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# **The Capital Constraining Effects of the Norwegian Wealth Tax**

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Master's Thesis in International Business

**NORGES HANDELSHØYSKOLE**

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## **Abstract**

Norway is one of the few countries that continues to tax an individual's level of accumulated wealth. The wealth tax is credited with increasing the progressiveness of the tax code and working to prevent Norway from experiencing the growing financial inequality most industrialized nations are facing. A number of countries have recently abolished their wealth tax over concerns that this form of taxation inhibits business investment and slows economic growth. This thesis uses a panel of privately owned Norwegian firms to test whether the primary owner being subject to the wealth tax increases the capital constraints a private firm faces. It was found that the standard indicators of capital constraints, dividend policy, firm size, and ownership structure, were not effective at sorting the firms into more and less constrained groups. Contrary to expectations, the wealth tax status of the owner was found to be negatively correlated with the firm's sensitivity to internal financing, with the firms not paying the wealth tax more capitally constrained than those not subject to the tax and using less debt in there financing of fixed capital. The ineffectiveness of the traditional separation criteria and the increased access to external financing available to the individuals who pay the wealth tax is an indication that for private Norwegian firms the owner's personal and professional contacts or status may be more important for securing external financing than the firm's business fundamentals. The negative capital constraining effects of the wealth tax are therefore minimal; the tax affects only the private firms least reliant on internal financing.

## Preface

Public policy and politics have always been an interest of mine. Taxation has long been a primary area of political disagreement in my native homeland, The United States of America (U.S.). Each state in the U.S. has a separate taxation system that allows for experimentation and the development of innovative tax policies. My home state of Florida is one of the few that imposes a form of wealth tax, specifically a tax on residential and commercial real estate values. This tax is no more controversial than any other form of tax in the U.S., however there are still frequent and vocal opposition movements protesting the property tax in Florida, and it is commonly discussed in the regional news media.

Moving to Norway I was interested and intrigued not only by the differences between attitudes towards taxation, but also in the differences between the tax codes. I was particularly interested in the Norwegian attitudes towards the progressiveness of the tax system. In Florida the property tax is defended as land and property in Florida is the state's primary natural resource, however in Norway the much more expansive wealth tax was put in place as a way to address social inequality. Studying the wealth tax has left me with a positive opinion about its usefulness in addressing the ever increasing inequality in the industrialized nations. I was interested in doing my Master's Thesis investigating the negative externalities associated with the wealth tax, so that the costs and benefits of this unique form of taxation could be more accurately discussed.

I have had the extraordinary opportunity to work with the wonderful people at Statistics Norway for this project. They not only allowed me access to their databases, but they also allowed me to borrow space in their offices while I was in Oslo. The staff of SSB were genuinely interested in helping me by answering my numerous questions and inviting me into their work family. I would specifically like to thank Erik Fjærli, who worked extensively with me to define the models used and discuss ideas about the paper, and Diana Iancu, who was a constant source of encouragement and was willing to help run Stata programs for me when I was unable to return to Oslo towards the end of the paper.

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## **1. Introduction & Research Motivation**

### **1.1 An Introduction to the Wealth Tax**

All governments require revenue in order to provide public goods and services such as safety, education, and infrastructure. In order to fund these projects the government collects funds from the population in the form of taxes. Taxes are placed on a variety of economic activity from the earning of a wage to the profit from the sale of a house, and in each of these instances the tax applies an additional cost to performing that economic activity. The additional cost will favor some activities over others and cause individual agents to adjust their economic decisions to take account of the new costs. It is in this way that any individual tax introduces inefficiencies and asymmetries in the economy of the country that levied it. It is no surprise then that the negative effect of various forms of taxation on a wide variety of economic activities is an important topic of discussion in academia and public media.

While forms of taxation vary widely between countries, the two most common forms of taxation are personal income taxes. These taxes are based on the yearly income an individual or entity receives throughout the course of a year. Typically this income is divided into separate taxable categories based on how it was earned, for instance whether it was from labor, ownership of productive capital, or the sale of appreciated property. The income taxes are also quite often separated based on the entity receiving the income, with firms and individuals being taxed separately. While income taxes are based on the yearly flow of wealth to an entity, other common taxes are levied against specific activities. Sales tax is a common example where the tax is not applied to a form of income but levied every time a specific economic activity occurs, in this case the sale

of an item. Other common transaction taxes include pollution taxes and licensing fees. Another, less common form of taxation is applied not on the exchange of money, or goods and services, but on the level of a specific asset owned.

A wealth tax is a form of tax levied on the level of accumulated wealth owned either by an individual or a firm. In practice wealth taxes are typically divided into one of two groups, a property tax and a total wealth tax. Property taxes are typically applied to individuals and firms equally, taxing only the value of land and permanent structures. The total wealth tax on the other hand is typically applied to a more encompassing measure of personal wealth and is not applied to firms or corporations, only natural persons. The exact calculation of personal wealth varies by system, however most consider an individual's ownership of land, property, firms, investments, and cash equivalent banking assets. (Mintz, 1991)

Wealth taxes are uncommon and under increasing public attack to be repealed. Since 2006 Sweden, Spain, Finland, Iceland and Luxembourg have all abolished their wealth tax (Eurostat). The February 2012 survey by the Organization for Economic Cooperation and Development (OECD) of the Norwegian economy listed capital taxation as one of the few areas in need of improvement; it was addressed in 4 of the 15 recommendations made by the report. Of these recommendations the report was particularly critical of the wealth tax. The report stated that it generated little tax income but caused large increases in the effective tax rate and the unequal treatment of housing property leads to distortions in investment. Using a nominal rate of return of 4% and an inflation rate of 2% the Norwegian Ministry of Finance calculated that the effective tax rate on equity shares for an individual paying the wealth tax is 113%

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(OECD Report, 2012). This rate suggests that individuals subject to the wealth tax will be unwilling to invest in any projects.

Figure 1: Effective Tax Rates from OECD Report.

	Without wealth tax	With wealth tax
Interest-bearing accounts	56%	113%
Shares	56%	113%
Owner-occupied housing	0%	14%
Rental housing	56%	79%

This chart is reproduced as presented in the 2012 OECD Economic Survey on Norwegian.

The OECD report also references the public debate and discussion surrounding the wealth tax. This debate focuses on many possible negative consequences from the wealth tax, but relatively few positive impacts. The main concerns are for the discouragement of domestic investment and the flight of wealthy individuals from the nation. Because the double taxation on capital gains is conceptually easy to explain, using the Effective Tax Rate (ETR) shown in figure 1, this argument is typically made without any reference to published studies. These two effects are also often mentioned together to justify an expected decrease in growth in countries that have a wealth tax (Hansson, 2002). Another main area of concern for the wealth tax is that it is not coupled to a flow of resources, like an income tax. If an individual's investments perform particularly poor or prosperously this year a wealth tax will be based on the total stock of wealth, of which the performance is only a small part, and will adjust little where as a capital gains tax would adjust automatically, being higher for periods where the individual has more income available from which to pay the tax. The concern is that during bad economic times a wealth tax will force some investors to cash out their



investment positions, in a depressed market, in order to have the liquidity necessary to pay the tax. The final argument against the wealth tax is that it is an additional cost on savings, which will reduce the aggregate savings rate in a country, reducing the available investable capital. The main appeal of these arguments is that the wealth tax penalizes the entire economy by placing too large of a tax burden on the engine of production, physical capital.

The counter argument to support the wealth tax is likewise not based on academic findings but on a moral appeal based on the idea that wealth and capital are not evenly distributed through the population and that their distribution is not related to ability or effort. Therefore large levels of accumulated wealth are disruptive to the equality and fairness of the society. An additional redistributive tax on the highest levels of accumulated capital will act to correct this societal imbalance and provide a more equitable environment.

### **1.2 The Effects of a Wealth Tax**

There is a small but growing body of research into the wealth tax and its effects, that focuses both on the moral implications related to the distribution of the tax burden as well as empirical measurements of behavioral changes. Michalos (1988) writes an argument for implementing a wealth tax in Canada to address growing wealth inequality and a high concentration of wealth in entrenched family lineages. Jourard (2002) reviews the tax systems of OECD countries and concluded that the lack of a wealth tax greatly undermined the redistributive properties of many tax systems. Isaacs (1977) makes the opposite moral argument that the tax is a levy against success and that it is incompatible with the United States' national identity. He goes further to state

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that issues arising from the expected non-compliance with the tax (tax avoidance) would make the tax unable to achieve its intended goal.

Econometric explorations of the empirical impact of the wealth tax are rare. Hansson (2002 & 2008) uses a cross country panel to investigate the effects of abolishing the wealth tax, finding a slight increase in both Gross Domestic Product (GDP) growth and entrepreneurship. Unfortunately both of these studies are possibly biased by their inability to measure all correlated government activity, a common concern in national level cross-country studies (Slemrod, 1995). Pichet (2007) finds that the French wealth tax leads to capital flight and high levels of tax avoidance. The overall cost he calculates from the tax is higher than the received revenue.

Tax theory based on the optimum distribution of tax burden between capital and labor is also applicable to the wealth tax because as Mieszkowski (1969) shows, a wealth tax is equivalent to a tax on business profits, assuming that the productivity of the capital stock is homogenous. If the productivity is assumed to be heterogeneous or monopoly pricing power exists, the wealth tax should be more socially efficient than a tax on business profits while taxing essentially the same base. Because of Mieszkowski's findings, if corporate income taxes decrease investment or economic growth then a wealth tax would also be expected to have a similar effect. Cummins, Hassett, and Hubbard (1996) found a significant negative effect on investment from changes in corporate income tax. Hall and Jorgenson (1967) also found that increasing the liberalness of the tax code's depreciation allowance, a decrease in the present value of the tax on capital, increased the investment rate.

As all taxes introduce inefficiencies into the market, a tax on capital cannot be viewed as a single event, but instead must be viewed as one of multiple tools at the government's disposal to provide public goods. Kocherlakota (2005) looked into the effects of various forms of taxation on a system where individuals could invest in human or physical capital and had a stochastic ability score with persistent shocks that modified the return received from capital. Because of the possibility of persistent negative shocks throughout an individual's life, a wealth tax with redistribution was found to be societally Pareto Optimal. Using a different model that also allowed for human and physical capital investment Pecorino (1993) found that the growth maximizing mix of taxation is levied more heavily against the factor more heavily in the consumption sector; however his initial model assumed that depreciation was not allowed. After adding depreciation for only physical capital the optimum growth taxation policy was skewed towards higher taxation on physical capital. Nerlove, Razin, Sadka and Weizsacker (1993) also discussed that if human capital depreciates, and they argue that it does, the current taxation policies heavily favor investments in physical capital because of the depreciation allowance differential.

### **1.3 Goals of this Paper**

This paper is designed to add to the growing body of research on the wealth tax by providing empirical evidence of the financial constraints and investment disincentives imposed by the tax. This paper will attempt to answer these questions while avoiding the omitted variable bias which Slemrod (1995) found is so troublesome in national level cross country studies. The problem with aggregated cross country studies is that because of the general perception of the wealth tax as growth suppressing by politicians and the international business community the decision to remove the wealth tax is often

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undertaken in parallel with other pro-business legal changes also intended to increase domestic investment and growth. For instance if the government also decreased the regulatory requirements to open a small business or increased the national budget contribution to establishing and funding business incubators. Many of these changes cannot be controlled for in the cross-country investigations.

By contrast this paper will focus on micro data, investigating the firm level effects from the wealth tax. First we will build an investment model that is useable for closely held private firms, that explicitly predicts the effects of a levied wealth tax on the investment decision. The model will be estimated using a panel of Norwegian privately owned firms from 2005 to 2009.

There are three main questions that we hope to address with this model and dataset through different specifications. The model, discussed in section 2, is based on the effects of capital constraints on a firm subject to the wealth tax. The capital constraint is a necessary component of the model since borrowed capital is not subject to the wealth tax, a non-constrained firm would therefore be able to continue investing using borrowed capital after the wealth tax made investing the owner's personal capital unprofitable. The primary question is if the owner of a private firm is subject to the wealth tax, does the investment in the firm decrease and does the firm's sensitivity to its internal wealth increase. Of the firms that are capitally constrained, do those with owners paying the wealth tax have a higher sensitivity to internal liquidity or a lower overall investment rate? Often in the public debate the argument is made that a wealth tax limits young firms' access to capital injections and unduly burdens startup firms. We will test if firms in this category are found to be more affected by the wealth tax.

The remainder of the paper will be organized as follows, first we will describe the Norwegian Wealth Tax, then the popular concerns about the effects of a wealth tax relevant to investment decisions will be investigated using prevailing theories, these findings will then be used to motivate the construction of an empirically testable model, and the paper will conclude with a discussion of the empirical effect of the wealth tax in the Norwegian case.

