Universität St.Gallen

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January 2010 Discussion Paper no. 2010-04

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Electronic Publication: http://www.vwa.unisg.ch

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Abstract

This survey of recent research in corporate finance discusses how business taxes, subsidies as well as a country's institutional development affect several important decision margins of heterogeneous firms. We argue that innovative firms, as a result of agency problems between insiders and outside investors, are most frequently finance constrained. We discuss how profit taxes reduce investment of constrained firms by their effect on cash-flow, and of unconstrained firms by their effect on the user cost of capital. Moreover, tax reform as well as tax financed R&D subsidies can enhance aggregate investment, innovation and efficiency by implicitly redistributing profits towards constrained firms where capital earns the highest return. We argue that the corporate legal form improves firms' access to external funds. We then explain the firms' choice between venture capital and bank financing and discuss how business taxation can affect venture capital financing on both the extensive and intensive margins. Finally, we review theory and evidence on how corporate finance may shape a country's comparative advantage in innovative industries as well as aggregate labor market performance when part of firms are finance constrained.

Keywords

Financing constraints, innovation, business taxation, subsidies, entrepreneurial choice.

JEL-Classification

G38, H24, H25.

The last decades have seen an unprecedented integration of domestic capital markets and a major increase in possible financing sources for private companies. Nevertheless, in many countries, a substantial share of firms still experiences difficulties in obtaining adequate funding for their investment projects. These frictions are often traced back to agency problems within firms. Outside investors typically find it difficult or even impossible to observe and control the behavior of managers or entrepreneurs and, for this reason, will hesitate to supply external funds. Incentive contracts can help to align the different parties' interests more closely but often do not succeed to fully eliminate agency problems. Borrowing remains restricted in financially dependent sectors so that firms are unable to fully exploit their investment opportunities. The traditional, neoclassical literature on business taxation abstracts from agency problems or models them only in reduced form (see Hassett and Hubbard, 2002; Auerbach, 2002; and Graham, 2003). Firms optimally invest until the return on investment is equal to the user cost of capital. Including agency problems and financing constraints introduces new determinants of investment absent from the neoclassical model, and changes the transmission channels for tax policy.

This chapter aims at giving an overview of how different company decisions are affected by various tax policy instruments when at least part of the firms are finance constrained due to agency problems between inside and outside investors. To organize the discussion, we present a simple theoretical model of constrained and unconstrained firms with endogenous organizational choice in Section 2. The model is based on Holmstrom and Tirole (1997) and Tirole (2006) and includes financing constraints due to moral hazard. When the managerial effort of entrepreneurs is not observable, a high success probability of the firm is guaranteed only if insiders keep a large enough financial stake in the firm. Accordingly, the company's income pledgeable as a repayment to external investors is reduced and limits the amount of external funding that the firm can obtain. This framework of financially constrained firms leads to predictions for the effects of taxes on investment and external financing that are entirely different from the traditional neoclassical model (Section 3). The firms that are most likely to be finance constrained are small, innovative growth

companies with relatively few own assets and large investment opportunities. Section 4 thus focuses on the implications of R&D subsidies as a prominent policy instrument to stimulate innovation and productivity when innovative firms have difficulty in fully exploiting investment opportunities due to financial constraints. Section 5 highlights the role of active intermediaries such venture capital in funding innovative firms: venture capitalists not only provide funds, but also add value by advising and monitoring the firm. Since this activity is costly, venture capital is more expensive than standard bank financing. Depending on the cost of venture capital financing relative to its productivity, it may be useful to different types of firms for different reasons, either because it raises a firm's external financing capacity or because it adds value. The impact of taxes is also dependent on these cases.

Section 6 argues that the effects of taxes depend on other institutional characteristics. We suggest that the quality of commercial law and accounting standards explains the advantages of the corporate legal form compared to sole proprietorships. Incorporation is valuable because it raises a firm's access to external capital, and these benefits are larger when accounting and reporting standards are tough. Taxes affect incorporation and the level of externally financed investment of corporate firms, and more so in countries with a good legal environment. Section 7 turns to firms' payout policy and the effects of dividend taxation. Section 8 discusses the new firm based literature in international economics and shows how financing frictions can endogenously determine a country's comparative advantage in innovative industries because innovative firms with large investment opportunities are the most likely to be finance constrained. Section 9 briefly touches on labor market issues of corporate finance. In the next section, we first review important empirical regularities on agency problems and the prevalence of financing constraints.

1. AGENCY PROBLEMS AND FINANCING CONSTRAINTS

The importance of financing constraints has been studied extensively in the empirical literature. This research has yielded several regularities in firm and country characteristics that make financing frictions more probable. We focus here on three aspects: First, the

quality of legal investor protection and the degree of financial market development; secondly, the size of firms as measured by their internal assets; and thirdly, the degree of innovativeness as an indicator of investment opportunities.

The availability of external funds rests on the willingness of banks and other financial intermediaries to invest in a business project. These incentives depend on the effective return they can expect in terms of future repayments and, in particular, the amount of funds they can retrieve in case of business failure. The effective return on external funds not only depends on specific firm characteristics but also on the legal environment that determines to which degree these claims will effectively be honored. The key argument is that a well developed institutional environment with tight investor and creditor protection, tough reporting and accounting standards and other governance rules narrows down the degree of managerial autonomy. Corporate insiders find it more difficult to misuse funds or to divert managerial effort to unproductive activities ('private benefits') so that outside investors will become more certain about repayment and more willing to supply funds. La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998) and the subsequent law and finance literature compiled several measures that summarize the quality of investor protection across countries: anti-director rights mainly capture the influence of outside shareholders in corporate decision processes while creditor rights reflect the ability to seize loan collateral in the case of a reorganization or bankruptcy. The effectiveness of legal rights is enhanced by the quality of law enforcement. La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1997, 2000b) show that countries which perform poorly along these measures, have less developed capital markets and firms in institutionally less developed countries experience greater difficulties in obtaining external finance (see Graff, 2008, and Spamann, 2008, for a critical review on the compilation of these indices).

Rajan and Zingales (1998) provide evidence that financing constraints are more prevalent in countries with poorly developed financial markets and that these restrictions impair the growth of companies that are dependent on external finance. However, it is not only the development of existing companies that is negatively affected. They also show that

the number of new firms created in financially dependent industries is particularly sensitive to the level of financial development. The level of entrepreneurship thus crucially depends on the financial environment.

Even in countries with poorly developed financial systems, financing constraints are not equally tight for all firms. In differentiating by firm size, Beck, Demirgüc-Kunt, and Maksimovic (2005) show that the smallest firms are most strongly affected. As financial and institutional characteristics improve, the constraints become less tight. Small firms catch up and benefit the most. These results are confirmed by Beck, Demirgüc-Kunt, and Maksimovic (2008) who focus on the importance of alternative sources of finance for small and large firms. Small firms, especially in poor institutional environments, are able to raise less external finance, in particular bank finance. Well developed property rights boost external financing in small firms more strongly than in large firms, and the increase mainly results from easier access to bank credit. Other sources of finance are not able to compensate for lacking access to bank financing. The same finding is also emphasized by Fisman and Love (2003) who study trade credit as an alternative funding source when financial markets are poorly developed. While established firms can effectively use trade credit to compensate for the non-availability of bank credit, this channel is practically closed to new firms.

The importance of firm size for financial market access is already apparent when the firm is created (see Aghion, Fally, and Scarpetta, 2007). Financial development most strongly raises entry rates of smaller firms whereas entry of larger firms shows no or even a negative response. Even in advanced economies, there is scope to promote entry of small firms and their subsequent growth by improving institutions.

The reading of the empirical literature also points to firm characteristics which create difficulties in accessing external financing. Financing constraints are more prevalent among small, innovative and entrepreneurial firms. Being small, they have little own funds. Being innovative, they typically have large investment opportunities and need large amounts of external funds compared to own assets. Finally, if the managerial and technological know-how is embodied in a dominating entrepreneur, agency costs are larger and external

investors are more hesitant to supply funds because it is more difficult to monitor the firm and to evaluate the incentives and potential of the entrepreneur. By implication, the firm's investment behavior becomes closely tied to internally available resources. In a neoclassical world without financing frictions, a firm would invest until the rate of return is equated to the user cost of capital, and investment would be independent of internal resources and institutional determinants of financial development. However, when investors are reluctant to lend capital because of severe uncertainties concerning repayment, firms use all available cash-flow to self-finance investment. Even with maximum self-financing, the external leverage of own funds is limited and restricts investment below the efficient scale where it still earns an excess return. Hence, when financing constraints are binding, these firms must be very profitable, have unexploited investment opportunities and earn an excess return.

