (A - D)/(1 - e\tau) - I$,

$$V^M = \max_{I,D} \ \alpha \cdot (1 - t_D) \left[D + \frac{(1-\tau)\theta f(I) + A - D - (1+i)A}{1+i} \right] + \frac{g(J)}{(1+i)q}. \quad (15)$$

The trade-off is in paying out funds to investors or retaining for investment and managerial perks.[5] Optimality requires

$$\begin{aligned} \frac{dV^M}{dI} &= \frac{(1-t_D)\alpha(1-\tau)\theta f'(I) - g'(J)/q}{1+i} = 0, \quad (16) \\ \frac{dV^M}{dD} &= \frac{(1-t_D)\alpha(1-e\tau)i - g'(J)/q}{(1-e\tau)(1+i)} \leq 0. \end{aligned}$$

Depending on the sign of the second condition, one must distinguish two cases.

No Dividend, $D = 0$: If paying dividends reduces the manager's rent, $\frac{dV^M}{dD} < 0$, she sets $D = 0$. Investment follows from

$$(1-t_D)(1-\tau)\alpha \cdot \theta f'(I) = g'(J)/q, \quad J = \frac{A}{1-e\tau} - I. \quad (17)$$

This condition implicitly determines productive investment I and, in turn, yields J. Investment no longer depends on user cost but rises with internal funds A, higher managerial profit share α, better governance or higher institutional quality (larger q). Using $\nabla \equiv -(1-t_D)(1-\tau)\alpha\theta f'' - g''/q > 0$, we have[6]

$$\begin{aligned} dI &= \frac{-g''}{(1-e\tau)q\nabla} \cdot dA + \frac{g'}{q\theta\nabla} \cdot d\theta + \frac{g'}{q\alpha\nabla} \cdot d\alpha + \frac{g'}{q^2\nabla} \cdot dq \quad (18) \\ &: \quad -\frac{(1-\tau)\alpha\theta f'}{\nabla} \cdot dt_D - \frac{(1-t_D)\alpha\theta f'}{\nabla} \cdot d\tau + \frac{-g''}{q\nabla} \frac{I+J}{1-e\tau} (e \cdot d\tau + \tau \cdot de). \end{aligned}$$

A larger profit share and better governance or a better institutional environment lead managers to focus more on value maximization and productive investment. Taxes or lower firm level productivity reduce firm value relative to the value of private benefits and thereby induce managers to shift resources from productive investments to unproductive ones. Unproductive investment changes by $dJ = d\frac{A}{1-e\tau} - dI$ and total spending by

$$d(I+J) = \frac{1}{1-e\tau} \cdot dA + \frac{A}{(1-e\tau)^2} (e \cdot d\tau + \tau \cdot de).$$

[5]Given diversified ownership, none of the shareholders has committed a dominant share of their portfolio to a single firm. In contrast to (6), we thus ignore the need for minimum dividends.

[6]Using the f.o.c., we can also write $\frac{dI}{dA} = \frac{g''/g'}{f''/f' + g''/g'} \frac{1}{1-e\tau} < \frac{1}{1-e\tau}$.

Dividend Payout, $D > 0$: If the firm pays dividends, investment is given by

$$(i) : \theta f'(I) = \frac{1-e\tau}{1-\tau} i, \quad (ii) : (1-t_D)(1-e\tau)\alpha i = \frac{g'(J)}{q}. \tag{19}$$

The manager productively invests I as in (i) and diverts J as in (ii) which, in turn, yields residual dividends $D = A - (1-e\tau)(I+J)$. Cash-rich firms choose productive investment to maximize firm value so that the return on investment is equal to the user cost of capital. In particular, productive investment is independent of own funds A. The manager shareholder conflict merely concerns the use of excess funds for dividend payments to investors vs. diversion of funds to perks and managerial benefits. We have

$$\begin{aligned}
dI &= \frac{f'}{-\theta f''} \cdot d\theta - \frac{f'}{-if''} \cdot di + \frac{\tau}{1-\tau}\frac{i}{-\theta f''} \cdot de - \frac{1-e}{(1-\tau)^2}\frac{i}{-\theta f''} \cdot d\tau, \qquad (20)\\
dJ &= -\frac{g'}{-ig''}di - \frac{g'}{-g''}\left[\frac{dq}{q} + \frac{d\alpha}{\alpha}\right] + \frac{g'}{-g''}\frac{dt_D}{1-t_D} + \frac{g'}{-g''}\left(e\frac{d\tau}{1-e\tau} + \tau\frac{de}{1-e\tau}\right),\\
d(I+J) &= \frac{f'}{-\theta f''}d\theta - \left[\frac{f'}{-if''} + \frac{g'}{-ig''}\right]di - \frac{g'}{-g''}\left[\frac{dq}{q} + \frac{d\alpha}{\alpha}\right]\\
&: \quad + \frac{g'}{-g''}\frac{dt_D}{1-t_D} + \left[\frac{f'}{-f''} + \frac{g'}{-g''}\right]\tau\frac{de}{1-e\tau} - \left(\frac{1-e}{1-\tau}\frac{f'}{-f''} - e\frac{g'}{-g''}\right)\frac{d\tau}{1-e\tau}.
\end{aligned}$$

Dividends $D = A - (1-e\tau)(I+J)$ are residual and change by

$$\begin{aligned}
dD &= dA - (1-e\tau)\frac{f'}{-\theta f''} \cdot d\theta + (1-e\tau)\frac{g'}{-g''} \cdot \left[\frac{dq}{q} + \frac{d\alpha}{\alpha}\right]\\
&: \quad + (1-e\tau)\left[\frac{f'}{-if''} + \frac{g'}{-ig''}\right] \cdot di - (1-e\tau)\frac{g'}{-g''} \cdot \frac{dt_D}{1-t_D} \qquad (21)\\
&: \quad + \left[(I+J)e + \frac{1-e}{1-\tau}\frac{f'}{-f''} - e\frac{g'}{-g''}\right] \cdot d\tau + \left[I + J - \frac{f'}{-f''} - \frac{g'}{-g''}\right]\tau \cdot de.
\end{aligned}$$

Table 1 summarizes the empirical predictions of how various shocks affect the intensive margin of investment.

Insert Table 1 About Here

Firm Values: In the interior regime (see 19), the firm pays dividends, $D = A - (1-e\tau)(I+J) > 0$. Investments I, J are independent of A so that firm value is flat, $dV/dA = 0$. Increased own funds are one to one paid out as dividends, $\frac{dD}{dA} = 1$. If the firm is in the constrained regime and thus cannot pay dividends, $D = 0$ and $A = (1-e\tau)(I+J)$, managers divert funds for perks and managerial benefits at the expense of productive investment and shareholder value. We have $\frac{dD}{dA} = 0$ as well as $\frac{1}{1-e\tau} > \frac{dI}{dA} > 0$ and $\frac{1}{1-e\tau} > \frac{dJ}{dA} > 0$ where both derivatives add up to $\frac{d(I+J)}{dA} = \frac{1}{1-e\tau} \geq 1$. Firm value thus

changes by

$$\begin{aligned} \text{corner} \quad &: \quad \frac{dV}{dA} = \frac{(1-t_D)(1-\tau)\left[\theta f'(I)\frac{dI}{dA} - \frac{1-e\tau}{1-\tau} i \frac{dI+dJ}{dA}\right]}{1+i} \gtrless 0, \qquad (22) \\ \text{interior} \quad &: \quad \frac{dV}{dA} = 0. \end{aligned}$$

Cash-poor firms do not pay dividends. Investment rises by less than A, $0 < \frac{dI}{dA} < 1$, since managers divert funds to unproductive uses serving only managerial benefits. Hence, $J = A - I$ also rises. The returns f' and g' shrink until (16b) holds with equality, moving the firm to the interior regime. For low assets, productive investment is constrained, i.e. $\theta f'(I) > \frac{1-e\tau}{1-\tau} i$. If the excess return is large, then $dV/dA > 0$, even if some funds are invested unproductively. When moving to the interior regime, $\theta f'(I) \to \frac{1-e\tau}{1-\tau} i$, firm value starts to decline, $dV/dA < 0$, although the manager's payoff still rises since she obtains private benefits. In the limit, firm value $\frac{dV}{dA} = \frac{(1-t_D)(1-\tau)}{1+i}\left[\theta f'(I)\frac{dI}{dA} - \frac{1-e\tau}{1-\tau} i \frac{1}{1-e\tau}\right]$ shrinks with assets near the cut-off: $\theta f' \to \frac{1-e\tau}{1-\tau} i$ yields $\frac{dV}{dA} \approx \frac{(1-t_D)(1-e\tau)i}{1+i}\left(\frac{dI}{dA} - \frac{1}{1-e\tau}\right) < 0$ since $\frac{dI}{dA} < \frac{1}{1-e\tau}$. Figure 3 illustrates.

