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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. This paper introduces a stylized theoretical framework to account for such differences and to explain the heterogeneous tax sensitivity of firm-level investments across firm types. We econometrically test the theoretical predictions, taking account of selection of firms into different regimes. 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.

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1 Introduction

Firms differ along several important dimensions: by age and own funds (young and mature), R&D intensity (innovative and less innovative), ownership structure (concentrated and dispersed), types of governance, and other characteristics. These 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 funds 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 funds and current profits), young and innovative firms 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., the personal income-tax level and progressivity, and profit-tax rates). Financially constrained firms earn an excess return on capital and tend not to respond to user-costs of capital. Taxes affect investment not via the user-costs 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-costs of capital, reflecting both personal income (dividend) and profit taxes, should become a more important determinant of investment for such firms relative to smaller ones.

At some point, the entrepreneur will wish to sell out to diversify her wealth, and the firm may become public. For that reason, 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 even more internal funds are available, firms pay dividends. In large, dividend-paying firms, investment depends on the user-costs of capital, while dividend payouts are driven by institutional and corporate-governance variables.

Empirical research on the tax determinants of investment falls in three 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-costs of capital. Hassett and Hubbard (2002) review the empirical literature and report estimates of investment elasticities with respect to the user-costs in the range between -0.5 and -1.0. Auerbach and Hassett (2003) show how the effects 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 et al. (1991) report elasticities of physical capital investment to cash-flow of around 0.4-0.5. Es-

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

timates 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. (2012, 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 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 funds, R&D intensity and ownership structure, firms respond in different ways to personal and corporate income 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 across firm types to effective (personal, corporate, and dividend) income taxation empirically. We make use of accounting information from a large data-set on individual firms. This data-set provides information on the profits, sales, financial assets, intangible assets (as a measure of R&D intensity), and owner structure of thousands of firms in a set of European countries. In conjunction with detailed information on those countries, we are able to determine the hypothetical first-best user-costs of capital per firm. Moreover, we will be able to assess to which extent the user-costs of capital matter more or less depending on the financial constraints firms face. The empirical approach unifies two features: (i) a flexible impact of taxes and costs of capital on firm-level investment, and (ii) the potential endogeneity of effective taxes due to the choice of the firm type (entrepreneurial versus managerial firms, and dividend payments or not, etc.). One merit of this approach is to determine empirically the susceptibility of investments across firms in terms of observable characteristics with special emphasis on the personal and corporate tax system.

The empirical analysis largely confirms theoretical predictions. In small entrepreneurial firms that are subject to credit rationing, investment depends positively and significantly on own cash-flow and on investor protection restraining the potential diversion of funds by entrepreneurs. For instance, a marginal increase of the cashflow ratio of cash-constrained firms raises investment of those firms by about 1.3 percent. A marginal increase in investor protection raises investment by such firms by about 0.3 percent. These variables lose power when firms are endowed with more own funds. Taxes negatively affect investment. With a semi-elasticity of about -2.6, the personal income tax is most relevant for small, cash-constrained entrepreneurial firms, while larger entrepreneurial firms are most negatively affected by the corporate tax (at a semi-elasticity of about -8.1). With non-dividend-paying managerial firms, investment is most negatively affected by the corporate tax (at a semi-elasticity of about -6.8) which becomes less important once firms start paying dividends (at a semi-elasticity of about -3.2). Dividend taxes mainly affect the extensive margin of investment. Institutional characteristics such as investor protection and accounting standards are important determinants of investment as well.

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, Section 5 reports on robustness checks, and 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 do not have an independent board that represents shareholder interests and, therefore, do not have 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] For predictions regarding a cross section of firms, 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 setting up a board and hire a manager which reduces the value to owners. Given this trade-off, smaller firms with limited own funds 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, yielding an unexploited excess-return on capital. 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, and corporate tax liabilities are T and T_1, respectively. 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 tax bases are $T \equiv -eI$ and $T_1 \equiv \theta f(I) + eI - rB$. For simplicity, we do not model any current taxable earnings in period 0 so that T is negative. In period 1, we need to

[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.

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 own funds,

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

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

First-Best: Using $B = D - A + (1 - e\tau) I$ in D_1, 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-costs of capital,[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 external debt which is limited to $B \leq (1 - e\tau) I$, or $D \leq A$.

Financing Constraint: We follow Ellul et al. (2010, 2012) for a simple way of modeling credit constraints. In period 1, investment and financing (I, B, and D) are predetermined. 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

[3]If interest on debt were not deductible, $T_1 = \theta f (I) + eI$, the user-costs 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-costs, $u < r$, as often happens in reality for 100% debt financing (at the margin).

$\phi' I$ 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 a small cost of diversion, she will never benefit from diverting minor amounts, since her total income $\pi_1 + \phi' I = \theta f + I - \tau T_1 - (1+r) B$ (prior to getting a return on equity) would not be affected by it.

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 do not add to final wealth, the entrepreneur is clearly better off by 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. Using $R \equiv 1 + (1-\tau) r$, this leaves the no-diversion constraint to be

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

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, $(1-\tau)\left[\theta f(I^*) - (1-e\tau) rI^*\right] < \phi I^*$.*

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]

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

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 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 About 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 does not 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:

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

see the discussion of (A.3) and the illustration in Figure 1. Since the financing constraint becomes binding only for tax reasons, while the firm would be unconstrained in the

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

absence of tax, we call this regime *tax-constrained* as opposed to the *cash-constrained* one. Investment of a tax-constrained entrepreneurial firm changes by

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

Results are as expected. A constant dividend tax rate has no impact any more, since it does not 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 About Here

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

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

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, $R(A-D) = \phi I - (1-\tau)(\theta f(I) - uI)$, and thereby the maximum level of external debt, $B = (1-e\tau)I - (A-D)$. Hence, both investment and external debt, I and B, are independent of A so that current dividends $D = A + B - (1-e\tau)I$ rise one to one with own funds, while dividends in the subsequent period 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 this relationship. There is a cut-off value A_c such that firms with $A < A_c$ are cash-constrained and do not pay dividends, while 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 own funds.

Insert Figure 3 About 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 (the firm is cash-rich), 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. Such firms do not pay dividends, not because of a shortage of own funds but rather because of managers' 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 initial-period financial identity $(1-e\tau)(J+I)=A-D$. In the subsequent 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 $V=(1-t_D)\left[D+D_1/(1+i)\right]$, 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 $V=(1-t_D)\left[(1-\tau)\,\theta f(I)-(1-e\tau)\,i\,(I+J)\right]/(1+i)$.

Managers decide on investment and dividend policy. Part J of total investment spending does not 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 (at dividend-share α) to realign manager and shareholder interests. Firm value is divided among managers and shareholders (superscripts M and B),[5]

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

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.

[5] We also introduce $V^*=V^M+V^B$.

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 scenario, there is no diversion of funds. Investment exclusively depends on the user-costs of capital.

