Stockholm School of Economics
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Master's Thesis

Capitalist Spirit Preferences, Saving Behaviour and the Distribution of Wealth

A Simulation Study for Sweden

Abstract

Wealth is very unequally distributed and highly concentrated among a small percentage of the population in virtually every country. This empirical regularity appears to be driven by the fact that saving rates increase with the level of permanent income. However, standard life-cycle models of consumption and saving fail to account for these empirical facts. In order to generate the observed heterogeneity in saving behaviour, Carroll (1998) proposed so-called "capitalist-spirit preferences" which include wealth directly in the utility function as a luxury good. The aim of this paper is to analyze the effect of capitalist spirit preferences on the consumption and saving paths of individuals and therefore on the distribution of wealth. To address these research questions a quantitative life-cycle model with capitalist spirit preferences and heterogeneous agents in terms of income is calibrated to Swedish data.

The results of this paper indicate the following: First of all, capitalist spirit preferences induce higher mean and median savings compared to the standard life-cycle model. Second, capitalist spirit preferences lead to higher saving rates as the level of permanent income of the agent increases. Moreover, the incentive to save due to the capitalist spirit decreases with age. This leads to the undesirable side effect that consumption increases exponentially during the last model periods for agents where the capitalist spirit is most active. Furthermore, this mechanism has the effect of reducing wealth inequality between different age cohorts. Therefore, only certain parameter calibrations lead to a higher concentration of wealth in the top end of the distribution. Without bequests none of the calibrations examined in this paper result in a higher gini coefficient for wealth compared to the standard life-cycle model. Allowing for bequests generates higher wealth inequality only for some calibrations.

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1 Introduction

Wealth is very unequally distributed and highly concentrated among a small percentage of the population in virtually every country. The richest one percent of the population commonly owns between 15 percent and 35 percent of total net wealth and gini coefficients above 0.7 are the norm rather than the exception (Davies and Sharrocks 2000). Moreover, wealth is usually much more unequally distributed than any measure of income. These empirical regularities appear to be driven by the fact that saving rates increase with the level of permanent income and that rich individuals do not decumulate all their wealth before they die (Dynan *et al.* 2000).[1] The standard life-cycle model of consumption and saving used in macroeconomics is unable to account for these empirical facts, as the only reason for saving within this model is to smooth consumption. Even when allowing for uncertainty and precautionary savings in the model, this does not change. Furthermore, although the inclusion of bequest motives in the model helps to generate a more unequal wealth distribution, voluntary bequests do not give a coherent explanation for the fact that there is no significant difference in the rate of asset decumulation between the elderly with and without children (Hurd 1986).

Recently, Carroll (1998) has suggested that the simplest way to explain the empirical facts is to include a direct preference for wealth into the utility function. Wealth should be modelled as a luxury good, so that saving rates increase with the level of permanent income. The idea behind these so-called capitalist spirit preferences is that there is an alternative use for income than simply consumption, namely accumulation of wealth for its own sake. This accumulation motive should become more and more important as the level of permanent income increases. This makes intuitive sense: once a certain saturation level of consumption has been reached, accumulating an additional unit of wealth could yield more utility than consuming it, as the marginal utility of consumption is virtually zero. The reasons why wealth might yield utility are numerous: it can confer status in society, power and influence, or it can be passed on to children or charitable foundations after death which is a form of altruism. Based on Max Weber's hypothesis that accumulation of wealth for its own sake is the essential spirit of capitalism, these preferences have become known as capitalist spirit preferences in the literature.

[1] Throughout the thesis, the term permanent income will mean average income over the life-cycle of an individual. The terms permanent income and lifetime income will be used interchangeably.

So far only two authors, Reiter (2004) and Francis (2005a, 2005b), have examined the effect of capitalist spirit preferences on the distribution of wealth through simulation studies. Both authors find that capitalist spirit preferences help to explain the extreme right skewness of the wealth distribution in the US. However, none of the authors considers the resulting consumption and saving profiles in sufficient detail.

The first aim of this thesis is to shed more light on the consumption and saving dynamics that result from capitalist spirit preferences. The second aim of the thesis is to examine the ability of capitalist spirit preferences to account for the wealth distribution in Sweden and in particular for the amount of wealth held by the richest one to ten percent of the population. In order to address these research questions an overlapping generations model with heterogeneous agents in terms of income will be calibrated to Swedish data. The simulated saving and consumption paths will then be analyzed for their plausibility and the resulting wealth distribution will be compared to actual data.

The contribution of this thesis to the existing literature is twofold. First of all, this is the first study that tests capitalist spirit preferences on non-US data. Moreover, the two papers by Francis (2005a, 2005b) are the only previous studies that examine the effect of additive capitalist spirit preferences on the distribution of wealth in a life-cycle setting. The second contribution is that the life-cycle saving and consumption patterns with capitalist spirit preferences and their plausibility are examined in more detail compared to previous papers. The thesis thus adds to the understanding of the dynamics that drive the saving behaviour with these preferences.

The structure of the thesis is as follows. In section two the main stylized facts about the distribution of wealth and saving behaviour are presented. Moreover, a brief exposition of the wealth distribution in Sweden will be given. Section three will then review the main theories that have been proposed in the literature to explain the empirical facts. Section four will outline the structure of the simulation model, which is followed by a section on the calibration of the model parameters. Saving and consumption paths from the simulation model are presented in section six. Moreover, the resulting wealth distribution will be compared to actual data in this section. Finally, section seven will conclude and identify areas for future research.

2 Saving Behaviour and the Distribution of Wealth

The following section first reviews the main stylized facts about the distribution of wealth and saving behaviour that have been established in empirical studies. Studies on the distribution of wealth exist for many countries, but as most existing empirical studies of saving behaviour are based on US data the findings from these papers will be regarded as general and therefore will be presented as stylized facts. In the second part of this section, more detailed facts about the distribution of wealth in Sweden will be presented which will form the basis for assessing the simulation results of this thesis.

2.1 Main Stylized Facts

Even though there are national differences in the distribution of wealth, some common patterns are present in virtually every country. The most striking feature about the wealth distribution is that it is mostly very unequal. Davies and Sharrocks (2000, p. 607) report that the wealth gini coefficient in developed countries is commonly in the range of 0.5 to 0.9.[2] In addition, wealth is usually much more unequally distributed than income, which typically has a gini coefficient between 0.3 and 0.4. These high degrees of inequality in the distribution of wealth are due to two phenomena: First, wealth holdings are highly concentrated in the top end of the distribution with the share of wealth held by the richest 1 percent of the population being between 15 and 35 percent, whereas their income share is usually less than 10 percent. Second, a significant fraction of the population usually holds very low or even negative net wealth.

Among developed countries, the distribution of wealth is most unequal in the U.S. with more than 30 percent of wealth in the hands of the richest 1 percent of the population, and more than 50 percent owned by the richest 5 percent (Cagetti and DeNardi 2005, p. 5). Among the more equal countries in terms of wealth held by the richest part of the population are Australia and Sweden, the latter one being the focus of this thesis. However, even in these countries about 20 percent and 41 percent of wealth is owned by the richest 1 percent and 5 percent respectively (Davies and Sharrocks 2000, pp. 628-642).[3]

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[2] The gini coefficient is a measure of inequality. It takes values in the range between zero and one. A gini coefficient of zero corresponds to perfect equality and a gini coefficient of one to perfect inequality.

[3] It must be kept in mind that all estimates of the distribution of wealth should be handled with care. Estimates

For such patterns in the distribution of wealth to evolve, it has to be that individuals with high lifetime income have higher saving rates than individuals with low lifetime income. Browning and Lusardi (1996) document that there is a strong positive relationship between income and saving in the U.S. and that large proportions of total saving can be attributed to the top end of the income distribution. As cross-sectional variation in income is much larger than variation in individual income they interpret this as an indication that saving rates are also positively related to the level of lifetime income. This view is confirmed in a more recent paper by Dynan, Skinner and Zeldes (2000). Using a number of different instruments for permanent income they find a strong positive relationship between permanent income and saving rates in the U.S. Moreover, they find evidence that households with high permanent income do not dissave substantially after retirement.

This leads to the next empirical regularity: A large fraction of aggregate wealth can be attributed to bequests. Kotlikoff and Summers (1981) were the first to show that only a little part of aggregate capital accumulation in the U.S. is due to life-cycle saving motives and that up to 80% of aggregate capital accumulation can be attributed to intergenerational transfers. Although their results have been contested, many other studies have concluded that a significant part of total wealth is accounted for by bequests. Davies and Sharrocks (2000, pp. 655-657) who review several of these studies conclude that roughly 35 to 45 percent of aggregate wealth are due to inheritance.

Even though bequests seem to play an important role in understanding saving behaviour and wealth inequality, voluntary bequests should only affect the saving behaviour of individuals with children. However, Hurd (1986) found that there is no difference in the rate of asset decumulation between elderly with and without children. More recently Carroll (1998) presents some evidence from the Survey of Consumer Finances (SCF) that the wealthy elderly without children are even less likely to dissave than those with children. In addition, only 5 percent of the entire SCF sample said that leaving a bequest was among the five most important reasons for saving. The fact that elderly people do not decumulate all their assets before they die can thus not be attributed to bequest motives alone.

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usually differ to some extent depending on whether household surveys, wealth tax data, estate tax records or investment income records are used as the data set. A common problem with household surveys is for example that they undersample the rich and thus do not reflect the top end of the wealth distribution accurately. However, no matter what data set is used, the general pattern that emerges is that wealth holdings are highly concentrated in the top end of the distribution in virtually all countries.

Another feature of the wealth distribution is that entrepreneurs are disproportionately represented in the top end of the wealth distribution. Cagetti and DeNardi (2006, pp. 838-841) document that business owners and self-employed make up 81 percent and 68 percent of the richest 1 percent and 5 percent of the population in the U.S.

Regarding the saving behaviour over the life-cycle Browning and Lusardi (1996) document the following facts for the US. First of all saving rates are positive for every age group starting from 25. Moreover, saving rates increase between 25 and retirement and decrease thereafter. Within each age group, mean savings are much higher than median savings which indicates that the wealth distribution is right skewed across all age levels and not just for the population as a whole. Savings are also higher for people without children than for people with children. Finally, the majority of saving is done by individuals in the top end of the wealth distribution.

2.2 The Distribution of Wealth in Sweden

The Swedish wealth distribution data presented in this section and used throughout the thesis is based on the HINK database from 1992 and taken from Domeij and Klein (1998, 2002).[4] As can be seen from *Table 2.1*, the distribution of wealth in Sweden is very unequal with a gini coefficient of 0.79. To a large extent, the degree of inequality is driven by the high proportion of people holding negative or zero net wealth, which is 24 percent. In fact, the bottom half of the wealth distribution still has a negative aggregate net wealth position. In contrast to that, the richest decile owns half of total net wealth. But even within the top decile wealth is highly concentrated: The richest 1 percent and 5 percent of the population own 13 percent and 33 percent of net wealth respectively.