2.3 Cross Section of Firms

The cross section includes entrepreneurial and managerial firms with further distinctions within each class, giving four types in total. In a life-cycle interpretation, firms start out entrepreneurial with concentrated ownership. (i) Those with low own assets are smallest and pay only a minimum amount of dividends to maximize internal funds. Investment is restricted by pledgeable cash flow, i.e., they are *cash-constrained*. (ii) Those with larger funds could invest at a first-best level and pay higher dividends. Given the tax advantage of debt, they prefer external credit relative to retained earnings and thereby end up constrained for tax reasons only, i.e., they are *tax-constrained*. At some level of funds, entrepreneurs sell out. The firm is acquired by diversified investors or goes public, requiring a lower return on equity. A manager is hired and a board is installed to control the firm. (iii) Managerial firms with limited own funds are non-dividend paying. They retain all profits for internal financing and, due to diversion of funds, do not fully exploit their productive investment opportunities. (iv) Cash-rich firms with large internal funds pay dividends and invest at an unrestricted level even though some investment is diverted to non-productive uses and thereby limits the amount of dividend distributions. We denote the cutoff values of assets by $A_c < A_m < A_d$ as Figures 2 and 3 illustrate.

The cutoff A_m divides firms into managerial and entrepreneurial firms indicating the particular agency problem faced by each subcategory of firm: entrepreneurial firms face financial constraints due to credit rationing, managerial firms face a manager shareholder conflict arising from the tendency to empire-building and overinvestment. Within each subcategory, defined by the thresholds A_c and A_d, the agency problem is alleviated as own funds rise. The empirical setup allows to identify the subgroups of firms and to test the theoretical predictions regarding tax effects on extensive investment.

3 Empirical Framework

3.1 Data Description

This study employs data from several sources. First of all, at the heart of the analysis are annual firm-level data published in Bureau van Dijk's Orbis Database on balance sheets of European companies between the years 2000 and 2013. Second, indices for bankruptcy laws as well as investor protection are taken from the World Bank's Doing Business 2012 Report. Additional country-level variables are taken from the World Bank's World Development Indicators. Finally, the paper utilises detailed data from Bösenberg, Egger, and Erhardt (2014) on the taxation of corporate profits, from Bösenberg, Rydzek, and Egger (2014) on the taxation of dividends, and from Egger, Radulescu, and Strecker (2013) on the taxation of personal income across countries and time. In the empirical analysis, we use a cross section of data for the period 2009-2013.

3.1.1 Company Balance Sheet Data

The company data include information on balance sheet figures and financial variables such as interest expenses. Additionally, since the theoretical model discerns managerial and entrepreneurial companies, information on ownership shares and firm age are other important bits of information. All monetary variables are deflated using country-time-specific GDP deflators obtained from the European Commission's AMECO database.

3.1.2 Data on the Institutional Environment

Country-level indicators on investor protection aim at measuring shareholder protection against the misuse of corporate assets in perks and pet projects. Based on a disclosure index, a director liability index, and a shareholder suits index the World Bank develops a *strength of investor protection index*, ranging from 1 (low strength) to 10 (high strength). The *strength of legal rights index* measures the extent to which the rights of borrowers are protected by bankruptcy and collateral laws, and also ranges from 1 (low strength) to 10 (high strength). A greater strength of legal rights or investor protection is expected to facilitate lending in a given country. In order to control for the economic state and the general investment climate in a country, we include data on GDP per capita, FDI inflows (in % of GDP), the percentage of bank nonperforming loans in total gross loans, domestic credit to the private sector (in % of GDP), domestic credit to the private sector provided by banks (in % of GDP), and total domestic credit by the financial sector (in % of GDP).

3.1.3 Taxation Data

The theoretical model alludes to the role of taxes on profits and dividends for managerial and entrepreneurial firms. Details on the effective marginal tax rate on companies' profits are available from Bösenberg, Egger, and Erhardt (2014). Firms differ in terms of the composition of their investments and assets (with regard to tangible versus intangible investments and also with regard to the type of fixed tangible investments such as those in machinery, buildings, etc.) and the associated specific tax deductibility and depreciation rates. Egger and Loretz (2010) determine industry-specific and firm-specific effective tax rates by taking the nature of typical investments per 4-digit sector of the NACE industry classification into account, and Bösenberg, Egger, and Erhardt (2014) provide an even more detailed approach, using long panel data covering the most recent years. While effective marginal tax rates on profits vary at the firm level, dividend taxes from Bösenberg, Egger, and Rydzek (2014) do so at the country level.

Finally, while the theoretical model in Section 2 only differentiates between corporate taxes and dividend taxes, we also include income taxes in the empirical analysis.[7] There

[7] In Section 2, one might set $t_D = 0$ and interpret τ as the entrepreneur's personal income tax rate.

are two reasons for doing so. First, depending on the legal form of a firm, income or corporate taxes might be relevant for profit taxation. Ex ante, we would expect income taxes being more important for small, constrained entrepreneurial firms. Second, we expect firms to use dividends and wages as (imperfect) substitutes to compensate shareholders and entrepreneurs.[8] We utilise data from Egger, Radulescu, and Strecker (2013) on the personal income tax schedule per country which permits computing effective personal income tax rates for any gross wage level by following the OECD's Taxing Wages approach. What mainly matters for the present purpose is that firm profits might be subject to personal income taxation for smaller enterprises. We use the effective marginal tax rate for an income amounting to ten times the average wage income in a given country to capture the relevant tax bracket for these firms.

3.1.4 Descriptive Statistics

For the main empirical analysis we restrict our sample to manufacturing firms for two reasons.[9] First, the investment process described in the theoretical model is mainly inspired by a classical manufacturing firm. Second, the construction of our investment variable is a proxy for physical investments such as machinery but barely reflects 'soft' investments such human capital formation that might be more relevant for service companies. Robustness checks using the universe of firms in the sample do not change our main results. The analysis is conducted for a cross section of our sample. For that purpose, all variables are computed as an average over the respective period of investigation, 2009-2013.

The main dependent variable – investment of firm ℓ, I_ℓ – is constructed from the balance sheet data as the average relative increase in fixed assets in the average year between 2009 and 2013, abstracting from annual depreciation.[10] It is expressed as a fraction (whereby 0.1 indicates a growth rate of 10%). In order to capture regular investment projects rather than mergers and acquisitions we exclude firms where I_ℓ exceeds unity. We

[8] Alstadsaeter and Jacob (2015) find that the 2006 Swedish dividend tax cut led owner-managers of closely held firms to significantly substitute managerial salaries for higher dividends. Sivadasan and Slemrod (2008) found an elimination of the tax penalty on wages paid to partners in partnership firms in 1992 in India let to significant shifting of income from profits to managerial wages.

[9] We use all firms whose main sector affiliation in the NACE Rev.2 2-digit classification is 10-33.