If managers are not wealth-constrained, the first-best solution 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 scenario 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 are 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 $J = (A - D) / (1 - e\tau) - I$,

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

The trade-off is in paying out funds to investors or retaining for investment and managerial perks.[6] Optimality requires

$$\frac{dV^M}{dI} = \frac{(1-t_D)\,\alpha\,(1-\tau)\,\theta f'(I) - g'(J)/q}{1+i} = 0, \tag{16}$$

$$\frac{dV^M}{dD} = \frac{(1-t_D)\,\alpha\,(1-e\tau)\,i - g'(J)/q}{(1-e\tau)\,(1+i)} \leq 0. \tag{17}$$

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

$$(1-t_D)\,(1-\tau)\,\alpha \cdot \theta f'(I) = g'(J)/q, \quad J = \frac{A}{1-e\tau} - I. \tag{18}$$

This condition implicitly determines productive investment I and, in turn, yields J. Investment no longer depends on user-costs 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[7]

$$\begin{aligned} dI &= \frac{-g''}{(1-e\tau)\,q\nabla} \cdot dA + \frac{g'}{q\theta\nabla} \cdot d\theta + \frac{g'}{q\alpha\nabla} \cdot d\alpha + \frac{g'}{q^2\nabla} \cdot dq \\ &: \ -\frac{(1-\tau)\,\alpha\theta f'}{\nabla} \cdot dt_D - \frac{(1-t_D)\,\alpha\theta f'}{\nabla} \cdot d\tau + \frac{-g''}{q\nabla}\frac{I+J}{1-e\tau}\,(e \cdot d\tau + \tau \cdot de). \end{aligned} \tag{19}$$

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 firm-level productivity reduce firm value relative to the value of private benefits and

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

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

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

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

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

$$(i) : \theta f'\left(I\right) = \frac{1-e\tau}{1-\tau} i, \quad (ii) : \left(1-t_D\right)\left(1-e\tau\right)\alpha i = \frac{g'\left(J\right)}{q}. \tag{20}$$

The manager productively invests I as in (i) and diverts J as in (ii) which, in turn, yields residual dividends $D = A - \left(1-e\tau\right)\left(I+J\right)$. Cash-rich firms choose productive investment to maximize firm value so that the return on investment is equal to the user-costs 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

$$\begin{aligned}
dI &= \frac{f'}{-\theta f''} \cdot d\theta - \frac{f'}{-if''} \cdot di + \frac{\tau}{1-\tau} \frac{i}{-\theta f''} \cdot de - \frac{1-e}{\left(1-\tau\right)^2} \frac{i}{-\theta f''} \cdot d\tau, \qquad (21)\\
dJ &= -\frac{g'}{-ig''} di - \frac{g'}{-g''}\left[\frac{dq}{q} + \frac{d\alpha}{\alpha}\right] + \frac{g'}{-g''}\frac{dt_D}{1-t_D} + \frac{g'}{-g''}\left(e\frac{d\tau}{1-e\tau} + \tau\frac{de}{1-e\tau}\right),\\
d\left(I+J\right) &= \frac{f'}{-\theta f''} d\theta - \left[\frac{f'}{-if''} + \frac{g'}{-ig''}\right] di - \frac{g'}{-g''}\left[\frac{dq}{q} + \frac{d\alpha}{\alpha}\right]\\
&: +\frac{g'}{-g''}\frac{dt_D}{1-t_D} + \left[\frac{f'}{-f''} + \frac{g'}{-g''}\right]\tau\frac{de}{1-e\tau} - \left(\frac{1-e}{1-\tau}\frac{f'}{-f''} - e\frac{g'}{-g''}\right)\frac{d\tau}{1-e\tau}.
\end{aligned}$$

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

$$\begin{aligned}
dD &= dA - \left(1-e\tau\right)\frac{f'}{-\theta f''} \cdot d\theta + \left(1-e\tau\right)\frac{g'}{-g''} \cdot \left[\frac{dq}{q} + \frac{d\alpha}{\alpha}\right]\\
&: +\left(1-e\tau\right)\left[\frac{f'}{-if''} + \frac{g'}{-ig''}\right] \cdot di - \left(1-e\tau\right)\frac{g'}{-g''} \cdot \frac{dt_D}{1-t_D} \qquad (22)\\
&: +\left[\left(I+J\right)e + \frac{1-e}{1-\tau}\frac{f'}{-f''} - e\frac{g'}{-g''}\right] \cdot d\tau + \left[I+J - \frac{f'}{-f''} - \frac{g'}{-g''}\right]\tau \cdot de.
\end{aligned}$$

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

Firm Values: In the interior regime the firm pays dividends, $D = A - (1 - e\tau)(I + J) > 0$, see (20). 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

$$\begin{aligned} \text{corner} &: \frac{dV}{dA} = \frac{(1 - t_D)(1 - \tau)\left[\theta f'(I)\frac{dI}{dA} - \frac{1-e\tau}{1-\tau} i \frac{dI+dJ}{dA}\right]}{1 + i} \gtrless 0, \\ \text{interior} &: \frac{dV}{dA} = 0. \end{aligned} \tag{23}$$

Cash-poor firms (low A) do not pay dividends. Investment rises less than proportionally with A, $0 < \frac{dI}{dA} < 1$, since managers divert some funds to unproductive uses that mainly serve managerial benefits. Hence, $J = A - I$ also rises. The marginal returns f' and g' shrink until (17) holds with equality, moving the firm to the interior regime. For low own funds, 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 towards the interior regime, $\theta f'(I) \to \frac{1-e\tau}{1-\tau} i$, firm value starts to decline, $dV/dA < 0$, even though the manager's objective still rises, since she derives private benefits from perks at the expense of owners. 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 own funds near the cut-off, i.e., $\theta f' \to \frac{1-e\tau}{1-\tau} i$ 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 Sections of Firms

In a cross section of firms, entrepreneurial and managerial firms coexist with further distinctions within each regime, giving four types in total. In a life-cycle interpretation, firms start out entrepreneurial with concentrated ownership. (i) Those with low own

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.

funds 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 do not pay dividends. They retain all profits for internal financing and, due to a 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 cut-off values of own funds by $A_c < A_m < A_d$, Figures 2 and 3 illustrate.

The thresholds in own-funds (A_i-)space separating the four types of firms are endogenously determined and give rise to extensive investment responses. The prime benefit of managerial firms is access to cheaper funds with a lower return i required by investors. The lower is the required return, the larger is the value of the firm which shifts up the schedule V^B in Figure 3 and moves the cut-off A_m to the left. It could thus be that the tax-constrained regime of entrepreneurial firms disappears.

3 Empirical Framework

3.1 Data Description

The empirical analysis in this study employs data from five 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, the subnational location, main industry affiliation, incorporation, status and legal form of companies in 40 European countries between the years 2000 and 2013. Second, data on accounting standards (Disclosure Index) as well as investor protection (Investor Protection Index) are taken from the World Bank's Doing Business 2013 Report. Finally, the paper utilizes detailed data from Bösenberg et al. (2014a) on the taxation of corporate profits, from Bösenberg et al. (2014b) on the taxation of dividends and from Egger et al. (2013) on the taxation of personal income across countries and time. Finally, the combined data-set consists of 42017 firms. We describe features of these data in the remainder of this subsection.

3.1.1 Company Balance-sheet Data

The company data include information of the following kind. First of all, key dependent variables to the empirical analysis at the firm level are investments and the value of the firm. Since the theoretical model discerns managerial and entrepreneurial companies, data on ownership shares and paid-out dividends are important bits of information. Regarding the financial environment, cashflow, external debt, firm size, and firm age are further variables which appear important in this context.

3.1.2 Investor Protection Data

Country-level indicators on investor protection aim at measuring shareholder protection against the misuse of corporate assets and are obtained from a survey of corporate and security lawyers. Based on regulations, company laws, and court rules, the World Bank develops an *Extent of Disclosure Index*, an *Extent of Director Liability Index*, and an *Ease of Shareholder Suits Index*, ranging from 1 to 10 each. The *Investor Protection Index* is obtained from a weighted average of these indices.