#### **1.4 A Wealth Tax – The Norwegian Case**

The Norwegian tax change was chosen to address these questions because the motivation behind the change was not to effect more efficient capital investment, but increasing the fairness and redistributive profile of the national tax system. Unless otherwise noted the information in this section is from *Report No. 11 to the Storting: Evaluation of the 2006 Tax Reform*. The Norwegian governmental report states that “From the time it took over in autumn 2005, however, the Government has been concerned with strengthening the distribution profile of the tax system, and that wealth tax should play an important part in this respect.” This is useful for a study of firm reaction to tax changes as it implies this tax reform is not a part of a larger business invigoration policy or legal initiative and any changes in investment detected are not due to unaccounted for political changes.

Before 2006 the Norwegian Wealth tax applied to any personal wealth over 151,000 NOK regardless of whether the wealth was owned by an individual or a couple. Wealth above this level was subject to a 1.1% yearly tax. An equity allowance allowed 35% of the total value of equity holdings to be excluded from the tax, and an 80% rule where the wealth tax was only applied at 1.1% until the point where the tax obligation exceeded 80% of the individual’s ordinary income. Once the tax exceeded this threshold

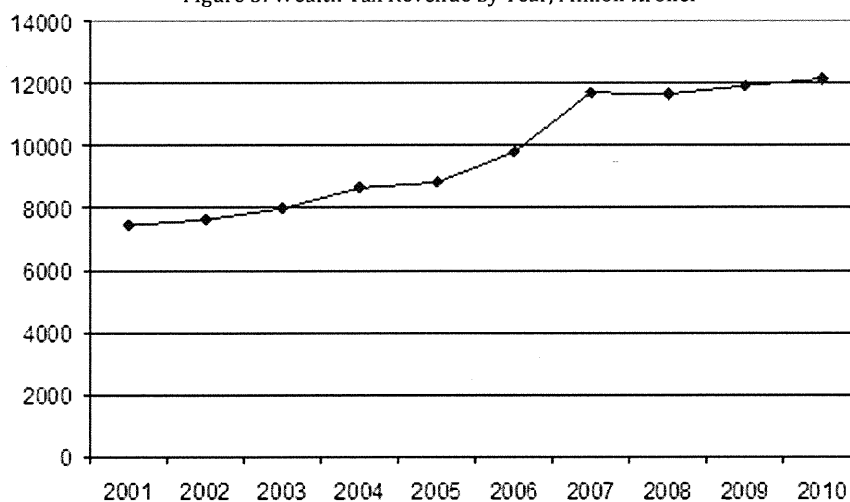
the remaining wealth was taxed at a rate of 0.6%. In 2006 the allowance was increased to 700,000 NOK per taxpayer, which increased the allowance to 1.4 million for a married couple. At the same time the rules for the Equity discount and the 80% rule were slowly phased out. The overall change shifted the tax burden to the higher wealth individuals while also increasing the level of tax paid by these individuals.

Figure 2: Wealth Tax Rule Changes

Year	Individual Allowance	Married Allowance	Equity Discount	The 80% Rule
2005	151,000	151,000	35%	.6% if tax > 80% OI
2006	700,000	1,400,000	20%	.6% if tax > 80% OI
2007	700,000	1,400,000	15%	.6% if tax > 80% OI
2008	700,000	1,400,000	0%	.8% if tax > 80% OI
2009	700,000	1,400,000	0%	No discount

The change in the allowance has reduced the number of taxpayers paying the wealth tax from 33 percent in 2005 to only 17 percent in 2011. The overall effect of these changes has been an increase in wealth tax revenue while narrowing the tax base.

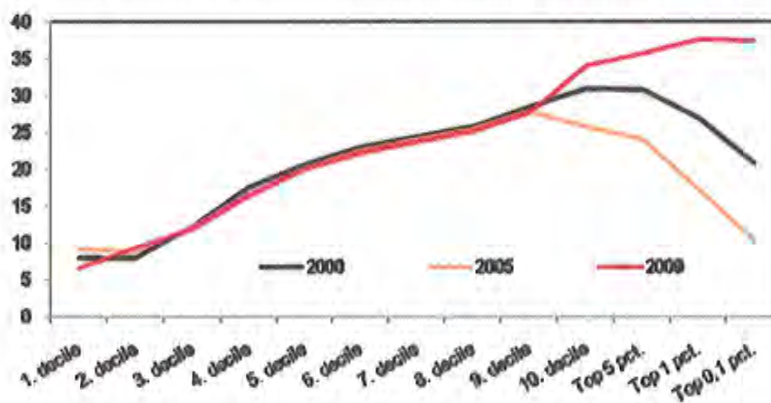
Figure 3: Wealth Tax Revenue by Year, Million Kroner



\*Source SSB

The Norwegian government believes that this change to the wealth tax is a vital part of correcting the redistributive profile of the total tax in the country. Figure 4 shows the average tax burden of individuals by income decile. The graph shows that since 2001 the Norwegian tax code has failed to properly continue the progressive intentions of the tax system. In 2005 an individual with an income in the top 1% paid the same average tax as an individual in the bottom 40% of the income distribution, significantly less than someone with an income in the 70% range. The wealth tax change was able to correct this issue and lead to a more progressive tax burden based on income distribution. Figure 5 expands the top 10% of the income into ten separate categories and separates the taxes paid into income and wealth tax, showing that the wealth tax pays an integral part in ensuring the progressivity of the tax system at the highest income levels.

Figure 4: Average assessed tax as a share of gross income by decile



Report on the tax assessment as a share of gross income by decile. Reproduced from the Norwegian report to the Storting on the effects of the tax law reforms.

Figure 5: Average Tax Rate of the top 10% income decile

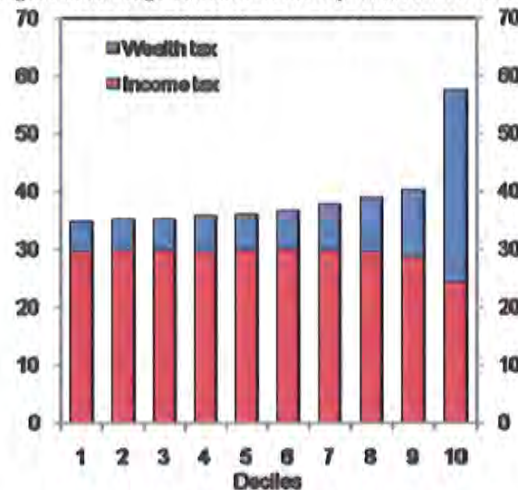


Figure as shown in Report No. 11 to the Storting: Evaluation of the 2006 Tax Reform.

The Norwegian report to the Storting on the effects of the tax reform mentions the possible negative investment effects from the wealth tax, but considers them to be less of a concern than the OECD report. The Norwegian report states that while it does not believe that the wealth tax “makes investment in Norway less interesting than investment abroad for Norwegian investors,” it is concerned that the “wealth tax can to some extent limit the supply of capital to enterprises that are obliged to resort to the Norwegian capital market... reduce(ing) the overall socio-economic return on the capital. There does remain one valuation differential that both reports suggest is problematic and will cause misallocation of investment capital, the greatly reduced valuations provided to residential property. The ultimate conclusion of the Norwegian report is that the wealth tax balances to social need for a progressive and redistributive tax system with the needs of the business community. The OECD report is more critical of the possible consequences of the wealth tax for business investment, and considers the benefits of societal equality and fairness to be of less importance.



## 2. Building a Testable Model

### 2.1 Why Cash Constrained Models

According to Mieszkowski (1969) for an individual's investment decision a wealth tax is comparable to a tax on corporate income. If the individual is faced with a possible investment opportunity through a privately owned firm, the owner's wealth at the end of the period will either be

$$W_{t+1} = (1 - \tau)(W_t + y_{t+1})$$

Or

$$W_{t+1} = (1 - \tau)W_t$$

where  $W$  is the owner's wealth, and  $y$  is the net income from the investment. Any fixed capital investment required by the opportunity would remain a part of the owner's total wealth  $W_t$  and any non-capitalized expenditure would be removed from the investment income to calculate  $y$ . For simplicity this example assumes the investment is instantly profitable, however if there is a long investment period before the returns the only change is the sign attached to  $y_{t+1}$ . Because the wealth tax applies to the owner's total wealth  $W_t$  regardless of if the investment is made or not, on the margin the value of the investment is the income less the wealth tax, or  $(1 - \tau)y_{t+1}$ . If the profits are negative on the investment the wealth tax also provides a tax shield equal to  $-\tau y_{t+1}$ , identical to the effects of an income tax. Therefore, for the purposes of deciding to invest, the wealth tax is identical in effect to a tax on the business profit in that it raises the investor's required rate of return in order to invest in a project. While this may lead to profitable projects not being invested in, if the firm has access to external credit, through debt or equity, the external capital will act as a substitute and the investment will be unaffected

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by the wealth tax. This follows directly from Modigliani and Miller's 1958 finding of the irrelevance of capital structure on a firm's investment decision.

If however external capital and internal capital are not perfect substitutes, due to either higher prices of external capital or its unavailability, the wealth tax will cause decreased investment and investment opportunities will be foregone. The availability of external capital will also correct the other proposed negative effects of the wealth tax; the discouragement of savings in high wealth individuals and the disconnection between the timing of the tax and the timing of the capital income.

It is important to note that this investment incentive effect is only valid for marginal investment decisions. Because the return to investments is typically small compared to the total value of the wealth employed, the majority of the tax burden is invariant to the investment decision, as long as capital is taxed evenly without regard to how it is employed.

## **2.2 Shifting from Savings to Consumption**

The second proposed consequence of the wealth tax that will be investigated in this paper is the possibility that the wealth tax discourages savings. To discuss this proposal and its possible effects on a firm's investment it is important to review the theories explaining an individual's decision between savings and consumption. The primary line of economic inquiry into an individual's decision between consumption and savings has been based on the Life Cycle Hypothesis since its introduction in 1954 by Modigliani and Brumberg. This theory explains the individual's decision as an attempt to maximize the total utility of consumption over their lifetime given the understanding that their income will not be consistent over this time. The model shown here is an adaptation of

the version presented in the Handbook of Public Economics, Volume 3, 2002. The individual is assumed to earn wages of  $a_t$  each year  $t$ , with an expected lifetime  $T$ , which is known to the individual. The only source of utility considered,  $u_t(\cdot)$ , in the model is derived from the current period consumption,  $c_t$ , no additional utility is gained from the total personal wealth,  $w_t^p$ . Therefore the purpose of savings is to maximize the function

$$\sum_{t=0}^T u_t(c_t)p^t \quad (1)$$

where  $p^t$  represents the time preference discount rate, with the condition that  $0 < p^t < 1$ . The model assumes that there is access to perfect financial markets allowing funds to be borrowed or lent at rate  $i$ . Any positive wealth holding of the individual is assumed to be automatically lent out and to earn the return  $i$ . The individual's wealth at the beginning of any period is then

$$w_t^p = [w_{t-1}^p + a_{t-1} - c_{t-1}]i \quad (2)$$

where  $w_t^p$  is the total wealth at the beginning of the period,  $a_{t-1}$  is the income that the individual received (this can be either labor income, capital income, or both), and  $c_{t-1}$  is the amount that the individual spent on consumption during the year. Any funds that were spent to purchase capital are not removed from the wealth, as  $w_t^p$  is a measure of total wealth including both productive capital (firm equipment) and liquid wealth (bank deposits).

Adding a wealth tax to the model is a straightforward procedure. In each period that the individual possessed wealth over the threshold value,  $\theta$ , at the end of the period  $t-1$ , the starting wealth is reduced proportionally to the tax  $\tau$

$$w_t^p = [w_{t-1}^p + a_{t-1} - c_{t-1}]i - [(w_{t-1}^p + a_{t-1} - c_{t-1}) - \theta]\tau$$

$$w_t^p = [w_{t-1}^p + a_{t-1} - c_{t-1}](i - \tau) + \theta\tau \quad (3)$$

Any period where the accumulated wealth is below the allowance, and the individual is therefore not subject to the wealth tax,  $\tau = 0$ , and equation (3) collapses equation (2). Equation (3) shows a direct reduction in the interest rate earned on the held assets once the individual accumulates more wealth than the threshold  $\theta$ . If the interest elasticity of savings is positive then the tax will cause individuals to switch from savings to consumption by decreasing the interest rate high wealth individuals receive. Callen and Thimann (1997) used a panel of households from 21 OECD countries from 1975 to 1995 to investigate the determinants of household savings. They found a significant positive effect on household and private savings from increases to the real interest rate.

Using the findings from Callen, being subject to the wealth tax would be expected to cause individuals to shift their income from investment to consumption. This finding theoretically confirms the concern that the wealth tax will decrease savings in the country and lead to lower total investment levels. This is true for a specific company only if, as stated previously, internal financing has a cost advantage over external financing, as the internal financing is equivalent to the portion of the owner's income allocated to investment. In this example the firm will also face capital constraints if external capital from the domestic market is not perfectly substitutable with external capital from the international markets, because the wealth tax in this instance is expected to decrease the level of available external domestic capital as well as the firm's internal capital. If, however, the external financing is a sufficient substitute for the internal financing then this reduction in owner investable wealth will be replaced by external financing. It is also important to note that this effect will only decrease

investment in firms that have exhausted their internal financing. If, even after the decrease in the owner's savings rate is accounted for, the firm is still generating more cash than is needed for investment and owner consumption the wealth tax will not influence the firm's investment level through this mechanism.