[10] We adjust investment using an investment deflator obtained from the European Commission's AMECO database (Price deflator gross fixed capital formation: other investment).

measure the interest rate, r, by the firm-specific ratio of total interest expenses and total liabilities at the beginning of the period. In order to obtain a measure of productivity, θ_ℓ, we follow Levinsohn and Petrin (2003).[11]

In the proposed theoretical framework, the main determinant for selection into the different regimes (cash-constrained and tax-constrained entrepreneurial firms, non-dividend paying and dividend paying managerial firms) are own funds. Clearly, in the theoretical model, own funds serve both as a variable indicating available liquid funds and as a firm size variable. Translating the model into an empirical setting, however, poses several challenges: Among others, firms differ in age and industry affiliation leading to different scales in balance sheet variables. Therefore, in order to properly choose the variables determining the different regimes, it is important to take into account the exact mechanisms present in the respective regimes. In the proposed theoretical framework, we observe two different kinds of agency problems: A manager shareholder conflict on the one hand and a conflict between an entrepreneur and an external investor on the other hand. Since the dataset allows us to observe the ownership structure of firms, we can determine if firms are potentially subject to a manager shareholder conflict or rather single entrepreneurs. For the empirical analysis, we define concentrated ownership according to the independence indicator provided by Bureau van Dijk. This variable equals zero for a company, if none of the recorded shareholders holds more than 50% of direct or total ownership.[12]

Both of the two potential agency problems are characterized by being facilitated by the presence of own liquid funds. Here, we choose the cash ratio defined as cash and cash equivalents holdings over total assets as a measure of own liquid funds, A_ℓ. The cash ratio is a standard measure of liquidity in finance and suits our theoretical definition where own funds are characterized by being available to firms besides debt finance and without raising external equity. Furthermore, scaling by total assets allows us to compare firms

[11]They propose an econometric strategy using intermediate inputs to control for correlation between input levels and the unobserved productivity process that commonly arises when estimating production functions. In this paper, we use the profit-adjusted value added to proxy for output, and the number of employees and total assets as primary factors of production and material costs to capture intermediate inputs. We estimate productivity for each firm and year exploiting the panel data for all firms and years in the data-set, and then average productivity over the time span 2009-2013 to obtain θ_ℓ.

[12]Given that we use a cross section of data, we exclude all firms that switch from dispersed ownership to concentrated ownership or vice versa between 2009 and 2013.

of different age or industry types. Note however, that the so chosen empirical equivalent of own liquid funds, A_ℓ, is no firm size variable.

The final dataset consists of a total of 44,863 firms from 25 different countries.[13] Summary statistics of all firm-specific variables are presented in Table 2. A list of countries is provided and details of all country-specific variables are presented in Table 3.

Insert Tables 2 And 3 About Here

On average, investment I_ℓ amounts to around 0.23 (23%) in the sample. The average firm has cash holdings relative to total assets of around 9% and is subject to an interest rate of 2.2%. The majority of firms, 63.3%, in the sample has a concentrated ownership structure. The effective marginal corporate tax rate amounts to 22.4% on average. Danish firms are subject to the highest marginal income tax rate of 59%, while Bulgarian firms pay 9% only. Merely half of the countries impose dividend taxes, and Swiss firms are subject to the highest dividend tax rate of 35% in the sample. According to the World Bank's Doing Business Report, British and Latvian borrowers benefit from a very high standard of legal rights, while Italian borrowers are worst off in the sample. Investor protection is most favorable in Ireland among the included countries.

3.2 Econometric Strategy

Figure 2 suggests a nonlinear (kinked) relationship between own funds and investment. Most importantly, it is inherently unobservable to the researcher where in own funds space the kinks occur. For the empirical analysis, we determine the threshold which divides firms into managerial and entrepreneurial ones based on the ownership structure of the firm. The theoretical framework models managerial firms as being subject to an agency problem arising from a manager shareholder conflict. Legally, this conflict becomes relevant as soon as none of the individual shareholders does have formal control. The legal threshold for this is an ownership of more than 50% of the shares which makes the threshold between an entrepreneurial firm and a managerial firm observable to the researcher. Theory implies that the selection into any of the two regimes is endogenous.

[13]Note, that we delete any observations with obvious reporting errors, such as negative balance sheet entries or balance sheet ratios exceeding unity.

Smaller firms are more likely to be entrepreneurial than bigger ones. In contrast, the two thresholds within the entrepreneurial and managerial regimes, respectively, are latent and need to be estimated.[14] In light of these features, we propose an econometric strategy which involves estimating an unobservable threshold within an endogenously chosen (entrepreneurial vs. managerial firm) regime by combining Hansen's (2000) sample splitting approach with Heckman's (1979) sample selection framework.

3.2.1 Estimation Strategy

We use subscripts $\ell \in \{c, t, m, d\}$ to denote (severely) cash constrained, tax constrained, managerial (non-dividend paying) firms, and dividend paying firms which are separated by three threshold values of A_ℓ. In a first step, we define a selection rule for the observable (entrepreneurial vs. managerial) firm type

$$q_\ell^* = z_\ell' \delta + u_\ell,$$

where q_ℓ^* is a latent variable measuring the net gains from concentrated share ownership, z_ℓ is a row vector of observable determinants thereof, δ is a conformable column vector, and u_ℓ is a disturbance term. While q_ℓ^* is unobserved, it generates an observable binary (managerial firm) variable

$$q_\ell = \begin{cases} 0 & \text{if } q_\ell^* \leq 0 \\ 1 & \text{if } q_\ell^* > 0. \end{cases} \tag{23}$$

The binary variable q_ℓ is defined such that all firms with dispersed ownership, i.e., m- and d-type firms, are assigned $q_\ell = 0$ and all firms with concentrated ownership, i.e., c- and t-type firms, are assigned $q_\ell = 1$. Furthermore, we propose the observed dependent variable I_ℓ to be determined by a piecewise-linear function of some independent variables x_ℓ. The coefficients of these variables are allowed to depend on the observed and unobserved

[14] According to the theoretical framework, one might identify the threshold within managerial firms by using observed dividend payments. Note, however, that in reality zero dividend payments would not have to be the right observable cutoff, because shareholders might ask for some small minimum dividend payment. In any case, there is no legally binding exogenous force justifying a threshold of zero dividend payments, so that we prefer treating that threshold as unobservable and estimating it. Given that dividend payments are a choice variable in the theoretical model (and in reality), we rather use our proxy variable for own funds to parameterize the respective threshold instead (see Hansen, 1997).

regimes, though, according to:

$$I_\ell = \begin{cases} \alpha_1 + x_\ell'\beta_c + e_{\ell 1} & \text{if } A_\ell \leq A_c \\ \alpha_1 + x_\ell'\beta_t + e_{\ell 1} & \text{if } A_c < A_\ell \leq A_m \\ \alpha_0 + x_\ell'\beta_m + e_{\ell 0} & \text{if } A_m < A_\ell \leq A_d \\ \alpha_0 + x_\ell'\beta_d + e_{\ell 0} & \text{if } A_d < A_\ell \end{cases} \tag{24}$$

where A_c and A_d are unobserved, whereas A_m is indirectly observed through q_ℓ. We assume the disturbances on I_ℓ, $(e_{\ell 0}, e_{\ell 1})$ and the disturbances on q_ℓ^*, u_ℓ, to follow a multivariate normal distribution with mean zero and variance-covariance matrix

$$\Omega_\ell(q_\ell = j) = \begin{pmatrix} \sigma_{e_j}^2 & \rho_j \sigma_{e_j} \\ \rho_j \sigma_{e_j} & 1 \end{pmatrix}, \quad j = 0, 1. \tag{25}$$

Note that the covariance between errors $e_{\ell 0}$ and $e_{\ell 1}$ are zero due to mutual exclusivity.

