STOCKHOLM SCHOOL OF ECONOMICS
Department of Economics
5350 Master's thesis in economics
Academic year 2019 – 2020

The Role of Capital Taxation in Sweden: Inheritance and Wealth Accumulation over the Lifecycle

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Abstract: Against the backdrop of increasing levels of wealth inequality in the Swedish economy, this thesis will deploy a large scale overlapping generations model with heterogeneous ability groups to evaluate the behavioral responses of individuals across the lifecycle as well as distributional and efficiency impacts of tax policy. Specifically, the paper will examine effects resulting from a reintroduction of inheritance taxation and varying rates of increase in the capital income tax rate. The model is closely calibrated to the Swedish economy and provides a confirmation of the equity – efficiency trade-off involved in redistributional tax policies. The findings suggest a varying rate of this trade-off, however, and indicate that certain levels of increased capital gains taxation can generate substantial increases in equality while maintaining limited distortionary effects. Additionally, the introduction of an inheritance taxation suggests non-negligible positive impacts on inequality with minimal distortionary impacts on aggregate economic outcomes.

Keywords: Inequality, Capital Tax, Overlapping Generations.

JEL: E21, E22, E27, E60, E62

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Date submitted: May 18 2020
Date examined: May 29 2020
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1. Introduction

Concerns regarding growing income and wealth inequality are becoming increasingly prevalent in public debate and academic research alike. While consistent longitudinal household wealth data is scarce, a number of reports indicate a significant widening of the gap between the rich and poor in a majority of advanced economies over the past thirty years (Piketty, 2011, 2014; Saez and Zucman, 2016). The rate of increase, however, varies and a large share of European countries have seen a relatively moderate rise in inequality rates compared to other regions. In this context, Sweden stands out with one of the highest growth rates in inequality between the mid-1980s and early 2010s among all OECD countries, increasing by over thirty percent (OECD, 2015). These differential inequality growth rates, even among countries with similar levels of development, indicate a significant role played by policy and institutions.

With this in mind, Sweden may be considered of particular interest within the inequality debate due to its historically strong welfare state-policies with regards to redistribution and social insurance, coupled with an emphasis on promoting growth and a "business friendly" economic climate. Previous research indicates that a non-negligible share of Sweden's increased income and wealth concentration can be attributed to demographic and structural factors (Robling and Pareliussen, 2017). These would include aspects such as an increased educational attainment leading to a wider gap between median and bottom earners, and an aging population resulting in a greater share of the population transitioning to lower income levels via retirement. However, while these aspects explain up to approximately forty percent of the change in Sweden's Gini coefficient over the past thirty years, a significant contributor to the growth in inequality comes from incomes at the upper end of the distribution having outpaced median earnings, in particular with regards to capital income (OECD, 2017; Bastani and Waldenström, 2018). Sweden's wage income distribution remains relatively flat, largely due to a high marginal tax rate on labor and narrow wage differences resulting from centrally coordinated wage bargaining, high skills and high employment. Capital gains, however, paint a different picture, with a majority of Swedes receiving very limited interest and dividend incomes but the top of the wealth distribution receiving a significant share of their income from this type of capital gain (Bastani and Waldenström, 2018; SCB, 2018).

While this concentration of assets is by no means unique to Sweden, the redistributive heritage of the economy combined with a series of capital tax reforms over the past thirty years makes it an interesting case study. To exemplify the changes in redistributive policy, we may note in particular the repeal of wealth and inheritance taxes in the mid-2000s, as well as an effective decrease on taxation of capital income from stocks and mutual funds through the introduction of a special savings account (Bastani and Waldenström, 2018). In light of these developments, this thesis aims to explore the role of capital taxation in the Swedish economy, with a particular emphasis on inheritance and capital income taxation. There is longstanding political and academic dispute regarding the need for and impacts of capital taxation, with a significant portion of research in the area pointing to its distortionary effects, and others highlighting the importance of redistribution and equality of opportunity. With this in mind, this paper will present an analysis of the Swedish economy using a large-scale overlapping generations model wherein parents and their children are linked by bequests and by the transmission of earnings ability. These links are further strengthened by the introduction of heterogeneous ability types in the economy, allowing us to analyze the impact of various tax regimes on inequality, efficiency and lifecycle behavioral responses. Specifically, the thesis will complement the current Swedish tax policy with the implementation of a number of inheritance and capital income tax scenarios and analyze effects on individuals' choices, equity with respect to consumption, assets and labor supply, as well as the distortionary effects of the varying tax regimes. The findings confirm the well-established equality – efficiency trade-off involved in redistributional tax policies but suggest that small, positive changes to the capital income tax could generate significant improvements in equality while having a limited negative effect on aggregate economic outcomes. With respect to inheritance taxation, we find more muted impacts but nevertheless note very limited negative efficiency impacts and a non-negligible redistributional power.

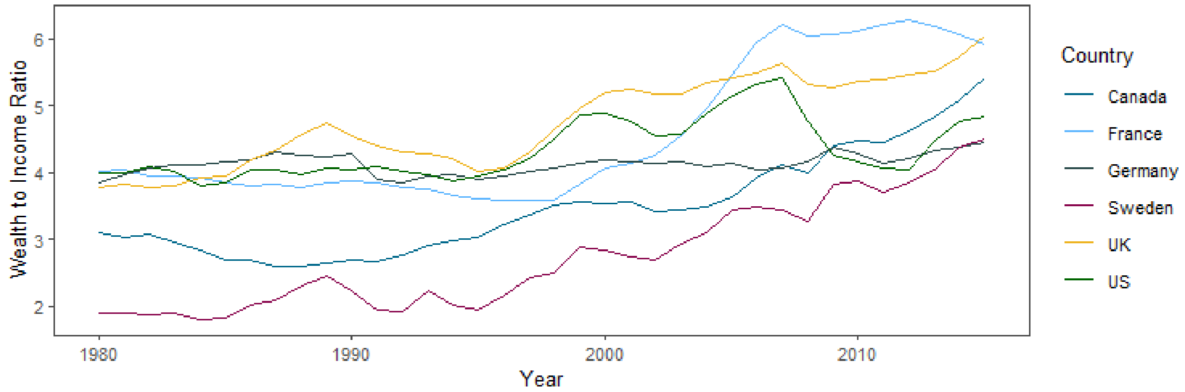
The paper is structured as follows. Section two will provide an extension of the empirical motivation and present a background to the Swedish capital taxation system, as well as a wider overview of the academic research on capital taxation. Section three will introduce the model specification and calibration. Section four will present the results of the analysis alongside a discussion concerning the behavioral responses, equity and efficiency outcomes of the tax policies and, briefly, the political feasibility of the different taxes. Section five will discuss potential areas for future research and Section six will conclude.

2. Background

2.1. The state of capital in Sweden

The role of capital has become increasingly prominent in most developed economies over the past three decades and, notably, the ratio of private wealth to national income has increased across the board. Figure 2.1.1 illustrates this phenomenon, tracking the ratio of net private wealth as a share of national income in the years 1980 – 2015 for a number of OECD countries. As can be seen, Sweden had a significantly lower relative share of capital up until the mid-1990s. However, in the years since, Sweden has more than doubled its value of private wealth relative to national income and caught up to other nations. However, whereas many other countries saw an increase in their relative share of private capital due to a transfer of public funds to the private sector (Alvaredo et al., 2017), this is not a significant driver in the Swedish case (Waldenström, 2017). Instead, the Swedish government remains an important part of the economy, primarily through the relatively large public pension system. The relative strength of the Swedish government plays a significant role in ensuring its efficiency with regards to redistributing income and mitigating rising inequality (Alvaredo et al., 2017). Indeed, as shown by Domeij and Flodén (2009), pre-government earnings inequality has increased significantly more than earnings after taxes and transfers, indicating that the Swedish state provides a non-negligible level of insurance.

Figure 2.1.1. Wealth to income ratios over time.



Source: Author's rendering of data from the World Inequality Database, Swedish National Wealth Database (Waldenström, 2017).

In understanding the dynamics of redistribution and the desirability of potential changes in capital taxation, it is central to consider how capital has been created, what the national private wealth is composed of and how sensitive it is to taxation – something that we will return to in our discussion of the academic research on capital taxation in section 2.2. Figures 2.1.2 and 2.1.3 illustrate the breakdown of capital assets in Sweden over time, with capital's share of wealth represented on the y-axis and corresponding to the direct ratio of assets to national wealth. We note a significant upswing in the value of property, starting in the mid-1990s. Rather than being a result of increased land or property ownership, however, this increase comes primarily from an increase in prices (Bastani and Waldenström, 2018). The value of financial assets also increased significantly during the same period, primarily due to increased savings in the country's pension funds leading to an increase in assets from approximately one fifth to a hundred percent of national income. Corporate shares also rose particularly quickly in this period, largely due to increases in stock prices, moving from 20 to over 50 percent of national income (Bastani and Waldenström, 2018).

Figure 2.1.2. Non-financial assets over time.

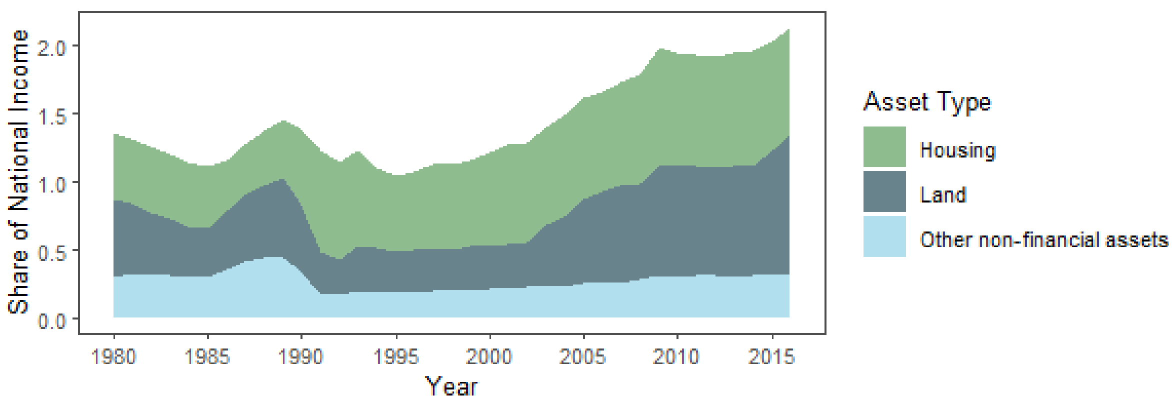
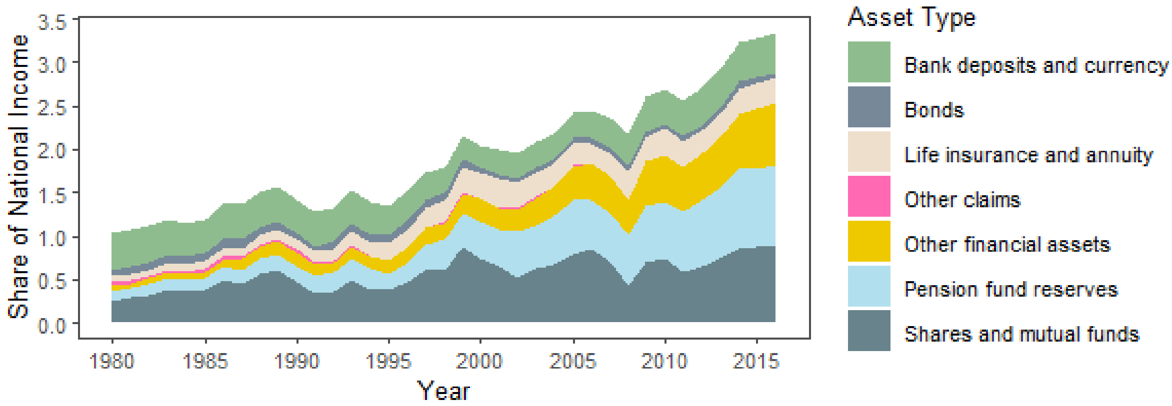


Figure 2.1.3. Financial assets over time.

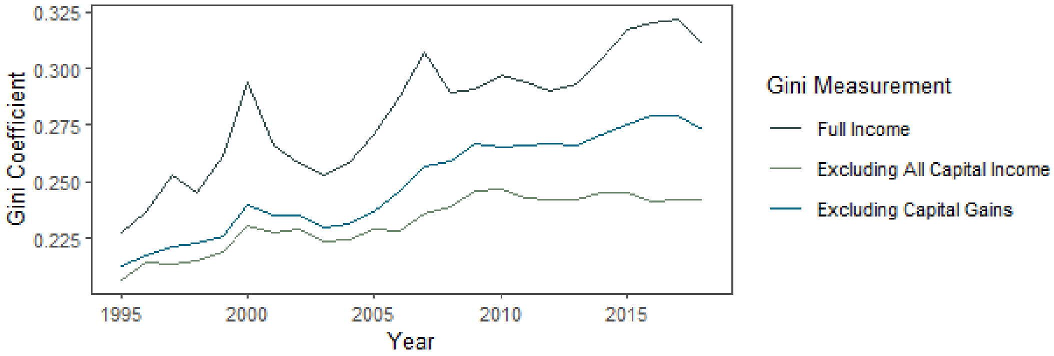


Source: Author's rendering of data from the Swedish National Wealth Database (Waldenström, 2017)

As illustrated above, wealth holdings in the economy have increased since the 1980s, with the Swedish population as a whole seeing their share of capital income rising by roughly two percent. However, this figure masks the fact that the bottom twenty percent of earners saw a decrease in their wealth holdings during that period, while the richest fifth of the Swedish population saw an increase by over ten percent (OECD, 2015). These numbers are in line with recent research indicating that capital income is particularly important for top earners, often making up the largest part of their income (Roine and Waldenström, 2011).

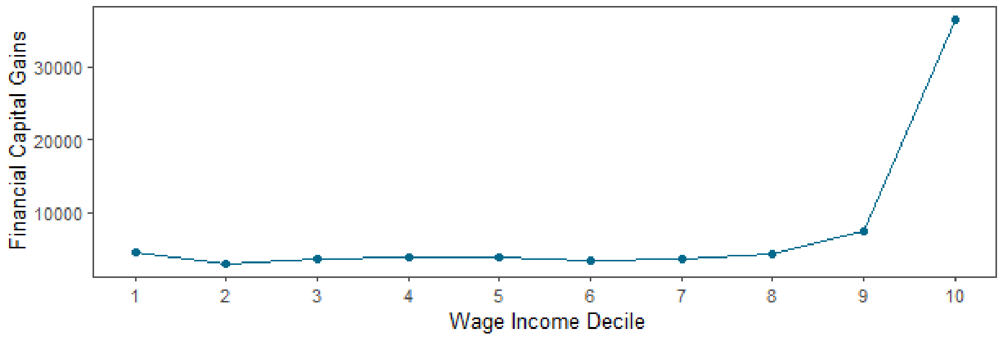
While Sweden, as noted above, still belongs to the group of the most equal advanced economies in terms of Gini measurements, it has seen a rapid increase in inequality outcomes since the 1980s. Figure 2.1.4 below presents a breakdown of the Swedish Gini coefficient, corresponding to measurements of total household income, income excluding capital gains but including dividends and interest earnings, and lastly excluding all capital income. From the graph we note that capital income appears to significantly increase income inequality, particularly in later years. Indeed, while research indicates a somewhat mixed view on the role of capital gains with respect to top income shares in developed economies (see, for example, Saez, 2005; Veall, 2010), Roine and Waldenström (2011) establish a clear link in the Swedish case and note that the income share of the top one percent is approximately forty percent higher when including realized capital gains. Utilizing data from SCB (2020a), Figure 2.1.5 further shows the correlation between wage earnings and interest and dividend income. It is worthwhile noting that there appears to be a non-negligible correlation between capital earnings and labor income, something further supported by the literature (see for example Bastani and Waldenström, 2018). We also note that a majority of Swedes earn very limited capital incomes but that there is a significant spike for the top ten percent.