### **2.3 Discontinuity Between Timing of the Wealth Tax and Income**

The wealth tax is not based on the flow of income to the individual, but instead on the stock of assets owned. While it may be said that individuals with more assets are more capable of paying higher taxes, not all assets are liquid and able to be applied to the tax burden. If for instance an individual had an opportunity to invest in a long term project that will tie up a large portion of their total wealth in non-liquid assets with a long investment horizon one of the typical concerns the investor will have to consider is if there will be enough liquid wealth available to fund their current level of consumption until the investment begins paying returns. Even if the individual has the wealth to make the investment they may forego it if there is not enough of a safety net of available liquid assets to fund the investor's current lifestyle. The wealth tax will place an additional yearly burden on the remaining liquid assets, and may further restrict the portion of the investor's total wealth that can be allocated to no-liquid assets or assets with longer investment horizons.

The worst case scenario is that the investment market changes and the investor does not earn a large enough return in the period to cover the wealth tax due. This will force the investor to sell off an otherwise profitable asset simply to pay their tax burden. If however the individual has access to perfect capital markets the owner could either

borrow the capital to pay the tax, or use the productive assets as collateral and switch their funding from internal to external. It is in this way that the negative secondary effects of the wealth tax are only experienced in any of the scenarios if the firm has limited access to cheap external capital.

## 2.4 Models of Capital Constrained Investments

Most models used in investment literature focus on either the Q model of investment or Euler Equations. Both methods are based around the maximization of the market value of equity, and use the capital market arbitrage condition as their starting point.

$$\rho_t V_t = (1 - m_t)\theta_t D_t + (1 - z_t)(E[V_{t+1}] - V_t) \quad (4)$$

The standard transformation of this model assumes quadratic adjustment costs and simplifies to

$$\frac{I_{it}}{K_{it}} = a_i + \frac{1}{b} Q_{it} + \varepsilon_{it} \quad (5)$$

While there are a few different ways to calculate  $Q_{it}$ , it always requires market values of either assets, the firm, or stock (Perfect Wiles, 1994). For this reason investigations into the cash constraints firms face using the Q model have focused only on publicly traded firms. Likewise the private firms currently being investigated lack the proper information necessary to calculate  $Q_{it}$ . The data available for these firms consists only of historical book values. This constraint suggests that the sales accelerator model may be the most appropriate and best performing measure of future investment opportunities available to the firm. Accelerator models assume a fixed ratio between output and capital level, at least over a small range of investment levels. Expected sales are given

exogenously to the model, but are correlated with historical sales levels and historical changes in sales. Because of the assumed constant ratio an increase or decrease in the rate of sales growth is expected to provide a proportional change in the growth rate of capital accumulation. Even with relaxed restrictions the growth rate in sales can be shown to be related to the investment opportunities the firm has available. For this purpose both current sales and the change in sales will be tested as measures, in place of  $Q$ , to control for the firm's investment opportunities. The new investment model using the sales accelerator model becomes:

$$\frac{I_{it}}{K_{it}} = \alpha_i + d_t + \pi_0 + \pi_1 \frac{S_{it-1}}{K_{it}} + \pi_2 \frac{C_{it}}{K_{it}} - \pi_3 \frac{L_{it}}{K_{it}} + \varepsilon_{it} \quad (6)$$

Where  $I_{it}$  is the investment in capital,  $S_{it-1}$  is the sales accelerator model and consists of the previous level of sales and the previous change in sales,  $C_{it}$  is a measure of financial assets available to the firm. Each of these measures are weighted by  $K_{it}$ , the firm's net capital. The firm's leverage,  $L_{it}$ , is included to help account for the increasing cost associated with debt borrowing and the possibility of the firm exhausting their capacity for debt.  $\pi_2$  is expected to be significant only if the firm is financially constrained. If the firm faces no financial constraints the cashflow should be independent of the investment decision and  $\pi_2$  should therefore be equal to zero. If the wealth tax increases the level of financial constraint a firm faces it would be expected to increase the significance of  $\pi_2$ .  $\pi_3$  is expected to be negative only for firms that are financially constrained, and may be magnified by the wealth tax.

## 2.5 Issues with Capital Investment

The standard investment model is based on the investment in long-term fixed capital having convex adjustment costs. This implies that firms have incentives to smooth their

level of investment over time in order to have the lowest adjustment costs each period. This does not fit the observed investment activity, where firms frequently have extended periods of non-investment and the investments that are made are typically undertaken in close proximity. This pattern is also correlated to firm size, where the smaller firms have more periods of non-investment and larger firms tend to have smoother investment cycles (Nilsen, 2003). In his investigation into the difference in the effect of financing constraints on short term investment and long term optimum capital stock Bayer (2006) found empirical evidence for a non-linear investment function with significant lumps in the firm's capital adjustment. In a 2008 follow-up paper, Bayer modeled these investment adjustment frictions to separate the short-term and long-term effects of structural imperfections in firm's ability to invest. The short-term investment decisions were found to be sensitive to financial structure but the long-term capital levels were not, providing evidence in support of the Modigliani-Miller theorem.

The reasons for firm's inability to perfectly adjust their investments in physical capital fall primarily into three categories: non-divisibility, complimentary effects, and permanence. The first problem faces firms who are actively looking to invest. A firm producing widgets may see a rise in the demand for their product by 100 units per day, however the smallest widget producing machine the firm can purchase makes 1000 widgets per day. The firm may find it more profitable to put off the purchase of the machine until the demand for its product is sufficient to warrant the cost of a 1000 widget machine, waiting for instance until excess demand reaches 500 units per day. Once the machine is purchased the firm now has excess production capacity and will not need to invest again until there is again excess demand. In this case the demand for



widgets could grow at a steady 200 units per day each year, but the firm would only invest in a new machine every 5 years.

Looking at the same firm it is easy to see the reasons for not only the long periods on non-investment, but why investments tend to be lumpy. When the firm upgrades the machinery, their production capacity greatly increases, but their actual daily production also increases, although to a lesser extent. The plant may find this new production requires additional storage locations, or an additional transport vehicle to ship the widgets to their customers. These additional investments are complimentary to the manufacturing process and are made at the same time in order to support the additional firm output.

The final imperfection in capital adjustments is the lack of a perfectly functioning secondary market for all forms of capital. Once installed some machines cannot be disassembled and reinstalled elsewhere, at least not without incurring costs that may exceed the value of the machine in question. Even if the relocation of the equipment is inexpensive and easy there may lack a sufficient number of customers that are interested in purchasing the equipment second-hand. In either case a firm may find itself clearly overcapitalized but unable to decrease their level of capital.

Due to these investment imperfections the sales accelerator model may have difficulty detecting the relationship between a small firm's investment levels and the firm's wealth tax status.

## **2.6 The Caggese Model**

Caggese (2007) built a model to address the concerns associated with the non-linearity of investment in physical capital and detect if a firm was cash constrained. He started

not with the above capital market arbitrage model, but with the following Cobb-Douglass production function:

$$y_{i,t} = \theta_{i,t} k_{i,t}^{\alpha} n_{i,t}^{\beta} \quad \text{where } \alpha + \beta < 1$$

The firm's wealth is then maximized with respect to a capital constraint based to the firm's internal financial wealth on the investment level and a non-reversible condition on investments in fixed capital  $k_{it}$ . The model found that because of the non-reversibility of long-term fixed capital it was a poor instrument for measuring a firm's capital constraints. Instead non-fixed variable capital  $n_{it}$  was expected to be more responsive to constraints on the firm's ability to invest and grow. Non-fixed variable capital is separated from fixed (or quasi-fixed) capital by its non-permanence. This form of "capital" is consumed by the business in the period it is purchased in and not capitalized on the books, it consists primarily of raw materials and inputs to the production process.

The final developed model by Caggese is:

$$\ln n_{i,t} = a_i + d_t + \pi_1 \ln \theta_{i,t-1} + \pi_2 \ln k_{i,t} + \pi_3 \ln n_{i,t} + \pi_4 \ln w_{i,t-1}^F + \varepsilon_{i,t} \quad (7)$$

Where the factors are from the above Cobb Douglas production function, and  $w_{i,t-1}^F$  is the firm's financial wealth and included to detect the firm's investment constraints. The derivation of this model is able to directly incorporate the wealth tax, predicting that it will only change the firm's investment level by providing a more severe capital constraint when compared to a firm without the wealth tax, a larger estimated  $\pi_4$ . This model has a few concerns, primarily the simultaneity implied by the model in the determination of the optimal investment among the three factors  $n_{i,t}$  and  $k_{i,t}$ . Another concern for the accurate estimation of the model is that  $w_{i,t-1}^F$  can be deconstructed into

$w_{i,t-2}^F + y_{i,t-1}$ . Therefore any correlation between the firm's variable capital and the previous period's sales would be detected by  $\pi_4$ . This effect is compounded by the fact that cash constrained firms by definition have low financial wealth relative to their yearly income, meaning that in these firms  $w_{i,t-1}^F$  will be more correlated with  $y_{i,t-1}$  than  $w_{i,t-2}^F$  as the previous wealth is expected to be smaller relative to the firm's income. As the stock of wealth in the firm approaches zero then the wealth available for investment at time  $t$  becomes simply the income received the previous period.

To address these concerns, the model could be transformed into:

$$\ln n_{i,t} = \alpha_i + d_t + \pi_0 + \pi_1 \ln y_{i,t-1} + \pi_2 \ln w_{i,t-1}^F + e_{i,t}^y \quad (8)$$

This removes the co-allocated production factors at the same time as explicitly removing the effect of the previous period's income from the measure of the firm's financial wealth. The estimated coefficient  $\pi_2$  is expected to be positive for any firm that is capital constrained and zero for any non-constrained firm. Because accumulated wealth,  $w_{t-1}^F$ , may be close to zero for any firm whose constraints are such that all income is invested each period the capital constraint may also appear as an increase in  $\pi_1$  between constrained and non-constrained firms.

The transformation does not however correct the model's primary downside, in attempting to overcome the concerns with the responsiveness of the  $Q$  (or sales accelerator) model's focus on fixed capital investment the Caggese model has lost sight of the original question of interest, "does the wealth tax decrease long term economic performance by limiting firm level investments?" The model instead detects if the wealth tax imposes capital constraints on the firm while simultaneously claiming that those constraints have little impact on the firm's investments into long-term fixed

capital capacity. Instead the capital constraints are explicitly assumed to simply be short term limits on the level of production output a firm can manage while still expecting the firm to be able to obtain optimal capital levels in the long-run.

## **2.7 The Two Models**

Neither of the two models is perfect for modeling the investigated firms. The sales accelerator model focuses directly on the question of interest, the firm's investment in physical capital. This focus is also its biggest weakness, as the variation in capital investment proves difficult to fit empirical models to. The Caggese model looks at a much more smooth and responsive variable, but can only speak to the severity of the capital constraints faced by the firms. It is therefore of interest to estimate both models and compare the results in order to ascertain the effects of the wealth tax.

The similarities and differences between the two models are also worth taking a moment to consider. Both models measure a one period flow of resources as the dependent variable. In the sales accelerator model it is the change in the level of fixed capital stock, while the Caggese model looks at the amount of discretionary capital consumed during the period. Both models adjust this measure to account for non-normality in the size of businesses and their investments. In the sales accelerator model, which is based on the  $Q$  model of investing, the investment level is theorized to be related to the current size of the firm's capital stock. The Caggese model however uses the exponential nature of the Cobb-Douglas production function to argue that the variables should be log-normal.

The independent variables in each model are similar as well, both models include the previous period's performance and the net financial wealth of the firm. The sales

accelerator model includes previous sales and the change in previous sales as the indicators of the firm's previous performance, while the Caggese model simply uses the previous period's net income. The net financial wealth is separated in the sales accelerator model into the firm's financial assets and total debt, unlike the Caggese model which combines the two measures into the net financial wealth.

### **3. Testing Specifications**

In their seminal paper on firm cash constraints, Fazzari, Hubbard, and Petersen (1988) separated the firms into two groups reasoned *a priori* to either face capital constraints or not and tested for differences in the sensitivity to cash flows between the two groups. Since then this method has been standard for investigating if a firm is constrained or not. The most common separation criteria used are dividend payouts, affiliation to industrial groups or banks, the firm's size and age, the presence of bond ratings, or the degree of shareholder concentration (Schiantarelli, 1996). Of the above criteria, the average dividend payout ratio, the firm's size, age, and degree of shareholder concentration will be tested as sorting criteria.

The dividend payout is slightly problematic as the recent 2004 corporate tax law changes are expected to decrease the firm dividend payouts significantly and much of the variation in dividend levels may have been lost. The firm's size is also problematic due to the possible correlation between large firm size and large owner wealth. Because the only criteria determining if an individual owner is subject to the wealth tax, sorting by firm size may be equivalent to sorting by the owner's wealth tax status. The age and shareholder concentration are therefore expected to be the best sorting criteria.