Let the sample considered and information available consist of $\{I_\ell, x_\ell, A_\ell, q_\ell, z_\ell\}_{\ell=1}^n$, where n denotes the number of cross-sectional units (in the present paper, firms). Conditional on q_ℓ, the econometric model (24) can be rewritten:

$$E[I_\ell | q_\ell = 0, x_\ell, z_\ell] = \alpha_0 + x_\ell'\beta_t + \mathbf{1}\{A_\ell \leq A_c\} x_\ell'(\beta_c - \beta_t) + \rho_0 \sigma_{e0} \lambda_{\ell 0} \tag{26}$$

$$E[I_\ell | q_\ell = 1, x_\ell, z_\ell] = \alpha_1 + x_\ell'\beta_d + \mathbf{1}\{A_\ell \leq A_d\} x_\ell'(\beta_m - \beta_d) + \rho_1 \sigma_{e1} \lambda_{\ell 1}, \tag{27}$$

where $\lambda_{\ell 0} = \frac{-\phi(z_\ell'\delta)}{1-\Phi(z_\ell'\delta)}$ and $\lambda_{\ell 1} = \frac{\phi(z_\ell'\delta)}{\Phi(z_\ell'\delta)}$ account for endogenous selection into the observable regimes of entrepreneurial and managerial firms. The least-squares estimator for threshold equations such as (26) and (27) proposed by Hansen (2000) corresponds to minimizing the objective functions

$$S_{n,0}^*(\theta_0) = \frac{1}{n_0} \sum_{\ell=1}^{n_0} \left\{ I_\ell - \alpha_0 - x_\ell'\beta_t - \mathbf{1}\{A_\ell \leq A_c\} x_\ell'(\beta_c - \beta_t) - \beta_{\lambda 0} \lambda_{\ell 0} \right\}^2 \tag{28}$$

$$S_{n,1}^*(\theta_1) = \frac{1}{n_1} \sum_{\ell=1}^{n_1} \left\{ I_\ell - \alpha_1 - x_\ell'\beta_d - \mathbf{1}\{A_\ell \leq A_d\} x_\ell'(\beta_m - \beta_d) - \beta_{\lambda 1} \lambda_{\ell 1} \right\}^2, \tag{29}$$

where $\theta_0 = (\alpha_0, \beta_c', \beta_t', \beta_{\lambda 0}, A_c)$, $\theta_1 = (\alpha_1, \beta_d', \beta_m', \beta_{\lambda 1}, A_d)$. Estimation follows a two-step procedure. In a first step, we estimate a Probit model to obtain estimates of δ and use these estimates to compute $\hat{\lambda}_{\ell 0}$ and $\hat{\lambda}_{\ell 1}$. In a second step, we minimize (28) and (29) given $\{\hat{\lambda}_{\ell 0}, \hat{\lambda}_{\ell 1}\}$ through concentration: we minimize the objective functions $S_{n,0}(A_c)$ and $S_{n,0}(A_d)$ given the respective threshold values and then optimize over A_c and A_d. Standard errors are obtained from the asymptotic covariance matrix for threshold regressions with sample selection bias developed in Egger and Erhardt (2015).

4 Main Results

We estimate the empirical model in three steps. In the first step, we estimate (23) by a probit model in order to obtain a consistent estimate of $\hat{\lambda}_{\ell 0}$ and $\hat{\lambda}_{\ell 1}$. The estimates for the Probit regression are presented in Table 4. In line with the theoretical model, the cash ratio reflecting own funds has a negative effect on selection into an entrepreneurial regime. Similarly, older firms and firms with more employees are more likely to be in managerial (m- or d-type) regimes. Higher corporate taxes seem to lead to selection into managerial regimes. The latter may reflect a mix of a better ability to avoid taxes as a managerial (especially, a dividend paying) firm and of the mechanisms at work in the model in Section 2, which establishes a heterogeneous tax sensitivity of firms across the considered regimes. Apparently, higher dividend tax rates also increase the probability of being a managerial firm. The estimates reported in Table 4 are used to compute the control functions $\hat{\lambda}_{\ell 0}$ and $\hat{\lambda}_{\ell 1}$ which enter the threshold regression framework.

Insert Table 4 About Here

Results of the integrated threshold regression are presented in Table 5.[15] This regression yields a critical cash ratio of $\hat{A}_c = 0.0300$ which separates cash and tax-constrained entrepreneurial firms, and $\hat{A}_d = 0.0181$ which separates dividend paying and non-dividend paying managerial firms. Note that the empirical choice of the threshold variable must not be confused with the theoretical variable own funds. Being scaled by total assets it is not related to firm size and hence, we do not have any theoretical prediction about their ordering in cash ratio space.

As predicted by the theoretical model, liquid funds as approximated by the cash ratio are most important for the investment of cash-constrained entrepreneurial firms and non-dividend paying managerial firms. Investment of both tax-constrained entrepreneurial firms and dividend paying managerial firms is also affected positively (albeit substantially

[15]Notice that a change in any variable which affects both regime selection as well as investment directly changes both the probability of being in one or another regime (reflected in $\hat{\lambda}_{\ell 0}$ and $\hat{\lambda}_{\ell 1}$) as well as investment directly. This makes any marginal effect of variables determining both regime selection as well as investment fundamentally nonlinear (see Cameron and Trivedi, 2005). For simplicity and greater transparency, we focus on the discussion of direct effects conditional on regime status (i.e., the parameter estimates reported in the tables).

less) by liquid funds. This might reflect the common conjecture that external finance is more costly than internal finance due to some additional agency problems not explicitly modeled here. Income taxes have a negative impact on investment for all types of firms. As hypothesized before, this might be due to some firms' legal form being subject to income taxation.[16]

Compared to income taxes, corporate taxes are more relevant in terms of both size and significance. Corporate taxes affect investment negatively across all types, with the effect being most pronounced for managerial firms where a tax increase of one percentage point leads to a decline in investment by 1.3 percentage points for non-dividend paying managerial firms and by 0.9 percentage points for dividend paying managerial firms.

Compared to corporate taxation, dividend taxes seem to be less important for investment decisions. As expected, the effect of dividend taxation is most pronounced for cash-constrained entrepreneurial firms and non-dividend paying managerial firms with a one percentage point increase in taxes leading to a decline in investment of 0.4 and 0.6 percentage points, respectively. However, there is also evidence for a negative effect of dividend taxation on the investment of tax-constrained entrepreneurial firms and dividend paying managerial firms. Interest rates affect investment negatively for all firms while productivity enters positively across all firm regimes. The the strength of legal rights index representing the strength of bankruptcy laws enters the regression positively as expected but we can not significantly differentiate the coefficient from zero. Investor protection indices seem to be negatively related to investment for dividend paying managerial firms. Finally, the Mills ratios should not be eliminated according to Wald-tests, pointing to endogenous selection effects into different regimes.

Insert Table 5 About Here

In general, the estimation results in Table 5 are aligned to a large extent with the theory outlined in Section 2, especially, with regard to the effect of taxation on investment.

[16]Unfortunately, we are not able to observe if firms are subject to income taxation or corporate taxation. We can observe the national legal form, but only some national legal forms can be uniquely assigned a certain tax regime (e.g. publicly traded incorporations are subject to corporate taxes). In many countries, for legal forms such as limited liability companies a firm can choose if they want to be taxed according to income or corporate taxation. Therefore, we decided to include both income and corporate taxation.

The empirical results point to a statistically significant and economically large effect of corporate taxation, and they indicate that the quantitative impact varies starkly across firm types, suggesting heterogeneous tax sensitivities of corporate profit taxes and dividend taxes that are qualitatively consistent with the hypotheses drawn from the above theoretical model.

5 Inference for Threshold Estimates

Confidence intervals for threshold estimates based on the asymptotic methods developed in Hansen (2000) and extended to models of sample selection by Egger and Erhardt (2015) are asymptotically conservative. The no-rejection set is based on tests of the likelihood ratio statistic for the set of potential threshold variables. In fact, based on these statistics we can not reject any threshold in the domains $A_c \in [0, 1]$ or $A_d \in [0, 1]$. Therefore, we employ bootstrap techniques to construct potentially tighter confidence intervals for the unobserved thresholds. Since the sampling distribution of the likelihood ratio is nonstandard and nonpivotal, standard bootstrap methods will yield inconsistent results. To address this problem, we use a prepivoting strategy developed by Beran (1987, 1988) to create an asymptotic pivot in a first stage. In a second stage, we carry out a further bootstrap sampling to estimate the finite sample distribution of that pivot.[17]

Insert Figure 4 and 5 About Here

As before, we use the set of potential thresholds to test them against the null of being the true minimizing threshold. The null hypothesis is rejected at the α level if the (asymptotically uniformly distributed) test statistic exceeds $1 - \alpha$. The test statistics for A_c and A_d are presented together with a line indicating the 10% confidence level in Figure 4 and Figure 5, respectively. Indeed, we find tighter confidence bands at the 10% level. For the unobserved threshold among entrepreneurial firms, $\hat{A}_c$, the bounds are $[0.0238; 0.1699]$ while for managerial firms the bounds are $[0.0000; 0.0625]$. Both graphs indicate that there might be further thresholds. However, it is not clear how the econometric strategy extends to several thresholds.[18]

[17] See Horowitz (2001) for a detailed description of this bootstrap iteration strategy.