Figure 2.1.4. Gini coefficients over time.



Source: Author's rendering of SCB data (2020a)

Figure 2.1.5. Correlation between wage earnings and capital income.



Source: Author's rendering of SCB data (2018)

The above figures give an indication of the income inequality in Sweden over the past thirty years. However, the status and development of wealth inequality is more difficult to identify, particularly since Sweden abolished its wealth taxation in 2007 and subsequently stopped collecting data on individual wealth. Some attempts to conquer the inherent measurement issues related to the wealth distribution have been made, notably by Lundberg and Waldenström (2018) who find that the level of wealth inequality has remained relatively unchanged over the past twenty years. However, the lack of development in this aspect is not necessarily a positive indicator. Looking at the wealth concentration at the top of the distribution, we note that the approximately 200 richest Swedish families collectively own almost twice as much wealth as the Swedish central government (Bastani and Waldenström, 2018).

While the wealth share development of the very richest Swedes is remarkably similar to other developed nations, Sweden has long been regarded as a redistribution-oriented country with a high degree of social mobility. Indeed, Sweden has one of the lowest cross-generational income persistence rates among industrialized countries (Björklund and Jäntti 2011; Corak, 2013), but as shown by Björklund, Roine and Waldenström (2012), this is primarily driven by low capital incomes for the majority of the population. For top earners and wealth holders, however, the fathers' income determines a significant share of their children's. Similarly, Adermon, Lindahl and Waldenström (2018) find that the cross-generational transfer of wealth (primarily via inheritances) plays a large role in the upper wealth and income distributions and Ohlsson, Roine and Waldenström (2014) show that the flow of inheritances and lifetime gifts are trending upwards in terms of shares of national income.

Having provided an overview of the accumulation and relative concentration of capital in the Swedish economy, it is worthwhile briefly discussing how it is currently impacted by government policies and related to redistribution. As highlighted in the introduction, a lot has changed in terms of the Swedish tax regime over the past thirty years. In addition to the wealth tax being abolished in 2007 along with the tax on inheritances and gifts in 2004, property taxes have decreased significantly and the introduction of a new type of savings account led to sharp cuts in the tax on capital income from stocks and mutual funds. The corporate tax has also been successively lowered since the 2000s, a trend that is not unique for Sweden. These changes, however, have resulted in the relative value of capital tax revenue to national income falling from approximately 2.2 percent in 1991 to just 1.3 percent in 2016, while maintaining a share of total tax revenue of roughly 10 percent (Bastani and Waldenström, 2018).

2.2. Literature review

The importance, skewed distribution and falling relative tax revenue contributions of capital in the economy could be seen as an encouragement of policy makers to introduce higher capital taxation in the name of equity and equality of opportunity. However, the role of capital taxation and its impacts on economic dynamics is a topic long contested both among the academic community and in public debate. This section will provide an overview and discussion of the theoretical perspectives in the field, with the aim of providing a clearer view of how capital taxation relates to economic indicators and some central political goals.

A majority of the modern research into optimal tax policy is based on the early contributions of Mirrlees (1971), and includes models where the government balances potential distortions introduced by capital taxation against the gains of financing public goods and redistribution (this differs from earlier research, where such redistributive goals were absent, see Bastani and Waldenström, 2018, for a survey of the topic). Typically, researchers employ some form of a social welfare function that defines how to measure and collate individual utility outcomes. There is a degree of normativity built into these analyses, with a core assumption in many models stating that it is in the government’s interest to balance differences in economic outcomes across luck, skill and ability levels in the population. Ideally, luck and skill levels would be observable to the government, enabling it to set individual taxes accordingly and fulfill its equity objectives. However, clearly individual circumstances are not apparent to such a degree, and individual agents in the economy have no motivation to reveal their true characteristics. Instead, tax policy needs to be based on observable characteristics and outcomes. Distortions to the system then arise when individuals find modes in which to seemingly alter or mask their features and outcomes.

Unlike the initial contribution by Mirrlees (1971), later research has included multi-period models with evolving skills and heterogeneity, implying that the state of the economy is dependent on both initial heterogeneity in terms of traits, ability or assets, economic choices such as investment in human capital, and realizations of economic shocks.

2.2.1. Arguments against capital income taxation

According to one of the most prominent theories within economics, furthered by researchers such as Chamley (1986), Judd (1985) and Atkinson and Stiglitz (1976), the optimal tax rate on capital income should be zero in the long run. To reach this conclusion, Chamley (1986) and Judd (1985) employ a neoclassical growth framework with infinitely lived representative individuals who supply labor in each period and smooth consumption over the lifetime by transferring wealth via savings. The savings further serve to finance investment and capital accumulation in the economy, and the optimal tax rate is set according to a function maximizing the welfare of the individual agent, corresponding to reaching a particular level of tax revenue in the most effective way. These models do not set redistribution as an explicit goal, and do not consider *how* tax revenue is spent within the economy or its implications on individual welfare. As a result of this, and of viewing capital taxation as a tax on all productive activity in the future, capital taxes create large and persistent investment distortions in the economy that grow over time. It is important to note, however, that households in reality do not have infinite planning horizons, and there is a significant degree of inequality arising from the fact that some individuals receive inheritances, while others do not.

Atkinson and Stiglitz (1976) reach the same conclusion as Chamley (1986) and Judd (1985), but utilize a two-period life-cycle model to show that progressive income taxation is more effective at counteracting inequality arising from heterogeneous ability than is capital taxation (or, specifically, differentiated commodity taxation). The model's conclusion, however, relies on a number of assumptions, primarily that the only source of heterogeneity in terms of income stems from differences in ability profiles. In this framework, and assuming that preferences for consumption are homogenous across society and that leisure is (weakly) separable from consumption in the utility function, the authors show that the sole driver of income inequality comes from the labor market, and not differences in savings rate per se. As such, redistribution should be based on labor income taxation, rather than capital income taxation. Subsequent research has extended this framework to several periods, but indicated that the results hold only if labor income tax is a function of historical and annual wage earnings – a regime that does not currently exist in any real economy (Bastani and Waldenström, 2018). In addition, any further types of heterogeneity, such as differences in initial assets or returns to investment, significantly challenge Atkinson and Stiglitz' (1976) findings. Pirttilä and Tuomala (2001) provide an example of this by showing how investment has diverging impacts on the wage rates of high and low skill workers. Specifically, they show that an increase in investment can have a significant negative impact on the wages of low-skilled labor, leading to a desirability of a positive capital income tax.

2.2.2. Arguments for the taxation of capital income

A primary factor not considered in the Chamley (1986) and Judd (1985) models above is that human capital accumulates over time just as physical capital does. This implies that policy makers need to manage distortions in the labor market induced by labor income taxation in addition to potential investment distortions arising from capital taxation (see for example Guvenen et al., 2013). Jacobs and Bovenberg (2010) analyze how income taxation affects individuals' human capital investment decisions and find that a positive capital tax indeed encourages increases in human capital accumulation. Additional strands of heterogeneity, as touched upon above, have also been found to generate a motivation for non-zero capital taxes. Banks and Diamond (2010) argue that individuals' earning abilities are often correlated to differences in ability to obtain high returns on investments, as well as how agents discount future consumption, findings further documented by Bach, Calvet and Sodini (2018). As these factors impact capital accumulation, capital taxation can be utilized as a complement to progressive income taxation and act as a tool to indirectly tax individuals with high ability, alleviating distortions in the labor market.

In a related strand of the literature, Dynan, Skinner and Zeldes (2004) show that agents at the upper end of the earnings distribution tend to save more than low-income individuals. This would, by extension, indicate differences in savings behavior between low and high ability types, and support the argument presented above that capital taxation can serve as a complement to labor income taxation and thereby help the government overcome challenges related to asymmetric information regarding the skills distribution. Gordon and Kopczuk (2014) and Bastani and Waldenström (2018) provide empirical support for these differences in savings behavior and consumption preferences, using data on US citizens and the Swedish population, respectively. While one may argue that the tax burden should be determined by economic circumstances, and not individual preferences, a growing body of research is finding evidence of how the differential savings rate may in fact be related to misperceptions or cognitive bias, rather than true preferences (Moser and Silva, 2017; Hosseini and Shourideh, 2017).

Capital taxation as discussed above primarily concerns the taxation of capital *gains*, from sources such as mutual funds or dividends. However, a primary driver of inequality is the cross-generational transfer of funds, making inheritance and gift taxation a potentially powerful tool of redistribution. There are, however, many different ways to approach and model bequest motives and the specification of utility functions can have significant impacts on desirability outcomes. Farhi and Werning (2010) utilize a two-generational framework where all capital (and as such, bequests) comes from labor efforts of the first generation and show that the optimal estate taxation is negative and progressive if your model specification takes into account the welfare of both parents and children. In other words, from a welfare perspective, their model implies that there should be a subsidy on inheritances that decreases in the size of the bequest, in order to balance the bequests that agents receive. In instances where this is not economically viable, the authors establish grounds for a zero taxation on all bequests bar the largest ones (which should be positive). A significant emission in the Farhi and Werning (2010) model, however, is that it assumes that individuals only differ in terms of their earnings ability. Extending the framework to one where agents receive varying and exogenously determined bequests but retain a homogenous savings preference, Cremer, Pestieau and Rochet (2003) find grounds for capital income taxation. Their findings come from an assumed correlation between initial endowments and skill levels, which means that agents with heterogeneous skills but the same labor income have different demand functions for consumption as well as different discount rates. A cornerstone of this model is the treatment of bequests as exogenous and unobservable to the government, and the authors show that if inheritances were indeed observable, welfare would be maximized by taxing away all heterogeneity in terms of initial endowments (see also Brunner and Pech, 2012). Piketty and Saez (2013) provide an additional extension of the framework introduced by Farhi and Werning (2010), by constructing a model where agents both give and receive bequests over the lifetime and have heterogeneous bequest tastes and labor productivities. In this context, the authors show that with a welfare function emphasizing the importance of redistribution, the optimal inheritance tax in the long run is positive and quantitatively large (in the range of 50 – 60 percent), and should be part of a wider capital tax regime including wealth and property taxes as well as taxes on capital gains. The findings that estate taxes provide welfare improvements in contexts with heterogeneous abilities and initial endowments are further supported by De Nardi and Yang (2016), who additionally establish and take into account cross-generational correlations of ability indicating that those who receive relatively larger bequests also often have higher earnings ability. Against this backdrop, the authors analyze the effects on capital accumulation and social welfare and find very limited impacts on the long run savings rate, but significant positive effects on a large majority of the population's welfare outcomes.

Analyses of capital tax rates using calibrated models are often carried out using overlapping generations (OLG) frameworks, that differ from the framework of Chamley (1986) and Judd (1985) in that agents no longer have infinite planning horizons. Instead, while the economy is still assumed to have an infinite horizon, each generation lives for a finite period and agents do not consider the effects of their savings decisions on future generations. This typically leads to a dynamic inefficiency arising as the economy is not always working at its full production capacity. However, positive capital taxes can play an important role in these models, by complementing public debt or age-dependent lump-sum transfers as a mode of transferring wealth and assets between different generations. Atkinson and Sandmo (1980) illustrate this dynamic through a representative agent two-period OLG model where individuals work in the first period and are retired in the second. In this framework they show that given a certain income effect on savings, a positive capital tax can indeed encourage agents to save more throughout their lifetime as well as enable governments to introduce lower labor income taxation and as a result induce younger agents to save more. Of course, there are other modes of redistribution between the young and old in the economy, such as pensions, and the optimal policy implications of the OLG framework are, similar to other models, sensitive to heterogeneity.

Introducing multiple periods in which individuals work typically generates further motivations for a positive capital tax, as individuals have age-dependent productivity profiles and, as such, labor supplies, requiring the introduction of some form of redistribution between ages. As age-dependent labor income taxes are typically not employed or viable and as consumption is widely regarded as a stronger substitute to leisure in older age, positive capital (savings) taxation can serve to encourage increases in labor supply and reduce wage tax-related distortions (Erosa and Gervais, 2002). The implications of the OLG framework on labor supply is further analyzed by Conesa, Kitao and Krueger (2009) who, in line with Erosa and Gervais (2002), find a non-negligible and positive optimal capital gains tax. As noted above, an age-dependent labor income tax is shown to be an alternative to capital gains tax in Erosa and Gervais (2002). However, supplementing their model with heterogeneity in terms of ability or the introduction of stochastic productivity shocks negates this result and indicates that to be effective, labor income taxation would have to be based on both age and present and past wage earnings of the agent (Bastani and Waldenström, 2018). Even in models such as those by Atkinson and Stiglitz (1976), Chamley (1986) and Judd (1985) the introduction of stochastic earnings shocks leads to an optimal positive rate of capital taxation due to imperfect markets and borrowing constraints (Bastani and Waldenström, 2018).

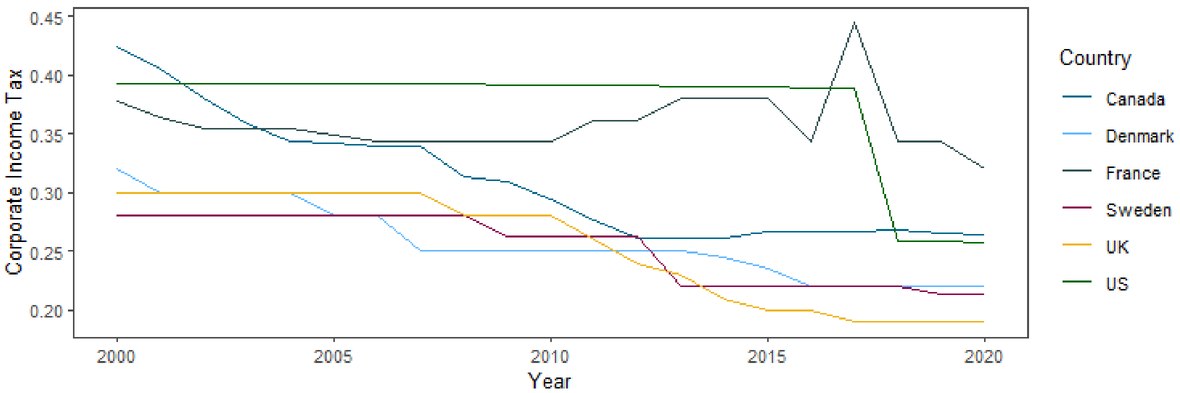
2.2.3. Different forms of capital taxation

While the above presents robust arguments in favor of capital taxation, there are numerous different ways in which policy makers can introduce capital taxation in the economy. A general wealth tax targeting all types of assets accumulated over the lifetime is, in standard models with equal returns on investment for all agents, equivalent to a capital income taxation (Guvenen et al., 2019). However, introducing heterogeneous rates of return to investment into the framework, Guvenen et al. (2019) show that a wealth tax can generate substantial increases in social welfare outcomes as it broadens the tax base, increases the tax burden on less productive entrepreneurs and increases the investment rates of more productive ones. Under capital income taxation, on the other hand, the more productive entrepreneurs face the highest tax burden, leading to negative impacts on aggregate productivity and output. Bastani and Waldenström (2018) further argue in support of the potential efficiency and equity gains of wealth taxation, maintaining that it can be seen as a way for governments to correct previous under-taxation of certain kinds of income. However, the introduction of a wealth tax can be problematic in a few ways, notably due to the possibility of individuals to transfer assets abroad and the difficulties associated with accurately defining the tax base and valuating assets (Bastani and Waldenström, 2018). In a recent study, Jakobsen et al. (2018) use historical administrative data to analyze how Danish individuals adjusted their investments following the abolition of the Danish wealth tax in 1997. They find that the tax has a negative impact on the wealth accumulation of the very rich, but a muted effect on the rest of the population, with resulting positive utility gains. The Jakobsen et al. (2018) study, however, suffers from similar issues as the wider wealth tax literature and uncertainties related to data and identification issues mean that any estimates are likely biased to one degree or other.