The theoretical prediction of the cash-flow sensitivity of investment has been studied extensively in the empirical literature (for a survey, see Hubbard, 1998). Schaller (1993) and Chirinko and Schaller (1995) find correlations between physical capital investment and internal funds around 0.4 for small firms, which are substantially higher than the corresponding values of around 0.2 for large firms.[1] Apart from firm size, another criterion that differentiates constrained and unconstrained firms, is their banking relationship. When firms have close ties to banks, the informational asymmetry is reduced, and they are more likely to obtain the required funding for their projects. Hoshi, Kashyap, and Scharfstein (1991) indeed report investment - cash flow sensitivities of only around 0.05 for these types of firms in Japan, whereas correlations for independent firms vary between 0.45-0.5. Similar numbers are found by Schaller (1993) and Chirinko and Schaller (1995) who separate firms according to their relationship to other groups of firms. Of course, spending on physical assets captures only part of a firm's total investments. When all categories of investment including working capital are taken into account, the sensitivity of total investment to cash flow in constrained firms typically exceeds 1 (Fazzari and Petersen, 1993; Calomiris and Hubbard, 1995; Carpenter and Petersen, 2002).

[1] The fact that significant correlations are also found for firms that are supposedly not affected by financing constraints, is often attributed to cash flow or internal funding capturing some residual investment opportunities.

Apart from the quality of the institutional environment and of the level of a firm's own assets, the nature of the investment project itself determines to a large extent whether a firm finds it difficult to raise sufficient external funds. Because of its novelty and potentially high technical sophistication, an innovative business idea aggravates information problems for outside investors. Further, the knowledge to carry out the project successfully is often intrinsic which makes the entrepreneur's effort essential but, at the same time, also very difficult to monitor. For these reasons, innovative firms are more likely to become credit rationed. In addition, since innovative firms by their very definition are highly productive, they have large investment opportunities and need large external funds which, again, makes it likely that the financing capacity is exhausted and investment becomes finance constrained. The empirical literature confirms that external financing of R&D activities itself, especially in small firms, is severely constrained and must, to a very large extent, be self-financed (Himmelberg and Petersen, 1994; Ughetto, 2008; Hall, 2002; Hall and Lerner, 2009). The cost of capital that is used for R&D spending is much higher than the one associated with more traditional investment. Furthermore, Guiso (1998) and Ughetto (2009) show that innovative firms are in general more likely to be constrained in all their activities requiring external funding which makes them unable to fully exploit the investment potential created by their innovations. The next section proposes a model of heterogeneous firms that reflects the above mentioned empirical regularities.

2. A SIMPLE MODEL

The following sections discuss how finance constraints can affect a variety of organizational decisions on top of capital investments. To guide this discussion, we present a unifying framework which is more fully analyzed in Keuschnigg and Ribi (2010). The model endogenously explains the emergence of credit constraints in small and innovative firms and, in particular, shows how finance constraints on subsequent expansion investment feeds back on the R&D decision even if R&D is fully self-financed.

Suppose there is a mass of entrepreneurs *E*, each running one firm. Entrepreneurs are endowed with own wealth *A*, reflecting the internal resources of the firm. We divide the life-cycle of a firm in an early stage where the firm can decide on a discrete R&D investment, and a subsequent expansion stage where physical capital is invested. Firms differ with respect to the success probability $q' \in [0,1]$ of the early stage activity, with probability $1-q'$ it fails and is closed down. Given type q', the firm decides whether or not to incur a fixed R&D cost *k* which must be financed out of own assets and is possibly subsidized at rate σ. R&D raises factor productivity θ_c of the production function $x_c = \theta_c f(I_c)$ where *f(I)* is increasing and concave. If the firm abstains from R&D and saves the fixed cost (or chooses lower R&D spending normalized to zero), it will be left with low productivity $\theta_u < \theta_c$ and a less efficient production technology $x_u = \theta_u f(I_u)$.

Once a firm has successfully survived the start-up phase, it enters the expansion phase and chooses physical capital investment and, thus, the subsequent production scale. Given initial wealth, R&D spending results in residual wealth $A_c = A - (1-\sigma)k$ while non-innovating firms have undiminished resources $A_u = A$. We assume that residual internal funds A_j, $j = u,c$, at this stage are insufficient to cover the desired investment level I_j. Hence, firms must raise external funds D_j.[2] Having negotiated a credit and the required repayment, the entrepreneur exerts unobservable managerial effort. Effort determines the success probability of expansion stage investment. If effort is high, investment is successful and output is produced with probability *p* while all investment is lost and no output produced with probability *1-p*. When choosing low effort, the survival probability falls to $p_L < p$, but the entrepreneur enjoys private benefits $B_j = bI_j$. When the entrepreneur is successful, she earn revenue from production sales, pays tax, repays the bank credit, and claims the residual profit. If the firm fails, investment is lost and earnings are zero.

[2] External funds could equivalently be raised in terms of outside equity or debt. To simplify the discussion, we exclusively stick to the interpretation of bank credits.

Surplus

Given a success probability *p*, resulting from high managerial effort, the entrepreneur's expected surplus π_j^e over own residual assets A_j in the expansion stage is

$$\pi_j^e = pv_j^e - RA_j, \quad v_j^e \equiv I_j + x_j - (1+i)D_j - T_j .$$

The entrepreneur's compensation in the success state, v_j^e, amounts to income from sales x_j and disinvestment I_j, after subtracting debt repayment (principal plus interest) and the tax liability T_j. Given insufficient internal resources, firms must raise external funds in the amount of $D_j=I_j-A_j$. Banks charge interest iD_j on risky business debt but must pay a risk-free interest rate *r* in the deposit market which is assumed fixed. The bank's expected profit is $\pi_j^b = p(1+i)D_j - RD_j$, where *R=1+r*. Competition drives bank profits to zero, giving *p(1+i)=R*, which links loan and deposit rates of interest. If she is able to get the required credit, the entrepreneur obtains the whole private surplus of the firm, $\pi_j = \pi_j^e + \pi_j^b = p(I_j + x_j - T_j) - RI_j$ which may also be written as $\pi_j = p(x_j - iI_j - T_j)$ by using the bank's zero profit condition.

When external financing is unconstrained and banks are perfectly competitive, the first best level of investment maximizes π_j and is given by $\theta_j f'(I_j) = u$ where *u* is the user cost of capital which depends on the specific tax system in place (see below). In the absence of tax, the user cost is the loan rate of interest, *u=i*. Investment is expanded until the return on capital is equal to the user cost. There is no excess return when firms are unrestricted in exploiting investment opportunities. Investment exclusively depends on the user cost as in neoclassical theory, but neither on the amount internal resources nor on institutional variables reflecting the governance of firms.

Financing frictions

Since banks cannot observe managerial effort directly, they must assure that lending is incentive compatible. They must thus leave the entrepreneur with a large enough stake

that guarantees high effort and, in turn, a high probability of success and repayment.[3] Lending is incentive compatible if, ex post, entrepreneurs prefer to apply high effort and to forgo private benefits, i.e.

$$pv_j^e \geq p_L v_j^e + bI_j \quad \Leftrightarrow \quad v_j^e \geq \beta I_j, \ \beta \equiv b / (p - p_L).$$

The entrepreneur's compensation v_j^e in case of success must thus lie above a certain threshold which depends on level of private benefits that could be consumed when shirking. This measure implicitly reflects the quality of corporate governance mechanisms and other institutional characteristics which are expected to determine the autonomy of insiders and their possibilities for misbehavior. From the bank's point of view, the incentive compatibility constraint restricts the amount of earnings which the firm can credibly pledge as a repayment of external credit: $(1+i)D_j \leq I_j + x_j - T_j - \beta I_j$. The right hand side is the firm's pledgeable income or external financing capacity.

Whether this constraint is binding or not depends on the size of a firm's pledgeable income relative to its financing needs, given by $D_j = I_j - A_j$. When technology $x_j = \theta_j f(I_j)$ is concave, the firm's financing capacity increases less than proportionately at high investment levels while external financing needs rise linearly. At large investment levels, the constraint eventually becomes binding as Figure 1 illustrates. To replicate the empirical regularities reported in Section 1, we assume that the credit constraint is binding for innovative firms but slack for standard firms, meaning that standard firms invest at the optimal scale where the return is equal to the user cost. By way of contrast, investment of innovative firms is constrained by their debt capacity, raising more external funds to expand investment would violate the incentive constraint and lead to a high probability of failure. Investment is thus implicitly determined by the financing constraint $(1+i)(I_c - A_c) = I_c + \theta_c f(I_c) - T_c - \beta I_c$, which is illustrated on the right hand panel of Figure 1. There are two important implications. First, since investment is lower than the first best level, the firm earns an excess return ($x'_c > u$)

[3] We assume that low effort reduces the success probability to p_L and by so much that either entrepreneurs or banks fail to break even. In either case, the project cannot be undertaken.

and, thus, has unexploited investment opportunities. Second, investment depends on own assets A_c and institutional characteristics as reflected in the parameter β.