[18] Compare also the discussion in Hansen (2000).

6 Robustness Checks

We conducted several robustness checks to assess the sensitivity of the results obtained in the previous section. We performed robustness checks for three reasons. First, in the main part of the text, we focused on manufacturing firms. The latter seems natural, as the theoretical model suggests financial constraints being related to necessary physical capital investments, which are of lesser importance for services than for goods production. However, in order to see how the results come out when including services producers, we will present one set of results for a larger sample, where goods and services producers are pooled together. Second, in the above analysis, we treated firm-level productivity as an observed rather than an estimated variable. It is common practice in applied economic research to do so, but it deflates the estimated standard errors. We had pursued this strategy in order to be able to present analytical model standard errors. However, in order to assess the sensitivity of the estimates of the parameter variance-covariance matrix, we will present properly jointly bootstrapped results of the full model below. Third, since the confidence set for the unobservable threshold between dividend paying and non-paying managerial firms, A_d, contains 0 we will present results, where we pool these two subsamples together and ignore a possible threshold at A_d. Fourth, legally on could argue that the relevant threshold for a manager shareholder conflict is defined by 25% of shareholder ownership rather than 50%. Therefore, we will present results based on data where we altered that critical level to consider less firms as to be potentially managerial in order to see whether this changes our main results.

Considering both manufacturing and services firms:
Results are presented in Table 6 and are qualitatively in line with the sample of manufacturing firms. As expected, in this enlarged sample, tax sensitivities of investment seem to be less pronounced, pointing to a less precisely measured dependent variable. The investment proxy used in the empirical analysis measures investment in fixed assets such as machinery rather than other 'soft' investment that might be more relevant for service firms, for example. Thus, it is not surprising that the tax sensitivities are smaller taking into account firms with investments that are less likely to be captured by our investment proxy.

Insert Table 6 About Here

Considering firm-level total factor productivity as an estimated regressor:
A second concern is the fact that we include productivity in our analysis which is estimated itself and might add additional variation in the disturbance term. Therefore, we report bootstrapped standard errors in Table 7 where we take into account the estimation of productivity in a preceding stage.[19] Standard errors are only slightly higher for this specification and the main results remain valid. Only some institutional characteristics can no longer be considered significant.

Insert Table 7 About Here

Disregarding the unobservable threshold A_d:
We conduct a third robustness check where we do not impose an endogenous threshold for managerial firms, given that the threshold estimate is less accurate than the threshold estimate for entrepreneurial firms. The corresponding results are presented in Table 8 and can be interpreted in the light of differences in tax sensitivities of the average managerial firm as compared to entrepreneurial firms. Corporate taxation seems to be more relevant for managerial firms than for entrepreneurial firms while for dividend taxation it seems to be reversed. Liquid funds seem to be relevant for managerial firms. However, managerial investment is less sensitive to an increase in the cash ratio than a cash-constrained entrepreneurial firm as hypothesized in the theoretical framework.

Insert Table 8 About Here

Altering the definition of managerial firms:
Before, we have defined a managerial firm to have a dispersed ownership structure with no shareholder having more than 50% of the shares. Strengthening this condition to define dispersed ownership such that no shareholder has more than 25% of shares naturally leads to a smaller subsample of managerial firms. Results for this analysis are presented in Table 9. Interestingly, the threshold for entrepreneurial firms remains at the same level underlining its robustness to different specifications. The main difference between the results seems to lie in the effect of dividend taxation which no longer enters significantly.

[19]Since productivity is estimated using the panel structure of the data, we block bootstrap the panel dataset and construct the cross section for the following steps from the respective (block) bootstrap sample.

As expected from our theory, the effects of dividend taxation are more pronounced for cash-constrained entrepreneurial firms and non-dividend paying managerial firms. Corporate taxation remains more relevant for managerial firms and, among those, even more so for non-dividend paying managerial firms.

Insert Table 9 About Here

The robustness checks confirm the consistency of the main results, especially, with respect to the effects of taxation. The negative effects of corporate taxation on firm-level investment and its heterogeneous magnitude are confirmed throughout the analysis. Furthermore, we find evidence that dividend taxes have a negative impact on investment especially for cash-constrained entrepreneurial firms and non-dividend paying managerial firms. In general, the effects of dividend taxes are less pronounced than the effects of corporate taxes. This might be due to several reasons: first, dividends can be substituted by wages for entrepreneurial firms; second, dividends can easily be smoothed across years thereby weakening their impact on a given years investment decision; and third, dividend taxes vary at the country level only, potentially leading to less accurate point estimates.

7 Conclusion

This paper sets up a theoretical model explaining the heterogeneous investment response of firms in different financial regimes. Our theoretical model postulates that small entrepreneurial firms are dependent on external credit and those with little own assets are most likely to be credit constrained and do not pay dividends. Larger firms with more own funds could invest at first-best levels but end up debt constrained due to the tax advantage of debt. When own funds are larger, entrepreneurs prefer to divest and sell to external investors who require a lower rate of return. Investors hire a manager and install a board to provide oversight and control and reduce unproductive self-serving investments by managers. Managers and shareholders have conflicting interests on the use of internal funds which may be allocated to finance productive investments, self-serving projects in the interest of managers, and paying dividends to shareholders. Managerial firms with relatively little own cash do not pay dividends and, since managers divert part of the resources, cannot fully exploit productive investment opportunities to the benefit

of shareholders. Large cash-rich managerial firms invest at unconstrained levels while the manager shareholder conflict over residual funds is over dividend payments versus retained earnings to finance less productive projects in the interest of managers. Due to these varying agency problems inherent to different types of firms, the model predicts heterogeneous investment sensitivities with respect to corporate and dividend taxes, own funds and institutional variables that affect the self-serving behavior of entrepreneurs and managers.

The empirical analysis employs a sample splitting method to allocate a cross section of 44,863 European firms to the four regime types identified in the theoretical model. We estimate the differential impact of taxes on investment across these types and find that the empirical analysis confirms the heterogeneous sensitivity of investment to different taxes across firms pointing to important policy implications: For all types of firms, corporate taxes are more relevant than dividend taxes, but managerial firms are more sensitive to corporate taxation than entrepreneurial firms. Dividend taxes are especially harmful for non-dividend paying managerial firms and cash-constrained entrepreneurial firms.

8 Appendix: Credit Constrained Investment

For an analytical solution, maximize V^E s.t. (2), $B = (1-e\tau)\,I - (A-D)$, i.e. the marginal source of finance is external debt, and the constraint (6): $V^E = \max_{I,D}$

$$(1-t_D)\left[D + \frac{D_1}{1+r}\right] + \lambda \cdot \frac{(1-\tau)\,\theta f(I) + (1-e\tau)\,I - (1+(1-\tau)\,r)\,B - \phi I}{1+r}. \quad \text{(A.1)}$$

Optimality with respect to I and $D \geqslant \bar{D}/(1-t_D)$ requires

$$\begin{aligned} \frac{dV^E}{dI} &= \frac{(1-t_D+\lambda)\,(1-\tau)\,[\theta f' - (1-e\tau)\,r] - \lambda\phi}{1+r} = 0, \quad \text{(A.2)} \\ \frac{dV^E}{dD} &= \frac{(1-t_D)\,\tau r - \lambda\,[1+(1-\tau)\,r]}{1+r} \leq 0. \end{aligned}$$

Firms differ by own assets, generating first period earnings A. There are two regimes.

First, if $dV^E/dD\big|_{D=\bar{D}/(1-t_D)} < 0$, the firm sets the lowest level of dividends to maximize internal financing. The shadow price is large, indicating a tight constraint. For cash-poor firms, the financing constraint binds even if dividends are cut to a minimum. Substituting $B = (1-e\tau)\,I - A + D$ and $D = \bar{D}/(1-t_D)$, the constraint implicitly determines investment. Given I, condition (i) above yields λ.