In Sweden, the wealth tax was abolished in 2007, and today personal wealth is taxed primarily through a capital income tax. Unlike many other countries, such as the US, Sweden has a dual income tax which allows for a proportional taxation of capital income combined with a progressive income tax, thereby letting the government effectively implement different capital and labor tax rates for high-ability individuals (Bastani and Waldenström, 2018). The differential, however, cannot be too great or it would encourage tax arbitrage, wherein agents shift income from one type to the other in order to obtain the lowest tax burden. When introduced, the dual income tax schedule followed a principle of uniformity, specifically to avoid issues related to excess tax planning and arbitrage. However, since then a number of changes in the tax system, including lower tax rates on closely held businesses and the introduction of a special savings account, has led to differentiated capital income tax rates in the Swedish economy and related distortions in the investment allocations (Alstadsaeter and Jacob, 2016; Bastani and Waldenström, 2018).

The primary source of tax revenue in most industrialized countries comes from corporate income taxation (Bastani and Waldenström, 2018). Unlike in the area of wealth taxation, there has been a significant amount of research carried out with regards to the impacts of taxing the profits of private firms and the potential distortionary effects it has on investment, returns to capital and wages. An early contribution by Harberger (1962) looks at differences in outcomes in open and closed economies and finds evidence of corporate taxation primarily impacting capital owners in closed economies, whereas open economies more often sees effects reaching the wage earners. The result stems from firms being able to move operations or capital abroad, generating a transfer of the tax burden onto the workers. Fuest, Peichl and Siegloch (2018) find similar results in their analysis of the German economy, where approximately 40 percent of the corporate income tax burden is transferred onto workers via lower wages. The main takeaway from these findings is that corporate taxation levels need to be set at a similar level across small open economies in order to prevent capital flight and excess negative impacts on labor incomes. This implication is further supported by Devereux, Lockwood and Redoano (2002) and is reflected in the development of corporate tax rates across OECD countries, illustrated in Figure 2.2.3.1. As can be seen in the graph, corporate tax rates tend to move similarly across similar economies over time, and have decreased from the range of 30 – 45 percent in the early 2000s to the range of 20 – 35 today. A final consideration with respect to the exercise in this paper is thereby that regardless of the calibrated optimal corporate tax rate it may not be economically viable to increase it when taking into account the nature of the Swedish economy.

Figure 2.2.3.1. Corporate income taxes across countries.



Source: Author's rendering of data from the OECD Tax Database.

The above forms of capital taxation focus mainly on the within-lifetime accumulation of assets. As noted earlier, however, a large source of inequality in the Swedish society stems from cross-generational wealth transfers, with shares of inherited wealth as large as 50 percent (Ohlsson, Roine and Waldenström, 2014). Additionally, using Swedish population registry data, Elinder et al. (2016) find that an overwhelming share of those who do inherit are those with high ability and high earnings. Given the apparent correlation between ability and bequest size, there is a potentially significant redistributional role of inheritance and estate taxation in the Swedish economy. There are, however, as illustrated above with respect to other forms of capital taxation, often numerous and opposing effects to consider relating to the introduction of the inheritance taxation. Bastani and Waldenström (2018) highlight three of these that are of particular concern in policy discussion. First, they note that inheritance can have an income effect on receivers, generating a higher labor supply (and as such, government revenues) on their behalf. In light of this, an inheritance tax would not only generate direct tax revenue, but also additional positive effects via the increased labor supply of receivers. The second point, however, maintains that a tax on inheritances may dissuade agents to work and save through their life, as it diminishes the utility gained from transferring assets to their children. Thirdly, and in response to the second point, the authors note that taxing accidental bequests would likely avoid the dampened motivations and remain an efficient way to tax wealth transfers (see also Hurd, 1989). The dynamic impacts of accidental and intentional bequests are further explored by Blumkin and Sadka (2004), who find that even in the case of accidental bequests (arising from imperfect annuity markets and uncertain lifetimes), the optimal linear estate tax is not necessarily set to 100 percent. Their model includes a full set of taxation instruments and the authors argue that the complete confiscation of accidental bequests may counteract the Pigouvian motive[1] for estate taxation and interfere with the redistributive effects of other taxes (see also Cremer, Gahvari and Pestieau, 2012). In summation, the literature offers mixed views as to the effects of inheritance taxation on efficiency and welfare outcomes as well as on labor supply incentives. However, most agree that inheritance taxes can be powerful tools in term of redistribution and often justified from an equity point of view (Piketty and Saez, 2013; Bastani and Waldenström, 2018).

Due to the difficulties of correctly defining and estimating labor supply and utility effects it remains a difficult task to specify how inheritance taxation should be implemented in practice. While the tax is commonplace in most OECD countries (albeit not in Sweden since its repeal in 2004), nations have chosen very different approaches in terms of basic deductions and minimum and maximum marginal tax rates. Table 2.2.3.1 below illustrates the different structures employed in a variety of OECD countries, including data from Sweden before its repeal of the tax.

Table 2.2.3.1. Inheritance taxation across countries.

Country	Basic Deductions (‘000 euros)	Marginal inheritance tax rate	
		Min.	Max.
Sweden	7	0.10	0.30
Denmark	37	0.15	0.15
France	100	0.05	0.45
Germany	500	0.07	0.30
US	4,675	0.18	0.40
UK	270	0.40	0.40

Source of data: OECD Revenue Statistics Database and Bastani and Waldenström (2018)

[1] Pigouvian in the sense that it corrects the labor market externalities arising from the income effect of the inheritance.

It is worth noting, however, that there are additional features built into the tax structure that determine how it interacts with labor supply choices and redistributional goals. For example, a majority of countries tax bequests – the amount of money received by children – whereas others, such as the US and UK tax the estate of the parent leaving the money behind. In addition, the marginal tax rate increases at different rates and as such applies for different sized inheritances (Bastani and Waldenström, 2018). Looking at the figures in the table, we note that the US has a remarkably high basic deduction compared to other countries in the sample, and Sweden (before its repeal) had a significantly lower basic deduction than other nations, implying that inheritance taxation applied to a large share of the population, and not just the higher end of the wealth distribution. These factors likely have a significant impact on how the taxation is received among the public, something that will be explored further in Section 4.4 when discussing the political feasibility of various tax schedules.

3. The model

3.1. Model specification

The analytical framework consists of a large-scale overlapping generations model, closely resembling the MIMER OLG model utilized by the Swedish National Institute for Economic Research. The model, however, provides an extension to MIMER by including heterogeneity across lifetime income groups by taking into account varying earnings ability in the population. It further provides an extension to the tax framework utilized in MIMER through the introduction of an inheritance tax levied on received bequests. The focus of analysis will be on efficiency and redistribution effects in the steady state under varying tax schedules, and as such the model does not explicitly consider population growth or productivity-related technological advancements.

3.1.1. Households

The household in the model consists of individuals who enter the economy at age 20 and may live until the age of 100, at which point they die with certainty. This implies that there are 81 cohorts alive at any given moment, and members of the economy make decisions depending on where in the lifecycle they are currently at. Individuals are further faced with age-varying survival probabilities at the end of each period. These probabilities are based on life expectancy indexes from SCB and will be expanded on in Section 3.2. Households draw utility from consumption, leisure and leaving bequests for younger generations, and are able to save a fraction of their income in each period in the form of assets. These savings are either transferred to the next period, multiplied by the rate of return on capital and deducted the capital income taxation rate, or transferred to the remaining generations as a bequest in case of death. Individuals work up to the current earliest eligibility age for guaranteed pension in Sweden, namely 65. During this period, they divide their time between leisure and work (with the total labor supply in each age normalized to 1), whereas after the age of 65, individuals are assumed to be fully transitioned to retirement, allocating the full time allotment to leisure.

Household income consists of wages or pension payouts, depending on the age of the household, as well as bequests, lump sum transfers and savings from the previous period. There are a number of taxes applied to the household throughout their life time, including labor income taxation and pension contributions deducted from labor income, capital gains taxation deducted from the transfer of assets between ages, and inheritance taxation applied to bequests received. The model further assumes that individuals enter the economy with zero assets, meaning that $a_{20} = 0$.

All individuals follow a lifecycle pattern of productivity in line with Erosa and Gervais (2002) and Bastani and Waldenström (2018). Additionally, individuals are randomly assigned to one of three lifetime ability types at birth and remain within their assigned ability type throughout their lives. The model thereby takes into account explicit differences in individuals' innate abilities and assumes three distinctive groups: group L with low ability, group M with medium ability and group H with high ability, denoted by e_λ, with $\lambda \in (L, M, H)$. These groups are constructed to correspond with low- medium- and high-income agents in the Swedish economy, and as such we define the low ability group as 20 percent of the population, the medium ability group as 70 percent of the population, and the high ability group as the remaining 10 percent of the population, with total population normalized to one for the purpose of simplification. All individuals are assumed to have the same time endowment and receive the same effective wage rate, but are endowed with varying rates of effective labor units according to their ability type. A higher wage rate is assumed to be positively correlated to labor supply, all other things equal, as the wage rate is competitively set and assumed to correspond to the price of leisure.

Households maximize lifetime utility in accordance with the following:

$$U_j = \sum_{i=20}^{100} \beta^{i-20} \left(\frac{\pi_{i-1}}{\pi_{20}}\right) \left[\left((1-d_i) \left(\ln\left(c_{it}^j\right) + \psi \left(\frac{\left(1 - l_{it}^j\right)^{1-\omega}}{1-\omega} \right) \right) \right) + d_i \phi \ln(b_{it}) \right]$$

where subscript *t* denotes the period and subscript *i* denotes the age of the household adults (which is assumed to be uniform across the household). β is the yearly discount factor, $(1 - d_i)$ corresponds to the survival rate of an individual aged i and thus the likelihood of surviving to age i + *1* and drawing utility from consumption and leisure, and d_i corresponds to the mortality rate and the likelihood of dying at the beginning of the year and receiving utility from bequeathing their assets. The probability of surviving until the next age is similarly denoted by $\frac{\pi_{i-1}}{\pi_{20}}$, with $\pi_{it} = \prod_{j=1}^{i}(1 - d_j)$ representing the probability to survive until age *i*. Log consumption is represented by $\ln(c_{it})$ and $(1 - l_{it})$ corresponds to the utility drawn from leisure. Additionally, parameters ψ and ω correspond to the disutility of labor and the Frisch elasticity determinant, respectively, and ϕ is set to correspond to the share of household net wealth left as bequests. The utility function is introduced at the point at which individuals enter the economy, namely at age $i = 20$.

Individuals retire at age $Rage = 65$. The budget constraint for individuals before retirement, $i < 65$, is as such:

$$c_{it} + s_{it} = (1 - \tau^a) r a_{it} + w_t e_\lambda e_i l_{it} (1 - \tau^l - \tau^{ndc}) + tr_{it} + (1 - \tau^b) beq_{it}$$

where s_{it} represents savings and follows the savings function $s_{it} = a_{i+1,t+1} - a_{it}$, r is the return on capital net of depreciation, a_{it} corresponds to assets, w_{it} is the wage rate, e_λ represents the innate ability category with $\lambda = \{L, M, H\}$ and e_i is the lifecycle productivity profile. Labor supply at age i in period t is further denoted by l_{it}, lump sum transfers correspond to tr_{it} and bequests received are denoted by beq_{it}. It is assumed that lump sum transfers are distributed equally among the population, independently of income or age. Lastly, taxes on assets, labor and bequests are denoted by τ^a, τ^l and τ^b respectively, and pension contributions are represented by τ^{ndc}.

Replacing the savings rate according to $s_{it} = a_{i+1,t+1} - a_{it}$ further gives the updated budget constraint:

$$c_{it} + a_{i+1,t+1} = (1 + (1 - \tau^a) r) a_{it} + w_t e_\lambda e_i l_{it} (1 - \tau^l - \tau^{ndc}) + tr_{it} + (1 - \tau^b) beq_{it}$$

For retired households, ages $i \geq 65$, the labor income is dropped and the budget constraint is instead:

$$c_{it} + a_{i+1,t+1} = (1 + (1 - \tau^a) r) a_{it} + tr_{it} + (1 - \tau^b) beq_{it} + p_i(l^h)$$

where $p_i(l^h)$ is a function of the lifetime labor supply $l^h = \{l_{20}, l_{21}, \dots, l_{64}\}$. The pension benefits are treated as defined benefit, and follow the below:

$$p_i^j(l^h) = \left(\tau^{ndc} e_\lambda w_t \sum_{i=20}^{64} l_i \, e_i \right) * \frac{1}{nRage}$$

where $nRage$ corresponds to the number of years in retirement.

In addition to the above, households are faced with the following constraints:

$$b_{i+1} \leq \big(1 + r(1 - \tau^a)\big) a_i$$

$$0 \leq l_{it} \leq 1$$

$$a_{20} = 0$$

$$a_{101} \geq 0$$

where the last constraint represents the transversality condition corresponding to households being unable to die in debt.

Given the utility function and constraints, we can retrieve the intertemporal Euler equation describing the fact that individuals must be indifferent between consuming an additional unit today and saving that unit for future consumption, as well as the marginal rate of substitution between labor and leisure for working households:

$$\frac{1}{c_i^j} = \beta \left((1 - d_{i+1}) \frac{1 + r(1 - \tau^a)}{c_{i+1}^j} + d_{i+1} \left(\frac{\phi}{a_{i+1}} \right) \right)$$

The Marginal Rate of Substitution between consumption and leisure:

$$\psi\,(1-l_i)^{-\omega} = \frac{we_\lambda e_i(1-\tau^l-\tau^{ndc})}{c_i} + \sum_{j=65}^{100} \beta^{j-i} * \frac{\pi_{jt}}{\pi_{it}} * \left(\frac{1}{c_j}\right) * \frac{\partial p_j^{ndc}}{\partial l_i}$$

where the partial derivative of the pension payment with respect to labor supply is given by:

$$\frac{\partial p_j^{ndc}}{\partial l_i} = w_t e_i e_\lambda \tau^{ndc}$$

3.1.2. Firms

The model further assumes a representative firm, producing one good in accordance with a standard Cobb-Douglas production function. The production sector is assumed to be perfectly competitive and relies on the use of capital and labor as inputs. The capital stock of the economy corresponds to the aggregate household savings, and is similarly to labor supply given by the utility maximizing decisions of the household described above.

The sole good of the economy is produced through the function: $Y_t = z_t K_t^\alpha L_t^{1-\alpha}$

where z_t represents total factor productivity and is assumed constant, and K_t and L_t are the total capital and the productivity adjusted labor, respectively, supplied in the economy at period t:

$$K_t = \sum_{i=20}^{100} N_{it} a_{it} \;\; and \;\; L_t = \sum_{\lambda=1}^{3} \sum_{i=20}^{100} N_{\lambda it} l_{it} e_i e_\lambda$$

where $N_{\lambda it}$, represents the share of the population made up by each ability group.

The representative firm looks to maximize its profits after tax and rental rates have been paid to capital owners according to the following expression:

$$\max_{\{K_s,L_s\}_{s=t}^{\infty}} \sum_{s=t}^{\infty} \left(\frac{1}{1+r}\right)^{s-t} ((1-\tau^y)\rho_s - rK_{s-1})$$

where $\rho_s = Y_s - w_s(1+\tau^{ndc_w})L_s - \delta K_{s-1}$, such that the profit function becomes:

$$\max_{\{K_s,L_s\}_{s=t}^{\infty}} \sum_{s=t}^{\infty} \left(\frac{1}{1+r}\right)^{s-t} ((1-\tau^y)(z_t K_{t-1}^\alpha L_t^{1-\alpha} - w_s(1+\tau^{ndc_w})L_s - \delta K_{s-1}) - rK_{s-1})$$

In the above equation, δ represents the depreciation rate of capital, τ^{ndc_w} is pension contributions paid by firms, and τ^y corresponds to the corporate tax on profits and is included in such a way that firms pay their taxes on profits made before capital owners receive their rent (Barro and Sala-i-Martin, 2004). By extension, this means that the corporate tax rate impacts directly how firms allocate between capital and labor.