In this context one needs to bear in mind that the HINK database does not oversample the rich and therefore is likely to underestimate the percentage of wealth within the top percentiles of the distribution. Domeij and Klein (1998) report that with a supplementary sample of very rich households the gini coefficient for the wealth distribution is even as high as 0.86. Another estimate of the Swedish wealth distribution based on the HUS database can

[4] The HINK is a household survey conducted by Statistics Sweden (SCB) with a sample size of about 10,000. An alternative dataset is the HUS. However, the sample size of the HUS is only slightly above 1,000 and people above the age of 75 are not included in the sample. A further discussion of advantages and disadvantages of the data sources is not undertaken.

be found in Lindh and Ohlsson (1998). They report that the percentage of wealth held by the top 1, 5, 10 and 20 percent of the Swedish population in 1992 was 19.5, 40.9, 58 and 80 percent respectively. It therefore needs to be kept in mind throughout the thesis that the fraction of wealth held in the top end of the distribution is rather larger than the figures that are used.

Figure 2.1: The distribution of net wealth in Sweden

Deciles	Net Wealth share
1^{st}	-0.06
2^{nd}	-0.01
3^{rd}	0.00
4^{th}	0.01
5^{th}	0.03
6^{th}	0.06
7^{th}	0.10
8^{th}	0.15
9^{th}	0.22
10^{th}	0.50
Top 5%	0.33
Top 1%	0.13
Share <=0	0.24
Gini coefficient	0.79

Source: Domeij and Klein (1998, 2002)

3 Literature Overview

Any attempt to explain the distribution of wealth in an economy has to be rooted in an understanding of the determinants of the saving behaviour of individuals. The central question that must be addressed is therefore "Why do people save?". The majority of the literature has tried to answer this question using dynamic equilibrium models with rational, utility maximizing individuals.[5]

[5] A comprehensive overview of the available literature on quantitative models to explain saving behaviour and wealth inequality is given by Cagetti and DeNardi (2005). In the recent past an alternative approach to explain the determinants of saving has been to use behavioural models. See Browning and Lusardi (1996, pp. 1846-1848) for a brief overview. As this thesis builds on the assumption of rational, optimizing individuals,

The basic model of consumption and saving is the so called life-cycle model which takes its inspiration from Modigliani and Brumberg (1954) and Friedman (1957). In its most basic form, individuals are assumed to be rational and to have intertemporally additive utility functions over consumption that take a quadratic form.[6] Given these assumptions the sole reason why individuals save is to smooth consumption over their lifetime. Using realistic income processes the model thus predicts a hump shaped age-savings profile and a smooth consumption level, implying that individuals borrow when young, save when in their middle-ages and run down their savings during retirement.

Even though the basic prediction of a hump-shaped age-savings profile seems consistent with the data, there are a number of problems with the simple life-cycle model: Most young people are net savers, consumption tends to track income and many people dissave less during retirement than the model predicts (Davies and Sharrocks 2000). Moreover, the model cannot explain the high concentration of wealth in the top end of the distribution because it predicts that people with high and low lifetime income should have the same saving rates. In the following, different extensions of the life-cycle model will be discussed that have been proposed to better account for the empirical facts.

One of the main further developments of the basic life-cycle model has been to introduce risk into the analysis and replace the assumption of quadratic utility by constant relative risk aversion (CRRA) utility to generate precautionary savings.[7] Precautionary saving motives help to explain the high saving levels displayed by young people with good earning prospects and to some extent also give a reason why retired people do not decumulate all their savings due to lifespan risk. However, the theory can not explain the high saving levels of the richest households and thus it is not able to account for the upper tail of the wealth distribution (Cagetti and DeNardi 2005, pp. 16-17). Carroll (1998) shows that a stochastic life cycle model only matches aggregate and average wealth data because it overpredicts savings by the median household and underpredicts savings by the rich. Other simulation studies show similar results.

behavioural models will not be touched upon in this literature review.

[6] This model setup is often referred to as the certainty-equivalence model because the introduction of uncertainty into the model framework has no effect on the model outcome. See Browning and Lusardi (1996) for a detailed discussion.

[7] In order to generate precautionary savings in the presence of uncertainty it is necessary that the utility function has a third derivative. Thus, with quadratic utility there are no precautionary motives for saving.

Huggett (1996) constructs an overlapping generations model for the U.S. with borrowing constraints, earnings and lifetime uncertainty as well as incomplete markets to insure against these risks. Individuals in this economy thus save for retirement, for precautionary reasons due to earnings uncertainty and to self-insure against lifetime uncertainty. His model is able to replicate the U.S. gini coefficient for wealth, but it does so by generating too many individuals with zero or negative wealth and too little wealth concentration in the upper tail of the distribution, in particular the model only generates half of actual wealth held by the top 1 percent. Similar results are obtained by Aiyagari (1994), who constructs an infinite horizon general equilibrium model with uninsured idiosyncratic risk and liquidity constraints. His model also cannot generate the high level of inequality in the distribution of wealth that is present in the data.

One way to explain the higher saving rates of rich people and the fact that many old people do not significantly decumulate their assets during retirement is to introduce intergenerational transfers into the model, where parents leave intentional bequests and invest into their children's ability. DeNardi (2004) uses an overlapping generations general equilibrium framework with lifetime and earnings uncertainty where parents transmit physical and human capital to their children. In the model, people save to self-insure against earnings shocks and life-span risk, for retirement and to leave bequests to their children. She calibrates the model for the US and Sweden and conducts various simulations. She finds that adding the bequest motive to the model substantially increases the wealth holdings of the rich. Including productivity inheritance further improves the model. However, even her model with bequests and productivity inheritance significantly underpredicts the wealth holdings of the richest 1 percent and to a lesser extent of the richest 5 percent. Moreover, intergenerational transfers can not explain the fact that there is no difference in the saving behaviour of individuals with and without children (Hurd 1986).

Based on the empirical observation that entrepreneurs constitute a large fraction of the wealthiest individuals, a number of recent studies have looked at the effects on the distribution of wealth of explicitly modelling entrepreneurial choice. Quadrini (2000) constructs an infinite horizon model with entrepreneurial choice and borrowing constraints. His model generates a wealth gini coefficient close to the one observed in the data. Moreover, the model almost replicates the high concentration of wealth in the upper tail of the wealth distribution. He also shows that the same model set-up excluding entrepreneurs fails in replicating the high wealth concentration. The crucial model features that drive the high concentration of wealth in the upper tail are the need to accumulate wealth in order to undertake an entrepreneurial activity, a cost advantage of internal financing due to intermediation costs and finally high risks associated with entrepreneurial activity which induce high precautionary savings.

Cagetti and DeNardi (2006) construct a life-cycle model with altruism across generations, entrepreneurial choice and endogenous borrowing constraints. Their model is able to replicate the U.S. wealth gini coefficient and the high concentration of wealth within the top 1 percent and 5 percent of the distribution. The key mechanism of their model is the presence of high returns to entrepreneurial activity coupled with borrowing constraints that induce entrepreneurs to keep on saving in order to expand their business. Moreover, the presence of intergenerational altruism is key in generating the high concentration of wealth in the top end of the distribution. Modelling entrepreneurial activity and its high returns thus seems to be an important factor in explaining the wealth distribution. However, even entrepreneurial models rely on a separate mechanism to induce successful entrepreneurs to save a lot.

Another relatively new approach to better explain the saving behaviour of the rich is to introduce a direct preference for wealth into the utility function of the individual. These preferences are known as capitalist spirit preferences in the literature based on Max Weber's proposition that the accumulation of wealth for its own sake is the fundamental 'spirit of capitalism'. The first scholar to introduce capitalist spirit preferences into the modern literature was Zou (1994).[8] In another paper Zou (1995) shows that a direct preference for wealth can explain why some individuals do not decumulate wealth after retirement and why there is no significant difference in the saving behaviour of households with and without children. In a more recent paper, Carroll (1998) suggests to include wealth as a luxury good within the utility function, as this will have the effect that individuals below a certain threshold of permanent income will behave as standard life cycle consumers, whereas

[8] In this paper Zou examines the implications of capitalist spirit preferences on growth. He also documents that the view that accumulation for the sake of accumulation is important in explaining saving behaviour has been shared by famous economists such as Adam Smith, Karl Marx and John Maynard Keynes. A number of other authors have considered a direct preference for wealth to study various issues. Bakshi and Chen (1996) analyze the implications on stock prices of including relative wealth status in a multiplicative form in the utility function of individuals. They find that asset pricing models perform better with such preferences. Pestieau and Thibault (2007) construct an overlapping generations model where individuals are distinguished by altruism and a direct preference for wealth. They show that in equilibrium a major part of wealth is held by individuals with a direct preference for wealth

individuals above this threshold will save at increasing rates as their lifetime income rises. One advantage of modelling a direct preference for wealth (capitalist spirit preferences) is that such preferences provide a rationale for rich individuals to keep on accumulating wealth regardless of whether they have children or not.

Building on capitalist spirit preferences Francis (2005a) calibrates a quantitative life-cycle model with heterogeneous agents and earnings uncertainty for the U.S. Her model is able to generate much larger wealth holdings in the top percentiles of the wealth distribution than a baseline precautionary savings model. However, the simulated wealth holdings in the top tail of the distribution are still too low. In the model the richest 1 percent of individuals hold less than half the wealth they actually do in the U.S.

In another study Francis (2005b) constructs a partial equilibrium model with infinitely lived heterogeneous agents, capitalist spirit preferences, earnings uncertainty and entrepreneurial choice. Her model generates a realistic wealth gini coefficient and the wealth holdings in the top end of the distribution match the U.S. data quite well. The mechanisms that drive the concentration of wealth in her model are high returns that can be earned through entrepreneurial ability and capitalist spirit preferences that induce high savings among the earnings rich and rich entrepreneurs. Reiter (2004) also uses a model set-up with capitalist spirit preferences and entrepreneurial choice. He finds that both components help to explain the inequality in the distribution of wealth in the US.

Instead of trying to explain the upper tail of the wealth distribution to account for the observed wealth inequality, another approach has been to look at the causes of the low levels of net wealth held in the bottom part of the distribution, as the high degree of wealth inequality present in the data is to some extent also driven by this phenomenon. Domeij and Klein (2002) study to what extent public pensions account for the observed wealth inequality in Sweden. They find that the redistributive public pension system helps to explain the large fraction of households with non-positive net wealth as it reduces the incentive to save for low income earners.

To sum up, capitalist spirit preferences appear to be a potentially useful theoretical concept to explain the saving behaviour of the rich and therefore to account for the high degrees of wealth inequality present in the data. It is therefore of scientific interest to gain a better understanding of the mechanisms that drive the saving behaviour in such a model.