3.1.3 Country-level Data on Profit and Personal Income Tax Schedules

The theoretical model alludes to the role of taxes on profits of managerial and entrepreneurial firms and on the personal income of managers in firms. Details on the effective (average and marginal) tax rates on companies' profits are collected in Bösenberg et al. (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 et al. (2014a) provide an even more detailed approach, using long panel data covering the most recent years. Egger et al. (2013) collect detailed panel data on the personal income tax schedule per country which permits computing effective personal income tax rates for any gross wage by following the OECD's Taxing Wages approach. Finally, Bösenberg et al. (2014b) collected data on dividend taxes. While the theory in Section 2 only differentiates between corporate taxes and dividend taxes, we also include income taxes.[8] Depending on the legal form of a firm, one of the two taxes might be more relevant than the other. Ex ante, we would expect income taxes being more important for small, constrained entrepreneurial firms.

3.1.4 Descriptive Statistics

The main dependent variable – investment of firm i over the respective period of investigation, I_i – is constructed from the balance sheet data as the percentage increase in fixed assets within a period of three years. Hence, investment at time t, I_{it}, is defined as the percentage increase in fixed assets from time t to $t+3$. With respect to the theoretical model in Section 2, the investment measure observed in the balance sheet data should be

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

interpreted as productive investment I rather than productive plus unproductive investment $I + J$. The interest rate, $\{r, i\}_i$, is calculated as the ratio of total interest expenses of a firm per total liabilities at the beginning of the period of investigation. In order to obtain a measure of productivity, θ_i, we follow recent theoretical work on heterogeneous firms (Melitz, 2003). In a first step, we estimate the industry-specific mark-up over unit-costs by the average ratio of sales to gross profits. This mark-up is used to calculate total production costs from total sales. Firm-level productivity is calculated as total production costs per worker at the beginning of the period of investigation.

Insert Table 2 About Here

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, A_i. As we assume that entrepreneurial firms do not have access to external equity markets to finance their investments, they must use either their liquid means or external debt to finance investment. To account for the liquid means firms can use, we choose the cashflow ratio defined as cashflows over total assets as a measure of A_i. In contrast to balance-sheet variables, cashflow is not linked to any assets in the current year but can directly be used for investment. Given that in the theoretical model the variable A denotes own funds that can be either paid out or used for any investments, cashflow is suited best to reflect this variable. Taxes as well as disclosure and investor protection indices are taken directly from the sources named above. In our analysis, we use a cross section of data for the period 2009-2013. In that case, I_i is the average of the growth of assets between 2009 and 2012 and 2010 and 2013, whereas he other variables refer to the beginning of that period. Additionally, we conduct robustness checks for a cross section over the years 2004-2007. Summary statistics of all variables are presented in Table 2.

On average, the growth of capital stocks was slow – $log(Investment)$ was negative – in the period 2009-2013 which includes the years of the Economic and Financial Crisis in Europe (we will conduct a sensitivity analysis where we use a pre-Crisis period). On average, personal income taxes are much higher (with 46%) than corporate profit tax rates (with 23%). In any case, relative to those tax rates, dividend tax rates are very low (with an average of 5% and a maximum of 15% in the sample). The variability of accounting standards is much larger in the sample of countries at stake than that of investor protection (to see this, compare the standard deviations tof these variables o the respective means). We suppress a discussion of the descriptive statistics on other variables employed in the analysis for the sake of brevity.

3.2 Econometric Strategy

Figure 2 suggests a nonlinear (kinked) relationship between own funds and investment. Most importantly, when starting from small own-funds levels and moving (to the right) towards larger ones, the figure suggests that there is a kink at a level of own funds for the marginal entrepreneur who switches from the cash-constrained to the tax-constrained regime at A_c. To the left of this entrepreneur (at lower levels of own funds), the marginal effect of own funds on investment is positive but is zero to the right of her (at higher levels of own funds). Most importantly, it is inherently unobservable to the researcher who – where in own-funds (A_i-)space – that entrepreneur is. Hence, the threshold is latent and needs to be estimated. Moreover, the figure points to two further threshold levels in own-funds space as we raise funds further beyond the level of the marginally less constrained entrepreneur: the first one occurs for the marginal managerial firm at A_m,[9] and the second one for the marginal dividend-paying managerial firm at A_d. The latter two regimes are inherently observable – it is known which firms have dispersed ownership and which do not; and it is known which of the firms with dispersed ownership pay dividends and which do not. In light of these features, we propose an econometric strategy which involves a latent, estimable threshold with two associated unobservable regimes, and two observable, endogenous regimes.

[9] We define managerial firms as ones with a dispersed ownership with no single owner having a share that exceeds 50%.

3.2.1 Integrated Threshold and Switching Regressions

The theoretical model suggests three thresholds in own-funds (A_i-)space which are associated with four regimes: two unobservable regimes of financially (cash-)constrained firms and less financially (or tax-)constrained firms; one observable, endogenous regime with concentrated ownership but without dividend payments; and one observable, endogenous regime with dividend-paying firms with dispersed ownership. For the subsequent notation, it is useful to use subscripts $\{c, t, m, d\}$ for the subspaces of A_i where the (severely) <u>c</u>ash-constrained, the <u>t</u>ax-constrained, the <u>m</u>anagerial (non-dividend-paying) firms, and the <u>d</u>ividend paying firms are located.

In the following we develop an econometric strategy that combines an unobserved threshold regression framework with an endogenous switching regression framework. For estimating the unobserved threshold A_c and the parameters of the fundamental drivers to the left (c) and the right (t) of it in own-funds (A_i-)space, we follow Hansen (2000) and Seo and Linton (2007). To account for the different observed thresholds we use a variant of Heckman's (1976) switching regression model for ordered choices as described by Terza (1987) and Greene (2002).

The two approaches (unobserved threshold regression and switching regression) can be combined as follows. First of all, it is useful to integrate the processes for the two observable thresholds (managerial, m, dividend-paying, d, and other) into a single one. For this, we may define a selection rule

$$q_i^* = z_i\delta + u_i,$$

where q_i^* is a latent variable, z_i is a row vector of observable determinants, δ is a conformable columns vector, and u_i is a disturbance term. While q_i^* is unobserved, it generates an observable integer-valued variable

$$q_i = \begin{cases} 0 & \text{if } -\infty < q_i^* \leq \mu_1 \\ 1 & \text{if } \mu_1 < q_i^* \leq \mu_2 \\ 2 & \text{if } \mu_2 < q_i^* < \infty \end{cases} \tag{24}$$

where the unknown cutoffs $\mu_1 < \mu_2$ have to be estimated. The categorical variable q_i is defined such that all firms with concentrated ownership, i.e., c- and t-type firms, are assigned $q_i = 0$ $(A_i \leq A_m)$, all firms with dispersed ownership that do not pay dividends, i.e., m-type firms, are assigned $q_i = 1$ $(A_m < A_i \leq A_d)$; and all firms with dispersed ownership that pay dividends, i.e., d-type firms, are assigned $q_i = 2$ $(A_d < A_i)$.