The wage and rental rate are given by the first order conditions with respect to capital and labor, according to the below first order conditions:

I: $\frac{\partial \pi_t}{\partial K_{t-1}}: (1-\tau^y)\alpha z_t(K_{t-1}^{\alpha-1} L_t^{1-\alpha}) - (1-\tau^y)\delta - r = 0$

II: $\frac{\partial \pi_t}{\partial L_t}$: $(1-\tau^y)(1-\alpha)z_t K_{t-1}^{\alpha} L_t^{-\alpha} - (1-\tau^y)w_s(1+\tau^{ndc_w}) = 0$

which correspond to expressions for the rental rate of capital, *r*:

$$r = (1-\tau^y)\alpha z_t (K_{t-1}^{\alpha-1} L_t^{1-\alpha}) - (1-\tau^y)\delta$$

and wage rate, *w*:

$$w_t = \frac{(1-\alpha)z_t K_{t-1}^{\alpha} L_t^{-\alpha}}{1+\tau^{ndc_w}}$$

The model does not incorporate open economy elements, and as such the interest rate is allowed to adjust according to the aggregate capital in the economy. Potential implications of this will be discussed further in sections 4 and 5.

3.1.3. The public sector

The public sector may be divided into two categories with the first one being in charge of taxation and lump sum transfers, and the second corresponding to the public pension agency.

Taxes are collected from labor income, individual's capital gains, bequests received and firm profits. As such, the total tax revenue is given by:

$$Tax\ Revenue = \tau^y(Y_s - w_s L_s - \delta K_{s-1}) + \tau^l L_t + \tau^a K_t + \tau^b B_t$$

It is assumed that the full tax revenue amount is redistributed to the population through age-independent lump sum transfers, where the aggregate transfer value, Tr_t, is equivalent to the tax income:

$$Tr_t = \tau^y(Y_s - w_s L_s - \delta K_{s-1}) + \tau^l L_t + \tau^a K_t + \tau^b B_t$$

$$Tr_t = \sum_{i=20}^{100} tr_{it} N_{it}$$

Pensions are assumed to follow a defined benefit structure, where the public pension agency provides payouts to the retirees in the current period and finances these by collecting pension contributions from the working-age population of the same ability-level in the same period. As the model does not take into account investment of pension savings, the amount contributed by individuals is equal to the amount they receive in retirement, given the assumption of a fixed contribution rate and no population growth. The pension agency is, similarly to the tax and transfer arm of the public sector, not considered an optimizing entity and has a balanced budget when the following holds:

$$P_t = \tau^{ndc} w_t L_t + \tau^{ndc_w} w_t L_t$$

where

$$P_t = \sum_{\lambda=1}^{3} \sum_{i=65}^{100} p_{\lambda it} N_{\lambda it}$$

3.1.4. Market clearing

Market clearing conditions are defined for all aggregate variables, with those of the public sector defined above. For capital markets to clear it is required that the aggregate capital, K_t, is equivalent to the total asset savings of individuals, a_{it}. Similarly, labor market clearing requires aggregate effective labor, L_t, to be equal the sum of productivity-adjusted individual labor supply, $e_i e_\lambda l_{i_t}$. Aggregate consumption, C, translates to the sum of all individual consumption in the economy, and the aggregate investment is total output net consumption. All market clearing conditions are formally defined below:

$$K_t = \sum_{i=1}^{100} N_{it} a_{it} \quad \forall t$$

$$L_t = \sum_{\lambda=1}^{3} \sum_{i=20}^{64} N_{\lambda it} e_\lambda e_i l_i \quad \forall t$$

$$C_t = \sum_{i=1}^{100} N_{it} c_{it} \quad \forall t$$

$$Y_t = C_t + I_t = C_t + K_{t+1} - (1-\delta) K_t \quad \forall t$$

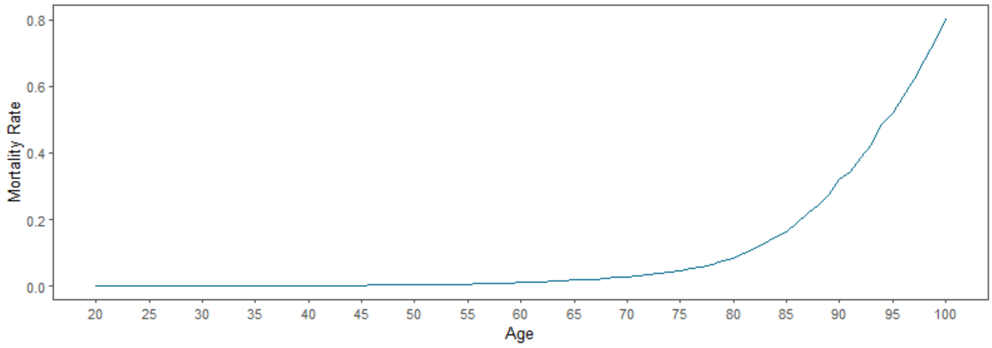
The equilibrium conditions further apply and entail allocations and prices such as individuals maximize their budget constraints, Euler equation and the MRS function, firms optimize according to the functions for wages and rental rates, and markets clear. Further, due to the exclusion of population and technology growth dynamics, the variables indicated above are stationary. The above optimizing and market clearing conditions are utilized to solve for the model steady state, through a recursive solver implemented in the MATLAB toolkit Dynare.

3.2. Model calibration

In the baseline model, variables are calibrated to match Swedish dynamics and data from 2019 as closely as possible.

Demographics data is taken from SCB in order to obtain mortality rates for the different ages (SCB, 2020b). Specifically, mortality rates are obtained from the SCB life expectancy index and collated to obtain an average for women and men within age groups based on 2019 data. The mortality rates of various age cohorts in the economy are illustrated in Figure 3.1 below. As shown in the graph, mortality rates are low and relatively stable until around the age of 70, when they start to increase significantly.

Figure 3.1. Mortality rates.



Source: Author's rendering of SCB data (2020b)

Household data includes the discount factor, disutility of labor parameter, ψ, Frisch elasticity determinant, ω and the bequest-related parameter ϕ. Table 3.1 provides an overview of the calibrated household parameters. The yearly discount factor is set to 0.99 as per Bucciol et al. (2016). The disutility of labor parameter is set to match an average labor supply of 0.235 units (Almerud, 2018) and ω is set to match a Frisch elasticity of 2.5 (following Rogerson and Wallenius, 2009). The parameter ϕ is set to correspond to the average share of household wealth left as bequests. Klevmarken (2004) approximate this share to the range of 10 – 20 percent of the total net wealth, and MIMER accordingly sets $\phi = 0.7$. However, Elinder et al. (2016) approximate the share of total net wealth left as bequest as upwards of 50 percent, and in light of this we provide a slightly inflated bequest parameter set to 0.75. Klevmarken (2004) additionally provides a distribution of inheritances to remaining age cohorts as per Table 3.2, based on Swedish data. In our model, bequests from an individual of ability type e_λ are distributed to individuals in the same ability group, based on the assumption that human capital and earnings ability are also passed through generations (see Piketty and Saez, 2013; Gordon and Kopczuk, 2014; Bastani and Waldenström, 2018).

Table 3.1. Household parameter values

Parameter	Value
Discount factor, β	0.99
Disutility of labor, ψ	3.6153
Frisch Elasticity, ω	1.3
Bequest utility, ϕ	0.75

Table 3.2. Bequest distributions over age groups

Age	Share of bequest (%)
20 – 30	14.8
31 – 40	20.8
41 – 50	28.6
51 – 60	22.6
61 – 84	13.2
85 – 100	0

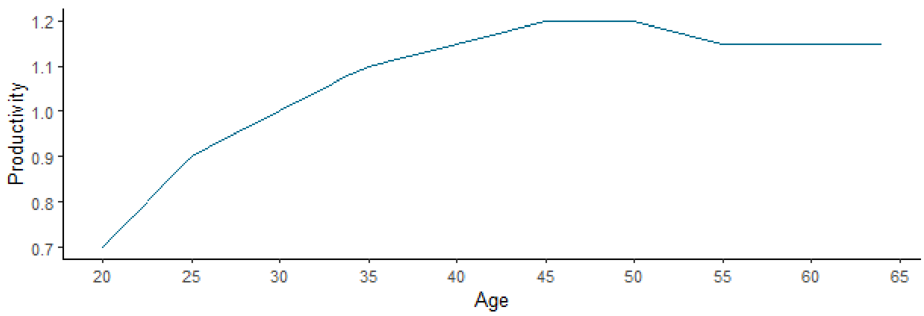
As noted above, individuals' ability is both age-dependent and heterogeneous across groups. The ability-type calibration is based on data from SCB (2020d) and is set to approximate the post-tax disposable income distribution of working age individuals in Sweden as of 2018. The low-ability group is set as the baseline such that $e_{\lambda=L} = 1$, and medium and high-ability groups are calibrated thereafter. These values are reported in Table 3.3 below.

Table 3.3. Ability types

Ability type	Value
Low, $e_{\lambda=L}$	1
Medium, $e_{\lambda=M}$	1.98
High, $e_{\lambda=H}$	5

The age-dependent lifecycle productivity profile is further illustrated in Figure 3.2 below, illustrating an increasing ability approximately until the individuals reach age 45, at which point it plateaus until age 50 and then gradually declines until retirement.

Figure 3.2. Age-dependent productivity profile



Source: Author's rendering of NIER data (Almerud, 2018).

In the production section we calibrate the depreciation rate, δ, in accordance with Olovsson (2009), and set it to 0.08. Capital's share of output is set to 0.3737 in line with data presented by NIER (Almerud, 2018) and the total factor productivity parameter, z, is normalized to one. Parameter values are presented below in Table 3.4.

Table 3.4. Firm parameter values

Parameter	Value
Capital depreciation rate, δ	0.08
Capital's share of output, α	0.3737
Total factor productivity, z	1

In addition, Table 3.5 below presents the baseline pension contributions and tax values for the household and production sectors, bar the inheritance taxation included in the model, set in accordance with data from the Swedish Tax Agency (Skatteverket, 2020) and Bastani and Waldenström (2018).

Table 3.5. Tax parameter values

Tax Rate Parameters	Value
Individual pension contributions, τ^{ndc}	0.16
Firm's pension contributions, τ^{ndc_w}	0.081
Wage income taxation, τ^{l}	0.15
Capital gains taxation, τ^{a}	0.22
Corporate profit taxation, τ^{y}	0.25

In the baseline model inheritance taxation is set to zero to reflect the current policy climate in Sweden. However, for the purpose of the analysis, several linear tax scenarios will be explored, ranging from $\tau_b = 0.10$ to $\tau_b = 0.60$, in ten percentage point increments. Additionally, increases to the capital gains taxation will be examined for $\tau_a \in (0.25, 0.30, 0.35, 0.40)$ in order to determine effects on consumption, labor supply and asset accumulation decisions over the lifecycle for the distinct ability groups.

4. Results

4.1. Baseline results

In our baseline model results, depicted in Figures 4.1.1, 4.1.2 and 4.1.3, we note a familiar hump-shaped consumption pattern over the lifecycle for the low and medium ability groups. We note that consumption peaks roughly at the same time for both of these groups, namely around age 70. The gradual decline in consumption after this point reflects the lower survival probabilities, entering the households' consumption decisions through the Euler equation. These individuals further see a typical capital accumulation pattern with a peak in savings at age 59 and 64 for low and medium ability types, respectively. The slight disparity in asset peaks corresponds to households starting to consume their savings as their income declines and, as the decline is steeper for the low-ability group due to lower relative lifetime savings, these households start eating their savings earlier on. Typically, we would expect savings to start to decrease around the age of retirement, when households transition from their wage income to the comparatively lower pensions, but in the case of the low ability group we instead note that retirement only accelerates the wealth decline. However, we note a further decumulation during retirement, which is present for all ability types, during which the households use their savings to complement retirement income and fund consumption. The decumulation of capital is somewhat steeper than the accumulation for both the low and medium ability groups, reflecting the shorter period of life remaining as well as the lower survival probabilities. In terms of labor supply, there is a notable increase during the first five years in the economy, where households work more in order to smooth consumption over the lifecycle. After this period, the labor supply curves stabilize until the age of 55, when the age-dependent productivity begins to decrease substantially, leading individuals to work more in order to maintain their consumption and savings. In all three graphs, we note that the medium and low ability groups' curves follow very similar paths over the lifecycle. However, the medium ability cohorts consistently work, save, and consume more relative to the low-ability cohort, indicating a dominant substitution effect wherein higher productivity (and, as a result, higher effective wage earnings) generates higher labor supply. This is further supported by the lack of a downward slope in the labor supply across the life cycle, in spite of changing age-dependent productivity.

Figure 4.1.1. Consumption over the lifecycle

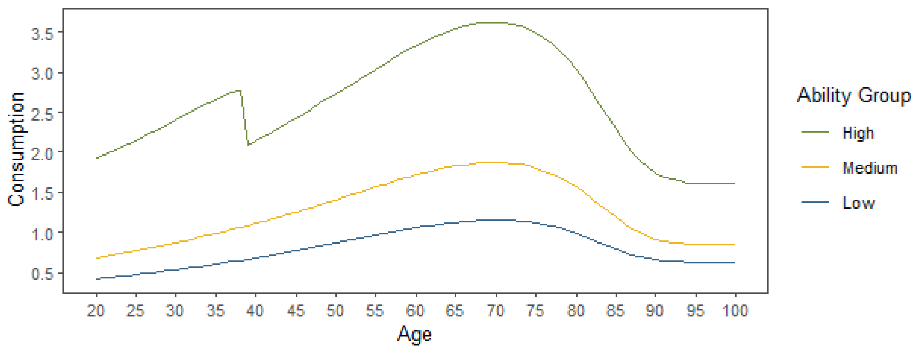


Figure 4.1.2. Labor supply over the lifecycle

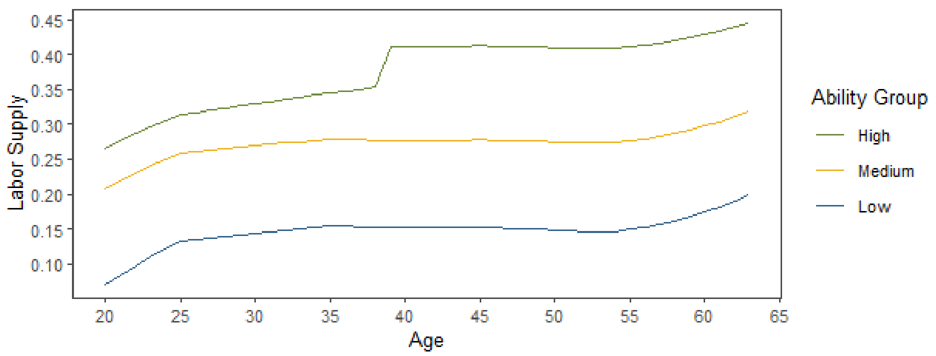
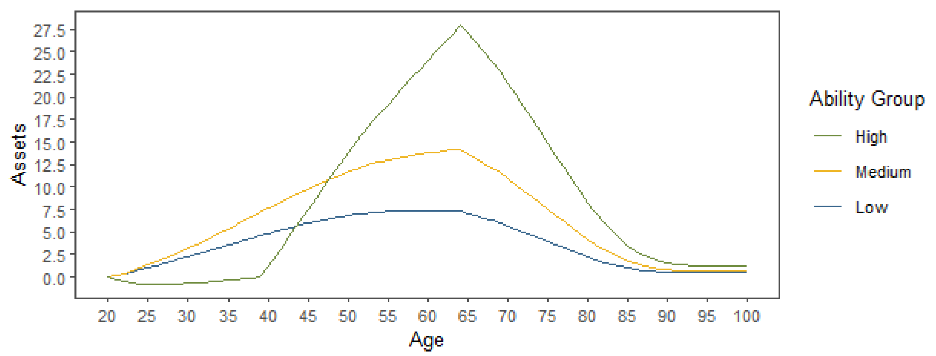