4 The Model

The model that I consider in this thesis is built upon the literature about capitalist spirit preferences. I construct a dynamic life-cycle model with heterogeneous agents similar to the one used by Francis (2005a). The centrepiece of the model is the assumption that households derive utility not only from consumption but also from wealth.[9] Labour is supplied inelastically and households face idiosyncratic earnings paths. Moreover, I model a simple pension and tax system. There is no uncertainty in the model and agents are assumed to be rational, which equates to the assumption of agents having perfect foresight. This implies that agents know all relevant variables such as their income path, their pension benefits, their inheritance and how long they will live with certainty when they begin their economic life. Agents in the model save for retirement, to possibly leave a bequest or to accumulate wealth for its own sake. The model does not include precautionary motives for saving as there is no uncertainty. However, this should not curtail the value of the analysis as the focus of the thesis is on the effect that capitalist spirit preferences have on the saving behaviour of individuals and therefore on the distribution of wealth. This section proceeds as follows. First, the demographics, preferences and budget constraints of the households are described. This is followed by a section on the modelling of the income process of households. Finally, the tax and pension systems operated by the government are described.

4.1 Households

4.1.1 Demographics

Agents have certain lifetimes and live for 60 periods. One model period corresponds to one year in the real world. Agents start their economic life at the beginning of age 21 and they work for 45 years. They retire at age 66 and die with certainty after having completed their 80^{th} year of living. In other words, retirement lasts 15 years. There is no population growth and every agent gets one child which starts economic life when the parent turns 41, i.e. there is a 20-year age gap between parents and children. Each generation faces the same distribution in terms of gender, family composition, education, and income shocks. The economy is thus populated by 60 overlapping generations, each of same size and income distribution.

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[9] The terms households and agents will be used interchangeably throughout the remainder of the thesis.

4.1.2 Preferences

It is assumed that households derive utility from consumption as well as from wealth. The utility function used in this thesis is the one proposed by Carroll (1998), which has been applied in simulations by Francis (2005a, 2000b) and Reiter (2004). Consumption and wealth enter additively into the utility function. The term for consumption is of the standard CRRA form. The term for wealth takes a modified Stone-Geary form.[10] Utility for agent i in period t, who started economic life in year s is given by:

$$U_t^{i,s}\left(c_t^{i,s}, a_t^{i,s}\right) = u\left(c_t^{i,s}\right) + v\left(a_t^{i,s}\right) = \frac{\left(c_t^{i,s}\right)^{1-\mu}}{1-\mu} + \theta \frac{\left(a_t^{i,s}+\gamma\right)^{1-\rho}}{1-\rho} \tag{1}$$

and lifetime utility for the same agent is given by:

$$U^{i,s} = \sum_{t=s}^{s+59} \beta^{t-s} \left[\frac{\left(c_t^{i,s}\right)^{1-\mu}}{1-\mu} + \theta \frac{\left(a_t^{i,s}+\gamma\right)^{1-\rho}}{1-\rho} \right] \tag{2}$$

where $c_t^{i,s}$ is consumption, $a_t^{i,s}$ represents assets/wealth, β is the time discount factor, μ is the coefficient of relative risk aversion for consumption and ρ controls the curvature of the utility of wealth. It is assumed that $0 < \rho < \mu$ which implies that both sub-utility functions, $u\left(c_t^{i,s}\right)$ and $v\left(a_t^{i,s}\right)$, are strictly concave and that the marginal utility of wealth decreases more slowly than the marginal utility of consumption. This renders wealth a luxury good. Furthermore, γ represents a modified Stone-Geary parameter and it is assumed that $\gamma > 0$. This second assumption ensures that the marginal utility of consumption is strictly greater than the marginal utility of wealth for initial levels of consumption. In particular, the inclusion of the positive intercept parameter γ generates heterogeneity in the demand for wealth: agents below a threshold level of permanent income will choose to decumulate all assets before dying, while agents above this threshold will choose to leave behind increasing amounts of wealth as the level of permanent income rises. Finally, the parameter θ determines the importance of the wealth term. If $\theta = 0$ the utility function reduces to the simple CRRA form used in the standard precautionary savings model.

[10] Originally, the Stone-Geary parameter provides a subsistence level of consumption. In this case it provides a threshold level for wealth. See Francis (2005a).

The inclusion of the term for wealth in the utility function, the so-called "capitalist spirit", provides a rationale for all agents with high permanent income to save at high rates, no matter if they have children or not. The exact reasons why agents value wealth remain unspecified in the framework and allow a flexible interpretation: For agents with children the capitalist spirit could be interpreted as a bequest motive. For agents without children the reasons why wealth might be valued for its own sake are numerous and need not be homogenous across agents: wealth might yield utility as it confers status. Alternatively wealth might yield power and influence and is therefore valued by agents.

4.1.3 Budget Constraint

It is assumed that agents receive strictly positive labour income ($y_t^{i,s}$) between age 21 and 65, which is given exogenously. Once agents retire they do not earn labour income anymore but instead receive a pension ($p_t^{i,s}$) which is provided by the government. Moreover, agents are assumed to start economic life without any assets, which implies that $a_{s-1}^{i,s} = 0$. The budget constraint for agent i in period t, who started economic life in year s is given by:

$$\left(1+\tau^{c}\right)\cdot c_t^{i,s} + a_t^{i,s} = \left[1+\left(1-\tau^{k}\right)\cdot r_t\right]\cdot\left(a_{t-1}^{i,s} + b_t^{i,s}\right) + \left(1-\bar{\tau}_{i,s,t}^{l}\right)\cdot\left(1-\tau^{p}\right)\cdot y_t^{i,s} + \left(1-\bar{\tau}_{i,s,t}^{l}\right)\cdot p_t^{i,s} \quad (3)$$

Consumption is denoted by $c_t^{i,s}$, the gross interest rate by r_t, bequests received by $b_t^{i,s}$ and net assets by $a_t^{i,s}$. The capital income tax, pension tax, consumption tax and average labour income tax applicable to the agent are denoted by τ^{k}, τ^{p}, τ^{c} and $\bar{\tau}_{i,s,t}^{l}$ respectively. In addition to the budget constraint, agents also face a borrowing constraint which prohibits them to hold negative net assets in any period of their life:

$$a_t^{i,s} \geq 0 \quad \forall t \in \left[s,\ \ s+59\right] \quad (4)$$

4.1.4 Decision Problem and First-Order Conditions

Agents choose sequences of consumption and assets that maximize lifetime utility (2) subject to the budget constraint (3) and the borrowing constraint (4). As long as the borrowing constraint is not binding this dynamic optimization problem yields the following first order condition that needs to be satisfied in every period of the agent's life:

$$u'\left(c_t^{i,s}\right)=\left(1+\tau^c\right)\cdot v'\left(a_t^{i,s}\right)+\beta\cdot\left[1+\left(1-\tau^k\right)\cdot r_{t+1}\right]\cdot u'\left(c_{t+1}^{i,s}\right) \tag{5}$$

Substituting in the marginal utilities of consumption and wealth yields:

$$\left(c_t^{i,s}\right)^{-\mu}=\left(1+\tau^c\right)\cdot\theta\cdot\left(a_t^{i,s}+\gamma\right)^{-\rho}+\beta\cdot\left[1+\left(1-\tau^k\right)\cdot r_{t+1}\right]\cdot\left(c_{t+1}^{i,s}\right)^{-\mu} \tag{6}$$

Compared to the standard life-cycle model where only consumption yields utility, the first-order condition with capitalist spirit preferences includes an additional term for the marginal utility of wealth. The intuition behind this optimality condition is the following: Consuming Δ more in period t yields direct utility of $\Delta\cdot u'\left(c_t^{i,s}\right)$. On the other hand, saving Δ in period t allows the agent to gain utility of $\Delta\cdot\left[1+\left(1-\tau^k\right)\cdot r_{t+1}\right]\cdot u'\left(c_{t+1}^{i,s}\right)$ in period t+1 through additional consumption, plus the direct utility of $\Delta\cdot\left(1+\tau^c\right)\cdot v'\left(a_t^{i,s}\right)$ that results in period t through the increase in wealth. In order to maximize lifetime utility, agents need to equate the marginal utilities associated with saving and consuming in all periods. In the last period of an agent's life, the first-order condition given by (5) / (6) reduces to:

$$u'\left(c_t^{i,s}\right)=\left(1+\tau^c\right)\cdot v'\left(a_t^{i,s}\right) \tag{7}$$

$$\left(c_t^{i,s}\right)^{-\mu}=\left(1+\tau^c\right)\cdot\theta\cdot\left(a_t^{i,s}+\gamma\right)^{-\rho} \tag{8}$$

This is due to the fact that the agent dies at the end of the period and no further utility will accrue. From expression (7) it can be seen that agents with sufficiently high permanent income will choose to die with positive net wealth, as the marginal utility of consumption is decreasing. On the other hand, agents with low permanent income would choose to die in debt if they were allowed to. This follows from the fact that γ is assumed to be positive and hence the marginal utility of consumption is higher than the marginal utility of wealth for initial levels of consumption. If permanent income is lower than these initial consumption levels, the agent will choose to die in debt in order to increase the marginal utility of wealth and lower that of consumption. It is therefore necessary to impose the condition that last period wealth must be greater or equal to zero for any model with capitalist spirit preferences, even if one assumes that agents do not face a borrowing constraint.

Looking at the first order condition more closely, it becomes clear that consumption will increase over time if the following condition is met:

$$\beta \cdot \left[1 + \left(1 - \tau^{k}\right) \cdot r_{t+1}\right] > 1 - \frac{\left(1 + \tau^{c}\right) \cdot v'\left(a_{t}^{i,s}\right)}{u'\left(c_{t+1}^{i,s}\right)} \tag{9}$$

Compared to the standard life-cycle condition for consumption growth, the inequality contains an additional term for the marginal utilities of wealth and consumption. As both marginal utilities are always positive, the right hand side of the inequality is smaller than for the life-cycle model, implying that consumption can increase even if the product of the time preference parameter and the net interest rate is below one. This applies in particular to agents with high levels of permanent income, because for them the ratio of the marginal utility of wealth to the marginal utility of consumption will be greater due to the fact that the marginal utility of consumption decreases faster than that of wealth.