Previously, three main questions were outlined as the goals for this paper. We now have the necessary tools to discuss the exact testing specifications that will be used.

### **3.1 Question 1: Does the wealth tax alone decrease investment and constrain capital**

For this test the firms will be separated into two groups based solely on their primary owner's wealth tax burden, and the coefficient estimations for equation (6) and (8) between the taxed and non-taxed groups will be compared. The equations are specified in such a way that  $\pi_0$  is the intercept for each equation,  $\pi_1$  is the coefficient in front of the firm's performance indicator, and  $\pi_2$  is the coefficient attached to the firm's financial assets. The hypothesis for this question states that if the wealth tax negatively impacts the investment level in the firm's investment  $\pi_0$  and  $\pi_1$  will not be equal between the two groups, specifically:

$$H_0: \pi_0^w \geq \pi_0^n \text{ and } \pi_1^w \geq \pi_1^n$$

$$H_1: \pi_0^w < \pi_0^n \text{ or } \pi_1^w < \pi_1^n$$

Where the superscript  $w$  denotes firms with a primary owner that pays the wealth tax, and  $n$  denotes non-taxed firms. If the null hypothesis is rejected, then the firms subject to the wealth tax will have lower average investment or lower responsiveness to investment opportunities as indicated by the firm performance.

Looking at the same set of estimated equations an alternative testable hypothesis is that the wealth tax places capital constraints on a firm. In this way sorting by the wealth tax obligation is functionally identical to sorting by any other *a priori* capital constraint indicator. This hypothesis, if true, would mean that the investments of wealth tax paying firms will be more responsive to changes in their financial status;

$$H_0: \pi_3^w = \pi_3^n$$

$$H_1: \pi_3^w \neq \pi_3^n$$

The value of the coefficient and its significance will be determined by a regression on only the subset of firms of interest. The significance of the difference in the coefficient value between the two groups will be determined by a Chow transformation.

### 3.2 Question 2: For firms that are capital constrained, does the wealth tax worsen the constraint

To test this hypothesis the firms will be sorted into groups consisting of capital constrained and unconstrained firms based on the sorting criteria of dividend ratio, size, and ownership stake. For each of these sorted groups the firms will further be separated into groups based on the taxable status of the primary owner's wealth.

	Constrained	Unconstrained
Tax Paying	Group 1	Group 2
Non-Taxed	Group 3	Group 4

The four groups will then be used to estimate each of the two models. The validity of the capital constraint sorting criteria will be tested by comparing the estimated coefficients for the model's measure of internal liquidity between groups 3 and 4.

$$H_0: \pi_3^3 = \pi_3^4$$

$$H_1: \pi_3^3 \neq \pi_3^4$$

If  $H_0$  is rejected then the sorting criteria correctly separated firms into more and less capitally constrained groups. If  $H_0$  is not rejected then no useful information can be determined by this series of estimated equations.

A comparison of the estimated coefficients in groups 1 and 3 will show if the tax places an additional burden on the firm's capital constraint. If this is the case the estimated coefficient  $\pi_3$  should be greater for the firms in group 1.

$$H_0: \pi_3^1 = \pi_3^3$$

$$H_1: \pi_3^1 \neq \pi_3^3$$

If this  $H_0$  is rejected and the wealth tax does significantly increase a firm's sensitivity to internal cash, meaning that the wealth tax decreases investment in capital constrained firms. The two remaining cross group comparisons are of less interest in answering the primary investigative question; however they are still worth discussing. If  $\pi_3$  is greater in group 2 than in group 4, then the wealth tax increases the level of capital constraints in even the less constrained groups. If that is true and the estimation of  $\pi_3$  for group 4 is not significantly different than zero, the wealth tax causes capital constraints in non-constrained firms.  $\pi_3$  being greater in group 1 than group 2 is expected and implied by the first test between group 3 and 4. In all groups subject to the wealth tax  $\pi_0$  and  $\pi_1$  are expected to be lower than the equivalent non-taxed group.

### **3.3 Question 3: Is the effect of the wealth tax dependent on the firm's lifecycle stage**

The functional investigation into this question is identical to the process outlined in question 2, but the interpretation is significantly different enough to warrant a separate discussion. The separation criteria of age was not included in the previous investigation because it is instead used here, though age alone is a poor indicator of a firm's lifecycle position, or maturity. Instead the firms will be sorted based on their ratio of retained earnings to total equity, as proposed by DeAngelo 2006, who found that this measure



was a highly significant proxy for the firm's lifecycle for purposes of predicting dividend payments.

The logic behind using a firm's ratio of retained earnings to total equity is based on the lifecycle hypothesis of the firm. At the time of founding a firm has no earnings and only the equity that was contributed by the owners. Young firms have significant investment opportunities, however they have little cash flow from operations. In order to finance these investments the firm either receives additional injections of equity or issues debt. At this point the majority of equity in the firm is still in the form of contributions. As the firm matures its operations begin generating more cash than is needed to finance the available investments, and it rapidly accumulates retained earnings. This continues until such a point that the retained earnings are so large that the firm begins to distribute its excess revenue in the form of dividends. This is when the firm's retained earnings are their largest as a percentage of the total equity.

Using the previous matrix of groups, with the separation now based on the maturity of the firm and its tax status.

	Growth	Mature
Tax Paying	Group 1	Group 2
Non-Taxed	Group 3	Group 4

Unlike before, the significance of the difference in  $\pi_3$  between groups 3 and 4 does not indicate that the constraint is properly identified, but instead indicates that the firm's maturity is correlated with its likelihood of facing capital constraints. Even if the difference cannot be said to be significant, a discussion of the difference between the estimated coefficients of groups 1 and 3 is still warranted and insightful. This is because the concern discussed in the public arena surrounding the negative effects of the wealth

tax on young firms is not motivated by the existence of capital constraints on these firms.

If group 1 either has lower investment levels,  $\pi_0^1 < \pi_0^3$  or  $\pi_1^1 < \pi_1^3$ , or is more capital constrained,  $\pi_3^1 > \pi_3^3$ , then the wealth tax can be said to decrease investment in immature firms. If however group 3 is also significantly more cash constrained than group 4,  $\pi_3^3 > \pi_3^4$ , and the wealth tax was found previously to worsen capital constraints, then the effect of the wealth tax on immature firms is most likely simply a function of their being more likely to be cash constrained.

## 4. Econometric Implications of the Testing Models

### 4.1 Fixed Effects Estimator

This discussion on econometric estimators is based on information from Wooldridge (2009) and Verbeek (2008). The approach taken to estimate the coefficients for the above investigations will be based on the fixed effects estimator. The fixed effects estimator builds on the standard Ordinary Least Squares (OLS) estimator by taking advantage of the fact that the dataset used contains observations of the same individuals over time. Because the individuals are not identical in regards to their observable characteristics it would be unreasonable to assume that they would be identical in their unobservable characteristics as well. In the normal OLS estimator these unobservable individual traits would be captured by the error term. Because the individual traits do not vary over time, their inclusion in the error term will lead to autocorrelated errors.

The fixed effects estimator solves this problem by allowing the intercept term to vary for each individual, moving the heteroskedastic unobservable individual traits from the error term to the intercept. This specification was already explicitly suggested in the two models previously presented which suggested that each firm would have an individual effect,  $a_i$ .

The fixed effect model is not the only approach to estimating coefficients using panel data. A common modification to the fixed effect estimator is to assume that the individual effects are random factors that are independently and identically distributed (i.i.d.) throughout the population. If this is true then the coefficients can be estimated using a modified version of the traditional OLS to account for the specific form of autocorrelation found in the OLS errors. This method is known as the random effects estimator, and because it exploits knowledge of the underlying distribution of  $a_i$  it is more accurate, more efficient, and has smaller calculated standard errors than the fixed effects estimator. The downside is that if the individual effects are not i.i.d., but instead correlated with one of the variables in the equation, the estimation of the coefficients will be biased and inconsistent. The unobservable individual effects expected to be of importance to the firm's investment in variable capital are the management ability, and the firm's competitive market position. Neither of these is expected to be randomly distributed through the population, and they are both expected to be correlated with the firm's sales, their financial wealth, and their investment levels. The random effects estimator is therefore expected to be biased when estimating investment equations.

#### **4.2 Exogeneity**

One main assumption of the fixed effects model is the exogeneity of the independent variables used. If the independent variable used is correlated with the error term the

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exogeneity assumption is violated and the coefficient estimation is biased, this is called being endogenous. Greene (2003) suggests that for econometric estimation of the coefficients, the repressors need not be strictly exogenous, simply weakly exogenous and predetermined. He also suggested the importance that the dependent variable not “Granger Cause” the independent variables used. Granger causality is the weakest form of causality and requires simply that the previous values of one variable are significant explanatory variables when regressed on the second. The test for this is simple,

$$x_t = \alpha + \beta_1 x_{t-1} + \beta_2 y_{t-1} + \varepsilon_t$$

If  $\beta_2$  is significantly different than 0,  $y$  is said to “Granger Cause”  $x$ . It is perfectly possible for this to be true while  $x$  also Granger Causes  $y$ . The causal relationship between the independent variable  $x$  and the dependent variable  $y$  is not obviously desirable in the equations defined above, but if the reverse causation is also true then the model has a feedback loop and the estimated coefficients are biased. Verification that investment does not Granger Cause the independent variables is therefore important for the validity of the results.

The main cause of endogeneity though is omitted variable bias. This occurs if there are unobservable traits that are correlated with both the independent and the dependent variables that are not included in the model. The primary concern for omitted variable bias comes from the conversion of the  $Q$  model into the sales accelerator model. In the model  $Q$  captures the majority of the relevant information on expected future profitability and investment opportunities for the firm. Without access to market values for the firm much of the forward looking information becomes unobservable. Likewise the Caggese model attempts to explain forward looking investment decisions based on historical information. Because the coefficients will be estimated by the fixed effects

estimator, any time-invariant omitted variable will not bias the coefficient estimation and will instead be captured by the individual specific effects. Additionally, only omitted variables that are correlated with investment, the firm's financial asset position, and the owner's wealth tax obligation will cause bias in the estimation of the coefficients, not all omitted variables that may influence the investment decision.

### **4.3 Stationarity**

Panel data, like all time-series data sets, is prone to spurious regressions if the data is not stationary. An OLS estimator, which the fixed effects estimator is a modification on, calculates the coefficients and their significance under the assumption that each variable has a constant mean over time, it is stationary. For each observation added to a stationary data series the estimation of the true variance and mean of the total population becomes more accurate to estimate. If, however, the data series is not stationary, each new observation added changes the mean. T-tests are no longer valid, as their size is not relevant, and the mean calculated will be different depending on the arbitrary length of the data series chosen for the empirical estimation.

Because a non-stationary time-series will bias the results of an estimated equation, all series used will be tested for stationarity before estimation. If any series are found to be nonstationary, then the equations will be estimated on the first difference, provided that a differencing forces stationarity.

The Harris-Tsavalis unit-root test will be used because of its small sample properties and its inclusion in statistical software packages. The test is attractive for this dataset because it is asymptotically consistent for a fixed and small time frame while the number of individuals approaches infinity. The other tests available have the

requirement that either the time dimension tends towards infinity, or that both dimensions of the panel tend towards infinity. These forms of unit-root tests perform poorly for panels of firm behavior, while the Harris-Tsavalis test was found to be an appropriate and accurate test for samples with small time dimensions (Hall, 2005).

## **5. The Data**

### **5.1 Panel Description**

The data for this project was accessed by permission from Statistics Norway (SSB)(Statistisk sentralbyrå). It was an unbalanced panel of 31,428 individual closely held private firms for the years 2005 to 2009. The data was collated by SSB and included a mixture of firm and owner information. Because the wealth tax is a personal tax and not a direct corporate tax, each firm's accounting data was merged with the primary owner's tax liability information. The firm data consisted of end of the year accounting data, as well as information on taxes paid. The owner data contained all reported tax relevant information, including taxes paid, various types of wealth holdings, and personal and family characteristics. The primary owner of each firm was determined from the business register.

In general the 2005 observations were removed from the tests due to possible contamination from the corporate tax changes that took effect at the end of the year 2004. The exception to this rule is the inclusion of 2005 end of year accounting stock variables in the calculation of 2006's flow variables. For instance the investments made in 2006 were calculated using the change in balance sheet items from the beginning of 2006, which was 2005's end of year data, to the end of 2006, which is recorded in the system as the firm's 2006 accounting data. Most of the 2005 tax reform effects are

expected to appear as flow variables during 2004 and 2005 (Alstadsæter, 2009), this implies that the end of year stock variables should have already taken into account any pertinent effects. Because the values are only being used as the baseline for future changes they should not provide any contaminating effects. The removal of the 2005 observations from the regressions will remove approximately a fifth of the sample size. This loss of size is preferable to allowing the possibility of confounding effects into the model estimation.

## **5.2 Sales Accelerator Measures of Investment**

Capital investment in the sales accelerator model, and the similar  $Q$  model, is defined as the change in long-term physical capital and real estate. The measurement used in this paper will exclude investment in real estate in an attempt to remove heteroskedasticity and extreme value bias from the estimated models. Because the firms in this panel are mostly small, they adjust their real estate holding very infrequently and the adjustments made are often sizable compared to the total value of the firm's assets.