[Insert Figure 1 about here.]

In this model, innovative firms are more easily finance constrained for two reasons. First, innovation results in a high productivity θ_c and boosts investment opportunities. Although more investment raises earnings and thereby also debt capacity, it increases one by one the need for external financing. Second, R&D spending in the early stage drains own resources and leaves firms with lower residual assets $A_c = A - (1-\sigma)k$ which again raises the need for more external funds to finance expansion investment. Compared to innovative growth companies, characterized with low residual assets but high investment opportunities, non-innovating firms are left with undiminished internal resources $A_c = A$ and little growth potential on account of low productivity. We henceforth assume that innovative firms are constrained and standard firms not.[4]

Early stage R&D investment

After entry, and before deciding on R&D spending, the entrepreneur learns the early stage success probability *q'* of the venture. We assume that the firm is fully able to self-finance R&D costs internally so that no adverse selection problem arises in financing R&D spending.[5] When undertaking R&D, the firm incurs a fixed cost, $(1-\sigma)k$ which is partly reduced by an R&D subsidy at rate σ, but can expect larger earnings $\pi_c > \pi_u$ on account of a higher productivity. Given that the firm survives the early stage only with probability *q'*, the net present value is $q'\pi_c / R - (1-\sigma)k$. When not spending on R&D, the net present value of the same firm would be $q'\pi_u / R$. The firm undertakes R&D if $q'\pi_c / R - (1-\sigma)k > q'\pi_u / R$. Since the early stage success probability reflects the heterogeneity of firms in their innovation potential, the critical type is given by

[4] See Keuschnigg and Ribi (2010) for a more rigorous statement of the required assumptions.
[5] We focus here on external financing of expansion investment to exploit the opportunities created by innovation, rather than on the financing of innovation itself.

$$q = \frac{(1-\sigma)kR}{\pi_c - \pi_u}.$$

Figure 2 illustrates how this cut-off value separates standard firms (values *q'* below *q*) from innovative firms (values *q'* above q). If *g(q')* is the density function of the firm distribution, the mass of standard firms surviving the early stage is $s_u = \int_0^q q' g(q') dq'$, while the mass of innovative firms surviving to the expansion stage amounts to $s_c = \int_q^1 q' g(q') dq'$. Average productivity can be defined as $\theta_E = \frac{s_u \theta_u + s_c \theta_c}{s_u + s_c}$, where the denominator is simply the expected value of *q'* over all types of firms.

[Insert Figure 2 about here.]

Using this framework, we can now discuss how profit taxation affects various business decisions and aggregate outcomes when part of firms are effectively finance constrained. We first discuss the different impact of taxes on constrained and unconstrained firms and thereby also highlight the differences to the neoclassical investment model. In particular, we emphasize that taxes will not affect the business sector in a uniform way but will involve intensive (on expansion investment) and extensive effects (on innovation) that are importantly driven by finance constraints. We then study the effects of R&D subsidies on innovation and capital investment. In subsequent sections, we will reinterpret the discrete R&D decision as organizational choice along other dimensions: venture capital versus bank financing and the incorporation decision. In the end, we turn to rather different areas and shortly discuss how finance constraints might affect dividend payout behavior, comparative advantage in an international setting, and labor market performance.

3. TAX REFORM

This model of heterogeneous firms illustrates how the impact of taxes changes when firms are finance constrained. Suppose the tax liability of a successful firm is $T_j = \tau(x_j - \lambda i I_j)$ where $I_j = A_j + D_j$. Profits x_j are thus taxed at a proportional rate τ, and a share λ of the total

financing cost is deductible from the tax base, including interest on bank debt D_j as well as an imputed return on equity A_j.[6] The user cost of capital then becomes $u = \frac{1-\lambda\tau}{1-\tau} \cdot i$. As shown above, unconstrained firms choose their investment scale such that the marginal return is equal to the user cost of capital, $\theta_u f'(I_u) = u$. As long as $\lambda < 1$, the profit tax raises the user cost above the rate of interest on loans and thereby discourages investment. Unconstrained firms thus act as predicted by traditional neoclassical investment theory (cf. Hall and Jorgensen, 1967, Hassett and Hubbard, 2002). The distortion of investment incentives, as measured by the concept of marginal effective tax rates, can be substantial: empirical estimates of the elasticity of investment with respect to the user cost of capital range between -0.5 and -1.0 (see Hassett and Hubbard, 2002).

In the tax reform literature, the ACE (allowance for corporate equity) tax system, as proposed by the Capital Taxes Group of the Institute for Fiscal Studies (1991), plays a prominent role. An ACE tax system allows for full deduction of (imputed) interest costs both on equity and debt which is replicated by setting $\lambda = 1$. This tax leaves the user cost of capital unaffected, $u=i$, and therefore avoids any tax distortion of investment when firms are unconstrained as in the neoclassical case (cf. King, 1975; Boadway and Bruce, 1984; Bond and Devereux, 1995, 2003). If innovative firms were unconstrained as well and the R&D subsidy rate were equal to the tax rate, the tax system would be fully neutral not only towards expansion investment but also towards the innovation decision as well (extensive margin).The same would hold for a cash-flow tax system which allows full deduction of investment expenses but, instead, denies deductions of interest cost (see cf. King, 1975; Boadway and Bruce, 1984; Bond and Devereux, 2003).[7] Both tax systems feature prominently in the tax reform literature, e.g. Devereux and Sorensen (2005), OECD (2007),

[6] Existing tax systems typically allow for deduction of interest on debt only. For simplicity, we do not include this as a separate case. Any tax system with $\lambda < 1$ leads to very similar distortions.

[7] With a cash-flow tax, the government denies interest deductions, $\lambda = 1$, but allows immediate deduction of net investment, equal to I at the beginning and $-I$ at the end of period. The net end of period value of taxes is $p\tau(x+I) - \tau IR = p\tau(x - iI)$. Subtracting this from private surplus gross of tax, $p(x - iI)$, yields $\pi = (1-\tau)p(x - iI)$ which is maximal when $x' = i$. Hence, the cash-flow tax is neutral in the first best as well.

and Auerbach, Devereux, and Simpson (2008). In this framework, the two tax systems are equivalent also when financing constraints are binding (see Keuschnigg and Ribi, 2009).

How do profit taxes affect investment when credit constraints are binding? As shown in Section 2, expansion investment in this case is not determined by the user cost of capital, but by the incentive compatibility constraint $(1+i)D_c = I_c + x_c - T_c - \beta I_c$. A positive tax liability T_c reduces the pledgeable income and, thus, firms' capacity to raise external funding, forcing them to cut back on investment. The mechanism by which taxes affect investment, is thus completely different for constrained and unconstrained firms so that taxes will have a different impact on different types of firms. In other words, there will be level and composition effects. This will also be important for aggregate innovation, since innovative growth companies are most likely to be constrained, will standard firms are not.

How finance constraints change key results in tax theory and therefore modify the impact of taxes on innovation and average productivity, is most clearly seen if we restrict attention to an ACE tax which is fully neutral in the unconstrained case. To be neutral in the presence of innovation, the ACE system must grant full deduction of R&D cost as well which requires $\lambda = 1$ and $\tau=\sigma$. We have seen that investment I_u of standard, unconstrained firms is independent of the tax rate τ in an ACE system. Being a tax on rent, expected private profit falls by $d\pi_u = -\pi_u \cdot \hat{\tau}$, where the change in the tax rate is defined as $\hat{\tau} = d\tau / (1-\tau)$. Note that, even if the tax system were not neutral, a tax-induced marginal change in I_u, by the envelope theorem, would not affect expected profit of unconstrained firms.

