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Fertility as a determinant of household's wealth

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Abstract

This research examines the effect of fertility on household's wealth, savings and reasons to save by conducting empirical analysis. This thesis enhances the current literature on the relationship between fertility and wealth by incorporating recent SCF data (2019) and a comprehensive range of control variables. The study offers a detailed understanding of the relationship between fertility, wealth, saving levels and saving behaviors, and provides additional insight in the non-linear relationship of fertility on wealth by analyzing the effect of the number of children on wealth separately. This paper finds positive significant estimates for fertility on households' savings level. The study also finds that having one child and having five children negatively affects wealth with an average decrease of respectively 150,604 and 423,080 dollars. Fertility positively influences saving for education, family, and home, but negatively affect saving for purchases, retirement, liquidity/future, and investment.

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1 Introduction

In recent years, wealth inequality has emerged as a much-debated topic, with headlines such as "The Wealth Gap in America is Growing, Too" (The New York Times, 2014) and "The World's Wealth is Looking Increasingly Unnatural" (The Economist, 2020) capturing public attention. The publication of Thomas Piketty's book "Capital" in 2014 has only added fuel to the fire, generating widespread interest and attention. Piketty's work provides an analysis of the unequal distribution of wealth and its impact on society, reigniting the conversation around economic inequality and its effects on individuals and nations. The statement that wealth is distributed unevenly is confirmed by the findings of Wolff (2016), who conducted an empirical research in the United States. The results indicate that the top 20% of households in the country held a minimum of 87% of the total net worth in 2013. The Covid-19 pandemic may have intensified the problem of wealth inequality, leading to renewed attention and concern. This is reflected in headlines such as The Economist's (2021) "The pandemic has widened the wealth gap. Should central banks be blamed?" and the Financial Times' (2021) "Wealthy winners take all in the pandemic". A much-debated issue, following from the increased wealth inequality is whether the current distribution of wealth is fair.

Researching wealth inequality is relevant because wealth inequality can have an impact on individuals, communities and society as a whole. High levels of wealth inequality can lead to social and economic disparities, for example in education (Pfeffer, 2018). Wealthier attendants have more resources to invest in their children, such as providing access to tutoring. This, could in turn result in reduced opportunities and hindered economic mobility. Research of Fernholz (2016) shows that economic mobility is indeed decreasing as wealth inequality increases. Furthermore, wealth inequality can affect economic growth negatively. Stiglitz (2016) finds evidence for the fact that, given the extremes of inequality in rich countries, greater equality and improved economic performance are complements. Additionally, there exists a relationship between political processes and wealth concentration. As those with more wealth possess more power (Zucman, 2019).

As wealth inequality impacts society, it gives reason to governments wanting to implement policies to affect wealth inequality. Zucman suggests the following in 2019: “There is need for better democratic transparency on wealth and have better access to data sources, this could contribute to improving the public discussion and the design of tax policies”. In order for policies intending to affect the wealth distribution to be effective or to be able to properly evaluate these policies it is important to understand the determinants of the wealth distribution. Mechanisms of saving behavior are crucial determinants of wealth inequality. The basic mechanism is that households that save more, consequently have a higher level of wealth. In the literature, several saving motives that influence wealth inequality are defined. These motives are intergenerational transmission and bequests, heterogeneity in preferences, earning dynamics, medical expense risk and financial knowledge. Another saving motive that could possibly affect wealth is fertility. So far, research done on the effect of fertility on wealth show mixed results. These mixed findings can be explained by two contradictory mechanisms. The first is that having children could lead to parents increasing their savings to manage expected increase in consumption costs and to save for the care of their children. The second mechanism is that children could decrease wealth because they lead to an increase in expenses, and thus parents have less money left to save. As fertility could be a determinant of wealth it is vital to establish the impact of fertility on wealth by conducting further research. In surveying wealth inequality, the Bewley model is used very often. The Bewley model is a class of macroeconomic models that assume a distribution of individual preferences, income, and constraints in an economy, and that these factors interact to shape the overall distribution of wealth in the economy. By simulating the behavior of (ex-ante) heterogeneous individuals in an economy, the Bewley model can provide insights into the determinants of the wealth distribution. Nevertheless, there exists a gap between the estimates for the wealth distribution predicted by these models and the actual distribution of wealth. The standard life cycle Bewley model framework assumes that fertility is exogenous, in other words, every household in the model has the same number of children. Incorporating fertility in these life cycle models may potentially narrow the disparity between the predictions of the standard Bewley life cycle model and the actual wealth inequality observed.

Previous studies have explored the correlation between fertility and wealth. However, more work is required to fully comprehend the impact of fertility on wealth inequality. The existing literature presents conflicting findings. This study aims to shed light on this relationship by utilizing the Survey of Consumer Finances (SCF) dataset, widely considered as the most comprehensive source of household's wealth data. This thesis will add to the current literature on estimating the wealth distribution by analyzing the following research question:

How does fertility affect household's wealth?

This paper contributes to the existing literature by offering a more precise comprehension of the relationship between fertility and wealth by utilizing recent data (2019) and a broad range of appropriate control variables. Furthermore, the effect of fertility on households' savings level and households' motives to save will be examined. This paper also contributes to the existing literature by providing an analysis of the impact of the number of children in a household, ranging from one to seven, on the household's wealth. Additionally, the findings could offer recommendations for future researchers to consider treating fertility as an endogenous variable in their models, which may lead to more accurate estimations of the wealth distribution.