Furthermore, the observed dependent variable I_i can be written as a linear function of some independent variables x_i. The coefficients of these variables, however, depend on the observed and unobserved regimes:

$$I_i = \begin{cases} \alpha + x_i\beta_c + e_{i0} & \text{if } A_i \leq A_c \\ \alpha + x_i\beta_u + e_{i0} & \text{if } A_c < A_i \leq A_m \\ \alpha + x_i\beta_m + e_{i1} & \text{if } A_m < A_i \leq A_d \\ \alpha + x_i\beta_d + e_{i2} & \text{if } A_d < A_i \end{cases} \tag{25}$$

where the first threshold, A_c, is unobserved. Let the sample considered and information available consist of $\{I_i, x_i, A_i\}_{i=1}^n$, where n denotes the number of cross-sectional units (in the present paper, firms). Defining $\gamma_0 = \beta_u - \beta_c$, $\gamma_1 = \beta_m - \beta_c$, and $\gamma_2 = \beta_d - \beta_c$, the model may be compactly rewritten as[10]

$$I_i = \alpha + x_i\beta_c + \left[\sum_{j=0}^{2} \mathbf{1}\{q_i = j\} \left(\mathbf{1}\{A_i > A_c\} x_i \gamma_j + e_{ij} \right) \right]. \tag{26}$$

[10]For convenience of interpretation of the results, we will generally present coefficients $\{\beta_c, \beta_t, \beta_m, \beta_d,\}$ and corresponding standard errors rather than $\{\beta_c, \gamma_0, \gamma_1, \gamma_2,\}$ in the tables below.

We assume the disturbances on I_i, (e_{i0}, e_{i1}, e_{i2}) and the disturbances on q_i^*, u_i, to follow a multivariate normal distribution with mean zero and variance-covariance matrix

$$\Omega_i(q_i = j) = \begin{pmatrix} \sigma_{e_j}^2 & \rho_j \sigma_{e_j} \\ \rho_j \sigma_{e_j} & 1 \end{pmatrix}. \tag{27}$$

Note that the covariance between errors e_{ij} and $e_{ij'}$ for $j \neq j'$ are zero due to mutual exclusivity. Each e_{ij} is bivariate normally distributed with u_i with a correlation ρ_j for $j \in \{0, 1, 2\}$. Since we can observe the regime-specific outcomes only for firms conditional on regime status, we have to account for possible selection bias.

Let us define $\mu_0 = -\infty$,

$$\lambda_{ij} = \frac{\phi(\mu_{j-1} - z_i\delta) - \phi(\mu_j - z_i\delta)}{\Phi(\mu_j - z_i\delta) - \Phi(\mu_{j-1} - z_i\delta)}, \quad \psi_j = \rho_j \sigma_{e_j}. \tag{28}$$

Then, what we can estimate is

$$E[I_i | x_i, z_i] = \alpha + x_i\beta_c + \left[\sum_{j=0}^{2} \mathbf{1}\{q_i = j\} \left(\mathbf{1}\{A_i > A_c\} x_i \gamma_j + \psi_j \lambda_{ij} \right) \right]. \tag{29}$$

The least-squares estimator proposed by Hansen (2000) for such a problem corresponds to minimizing the objective function

$$S_n^*(\theta) = \frac{1}{n} \sum_{i=1}^{n} \left\{ I_i - \alpha - x_i\beta_c - \left[\sum_{j=0}^{2} \mathbf{1}\{q_i = j\} \left(\mathbf{1}\{A_i > A_c\} x_i \gamma_j + \psi_j \lambda_{ij} \right) \right] \right\}^2, \tag{30}$$

where $\theta = (\beta_c', \gamma_0', \gamma_1', \gamma_2', \psi_0, \psi_1, \psi_2, A_c)$ is assumed to exhibit a compact parameter space. Seo and Linton (2007) employ a smoothed least-squares estimator defining a kernel function $\mathcal{K}(\cdot)$ with $\underset{s \to -\infty}{\mathcal{K}(s)} = 0$ and $\underset{s \to \infty}{\mathcal{K}(s)} = 1$. The smoothed objective function reads:

$$S_n^*(\theta) = \frac{1}{n} \sum_{i=1}^{n} \left\{ I_i - \alpha - x_i\beta_c - \left[\sum_{j=0}^{2} \mathbf{1}\{q_i = j\} \left(\mathcal{K}\left(\frac{A_c}{b_n}\right) x_i \gamma_j + \psi_j \lambda_{ij} \right) \right] \right\}^2, \tag{31}$$

where b_n denotes the sample-analogue for the bandwidth. The smoothed least-squares estimator corresponds to

$$\theta_n = \arg\min_{\theta \in \Theta} \; S_n(\theta; b_n). \tag{32}$$

This optimization problem is solved by a two-step procedure. First, one solves the least-squares problem for a given A_c, and, in a second step, one uses these estimates to solve (32) for A_c.

4 Main Results

We estimate the empirical model in three steps. In the first step, we estimate (24) by an ordered probit model in order to obtain a consistent estimate of $\hat{\lambda}_j$. The estimates for the ordered probit regression are presented in Table 3. In line with the theoretical model, the cashflow ratio reflecting own funds has a positive effect on selection into *higher* regimes in own-funds (A_i-)space. Similarly, older and more productive firms are more likely to be in managerial (m- or d-type) regimes. Apparently, the size of the firm measured by the log of total assets is not associated with a higher probability of being in a managerial regime. This result is not contradicting the theoretical model in Section 2, however. The own-funds-space which mainly explains selection into the different regimes is determined by the liquid means that firms can use for investment. The latter may differ from total assets of a firm which mainly reflect the value of plants and equipment. Hence, total assets may be expected to capture mainly sectoral characteristics rather than regime-specific ones.

Higher corporate taxes seem to lead to selection into *higher* regimes in A_i-space. The latter may reflect a mix of a better ability to avoid taxes as a (especially, a dividend-paying) managerial firm and of the mechanisms at work in the model in Section 2, which establish a heterogeneous tax sensitivity of firms across the considered regimes. Apparently, higher dividend tax rates reduce the probability of being a managerial, especially, a dividend-paying firm.

Estimates of the linear index in conjunction with the cut points (μ_1, μ_2) in (24) as reported in Table 3 are used to compute the control functions $\hat{\lambda}_j$ in line with (28). The latter enter the threshold regression framework. In the second and third step, we estimate the parameter vector θ and A_c based on (32) as described at the end of the previous section.

Results of the baseline integrated threshold regression are presented in Table 4. This regression yields a critical cashflow ratio of $A_c = 0.1045$ which separates cash- and tax-constrained entrepreneurial firms. Notice that this estimate is statistically significantly different from zero. The estimate of A_c is higher than the average cashflow ratio, which amounts to 0.0627, according to Table 2. Given an estimate of A_c together with the observed regime status for managerial firms that pay dividends and those which do not, we can compare how the explanatory variables affect investment differently across these regimes.

The theoretical model suggests that the own funds that a firm has accumulated from previous periods will enhance investment for financially constrained firms and non-dividend-paying managerial firms. The empirical results clearly support these predictions: an increase in the cashflow ratio increases investment for constrained entrepreneurial firms as well as for non-dividend-paying managerial firms, while the cashflow ratio appears to be less relevant for tax-constrained entrepreneurial firms and dividend-paying managerial firms. These results indicate that the theoretical model is able to model some of the channels determining firm-level investment for different regimes.

Insert Table 4 About Here

To that effect, the empirical results regarding the tax sensitivity of firms appear to accord with the theoretical hypotheses qualitatively. Clearly, corporate taxes as well as income taxes reduce investment for all types of firms, but the effects vary substantially in their size. Tax-constrained entrepreneurial firms are severely affected by corporate taxes:[11] if corporate taxes were to be raised by 10 percentage points, investment of cash-constrained entrepreneurial firms would drop by around $|100\exp(-0.07824)-100| \approx 8\%$, while investment of dividend-paying managerial firms would drop by $|100\exp(-0.32495)-100| \approx 28\%$.