The second regime applies when firms are cash-rich and pay debt financed dividends $D > \bar{D}/(1-t_D)$ to exploit the tax advantage of debt. The second condition above gives λ, which is used in condition (i) to yield

$$\lambda = \frac{\tau r \cdot (1-t_D)}{1+(1-\tau)\, r} > 0, \quad \theta f'(I_n) - (1-e\tau)\, r = \frac{\tau}{1-\tau}\frac{r\phi}{1+r} > 0. \tag{A.3}$$

Investment is independent of own funds. Given I_n, the constraint implies a level of debt B which, in turn, yields dividends $D = A + B - (1-e\tau)\, I$. In the absence of tax, the firm invests at the first best level noted in (5). There is no preference for external debt over retained earnings so that dividends are not determined.

Due to the tax preference of external debt, the firm ends up always constrained, $\lambda > 0$, and earns an excess return on investment, $\theta f'(I) > (1-e\tau)\, r$. To exploit the tax advantage in the first best, where I^* is given by $\theta f'(I^*) = (1-e\tau)\, r$, the firm pays out all earnings as dividends, $D = A$, and finances investment entirely with external debt, $B = (1-e\tau)\, I^*$. With zero retained earnings, the financing constraint is violated, see Assumption 1, yielding the constrained solution in (A.3). The constraint in (6) introduces a trade-off between investment and dividends, $\partial I/\partial D = -R/k$, see (7).[20] Noting the partial effects on firm value in (4), the firm raises dividends and reduces investment until firm value is maximized, $\frac{dV^E}{dD} = \frac{\partial V^E}{\partial D} + \frac{\partial V^E}{\partial I}\frac{\partial I}{\partial D} = 0$. It becomes optimal to cut investment below the first best level I^* and, instead, use external debt to pay out more dividends. We call this a 'tax constrained' as opposed to the 'cash-constrained' regime. Substituting partial derivatives and using k yields (A.3) again.

Due to the tax preference for debt, entrepreneurial firms are always constrained. Cash constrained firms do not pay dividends while firms with more own funds are able to raise more external debt and pay dividends to exploit the tax advantage of debt. To separate cash-constrained and tax-constrained firms, set $D = \bar{D}/(1-t_D)$ and investment I_n as in (A.3) to obtain the threshold value A_c from (6).

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Figure 1: Entrepreneurial investment.

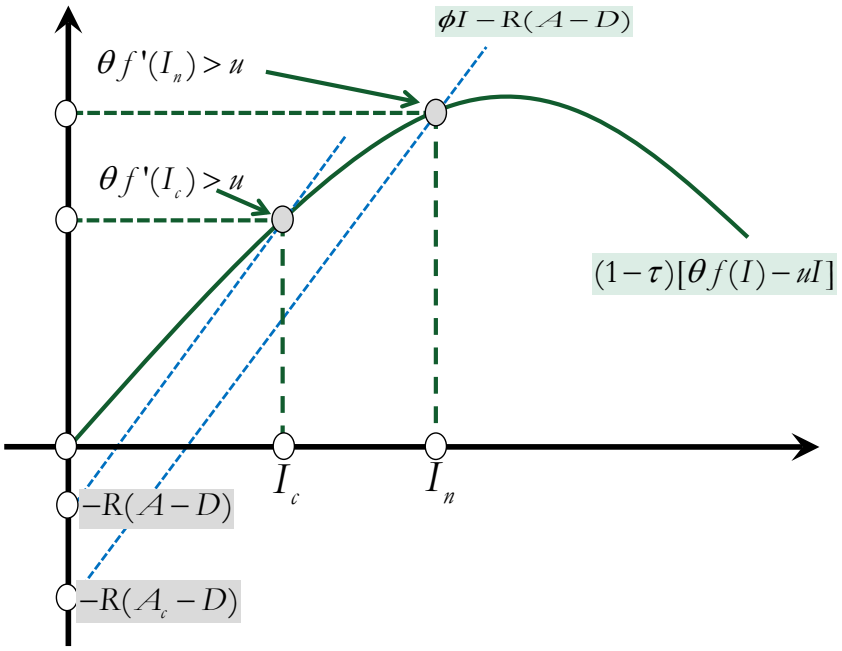

Figure 2: Firm investment in the cross-section.

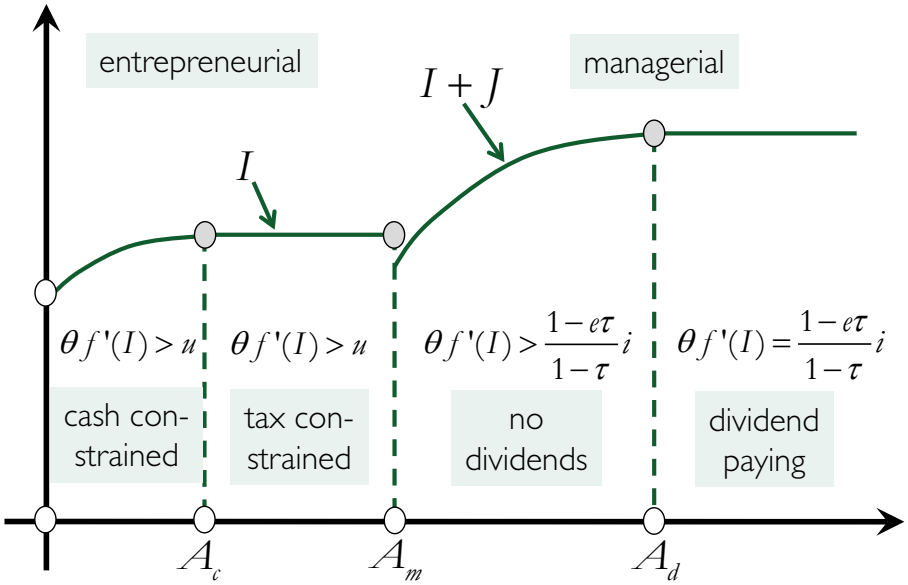

Figure 3: Firm values in the cross-section.

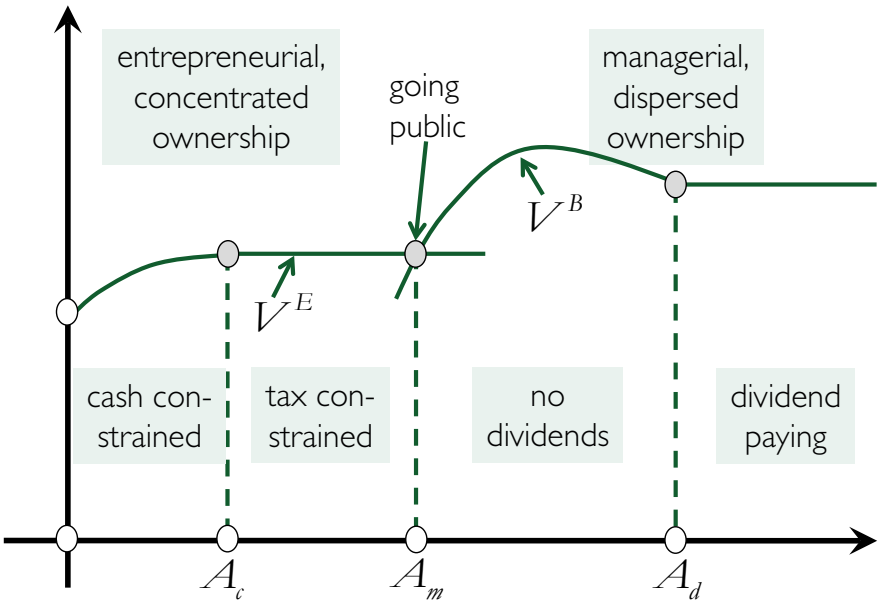

Figure 4: Confidence interval construction for A_c based on bootstrap iteration.