This thesis proceeds as follows. The following section presents an overview of the related literature. Section 3 presents the empirical research methods used. Followed by section 4 that describes the data used for this thesis. Section 5 shows the results. The paper finishes with a conclusion in section 6, in which limitations and opportunities for future research in the field are discussed as well.

2 Literature review

This literature review begins with examining relevant literature on the distribution of wealth. Then the review goes more in-dept on the other determinants (besides fertility) of wealth. In this part, the Bewley model (1977) is introduced, a model that is often used for studying the distribution of wealth. In the last part of this section, the review narrows down to the effect of fertility on wealth, which is the determinant of wealth that is the focal point of this paper.

2.1 Distribution of wealth

In order to provide a clear understanding of the concept of wealth, wealth is specified. Household net wealth includes all the non-financial assets—real estate, land, buildings, etc.—and financial assets—equities, bonds, bank deposits, life insurance, pensions funds, etc.—over which households can enforce ownership rights and that provide economic benefits to their owners, net of any debts (Alvaredo et al., 2016; Piketty & Zucman, 2014).

In the literature, there is a consensus that wealth is highly concentrated. However, there is disagreement about the precise magnitude of this concentration. Rodriguez et al. (2002) finds that in the United States, the households in the top 1 percent of the wealth distribution own 34.7 percent of the total sample wealth in 1998. Cagetti and De Nardi (2008) find similar results for the United States for the year 2001, the top 1% of the population owns one third of total wealth. This is consistent with the results of Roine and Waldenstrom (2014) for the year 2010. Their findings indicate that the top 1% owns 34.5 percent of total wealth in the United States. For France, Piketty (2014) states that the top 1% owns 25 percent of total wealth in the year 2010. In his book, Piketty (2014) presents evidence suggesting that there has been a rise in wealth inequality over the past four decades. He posits that this trend is driven by the phenomenon that the rate of return on capital (r) is consistently higher than the rate of economic growth (g) over the long term. This results in capital income (and subsequently wealth) being disproportionately concentrated, as compared to labor income. Moreover, Saez and

Zucman (2016) also find that wealth inequality is rising over time for the United States. To obtain these results, Saez and Zucman (2016) use data on income tax returns and macroeconomic household balance sheets. According to the paper, the top 0.1% has seen a significant increase in their share of total wealth, rising from 7 percent in the late 1970s to 22 percent in 2012 (Saez & Zucman, 2016). Vermeulen (2018) finds that household wealth surveys are downwardly biased in estimating the top tail of wealth shares. The top tail of wealth shares refers to the portion of the distribution of wealth that is held by the wealthiest. The estimates for the top tail in the United States, United Kingdom and nine other countries in Europe are significantly higher than those calculated from wealth surveys alone. Table 2.1 presents empirical estimates of Rodriguez et al. (2002), Cagetti and De Nardi (2008), Roine and Waldenstrom (2014), Vemeulen (2018) and Saez and Zucman (2016). The results are presented in chronological order of year that is estimated. The estimates do not deviate substantially from each other, however there is some variability within the estimates.

Table 2.1 Estimates for top the 5% and 1% wealth shares

Paper	**Top 5% US**	**Top 1% US**	**Year**
Rodriguez et al. (2002)	57,8%	34,7%	1998
Cagetti and De Nardi (2008)	57,7%	32,7%	2001
Roine and Waldenstrom (2014)	62,9%	34,5%	2010
Vermeulen (2018)	53–63%	31–37%	2010
Saez and Zucman (2016)	n.a.	41,8%	2012

2.2 Wealth and saving

Inequality in the distribution of wealth is driven by income differences, but besides that may also be determined by disparities in saving behavior and bequests (Cagetti & De Nardi, 2008). There are several mechanisms of saving behavior defined in the literature that significantly affect the wealth distribution. These mechanisms are added to a saving model and subsequently the model is better able to predict the wealth distribution that is observed in the actual data. The model for predicting the wealth distribution that is typically employed is the Bewley (1977) model.

This paragraph begins with an explanation of the fundamental version of the Bewley model, aimed at providing a clear understanding of the basic framework. This is followed by an elaboration of extended versions of the model. The Bewley model (1977) is a macroeconomic model in which agents are ex-ante identical. A model in which agents are ex-ante identical means that all agents in the model have identical information and knowledge (i.e. there is no information asymmetry) about a future event or situation before it occurs. The Bewley (1977) framework has an infinite horizon set-up, meaning that the analysis is conducted over an infinitely long time horizon. In the model, there are multiple periods. In each period agents receive a state-dependent income (Light, 2020). The Bewley model assumes that the states of the economy evolve over time according to a stochastic process, which introduces uncertainty into the model. This stochastic process captures the fact that the future states of the economy are not entirely predictable, and that there is a degree of randomness in how they unfold over time. The agents in the model derive their incomes from the states of the economy, which means that their incomes also follow a stochastic process. The stochastic nature of the agents' incomes arises from the fact that the agents are subject to the same uncertain and unpredictable economic conditions as the states themselves. Subsequently, when agents have received income, agents must make choices about how much to save and consume in each period. The agents are able to move assets between periods solely through investment in a risk-free bond, while being either prohibited from borrowing or subject to a borrowing constraint. All agents have identical preferences. We define the preferences for household *i* as:

$$E_0 \sum_{t=0}^{\infty} \beta^t u(c_t) \tag{1}$$

where $\boldsymbol{E_0}$ denotes the expected value of the expression, starting from time 0. **β** is the discount factor, which reflects how much an individual values consumption in the present versus in the future, ***t*** denotes the time period, $\mathbf{u(c_t)}$ is the utility function that represents the individual's preferences for consumption. It is a function of consumption at time t, denoted by $\mathbf{c_t}$. The budget constraint of household *i* is defined as follows:

$$c + a' = \mathrm{wz} + (1 + r)a \quad c \geq 0, \qquad a' \geq -\mathrm{B} \tag{2}$$

where **c** denotes how much agents consume, $\boldsymbol{a'}$ denotes how much agents choose to save in the form of holding risk-free assets: agents can use these assets in order to self-insure against earnings risk, **w** is the wage rate, **r** indicates a net interest rate, **z** refers to an exogenous factor of income that incorporates stochastic risks, for example risks due to unemployment. This exogenous process follows a finite state Markov chain with given stochastic matrix *P.* $\boldsymbol{a}$ are asset holdings carried into the period. The borrowing limit is defined as **B.** To clarify the difference between $\boldsymbol{a}$ and $\boldsymbol{a'}$: $\boldsymbol{a}$ represents the level of end-of-period assets that a household can hold at the beginning of a period, before it receives income and makes consumption and saving decisions. After receiving income, the household can choose to consume a portion of it and save the rest, which increases its level of end-of-period assets to $\boldsymbol{a}'$. In the next period, $\boldsymbol{a}'$ becomes the new level of assets that the household can hold at the beginning of the period.

In the explained Bewley model, people save in order to build up a reserve of assets that can serve as a buffer against unexpected earnings fluctuations (Carroll, 1997). The purpose of this buffer is to provide a form of self-insurance against income fluctuations. Carroll (1997) argues that according to the model, households stop saving when they have accumulated a sufficient buffer stock. This implies that the saving rate of the richest is zero. However, in reality wealthy individuals tend to maintain high levels of saving. Hence, the model cannot account for the accumulation of large wealth holdings.

In the study of De Nardi and Fella (2017), the authors summarize key facts about the distribution of wealth and what models have been able to explain this distribution. De Nardi and Fella (2017) explain that in the fundamental version of the Bewley model, the differences in wealth holdings between agents are generated by random earning shocks. Illustratively, when agents experience a series of negative shocks, they may need to dip into their savings, leading to a decrease in wealth relative to those who have experienced a series of positive shocks. Nevertheless, even larger earnings shocks are not sufficient to account for the level of wealth inequality that is observed in the real world. This is due to the fact that there is no clear mechanism that would encourage wealthier agents to maintain (high) levels of savings (De Nardi & Fella, 2017).

The fundamental Bewley model does not include the life cycle aspect of saving decisions. The omission of the life cycle dimension in the Bewley model implies that the model fails to capture the variation in wealth resulting from the fact that individuals typically begin their careers with minimal or no assets and gradually build wealth throughout their lives by participating in the labor market (De Nardi & Fella, 2017). The incorporation of a life cycle element into the model results in what is known as an overlapping generations model (OLG). In an OLG model, the economy is divided into a sequence of generations, with each generation living for a finite period of time and overlapping with the preceding and succeeding generations.

The Hugget (1996) model is a Bewley-model variant that considers life cycle characteristics. Describing this model will offer a clear understanding of an OLG Bewley framework. This study opts to emphasize on an OLG model as fertility is the primary focus of this thesis and is a crucial component of a household's lifecycle. In the OLG model of Hugget (1996) the preferences for household *i* are identical and defined as:

$$E\left\{\sum_{t=1}^{N}\beta^{t}\left(\prod_{j=1}^{t}s_{t}\right)u(c_{t})\right\}$$

(3)

where ***E*** denotes the expected value of the expression, ***N*** denotes the number of periods in an agent's lifetime. **Π** denotes the probability distribution of idiosyncratic income shocks that households face. Agents have a survival probability that depends on their age. This is denoted by s_t and thus represents the likelihood of an agent surviving up to a given age ***t***, assuming they have already survived up to the previous age ***t-1***. In other words, s_t is the conditional probability of an agent surviving up to age ***t*** given that they have already survived up to age ***t-1***. **u(c$_t$)** is the utility function that represents the individual's preferences for consumption. The utility function is a relative risk-averse function. This function is defined as:

$$u(c_t)=\frac{c_t^{1-\sigma}}{1-\sigma}$$

(4)

where ***σ*** denotes risk aversion and ***c*** consumption. In this model, agents save, as in the fundamental Bewley model (1977), to insure themselves against earnings risk. However, the Huggett (1996) model also incorporates other motives for saving, such as saving for retirement and building a cushion in case they live a long life. Additionally, if agents die prematurely, they leave accidental bequests. In the literature, a distinction is made between accidental and voluntary bequests. Accidental bequests refer to the unintended transfer of wealth that occurs when a household dies before consuming all their assets. In contrast, voluntary bequests are planned transfers of wealth that households choose to leave to their heirs. In the Huggett (1996) model, households do not plan to leave bequests, but may do so accidentally if they die before consuming all their assets. In the model, the budget constraint of household *i* is defined as follows:

$$c+a'=\mathrm{e}(z,t)\mathrm{w}+(1+r)a+\mathrm{T}+\mathrm{b_t}$$
$$c\geq 0,\qquad a'\geq -\mathrm{B},\qquad a'\geq 0 \text{ if } t=N$$