Figure 4.1.3. Asset accumulation over the lifecycle

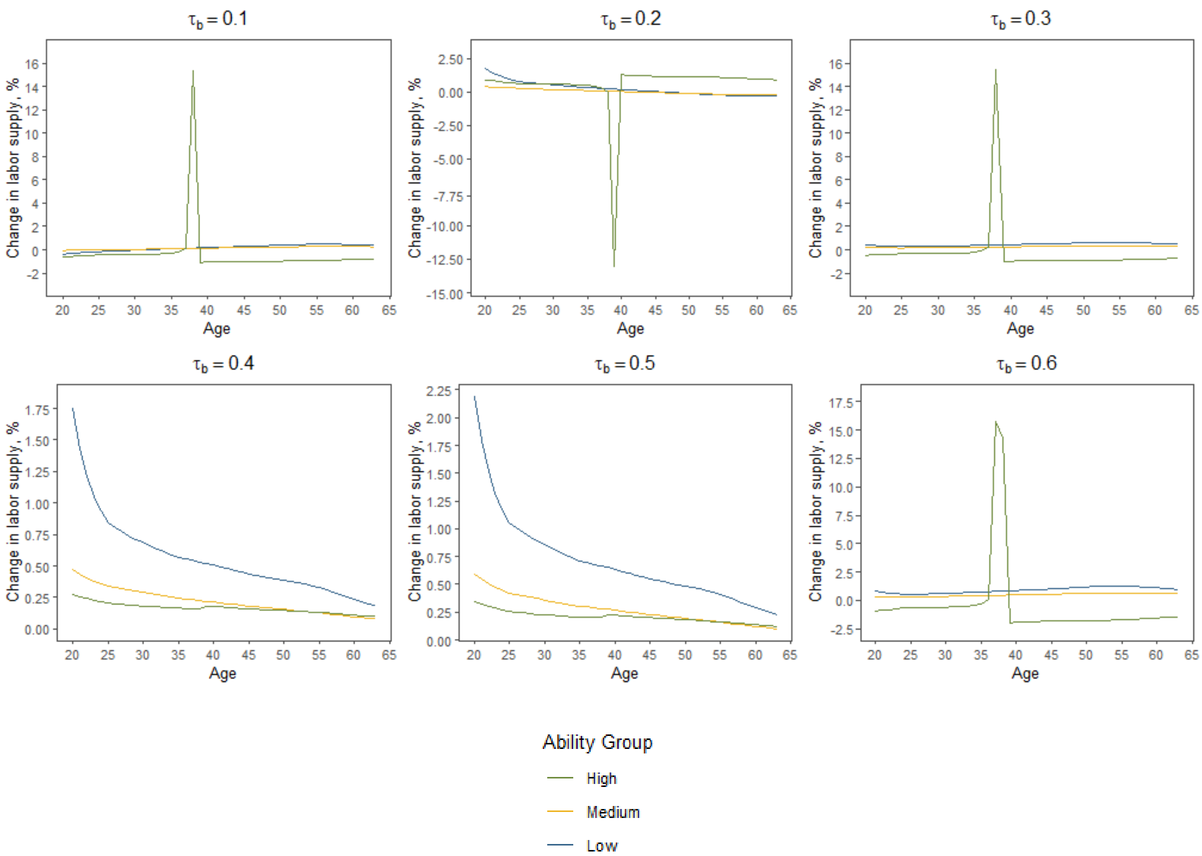


The lifecycle choices of the high ability group stand out somewhat compared to those of the low and medium ability cohorts. Overall, the consumption and labor profiles are consistently higher, and follow a relatively similar pattern bar a significant dip (increase) in consumption (labor) around age 40. This is further mirrored in the asset accumulation graph of the high ability group, where we note that households borrow money (i.e. have negative assets) for the first 19 years of economic life, and actively start saving around the age of 40, corresponding to a jump in labor supply and temporarily lowered consumption. While this may appear puzzling at first, a likely reason for this sudden spike lies in the age-dependent productivity profile, which, after an initial increase during the early years of life, starts to flatten out at age 40. The reason that we do not see a similar spike for the other two ability groups is related to their relative effective wages and resulting ability to accumulate assets. Specifically, the reason that individuals of high ability want to borrow when they are young is due to their future wages being sufficiently higher than their current ones. They are at their highest level of debt at age 25, after the first initial and steep increase in productivity. After this point, individuals continue to borrow but successively smaller amounts, until they reach a certain productivity level around age 40, and start accumulating assets. This savings pattern enables high ability individuals to smooth consumption over the lifetime by bringing consumption forward in the periods when they have lower effective wages. Due to the positive interest rate, however, they are not able to perfectly smooth consumption, and to transition into positive savings, households are required to temporarily cut consumption and permanently increase their labor supply. In summation, the asset and labor supply decisions of the high ability group indicate that in their first years in the labor market, given their current and future wages, they have a higher relative preference for leisure. However, when their effective wages increase beyond a certain point (at around age 40) and the opportunity cost of leisure increases, the substitution effect outweighs the income effect and they start working, and saving, more in order to ensure and stabilize future consumption.

4.2. Inheritance taxation

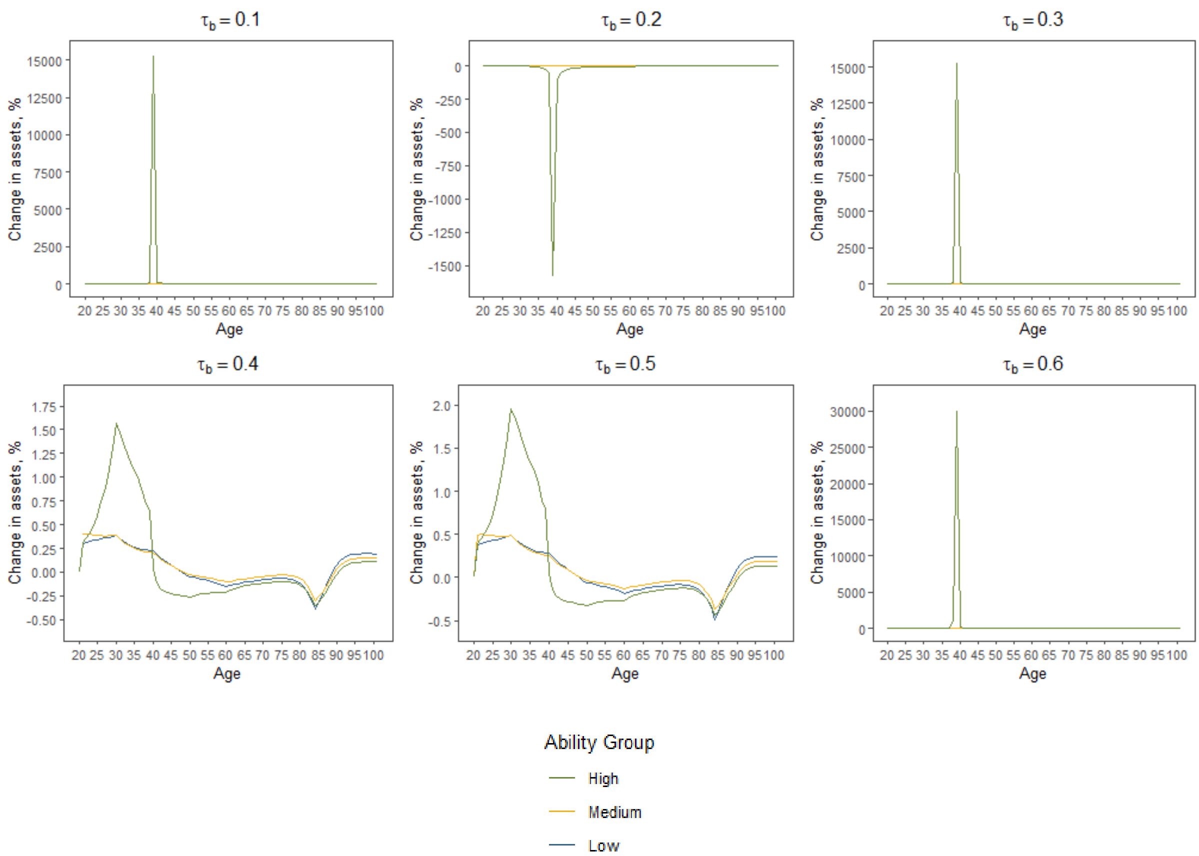
As described in section 3.2 there is currently no inheritance taxation in Sweden. In understanding the potential effects of an inheritance taxation on the economy, we thereby introduce six varying rates of inheritance taxation and examine the impacts on individuals' labor supply, consumption, and asset accumulation choices. Figure 4.2.1 below illustrates the effects of inheritance tax rates ranging from 10 to 60 percent on labor supply decisions for the three distinct ability groups. The graphs portray percentage differences from the baseline scenario and indicate significant spikes in labor supply for the high ability group when the inheritance tax is set to 10, 30 and 60 percent. However, for $\tau_b = 0.2$ there is an opposite effect and high ability individuals instead decrease their labor supply. Lastly, for $\tau_b = 0.4$ and $\tau_b = 0.5$ there is no apparent spike either way, and, overall, the labor supply effects for all three ability groups are practically absent, in the range of 0 – 2.25 percent and the largest relative impact on the low ability group.

Figure 4.2.1. Changes in labor supply under varying inheritance tax rates.



While these disparate patterns initially seem disconcerting and the percentage jump in labor supply for the high ability group in four of the cases appears high, the increase in labor supply in absolute terms is relatively small. Looking specifically at $\tau_b = 0.1$, we note that the change in labor supply corresponds to an increase from approximately 0.35 to 0.4 at age 38. Examining this closer, we note that this change mirrors the one in the baseline scenario, but occurs one year earlier, thereby causing the seemingly big increase. Indeed, looking at the data for $\tau_b = 0.3$ and $\tau_b = 0.6$ we see the same pattern, whereas in the case of $\tau_b = 0.2$ the increase in labor supply is delayed one year as compared to the baseline. The question then remains where this change in timing comes from and why it is absent for $\tau_b = 0.4$ and $\tau_b = 0.5$. A likely cause lies in the (non-productivity adjusted) wage level, which is higher in the steady states where we observe the positive increases. This seemingly corresponds to the high ability households reaching their breakpoint with regards to the opportunity cost of leisure earlier, thereby inducing them to start working more and saving one year ahead of the baseline scenario. In the cases of $\tau_b = 0.4$ and $\tau_b = 0.5$, however, the wage level is approximately the same as in the baseline scenario, inducing much smaller changes in the household decisions. Indeed, in these two cases, we note that the largest change is made by the low-ability households and even then, the increase only corresponds to a maximum of 2.24 percent, or, in real terms, an increase from 0.0705 to 0.0720.

Figure 4.2.2. Changes in asset accumulation under varying inheritance tax rates.

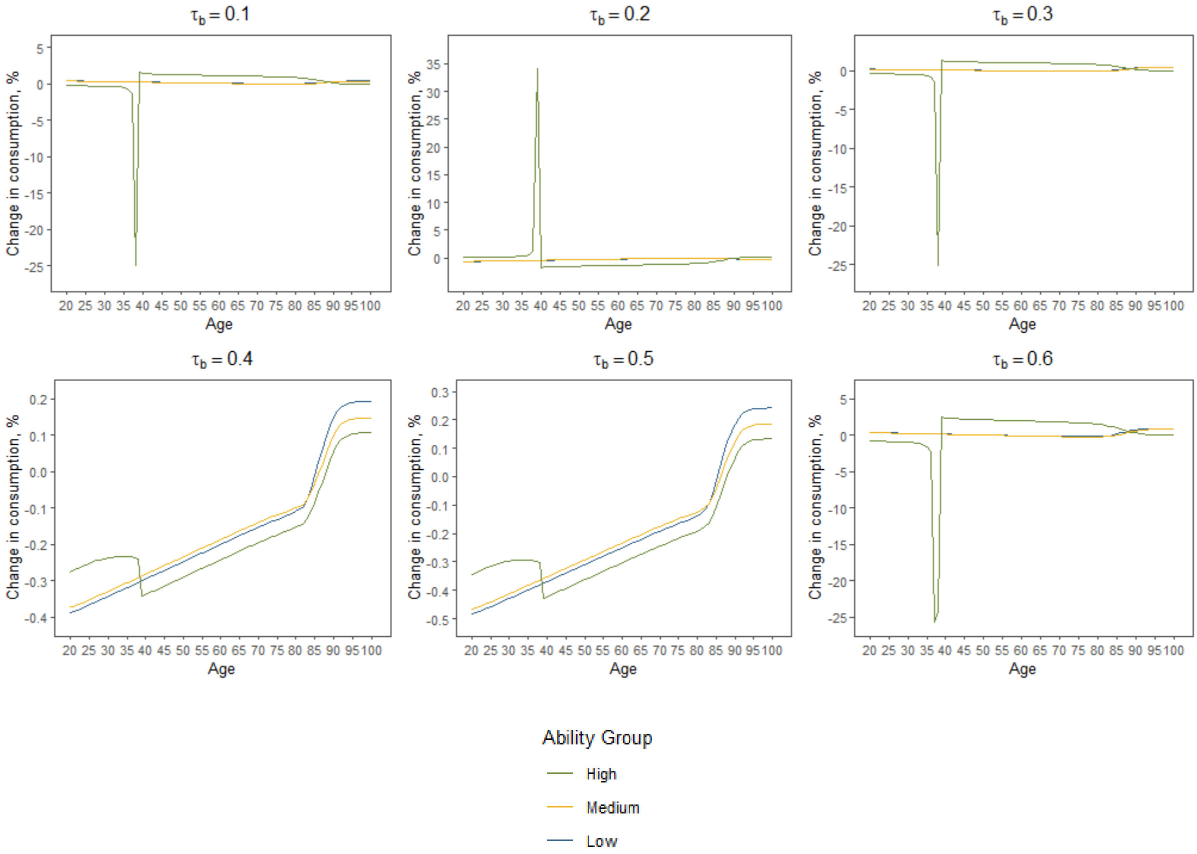


Looking at the corresponding changes in asset accumulation (savings) choices by households under the varying rates of inheritance taxation (Figure 4.2.2), we note spikes in the high ability curves in the cases of

$\tau_b = 0.1, \tau_b = 0.2, \tau_b = 0.3$ and $\tau_b = 0.6$, mirroring those in the labor supply figures. This follows from the fact that individuals start saving more in the same period that they increase their labor supply, and can be traced back to the higher wage level, as in the cases above. For $\tau_b = 0.4$ and $\tau_b = 0.5$ we again see limited relative changes in asset accumulation, but note a small but significant increase in assets for the high ability group in ages 20 to 38, reflecting a lower inclination to borrow in these periods. The compressed borrowing rate likely traces back to the interest rate of capital, which in these cases is slightly higher than in the baseline scenario. As a result, individuals pay higher interest on any loans they take and thereby receive lower utility from borrowing as compared to the baseline economy. Due to the limited difference in interest rate, this change is somewhat muted. However, the results can also be seen in periods where high ability individuals would have positive assets (from age 39 onwards), where we note a very small but persistent decrease in asset accumulation relative to the baseline over the years in which the households are active in the labor market. This likely reflects that individuals need to own and accumulate less capital in order to smooth consumption over the lifecycle. Lower ability households also see a slight increase in their asset holdings in the first periods of economic life. Unlike the high ability individuals, however, this reflects increased savings, rather than decreased debt, and likely reflects the higher incentives for savings at a younger age. Indeed, we note that for the first few years the medium ability individuals increase their savings slightly more than the low ability ones, indicating that their higher earnings ability allows them to better smooth consumption via increasing early asset holdings. Low ability households, who are borrowing constrained, can put aside a smaller share of their income for savings and still maintain an optimal level of consumption. This indicates that the higher interest rate primarily seems to benefit those of medium and high ability while having a limited impact on low ability cohorts.