Given that cash-constrained entrepreneurial firms are smaller than m-type or d-type firms on average, it is not surprising that the parameter of corporate taxes is not significant

[11] 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 $\hat{\lambda}_j$) 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).

for t-type firms. In general, the negative impact of income taxation seems to be smaller than the effect of corporate taxation for tax-constrained entrepreneurial firms and non-dividend-paying managerial firms where a 10 percentage-point increase of the tax implies a reduction of investment growth of around 35% and 18%, respectively, conditional on the regime. In contrast, dividend-paying managerial firms are affected similarly by corporate and incomes taxes.

Previous work suggests that the effect of dividend taxes on investment is related to the marginal source of financing. Consistent with the theoretical model outlined in Section 2, the empirical results suggest a negative parameter on dividend taxes for cash-constrained and non-dividend-paying managerial firms. In the theoretical model, a wider impact of dividend taxation across firms flows from its impact on the extensive margin. The evidence on negative dividend-tax parameters across the board might indicate that the theoretical model does not capture all channels influencing investment behavior of firms especially with respect to the marginal source of financing, or that investment to some extent captures changes at both the extensive and the intensive margins.

The theoretical model suggests that investment is strictly increasing in productivity, since more productive firms can yield higher returns from a given investment level. The empirical finding of a positive parameter on (log) productivity is consistent with this view. Furthermore, the estimates suggest an important role for investor protection across all firms. To the extent that a positive effect of investor protection is found even for dividend-paying managerial firms, this evidence goes beyond the hypotheses flowing from the model in Section 2. The parameter on the variable measuring accounting standards is positive for entrepreneurial firms, as hypothesized by our model, even though the estimate is significant only for the tax-constrained entrepreneurial firms. Interest rates appear to have a negative parameter for managerial firms and tax-constrained entrepreneurial firms, while the parameter is not statistically different from zero for the investment of cash-constrained entrepreneurial firms. Arguing in line with the theoretical model, cash-constrained firms are likely to earn an excess-return on investment and, therefore, should be willing to pay high interest rates. The control function captured by the terms $\psi_j \hat{\lambda}_j$ should not be eliminated according to F-tests or Wald-tests, pointing to endogenous selection effects into different regimes.

In general, the estimation results in Table 4 are aligned to a large extent with the theory outlined in Section 2, especially, with regard to the effect of income and corporate taxation on investment. 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 personal income taxes that are qualitatively consistent with the model.

5 Robustness Checks

In a first experiment, we check to which extent the results in Table 4 might be driven qualitatively by the after-Financial-Crisis sample period 2009-2013. An advantage of using recent data is that the quality and coverage of the firm-level data is highest in comparison to earlier years. However, we need to make sure that the Financial Crisis did not induce abnormal investment behavior. Therefore, we use the same variable definitions and sources but conduct our empirical analysis with a cross section of data for the pre-Financial-Crisis years 2004-2007. The corresponding results are presented in Table 5. Relative to the results discussed in the previous section, the effects of all taxes included in the model remain largely unchanged qualitatively with one exception: corporate taxes appear to be more relevant in determining investment of cash-constrained firms rather than income taxes in the pre-Crisis period than in the post-Crisis period. Moreover and quite interestingly, the estimation results for the pre-Crisis versus post-Crisis years suggest that investment became more sensitive to investor protection and accounting standards in the Crisis period relative to the earlier period.

Insert Tables 5-8 About Here

In a second experiment, inspired by the discussion at the end of Section 2.3, we treat the cash-constrained and tax-constrained entrepreneurial firms as one homogeneous sample (doing so is rejected statistically on the basis of F-tests or Wald-tests). The associated econometric model is a pure switching model with two endogenous but observable regimes. As in the earlier results the parameters on the individual control-function terms ($\hat{\lambda}_j$) are statistically significantly different from zero, and they are jointly statistically significantly different from zero. The results presented in Table 6 show that the effects of taxes on investment become considerably weaker relative to the benchmark model in the previous section (Table 4), but they are qualitatively similar to the previous results.

In a third experiment, we ignore the endogeneity of the observable regimes and thresholds in the model and run the same regressions as in Table 6 (lumping all entrepreneurial firms together) by OLS without the control function. Clearly, the joint significance of the control-function terms ($\hat{\lambda}_j$) suggests that this is inappropriate conditional on the first stage (the ordered-probit results), but it might be the case that the quantitative impact of doing so is small. It turns out that this is not the case. A comparison of the coefficients, e.g., on the tax variables between Tables 6 and 7 suggests that ignoring endogeneity of the firm regimes leads to largely different quantitative effects of taxation conditional on regime status. A compact measure of this difference would be a Hausman-type statistic, where we would employ the weighted sum of squared differences in the parameter vectors between Tables 6 and 7, where the weights would be the inverse of the differences in the matrices of variances and covariances of the parameter vectors. This statistic is χ^2-distributed with as many degrees of freedom as there are parameters, and it is statistically significant in this case, being equivalent to a joint F-test of the control-function terms ($\hat{\lambda}_j$) based on the results in Table 6.

In a fourth and last experiment, we address an alternative classification of firms in the tax-constrained entrepreneurial regime. In the baseline model in Table 4, the threshold A_c which separates cash-constrained and tax-constrained firms is treated as unobserved and estimated. As an alternative to this strategy, we now calculate implicit dividend payouts by entrepreneurial (non-listed) firms and consider the cash-constrained and tax-constrained regimes to be endogenous but observable based on this metric. Doing so means to consider four endogenous regimes (which we dub $\{0c, 0t, 1, 2\}$) in a switching regression and employing four associated control-function terms ($\hat{\lambda}_j$), while abandoning the idea of an unobservable threshold in own-funds (A_i-)space to discern those two (in this case treated as observable) regimes. The associated results are presented in Table 8. Indeed, the corresponding results suggest that in the tax-constrained regime investment depends substantially on the cashflow ratio, indicating that in this specification firms are selected into the tax-constrained regime which are entrepreneurial but still dividend-paying. In Table 8, all regimes are identified by whether they pay dividends or not and whether they are listed on the stock-market or not. In contrast, in the benchmark results we search for the marginal firm among the entrepreneurial ones, where behavior changes significantly. The pattern of parameters on the tax variables is indeed quite different between the four regimes following the classification in Table 8 from the one in Table 4. Since dividend payouts of small firms cannot be measured as precisely as for large firms (i.e., there is measurement error about the observable threshold between the cash-constrained and the tax-constrained firms) and the data are not permitted to show where in own-funds (A_i-)space behavior changes between what we refer to as cash- and tax-constrained firms, the benchmark model in Table 4 seems preferable over the one in Table 8.

6 Conclusions

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 funds 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. The model predicts heterogeneous investment sensitivities with respect to personal and corporate taxes, own cash-flow and institutional variables affecting the self-serving behavior of entrepreneurs and managers.

Using a large set of country and firm-level data, the empirical analysis largely confirms theoretical predictions. In small entrepreneurial firms subject to credit rationing, investment positively and significantly depends on own cash-flow and on investor protection restraining potential diversion of funds by entrepreneurs. These variables lose power when firms are endowed with more own funds. Taxes negatively affect investment where the personal income tax is most relevant for small entrepreneurial firms, while larger ones are most negatively affected by the corporate tax. With non-dividend-paying managerial firms, investment is most negatively affected by the corporate tax which becomes less important once firms start paying dividends. Dividend taxes mainly affect the extensive margin of investment. Institutional variables such as investor protection disclosure of accounting information are important determinants of investment as well.