(5)

where **c** denotes consumption, $\boldsymbol{a'}$ denotes the holding risk-free assets for next period, ***e(z,t)*** is a function that represents the individual-specific component of the income process, where ***z*** denotes an individual's productivity type, and ***t*** denotes an individual's age. **w** denotes net wage rate, **r** interest rate. **T** represents the total value of accidental bequests left by individuals who pass away in a given period, and it is assumed that the government redistributes this value equally to all living individuals. $\mathbf{b_t}$ denote social security payments to the people that are retired. According to De Nardi and Fella (2017), it is crucial to model social security as it redistributes a portion of income from young individuals to older individuals, which leads to a reduction in the saving rate.

Huggett (1996) calibrates the model to key features of the United States data, resulting in a better fit of the Gini coefficient of wealth compared to the Bewley model that lacks the life cycle component. However, the Gini coefficient is derived through having too many people holding little wealth, rather than through a concentration of wealth within the upper percentiles of the wealth distribution (De Nardi & Fella, 2017). This is due to the model's inability to account for the reason why rich individuals keep saving at high rates. This results in the fact that the model of Huggett overestimates the proportion of individuals with little to no saving.

Gabaix et al. (2016) criticize the use of random growth models (e.g. a fundamental Bewley model) to explain the distribution of income and wealth. They specifically argue that these models are not able to explain rapid changes in tail inequality. Tail inequality refers to the concentration of income or wealth among individuals at the upper end of the distribution. These random growth models assume that wealth accumulation is a purely random process and cannot account for sudden, large changes in the distribution of wealth. Gabaix et al (2016) argue that random growth models are focused on steady states rather than on the transition dynamics between different states. Following the authors, type dependence and scale dependence should be included in a growth model in order to be able to explain the rapid changes in tail inequality. Type dependence means that different types of individuals (e.g. individuals with different levels of talent or luck) may have different rates of wealth accumulation, which can lead to sudden changes in the distribution of wealth. Scale dependence means that the speed of wealth accumulation may be influenced by the size of an individual's wealth. For example, if an individual has a small amount of wealth, they may have limited opportunities to invest and grow their wealth quickly, whereas if they have a large amount of wealth, they may be able to invest more and grow their wealth at a faster rate.

Neither infinite-horizon (e.g. the fundamental Bewley model) nor the life cycle variations of the Bewley (e.g. the Huggett 1996 model) models closely align with the observed wealth distribution. These models contain limited saving motives and may, as a result, match the savings of individuals for incorrect reasons (De Nardi & Fella, 2017). The inclusion of additional saving motives in the model leads to an improved fit of the wealth distribution. In the next part of the literature review, the review focusses on these mechanisms.

The first is mechanism that could improve the fit of a Bewley model is including intergenerational transmission of bequests and human capital. Gale and Scholz (1994) conducted a cross-sectional analysis, using data from the SCF, to estimate how much wealth can be attributed to intergenerational transfers. Their findings indicate that intergenerational transfers contribute significantly to the accumulation of total wealth, comprising between 50 and 60 percent of total wealth. Furthermore, a study conducted by Elinder et al. (2018) utilized population register data to investigate the relationship between inheritances and wealth in Sweden. The authors conducted an empirical analysis by estimating the direct mechanical effect of inheritance on wealth inequality among heirs. This effect represents the immediate distributional change that results from adding the inherited amount to the heirs' pre-inheritance wealth. The study's findings suggest that inheritances had a reducing effect on wealth inequality, as indicated by a decrease in the Gini coefficient or top wealth shares. However, the analysis also revealed that inheritances increase the absolute dispersion of wealth, which means that the distribution of wealth becomes more spread out. In other words, as a result of inheritances, the gap between the wealthiest and the least wealthy widens, even if the concentration of wealth among the top few percentiles declines. Moreover, Becker and Tomes (1979) also research the intergenerational transmission of bequests and examine human capital. The authors employ an OLG model in which agents live for two periods, agents make decisions about consumption, savings, labor supply and education. The authors find that in the presence of borrowing constraints, parental transfers first come in the form of children's human capital investment. Once the optimal level of human capital investment has been attained, parents find it optimal to start giving bequests. In this framework, bequests are considered a luxury good because they are a type of transfer that parents provide to their children only after they have invested optimally in their children's human capital. A luxury-type bequest is a form of voluntarily bequests. De Nardi's (2004) paper incorporates the transfer of human capital and luxury bequests into the OLG Bewley model of Huggett (1996). In this model, human capital is included in the model as productivity inheritance. The paper defines productivity inheritance as the transmission of an individual's ability to produce output to their children, which is modeled as a combination of genetic endowments and acquired skills and knowledge. De Nardi (2004) finds that adding the bequest motive to the model leads to the following increase in the concentration of wealth, her estimate for the top 1% in the United States increases by 7 percent (from 7 percent to 14 percent). When productivity inheritance is added to the model as well, the estimate increases from 14 percent to 18 percent for the top 1%. Table 2.2 shows estimates for the top 5% and top 1% wealth shares. The initial two rows exhibit estimates derived from actual wealth data in the United States for the year 1998. The remaining three rows present the estimations of De Nardi (2004), obtained by conducting these models.