The percentage change in consumption plots for the varying rates of inheritance taxation (Figure 4.2.3) reflect many of the same patterns that we observed for labor supply and saving. For $\tau_b = 0.1, \tau_b = 0.2, \tau_b = 0.3$ and $\tau_b = 0.6$ we see the same familiar spikes induced by changing labor supply and asset accumulation choices. In this instance, the positive changes in consumption are related to a delayed savings decision, whereas the negative spikes reflect the decision to step out of debt one period earlier than in the baseline scenario. This corresponds to a temporary but significant decrease (increase) in consumption for high ability households, but it is worth noting that these changes would have occurred in the baseline as well, only one period later (earlier). For the remaining tax rates, we note that consumption decreases the most for low-ability households at the early periods of life, whereas these households also see the greatest increase towards the end of their life. These changes are, however, minute and we may conclude that the imposed inheritance taxes have a limited impact on households' ability to smooth consumption and indeed on their optimizing decisions overall.

Figure 4.2.3. Changes in consumption under varying inheritance tax rates.



Due to the obscuring effects of the comparatively large spikes for high ability households, Figure 4.2.4 and 4.2.5 present the percentage changes in household decisions with the fluctuating values imputed to reflect the direction of change but exclude the extreme values. Taking a closer look at the labor supply graphs, we note very small changes in labor supply across the life cycle under all tax policies, with the largest induced change observed for $\tau_b = 0.5$, at roughly 2.25 percent for the low ability households. Indeed, it appears that all levels of inheritance taxation have very limited impacts on household labor decisions and asset choices, indicating an overall muted effect on the economy that will be verified and examined closer in section 4.4. The limited impact of the taxes is likely related to the relatively small bequests left by households in the baseline scenario, with the low ability group bequeathing 13.2 percent of their average lifetime assets, the medium ability group bequeathing 10.14 percent of their average assets, and the high ability group bequeathing 14.19 percent.

Figure 4.2.4. Changes in labor supply under varying inheritance tax rates, with imputed values.

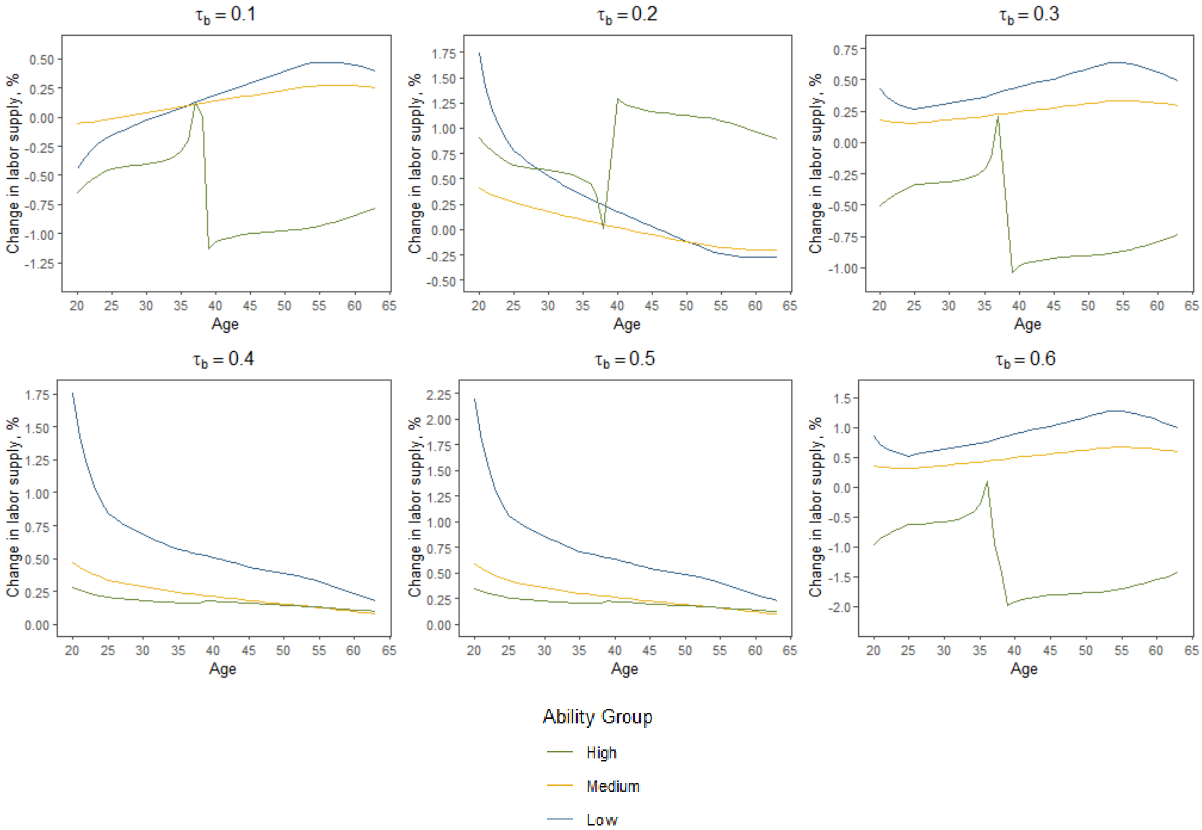
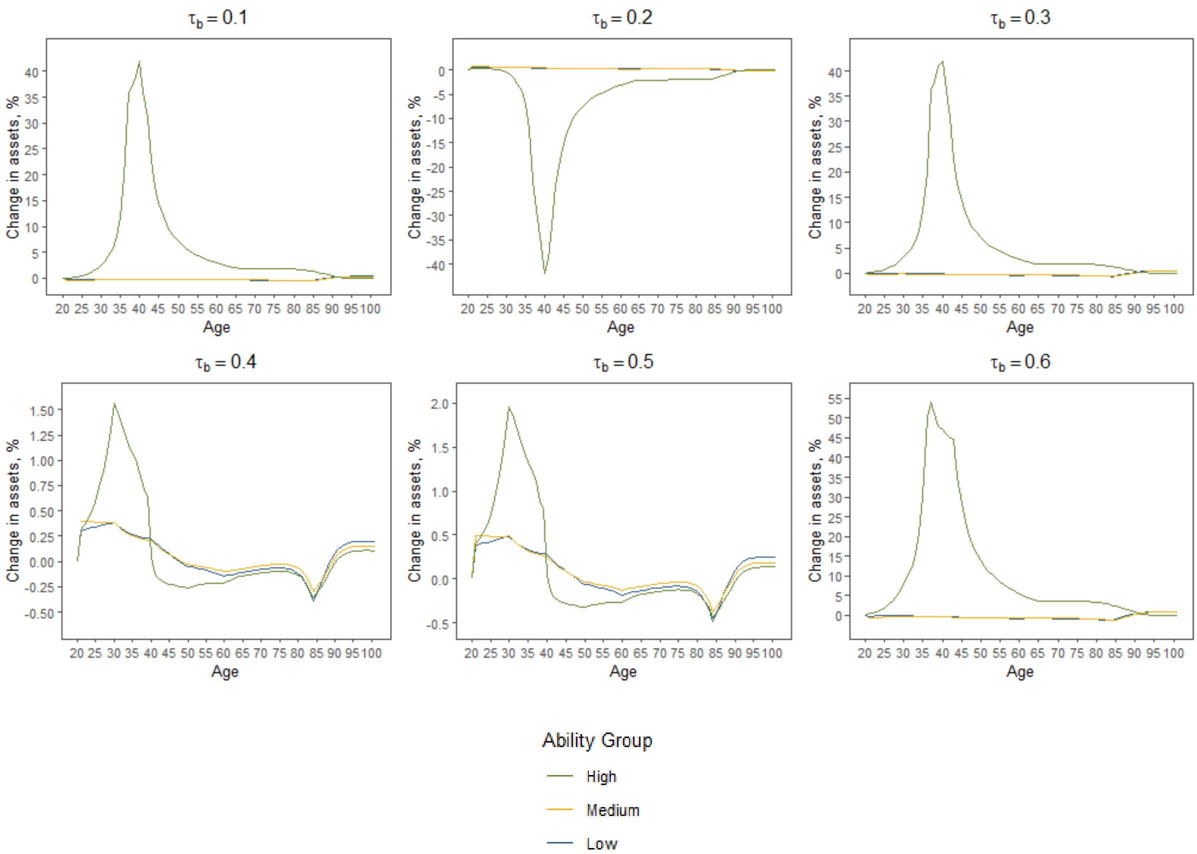


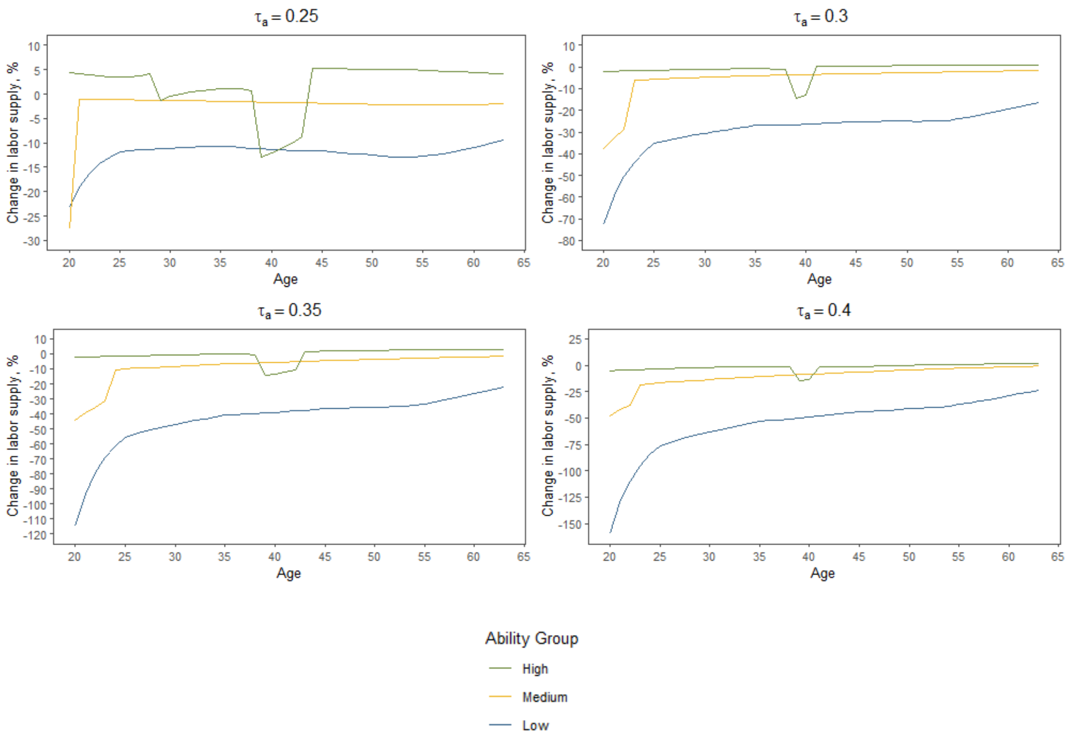
Figure 4.2.5. Changes in assets under varying inheritance tax rates, with imputed values.



4.3. Wealth (capital gains) taxation

Figure 4.3.1 below illustrates the effects on household labor supply decisions of four distinct levels of capital gains taxation. We note a much more even effect of the capital gains taxation as compared to the inheritance taxation, with no extreme values for any of the ability groups, indicating that the capital gains taxation does not influence the timing of individuals' decisions to as great of an extent. However, we note that the high ability individuals see a dip in labor supply around the ages of 38 – 40, mirroring the changes in savings, consumption and labor decisions noted in the baseline scenario. After this period, the high ability individuals return to a somewhat higher labor supply than in the baseline economy, likely due to the capital gains tax exerting a negative effect on their savings, inducing them to rely more on wage income to stabilize and ensure lifecycle consumption. Overall, the high ability households are the only ones experiencing an increase in labor supply, with the medium and low ability individuals choosing to work relatively less. The graphs indicate a steep decline in labor supply in the first periods in particular for medium ability groups, which then goes back to and maintains a similar level to the baseline scenario. Low ability individuals, however, maintain a significantly lower labor supply throughout their lifecycle and see a considerable drop in the first five periods of life. The effect on low income households likely comes from the slightly lower wage, as compared to the baseline, generated by the higher labor supply from high ability types, combined with the higher transfers generated by the increased capital gains tax revenue. Low income households were also less reliant on assets in the baseline scenario, and are thereby less exposed to the increase in the tax rate. As a result, they do not have to increase their labor supply to maintain consumption to the same degree as medium and high-income households. The aggregate effects of the tax policies will be further developed on in section 4.4.

Figure 4.3.1. Changes in labor supply under varying capital income tax rates.



Looking at the changes in assets induced by increased levels of capital gains taxation (Figure 4.3.2 below), we note a very significant decrease for high-ability individuals around the age of 40, similar to those observed under the introduction of inheritance taxation, but even larger in magnitude. Examining the data, we note that these households postpone their savings decision further in these instances compared to the baseline scenario. Notably, rather than transitioning to positive assets at the age of 40, as in the baseline, under capital taxation, high ability individuals continue to borrow until the age of 45 in the case of $\tau_a = 0.25$. Similar to the inheritance tax simulation, we can trace this decision back to the wage level, which in the case of $\tau_a = 0.25$ is approximately 3 percent lower than the baseline level. This indicates that the opportunity cost of leisure for high ability types does not reach its breakpoint until later in life. However, unlike in the inheritance tax scenario, the wage decrease is largely driven by lifecycle increases in high-ability individuals' labor supply that, as noted above, stems from the relatively lower capital income they receive. Further, we note a significant decrease in medium ability types' assets towards the end of their lifetime. At this point, the households have depleted their savings, and begin to borrow to sustain consumption. The fact that they do not perfectly smooth their consumption (through savings) in this case is likely related to the very low survival probabilities at this age and that under the increased capital taxation they accumulate less assets during their working life. This can be seen more clearly in Figure 4.3.3 which has removed the outliers in a similar fashion to figures 4.2.4 and 4.2.5 and we note that in spite of the debt levels taken on, individuals who survive until the age of 100 meet the transversality condition and exit the economy with positive assets. Examining the asset path closer, we see that medium ability type households see a consistent decrease in their savings as compared to the baseline whereas low ability households are barely affected, likely reflecting the already low level of capital assets in these households in the baseline scenario. For high ability households we note a decreased rate of borrowing when young for $\tau_a = 0.25$, but no similar pattern for the other capital gains taxation rates. In all four cases, the interest rate of capital is higher than in the baseline, which by extension means that it is more expensive to borrow. However, the higher capital gains taxation also leads to substantially lower levels of capital in the economy, and as capital is included in the wage equation this generates consistently lower (non-productivity adjusted) wage rates which ultimately alters the households' savings decision and impacts the leisure – consumption trade-off.

Figure 4.3.2. Changes in assets under varying capital income tax rates.