7 Appendix

A. 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, 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 funds, generating first period earnings A. There are two regimes.

First, if $dV^E/dD\big|_{D=0} < 0$, the firm sets dividends to zero ($D = 0$) to allow for maximum internal financing. In this case, the shadow price is very large, indicating a tight constraint. For cash-poor firms, the financing constraint binds even if no dividends are paid out, $D = 0$. Substituting $B = (1 - e\tau) I - A$, the constraint implicitly determines investment I (with $D = 0$ in 6), which becomes dependent on own funds A. Given I, condition (i) above yields λ.

The second regime applies when firms are cash-rich and pay debt financed dividends $D > 0$ to exploit the tax-advantage of debt. The second condition above yields λ, which is used in condition (i) to yield

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

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 scenario, 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, $\partial I/\partial D = -\partial I/\partial D = -R/k$, see (8).[12] 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 always end up 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 $D = 0$ and investment I_n as in (A.3) to obtain the threshold value A_c from (6).

B. New and Old Views The new view of dividend taxation holds that firms finance investment with retained earnings as is common with cash-rich firms. The old view applies to cash-poor firms and holds that they raise new equity to finance investment. Allowing for old and new equity, firm valuation by existing owners is governed by the no-arbitrage condition $i = \left[(1-t_D)\,D + \left(\tilde{V}_1 - \tilde{V} - B\right)\right]/\tilde{V}$ where B_t is new equity and $\tilde{V}_1 - \tilde{V} - B$ stands for capital gains of existing owners. Rearranging and using end-of-period value $V \equiv (1+i)\,\tilde{V}$ yields $V = (1-t_D)\,D - B + V_1/(1+i)$. Substituting the same expression for V_1 and noting end point conditions $V_2 = 0$ and disinvestment $B_1 = -B$ yields

$$V = (1-t_D)\,D - B + \frac{(1-t_D)\,D_1 + B}{1+i}. \tag{B.1}$$

Equating inflows and outflows, financial identities in the first and second periods are

$$A + B = D + (1-e\tau)\,I, \quad (1-\tau)\,Y + (1-e\tau)\,I - (1+i)\,A = D_1 + B. \tag{B.2}$$

[12] An increase in dividends reduces retained earnings and has the same effect as a reduction in earings.

The second identity states inflows from earnings plus disinvestment net of the opportunity cost $(1+i)\,A$ of own funds, since we want to state firm value as surplus. The first identity says that net of tax investment spending is financed by retained earnings $A-D$ and new equity B. Substituting into the second one yields

$$(1-e\tau)\,I=(A-D)+B, \quad D_1=(1-\tau)\,Y+A-D-(1+i)\,A. \tag{B.3}$$

The maximization problem becomes

$$\begin{aligned} V &= \max_{D,B}\,(1-t_D)\,D-B+\frac{(1-t_D)\left[(1-\tau)\,\theta f\,(I)-D-iA\right]+B}{1+i} \\ &: \quad s.t. \quad I=(A-D+B)\,/\,(1-e\tau)\,. \end{aligned} \tag{B.4}$$

Optimality conditions are

$$\begin{aligned} \frac{dV}{dD} &= (1-t_D)+(1-t_D)\,\frac{-\,(1-\tau)\,\theta f'\,(I)\,/\,(1-e\tau)-1}{1+i}\le 0, \\ \frac{dV}{dB} &= -1+\frac{(1-t_D)\,(1-\tau)\,\theta f'\,(I)\,/\,(1-e\tau)+1}{1+i}\le 0. \end{aligned} \tag{B.5}$$

A firm never pays dividends and issues new equity simultaneously. The old view holds that cash-poor firms with an excess-return do not pay dividends and must issue new equity. Since financing investment with new equity does not reduce tax liability, the dividend tax reduces the return on investment but not its cost and, therefore, distorts investment:

$$\begin{aligned} \text{old view} &: \frac{dV}{dD}<0,\frac{dV}{dB}=0 \quad\Rightarrow\quad \theta f'\,(I)=\frac{1-e\tau}{(1-t_D)\,(1-\tau)}\cdot i, \\ \text{new view} &: \frac{dV}{dD}=0,\frac{dV}{dB}<0 \quad\Rightarrow\quad \theta f'\,(I)=\frac{1-e\tau}{1-\tau}\cdot i. \end{aligned} \tag{B.6}$$

By the new view, the marginal source of funds is retained earnings rather than external equity. By reducing dividends today (using funds to internally finance investment) and raising dividends tomorrow when retained earnings are distributed, the dividend tax does not affect total tax liability over the firm's life. The dividend tax is neutral, see (B.6).

When firms abstain from issuing new equity and exclusively rely on retained earnings ($B=0$), firm value (surplus) in (B.4) reduces to [use $A-D=(1-e\tau)\,I$]

$$V=(1-t_D)\,\frac{(1-\tau)\,\theta f\,(I)-i\,(A-D)}{1+i}=(1-t_D)\,\frac{(1-\tau)\,\theta f\,(I)-(1-e\tau)\,iI}{1+i}. \tag{B.7}$$

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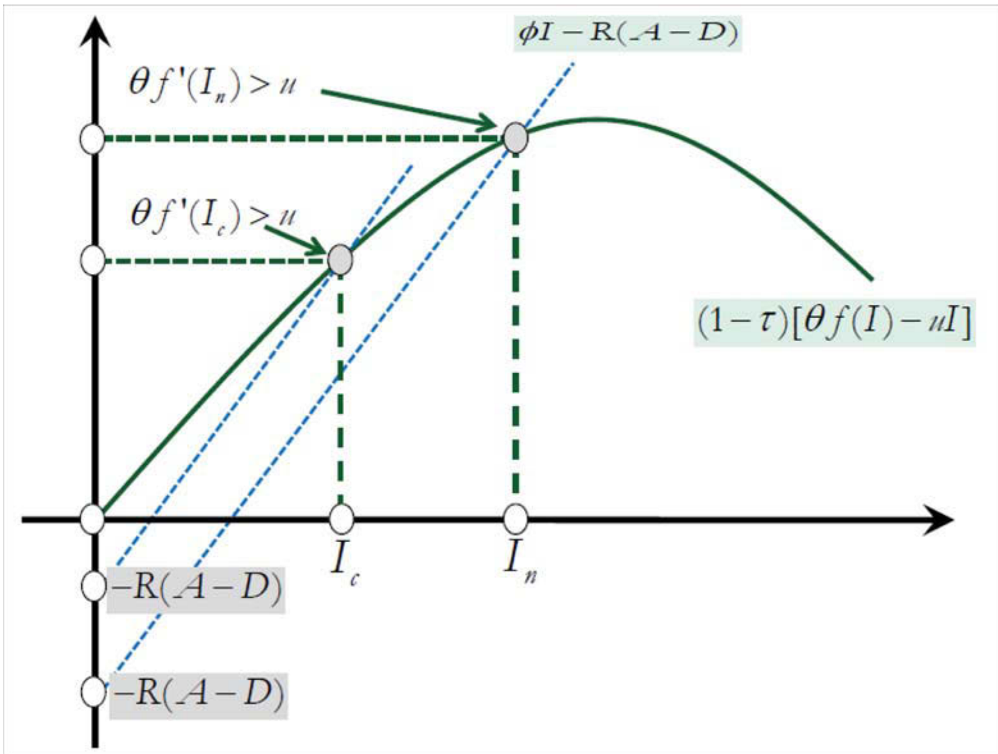