Table 1.2 Estimates for the top 5% and 1% wealth shares derived from actual data and predictions obtained from Bewley-model by De Nardi (2004)

Data / model	Top 5% US	Top 1% US
1998 U.S. data (SCF) from De Nardi (2004)	53%	29%
1998 U.S. data from Rodriguez et al. (2002)	57,8%	34,7%
Model of De Nardi (2004) with no intergenerational links & equal bequests to all	27%	7%
Model of De Nardi (2004) with parent's bequest motive	37%	14%
Model of De Nardi (2004) with parent's bequest motive and productivity inheritance	42%	18%

The second saving mechanism is heterogeneity in preferences. Heterogeneity of preferences refers to heterogeneity in time preferences and risk-aversion. According to Cagetti (2003), heterogeneity in both of these variables help to explain the different amounts of wealth held by households. Krusell and Smith (1998) extended a Bewley model an infinite horizon set-up with heterogeneity in time preferences (and kept risk-aversion constant). The researchers introduced a stochastic process for each dynasty's discount factor. In the context of the Bewley model, a dynasty refers to a group of individuals who are born at the same time and who share the same set of economic opportunities and constraints over their lifetimes. The discount factor for a dynasty is a measure of how much the agents in the dynasty values consumption in the future relative to consumption in the present. A stochastic process in a discount factor refers to the fact that the discount factor itself is subject to random variations or uncertainties over time. The relationship between savings and discount factors is as follows: individuals with lower discount factors will be more willing to save and defer consumption, leading to greater accumulation of wealth over time. In contrast, individuals with higher discount factors will be more likely to consume in the present, leading to lower accumulation of wealth over time. The findings of the research indicate that a small degree of stochastic heterogeneity in discount factors results in the model matching the deviation of the wealth distribution (compared to the Huggett 1996 model that does not include heterogeneity in discount factors). Nevertheless, this model is not able to match the wealth concentration at the top 1%. Hendricks (2004) does also extent the Bewley model with time-preference heterogeneity. However, in contrast to Krusell and Smith (1998), no infinite-horizon setup is used. In this research, the observed concentration of wealth is found to have only a minor correlation with the heterogeneity of time preferences. This can possibly be attributed to the presence of an additional saving motive, namely savings for retirement, which does apply in a case with a finite horizon. Paz-Pardo (2016) analyses a Bewley model with preference heterogeneity, the luxury-type bequest motive and productivity inheritance. The paper finds that adding these forces indeed helps to better fit the wealth concentration among the top 1% wealthiest.

The third extension are earning dynamics. The paper of Arellano et al. (2017) analyzes the nature of income persistence and the transmission of income shocks to consumption. Income persistence refers to the degree to which an individual's income level remains stable over time. The authors use the consumption and asset data of the Panel Study of Income Dynamics (PSID) from 1999 to 2009. The study finds that the impact of earnings shocks varies depending on the individual's earnings history, resulting in heterogeneous responses in consumption. Castaneda et al. (2003) adds earning dynamics to their model. This model incorporates two stages of the life cycle, the working period and the retirement phase. The researchers assume that every household starts its working life with a shock drawn from a distribution of low and high productivity shocks. The low-productivity shocks are more likely than the high-productivity shocks. The process of productivity shock has been adjusted to match characteristics of both earnings and wealth distributions in the United States. The adjustments show that the highest level of productivity is more than 100 times greater than the second-highest level. This means that there is a significant gap between the highest and lesser productivity levels. In addition, an individual who has the highest level of productivity has a more than 20 percent chance of being 100 times less productive in the next period. As a result, households with high earnings face a higher risk of earning less and hence save more to protect themselves against that risk (De Nardi & Fella, 2017). Therefore, households with higher earnings accumulate a large amount of assets as a precautionary measure. This reasoning explains how including earning dynamics in the model leads to the fact that the paper of Castaneda et al. (2003) finds a long right tail in the distribution of wealth.

The fourth saving mechanism that should be added to the Bewley model to better fit the observed data is medical expense risk. De Nardi et al. (2010) developed a model of saving for retired single people, including heterogeneity in medical expenses, life expectancies and bequest motives. The study conducted shows that out-of-pocket medical expenses increase at a significant rate as individuals age and their permanent income increases. The risk for living longer, which may result in costly medical care, is identified as a determinant for savings among higher-income elderly. Additionally, the research findings indicate that among the elderly population, those with higher lifetime income not only attain retirement with greater wealth, but also experience a slower depletion of their net worth during the retirement period. Adding out-of-pocket medical spending to the model helps explaining the high wealth level of people with higher incomes for the duration of retirement (De Nardi, 2010). Kopecky and Koreshkova (2014) extend the Bewley model with out-of-pocket medical and nursing home expenses and find similar results. Adding these forces helps explaining the wealth concentration in the right tail of the distribution. The paper calibrates the model to the United States, the findings show that out-of-pocket expenses account for 13.5 percent of aggregate wealth.

Another determinant of wealth is heterogeneity in rates of return. Fagereng et al. (2020) find that returns on assets are positively correlated with wealth. The paper uses 12 years of population data from Norway's administrative tax to examine the average returns on net worth. The analysis shows significant variation in average returns on net worth. Additionally, the study finds that the heterogeneity in returns does not solely originate from variations in the allocation of wealth between safe and risky assets but depend on even narrow asset classes. Benhabib et al. (2014) employs a Bewley model with idiosyncratic capital income risks, thus heterogeneity in rates of return. The paper finds that adding this force to the model results in the wealth distribution having a fat right tail. The paper mentions that including idiosyncratic capital income risks can reproduce fundamental stylized properties of the wealth distribution for the United States.