The change in long-term physical capital has extreme values on both the positive and negative tail, with values ranging from -244,252 (thousands of NOK) to 517,871. The mean value is 330, while the median value is only 9. Less than the top 10% of firms have an investment for the period of over 1,000.

## **5.3 Total Capital**

In the sales accelerator model all variables used are weighted by the firm's beginning of period capital. The measure used in this paper is the beginning of period fixed capital assets. This value was obtained from the business register and is based on the current book value of the firm's assets. Book values are poor representations of the actual

physical capital employed by a firm as it is heavily dependent on the firm's depreciation policy and the length of time the firm has held the assets. For this reason, the total capital used in the standard sales accelerator model is in theory the market's replacement value and not the historical book value. Because there is no liquid and transparent market for many of the industrial fixed assets that firms own, and because the data available does not list asset holdings by individual item, it is impossible to calculate true current market prices for the assets a firm holds.

The most promising method of estimating the current value of a firm's capital stock based on the historic cost book values was the method suggested by Raknerud et al (2007). They use a method which calculates the market value of the firm's capital stock based on the firm's year of establishment, a weighted index of industrial asset prices, and an estimated reduction rate that accounts for depreciation and plant closures. The accuracy of this method is directly related to the time dimension of the panel. This is because the more time between the start of the panel and the average year of establishment for the firms in the panel, the more inputs into the model must be estimated and the less accurate the calculated current capital asset values will be.

This method has three concerns that made it unusable for this analysis; first, the panel acquired through SSB did not have a significant enough time dimension to allow for accurate calculation of the capital stock. Because their method assumes each firm has a smooth investment and depreciation profile over the unobserved years, pre-sample years, each additional year between the establishment of the firm and the start of the panel introduces estimation errors and decreases the relevance of the calculated values. Secondly, the price index is not expected to be stationary, but instead increasing each year, therefore the adjusted capital stock cannot be said to be strictly stationary. The



introduction of nonstationarity to the dependent variable calculation should be avoided if a feasible alternative would be available. Finally, because the adjustments to the historical cost of the fixed assets are adjusted via a pricing index these adjusted figures do include information on the current and historical financial movements and pricing bubbles. This will introduce purely financial effects into the measure of investment, preventing it from accurately representing only the firm's current decision to increase or decrease its capital stock.

It is also important to note that this method was developed to calculate the national aggregate capital stock, which is useful in many investigations of national level production, not to allow comparison between company size. For this use it was designed to only be accurate on average for the firms reviewed, the model overestimating or underestimating the value of a specific firm would not have the effect on national capital stock that it would when calculating the differential in investment between two similar firms. Because the measure is being used here as a weighting device it faces many issues that are not present in its intended use, and is not an appropriate adjustment in this model. The historical cost will be used instead.

#### **5.4 Weighted Investment**

The investment weighted by the beginning of the period long-term fixed capital assets was also found to exhibit extreme outlying values. The sample was censored at a one period investment of greater than 100 times the firm's beginning asset value. These high investment levels were not incorrectly calculated; the firms simply had very small initial levels of long-term fixed capital assets, therefor even small investment levels led to large investment growth rates. Even after censoring the data still proved to be highly

skewed to the right with the mean value of 1.27 being higher than the value of 75% of the sample. The median was only 0.011.

### **5.5 Non-Investment and Lumpiness of Capital Accumulation**

Of the 299,924 observations in the panel set, 182,391 remained after the investment in physical capital was calculated as above. These remaining observations exhibited periods of non-investment and low levels of divestment, as previously discussed. Approximately 41% of the observations (75,411) were equal to or less than zero, 53,371 (29%) of which indicated periods of no investment. Only 22,000 of the approximately 182,000 (12%) observations over the period indicated a firm lowering the level of capital assets they owned.

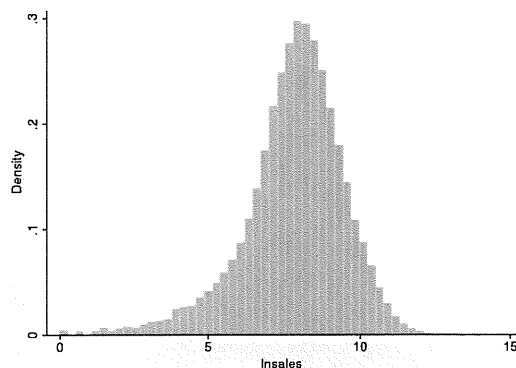
In addition to the nonlinearities in investment discussed in section 2.5, another explanation for the low levels of detected investment is the business model of the firm. For instance, many firms who provide primarily human services have large stocks of human capital and little to no fixed tangible assets. These low capital firms are also less likely to adjust their stock in physical capital in reaction to changing market conditions as their business model primarily adjusts output by altering human capital. 23,308 of the observed periods of no investment were due to the firm not owning any fixed tangible assets. These observations are of firms who structurally do not require these assets to operate, as all but 265 of the observations also posted a profit or loss during the period that they had no reported long term fixed capital. Only 2,770 of the firms in the sample transitioned from a state of owning no long term fixed capital assets to owning them.

### 5.6 Investment in the Caggese Model

The measure of flexible capital used to calculate the firm's investment was the change in the sum of current assets. This accounting balance sheet item includes finished goods inventory, unfinished goods inventory, the value of funds owed to the firm by its customers, and any prepaid expenditures (such as prepaid rent). The Caggese Model requires the natural log of investment to be used, therefore the asset level was logged and then the log value of the previous level was subtracted to leave the one period change in the log of total current assets.

### 5.7 The Firm's Sales

The firm sales information used in the models is directly taken from the business accounting register's income statement, and has not been modified. The variable for firm sales was highly skewed with a long positive tail. The mean value was 5,983.9 while the median value was only 2,073. The log value of sales was found to be more normally distributed with a long negative tail.



The sales as weighted by the firm capital, the sales measure used in the sales accelerator model, retained the non-normal distribution observed in the original value of sales.

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### **5.8 Cash and Net Financial Assets**

For the sales accelerator model the measurement of investable capital used was identical to the one used by Fazzari, Hubbard, and Petersen (1988), the current period change in cash weighted by the firm capital. The measurement of capital used to calculate this ratio is identical to the definition used to calculate the investment-capital ratio. The measure of financial assets in the Cageese model is not a flow variable, but the stock value. This value includes the firm's cash and liquid financial assets, less outstanding debt.

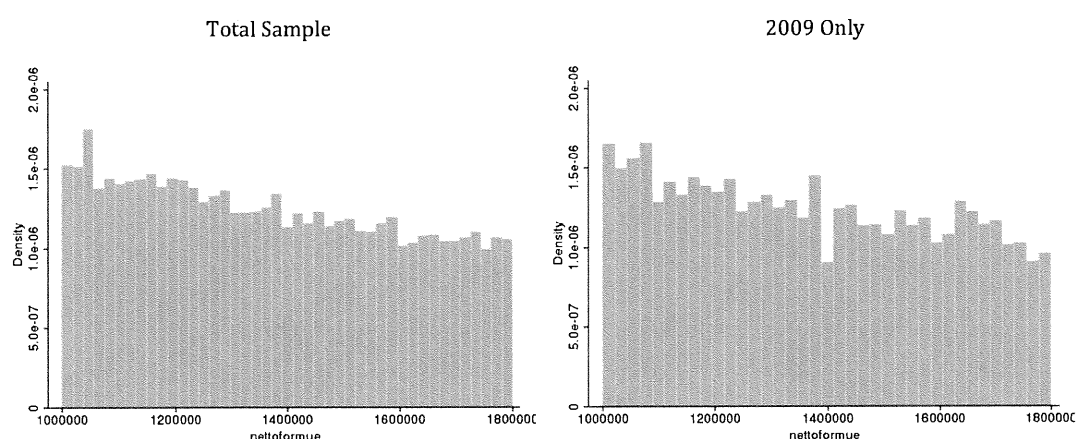
### **5.9 The Owner's Wealth Tax Obligation**

The owner's marginal tax rate on wealth was calculated by Statistics Norway's Lotte-Skat model. Developed originally in the 1970's the model has been an important policy tool used by the Norwegian Ministry of Finance to calculate tax effects. The model contains detailed information from individual tax returns and the Norwegian Household Register. This information was used to simulate the change in tax due for an individual if their net worth was increased, the percentage of this additional wealth that was required to be paid as a tax was then calculated as the marginal tax rate on wealth for the individual. (Aasness, 2006)

The average marginal wealth tax rate is 0.50%, with a minimum rate of 0 and a maximum calculated rate of 2.2. The expected maximum rate was 1.1, which is the effective rate stated by Norwegian law, less than 0.5% of the sample exceeded this marginal rate and this anomaly is due to the increased wealth causing the individual to no longer be eligible for unrelated tax breaks and therefore it is an accurate estimation

of the cost the individual would face from increasing their taxable net wealth. Approximately 30% of the observations have a marginal rate equal to the 1.1 maximum, and 43% have a marginal tax rate of zero, the minimum rate observed. Any firm whose primary owner has a non-zero marginal tax rate for wealth is considered to be subject to the constraint of the wealth tax for purposes of separation into research groups, even if the owner has a marginal wealth rate less than the stated rate of 1.1%.

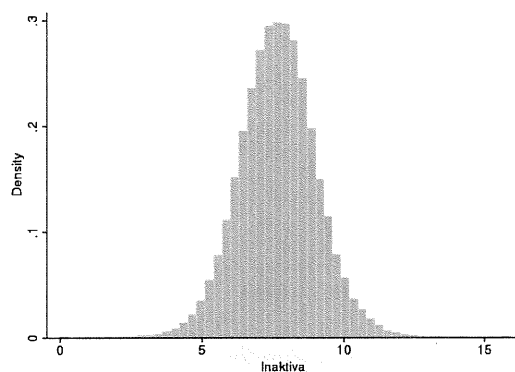
Figure 6: Density of Net Wealth around 1.4 Million



There is evidence of tax motivated adjustment to an individual's net wealth directly at the point where it becomes taxable at 1.4 million kroner. Figure 6 is the sample density of individual net wealth around the cutoff point, first for the entire sample then for only the last year of the panel. The lower concentration of observations at 1.4 million increased each year since the 2006 change so that it is only easily identifiable in 2008 and 2009. This effect may be due to a form of tax evasion where assets of higher value are not reported or underreported, or it could indicate an investment disincentive where an individual near the threshold has no incentive to invest their wealth to the point where it would become taxable.

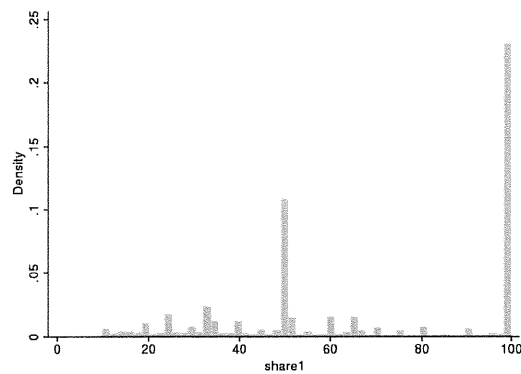
### 5.10 Sorting Criteria – Size

The firm size, as determined by total assets was heavily skewed with a long positive tail. Because there is no theory stating the exact size when a firm is expected to gain sufficient mass to overcome external financing constraints the sample was split using the mean and median values as the separation criteria. The mean value for total firm assets was 6,842.4 thousand kroner, however over 75% of the firms in the sample fell below this number. The median value for firm assets was 2,158. The firm's net assets appear to be approximately normally distributed, with a mean value of 8.83.



### 5.11 Sorting Criteria – Ownership

As the ownership share becomes more concentrated it is theorized that the agency and asymmetry of information costs associated with external financing also increases, reducing the substitutability of external capital for internal capital. This is why the firms with highly concentrated ownership structures are expected to be more capitally constrained. The primary owner's ownership share has a mean value of 68% in the panel constructed. The distribution shows a large concentration at 50% and 100% with over 40% of firms being entirely owned by one individual.



### 5.12 Sorting Criteria – Dividend

The firm's dividend payments were not directly recorded in the business register, and were instead calculated manually by taking the change in total equity for the period and removing the retained earnings for the period. This measured the net capital contributed to the firm in the period, and any dividends paid were assumed to be the inverse. In 25,929 of the observations the firm paid no dividend and acquired an additional injection of capital. Two separations were attempted under the dividend category for sensitivity analysis. The separation criteria was based on the dividend as a percentage of the firm's net income, if the dividend paid in a period was below 5%, or 10%, then the firm was determined to be cash constrained. A dividend ratio was chosen as the cutoff point, as opposed to the more traditional cutoff point of simply if the firm is paying a dividend in the period, because in practice the firm's dividends tend to remain positive once a firm begins issuing dividends. For private firms this is typically associated with the owners requiring the dividend payments to fund their personal expenditures and tax imperfections make dividends a cheaper way to fund these than a salary. Using the ratio allows the owner to transition from a non-constrained state to a constrained state while still distributing to himself a portion of firm funds to finance personal expenses.