Fig. 1: Entrepreneurial Investment

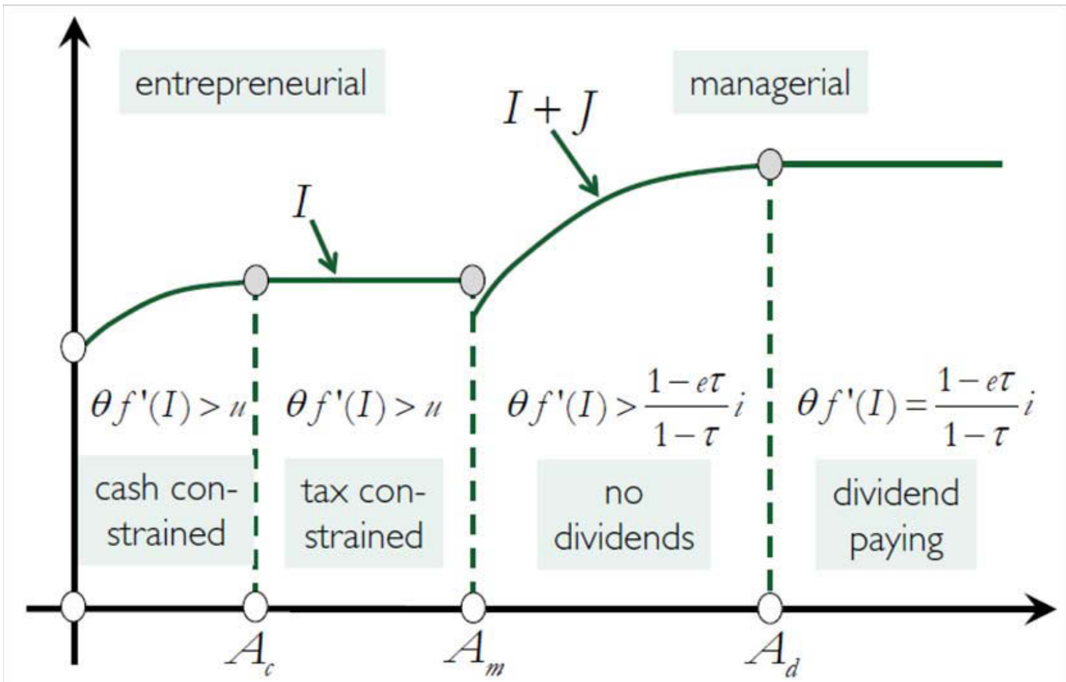

Fig. 2: Firm Investment in the Cross-Section

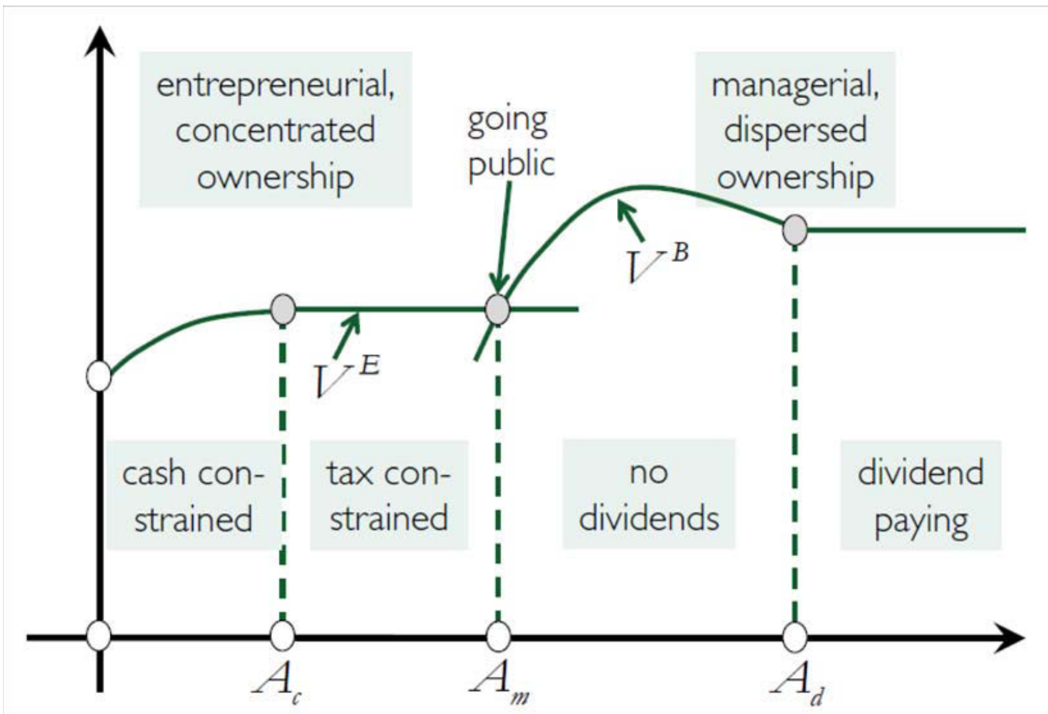

Fig. 3: Firm Values in the Cross-Section

Table 2: Summary Statistics

Variable	Obs.	Mean	Std. Dev.	p(10)	p(90)	Median
log(Investment)	42017	-0.7326	1.9274	-3.0222	1.5495	-0.7325
Income tax	42017	0.4644	0.1050	0.4297	0.5829	0.4490
Corporate tax	42017	0.2258	0.0529	0.1528	0.2880	0.2278
Dividend tax	42017	0.0488	0.0537	0	0.15	0.05
Interest rate	42017	0.0198	0.0240	0.0015	0.0410	0.0150
log(Productivity)	42017	11.7304	1.1757	10.4161	13.1314	11.6944
Cashflow ratio	42017	0.0627	0.1283	-0.0240	0.1772	0.0520
Investor protection	42017	5.5979	0.6215	5	6.7	5.3
Accounting Standards	42017	6.4244	2.0060	5	10	7

Table 3: First Stage: Ordered Probit Regression.

Variable	Coeff.	Std. Dev.
Age	0.0035	0.0004
log(Total assets)	-0.0173	0.0039
Cashflow Ratio	0.3896	0.0496
Income Tax	-1.1469	0.0694
Corporate Tax	1.5143	0.1280
Dividend Tax	-0.2543	0.1322
log(Productivity)	0.0378	0.0057
Cut Point 1 (μ_1)	0.4770	0.0728
Cut Point 2 (μ_2)	1.0000	0.0729

Table 4: Estimation Results of the Integrated Threshold Regression.

	Entrepreneurial Firms		Managerial Firms	
log(Investment)	Cash-constr.	Tax-constr.	No Dividends	Dividends
Variable	Coeff.	Coeff.	Coeff.	Coeff.
Cashflow ratio	1.2696	-0.6817	1.5839	1.0327
	(0.3915)	(0.2141)	(0.7145)	(0.4703)
Income tax	-2.5860	-4.2396	-1.9380	-4.2920
	(0.4125)	(0.6870)	(0.3976)	(0.6765)
Corporate tax	-0.7824	-8.0747	-6.7717	-3.2495
	(0.9455)	(1.1361)	(1.1521)	(0.8103)
Dividend tax	-1.9408	-1.5604	-2.9131	-2.0461
	(0.3858)	(0.2674)	(0.6856)	(0.7536)
Investor protection	0.2598	0.3508	0.2581	0.3469
	(0.0363)	(0.0597)	(0.0334)	(0.0573)
Accounting standards	0.0095	0.1912	0.1305	0.0497
	(0.0095)	(0.0268)	(0.0283)	(0.0119)
Interest rate	0.0226	-2.6394	-5.3365	-5.6884
	(0.8352)	(0.7455)	(1.3997)	(1.6539)
log(Productivity)	0.1057	0.1451	0.1015	0.1525
	(0.0300)	(0.0375)	(0.0245)	(0.0351)
Constant	-0.9274	-0.9274	-0.9274	-0.9274
	(0.1797)	(0.1797)	(0.1797)	(0.1797)
λ_0	1.8216	1.8216		
	(0.7200)	(0.7200)		
λ_1			0.9505	
			(0.2934)	
λ_2				0.2378
				(0.1266)
Threshold (Cashflow ratio)	0.1045			
	(0.0103)			
All firms	42017			

Notes: Standard errors in parentheses are based upon bootstrapping with 100 replications.