Entrepreneurship is the following determinant of wealth that has been discussed in the literature. Cagetti and De Nardi (2006) conduct a Bewley model that allows for entrepreneurial entry, exit and investment decisions in the presence of borrowing constraints. Adding entrepreneurship to the model results in the model fitting the wealth data of entrepreneurs and workers. In contrast with Hendricks (2004), this paper does not find a better fitting of the observed wealth distribution by adding entrepreneurship to the model. Nevertheless, Cagetti and De Nardi (2006) find that more stringent borrowing restrictions lead to a decrease in wealth concentration, and result in smaller average firm sizes, reduced aggregate capital, and a lower proportion of entrepreneurs. Furthermore, the study finds that voluntary bequests enable individuals of high ability to establish or enlarge entrepreneurial activity.

The last determinant before going in dept into the determinant fertility is financial knowledge. The acquisition of financial knowledge empowers households to effectively manage and allocate their resources throughout the various stages of their lives in a world of uncertainty and imperfect insurance (Lusardi et al., 2017). Delavande et al. (2008) present a theoretical framework in which financial knowledge is treated as a form of human capital. Through the analysis of this model, it is found that an enhancement in financial knowledge leads to an increase in the potential expected return of assets, this could in turn increase wealth accumulation. The paper of Lusardi et al. (2017) added the variable financial knowledge to a Bewley life cycle model. The findings demonstrate that financial knowledge significantly influences the wealth distribution. According to the study, financial knowledge accounts for 30 to 40 percent of the distribution of retirement wealth.

In conclusion, the saving mechanisms, or determinants of wealth, have been defined in the literature as intergenerational transmission and bequests, heterogeneity in preferences, earning dynamics, medical expense risk, and financial knowledge. It is crucial to understand these determinants because they should be taken into consideration in policy making decisions. However, more work is needed to fully understand the importance of each factor in shaping the wealth distribution and to determine the most useful and practical models to study it. In the literature so far, fertility is also examined as a determinant of wealth. However, fertility has never been included as an endogenous variable in a Bewley-model.

2.3 Fertility and wealth

As a means of clarifying the concept of fertility, in this thesis, the term is defined as the number of children in a household. In the existing literature, studies have been conducted to analyze the relationship between fertility and wealth. However, the literature presents contradictory findings, with some studies suggesting a positive correlation between having children and wealth accumulation, while others find a negative relationship. Hence, there is no consensus on the impact of fertility on wealth. It has relevance to understand the relationship between fertility, saving, and wealth, as this can help to bridge the gap between the predictions of Bewley models and the actual wealth distribution. If we are better able to predict the distribution of wealth and hence understand the wealth distribution better, we can also implement more effective policy to affect the wealth distribution.

The inconsistent findings of the effect of fertility on wealth could possibly be explained by contradictory mechanisms that play a role in the impact of fertility on wealth. The first mechanism is that caregivers increase their savings. There are many reasons why caregivers might choose to increase their savings. For example, they may want to save up for education expenses related to their children's schooling. Additionally, saving money can help provide a safety net for unexpected emergencies, such as when a child becomes ill. Lastly, parents may also want to ensure that they have enough funds to purchase or maintain a home that can accommodate their growing family. This saving behavior may result in an increase of wealth. The second mechanism is the increase in expenses that caregivers experience as a result of having children. These expenses reduce the amount of disposable income available for saving, which may lead to a decrease in the amount of savings made by caregivers. This, in turn, will lead to a decrease in the accumulation of wealth.

The paper of Modigliani (1985) provides a review of the theory and determinants of the Life Cycle Hypothesis (LCH) of saving. The LCH of saving is a theory that suggests individuals save and spend money in anticipation of their future needs, which change over the course of their lifetime. According to the theory, individuals tend to save during their working years, when their income is typically higher, in order to prepare for future periods of lower income, such as retirement. The theory suggests that individuals strive to maintain a relatively consistent level of consumption throughout their lifetime, adjusting their saving and spending behavior to accommodate changes in income and expenses over time. This LCH differs from the Bewley model as the Bewley model assumes that individuals face uncertain future income and expense shocks, and that their ability to borrow or lend money may be limited. These assumptions do not apply to the LCH. Hence, the LCH and the Bewley model represent two different approaches to understanding individual savings behavior. Modigliani (1985) examines the relationship between individual savings behavior and national wealth accumulation by reviewing the literature on the LCH model. Furthermore, the researcher builds on the LCH model and includes uncertainty, borrowing constraints and bequest motives in the new model. According to Modigliani (1985)'s paper, the empirical evidence endorses that as the number of children in a household rises, the amount of net worth accumulation decreases. The author also states that according to the LCH, households have a tendency to save less when they have more children living with them, while they tend to save more when their children have moved out of the household. Hence, Modigliani (1985) finds a negative relationship between having children and saving. The paper thus states that having children has a negative effect on savings of households and in subsequently on wealth accumulation.