4.2 The Earnings Process

Labour income is given exogenously in the model.[11] Agents start to work at age 21 and retire when turning 66, i.e. agents work for 45 years. During retirement it is assumed that labour income is equal to zero for all agents. The income process used in this thesis is the same as in Domeij and Flodén (2007b). Agents are heterogeneous in terms of their characteristics and thus face idiosyncratic income paths. Log income is assumed to depend deterministically on a polynomial of age, the education level and the family composition. Moreover, each agent’s income is characterized by an idiosyncratic fixed effect and a permanent component that is assumed to follow a random walk. In addition, income is also subject to a temporary shock in every period. The earnings process can therefore be described by the following equations:

$$\ln y_{t}^{i,s} = x_{t}^{i,s}\alpha + \psi_{t}^{i,s} + \delta^{i,s} + \varepsilon_{t}^{i,s} \tag{10}$$

$$\psi_{t}^{i,s} = \psi_{t-1}^{i,s} + \eta_{t}^{i,s} \tag{11}$$

[11] Throughout the thesis the terms earnings and labour income will be used synonymously.

where $x_t^{i,s}$ represents a vector of household observables (age, education, family composition) and α the corresponding regression coefficients, $\psi_t^{i,s}$ is the permanent earnings component, $\eta_t^{i,s}$ is the permanent earnings shock, $\delta^{i,s}$ is the permanent fixed effect that is drawn at the beginning of an agent's economic life and $\varepsilon_t^{i,s}$ is the temporary earnings shock. All random shocks and components are assumed to be normally distributed with zero mean and constant variance over time and across individuals:

$$\delta^{i,s} \sim N\left(0, \sigma_\delta^2\right) \tag{12}$$

$$\varepsilon_t^{i,s} \sim N\left(0, \sigma_\varepsilon^2\right) \tag{13}$$

$$\eta_t^{i,s} \sim N\left(0, \sigma_\eta^2\right) \tag{14}$$

4.3 The Government

The government levies a proportional tax on capital income (τ^k) and consumption expenditure (τ^c) and a progressive tax (τ^l) on pension benefits and on labour income net of pension contributions. Similar to Elger and Lindqvist (2007) the progressive labour income tax is modelled as a system of income brackets I_j to which different marginal tax rates τ_j^l apply. Income below the threshold level I_0 is tax deductible. For example if $I_1 < \left(1-\tau^p\right)\cdot y_t^{i,s}$ then total labour income taxes paid are:

$$T_t^{i,s} = \tau_1^l \cdot \left(I_1 - I_0\right) + \tau_2^l \cdot \left[\left(1-\tau^p\right)\cdot y_t^{i,s} - I_1\right]$$

and the average labour income tax paid is given by:

$$\bar{\tau}_{i,s,t}^l = \frac{T_t^{i,s}}{\left(1-\tau^p\right)\cdot y_t^{i,s}} \tag{15}$$

Furthermore, the government is assumed to operate a simple pension system. A proportional pension tax (τ^p) is levied on gross earnings and there is no cut-off point for pension contributions. Pension tax receipts are used by the government to pay out a common lump-sum pension benefit to every retired person. Pension benefits therefore do not depend on the level of individual contributions to the system or on past earnings. Even though the assumed system is much simpler than in reality, the results by Domeij and Klein (2002) indicate that for the purpose of explaining the bottom part of the wealth distribution, the Swedish pension system is well approximated by a system with lump-sum benefits.

5 Calibration

After having established the model structure in the previous section, the calibration of the relevant parameters to simulate the model will be presented in the section below. The parameter estimates for the earnings process are taken from Domeij and Flodén (2007b), who estimate these parameters from the LINDA database with GMM using level moments. The estimated variance of the fixed effect is $\sigma_\delta^2 = 0.0189$, that of the temporary income shock is $\sigma_\varepsilon^2 = 0.0422$ and that of the permanent income shock is $\sigma_\eta^2 = 0.0043$. The parameter estimates for the deterministic components of the earnings process are for the year 1994 and have been obtained from Martin Flodén upon request. A detailed table including all estimated parameter values for the earnings process as well as the distribution of education levels and family composition across the population can be found in the appendix. For the simulation of the income paths it is assumed that the education level and family composition of each agent is constant over time. As the parameters of the earnings process are estimated with data in real 2004 SEK, the simulated income paths are deflated back to their nominal level in 1994 with the CPI.[12]

The coefficient of relative risk aversion for consumption μ is set to 2 as in Francis (2005a) and Reiter (2004). This is in line with standard parameter values used in the literature on precautionary savings. The parameter θ which controls the strength of the capitalist spirit is set equal to 1. A number of different parameter values are investigated for ρ and γ to better assess the effect of capitalist spirit preferences on consumption, savings and the distribution of wealth. In order to use similar parameter values as Francis (2005a) and Reiter (2004) I divide the simulated income paths by 10 as this is approximately the SEK/US$ exchange

[12] The CPI was 279 in 2004 and 249 in 1994, which results in a deflation factor of 0.89 (The CPI data was taken from the SCB homepage).

rate.[13] The gross interest rate earned on assets is assumed to be constant over time and calibrated at 3 pecent p.a. as in Domeij and Klein (2002). The discount factor β is calibrated at 0.96 as in Francis (2005a).

As the income process is estimated for 1994, all tax figures are chosen at the level prevailing in that year if data was available.[14] The capital income tax is set at 30 percent, which is the level that prevails since the tax reform in 1991. The deduction levels for labour income were between SEK 8,800 and SEK 17,800 in 1994. I take SEK 10,000 as the standard deduction level for all income levels. Income above this deduction level is taxed at the average local tax rate of 31.5 percent.[15] In addition, all income above SEK 198,700 is subject to central government income tax at 20 percent. As consumption is treated as a homogenous good in the model an average consumption tax is needed. I calculate the consumption tax by dividing total net VAT revenue of SEK 176 bn by total nominal household consumption expenditure of SEK 921 bn.[16] The consumption tax is therefore set at 19.1 percent. The proportional pension tax is set at 16 percent.

Table 5.1: Calibrated parameters of the model

Parameter	Definition	Calibrated Value
μ	Coefficient of relative risk aversion (cons.)	2
ρ	Coefficient of relative risk aversion (wealth)	1.7 / 1.1
γ	Intercept parameter (wealth)	0.5m/0.15m/5m/800m
θ	Strength of the capitalist spirit	1
β	Discount factor	0.96
τ^c	Consumption tax	19.1 %
τ^k	Capital income tax	30.0 %
τ^p	Pension tax	16.0 %
τ_1^l	Marginal labour income tax (10000 – 198700)	31.5 %
τ_2^l	Marginal labour income tax (>1987000)	51.5 %

[13] The effect on savings and the wealth distribution for a given choice of ρ and γ depends on the absolute value of income.

[14] All tax data is taken from the Swedish Tax Agency (2007).

[15] This is the average local tax rate for 1995, because figures for 1994 were not available.

[16] These figures are for 1996. VAT figures before 1996 exclude certain payments and it therefore seems more appropriate to take figures for 1996 to arrive at a representative consumption tax rate. The value for household consumption expenditure has been taken from the SCB homepage.

6 Simulation Results

The results of the model simulation are analyzed in this section. At first, the simulated income distribution is presented as this is the major input into the model. This is followed by a comparison and analysis of the saving paths under different parameter calibrations. The next sub-section focuses on the consumption paths and their plausibility. Finally, the wealth distributions for the various calibrations are presented and interpreted.

The model was solved for five generations that are linked through bequests, each generation consisting of 10,000 agents. In a first step the lifetime earnings profiles for all agents in the model were simulated. In a second step, the model was solved for all agents using numerical methods to approximate the solutions. As each generation in the model faces the same distribution in terms of gender, family composition, education, and income shocks, the last generation that the model was solved for was assumed to be representative of all generations inhabiting the economy. The cross-sectional income and wealth distributions that are presented in the following part are therefore based on the life-cycle profiles of the last generation. All nominal numbers reported are in SEK 100,000.

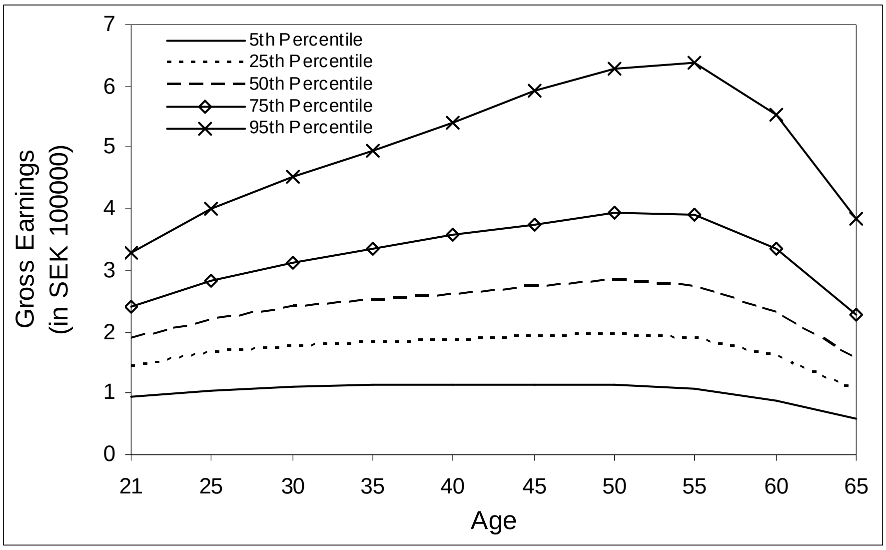
6.1 The Income Distribution

The main descriptive statistics for the simulated income distribution can be found in *Table 6.1*. The simulated income distribution fits the data reasonably well: The mean for gross earnings of SEK 270,000 is fairly close to the deflated figure for 1994 of SEK 260,000 that is reported in Domeij and Flodén (2007a). The simulated gini coefficient for gross earnings of 0.27 also closely matches the value of 0.26 reported in Domeij (2006). It can also be seen that the tax system has an equalizing effect on the income distribution, with the gini coefficient for after tax earnings being 0.23. The gini coefficient for disposable income was found to be higher than for after tax income but lower than for gross income. The exact shape of the disposable income distribution varies depending on the calibration of the capitalist spirit parameters, due to their effect on the distribution of wealth. As an example, the disposable income distribution for the calibration with $\rho = 1.7$ and $\gamma = 0.5m$ is also included in the table. *Figure 6.1* displays the percentiles of the simulated gross income distribution by age.