A tax increase changes expected profits of innovative firms in a different way, by $d\pi_c = -\pi_c \cdot \hat{\tau} + \rho p \cdot dI_c$, where $\rho \equiv (1-\tau)(x_c' - u)$ is the after-tax excess return on investment. When access to external finance is restricted, investment cannot be expanded until its marginal return equals the user cost of capital which is equal to the loan rate i in a 'neutral' ACE tax system. Investing more would still earn a positive excess return and boost expected profit but the firm can't get the required funds. Differentiating the financing constraint yields $dI_c = -\frac{\pi_c}{m} \cdot \hat{\tau} + \frac{(1-\sigma)kR}{m} \cdot \hat{\sigma}$, with $m \equiv (\beta - \rho)p > 0$ and $\hat{\sigma} \equiv d\sigma / (1-\sigma)$. The R&D decision

results in an innovation threshold q which also separates constrained and unconstrained firms as in Figure 2. Since an ACE system sets the subsidy rate equal to the tax rate, i.e. $\hat{\tau} = \hat{\sigma}$, we find that investment falls, $dI_c < 0$, when we use the cut-off value q as in Section 2. Since investment of constrained firms is sensitive to cash-flow, a tax on rent is no longer neutral because it tightens the finance constraint. Different from unconstrained firms where the envelope theorem applies, the marginal reduction in I_c leads to an additional profit loss which is proportional to the excess return on restricted investment. Hence, the tax reduces expected profit beyond the reduction in rent that would also occur with unconstrained firms.

The innovation decision is driven by the profit gain as a result of R&D investment which is equal to the difference in expected profit of an innovative and a standard firm. Since the tax squeezes expected profit of an innovative firm relatively more than of a standard firm, it reduces the return to innovation. The cut-off value of the early stage success probability, $q = (1-\sigma)kR / (\pi_c - \pi_u)$, which also separates standard from innovative firms, must thus rise. In consequence, the share s_c of innovative firms and aggregate productivity θ_E must both decline when the tax rate in a 'neutral' ACE system is increased. What is a neutral tax in the neoclassical model, is no longer neutral when (part of) firms are finance constrained. Aggregate investment declines both in the intensive and extensive margins.

When innovative firms are constrained, profit taxes thus hurt them more strongly and dampen aggregate innovative activity on account of a negative selection effect. Due to the pre-existing investment distortion, the ensuing welfare loss is of first order even when starting from an untaxed equilibrium. In fact, it is proportional to the excess return earned by constrained firms. Hence, the negative consequences are more severe the tighter the financing constraints are. It thus seems a preferred strategy of tax reform to modify the system in a way that reduces the negative impact on innovative and financially constrained firms. The extra activity of firms which earn an excess return on investment, promises important efficiency gains. It is important to emphasize that these efficiency gains have nothing to do with innovation spillovers and other external benefits from innovative firms, but result exclusively from the relaxation of finance constraints.

One such possibility is a tax cut cum base broadening strategy. Many countries have seen such reform over the last three decades, although presumably for other reasons. The average statutory corporate income tax rate of 17 OECD countries has dropped from above 50.9% in 1982 to 30.8% in 2006 (OECD, 2007). Over the same time period, depreciation allowances have dropped in more than half of these countries, implying a broadening of the tax base. In the present framework, we can examine tax base broadening by reducing the share λ of financing costs that can be deducted from the base. Starting out from a pure ACE system with $\tau = \sigma > 0$ and $\lambda = 1$, we may thus consider a reduction of λ to broaden the tax base, and then cut the tax rate τ to keep the reform revenue neutral. Starting out from a pure ACE system where the tax rate does not affect the user cost of capital, a small cut in the tax rate has no impact on investment of standard firms. However, restricting the deduction λ of interest expenses clearly inflates the user cost and discourages investment I_u.

By way of contrast, the tax cut stimulates investment of innovative firms because investment is sensitive to cash-flow, whereas the reduction in λ has the opposite effect. In Keuschnigg and Ribi (2010) we show that the positive effect dominates which boosts investment I_c. The policy implicitly redistributes from standard to innovative firms. Since innovative firms are constrained and earn an excess return, the marginal investment expansion makes innovative firms even more profitable whereas a marginal change in I_u has no effect on expected profit of standard firms. Given that the policy makes innovative firms relatively more profitable, the returns to R&D increase, the innovation threshold q falls and more firms engage in R&D. The revenue neutral tax cut cum base broadening policy shifts investment from standard to innovative firms, induces a larger share of firms to innovate and, thus, boosts average productivity θ_E. The policy yields aggregate efficiency gains that are, again, proportional to the excess return on investment of constrained, innovative firms.

4. INNOVATION AND R&D SUBSIDIES

Incentives for private R&D play an important role in most countries' innovation policies. Two main reasons are commonly stated why policy should promote innovation in

private companies: positive spillovers and financing constraints. The first argument, dating back to Nelson (1959) and Arrow (1962), follows from the observation that innovating firms often cannot fully appropriate the output from private R&D. Other companies can at least partly use the innovation outcomes, thus benefiting from positive spillovers. Since they cannot reap the full social return on R&D investments, firms tend to invest too little in R&D which creates a case for strengthening R&D incentives. Public support can take several forms: most common is direct funding in the form of government contracts, competitive grants or subsidized loans. However, in recent years, fiscal incentives like tax credits have become more important (OECD, 2008).

The empirical literature has extensively studied the effects of these measures on private R&D. An important concern, especially in the case of direct funding, is that public support might simply substitute for private R&D spending and lead to crowding-out effects. In their survey of studies that measure the effectiveness of direct public funding of private sector R&D, David, Hall, and Toole (2000) indeed emphasize a large ambiguity in empirical findings on this question. With regard to fiscal incentives, the empirical evidence is more consistently positive. Hall and Van Reenen (2000) conclude that one dollar in tax credits leads to about one dollar of additional business R&D. In their cross-country study, Bloom, Griffith and Van Reenen (2002) find that when tax credits reduce the cost of R&D by 10%, one can expect the level of R&D activity to rise by roughly 10% in the long run.

The second common rationale for public support refers to financing constraints of innovative firms. Even more than with standard investment, the quality of inventions and their market potential is difficult to judge by outside investors who are not directly involved in the innovation process. Hence, the entrepreneurial effort towards R&D intensive investment is largely unobservable to outside investors. For these reasons, innovating firms find it even more difficult to raise external finance for R&D purposes than for more standard physical investment.[8] The empirical literature confirms that capital costs are higher for R&D intensive investment than for standard investment, especially for small firms (cf. Hall, 2002; Hall and

[8] In our model, one may think of R&D investment in a broad sense as consisting of a fixed R&D cost and a variable capital investment to implement the innovation. While R&D is fully self-financed, financing constraints restrict variable capital investment.

Lerner, 2009). Consistent with the fact that these firms mainly rely on internal resources to finance their innovation activities, the correlation between investment and own cash flow is also significantly higher for the R&D investment category (Brown and Petersen, 2009).

How effective is public R&D support when firms are subject to financing constraints for these activities? There are a few empirical studies that shed light on this question. Hyytinen and Toivanen (2005) study the relationship between financing and innovation in small and medium size enterprises (SMEs) in Finland. Capital market imperfections prove to be an obstacle for innovative activities and the growth of these companies. Government funding of business R&D is found to be an important complement to capital markets. In industries that depend more strongly on external finance, government funding significantly stimulates R&D activity, leading also to more growth-oriented firms. Czarnitzki (2006) reports similar findings for SMEs in West Germany, whose R&D activities are constrained by both internal and external resources. Public funding raises their probability to engage in R&D by 24 percentage points.

This last result also points to a discrete modeling of R&D activity as in our theoretical framework. A subsidy to the innovation cost *k* directly reduces the amount of private R&D spending. Hence, the expected net present value of the innovation strategy rises which induces more firms to innovate and spend on R&D. The subsidy becomes even more effective when firms experience problems with external funding because R&D drains own resources and thereby limits the amount of possible self-financing to implement the innovation with subsequent capital investments. These firms cannot exploit their full growth potential that would be possible with their more productive technology. The constraint on expansion investment reduces an innovating firm's profits and, thus, reduces the returns to R&D and the level of innovative activity on the extensive margin. A tax relief or a subsidy σ on private R&D spending leaves innovative firms with more internal assets $A_c = A - (1-\sigma)k$ which are still available for self-financing a larger part of expansion investment. An R&D subsidy thus relaxes the financing constraint and enables innovative firms to raise more external funds and to invest capital I_c at a larger scale. Firms grow larger and come closer to

their efficient scale. Due to the excess return on constrained investment, the additional growth boosts expected profit of an innovative firm. In consequence, innovation becomes even more profitable which induces more firms to invest in R&D. Brighi, Corigliano, and Torluccio (2009) confirm that R&D subsidies also stimulate external financing and equipment investment on top of R&D. In Japan as well, the public support programs for innovative firms under the SME Creative Business Promotion Law strengthen the asset growth in the participating companies (Honjo and Harada, 2006).