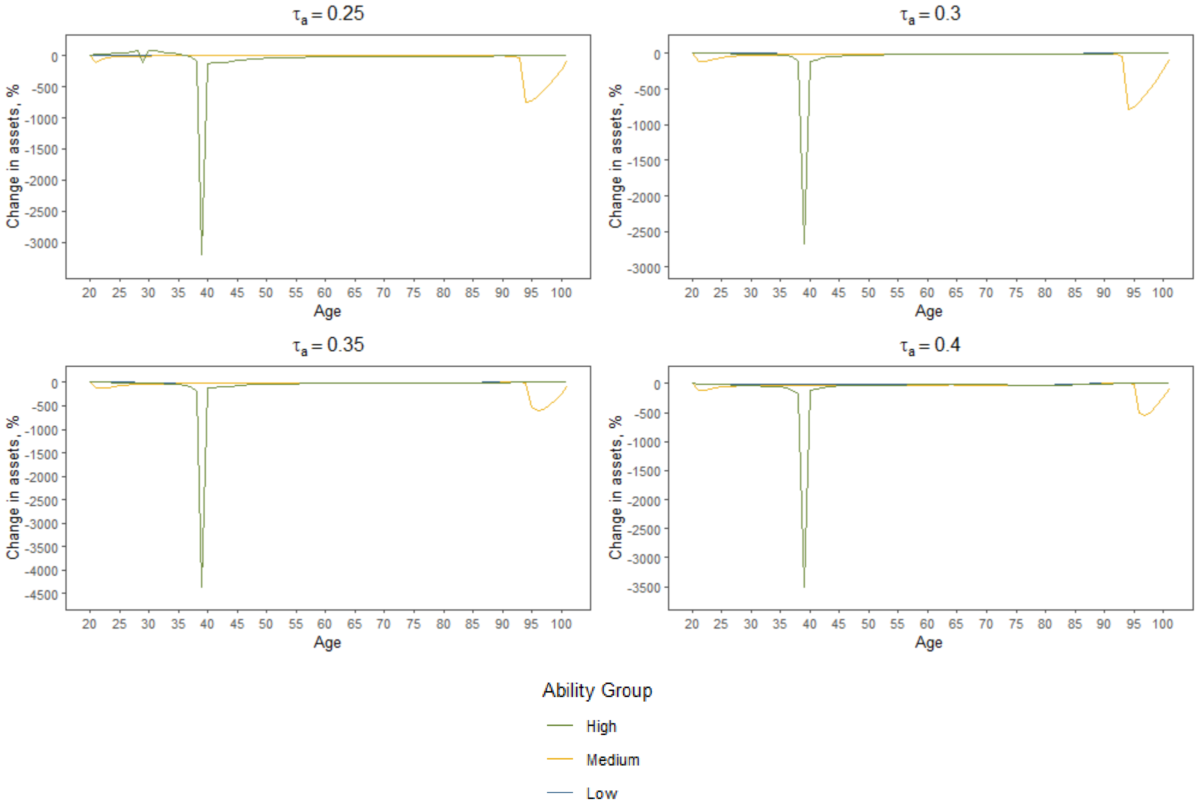
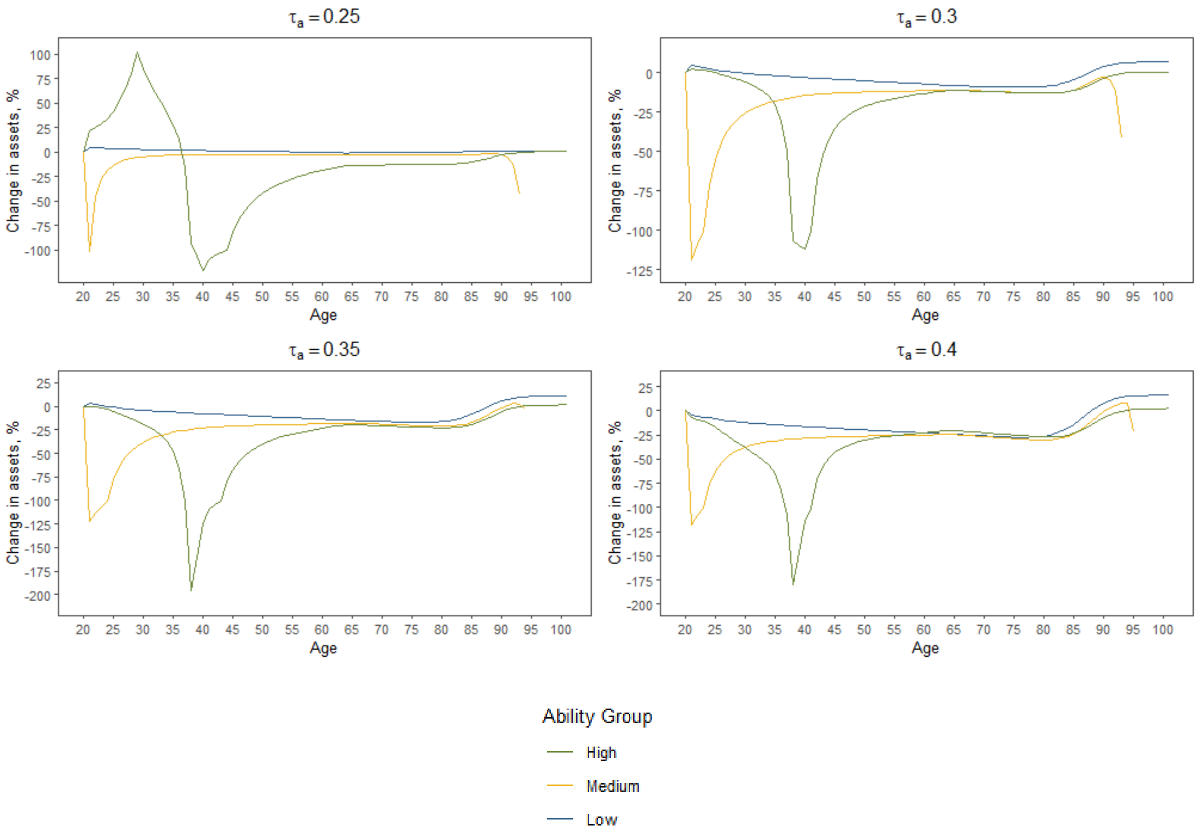


Figure 4.3.3. Changes in assets under varying capital income tax rates, with imputed values.



The households' consumption decisions are illustrated in Figure 4.3.4 and 4.3.5 (excluding extreme values) below. We note that the consumption decisions closely reflect households' savings patterns and that medium ability type individuals see a large increase in consumption around the age of 94, mirroring their increased borrowing rate. We also note a smaller increase in consumption for high ability types around the age of 40, reflecting their increased level of debt at this time. Removing the extreme percentage changes generated by medium type households, we are able to take a closer look at the lifecycle changes for all ability types and note relatively smaller changes for low-ability households. The changes in consumption for these individuals, however, becomes more pronounced as the capital gains tax increases and we see a slight positive change towards the end of their lives. This was similarly reflected in the graphs depicting changes in asset holdings above, and is likely a result of the increased level of transfers in the economy. As the low ability types' baseline income was lower than that of medium and high ability individuals, the increase in transfers constitutes a relatively larger increase in income for these households. Combined with limited initial asset holdings in the baseline simulation, low ability households appear to do better under increased capital gains taxation, unlike the other two groups, whose paths are less straightforward.

Figure 4.3.4. Changes in consumption under varying capital income tax rates.

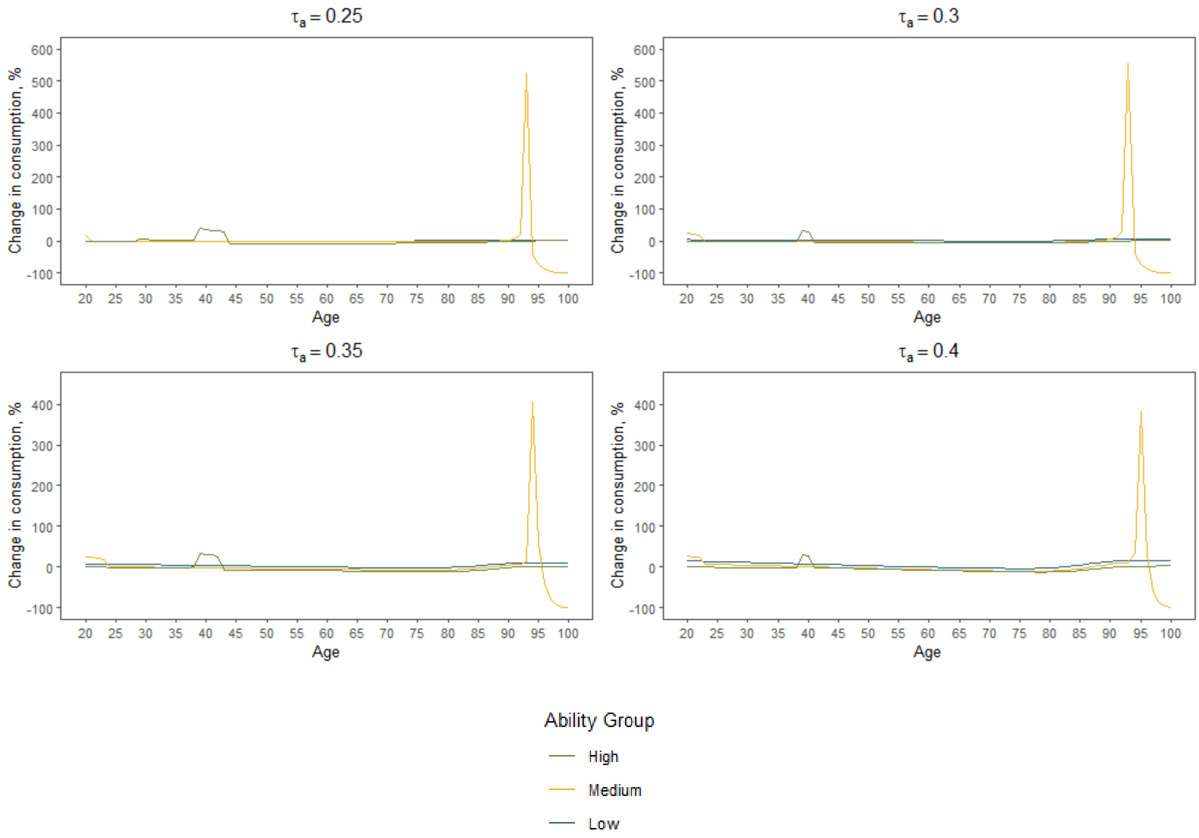
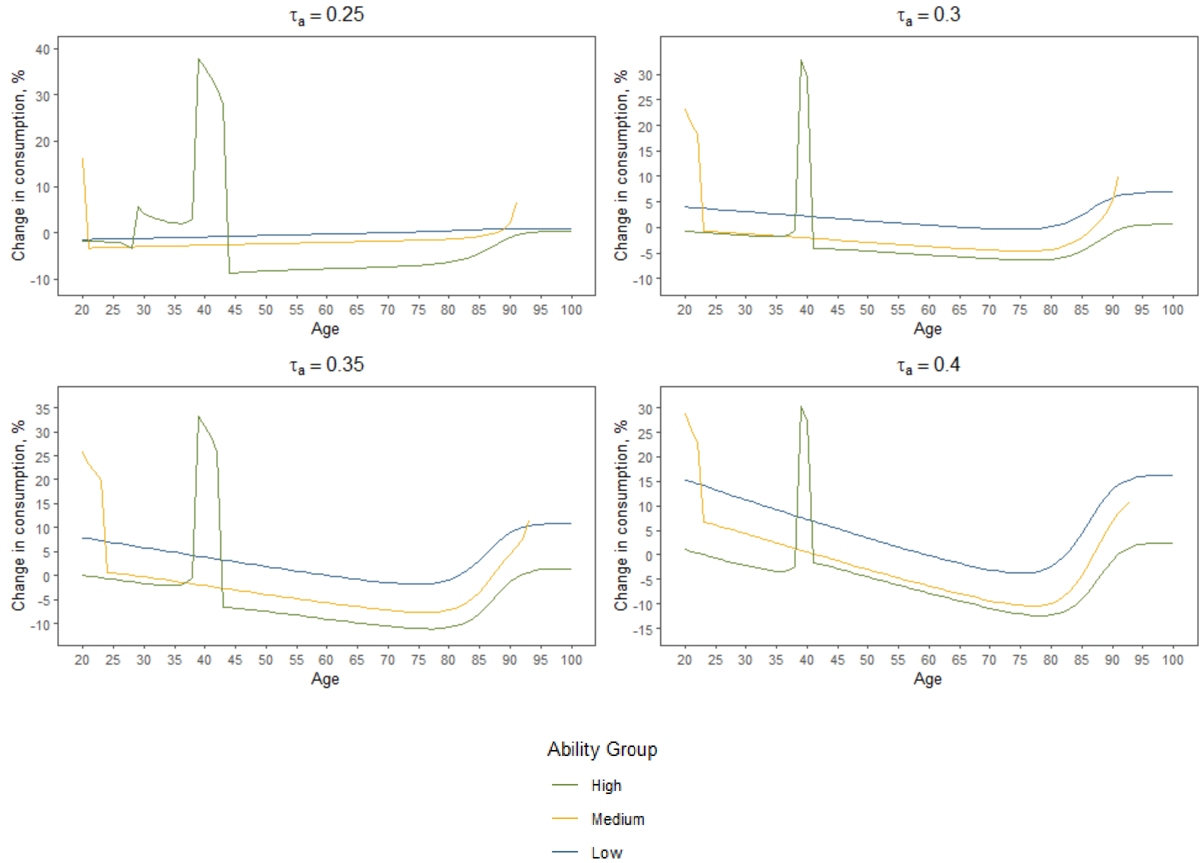


Figure 4.3.5. Changes in consumption under varying capital income tax rates, with imputed values.



4.4. Efficiency and inequality outcomes

Having examined the impacts of inheritance and capital gains taxation on the households' consumption, saving and labor supply choices, this section will compare the effects of the varying tax rates on the economy-wide dispersion of wealth, consumption and labor supply as captured by Gini coefficients.

The Gini coefficients are computed according to:

$$G_{tk} = \frac{1}{n}\left(n + 1 - 2 * \left(\frac{\sum_{i=1}^{n}(n+1-i)k_{\lambda})}{\sum_{i=1}^{n} k_{\lambda}}\right)\right)$$

where G_{tk} is the Gini coefficient and takes a value between zero and one, with zero representing complete equality and one representing complete inequality. Further, k_{λ} represents the variable of interest, namely labor supply, assets and consumption, respectively, of the various ability groups. The number of households, *n*, has been normalized to ten for the purpose of these calculations, with each ability group represented according to their share of the total population.

Table 4.4.1 shows the baseline and treatment Gini coefficients, with treatment Gini coefficients represented as a percentage change from the baseline.[2] We note that the baseline Gini coefficients are significantly lower

[2] For the full Gini coefficients of treatments, please refer to the Appendix.

than those established for the Swedish economy (SCB, 2020a), indicating that the model compresses inequality as compared to the real distributions. This likely comes from the imposed condition that individuals enter the economy with no assets aside from a small share of bequests, which fails to capture the dynasty structure and corresponding concentrated wealth observed in the Swedish economy. Additionally, as noted above, the households bequeath relatively small shares of their lifetime wealth, in spite of the higher bequest motive calibration, ϕ, as compared to MIMER. However, while the overall inequality measurement does not reflect the actual observed values, the percentage changes can be seen as an indication of the direction of impact and relative magnitude of effects for the respective tax policies.

Overall, we see a relatively muted effect of the inheritance taxation on inequality across assets, consumption and labor supply, and a somewhat surprising positive effect of three of the tax rates on asset (wealth) inequality, indicating that the taxes increased inequality in these cases. However, this increase likely reflects the increased savings rate of high-ability households that was observed in section 4.2. As these households start to save earlier under the inheritance tax rates $\tau_b \in (0.1, 0.3, 0.6)$, they accumulate more assets over the lifetime as compared to the low and medium ability households, thereby driving up the inequality coefficient. In these cases, we also note a slight decrease in the labor inequality, reflecting the relative decrease in labor supply on behalf of the high-ability types, combined with a small increase in the lifecycle labor supply of both medium and low-ability households. We see the opposite effect for $\tau_b \in (0.2, 0.4, 0.5)$, where high-ability types increase their labor supply and decrease their relative savings, in line with the results outlined in section 4.2. Consumption, in turn, remains relatively stable for all tax schedules, with changes below one percent across the board. This indicates that households are able to continue to smooth their consumption by minor adjustments in their labor supply and asset choices.