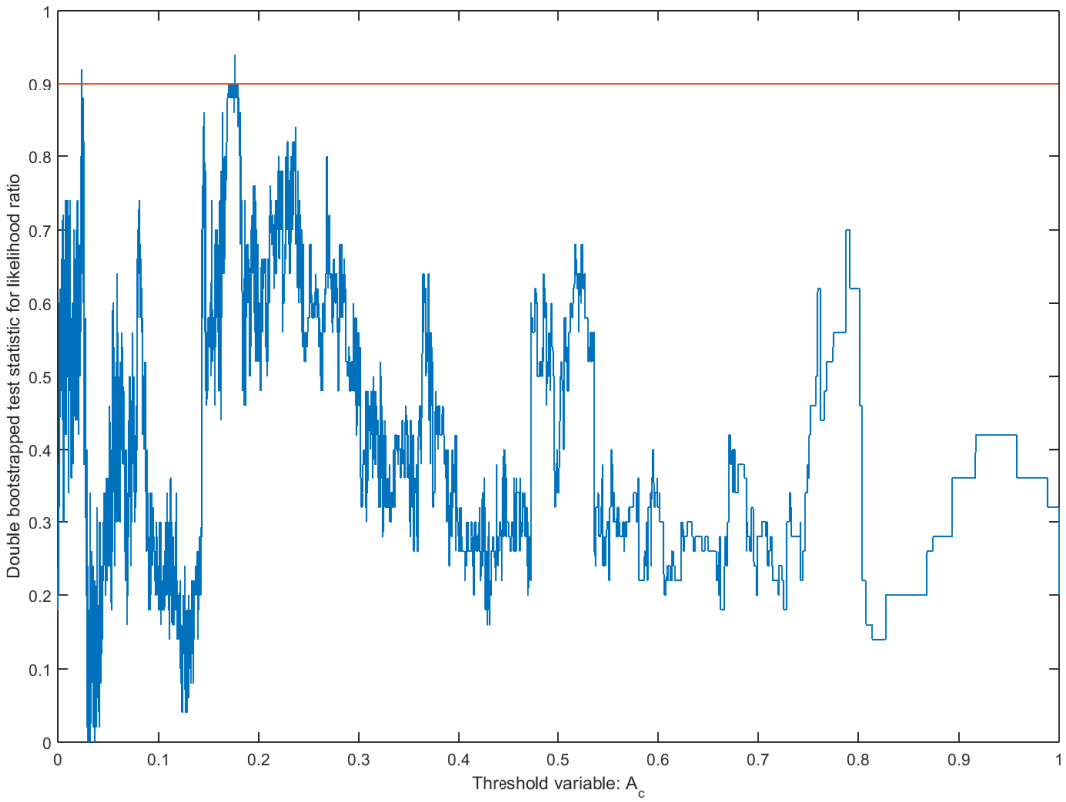

Figure 5: Confidence interval construction for A_d based on bootstrap iteration.

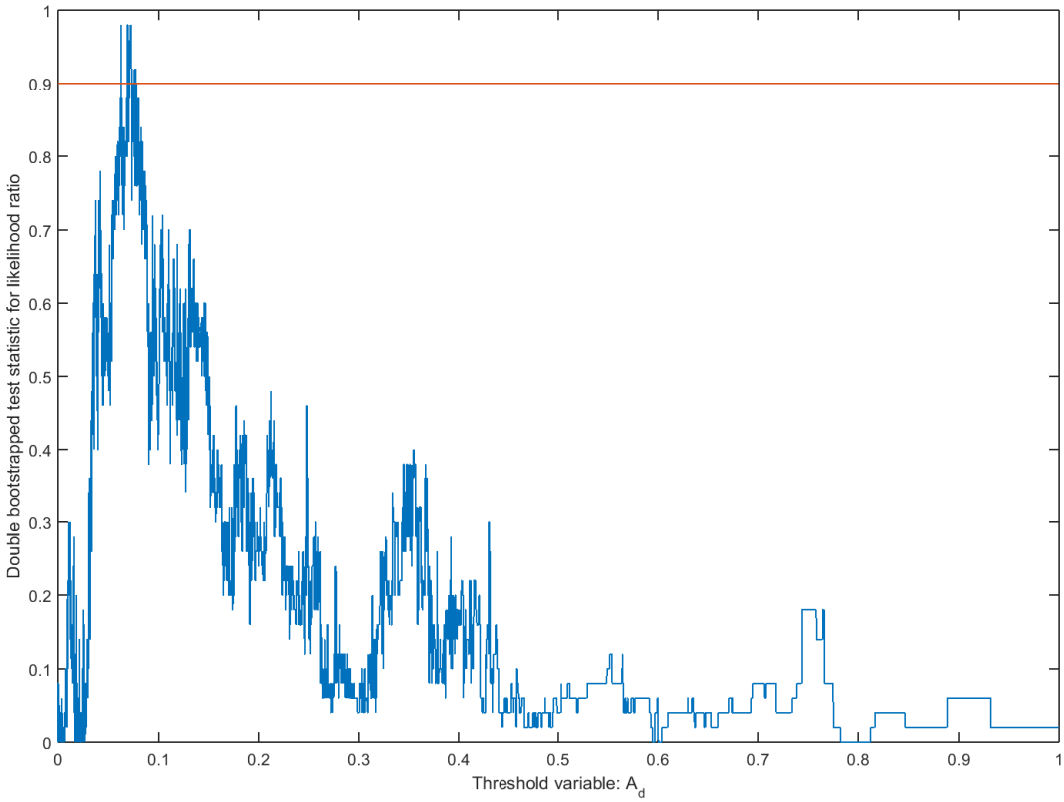

Table 1: Comparative Static Effects of Drivers of Intensive Investment.

		Entrepreneurial Firms		Managerial Firms			
		Cash con.	Tax con.	No Div.		Div.	
Independent Variables		(7)	(8)	I: (18)	I+J	I: (20)	I+J
Tax credit	e	+	+	+	+	+	+
Corp. tax rate *)	τ	–	–	–	+	–	–
Div. tax rate	t_D	–	0	–	0	0	+
Interest entr. firms	r	–	–				
Interest man. firms	i			0	0	–	–
Firm productivity	θ	+	+	+	0	+	+
Own funds	A	+	0	+	+	0	0
Accounting standards	$1/\phi$	+	+				
Investor protection	q			+	0	0	–
Management share	α			+	0	0	–

*) The effects of τ hold at least for small e.

Table 2: Summary statistics

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Investment	0.229	0.219	0	1
Cash ratio	0.091	0.118	0	1
Corporate tax	0.224	0.069	-0.013	0.355
Interest rate	0.022	0.023	0	0.678
log(Productivity)	7.432	0.688	2.864	13.978
Concentrated ownership	0.633	0.482	0	1
N	44863			

Table 3: Country level variables

Country	**N**	**Income tax**	**Dividend tax**	**Legal rights**	**Investor protection**
AUT	203	0.39	0.25	7.00	5.00
BEL	405	0.42	0.05	6.00	7.00
BGR	513	0.09	0.00	9.00	6.00
CHE	15	0.36	0.35	8.00	3.00
CZE	1577	0.15	0.15	6.00	5.00
DEU	4150	0.47	0.05	7.00	5.00
DNK	4	0.59	0.28	9.00	6.30
ESP	7140	0.43	0.00	6.00	5.00
FIN	472	0.40	0.00	8.00	5.70
FRA	3531	0.39	0.05	7.00	5.30
GBR	1585	0.35	0.00	10.00	8.00
GRC	14	0.40	0.17	4.00	4.70
HRV	3	0.45	0.00	7.00	3.30
HUN	82	0.30	0.00	7.00	4.30
IRL	65	0.42	0.00	9.00	8.30
ITA	18149	0.45	0.05	3.00	6.00
LUX	13	0.39	0.15	4.00	4.30
LVA	11	0.19	0.00	10.00	5.70
NLD	11	0.52	0.00	6.00	4.70
POL	785	0.38	0.19	9.00	6.00
ROM	3539	0.13	0.10	9.00	6.00
SRB	533	0.10	0.00	7.00	5.30
SVN	1154	0.35	0.00	4.00	7.30
SWE	897	0.43	0.00	8.00	6.30
TUR	12	0.35	0.00	4.00	5.70
Total	44863	0.39	0.05	5.45	5.76

Table 4: First Stage: Probit regression.

Dependent Variable: Concentrated Ownership = 1		
Cash ratio	-0.3958***	(0.0543)
Income tax	-0.1167	(0.1639)
Corporate tax	-1.1952***	(0.2125)
Dividend tax	-1.7282***	(0.2997)
Interest rate	-1.1410***	(0.2837)
log(Productivity)	0.0655***	(0.0163)
Legal rights	0.0567***	(0.0073)
Investor protection	-0.0028	(0.0114)
Age	-0.0071***	(0.0006)
Age^2	0.0000***	(0.0000)
log(Employees)	-0.0369***	(0.0082)
log(Total Assets)	0.0613***	(0.0068)
Constant	-0.4115**	(0.1667)
Country controls	yes	
N	44863	

Notes: Standard errors in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% test levels, respectively.