The fact that R&D tax credits apply to a rather broad group of firms and thus leads to large losses in tax revenue, raises concerns with regard to their cost-effectiveness (cf. Griffith, Redding, and Van Reenen, 2001). In our theoretical model, we can in fact examine whether an increase in the subsidy rate σ that is financed in a revenue neutral way by a parallel increase in the tax rate, is still able to boost innovation, or whether this is a self-defeating policy strategy. Starting out from an ACE system with $\lambda = 1$ and $\tau = \sigma > 0$, this revenue neutral policy has unambiguously negative effects on standard firms, even though the ACE tax is neutral with respect to unconstrained investment I_u. Standard firms cannot benefit at all from the larger R&D subsidy, but the tax increase eats into their profits. The effect on investment incentives of innovative firms is, a priori, ambiguous. A larger subsidy σ leaves firms with more internal resources and allows them to expand equipment investment. The tax increase, however, reduces the firms' pledgeable income and, thus, their ability to raise external funds which restricts investment I_c. In Keuschnigg and Ribi (2010), we show that the combined effect is positive if the number of innovative relative to standard firms is not too large. Standard firms are clearly net tax payers in this scheme, and the investment distortion is zero to the first order with an ACE tax in place. The revenue extracted from these firms thus entails no efficiency loss. When there are few innovative and many standard firms, the government budget constraint implies that a very small tax increase on all firms suffices to finance a relatively large R&D subsidy for relatively few innovating firms. Such a scenario clearly redistributes from away from standard firms, reduces the net present value of tax and subsidy payments of innovative firms, thereby relaxes their financing constraint

and helps these firms to invest more. Since investment of constrained innovative firms yields an excess return, these firms become more profitable beyond the direct *net* tax subsidy. In consequence, the higher returns to R&D stimulate innovation and boost aggregate productivity. This revenue neutral redistribution policy yields efficiency gains that are proportional to the excess return on constrained investment. Allowing firms to exploit investment opportunities with a strictly positive net value to a larger extent clearly boosts aggregate income and welfare.

As these last two sections have shown, the presence of financing constraints has important implications for the effects of tax policy. Profit taxes such as an ACE (or cash-flow) tax do not affect the user cost of capital and, therefore, are neutral towards investment of unconstrained firms. However, they still hurt innovative companies by reducing cash-flow and pledgeable income which prevents them to fully exploit the investment opportunities created by early stage innovation. In consequence, fewer firms will engage in R&D so that innovation and productivity decline. Since constrained firms earn an excess return, the reduction in investment leads to a first order welfare loss. Given that constrained and unconstrained firms coexist, there are several possibilities for revenue neutral policy changes that implicitly redistribute towards innovative firms. Examples are an R&D subsidy financed with a higher profit tax or a tax base cum base broadening policy. These redistributive, revenue neutral policies help to relax finance constraints of innovative firms and allow them to exploit unrealized investment opportunities with an excess return. Such redistribute policies thus raise innovation and efficiency. We next turn to the role of more active financial intermediaries such as venture capital, and to the implications of finance constraints on other business decisions.

5. VENTURE CAPITAL VERSUS BANK FINANCING

Young high-tech companies with a high growth potential often receive at least part of their external funding from venture capitalists.[9] These financiers have a lot of industry experience and managerial know-how. Venture capital (VC) firms are thus able to support their portfolio companies with advice and professional support, on top of supplying part of the external financing (see Cumming and Johan, 2007). Their advice and monitoring activity may not only raise the survival prospects of firms but can also often facilitate their access to other sources of financing. In the U.S., where the VC industry is most mature, VC financed R&D accounted only for around 3% of corporate R&D activities from 1983 to 1992, but generated about 8% of industrial innovation and even more in later periods (Kortum and Lerner, 2000). During the 1990s, more than 30% of initial public offerings were backed by VC (Gompers and Lerner, 2001).

However, active monitoring and advice also makes VC more expensive than passive bank loans and is, thus, not appropriate for all young firms. Firms must have large enough growth opportunities to favor the involvement of a VC.[10] We thus replace the distribution of firms by their early stage success probability $q' \in [0,1]$ with a productivity distribution across firms in an interval $\theta \in [\theta_0, \theta_1]$ (see Keuschnigg, 2009, for details). We also replace the discrete innovation decision in the preceding sections with a discrete choice between bank financing only and VC and (residual) bank financing as the other option.

An entrepreneur with little own wealth must raise external funds and chooses from different sources. All intermediaries are assumed to be perfectly competitive and will supply funding only to the extent that lending is incentive compatible. A passive bank loan requires the payment of a loan rate, but offers no further assistance. In contrast, VCs not only provide funds but actively monitor the firm and provide advice (Kaplan and Strömberg, 2001, and). This value increasing activity results, for instance, in a shorter time until a product is introduced in the market and contributes to the professionalization of the firm in other ways (Hellmann and Puri, 2000). It is assumed that the active involvement of a VC boosts the

[9] This section draws on Keuschnigg (2009) who also presents a formal model of venture capital and bank financing to discuss public policy. Cosh, Cumming and Hughes (2009) analyze empirically firms' choice from several sources of external funding and find support for the pecking order theory.

[10] Empirically, selection and active influence by venture capitalists are simultaneously important (cf. Sorensen, 2007).

expected value of the firm by raising the success probability by p^V to a level of $p + p^V$ if both the entrepreneur and the VC exert high effort. Since the VC's activity is not verifiable and observable either, a double moral hazard problem emerges. The higher survival chances, however, is assured only if both agents are incentivized ex post by retaining a large enough stake in the firm. In other words, two incentive constraints must now be fulfilled for lending with a high repayment probability to be incentive compatible.

To assure high managerial effort as well as advice and monitoring, and given the effort costs of these activities, both the entrepreneur (analogous to Section 2) and also the VC must each retain a large enough stake in the firm's future cash-flow. Compensating the advisory input on top of the cost of capital makes VC financing more expensive than bank loans. Firms are thus willing to cede to VCs no more than the smallest incentive compatible cash-flow share that just guarantees their advisory input. Given that VCs are competitive and receive a repayment equal to the required compensation for advice, firms will ask for a level of funding that allows VCs no more than break even with a zero expected profit. Having secured an active role of the VC and already part of the external funding, firms leverage their own wealth augmented by VC funds with additional bank loans to further expand investment. Hence, the marginal funds for additional investment are raised from banks. With larger investment, repayment of bank loans rises as well so that the entrepreneur's residual profit income shrinks accordingly. Investment and bank lending can thus be expanded until the entrepreneur's share shrinks to the minimum amount necessary that prevents shirking to keep the entrepreneurial effort high.

Since firms can always finance with bank loans alone, although possibly at a smaller scale, the question is whether they should additionally apply for VC funding. Since VC financing is more costly, it is not preferred by all firms equally. Keuschnigg (2009) considers a situation, characterized by certain parameter conditions, where entrepreneurs with low productivity prospects rely only on bank credits since VC advice is not sufficiently valuable from them to warrant the extra cost. Firms with very high productivity find that the value of VC advice more than compensates for the larger cost of VC funding. There is thus a clear

sorting in the market for business financing. Firms with very high productivity attract VC financing which is further leveraged by additional bank loans while less productive firms finance themselves exclusively with standard bank loans. This replicates the stylized fact that VC financing is mainly concentrated among the most innovative start-ups with the largest growth potential.

Taking the perspective of this framework, public policy can influence the VC sector in several ways.[11] On the supply side, one important channel by which the volume of VC financing is affected, relates to the regulatory restrictions of public investment funds. In the U.S., the Department of Labor's clarification of the 'prudent man' rule in 1979 had a significant impact on VC fundraising (Gompers and Lerner, 1998). There are two ways in which a higher supply of VC funds might benefit firms: first, it should reduce the capital cost of VC firms which translates into lower financing costs of firms in a competitive VC market. Second, to the extent that individual VC firms are able to invest the additional funds in a larger portfolio of firms, they might gain further experience and be able to add more value to their individual firm investments. With VC advice is more productive, VC funding should be attractive for a larger range of firms. If, for both reasons, a larger share of firms attracts VC financing, aggregate productivity and innovation based growth should be stimulated.