Table 6.1: Descriptive statistics of the simulated income distribution

Deciles	Disp. Income	Gross Earnings	After Tax Earnings
1st	0.04	0.04	0.04
2nd	0.05	0.05	0.06
3rd	0.07	0.06	0.07
4th	0.08	0.07	0.08
5th	0.09	0.08	0.09
6th	0.10	0.10	0.10
7th	0.11	0.11	0.11
8th	0.12	0.12	0.12
9th	0.14	0.15	0.14
10th	0.20	0.21	0.19
Top 5%	0.11	0.12	0.11
Top 1%	0.03	0.03	0.03
Gini coefficient	0.24	0.27	0.23
Mean	1.58	2.70	1.47
Median	1.49	2.42	1.41
Std. Dev.	0.72	1.42	0.64
Max	13.55	27.08	11.46
Min	0.10	0.11	0.10

Figure 6.1: Percentiles for gross earnings by age



6.2 Saving Profiles over the Life-Cycle

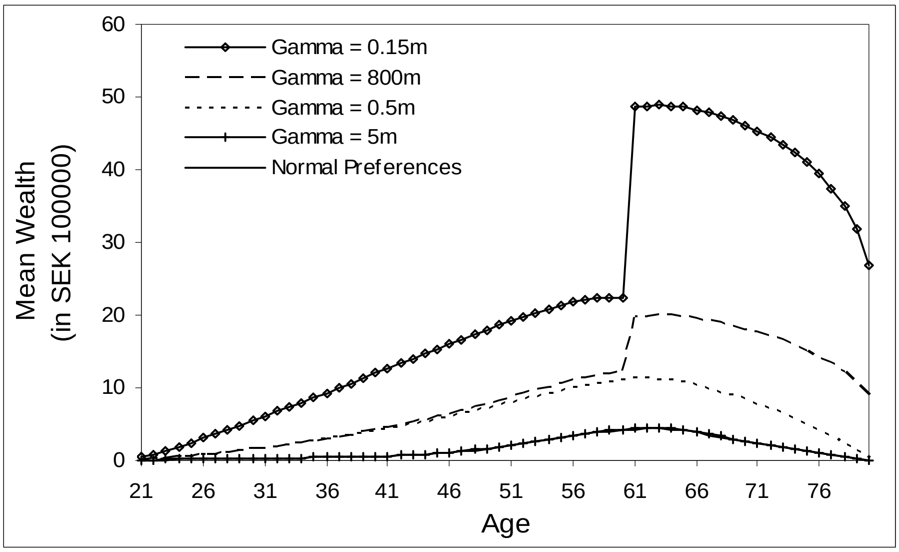
As mentioned in the section on the calibration of the parameters, the model has been solved for a number of different parameter combinations for the wealth term of the utility function in order to better understand the dynamics of the model. The parameter combinations have been chosen so that only part of the population will die with wealth. The parameter combinations used were $\gamma = 0.5m/\rho = 1.7$, $\gamma = 0.15m/\rho = 1.7$, $\gamma = 5m/\rho = 1.7$ and $\gamma = 800m/\rho = 1.1$. Looking at *Figure 6.2* it is obvious that capitalist spirit preferences have the effect of raising overall savings in the economy compared to the normal life-cycle model. Mean wealth holdings are greater or equal compared to those in the standard life-cycle model at any age. The reason for this becomes clear when one recalls the first-order condition given by (5):

$$u'\left(c_t^{i,s}\right) = \left(1+\tau^c\right)\cdot v'\left(a_t^{i,s}\right) + \beta\cdot\left[1+\left(1-\tau^k\right)\cdot r_{t+1}\right]\cdot u'\left(c_{t+1}^{i,s}\right)$$

As the marginal utility of wealth is always positive, the right hand side of the above equation is larger than in the standard life-cycle model. Hence, consumption at time t must be smaller in order to increase the marginal utility, implying that saving is larger. The smaller the marginal utility of wealth, the smaller will be the difference in savings between the capitalist spirit model and the standard life-cycle model. This can also be seen from *Figure 6.2*: For the simulation with $\gamma = 5m/\rho = 1.7$ there is virtually no difference in aggregate savings to the standard life-cycle model. The other three calibrations are characterized by much larger average savings than the standard life-cycle model, as the marginal utility of wealth is greater with these parameter values.[17]

[17] A comparison of the marginal utilities can be found in the appendix.

Figure 6.2: Mean wealth by age for different calibrations of the model

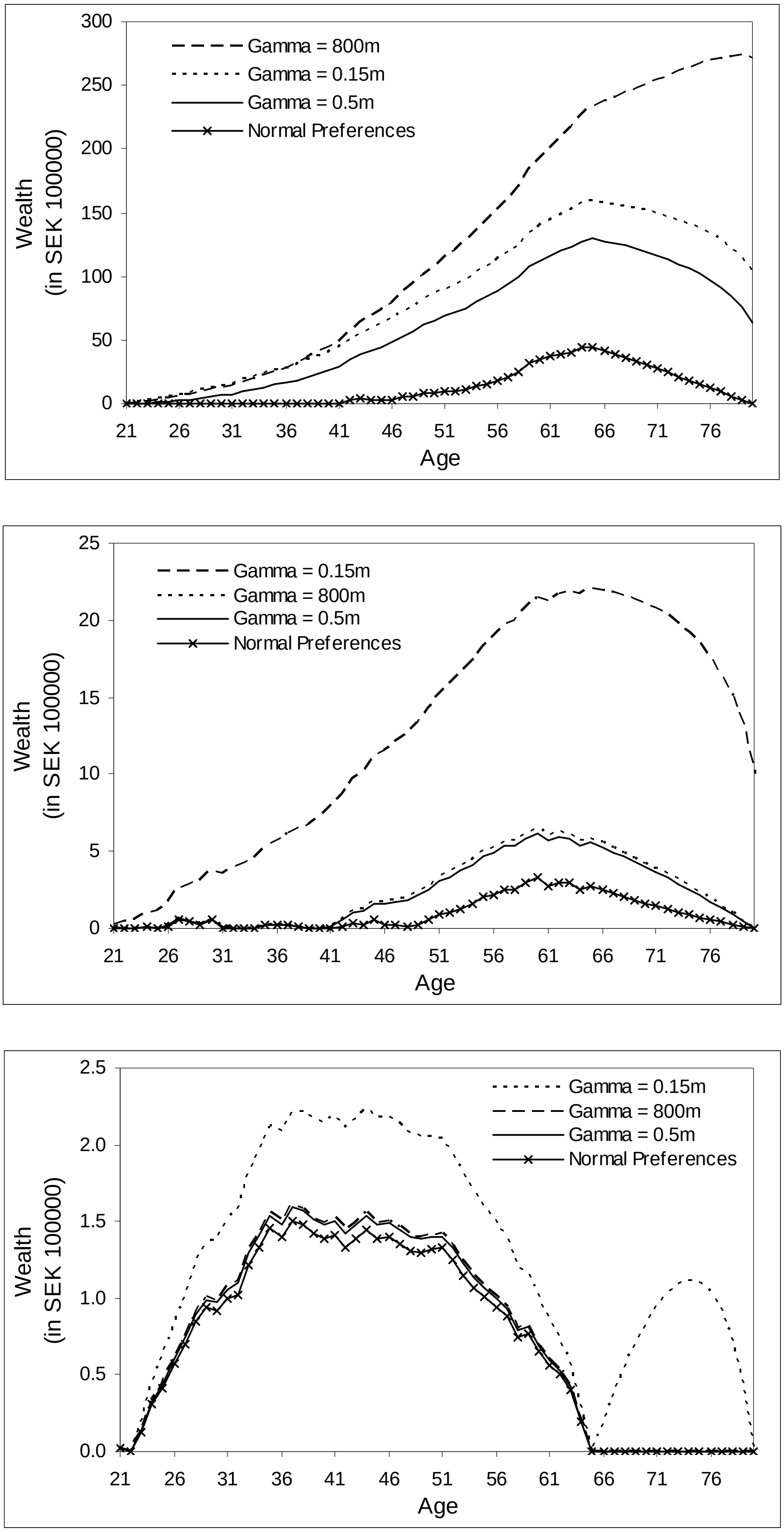


The jumps in mean savings for the calibrations with γ = 0.15m/ρ = 1.7 and γ = 800m/ρ = 1.1 are due to bequests. As there is no lifetime uncertainty in the model, bequests are always received at age 61. Bequests are very low for the calibration with γ = 0.5m/ρ = 1.7 as only people who draw the highest levels of permanent income choose to die with wealth. For the calibration with γ = 800m/ρ = 1.1 only slightly more people leave bequests, but the people that leave bequests leave fairly large ones. Finally, in the calibration with γ = 0.15m/ρ = 1.7 almost every agent chooses to die with wealth, making aggregate bequests very large as can be seen from *Figure 6.2.* These observations lead to the next characteristics of the capitalist spirit model, the saving profiles for different levels of permanent income.

Figure 6.3 displays the life-cycle saving paths of a high income, middle income and low income agent for the various model calibrations.[18] The saving paths for the calibration with γ = 5m/ρ = 1.7 have been excluded as they are almost identical to the paths with normal preferences. As can be seen from the figure, capitalist spirit preferences lead to heterogeneous saving paths for different levels of permanent income.

[18] The saving paths are for one particular stochastic realization of a high income, middle income and low income path. For another agent with similar permanent income the saving path will therefore look slightly different. This is however not a problem for the analysis, as the focus is on the difference of the saving paths for different parameter calibrations given the same income path.

Figure 6.3: Sample saving profiles for a high, middle and low income agent



The heterogeneity in the saving paths depends on the calibration of the capitalist spirit parameters: the parameter ρ determines how quickly the marginal utility of wealth decreases, while the intercept parameter γ determines the level of permanent income above which agents choose to die with wealth. The lower ρ is, the slower is the decrease in the marginal utility of wealth and for any given ρ, a higher γ increases the threshold level of permanent income beyond which agents choose to die with wealth. At this point it is important to mention that capitalist spirit preferences are active for all agents in the economy and therefore will affect their saving profiles, irrespective of income. Only the magnitude by which capitalist spirit preferences affect the saving behaviour of the agent will depend on his income.

For low income agents, the saving behaviour is not much different to the life-cycle model except for the calibration with $\gamma = 0.15m/\rho = 1.7$. Agents save while working to smooth consumption and they decumulate all assets before retirement as the pension provided by the government is higher than the level of permanent income. The hump-shaped savings during retirement for the calibration with $\gamma = 0.15m/\rho = 1.7$ shows that the wealth term can also be of importance for low-income agents, even if they do not choose to die with wealth: saving during the initial periods of retirement generates enough utility of wealth to induce the agent to delay consumption.[19]

For middle income agents, the difference in saving behaviour compared to the life-cycle model is already more pronounced. For the calibrations with $\gamma = 0.5m/\rho = 1.7$ and $\gamma = 800m/\rho = 1.1$ the marginal utility of wealth is still low enough so that agents choose to leave no wealth behind when they die. However, the wealth term in the utility function induces them to save more in their middle ages. For the calibration with $\gamma = 0.15m/\rho = 1.7$, middle income agents already choose to leave significant wealth behind when they die. This is due to the lower intercept parameter compared to the case with $\gamma = 0.5m$.

For all three calibrations, high income agents have substantially different saving paths compared to the life-cycle model and they leave behind sizeable amounts of wealth. The calibration with $\gamma = 800m/\rho = 1.1$ results in the most extreme savings path. This is due to the fact that once the threshold level of permanent income at which wealth is left behind is reached, the amount of wealth left behind increases fairly rapidly as the level of permanent

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[19] This mechanism will be explored in further detail below in the section on consumption dynamics.

income rises due to the slow decrease in the marginal utility of wealth resulting from the low parameter of $\rho = 1.1$.