Table 4.4.1 – Gini Coefficients, % Change from baseline, Inheritance Tax

Steady state variable	Baseline	Inheritance tax, 10%	Inheritance tax, 20%	Inheritance tax, 30%	Inheritance tax, 40%	Inheritance tax, 50%	Inheritance tax, 60%
$a_{i\lambda}$	0.1053	4.87%	-4.99%	4.79%	-0.16%	-0.21%	9.62%
$c_{i\lambda}$	0.1492	0.07%	-0.33%	0.05%	-0.16%	-0.17%	0.23%
$l_{i\lambda}$	0.1137	-0.61%	0.39%	-0.77%	-0.33%	-0.41%	-1.50%

Table 4.4.2 – Gini Coefficients, % Change, Capital Gains Tax

Steady state variable	Baseline	Capital gains tax, 25%	Capital gains tax, 30%	Capital gains tax, 35%	Capital gains tax, 40%
$a_{i\lambda}$	0.1053	-26.2%	-12.29%	-22.34%	-8.40%
$c_{i\lambda}$	0.1492	-2.40%	-4.37%	-6.63%	-8.20%
$l_{i\lambda}$	0.1137	13.23%	26.67%	41.76%	53.07%

Table 4.4.2 presents the corresponding changes in Gini measurements for the introduction of the various capital gains tax rates. In this instance we note a significantly larger impact on inequality across all of the variables as compared to the inheritance tax. We also see a decrease in inequality with respect to both consumption and assets across all of the tax rates, with the largest decrease in wealth observed for $\tau_a = 0.25$ and the greatest decrease in consumption inequality for $\tau_a = 0.40$. The decrease in wealth (asset) inequality for $\tau_a = 0.25$ is likely generated by the significant decrease in savings rate for both medium and high-ability households compared to the baseline, with medium ability households decreasing their savings by approximately 7.5 percent and high ability households by over 20 percent. Low-ability households, on the other hand, increase their savings rate slightly, likely due to the higher interest rate on capital generated by the drop in savings by the rest of the population. For $\tau_a = 0.30$, the wage falls and low and medium ability households appear to not be able to save to the same extent as before, with λ_M savings decreasing by a further 11.5 percent. High ability types, however, make much smaller adjustments in their labor supply and still make enough to be able to save a significant fraction of their wage income and take advantage of the higher interest rate, thereby accumulating relatively more capital as compared to the other ability groups in this scenario. In the last two tax schedules, however, this effect diminishes and high ability households decrease their savings significantly, whereas the decrease is more muted for medium types, in particular under $\tau_a = 0.40$, leading to a relatively smaller equality increase for this tax specification. The continued wage decrease that follows from the increased capital gains tax further leads to a significantly lower labor supply for low ability types, who as a result earn less wage income and save less, moderating the redistributional and equity impacts of the tax. The labor supply responses can be further seen from the Gini coefficients of labor in table 4.4.2, with the increases in inequality here reflecting the relatively larger negative impact on low and medium types' labor supply choices. The fact that high ability individuals had a higher share of their income come from assets in the baseline scenario means that the increasing capital gains tax has a larger effect on them, leading them to decrease their labor supply to a lesser extent than low and medium types as a result of falling wages, hence increasing the gap between the ability groups' lifecycle labor supply.

The results above indicate that the capital gains taxation is significantly more effective than the inheritance tax at reducing inequality, in particular with regards to the asset accumulation of individuals over the lifecycle. However, we also note an increased labor supply inequality, reflecting the reduced labor supply of low ability individuals, following a lower wage rate and higher lump sum transfers, and increased or maintained labor supply of high ability types. In addition, the effect on lifecycle consumption inequality is relatively muted but still produces increases in equality as a result of the higher capital gains tax.

With distortionary taxes, such as the capital gains tax in particular, there are probable costs to the economy in terms of efficiency. A central aspect of policy evaluation is thereby comparing not only the equity outcomes but the overall efficiency changes resulting from the introduction of the tax increase. Tables 4.4.3 and 4.4.4 illustrate these efficiency changes for inheritance taxation and capital gains taxation, respectively.

The aggregate impacts of the inheritance taxation are, as expected, relatively small, with all tax rates generating changes of less than 1 percent in the economy-wide measures of output, consumption, labor and capital. This stems from the relatively low percentage of lifetime wealth bequeathed by the individuals in the economy, and the limited impacts on lifecycle choices of the majority of the population. As noted in section 3.2, the introduction of the inheritance tax primarily affected high-ability households who constitute a smaller share of the total population (ten percent), thereby limiting the impacts on lower ability types. As noted above, however, the introduction of an inheritance tax of $\tau_b = 0.20$ did generate a non-negligible equality increase, in particular with respect to lifetime assets.

Table 4.4.3. – Efficiency Impacts of Inheritance Taxation, % Change from baseline

Steady state variable	Baseline	Inheritance tax, 10%	Inheritance tax, 20%	Inheritance tax, 30%	Inheritance tax, 40%	Inheritance tax, 50%	Inheritance tax, 60%
Output, Y	141.78	0.19%	-0.28%	0.13%	-0.13%	-0.16%	0.26%
Cons., C	106.68	0.14%	-0.26%	0.06%	-0.16%	-0.21%	0.12%
Labor, L	28.54	-0.02%	0.17%	0.08%	0.20%	0.25%	0.16%
Capital, K	501.46	0.34%	-0.35%	0.34%	-0.02%	-0.02%	0.68%

Looking at the efficiency impacts of capital gains taxation in table 4.4.4, we note a considerably higher negative effect on aggregate variables, that increases consistently as the tax is raised. The largest impacts are, unsurprisingly, noted for capital, where we see a 28 percent decrease in economy-wide capital accumulation for $\tau_a = 0.40$. This decrease corresponds to an 8.4 percent decrease in asset inequality, as noted in table 4.4.2, and can be compared to an aggregate capital decrease of 0.35 percent and asset inequality decrease of 4.99 percent for the inheritance tax rate $\tau_b = 0.2$. However, we note that the capital gains taxation of $\tau_a = 0.25$ (corresponding to a three percentage point increase as compared to the baseline level) generates a significant improvement in equality while maintaining relatively muted effects on the economic aggregates. While there is an inherent trade-off between efficiency and equality gains that policy-makers need to balance, the capital gains taxation thereby indicates that relatively large equality gains are attainable without sacrificing too much of the economic efficiency. Overall, both the Gini coefficients and efficiency indicators align to the literature, bar some unexpected impacts resulting primarily from labor supply decisions and decreased savings in the high ability groups under certain inheritance taxation levels. The significant impacts of even a small increase in capital gains taxation on both inequality and efficiency encourage further research into this area, potentially taking into account different types of asset holdings and reflecting the existence of the Swedish “special savings account” that only have an effective capital income tax of roughly ten percent.

Table 4.4.4. – Efficiency Impacts of Capital Gains Tax, % Change from baseline

Steady state variable	Baseline	Capital gains tax, 25%	Capital gains tax, 30%	Capital gains tax, 35%	Capital gains tax, 40%
Output, Y	141.78	-3.53%	-5.41%	-7.69%	-8.54%
Consumption, C	106.68	-1.86%	-1.90%	-2.55%	-2.12%
Labor, L	28.54	-1.34%	-4.32%	-6.27%	-8.41%
Capital, K	501.46	-8.60%	-16.10%	-23.32%	-28.02%

An additional dimension that policy-makers need to take into account when formulating the tax regime is the political feasibility of distinct policies. Capital taxes may be particularly polarizing due to the skewed distribution of capital assets, as compared to wage income, in Sweden. Scheuer and Wolitzky (2016) examine the relationship between political support for capital tax reform and the dispersion of capital assets in the economy, and note that there is a significant constraint on policy-makers, as there is limited popular support for any substantially redistributive policies. Bastani and Waldenström (2018) further look specifically at the political feasibility of a re-introduction of the inheritance taxation in Sweden via a survey on 4,000 randomly selected respondents. The authors find that the Swedish population appears open to the introduction of an inheritance tax on large bequests, but show limited support in favor of a general inheritance tax even if it corresponded to a decrease in other capital or wage-related taxes. However, the authors do not specify the degree of progressivity of the supposed tax, and a large share of respondents (51 percent) remain negative when asked about the progressive structure. This finding is quite surprising, as the progressive inheritance taxation should only impact a small subset of the population, and may limit the political feasibility of such a policy. This is likely an issue with regards to the capital gains taxation as well, however, and would benefit from closer evaluation.

5. Caveats and further research

A core element of the analysis presented in this paper is the introduction of heterogeneous ability groups in the economy, roughly reflecting the post-tax disposable income distribution in Sweden. While this calibration enables us to observe the differential lifecycle choices and behavioral responses to capital taxation arising from varying levels of human capital and earnings ability, the model could be further refined by a closer calibration of the ability types. Such a recalibration could take into account the hours worked to estimate the dynamics of hourly earnings processes. A potential methodology for this process is proposed by DeBacker and Ramnath (2018), who use US survey data and tax returns to impute hours worked onto administrative data in order to find hourly earnings. This method is shown to generate a more accurate depiction of top income earners and an income and wealth distribution closely mirroring that of the US economy (DeBacker et al., 2018). A similar impact may be generated by the explicit inclusion of voluntary bequests in the model, as indicated by De Nardi (2003). In her paper, De Nardi shows that extending the bequest motive from purely accidental promotes a greater asset retention in old age, in particular among the very rich. Additionally, she shows that modelling bequests as a luxury good further contributes to the accumulation of assets at the upper tail of the wealth distribution, through assigning a relatively stronger bequest motive to the rich as compared to the rest of the population.

The specific design of the tax policy is also closely linked to its redistributional and distortionary effects. As could be seen in the results in the above section, the increases in capital taxes lead to relatively large differences in labor supply choices for all ability groups. Further extending the model to reflect the progressive nature of the Swedish income taxation may thereby generate slightly different results. It is worth noting, however, that the largest shifts in labor supply were observed for lower ability individuals, who would likely not be affected by the progressivity of income tax. High ability groups, on the other hand, maintained similar or slightly increased labor supply levels reflecting their shift from capital to wage income. In light of this, the general results observed in this paper should be robust to the inclusion of a progressive income tax, as the motivation for high-ability types to shift income would remain present. The structure of the proposed capital tax regimes, however, may have a significant impact on both equity and efficiency outcomes. Extending the model to account for basic deductions and progressivity in capital income taxation would be a promising area for future research and would, combined with a more precise ability calibration, likely generate further positive impacts in terms of equality increases. The design of taxes is further indicated by Bastani and Waldenström (2018) as a significant determinant for the political feasibility of certain policies. Specifically, they note that the Swedish population appears more open to tax structures that display a stronger redistributional aspect, indicating that the inclusion of progressivity elements may further raise the political viability of a tax increase.

A further potential extension of the model would include population growth dynamics and demographic change. As previously noted, approximately 40 percent of the increase in inequality rates in Sweden may be attributable primarily to changing demographic characteristics. These demographic changes pertain both to a widening gap between bottom and top income earners as a result of increasing educational attainment, and to an ageing population. The decline in the proportion of young people to retirees is of particular interest in light of the structure of the Swedish pension system. In many countries, the sustainability issue arising from an aging population and a relatively smaller working population leads to projected pension benefit spending exceeding contributions. The Swedish system avoids this problem by actuarially connecting benefits to contributions and placing all adjustment on the side of benefits. The issue thus becomes one of decreasing pension adequacy and potential rising uncertainty. As pension incomes, on average, are already significantly lower than wage earnings, this development would place even greater importance on the accumulation of savings during the lifecycle and exacerbate inequality arising from differential savings rates across the wealth distribution. To understand these changes and their relationship to increasing capital taxation, the model presented in this paper could be extended through the introduction of projections of demographic trends and pension expenditure.

Lastly, the model applied in this paper assumes a closed economy, meaning that capital is immobile and investment rates are wholly dependent on the individual savings of households in the economy rather than any international flows. However, this assumption constitutes a primary limitation of the model, particularly with regards to the effects of capital gains taxation. As noted in the results section above, the implementation of a higher capital gains tax lead to high ability households reducing their savings and consumption, while increasing their labor supply as a means to smooth consumption. However, if capital were internationally mobile these effects would likely be significantly more muted, especially considering the lower marginal tax rates on capital in place in other countries (Bastani and Waldenström, 2018). Nevertheless, as noted by DeBacker et al. (2018) the extent of capital mobility is somewhat unclear and as such the results in this paper should still provide an indication of the effects of increased capital gains taxation as well as provide a strong foundation for further research.

6. Conclusion

This paper has presented a large-scale overlapping generations model with heterogeneous ability groups, calibrated to closely match the dynamics in National Institute of Economic Research's analysis of the Swedish economy. Through the introduction of heterogeneous ability, the model is able to capture the dynamic inequality and behavioral responses to various tax regimes, enabling an evaluation of tax policies based on equity as well as efficiency.

Against the backdrop of increasing inequality rates primarily stemming from a concentration of capital assets, the paper has analyzed the impacts of two types of capital taxes on lifecycle choices, inequality, and aggregate outcomes. The findings confirm a significant trade-off between equality and efficiency in the majority of cases, but indicate that moderate increases in the capital income taxation level could generate substantial improvements in equality with relatively small negative impacts on aggregate variables. Similarly, the results for inheritance taxation imply that an increased rate of estate taxation could have non-negligible redistributional effects at a minimal efficiency cost. We note, however, that the bequest rate in the model is slightly below that indicated by literature (Elinder et al., 2016), particularly for the top 10 percent of the income and wealth distribution. In light of this, future research may benefit from a re-calibration of the bequest motive through, for example, the explicit allowance of voluntary bequests. This would allow researchers to confirm the results indicated in this paper and further open up to a wider discussion regarding the appropriate design of the tax policy.

The model deployed further captures the complex relationships between labor supply, consumption, income and savings decisions and the non-uniform relationship between capital tax and outcomes. This is particularly noticeable in certain cases of inheritance taxation, where an increase in the tax generates an increase in inequality, as opposed to the expected decrease. The framework indicates a particular sensitivity to capital income taxation, wherein marginal increases show substantial effects on outcomes. In light of this, a further examination of smaller increases in the capital income taxation should be explored to closer pinpoint the dynamics in the economy.

Overall, the thesis indicates a potentially positive and significant role of increased capital taxes in the Swedish economy, in particular due to the model undershooting the observed level of inequality, suggesting that the effects generated in the simulations would be of greater magnitude in the real-world economy.

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A. Appendix

This appendix presents the full Gini coefficients resulting from the set of inheritance and capital gains taxation schemes.

Table A.1 – Gini Coefficients, Inheritance Tax

Steady state variable	Baseline	Inheritance tax, 10%	Inheritance tax, 20%	Inheritance tax, 30%	Inheritance tax, 40%	Inheritance tax, 50%	Inheritance tax, 60%
$a_{i\lambda}$	0.1053	0.1105	0.1001	0.1104	0.1052	0.1051	0.1155
$c_{i\lambda}$	0.1492	0.1493	0.1487	0.1493	0.1490	0.1490	0.1496
$l_{i\lambda}$	0.1137	0.1130	0.1142	0.1128	0.1133	0.1132	0.1120

Table A.2. – Gini Coefficients, Capital Gains Tax

Steady state variable	Baseline	Capital gains tax, 25%	Capital gains tax, 30%	Capital gains tax, 35%	Capital gains tax, 40%
$a_{i\lambda}$	0.1053	0.0777	0.0924	0.0818	0.0965
$c_{i\lambda}$	0.1492	0.1427	0.1427	0.1393	0.1370
$l_{i\lambda}$	0.1137	0.1288	0.1440	0.1612	0.1741