The demand for VC is sensitive to a number of subsidy and tax measures. Small high-growth companies which are often financed by VC, are also typically the target of public subsidy programs that aim at stimulating business creation as a means to promote innovation. In the U.S., the Small Business Innovation Research (SBIR) program substantially enhanced the participating firms' employment and sales growth, and it increased their likelihood to receive VC financing (Lerner, 1999). In the model, start-up subsidies reduce the amount of external financing and, for a given amount of pledgeable income, relaxes the financing constraint. In consequence, firms can raise more external VC and bank financing. Since the effect is stronger for VC backed investments, more firms are induced to apply for VC financing. Given that innovative firms on average get more profitable,

[11] Cumming, Schmidt and Walz (2010) find evidence that cross-country differences in the legal environment, including legal origin and accounting standards, facilitate VC financing, and Armour and Cumming (2006) find other institutional determinants to be important, such as taxes and subsidies, presence of stock markets or the quality of bankruptcy law.

these subsidies are likely to strengthen incentives for early stage R&D investments and entrepreneurial entry. Start-up subsidies thus raise demand for VC financing both on the intensive and extensive margins.

As in the model with pure bank financing, profit taxes also reduce innovative firms' pledgeable income and, thereby, restrict external financing and the level of investment. Due to their larger size, VC backed firms are more strongly affected so that VC financing becomes relatively less attractive as compared to pure bank financing. Reflecting a selection effect, profit taxes should reduce the share of new firms using VC financing. In addition, the profit tax reduces the net present value of a new firm at the date of entry before selecting into one of the two financing modes. Reflecting a level effect, profit taxation should thus reduce entry and shrink the number of new, high-tech start-ups. Entry will also depend on the tax burden on the alternative career option of a potential entrepreneur, i.e. dependent employment elsewhere, net of labor taxes. Occupational choice is thus driven by the relative effective tax burden on wage and profit income. To sum up, an increase in profit taxes, relative to wage taxes, should have a negative level effect on account of reduced entry, and a negative selection effect, on account of fewer entrants demanding VC financing.

Profit income can accrue in different forms, dividends or capital gains. During the start-up period, the return to investment of both entrepreneurs and VCs mainly consists of capital gains. The capital gains tax might therefore constitute a strong disincentive to VC investment. Empirical studies, however, point to the fact that a large share of (institutional) venture investors are not subject to the individual capital gains tax so that VC fund raising and, thus, VC supply might not be affected too much (cf. Poterba, 1989; Gompers and Lerner, 1999). VC demand by entrepreneurs, on the other hand, is significantly reduced by capital gains taxes. On the other hand, corporate taxes are levied at the firm level and reduce the value of firms irrespective of whether profit is distributed in terms of dividends or capital gains. In particular, corporate taxes reduce returns to VC investors and entrepreneurs as well. Studying data on 14 European countries, Da Rin, Nicodano and Sembenelli (2006) find that a lower corporate capital gains tax stimulates the creation of highly innovative firms.

They interpret this as evidence that the tax cut also boosts VC monitoring incentives, thus stimulating firm performance and VC investment, a point which is emphasized in Keuschnigg and Nielsen (2004).

6. INCORPORATION

The tax treatment of entrepreneurial income to a large extent depends on the firm's organizational form. Income from non-corporate firms or sole proprietorships is subject to personal income taxes which tend to be steeply progressive in most countries. Corporate income, on the other hand, is first subject to corporate tax, and subsequently to dividend and capital gains taxes at the shareholder level.[12] The total effective tax on corporate income also depends on measures to alleviate the potential double taxation, either by applying reduced tax rates on dividends or capital gains, or by some form of tax credit for prepaid corporate tax. Some countries even tax according to the so called classical system where there is full double taxation of corporate profits. The different tax treatment of income from sole proprietorships and corporate firms is one important factor influencing the relative attractiveness of the two alternative organizational forms.

However, the choice of organizational form is also importantly driven by other economic factors. Corporate entities must comply with tight accounting and reporting standards and book keeping regulations. On the one hand, this makes them more transparent for outside investors, reduces the informational asymmetry, makes insiders more accountable to outside stakeholders and narrows down the room for managerial misbehavior. Via this channel, the corporate form improves firms' access to external financing. On the other hand, the tighter reporting requirements impose extra administrative overhead costs which make this legal form more expensive. Another difference is that entrepreneurs are liable with their full private wealth whereas the corporate form offers limited liability and protects the private wealth of entrepreneurs in case of bankruptcy.

[12] See Desai, Dharmapala and Fung (2007) on how the progressivity of the personal income tax system influences equity ownership concentration.

To explain how taxes and the quality of the legal environment as reflected in corporate law affect firms' choice of organizational form, one may again consider the model set out in Section 2.[13] The discrete choice now relates to the incorporation decision, i.e. whether to adopt the corporate legal form or stay non-corporate. We also abstract from productivity differences θ of different types of firms. However, we argue that tighter book keeping standards result in a greater transparency of firms which reduces information problems, makes insiders more accountable and thereby narrows down the private benefits that managers could potentially enjoy when shirking. Corporate firms thus have a lower β, and therefore need a lower income share to keep them properly incentivized. In turn, the company's pledgeable income rises and allows firms to raise more external capital. This mechanism essentially formalizes the argument that the corporate form is valuable in improves access to the capital market. On the other hand, the corporate form is not for free. Firms need to invest in their reporting and book keeping procedures to comply to the legal standards which is captured in a fixed cost *k* (and replaces the fixed R&D cost of Section 2). This alone would explain the impact of incorporation on the extensive and intensive margins, i.e. the share of firms choosing to incorporate, and the larger scale of investment that corporate firms can realize on account of better access to external capital.

To discuss the importance of limited liability, assume that on top of financial assets *A*, entrepreneurs are also endowed with additional private wealth *H*, such as their own family house. This private asset cannot be directly invested in the firm, but it may serve as a collateral with the bank. Arguably, the consumption value $(1 + \alpha)H$ is higher for the individual than the collateral value *H* for the bank, for instance due to an additional consumer surplus from living in one's own house. When the entrepreneur adopts the non-corporate form and runs the firm as a sole proprietorship, banks can seize not only the financial assets *A* invested in the firm, but also the private assets *H* when the business fails. Losing her private asset might be exceedingly costly for the entrepreneur so that she looks for ways to protect it. Incorporation is a possibility to do so. When incorporating, the entrepreneur can choose

[13] This exposition builds on Egger, Keuschnigg, and Winner (2009).

whether or not she wants to put up her private asset *H* as a collateral to secure additional bank credit. On the positive side, offering *H* as a collateral allows the firm to raise additional credit to finance a larger investment and thereby to boost expected income.[14] On the negative side, losing the consumer surplus due to the higher consumption value of the private asset in case of bankruptcy might reduce expected utility too much. Therefore, if they are very risk averse (in the sense of attaching a high consumer value on the private asset), entrepreneurs prefer limited liability (see Egger, Keuschnigg, and Winner, 2009). This discussion shows that limited liability does not unambiguously favor incorporation. If the consumer value is low, entrepreneurs would put up their private assets as collateral anyway, irrespective of whether they incorporate or not. A similar point is heuristically stated in Berkowitz and White (2004).

Since incorporation is costly and results in fixed overhead costs *k* of complying to book keeping standards, the expected surplus of a corporate firm π_c must exceed the expected surplus π_u of the same firm in non-corporate form, in order to induce at least some firms to incorporate. Figure 2 above is conveniently reinterpreted: entrepreneurs with less promising ventures and an early stage success probability $q'<q$ prefer to stay non-corporate. Firms with larger potential prefer to incorporate and invest in the accounting system to comply with reporting and accounting regulations. The greater transparency and accountability allows them to raise more external capital and exploit their business idea to a larger extent. For this reason, corporate firms should be larger, given identical other firm characteristics such as factor productivity.

The differential tax treatment of corporations and sole proprietorships affects the incorporation decision and leads a margin of firms to change their organizational form for tax reasons. The model predicts that the share of corporate firms relative to sole proprietorships is higher the lower the corporate tax rate, dividend and capital gains taxes, and the higher the personal income tax. MacKie-Mason and Gordon (1997) provide evidence that double taxation of corporate income is a significant impediment to incorporation. Using historical

[14] Presumably for this reason, authors like Armour and Cumming (2008) find that bankruptcy law significantly affects self employment rates.

U.S. data, Goolsbee (1998) finds that higher corporate taxation is associated with higher non-corporate capital, but the economic significance is rather small. However, exploiting cross-sectional rather than time-series data, Goolsbee (2004) finds that the sensitivity of incorporation choice to tax differences is substantially larger than in previous studies which is also confirmed for European countries by De Mooij and Nicodème (2008) and Egger, Keuschnigg, and Winner (2009). Gordon (1998) and Cullen and Gordon (2007) emphasize that the potential to take advantage of lower tax burdens via incorporation stimulates entrepreneurial activity.