### 5.13 Sorting Criteria – Firm Lifecycle

The measure of the firm's lifecycle was calculated as the ratio of earned equity (or retained earnings) to contributed capital. Though theoretically similar to the definition used by DeAngelo (2006) this measure was more pure for purposes of *a priori* separation based on capital constraints. The firms with primarily contributed capital were theorized to be more constrained than those whose earned equity exceeded their contributed equity. A logical point to separate the firms into mature and immature would be a value of 1, where the firms had earned as much through their operations as the owner had contributed. Due to the large number of firms with negative earned equity over 25% of the sample had a negative value for this ratio, implying that the firms with a value close to 1 had already been in the growth phase for multiple years.

In order to separate the firms into mature firms and those in the earliest stages of growth, when a firm should be the most sensitive to constraints in internal and external capital, the two separation points used were a ratio of .05 or .20. The firms were defined as immature or in the early stages of growth if the ratio was below this point. Both measures were below the median value of 0.93.

## 6. Results

### 6.1 Unit Root Tests

The Harris-Tzavalis unit root test rejected the null hypothesis of the series containing a unit root, figure 9. Because the series were all found to be stationary further differencing is not required before the series can be used to estimate the model.



Figure 9: Results of the Harris-Tzavalis Unit Root Test

	Investment	Sales	ΔSales	Cash	Ln(Sales)	Leverage	Ln(Financial Assets)	Ln(Current Assets)
Harris-Tzavalis	-0.3598	-0.3091	-0.4859	-0.4917	0.1370	-0.3664	0.0329	-0.2836
H0: Unit Root	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

The chart shows the estimated rho coefficient for the Harris-Tzavalis test above the p-value for the test

## 6.2 Separation by Wealth Tax Obligation

The two models, equation (6) and (8) were estimated after splitting the sample into two groups based on the owner's current wealth tax burden. The taxed group consisted of 138,226 individual observations compared to the non-taxed group's 106,085 observations.

Figure 10: the estimated investment sensitivity to cash

	Non-taxed	Significance of Difference	Taxed
Sales Accelerator Model	-.10899 ** (.03651)	1.76 0.078	.00344 (.00992)
Caggesse Model	.11138 ** (.04322)	-2.15 0.012	.08459 ** (.02248)

The chart shows the estimated coefficient used to detect capital constraints in each model with the robustly calculated standard errors in parenthesis. The column labeled "significance of difference" contains the t-test statistic and the p value of the test that the two adjacent coefficients are equal.

\* Significant at 5% \*\* Significant at 1%

For the sales accelerator model, the previous period sales was only a significant indicator of investment level for the firms subject to the wealth tax, and the previous period's change in sales was not significant for either group. The leverage was significant and positive for each group, at the 1% level for the non-taxed group and the 5% level for the taxed firms, though the difference was not significant. The firm leverage was expected to detect the decreased investment caused by the increasing cost of debt as the leverage increases, and was therefore theorized to have a negative sign. The positive sign may indicate that the variable is instead detecting the financing structure

of the firm's investment. If the firm has access to debt financing and primarily uses it to finance investments in physical capital, the leverage would increase with capital investment. This would indicate that neither group is, on average, strictly capitally constrained and that both groups still have access to the debt markets.

None of the coefficients were individually significantly (at the 5% level) different for this model between the taxed and non-taxed groups. The only variable found to be significantly different between the two groups at the 10% level was the change in firm cash, though the model shows that the taxed firms are less sensitive to changes in cash, the opposite of the expected result. The sign of cash, if significant, was expected to be positive, instead the only significant coefficient was negative. The investment in an unconstrained firm would be expected to be unrelated to the change in the firm's cash, the negative coefficient is therefore detecting an undue interdependence between cash and capital investment in these firms, just not the relationship hypothesized. Instead the model seems to be capturing the firm's forced tradeoff between a high level of investment and accruing financial assets. This tradeoff would be more pronounced in the firms who have lesser access to external funding and rely primarily on internal cash for investments. In this way the excess correlation between the changes in the firm's cash and its investment level would indicate not a capital constraint, but higher investment sensitivity to internal funds. Those firms whose primary owner is subject to the wealth tax were not found to have this high investment sensitivity to internal funds.

In the Caggese model both firms have a positive and significant coefficient for the net financial assets, indicating that the average firm in both groups faces capital constrained investment decisions. This model also found that the investment decisions in firms with a primary owner subject to the wealth tax are on average significantly less sensitive to

the availability of internal firm financing, reaffirming the results from the Sales Accelerator Model. There are a few possible causes for this unexpected result. This outcome may be due to the wealth tax status signaling that the primary owners have additional capital available to invest. Because paying the wealth tax is based on the owner's total capital, it may be correlated with the size of the firm or other factors that would prevent the firm from being cash constrained. The final reason could be a social one, as currently only the wealthiest 17% of households in Norway pay the wealth tax this variable can be seen as an indicator of the owner being in the upper echelon of the social network. This social status may afford their businesses easier access to loans or external equity to use for investing.

The lagged value of sales in the Caggese model is significant for the untaxed firms, but has an unexpected sign, which may indicate a misspecification in the model. This coefficient is significantly different between the two groups, with the taxed group having a coefficient closer to zero than the estimated coefficient for the untaxed firms, at a 1% significance level, while still being different than zero at the 5% level.

The two models together suggest that the firms in the panel are on average subject to some amount of influence on their investment decisions based on the available financing. The long term durable assets were found to be highly collateralized for both taxed and untaxed firms, with no significant difference found between the two groups. For this asset group the firms were able to secure any needed external financing. The average firm in the non-taxed group was however found to be sensitive to the amount of internal financing available when making investment decisions. This sensitivity was significantly reduced for the firms subject to the wealth tax, with the firms in being found to have no forced tradeoff between amassing long-term physical capital and

financial reserves. The differences found in the investment models between the two groups indicate that the firms whose primary owner is subject to the wealth tax have, on average, better access to external substitutes for internal financing.

### 6.3 The Wealth Tax Effect on Constrained Firms

In this section we attempt to address concerns that the above results are due to a correlation between the firm's tax status and other causes of capital constraints, or other indicators of capital market access. Figure 11 shows the number of observations in each of the four possible groups based on the previously discussed measures of constraint and the owner's tax status. The portion of the untaxed firms that are also considered to be tax constrained is higher for each measure except the dividend measures. The biggest difference can be seen in the firms separated by the median firm size, indicating that the firms subject to the wealth tax are on average larger.

Figure 11: Number of Observations by Group Pairing

	Unconstrained & Untaxed	Unconstrained & Taxed	Constrained & Untaxed	Constrained & Taxed	Percent Untaxed	Percent Taxed
Mean Size	10657	35200	95428	103026	90%	75%
Median Size	38536	83311	67549	54915	64%	40%
Share 1	20048	37700	86037	100526	81%	73%
Share 2	44640	68465	61445	69761	58%	50%
Dividend 1	42641	52273	63444	85953	60%	62%
Dividend 2	48169	56247	57916	81979	55%	59%

Neither the mean nor median size proved to be effective at separating the firms based on sensitivity to cash in the sales accelerator model. The subsample groups suffered from their reduced sample size, and therefore had larger standard errors than the previous non-separated estimations. The taxed group was found to be significantly more sensitive to cash flows for the subset of firms with long-term fixed assets less than the median value, however the firms in this subset cannot be said to be significantly different from the firms above the median value. The Caggese model found that the firm

size was significant at separating the taxed firms into more and less financially sensitive firms, however the smaller firms were found to be less sensitive than the larger firms in both specifications. With the exception of the group of firms larger than the median value, there was no significant difference in the capital constraints faced by the taxed and non-taxed firms, and that group found the taxed firms to be less sensitive to the firm wealth.

Figure 12: The Coefficient Estimations for the Sensitivity to Internal Cash with Firms Separated by Median and Mean Size

Sales Accelerator Mean				Caggese Mean			
	Non-taxed	Significance of Difference	Taxed		Non-taxed	Significance of Difference	Taxed
Constrained	-.22948 (.21596)	1.40 0.300	.11032 (.18959)	Constrained	.07141 ** (.01723)	1.52 0.130	.05945 ** (.00864)
Significance of Difference	1.35 0.176		.052 0.674	Significance of Difference	1.83 0.068		2.80 0.005
Non- Constrained	-.07686 ** (.02832)	0.83 0.407	.0015 (.01062)	Non- Constrained	.00902 (.05035)	1.68 0.094	.12433 ** (.02613)

Sales Accelerator Median				Caggese Median			
	Non-taxed	Significance of Difference	Taxed		Non-taxed	Significance of Difference	Taxed
Constrained	-.01777 (.02578)	2.28 0.023	-.1381 ** (.04918)	Constrained	.07065 ** (.01912)	0.90 0.369	.05753 ** (.01072)
Significance of Difference	0.89 0.406		0.56 0.576	Significance of Difference	0.38 0.704		2.57 0.010
Non- Constrained	-.08132 ** (.01879)	1.31 0.191	.00229 (.01226)	Non- Constrained	.10652 ** (.0399)	2.07 0.039	.09556 ** (.01359)

The chart shows the estimated coefficient used to detect capital constraints in each model with the robustly calculated standard errors in parenthesis. The column and row labeled "significance of difference" contains the t-test statistic and the p value of the test that the two adjacent coefficients are equal.

\* Significant at 5% \*\* Significant at 1%

The percentage of equity held by the primary owner was a borderline significant sorting criteria for the Sales Accelerator if the constrained firms were defined as any firm where the primary owner possessed at least 50% of the total equity. The sorting criteria did not significantly detect differences in capital constraints according to the Caggese model, and the taxed firms were found to either be equivalent to the similarly sorted untaxed firms, or less sensitive to internal financing.

Figure 13: The Coefficient Estimations for the Sensitivity to Internal Cash with  
Firms Separated by Concentration of Ownership  
Sales Accelerator Ownership >50% Caggese Ownership > 50%

	Non-taxed	Significance of Difference	Taxed		Non-taxed	Significance of Difference	Taxed
Constrained	-.24454 ** (.08236)	1.80 0.072	.00631 (.01114)	Constrained	.07723 ** (.01922)	1.35 0.178	.08083 ** (.00905)
Significance of Difference	1.90 0.057		1.73 0.83	Significance of Difference	0.20 0.838		1.66 0.097
Non- Constrained	-.08861 ** (.01748)	0.79 0.429	-.15841 (.11901)	Non- Constrained	.05668 (.03381)	0.30 0.767	.03489 (.02081)

	Non-taxed	Significance of Difference	Taxed		Non-taxed	Significance of Difference	Taxed
Constrained	-.18163 ** (.04008)	2.94 0.003	.00683 (.01248)	Constrained	.07629 ** (.02233)	0.65 0.518	.08941 ** (.01997)
Significance of Difference	1.49 .135		1.40 0.162	Significance of Difference	1.17 0.242		1.81 0.070
Non- Constrained	-.08743 ** (.01331)	0.29 0.773	-.07136 (.09372)	Non- Constrained	.08709 ** (.02465)	3.40 0.001	.04591 ** (.01311)

The chart shows the estimated coefficient used to detect capital constraints in each model with the robustly calculated standard errors in parenthesis. The column and row labeled "significance of difference" contains the t-test statistic and the p value of the test that the two adjacent coefficients are equal.

\* Significant at 5% \*\* Significant at 1%

The firm's dividend ratio proved unable to separate the firms based on the severity of their capital constraints. The taxed and non-taxed groups are not significantly different, at the 5% level, in any of the groups tested. Because the dividend policy of the firms is not of any interest outside of a possible signal of capital constraints no further information could be gained from this specification.

If the firms are separated into constrained and non-constrained groups based on the classical distinction of capital constraint for a firm, the act of paying a dividend during the period, we find that the separation criteria performs poorly. The firms which pay dividends are on average no more sensitive to the internal financing of the firm than those that retain their earnings. This result was not unexpected, as discussed in section 5.12. The finding of increased sensitivity to internal financing for firms paying a dividend in the Caggese model, presented in figure 15 (div3), contradicts the earlier findings of no difference and is difficult to discuss as the dividend payment is not a valid

indicator of capital constraint. Without the separation criteria validly distinguishing between the constrained and non-constrained firms, the proper measure of the effect of the wealth tax would be the results from the total sample presented in section 6.2.