Table 5: Estimation Results of the Integrated Threshold Regression - Pre-Crisis Data.

	Entrepreneurial Firms		Managerial Firms	
log(Investment)	Cash-constr.	Tax-constr.	No Dividends	Dividends
Variable	Coeff.	Coeff.	Coeff.	Coeff.
Cashflow ratio	0.8583	-1.2977	-1.1228	0.6044
	(0.3037)	(0.2808)	(0.6532)	(0.4394)
Income tax	0.4933	-1.8799	-0.4900	-1.1515
	(0.3494)	(0.4973)	(0.2438)	(0.4478)
Corporate tax	-2.4489	-6.4547	-6.1560	-3.5017
	(0.4998)	(0.7523)	(0.7224)	(0.2626)
Dividend tax	-1.0423	-1.1307	-1.2592	-0.0139
	(0.4847)	(0.2834)	(0.6381)	(0.0071)
Investor protection	-0.0232	-0.0319	0.0948	0.1885
	(0.0428)	(0.0666)	(0.0284)	(0.0543)
Accounting standards	-0.0550	-0.0371	-0.0298	-0.0382
	(0.0106)	(0.0164)	(0.0205)	(0.0064)
Interest rate	-1.7413	-3.0523	-7.0417	-8.6007
	(1.3383)	(0.5471)	(2.3342)	(2.0062)
log(Productivity)	0.0175	0.1778	0.0373	0.0735
	(0.0250)	(0.0317)	(0.0158)	(0.0312)
Constant	-0.4941	-0.4941	-0.4941	-0.4941
	(0.1598)	(0.1598)	(0.1598)	(0.1598)
λ_0	-1.1382	-1.1382		
	(0.2989)	(0.2989)		
λ_1			0.5523	
			(0.2327)	
λ_2				0.0355
				(0.1126)
Threshold (Cashflow ratio)	0.1619			
	(0.0197)			
All firms	36879			

Notes: Standard errors in parentheses are based upon bootstrapping with 100 replications.

Table 6: Estimation Results of the Endogenous Switching Regression - Two Observable Regimes Only.

	Entrepreneurial	Managerial Firms	
log(Investment)	Firms	No Dividends	Dividends
Variable	Coeff.	Coeff.	Coeff.
Cashflow ratio	0.6256	2.0080	2.4211
	(0.1129)	(0.2986)	(0.2469)
Income tax	-2.0408	-4.5212	-4.1358
	(0.2587)	(0.6935)	(0.5398)
Corporate tax	-2.9145	-0.1394	-1.5211
	(0.4047)	(0.9842)	(0.8257)
Dividend tax	-1.8207	-0.4702	-1.0375
	(0.2384)	(0.5599)	(0.4767)
Investor protection	0.2274	0.1185	0.1160
	(0.0211)	(0.0491)	(0.0392)
Accounting standards	0.0384	0.0747	0.1273
	(0.0088)	(0.0234)	(0.0173)
Interest rate	-1.9419	-4.6656	-4.5232
	(0.4688)	(1.0216)	(1.0038)
log(Productivity)	0.0770	0.1572	0.1656
	(0.0119)	(0.0271)	(0.0231)
Constant	-0.3636	-4.2692	-6.5727
	(0.2317)	(0.5663)	(0.8811)
λ_0	1.8715		
	(0.3676)		
λ_1		4.1455	
		(0.5375)	
λ_2			3.0942
			(0.5119)
Firms per regime	27478	6968	7571

Notes: Standard errors in parentheses are based upon bootstrapping with 100 replications.

Table 7: Estimation Results of OLS Regression Including Interactions - Three Observable Regimes Only.

log(Investment)	Entrepreneurial Firms	Managerial Firms No Dividends	Managerial Firms Dividends
Variable	Coeff.	Coeff.	Coeff.
Cashflow ratio	0.2518	0.4407	1.4681
	(0.0851)	(0.2165)	(0.2016)
Income tax	-0.9845	-0.0700	-1.5687
	(0.1535)	(0.3767)	(0.3274)
Corporate tax	-4.4319	-6.3166	-5.6765
	(0.2669)	(0.5104)	(0.5058)
Dividend tax	-1.5932	0.6012	-0.6350
	(0.2289)	(0.5076)	(0.4640)
Investor protection	0.2298	0.1888	0.1071
	(0.0197)	(0.0400)	(0.0344)
Accounting standards	0.0398	0.0761	0.1379
	(0.0087)	(0.0214)	(0.0175)
Interest rate	-1.9416	-4.6599	-4.8050
	(0.4637)	(0.9927)	(1.0464)
log(Productivity)	0.0462	0.0370	0.0752
	(0.0095)	(0.0171)	(0.0170)
Constant	-1.2150	-1.2150	-1.2150
	(0.1323)	(0.1323)	(0.1323)
All firms	42042		

Notes: Standard errors in parentheses are based upon bootstrapping with 100 replications.

Table 8: Estimation Results of Endogenous Switching Regression - Four Observable Regimes.

	Entrepreneurial Firms		Managerial Firms	
log(Investment)	Cash-constr.	Tax-constr.	No Dividends	Dividends
Variable	Coeff.	Coeff.	Coeff.	Coeff.
Cashflow ratio	1.5131	4.3633	7.3104	6.1560
	(0.2291)	(0.3140)	(0.5448)	(0.4099)
Income tax	-0.9144	-1.9530	-1.5280	-2.4766
	(0.2589)	(0.2037)	(0.4104)	(0.3233)
Corporate tax	-2.7795	-0.3132	0.8887	-0.0349
	(0.4731)	(0.4791)	(0.7556)	(0.6515)
Dividend tax	0.4711	-0.4826	3.7870	1.7505
	(0.3877)	(0.3326)	(0.5957)	(0.4930)
Investor protection	0.1609	0.2047	0.0866	0.0930
	(0.0336)	(0.0275)	(0.0487)	(0.0389)
Accounting standards	0.0410	0.0328	0.0519	0.1084
	(0.0151)	(0.0108)	(0.0232)	(0.0172)
Interest rate	-2.1006	-1.9765	-4.2600	-4.0811
	(0.6908)	(0.6316)	(1.0130)	(0.9961)
log(Productivity)	0.1355	0.1977	0.3110	0.2884
	(0.0181)	(0.0183)	(0.0294)	(0.0247)
Constant	0.0819	-3.5395	-9.1852	-12.3765
	(0.2911)	(0.2782)	(0.6994)	(0.8940)
λ_{0c}	2.2030			
	(0.2938)			
λ_{0t}		3.4606		
		(0.2671)		
λ_1			6.0648	
			(0.4416)	
λ_2				5.2374
				(0.4067)
Firms per regime	13261	14179	6968	7571

Notes: Standard errors in parentheses are based upon bootstrapping with 100 replications.