Institutional factors also play an empirically important role for organizational choice. The model suggests that well developed accounting and reporting standards, in making corporate firms more transparent, facilitate access to external funding, leading to more investment, larger profits and favoring incorporation. By way of contrast, compliance and overhead costs associated with the corporate legal form should discourage incorporation. The empirical study of Egger, Keuschnigg and Winner (2009) confirms these hypotheses. They also find that anti-director rights which measure the control and influence of outside shareholders on managers (La Porta et al., 1998), have a negative impact on incorporation. Accessing data from 52 countries, Demirgüc-Kunt, Love and Maksimovic (2006) also find that institutional determinants like the efficiency of legal systems and bankruptcy processes, a low regulatory burden and well developed financial markets make the corporate form more valuable and encourage incorporation.

7. DIVIDEND TAXATION

Shareholders receive the return on investment mainly in two ways: dividends or capital gains.[15] Their tax treatment, however, differs importantly: often, dividends are taxed at a higher rate than capital gains, and tax payment on the latter is typically deferred until realization, which also implies a lower effective tax rate. Despite this tax discrimination, a lot of firms nevertheless pay out dividends on a regular basis - a fact which was termed a

[15] We neglect share repurchases which are highly volatile over time (see Gordon and Dietz, 2009).

"dividend puzzle" by Black (1976). Explanations of payout behavior are driven by the presence of information asymmetry between firm insiders and outside shareholders. For instance, the signaling theory of dividends as in Bhattacharya (1979) presumes that managers pay dividends in order to transmit information to investors about future prospects of the firm. An alternative approach claims that managers with empire building tendencies want to retain earnings within a firm and invest free cash flow in projects that might not carry much value for shareholders (Jensen, 1986). Shareholders would then pressure for dividend payments to increase investment efficiency. A more recent model by Chetty and Saez (2009) focuses on the incentives of managers to invest in productive projects which benefit all shareholders, or in pet projects that increase only manager utility. Incentive pay in the form of company shares induces managers to pay dividends.[16]

Empirical studies on dividend taxation or payout policies in general confirm the relevance of agency problems.[17] The quality of corporate governance and legal protection is thus importantly related to the level of dividend payments. La Porta, Lopez-de-Silanes, Shleifer, and Vishny (2000a) show that in countries with strong minority shareholder rights, firms make higher dividend payouts than in countries with a lower quality of investor protection. This supports the hypothesis that investors use their shareholder rights to force firms to pay out cash. Pointing to a similar agency concern, Christie and Nanda (1994) demonstrate that the announcement of a tax on undistributed corporate profits in 1936 led to higher share prices. The reaction was particularly strong among firms with traditionally low payouts. The fact that investors welcomed the larger dividend pay-out at the expense of internal reinvestment of free cash-flow, points to shareholder concerns of inefficient internal investments by managers.

Particularly rich evidence became available by the 2003 tax reform in the U.S. Until 2003, the U.S. pursued the classical regime of full double taxation, i.e. a firm's income was

[16] The older literature on dividend taxation in public economics has long abstracted from explicit agency concerns in the determination of dividend payments. The "old view" presumes that investors have some given interest in receiving dividends, making firms pay them despite the tax disadvantage (cf. Poterba and Summers, 1983, 1985). In contrast, the "new view" of dividend taxation rules out new share issues or repurchases, leading to retained earnings as the marginal investment source and dividends as residuals which can be paid out to investors (Auerbach, 1979; Bradford, 1981). For an in-depth discussion of these two views, see Auerbach (2002).

[17] The empirical validity of the signaling approach seems most controversial, see for instance Bernheim and Wantz (1995), DeAngelo, DeAngelo, and Skinner (1996, 2004), and Grullon and Michaely (2004).

taxed by the corporate tax, and any dividends distributed subsequently were fully subject to personal income taxes at the shareholder level. In 2003, the Jobs and Growth Tax Relief Reconciliation Act reduced the tax rate on dividends to a maximum of 15%. This huge reduction in the tax rate led to considerable changes in firms' payout policies and valuations.[18] Analyzing only the first quarter following the passage of the tax reform, Blouin, Raedy and Shackelford (2004) find a 9% increase of aggregate dividend payments. The changes were higher in firms with high levels of inside ownership, confirming the effectiveness of incentive pay with self-interested managers. However, the rise in dividend payments seems to be driven by one-time large dividends, and not by a general rise in regular payments. Taking into account four quarters after the tax reform, Chetty and Saez (2005) report more substantial effects. They find that dividend payments increased by 20% following the tax cut. Very striking is the increase in the number of firms that didn't pay dividends before and started payouts after the reform. The share of companies paying dividends rose from 20% in the fourth quarter of 2002 to 25% in the second quarter of 2004. Firms paying regular dividends were also significantly more likely to increase their payments, and the number of one-time dividends rose substantially. The paper confirms strong heterogeneity of the effects across firms. The changes in payout behavior were stronger in firms where top executives held more shares. In addition, companies with high shares of taxable institutional ownership or large independent shareholders on the board of directors responded more strongly which points to an effective monitoring role of these agents. The model developed in Chetty and Saez (2009) can explain these observations, stipulating that managers have a desire for pet projects but can be influenced by incentive pay in the form of firm shares and by monitoring via the board of directors.

One question regarding the observed increase in dividend payments is whether they only substituted for share repurchases. This would imply that firms merely changed the relative weights of the different ways in which they distribute cash flow but did not necessarily raise its total amount. Brown, Liang, and Weisbenner (2007) show that firms which initiated

[18] See also Dharmapala (2009) for a discussion of the effects of this tax reform.

dividend payments after the tax cut, indeed were more likely to reduce share repurchases, whereas Blouin, Raedy, and Shackelford (2007) confirm substitution for a larger group of firms. Chetty and Saez (2005), however, can show that at least in the group of dividend-initiating firms, the total amount of payouts rose significantly. Overall, these studies confirm that agency concerns are an important motivator for investors to exert pressure on firms and make them pay out dividends. In firms with sufficient cash flow to finance their productive investment needs, a reduction in the dividend tax helps to align investors' and managers' interest. Indeed, Chetty and Saez (2009) show that a corporate income tax leads to lower efficiency losses than the dividend tax in this situation.

8. FINANCE AND COMPARATIVE ADVANTAGE

Corporate finance can importantly affect macroeconomic outcomes. Since innovative firms are most likely to be finance constrained, the quality of corporate finance determines the expansion of innovative industries. In open economies, the structural characteristics of the financial system and the financial robustness of firms can, thus, importantly shape a country's comparative advantage in financially dependent sectors. Hence, the results of classical trade theory which emphasizes differences in relative factor endowments and productivity across countries as determinants of international trade, must be modified. An extended version of the model of Section 2 can endogenously explain how corporate governance indicators and measures of financial development affect trading patterns (see also Egger and Keuschnigg, 2010).[19] Potential entrepreneurs can again set up a firm in the innovative sector. Since entrepreneurial inputs are crucial for the success of the venture, the innovative sector is assumed labor intensive. For simplicity, investment *I* per firm is fixed, but the productivity of that investment may vary widely in the sense that the output per firm is a draw from $\theta \in [0, \infty)$. In order to incentivize the manager to exert high effort, he must be paid a minimum compensation, which reduces the firm's pledgeable income. Some firms with a low productivity θ and low earnings are denied external funding when pledgeable income

[19] Matsuyama (2005) also provides a model that demonstrates how credit market imperfections affect trade. However, in his analysis, credit constraints are not endogenously explained.

turns out too low for lending *I-A* to be incentive compatible. The financial market frictions thus constrain the innovative sector along its extensive margin at the lower end of firm productivity. Workers as well as the potential entrepreneurs who do not start their own firm, are employed in a standard, capital intensive sector. This traditional sector combines labor and capital to produce a standard good and is not finance constrained. The industrial structure within a country thus depends on the relative prices of the produced goods, but also on financial institutions. The key insight is, that the innovative sector becomes larger when the quality of corporate governance mechanisms improves which reduce managerial agency costs and relax finance constraints, and when firms are financially more robust and are endowed with more own resources. Ju and Wei (2005, 2008) also emphasize that the institutional quality of the financial sector supports the expansion of financially constrained sectors. Different financial development of countries also prevents factor price equalization which would otherwise hold in a standard trade model with identical technologies.[20]

Clearly, when part of the firms are financially constrained, the distribution of financial capital within a country plays a role for comparative advantage. The amount of wealth in the hands of innovative entrepreneurs determines the financial robustness of firms in terms of own resources and importantly influences the relative size of the innovative, financially constrained sectors. Wynne (2005) discusses this point in the context of family firms and the role of bequests as an important transmitter of wealth. Further, Antràs and Caballero (2009) argue that whereas trade and international capital flows are substitutes classical trade models, the presence of financial frictions makes goods trade and capital flows complementary. Trade integration can raise the flow of capital into economies with less-developed financial markets.