Figure 14: The Coefficient Estimations for the Sensitivity to Internal Cash with Firms Separated by Dividend Payment Ratio  
Sales Accelerator Dividend Payment < 5% of Income      Caggese Dividend Payment < 5% of Income

	Non-taxed	Significance of Difference	Taxed		Non-taxed	Significance of Difference	Taxed
Constrained	-.11656 ** (.02684)	0.04 0.964	-.09425 (.15157)	Constrained	.07388 ** (.01837)	1.88 0.60	.05147 ** (.00801)
Significance of Difference	0.99 0.321		0.02 0.984	Significance of Difference	1.35 0.178		1.15 0.501
Non-Constrained	-.00282 (.02129)	0.44 0.663	.01984 (.02505)	Non-Constrained	-.0238 (.12234)	1.02 0.308	.29231 ** (.08038)

Sales Accelerator Dividend Payment < 10% of Income

	Non-taxed	Significance of Difference	Taxed
Constrained	-.11407 ** (.02302)	0.08 0.939	-.10822 (.14969)
Significance of Difference	0.51 0.613		0.05 0.959
Non-Constrained	-.05315 * (.02734)	1.67 0.095	.02011 (.02566)

Caggese Dividend Payment < 10% of Income

	Non-taxed	Significance of Difference	Taxed
Constrained	.08927 ** (.01884)	2.09 0.36	.05117 ** (.00832)
Significance of Difference	1.60 0.109		1.11 0.268
Non-Constrained	.02108 (.08181)	0.70 0.487	.22252 ** (.05901)

The chart shows the estimated coefficient used to detect capital constraints in each model with the robustly calculated standard errors in parenthesis. The column and row labeled "significance of difference" contains the t-test statistic and the p value of the test that the two adjacent coefficients are equal.

\* Significant at 5%    \*\* Significant at 1%

Figure 15: The Coefficient Estimations for the Sensitivity to Internal Cash with Firms Separated Into Those Paying or Not Paying Dividends in the Current Period  
Sales Accelerator      Caggese

	Non-taxed	Significance of Difference	Taxed		Non-taxed	Significance of Difference	Taxed
Constrained	-.06579 (.04657)	0.75 0.453	-.37399 (.38194)	Constrained	.21473 * (.08725)	0.96 0.335	.03029 (.05274)
Significance of Difference	0.14 0.890		0.79 0.432	Significance of Difference	1.10 0.310		0.77 0.444
Non-Constrained	-.09635 * (.04391)	1.60 0.109	-.00159 (.00819)	Non-Constrained	.05947 ** (.01685)	2.21 0.027	.07370 ** (.00907)

The chart shows the estimated coefficient used to detect capital constraints in each model with the robustly calculated standard errors in parenthesis. The column and row labeled "significance of difference" contains the t-test statistic and the p value of the test that the two adjacent coefficients are equal.

\* Significant at 5%    \*\* Significant at 1%

Overall the standard separation criteria proved to be ineffective at distinguishing between the capitally constrained and non-constrained firms. Despite these limitations, in every subset tested the firms subject to the wealth tax were either equivalent to or less sensitive to internal financing than the untaxed firms.

#### 6.4 The Wealth Tax and Immature Firms

The firm's lifecycle measure, as defined by the ratio of retained earnings to total equity, remained as poor at categorizing the firms into more and less capital sensitive as the more traditional measures. This may be due to the arbitrary nature of the decision of where to place the cutoff point, as the theory states no exact level of retained earnings that indicates a firm has left the growth phase. The cutoff points defined split the untaxed firms evenly, while the taxed firms skewed largely to the unconstrained end of the spectrum. This indicates that these firms have either been operating longer, are significantly more profitable, or their financing structure relies more heavily on debt financing than contributed equity.

Figure 16: Number of Firms by Group

	Untaxed	Taxed
Unconstrained LC1	61,512	109,066
Constrained LC1	44,573	29,160
Unconstrained LC2	56,948	103,704
Constrained LC2	49,137	34,522

The financial responsiveness of the taxed firms in the sales accelerator model was not found to be significantly different from zero for any of the groups. The investment in non-constrained firms was less sensitive to the firm's cash flow than the non-taxed group at the 1% level, while the capitally constrained groups were not significantly different. The standard error calculated for the constrained firms subject to the wealth tax was much greater than the standard errors for the other groups, which indicates the



firms in this group vary widely in their capitally constrained status, compared to the other groups.

The less mature firms, in this instance indicated as capitally constrained, subject to the wealth tax were found to only vary significantly from their non-taxed compatriots in their estimated coefficient of leverage; the significance is not great though, with a p-value of 0.063 and only for using the more restrictive separation criteria. The value of leverage for both groups is, as was discussed in section 6.2, positive, indicating that the variable is capturing the firm's financing rather than the capital constraints. If the significance is not spurious this would lend support to the observation that firms subject to the wealth tax use more debt financing, or have easier access to debt financing in the early stages of their growth. The regressions for the unconstrained firms found the leverage irrelevant in the investment models.

Figure 17: The Coefficient Estimations for the Sensitivity to Internal Cash with Firms Separated by Their Ratio of Earned Equity to Contributed Capital  
Sales Accelerator Earned Equity < 5% of Contributed Capital      Caggese Earned Equity < 5% of Contributed Capital

	Non-taxed	Significance of Difference	Taxed		Non-taxed	Significance of Difference	Taxed
Constrained	-.10036 ** (.02319)	0.94 0.347	-.61275 (.70938)	Constrained	.08690 (.08733)	0.27 0.788	.11978 ** (.03823)
Significance of Difference	0.29 0.774		0.96 0.339	Significance of Difference	1.90 0.058		0.20 0.842
Non- Constrained	-.08785 ** (.01764)	4.34 0.000	.00614 (.01041)	Non- Constrained	.05477 ** (.01443)	4.83 0.00	.07176 ** (.00877)

Sales Accelerator Earned Equity < 20% of Contributed Capital      Caggese Earned Equity < 20% of Contributed Capital

	Non-taxed	Significance of Difference	Taxed		Non-taxed	Significance of Difference	Taxed
Constrained	-.11366 ** (.02224)	1.67 0.096	-.89567 (.50293)	Constrained	.05147 (.06942)	0.64 0.521	.07462 * (.03058)
Significance of Difference	0.62 0.537		1.72 0.085	Significance of Difference	0.67 0.506		0.94 0.349
Non- Constrained	-.08939 ** (.01772)	4.30 0.000	.058939 (.06302)	Non- Constrained	.05466 ** (.01486)	2.22 0.026	.07284 ** (.00896)

The chart shows the estimated coefficient used to detect capital constraints in each model with the robustly calculated standard errors in parenthesis. The column and row labeled "significance of difference" contains the t-test statistic and the p value of the test that the two adjacent coefficients are equal.

\* Significant at 5%    \*\* Significant at 1%

The Caggese model showed a curious effect, while the lifecycle indicator was unable to predict the level of constraint the firm faces, it does find that more mature firms are more sensitive to internal capital when investing. This finding is consistent between the two definitions used to separate firms. This may either be an indication of the wealth tax increasing the firm's capital constraints, or it may simply be the model detecting a correlation between the growth of working capital and financial assets in the more mature firms. The Caggese model has consistently found the investment of firms in the sample to be sensitive to changes in the firm's net financial assets.

### **6.6 Other Findings**

In addition to the wealth tax making investment more sensitive to the financial assets of the firm, there is a possibility that the additional cost associated with the tax may make a firm less responsive to market opportunities. Since knowing the actual investment opportunities are impossible the above models used the firm's sales as a proxy for the firm's investment needs. If a firm subject to the wealth tax cannot take advantage of these opportunities as well then the coefficient in front of sales measure multiplied by the wealth tax dummy in the Chow specification test should be negative and significant. The results in figure 18 show that for the sales accelerator model the investment responsiveness to sales is not significantly different from zero, while in the Caggese model the coefficient for the constrained groups is significant and positive. Therefore the taxed firms are found to be more responsive to sales if sorted by common indicators of capital constraints. Given that the separation criteria proved incorrectly specified in all cases, the best measure for the difference in responsiveness to sales is the estimated coefficient for the total, non-sorted panel.

The coefficients in front of the previous period's sales and the change in sales in the sales accelerator model were not significantly different from zero, meaning that a firm's investment in physical assets was not appreciably less responsive to changes in firm performance if the owner pays the wealth tax. The Caggese model estimated the coefficient of the taxed sales as 0.10, a positive and significant value at a 1% confidence level. The coefficient of sales for the non-taxed firms in the panel was significant and negative, with an estimated value of -0.23. This means that the taxed firms are less responsive to sales, however the untaxed firms are estimated to be responding negatively to sales when investing.

Figure 18: Responsiveness to sales

Model	SA – Unconstrained	SA – Constrained	Caggese – Unconstrained	Caggese – Constrained
Size 1	.018 (.051)	.037 (.048)	.021 (.122)	.084 ** (.021)
Size 2	.0057 (.041)	.0093 (.018)	.137 ** (.051)	.071 ** (.025)
Share 1	.058 (.040)	.040 (.053)	.012 (.041)	.120 ** (.020)
Share 2	.032 (.032)	.166 ** (.054)	.098 ** (.035)	.110 ** (.023)
Dividend 1	-.268 (.152)	.078 * (.035)	.086 (.064)	.082 ** (.025)
Dividend 2	-.248 * (.107)	.071 (.037)	.097 (.056)	.087 ** (.026)
Dividend 3	-.0006 (.047)	-.018 (.047)	.105 ** (.022)	.192 * (.093)
Lifecycle 1	.111 ** (.033)	.036 (.092)	.063 (.008)	.076 ** (.024)
Lifecycle 2	.103 ** (.033)	.038 (.082)	.088 ** (.024)	.157 ** (.054)

The estimations of the coefficient for sales multiplied by the wealth tax indicator variable.

The standard errors are reported in parenthesis below the coefficient estimation.

\* Significant at 5%    \*\* Significant at 1%

## 7. Conclusion

In almost all tested specifications the firms whose primary owner paid the wealth tax were less likely to be sensitive to the internal financing when making investment

decisions; these firms did not face the same tradeoff between amassing physical productive capital and financial assets. This effect persisted even after the firms were split into groups based on their expected *a priori* status of capital constraints. The firms in the panel, however, proved to not be separable into constrained and unconstrained using conventional methods. This may be an indication that traditional measures such as size and agency costs may be less relevant for small privately held firm's access to external financing. The wealth tax indicator proved to be the best criteria for separating firms based on their sensitivity to internal financing, though the effect was not in the direction expected.

The reason for this effect is twofold, first, if the owner of a firm pays the wealth tax in Norway this is an indicator of social connectedness. Second, the alarming marginal tax rates discussed by the OECD report and in the public news media may not tell the whole or correct story of the incentive structure the wealth tax creates. The first option, the importance of social connections for a firm's ability to access external financing, was discussed as a possible explanation for the unusual results in section 6.2, the difficulty in separating the firms based on capital constraints found in section 6.3 and 6.4 adds validity to this option by suggesting that the level of capital constraints faced by a private firm is not dependent on traditional theories applicable to publicly traded firms. If a small privately held firm is at a disadvantage in securing outside capital, the owner's connections to the local business community and name recognition may act as a valuable tool in securing loans from banks or equity from other personal contacts. As the wealth tax is an indicator that the owner is in the top 17% of the nation's income bracket, it is reasonable to assume that these owners would have a more extensive network of personal contacts within their local business and political leadership.

Furthermore, the possession of large amounts of wealth requires an individual to have many contacts that others never make, such as personal accountants, financial brokers, and personal lawyers; all of whom can provide assistance when seeking financial injections for a profitable small business.

Unlike most forms of income tax, the effects of the wealth tax are persistent during periods of non-investment on the part of the individual, which leads to an interdependence between the tax burden from the tax and the taxpayers decisions different from the simple decision to participate in the investment market or not. Discussions surrounding the wealth tax effects tend to only focus on the cost of the tax on investment actions, ignoring the fact that the tax burden is much heavier on inaction on the part of the individual. Returning to the OECD reported effective tax rates (ETR) including the wealth tax, first presented in section 1.1, we can see how important it is when discussing the wealth tax to contrast any effect claimed with the alternative effect of non-action or underinvestment on the part of the taxed individual.

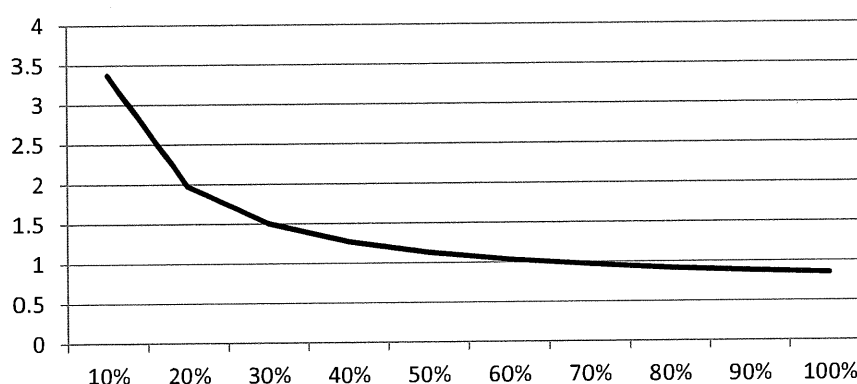
The OECD calculated the effective tax rate as the combined corporate and wealth tax burdens divided by the total profit in the period. The profit was calculated as simply the rate of return multiplied by the productive capital, and the corporate tax is then this profit multiplied by the corporate tax rate. Calculating the wealth tax is not quite as straight forward, as it is assessed on the total wealth owned at the end of the period, it includes the total wealth at the beginning of the period plus any appreciation in value due to inflation and the profit earned in the period, or:

$$\text{Wealth Tax} = \text{Tax rate} * (\text{Total Starting Wealth} * (1 + \text{Inflation}) + \text{Profit})$$

One key assumption here is that the starting wealth used to calculate the wealth tax due is not identical to the wealth base used to calculate the one period profit, as not all the owner's possessed wealth is necessarily productively invested. The OECD report assumes an even distribution of the individual's wealth between productive and non-productive assets. Unlike an income tax which is indifferent to the proportion of total wealth that is productively invested, the wealth tax penalizes non-productive wealth. The ETR decreases as the percentage of wealth actively generating returns increases.