In summary, capitalist spirit preferences seem to induce the heterogeneity in the saving behaviour of agents with different level of permanent income, for which they were proposed by Carroll (1998). The degree of heterogeneity crucially depends on the calibration of the parameters of the wealth term in the utility function.

6.3 Consumption Dynamics

The consumption paths for the same levels of income as above are displayed in *Figure 6.4*. Even though consumption is just the other side of saving and therefore simply represents the model results from the opposite viewpoint, the graphs below help in understanding what drives saving in the capitalist spirit model. The most striking aspect about the consumption paths is that consumption increases exponentially in the last model periods for the agents for whom the wealth term in the utility function is most relevant. It has been mentioned in section 4.1.4 that consumption will increase if inequality (9) is fulfilled. But in order to better understand why consumption increases so drastically it is helpful to look again at the first order condition given by (5):

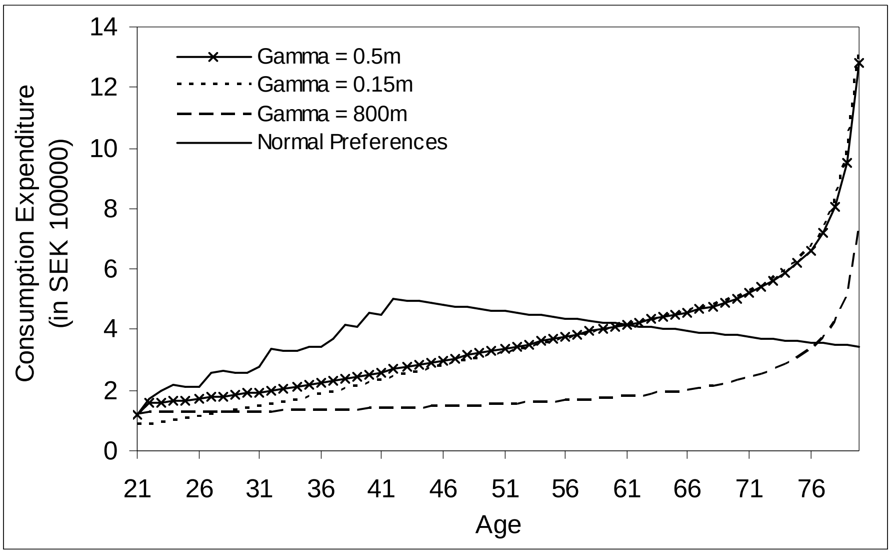
$$u'\left(c_t^{i,s}\right) = \left(1+\tau^c\right)\cdot v'\left(a_t^{i,s}\right) + \beta \cdot \left[1+\left(1-\tau^k\right)\cdot r_{t+1}\right] \cdot u'\left(c_{t+1}^{i,s}\right)$$

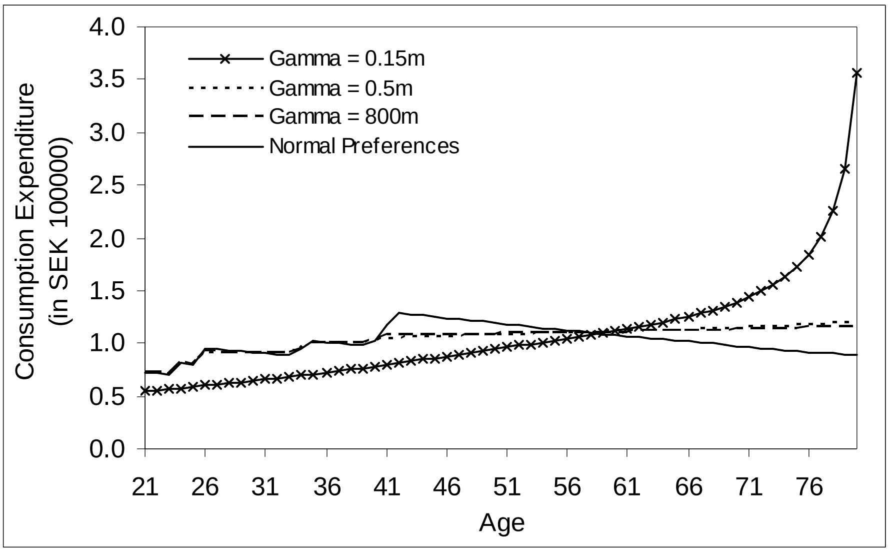
As this condition needs to be fulfilled in every period, we can iteratively substitute next period's marginal utility of consumption with the respective first-order condition until the last period. Under the assumption that the interest rate is constant across time, consumption in any period can therefore be expressed as:

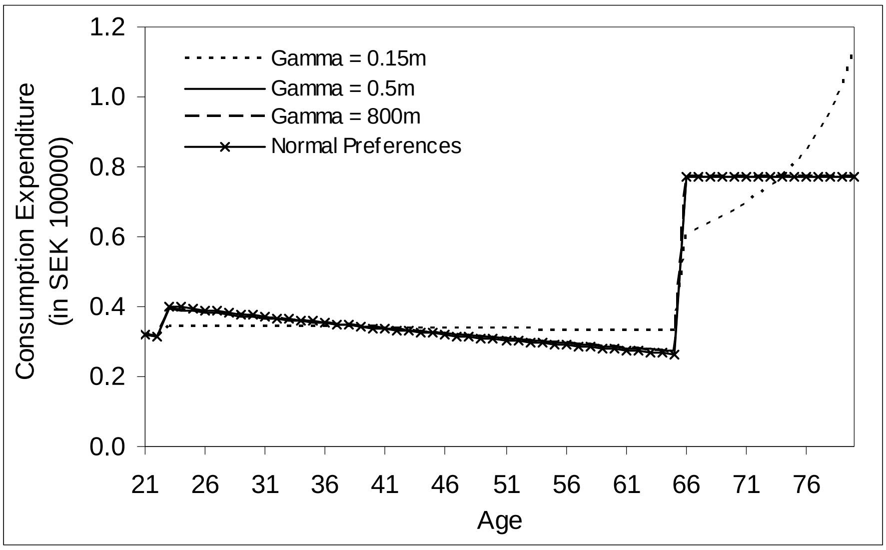
$$u'\left(c_t^{i,s}\right) = \sum_{j=t}^{s+59} \beta^{j-t} \cdot \left[1+\left(1-\tau^k\right)\cdot r_{t+1}\right]^{j-t} \cdot \left(1+\tau^c\right)\cdot v'\left(a_j^{i,s}\right) \qquad (16)$$

In words, the above expression means that the marginal utility of consumption at time t must be equal to the sum of all discounted present and future marginal utilities of wealth. The intuition behind this condition is straightforward: Consuming Δ more in period t yields direct utility of $\Delta \cdot u'\left(c_t^{i,s}\right)$. On the other hand, saving Δ allows the agent to gain direct utility of $\Delta \cdot \left(1+\tau^c\right)\cdot v'\left(a_t^{i,s}\right)$ in period t through the increase in wealth. But the increase in wealth is still there in the next period leading to utility of $\Delta \cdot \beta \cdot \left[1+\left(1-\tau^{k}\right) \cdot r_{t+1}\right] \cdot \left(1+\tau^{c}\right) \cdot v'\left(a_{t+1}^{i,s}\right)$. The same logic continues up to the last period, resulting in the sum in equation (16). Each period closer to the agent's death, one term for the marginal utility of wealth drops out of the sum. If inequality (9) is fulfilled, this implies that the right hand side of (16) gets smaller each period. This in turn implies that the marginal utility of consumption needs to decrease, i.e. that consumption will increase. If the wealth term in the utility function is of importance, capitalist spirit preferences therefore induce agents to save particularly in younger years, as the reward in terms of utility through wealth is high. However, this dynamic has the undesirable side-effect that consumption increases drastically towards the end of the agent's life for all agents for whom the capitalist spirit term is of importance. This model feature is clearly unrealistic.

Figure 6.4: Sample consumption profiles for a high, middle and low income agent







6.4 The Distribution of Wealth

After having looked at the saving profiles for different levels of permanent income, the resulting distributions of wealth will be examined in this section. *Tables 6.2 and 6.3* below summarize the wealth distributions for the various model calibrations. The most surprising result is that the calibrations with γ = 0.5m/ρ = 1.7 and γ = 0.15m/ρ = 1.7 result in a more equal wealth distribution than the standard life-cycle model with gini coefficients of 0.61 and 0.48 respectively, while the life-cycle model results in a gini coefficient of 0.68. The wealth shares of the top 1 percent and 5 percent of the distribution are also lower than for the life-cycle model.

At first, these results seem counterintuitive because the calibrations result in more heterogeneity in the saving paths of agents. However, recalling that the incentive to save with capitalist spirit preferences is particularly strong for younger agents gives an explanation for the more equal distribution of wealth: even though the distribution of wealth can become more unequal within an age cohort, especially towards the end of the life-cycle, the difference in savings between young, middle aged and old agents gets smaller. This can be seen from *Figure 6.5* below which plots the ratios of median savings for young and old agents compared to middle age agents. Higher ratios imply more equal wealth holdings and clearly the standard life-cycle model exhibits the lowest ratios.

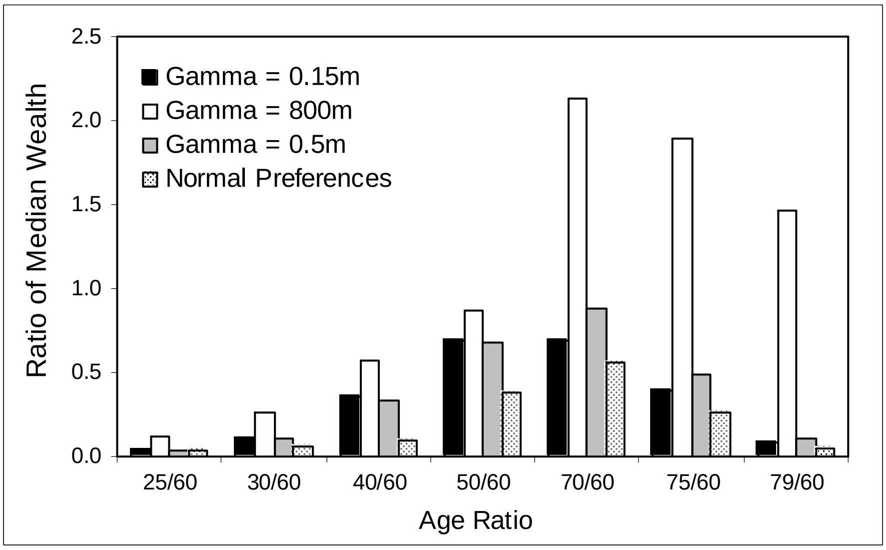
Table 6.2: The distribution of net wealth – Shares held by deciles