There is substantial empirical evidence on the importance of financial development for trade patterns. Svaleryd and Vlachos (2005) find that finance substantially influences the industrial specialization in OECD countries. The quantitative impact is even greater than the effect of differences in human capital. Beck (2003) shows that countries with better-

[20] Kletzer and Bardhan (1987) provide a similar argument, focusing on international credit markets. When countries differ with respect to their sovereign risk, they experience different capital costs and thus financing problems, which prevent factor price equalization despite identical factor endowments and production technologies.

developed financial sectors have higher export shares and trade balances in industries which rely more heavily on external finance. The same also holds for countries that have better access to international equity markets (Manova, 2008a). As Manova (2008b) demonstrates, the increase in export volumes associated with better financial markets is to a large part due to firm selection into exporting, highlighting the importance of the extensive margin of exporting. In sectors that are more financially vulnerable, countries with better developed financial systems also export a wider variety of products.

9. FINANCE AND LABOR MARKETS

Financing constraints are also important for labor market outcomes, and labor market policies can feed back on the firm's ability to raise external capital and invest. Given that investment and labor demand of firms tend to move together, financial frictions can importantly affect aggregate employment. To formalize this argument, one may again consider the model in Section 2. For simplicity, one may assume that a firm's labor demand is proportional to firm size I_j, $j = u,c$.[21] The entrepreneur's incentive compatibility constraint is $(1+i)D_j \leq I_j + x_j - wl_j - T_j - \beta I_j$, where the tax liability amounts to $T_j = \tau(x_j - wl_j - \lambda i l_j)$ and the wage w is the same for all workers. The payroll subtracts from pledgeable income. When innovative firms are financially constrained, a higher wage rate must reduce the available external credit and the firms' leverage. Less investment I_c implies a lower labor demand. In standard firms, labor demand and investment are determined by $\theta_u f'(I_u) = u + w$ where $u = \frac{1-\lambda\tau}{1-\tau} \cdot i$. A higher wage discourages hiring. It is not clear a priori which type of firms responds more strongly to rising wages: the standard firms' behavior is guided by the elasticity of the revenue function $f(I)$, whereas innovative firms' labor demand is determined by the tightness of the financing constraint. However, because of the presence of constrained firms, better institutions of corporate governance or larger own equity of firms now become new fundamental determinants of aggregate employment.

[21] Full complementarity makes the analysis very simple. If there is some substitutability between capital and labor, firms have an incentive to raise their capital investment when labor costs rise which probably dampens the negative effect on investment. The empirical studies mentioned below, however, in general report a negative impact of measures affecting labor cost on investment levels.

Labor market protection and high unemployment benefits and social assistance tend to boost wages and reduce employment in of both constrained and unconstrained firms, although the specific mechanism is entirely different. For instance, generous unemployment insurance boosts the outside option of workers and consequently raises their reservation wages (Fishe, 1982; Feldstein and Poterba, 1984), which are at least partly shifted to employers and, thus, inflate a firms' labor costs. High personal income taxes similarly tend to be shifted partly to employers. On the firm side, firing taxes or severance pay tend to raise wage costs. Calcagno, Kraeussl, and Monticone (2008) study a recent reform of severance indemnities in Italy. There, firms must set aside each year 1/13.5 of a worker's annual salary, and the resulting capital is paid to workers upon separation. Before the reform, the accumulating capital was kept inside businesses and served as a cheap form of long-term debt. Starting with July 2007, workers can choose if they want any future flows to be invested in pension funds instead of being kept in the firm. To the extent that this option is indeed chosen, firms' liquidity decreases and their external financing capacity deteriorates. Taking into account the severity of financing constraints of Italian SMEs, the authors provide simulations that predict a fall in the investment level of 130-147% of the total outflow to pension funds in the long run.

A few studies have analyzed the interaction between more general levels of employment protection and financing constraints. Employment protection increases a firm's adjustment costs when it has to rescale its operations, but also includes firing costs that raise a company's labor cost more directly. Analyzing data for ten European countries over 1994-2000, Calcagnini, Giombini, and Saltari (2009) argue that firms which are hit by a negative shock, experience tighter financing constraints in countries with strong employment protection. Investment is generally lower when both labor and capital markets are very rigid. Cingano, Leonardi, Messina, and Pica (2010) analyze firms' investment behavior in more detail, using data from 14 European countries over the period 1997-2003. Strong employment protection reduces the capital-labor ratio in general. The effect is, however, of lower magnitude in firms that have higher internal assets and are thus less likely to be

financially constrained. Similarly, also the value added per worker is more heavily reduced by labor market rigidities when financing frictions are present.

Firms that face financing problems thus seem to be more seriously affected by a broad range of public policy instruments that raise labor costs and reduce firms' flexibility in firing decisions. Lower investment is accompanied by higher unemployment. The empirical studies suggest that in countries where both markets are characterized by substantial rigidities, complementary reforms in both markets would have more beneficial implications than policy efforts targeted at one market only.

10. CONCLUSION

Investment in small innovative firms, typically the most dynamic sector in an economy, is often fraught with financing problems. The effects of public policy instruments targeted at these firms then depend on how these measures interfere with the financing constraints. As constrained companies invest at an inefficiently low scale, corporate taxation is particularly harmful to them. Even 'neutral' tax systems which do not affect the user cost of capital, still reduces cash-flow and, thereby, investment of constrained firms. Further, entrepreneurs become more reluctant to undertake R&D, leading to less innovation and lower average productivity levels in the economy, when taxes erode cash-flow and thereby tighten up finance constraints and restrict investment of innovative firms. In contrast, R&D subsidies or more generous deductions in the tax code strengthen the firm's internal resources and relax financing constraints, thereby allowing firms to exploit the investment opportunities created by innovation to a larger extent. In this survey, we have emphasized the new transmission channels as well as the welfare implications of tax and subsidy policy in a wide range of policy areas when part of firms are finance constrained and investment becomes sensitive to cash-flow. We have also emphasized the ways how institutional and legal reform and financial development can improve aggregate economic performance.

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Figure 1: Investment in Constrained and Unconstrained Firms

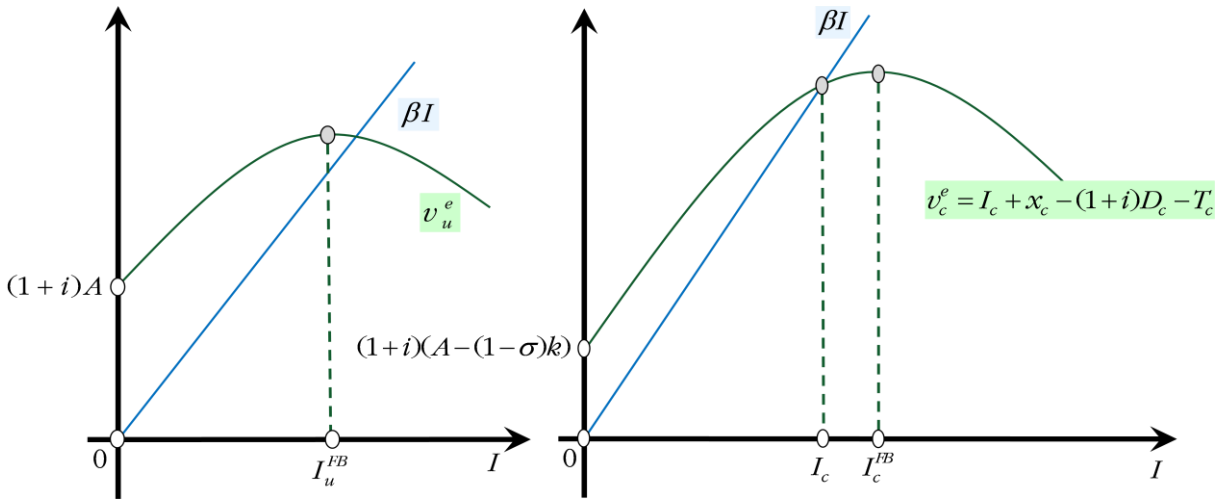

Figure 2: Organizational Choice