In 2000, Tin examines the LCH and its implications for savings behavior and the demand for financial assets. Tin (2000) uses panel-data from the Survey of Income and Program Participation (SIPP) conducted by the U.S. Bureau of the Census and employs the ordinary least square (OLS) estimation method. In his study, Tin found that people have different propensities to save and invest in financial assets depending on their life cycle and socio-economic characteristics. He argues that this implies that using aggregate estimates of asset demand to guide monetary policies, which assume that everyone behaves in the same way, may not be accurate. In particular, he suggests that the assumption of a constant marginal propensity to save across individuals may be misleading, and that policymakers should take into account the heterogeneity of individual behavior when making decisions about monetary policy. The regression results of Tin indicate that married couples with children tend to save less than married couples without children. Tin gives the following rationale for this result, as the number of children increases, married women are more prone to leave the labor force or work on a part-time basis to care for their families compared to their childless counterparts. Therefore, husbands of married females who stay home to attend to their children have become the primary income source for their households. And hence the level of income of the household decreases. According to Tin, this reduction in income level and the rise in consumption among households with children have led to a decrease in savings compared to households without children.

Dynan et al. (2004) examine whether households with higher-lifetime income save more than households with lower income levels. The examination is done empirically with data from the SCF, the Panel Study of Income Dynamics (PSID) and the Consumer Expenditure Survey. These surveys concern households in the United States during the 1980s and 1990s. Dynan et al (2004) keep income constant. The authors find a strong relationship between saving rates and lifetime incomes. Moreover, the authors also examine the effect of children on saving. The hypothesis of Dynan et al. (2004) is that children positively affect saving rates. The reasoning the authors give for this hypothesis is as follows, households with children would save more for bequest than households without children (in order to leave bequests to their children upon their demise). In the analysis, income is held constant. Nevertheless, the findings do not provide evidence for the fact that households with children have a higher saving rate than childless households. The authors do also not find that having children negatively affect saving rates. This is in contrast with Tin (2000) and Modigliani (1985), this could possibly be explained by the fact that income is kept constant in the model of Dynan et al. (2004).

Schmidt and Sevak (2006) empirically assess how household wealth in the United States varies by gender and family type. The authors conduct OLS and quantile regressions. The data used in this study consists of PSID data collected in 1994, 1999, and the period from 2001 to 2005. In the study, a distinction is made for the ages of children and the number of children in a household. The paper finds that wealth does vary with ages of children. However, for the first category - children under the age of 18 - no statistically significant correlation was found with wealth. Nonetheless, the authors do show that having children aged 18 to 24 has a negative effect on wealth accumulation. This may be due to the high costs of supporting children who are pursuing higher education or starting their careers. On the other hand, having grown-up children (in this study, children older than 25) is positively correlated with a household's wealth. This may be because grown-up children are less likely to be financially dependent on their parents. Overall, the study highlights the importance of considering family composition and the ages of children when examining household wealth in the United States. This finding is in agreement with the LCH which states that households tend to save more when their children have moved out of the household. However, it should be noted that in the research of Schmidt and Sevak (2006), the model does not explicitly take into account when children move out of the house. Nonetheless, it is likely that grown-up children are moved out of the household.

Yamokoski and Keister (2006) examine variations in wealth across marital status, gender, and parenting status in the United States. To conduct their analysis, the authors draw on data from the National Longitudinal Survey of Youth 1979 cohort, which focuses on the younger members of the baby boomer generation. The authors created a pooled cross-section time-series data set and conducted multivariate regression analysis to estimate the effects of marital status, gender and parenting status on wealth. The models conducted show a significant positive effect of number of children on wealth. Hence, the findings indicate that net worth does increase when people have children. The authors explain this finding by arguing that caregivers increase their savings in order to provide for the care of their children and to secure a residence that can accommodate the growing family. In this model, the ages of children and the number of children in a household are not considered. In 2007, Yamokoski investigates the effects of gender, marital status, and parenthood on asset accumulation. She uses the National Longitudinal Survey of Youth 1979 and conducts regression analysis. This paper also indicates that being a parent increases the predicted values of net worth. It is worth noting that as in previous models, the models used do not consider the ages and number of children in the household.

Scholz and Seshardi (2007) develop three LCH models using panel data from the Health and Retirement Study (HRS) spanning the years 1992 to 2002. The first model is an LCH model that assumes complete markets and no uncertainty. Complete markets refer to the assumption that all households have access to the same financial products and investment opportunities without restrictions or frictions, such as taxes, transaction costs, or borrowing constraints. The second model is an LCH model that includes uncertain lifetimes, uninsurable earnings, uninsurable medical expenses, and borrowing constraints (or credit constraints). In the third model, the authors consider the same model as model 2 but enrich the model with endogenous fertility. The authors state that descriptive data of the HRS suggest that there are at least three ways in which children may impact household wealth. Firstly, family size is positively associated with lifetime earnings. Then, the number of children is negatively correlated with lifetime income, which may result in wealth disparities between high and low-income households, assuming children are expensive. Thirdly, the authors argue that households with more children tend to have them at later stages in life, meaning that children are present in the household for a larger proportion of the adult's working years. Moreover, Sholz and Seshardi (2007) show that deviation in the timing of children affect wealth levels of households. They estimate that having a first child at a younger age is associated with lower household wealth in later years. Specifically, they find that having a first child at age 20 is associated with a 4.4% decrease in household wealth by age 45, while having a first child at age 30 is associated with only a 1.9% decrease in wealth by age 45. This suggests that delaying childbearing may allow parents to accumulate more wealth before having children. The findings also indicate that the number of children born has a negative effect on household wealth. They estimate that each additional child is associated with a 4.3% decrease in household wealth, on average. Furthermore, Scholz and Seshardi's research indicates that households with lower incomes and larger numbers of children generally experience longer periods of credit constraints compared to wealthier households. When the authors removed the variation in number of children in a household (which was based on income) from their model, they found that the model predicted that richer households would face credit constraints for longer periods than poorer households due to their steeper age-earnings profiles. In other words, wealthier households tend to experience a more rapid increase in earnings as they age, which prolongs their exposure to credit constraints. The authors' conclusion is that the variation in wealth across households can be partially explained by the interaction between the distributions of earnings and number of children. Specifically, households with lower incomes and more children tend to experience lower rates of wealth accumulation due to their longer exposure to credit constraints, which ultimately contributes to the wide dispersion of wealth holdings.