Deciles	Data	$\gamma = 0.5m$ $\rho = 1.7$	$\gamma = 0.15m$ $\rho = 1.7$	Life-Cycle Model
1st	-0.06	0.00	0.00	0.00
2nd	-0.01	0.00	0.02	0.00
3rd	0.00	0.01	0.03	0.01
4th	0.01	0.02	0.05	0.01
5th	0.03	0.04	0.06	0.03
6th	0.06	0.07	0.09	0.04
7th	0.10	0.10	0.11	0.08
8th	0.15	0.14	0.15	0.13
9th	0.22	0.21	0.20	0.23
10th	0.50	0.40	0.29	0.47
Top 5%	0.33	0.25	0.16	0.31
Top 1%	0.13	0.07	0.04	0.09
Share ≤ 0	0.24	0.08	0.002	0.18
Gini coefficient	0.79	0.61	0.48	0.68

Table 6.3: The distribution of net wealth – Shares held by deciles

Deciles	Data	$\gamma = 800m$ $\rho = 1.1$ 5th generation	$\gamma = 800m$ $\rho = 1.1$ 1st generation	$\gamma = 5m$ $\rho = 1.7$
1st	-0.06	0.00	0.00	0.00
2nd	-0.01	0.00	0.00	0.00
3rd	0.00	0.01	0.01	0.01
4th	0.01	0.01	0.02	0.01
5th	0.03	0.02	0.03	0.03
6th	0.06	0.04	0.05	0.04
7th	0.10	0.06	0.08	0.08
8th	0.15	0.10	0.12	0.13
9th	0.22	0.16	0.19	0.22
10th	0.50	0.59	0.50	0.47
Top 5%	0.33	0.45	0.35	0.30
Top 1%	0.13	0.21	0.12	0.09
Share ≤ 0	0.24	0.09	0.09	0.17
Gini	0.79	0.74	0.68	0.68

Figure 6.5: Ratios of median wealth by age



The most interesting calibration is the one with $\gamma = 800m/\rho = 1.1$. The wealth distribution for the first generation that has not received any bequests displays the same level of wealth inequality as the standard life-cycle model with a gini coefficient of 0.68. However, this calibration of the capitalist spirit model does result in higher shares of wealth held by the richest part of the population. The shares of wealth held by the top 1, 5 and 10 percent of the population are 12, 35 and 50 percent respectively which come fairly close to the levels of 13, 33 and 50 percent seen in the data.[20]

Looking at the distribution of wealth for the fifth generation of the same calibration, it is striking that wealth inequality has increased substantially. The gini coefficient is now 0.74 and the wealth shares held by the richest 1, 5 and 10 percent are now 21, 45 and 59 percent respectively. These figures come close to the numbers of 19.5, 40.9 and 58 percent reported by Lindh and Ohlsson (1998). The mechanism that causes the increase in wealth inequality is that very large bequests occur occasionally and the agent inheriting the wealth will leave an even larger amount of wealth behind and so on. Inherited wealth therefore increases over time and the distribution of wealth will become more unequal. The richest part of the population is thus made up of older agents (>60) that have inherited large estates. This can also be seen from *Figures 6.6 and 6.7* which plot the wealth percentiles over the life-cycle for both generations.

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[20] It needs to be kept in mind that the data probably underestimates the shares of wealth held by the richest part of the population.

Figure 6.6: Percentiles of the wealth distribution per age for γ = 800m and ρ = 1.1 (1st generation)

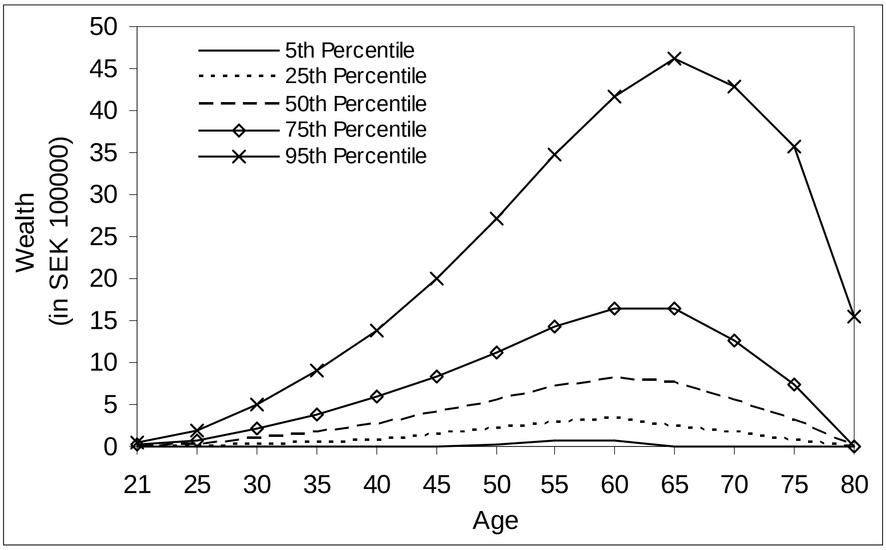
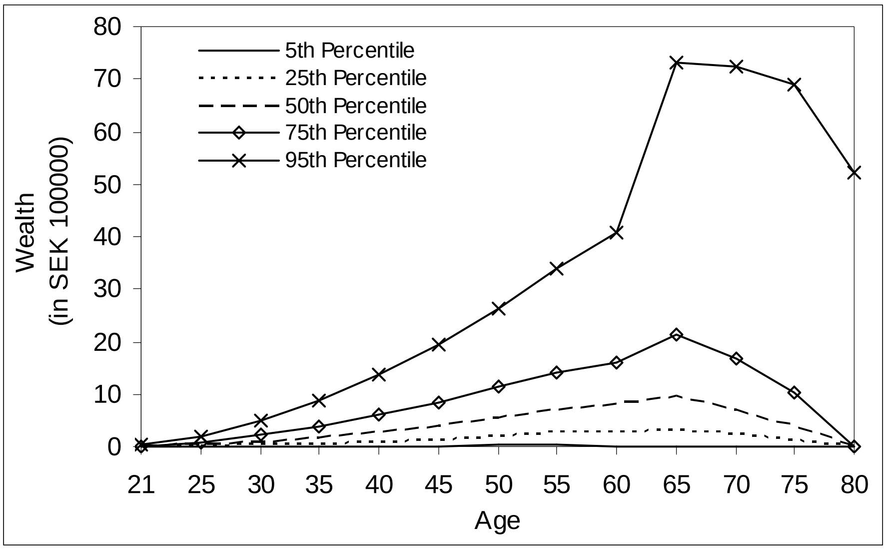


Figure 6.7: Percentiles of the wealth distribution per age for γ = 800m and ρ = 1.1 (5th generation)



Figures 6.8 to 6.10 plot the percentiles of the wealth distribution by age for the other model calibrations. The figures confirm the conclusions drawn above. The difference in savings between young, middle aged and old agents is largest for the life-cycle model. For the calibration with γ = 0.15m and ρ = 1.7 almost every agent chooses to die with wealth which has an equalizing effect on the wealth distribution and the resulting gini coefficient is therefore quite low with 0.48. The percentile shapes for the calibration with γ = 0.5m and ρ = 1.7 are similar to the life-cycle model only that young people save more which reduces the gini coefficient to 0.61.

Figure 6.8: Percentiles of the wealth distribution per age for γ = 0.15m and ρ = 1.7

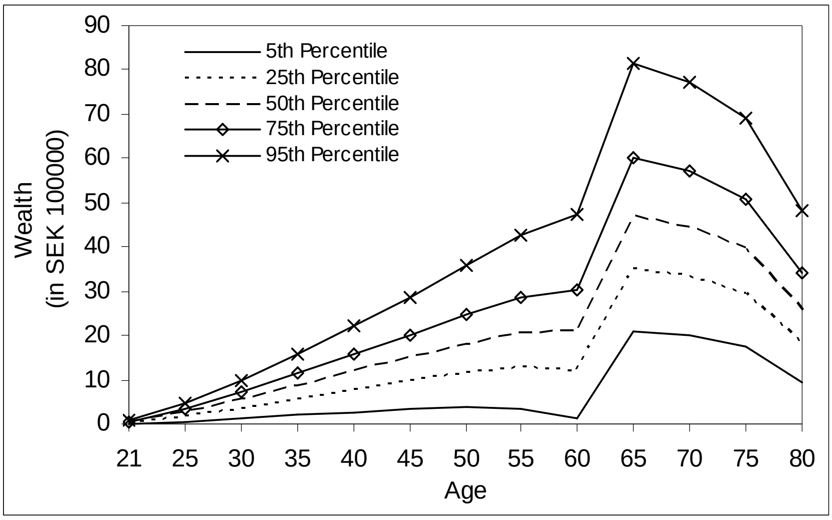


Figure 6.9: Percentiles of the wealth distribution per age for γ = 0.5m and ρ = 1.7

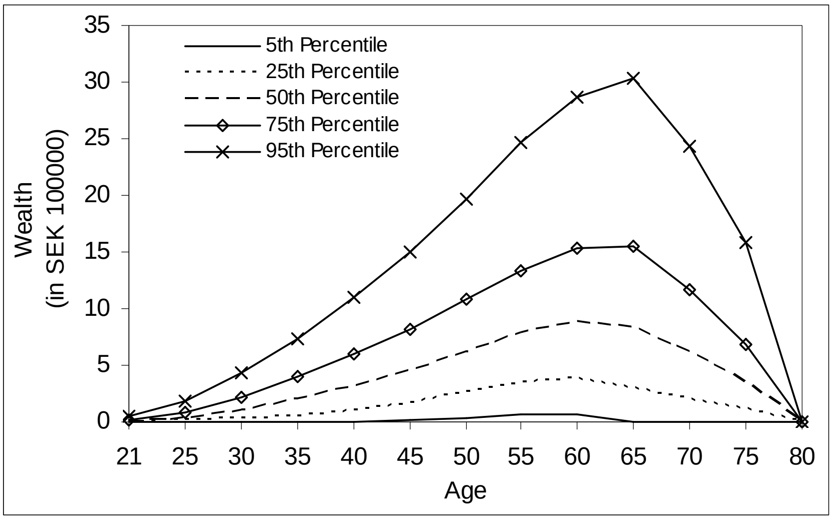
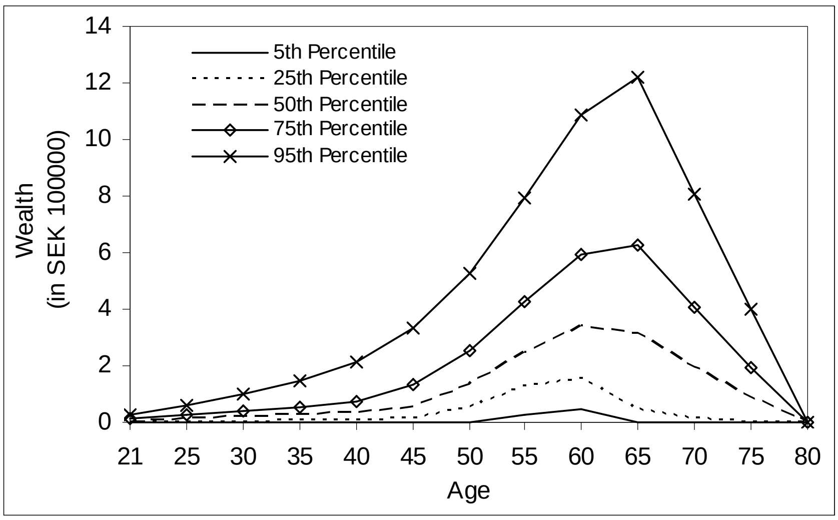


Figure 6.10: Percentiles of the wealth distribution per age for normal preferences



As can be seen from *Table 6.3* the model calibration with $\gamma = 5m/\rho = 1.7$ results in essentially the same wealth distribution as the life-cycle model, because the intercept parameter is set so high that the saving behaviour of all agents is only affected marginally as was already noticed in section 6.2.