Table 5: Threshold regression results.

	Entrepreneurial firms		Managerial firms	
Investment	Cash-constr.	Tax-constr.	No dividends	Dividends
Variable	Coeff.	Coeff.	Coeff.	Coeff.
Cash ratio	1.6769***	0.1722***	2.2990***	0.2392***
	(0.2249)	(0.0145)	(0.5691)	(0.0175)
Income tax	-0.1714***	-0.1357***	-0.1374	-0.1666***
	(0.0505)	(0.0382)	(0.0933)	(0.0536)
Corporate tax	-0.8818***	-0.8238***	-1.2513***	-0.9349***
	(0.0693)	(0.0556)	(0.1061)	(0.0724)
Dividend tax	-0.4010***	-0.2074***	-0.6069***	-0.2041**
	(0.0855)	(0.0678)	(0.1695)	(0.0955)
Interest rate	-0.5508***	-0.2628***	-0.7062***	-0.2541***
	(0.1077)	(0.0704)	(0.1818)	(0.0927)
log(Productivity)	0.0184***	0.0210***	0.0276***	0.0174***
	(0.0039)	(0.0035)	(0.0063)	(0.0044)
Legal environment	0.0023	0.0009		
	(0.0019)	(0.0017)		
Investor protection			-0.0057	-0.0083**
			(0.0068)	(0.0041)
Constant	0.1965***		0.1513***	
	(0.0339)		(0.0467)	
Mills ratio	-0.0281		0.1042***	
	(0.0244)		(0.0250)	
Country controls	yes	yes	yes	yes
Threshold	0.0300		0.0181	0.0181
N	44863			

Notes: Standard errors in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% test levels, respectively.

Table 6: Robustness: All firms.

	Entrepreneurial firms		Managerial firms	
Investment	Cash-constr.	Tax-constr.	No dividends	Dividends
Variable	Coeff.	Coeff.	Coeff.	Coeff.
Cash ratio	0.9912***	0.1237***	0.7137***	0.1435***
	(0.0368)	(0.0075)	(0.0352)	(0.0122)
Income tax	-0.1261***	-0.2074***	-0.0467	-0.2393***
	(0.0255)	(0.0271)	(0.0376)	(0.0454)
Corporate tax	-0.5156***	-0.4545***	-0.6466***	-0.3192***
	(0.0264)	(0.0304)	(0.0366)	(0.0468)
Dividend tax	-0.1037**	0.0220	-0.2038***	-0.0815
	(0.0428)	(0.0467)	(0.0715)	(0.0826)
Interest rate	-0.3048***	-0.1403***	-0.4897***	-0.2436***
	(0.0397)	(0.0363)	(0.0631)	(0.0661)
log(Productivity)	0.0131***	0.0217***	0.0202***	0.0277***
	(0.0016)	(0.0019)	(0.0025)	(0.0030)
Legal environment	-0.0013	-0.0020*		
	(0.0010)	(0.0012)		
Investor protection			-0.0053**	-0.0054*
			(0.0027)	(0.0033)
Constant	0.2633***		0.0154	
	(0.0197)		(0.0280)	
Mills ratio	-0.2005***		0.2471***	
	(0.0201)		(0.0128)	
Country controls	yes	yes	yes	yes
Threshold	0.0831		0.1140	
N	184940			

Notes: Standard errors in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% test levels, respectively.

Table 7: Manufacturing firms baseline regression with bootstrapped standard errors.

	Entrepreneurial firms		Managerial firms	
Investment	Cash-constr.	Tax-constr.	No dividends	Dividends
Variable	Coeff.	Coeff.	Coeff.	Coeff.
Cash ratio	1.6769***	0.1722***	2.2990***	0.2392***
	(0.2850)	(0.0203)	(0.7947)	(0.0549)
Income tax	-0.1714***	-0.1357***	-0.1374	-0.1666*
	(0.0485)	(0.0452)	(0.0883)	(0.0873)
Corporate tax	-0.8818***	-0.8238***	-1.2513***	-0.9349***
	(0.0814)	(0.0656)	(0.1653)	(0.1665)
Dividend tax	-0.4010***	-0.2074***	-0.6069**	-0.2041*
	(0.0664)	(0.0743)	(0.2740)	(0.1171)
Interest rate	-0.5508***	-0.2628***	-0.7062***	-0.2541
	(0.1416)	(0.1015)	(0.2007)	(0.1998)
log(Productivity)	0.0184***	0.0210***	0.0276***	0.0174**
	(0.0044)	(0.0034)	(0.0087)	(0.0071)
Legal environment	0.0023	0.0009		
	(0.0021)	(0.0018)		
Investor protection			-0.0057	-0.0083
			(0.0070)	(0.0082)
Constant	0.1965***		0.1513**	
	(0.0424)		(0.0661)	
Mills ratio	-0.0281		0.1042**	
	(0.0450)		(0.0410)	
Country controls	yes	yes	yes	yes
Threshold	0.0300		0.0181	
N	44863			

Notes: Standard errors in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% test levels, respectively.

Table 8: Threshold regression results with three regimes.

	Entrepreneurial firms		Managerial firms
Investment	Cash-constr.	Tax-constr.	
Variable	Coeff.	Coeff.	Coeff.
Cash ratio	1.6769***	0.1722***	0.3340***
	(0.2249)	(0.0145)	(0.0167)
Income tax	-0.1714***	-0.1357***	-0.1512***
	(0.0505)	(0.0382)	(0.0470)
Corporate tax	-0.8818***	-0.8238***	-0.9594***
	(0.0693)	(0.0556)	(0.0635)
Dividend tax	-0.4010***	-0.2074***	-0.1598*
	(0.0855)	(0.0678)	(0.0915)
Interest rate	-0.5508***	-0.2628***	-0.3504***
	(0.1077)	(0.0704)	(0.0841)
log(Productivity)	0.0184***	0.0210***	0.0184***
	(0.0039)	(0.0035)	(0.0040)
Legal environment	0.0023	0.0009	
	(0.0019)	(0.0017)	
Investor protection			-0.0091***
			(0.0036)
Constant	0.1965***		0.0917*
	(0.0339)		(0.0479)
Mills ratio	-0.0281		0.1351***
	(0.0244)		(0.0246)
Country controls	yes	yes	yes
Threshold	0.0300		
N	44863		

Notes: Standard errors in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% test levels, respectively.

Table 9: Robustness: Ownership cutoff for managerial firms at 25%.

	Entrepreneurial firms		Managerial firms	
Investment	Cash-constr.	Tax-constr.	No dividends	Dividends
Variable	Coeff.	Coeff.	Coeff.	Coeff.
Cash ratio	1.6481***	0.2159***	0.3611***	-0.0165
	(0.1826)	(0.0194)	(0.0505)	(0.4391)
Income tax	-0.2087***	-0.2054***	-0.3302**	-4.2828***
	(0.0667)	(0.0584)	(0.1371)	(3.7638)
Corporate tax	-0.6325***	-0.5734***	-0.7625***	-4.4102***
	(0.0913)	(0.0820)	(0.1976)	(1.4060)
Dividend tax	-0.1425	0.0501	-0.1352	0.3908
	(0.1116)	(0.1036)	(0.2134)	(2.3375)
Interest rate	-0.6044***	-0.2505**	-0.6479**	-17.0780***
	(0.1221)	(0.1005)	(0.2603)	(3.5165)
log(Productivity)	0.0464***	0.0471***	0.0503***	0.0711
	(0.0054)	(0.0052)	(0.0125)	(0.0612)
Legal environment	0.0020	0.0008		
	(0.0026)	(0.0024)		
Investor protection			-0.0119	-0.2584
			(0.0091)	(0.2489)
Constant	0.0011		-0.3576**	
	(0.0504)		(0.1773)	
Mills ratio	-0.8760***		0.1971***	
	(0.0689)		(0.0374)	
Country controls	yes	yes	yes	yes
Threshold	0.0300		0.4994	
N	46268			

Notes: Standard errors in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% test levels, respectively.