Figure 19

### Effective Tax Rate by Percentage of Capital Earning a Return



Using a rate of return of 4%, an inflation of 2%, a corporate tax rate of 56%, and a wealth tax rate of 1.1%. The assumed rates are identical to the OECD assumptions used to generate figure 1.

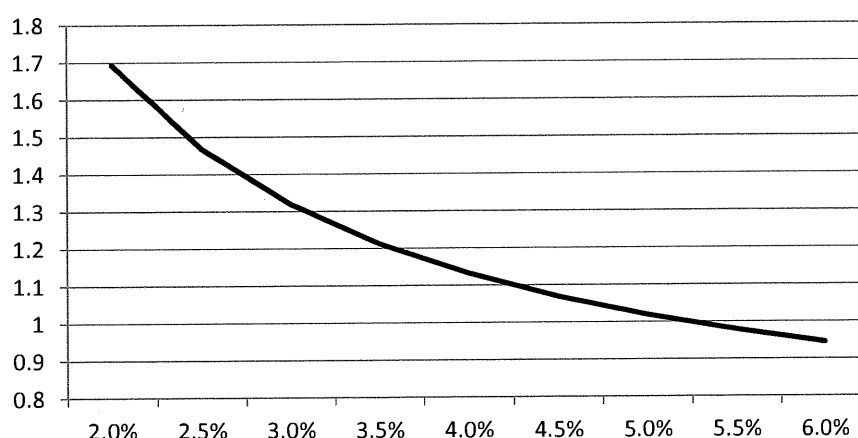
If 100% of an individual's wealth is actively generating returns the effective tax rate is only 85.15%. While it may seem unlikely that an individual would only have assets that are actively invested, the reality is that only a portion of an individual's wealth is taxed. For a married couple the first 750,000 NOK of wealth is exempted from the tax. If this couple had 1,000,000 NOK of wealth they would only require 25% of their wealth to be actively invested in order for the entirety of the taxable portion of their wealth to count as productive for calculating their ETR. The main source of non-productive (excluding

gains from capital appreciation) wealth holding for the average family is their home, however there are generous allowances and valuations for housing that minimizes its impact.

Unlike an income tax the wealth tax rate is also highly variable depending on the rate of return that an asset is earning. The cost of the wealth tax is greater on underperforming assets, but lower for assets with higher rates of return.

Figure 20

### Effective Tax Rate as Return Varies



Calculated using a rate of return of 4%, an inflation of 2%, a corporate tax rate of 56%, and a wealth tax rate of 1.1%. A 50% ratio of productive to non-productive assets was used.

The wealth tax therefore does not discourage investment in general; instead it discourages holding non-performing or underperforming assets.

The findings in this paper are not a causal relationship, but a correlation. Regrettably the 2004/2005 corporate tax overhaul in Norway, combined with the short timeframe of the available panel made fully exploiting the wealth tax law change to determine a causal relationship impossible. Even without a causal relationship the findings are of policy importance. Because the wealth tax only affects the individual firms within the sample found to be the most robust to changes in internal financing, the wealth tax

should not place a capital constraint on the businesses it affects. The tax was also not associated with an excess burden on the less mature firms, as the firms in this subset subject to the wealth tax were not significantly more sensitive to the availability of internal financing than the nontaxed firms but were shown to be more responsive to changes in market conditions.

In all, no evidence was found to support the claim that the wealth tax is harmful to business investments. The findings suggest that non-financial and unobservable characteristics of the firms owned by payers of the wealth tax may allow these firms better access to external resources and to rely less on internal financing than other small private firms. By only taxing the most robust private firms, a wealth tax may have less of a negative impact on investment than a corporate income tax which raises a similar level of revenue.

## **8. Further Study**

This thesis studied the capital constraining effects of the wealth tax on privately owned firms, however the traditional methods of identifying capitally constrained firms proved to be ineffective for these firms. It may be that the idea of capital constraints being exogenous is inappropriate for this subset of enterprises and an endogenous switching model may be able to improve the categorization of the firms.

Further the concerns over the non-linear effect of the wealth tax during periods of lowered performance were not adequately addressed by this study and require a different method to review. This is a crucial part to understanding unintended economic impacts of the wealth tax in Norway, and should be studied in greater detail.



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**References**

Aasness, Jørgen, John K. Dagsvik and Thor O. Thoresen. 2006. The Norwegian tax-benefit model system LOTTE. *Research Department, Statistics Norway*.

Abel, Andrew B. and Olivier J. Blanchard. 1983. An Intertemporal Model of Savings and Investment. *Econometrica*, Vol. 51, Issue 3, pp. 675-692

Alstadsæter, Annette and Erik Fjærli. 2009. Neutral Taxation of Shareholder Income? Corporate Responses to an Announced Dividend Tax. *International Tax and Public Finance*, Vol. 16, pp 571-604

Attanasio, Orazio P. and Matthew Wakefield. 2008. The Effects on Consumption and Saving of Taxing Asset Returns. *The Institute for Fiscal Studies Working Paper Series*, and to be published by Oxford University Press.

Bayer, Christian. 2006. Investment Dynamics with Fixed Capital Adjustment Cost and Capital Market Imperfections. *Journal of Monetary Economics*, Vol. 53, Issue 8, pp. 1909-1947

Bayer, Christian. 2008. On the Interaction of Financial Frictions and Fixed Capital Adjustment Costs: Evidence from a Panel of German Firms. *Journal of Economic Dynamics and Control*, Vol. 32, Issue 11, pp. 3538-3559

Bernheim, Douglas B. 2002. Taxation and Saving. *Handbook of Public Economics*, Vol. 3, pp. 1174-1240

Bond, Stephen and Costas Meghir. 1994. Dynamic Investment Models and the Firm's Financial Policy. *The Review of Economic Studies*, Vol. 61, No. 2, pp. 197-222

Browning, Martin and Thomas F. Crossley. 2001. The Life-Cycle Model of Consumption and Saving. *The Journal of Economic Perspectives*, Vol. 15, No. 3, pp. 3-22

Callen, Tim and Christian Thimann. 1997. Empirical Determinants of Household Saving: Evidence from OECD Countries. *International Monetary Fund (IMF) Working Paper Series*, No. 97/181

Caggese, Andrea. 2007. Testing Financing Constraints on Firm Investment using Variable Capital. *Journal of Financial Economics*, Vol. 86, pp. 683-723

Cummins, Jason G., Kevin A. Hassett, R. Glenn Hubbard, Robert E. Hall, and Ricardo J. Caballero. 1994. A Reconsideration of Investment Behavior Using Tax Reforms as Natural Experiments. *Brookings Papers on Economic Activity*, Vol. No. 2, pp.1-74

Cummins, Jason G., Keven A. Hassett, and R. Glenn Hubbard. 1996. Tax Reforms and Investment: A Cross-Country Comparison. *Journal of Public Economics*, Vol. 62 pp. 237-273

Dasgupta, Partha, and Joseph Stiglitz. 1972. On Optimal Taxation and Public Production. *The Review of Economic Studies*, Vol. 39, No. 1, pp. 87-103

DeAngelo, Harry, and Linda DeAngelo, Rene M. Stulz. 2006. Dividend Policy and the Earned/Contributed Capital Mix: a Test of the Life-Cycle Theory. *Journal of Financial Economics*, Vol. 81, pp. 227-254

Fazzari, Hubbard, and Petersen. 1988. Financing Constraints and Corporate Investment, *Brookings Papers on Economic Activity*, Vol. 1988, No. 1, pp. 141-206

Greene, William H. 2003. *Econometric Analysis*. Fifth ed. *Prentice Hall*, New Jersey

Hall, Bronwyn & Jacques Mairesse. 2005. Testing for Unit Roots in Panel Data: An Exploration Using Real and Simulated Data. *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg*, Cambridge University Press

Hadlock, Charles J. 1998. Ownership, Liquidity, and Investment. *IRAND Journal of Economics*, Vol. 29, No. 3, pp. 487-508

Hall, Robert E., and Dale W. Jorgenson. 1967. Tax Policy and Investment Behavior. *The American Economic Review*, Vol. 57, No. 3 pp.391-414

Hansson, Åsa. 2002. The Wealth Tax and Economic Growth. *Working Papers*, Department of Economics, Lund University

Hansson, Åsa. 2008. The Wealth Tax and Entrepreneurial Activity, *Journal of Entrepreneurship*, Vol. 17 pp. 139-156

Isaacs, Barry L. 1977. Do We Want a Wealth Tax in America, *University of Miami Law Review*, Vol. 32

Joumard, Isabelle. 2002. Tax Systems in European Union Countries, *OECD Economic Studies*, No. 34

Kocherlakota, Narayana R. 2005. Zero Expected Wealth Taxes: A Mirrlees Approach to Dynamic Optimal Taxation. *Econometrica*, Vol. 37, No. 5 pp.1587-1621

Michalos, Alex C., The Case for a Progressive Annual Net Wealth Tax. *Public Affairs Quarterly*, Vol. 2, No. 2 (April 1988), pp. 105-140

Mieszkowski, Peter. 1969. Tax Incidence Theory: The Effects of Taxes on the Distribution of Income, *Journal of Economic Literature*, Vol. 7, No. 4 pp. 1103-1124

Mintz, Jack M., and Jesus Seade. 1991. Cash Flow or Income? The choice of Base for Company Taxation, *The World Bank Research Observer*, Vol. 6, No. 2 pp. 177-190

Nerlove, Marc, Assaf Razin, Efraim Sadka, and Robert K. von Weizsacker. 1993. Comprehensive Income Taxation, Investments in Human and Physical Capital, and Productivity, *Journal of Public Economics*, Vol. 50 pp. 397-406

Nilsen, Øivind Anti. 2003. Zeros and Lumps in Investment: Empirical Evidence on Irreversibilities and Nonconvexities. *The Review of Economics and Statistics*, Vol. 85, No. 4, pp. 1021-1037

OECD. 2012. Economic Surveys Norway, *OECD Working Papers*

Owens, J. Evans. 1983. Tax Policy, The Interest Elasticity of Savings, and Capital Accumulation: Numerical Analysis of Theoretical Models. *The American Economic Review*, Vol. 73, No. 3, pp. 398-410

Owens, Sian and Alfred Yawson. 2010. Corporate Life Cycle and M&A Activity. *Journal of Banking & Finance*, Vol. 34, pp. 437-440

Pecorino, Paul. 1993. Tax Structure and Growth in a Model with Human Capital. *Journal of Public Economics*, Vol. 52 pp. 251-271

Perfect, Stephen B. and Kenneth W. Wiles. 1994. Alternative constructions of Tobin's q: An empirical comparison. *Journal of Empirical Finance*, Vol. 1, Issue 3-4, pp. 313-341

Pichet, Eric. 2007. The Economic Consequences of the French Wealth Tax. *La Revue de Droit Fiscal*, Vol. 14, p. 5, April

Raknerud, Arvid, Dag Rønningen and Terje Skjerpen. 2007. A Method for Improved Capital Measurement by Combining Accounts and Firm Investment Data. *Review of Income and Wealth*, Series 53, No. 3

Schiantarelli, Fabio. 1996. Financial Constraints and Investment: A Critical Review of Methodological Issues and International Evidence. *Oxford Review of Economic Policy*

Slemrod, Joel. 1990. Optimal Taxation and Optimal Tax Systems, *The Journal of Economic Perspectives*, Vol. 4, No. 1 pp. 157-178

Slemrod, Joel, William G Gale, and William Easterly. 1995. What Do Cross-Country Studies Teach about Government Involvement, Prosperity, and Economic Growth?, *Brookings Papers on Economic Activity*, Vol. 1995, No. 2 pp.373-431

Stiglitz, J. E. 1969. The effects of Income, Wealth, and Capital Gains Taxation on Risk-Taking, *The Quarterly Journal of Economics*, Vol. 83, No. 2 pp. 263-283

Stiglitz, Joseph E. Taxation. 1973. Corporate Financial Policy and the Cost of Capital, *Journal of Public Economics*, Vol. 2, pp. 1-34

Summers, Lawrence, Jonathan Gruber, and Rodrigo Vergara. 1993. Taxation and the Structure of Labor Markets: The Case of Corporatism, *The Quarterly Journal of Economics*

Verbeek, M. 2008. A Guide to Modern Econometric. Third ed. *Jonh Wiley & Sons*, England

Wooldridge, J.M. 2009. Introductory Econometrics: A Modern Approach. Fourth ed. *Cengage Learning*, Canada