7 Conclusion

This thesis started out with establishing the empirical regularity that wealth is very unequally distributed and highly concentrated among a small percentage of the population in virtually every country. This phenomenon appears to be driven by the fact that saving rates increase with the level of permanent income. In the literature review it was shown that the standard life-cycle model of consumption and saving fails to account for these empirical facts even when incorporating capital market imperfections, risk and precautionary savings. Moreover, including voluntary bequest motives in the framework does not provide a coherent explanation for the fact that there is no significant difference in the rate of asset decumulation between the elderly with and without children. Finally, even though explicit modelling of entrepreneurial activity helps to account for the high concentration of wealth within the richest percentiles of the population, an additional mechanism such as borrowing constraints is needed in order to induce successful entrepreneurs to save at high rates.

In order to generate the observed heterogeneity in saving behaviour, Carroll (1998) has suggested to include wealth directly into the utility function as a luxury good. The idea behind such a preference structure is that there is an alternative use for income than simply consumption, namely accumulation of wealth for its own sake and this accumulation motive should become more important as the level of permanent income rises. Based on Max Weber’s hypothesis that accumulation of wealth for its own sake is the essential spirit of capitalism, these preferences have become known as capitalist spirit preferences in the literature. The reasons why wealth might yield utility are numerous: it can confer status in society, power and influence, or it can be passed on to children or charitable foundations after death which is a form of altruism.

So far only two authors, Francis (2005a, 2005b) and Reiter (2004) have examined the effect of capitalist spirit preferences on the distribution of wealth. Both authors found that capitalist spirit preferences help to explain the high concentration of wealth in the top end of the distribution in the US. However, neither of these authors considered the resulting consumption and saving profiles in detail. Therefore, the aim of this thesis was to shed more light on the consumption and saving paths that result from a model with capitalist spirit preferences. Moreover, the aim was to determine whether the saving paths from such a model result in a distribution of wealth that is more in line with the empirical facts, as claimed by Francis (2005a, 2005b) and Reiter (2004). In particular, the question was whether capitalist spirit preferences help to explain the high concentration of wealth within the richest percentiles of the population. To address these research questions, a quantitative life-cycle model with capitalist spirit preferences and heterogeneous agents in terms of income was calibrated to Swedish data.

The simulation results from this model allow the following conclusions: First of all, capitalist spirit preferences lead to higher mean and median savings at every age compared to the standard life-cycle model. Second, capitalist spirit preferences lead to higher saving rates as the level of permanent income of the agent increases. The heterogeneity in saving behaviour depends crucially on the nominal levels of income and the parameter values chosen for the wealth term in the utility function. One feature of the particular functional form used in this thesis is that the incentive to save due to the capitalist spirit is greater for agents in their early years of life. This follows from the fact that saving in any period yields utility during all future periods the agent still faces and this number of periods gets less as the agent ages. An unwanted side-effect of this mechanism is that consumption increases exponentially during the last model periods for all agents for whom the capitalist spirit is most relevant. This is clearly unrealistic.

The effect of capitalist spirit preferences on the distribution of wealth is ambiguous. On the one hand, these preferences can lead to more inequality in wealth within an age cohort, especially towards the end of the life-cycle. On the other hand, these preferences lead to less wealth inequality between different age cohorts as the incentive to save is relatively higher for young agents. Without bequests none of the model calibrations examined in this thesis lead to a higher gini coefficient compared to the standard life-cycle model. However, calibrations with a coefficient of relative risk aversion for wealth (ρ) of close to one and an intercept parameter (γ) set high enough to make the capitalist spirit of importance only to the richest agents does lead to a higher concentration of wealth within the richest decile. Allowing for bequests, the same calibration leads to increasing wealth inequality over time as a few agents bequeath ever larger wealth and thus results in a more unequal wealth distribution than the standard life-cycle model. If the parameters of the sub-utility function of wealth (ρ and γ) are chosen so that the capitalist spirit is of importance for almost every agent, the wealth distribution gets more equal compared to the standard life-cycle model.

The findings of this thesis regarding the usefulness of capitalist spirit preferences to account for the higher saving rates of the rich and the enormous concentration of wealth in the top end of the distribution are therefore somewhat more restrictive than the findings by Francis (2005a, 2005b) and Reiter (2004). First of all, capitalist spirit preferences corrupt the consumption paths of the rich towards the end of the life-cycle due to the fact that the incentive to save is larger when the agent is young. Second, the resulting wealth distribution is not necessarily more unequal than the wealth distribution resulting from a standard life-cycle model. This will depend on the choice of capitalist spirit parameters and the inclusion of bequests into the model.

There are a few limitations of the analysis in this thesis that need to be pointed out: First of all this thesis did not adopt a general equilibrium framework and changes in the capitalist spirit parameters were not accompanied by changes in other parameters to keep the capital-output ratio constant. Furthermore, no earnings and lifetime uncertainty was incorporated into the framework. Finally, even though previous studies have found that entrepreneurial choice is an important factor in explaining the high concentration of wealth, this was not incorporated into the model in order to make the numerical solution of the model not too complex

To conclude one can say that capitalist spirit preferences are an attractive theoretical concept to explain differences in saving rates for various levels of permanent income. However, the specific functional form used in this thesis has some undesirable characteristics. In particular, the fact that the incentive to save is higher for younger agents leads to unrealistic consumption paths for richer households. Moreover, this mechanism has the effect of reducing wealth inequality between different age cohorts. It is therefore questionable whether capitalist spirit preferences in the form used throughout this thesis are an accurate description of the behaviour of individuals. Future research should therefore look at other mathematical formulations for capitalist spirit preferences that have less undesirable side-effects.

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Appendix

Table 7.1: Parameter estimates of the income process

Parameter	Associated Variable	Parameter Value
α_0	Constant	7.4524010
α_1	Age	0.4323371
α_2	Age^2	-0.0164358
α_3	Age^3	0.0002818
α_4	Age^4	-0.0000018
α_5	Family dummy 1: male and 1 child	-0.0975115
α_6	Family dummy 2: male and 2 children	-0.1201964
α_7	Family dummy 3: male and 3 children	-0.2568307
α_8	Family dummy 4: male and ≥ 4 children	-0.5787541
α_9	Family dummy 5: female and no children	-0.1586151
α_{10}	Family dummy 6: female and 1 child	-0.3519534
α_{11}	Family dummy 7: female and 2 children	-0.5041866
α_{12}	Family dummy 8: female and 3 children	-0.6494611
α_{13}	Family dummy 9: female and ≥ 4 children	-0.8436839
α_{14}	Family dummy 10: couple and no children	0.2875126
α_{15}	Family dummy 11: couple and 1 child	0.2264280
α_{16}	Family dummy 12: couple and 2 children	0.1568576
α_{17}	Family dummy 13: couple and 3 children	-0.0050642
α_{18}	Family dummy 14: couple and ≥ 4 children	-0.2242931
α_{19}	Education dummy 2: at least some high school	0.1365967
α_{20}	Education dummy 3: at least some university	0.3713649
α_{21}	Consumption equivalents within the family[21]	0.2054259
σ_η	Standard deviation of permanent income shock	0.0655700
σ_δ	Standard deviation of the fixed effect	0.1374800
σ_ε	Standard deviation of the temporary income	0.2054300

Source: Domeij and Flodén (2007b)

[21] The number of consumption equivalents within a family is defined by the “OECD equivalence scale” as follows: The value 1.0 is assigned to the first household member, a value of 0.7 to each additional adult and a value of 0.5 to each child.

Table 7.2: Distribution of education levels and family composition

Variable	Share in the Population in %
Family dummy 0: male and no children	13.49
Family dummy 1: male and 1 child	0.34
Family dummy 2: male and 2 children	0.11
Family dummy 3: male and 3 children	0.03
Family dummy 4: male and ≥ 4 children	0.00
Family dummy 5: female and no children	9.24
Family dummy 6: female and 1 child	1.67
Family dummy 7: female and 2 children	0.98
Family dummy 8: female and 3 children	0.23
Family dummy 9: female and ≥ 4 children	0.04
Family dummy 10: couple and no children	31.08
Family dummy 11: couple and 1 child	16.34
Family dummy 12: couple and 2 children	18.45
Family dummy 13: couple and 3 children	6.47
Family dummy 14: couple and ≥ 4 children	1.53
Education dummy 1: no high school	23.34
Education dummy 2: at least some high school	48.74
Education dummy 3: at least some university	27.93

Source: Domeij and Flodén (2007b)

Table 7.3: Marginal utilities of wealth for the different calibrations of the model

Calibration	Marginal Utility of Wealth for a = 0
$\gamma = 0.5m$ / $\rho = 1.7$	2.05×10^{-10}
$\gamma = 0.15m$ / $\rho = 1.7$	1.59×10^{-9}
$\gamma = 5m$ / $\rho = 1.7$	4.09×10^{-12}
$\gamma = 800m$ / $\rho = 1.1$	1.61×10^{-10}

Table 7.4: Distribution of net wealth in other simulations studies of Sweden

Deciles	**Data**	**Domeij&Klein (2002)**	**DeNardi (2004)**
1^{st}	-0.06	-0.01	
2^{nd}	-0.01	0.00	
3^{rd}	0.00	0.00	
4^{th}	0.01	0.02	
5^{th}	0.03	0.04	
6^{th}	0.06	0.07	
7^{th}	0.10	0.10	
8^{th}	0.15	0.15	
9^{th}	0.22	0.22	
10^{th}	0.50	0.41	
Top 5%	0.33		0.34
Top 1%	0.13	0.07	0.10
Share ≤ 0	0.24	0.22	0.33
Gini	0.79	0.66	0.75