Love (2010) surveys the impact of demographic shocks on optimal decisions about saving, life insurance and asset allocation. In the context of this paper demographic shocks refer to changes in marital status or the number of children in a household. The paper conducts an empirical analysis and uses panel-data from the HRS and the PSID for the period between 1992 and 2002. The findings show that marital-status transitions affect optimal households' decisions (especially in the case of widowhood and divorce instead of getting married in the first place). The findings indicate that children have a significant impact on individuals' portfolio choices. Also, having children interact with changes in marital status. The interaction effect means that the impact of children on portfolio choice depends on whether the household experiences a change in marital status. Moreover, Love finds that having children has a significant negative effect on household savings. Specifically, the paper finds that having one child reduces the probability of saving by about 3 percentage points and having two or more children reduces it by about 6-7 percentage points.

In 2018, Maroto uses panel-data from the National Longitudinal Survey of Youth from the years 1986 till 2012. The researcher combines fixed-effects and unconditional quantile regression models to examine the effect of having children in different age groups on wealth. The results suggest that the impact of having children on wealth differs across the distribution. For families with incomes at or below the median, having children of all ages was linked with a decrease in wealth. Maroto argues that this is possibly attributed to the expenses of raising children. Nonetheless, for families at the 75th percentile and higher, households having children under the age of 18 was related to an augmentation in wealth. However, as soon as the children reached adulthood, the wealth declined. This finding contradicts the life cycle hypothesis, which posits that people usually save more when their children leave the household, resulting in an increase in wealth. This contradiction may be explicable by the fact that children around the age of 18 are still living with their parents and have higher expenses. It is possible that the effect is only visible at a later age, as in the paper of Schmidt and Sevak (2006), where an increase in wealth was observed when children were older than 25 years. Also, Maroto (2018) argues that for the families, at or below the median, the expenses associated with childbearing surpassed the incentives to save.

To summarize, while the exact quantitative significance of fertility in determining wealth remains to be established, previous research has demonstrated that fertility has an impact on saving behavior and ultimately household wealth. The exact impact of fertility on wealth varies with ages of children, ages at which parents have children, marital status and credit constraints. The literature on the determinants of wealth is extensive, yet there is a paucity of studies that investigate the effects of children on savings and wealth. While a handful of studies do exist, most of these are based on data from earlier years, with the majority not extending beyond 2002. An exception is the panel-data study conducted by Maroto in 2018, which uses data that extends until 2012. It could be the case that changes are occurring with regard to the costs of having children. For example, the costs of caring for children may have fallen because of advances in technology, leading to households with children able to save more. Costs could also have been increased due to inflation. This suggest that the effect of having children on wealth may have changed in more recent years compared to earlier years. Existing research is based on older data and the exact effect of fertility on wealth has not yet been defined in the literature for earlier years, as these studies point in different directions. Therefore, further investigation into this relationship can help to better comprehend the wealth distribution, enabling more effective policy distributions. This thesis contributes to the existing literature on the relationship between fertility and wealth, saving, and motives to save by incorporating recent data from 2019 and utilizing a broad range of control variables. By incorporating up-to-date data and an extensive set of relevant control variables, this study provides a more nuanced and accurate understanding of the complex relationship between fertility, wealth, saving and saving behaviors. Moreover, this paper contributes to the existing literature by examining the effect of number of children on wealth separately in order to gain more insight in this relationship.

3 Method

The research design employed in this study to investigate the correlation between fertility and wealth is the Ordinary Least Squares (OLS) regression model. The regression model consists of the dependent variable, independent variable and the control variables (and the error term). The following regression equation is conducted:

$$\begin{aligned} W = \beta_0 + \beta_1 fertility + \beta_2 age + \beta_3 married\_lwp + \beta_4 no\_high\_school + \beta_5 high\_school\_GED \\ + \beta_6 college\_associate + \beta_7 bachelor\_or\_higher + \beta_8 Hispanic + \beta_9 bBack \\ + \beta_{10} female + \beta_{11} income + \beta_{12} employed + \beta_{13} entrepreneur \\ + \beta_{14} creditconstraint + \beta_{15} finlit + \beta_{16} risk\_aversion + \beta_{17} risk\_seeking + \varepsilon \end{aligned} \tag{6}$$

In this regression *W* stands for household net worth, *fertility* stands for the number of children. The model will also be run with *having children or not* as independent variable instead of *fertility* in order to examine the effect if the number of children is not taken into account. Furthermore, *married_lwp* stands for married or living with person, *no_high_school* refers to no schooling, *college_associate* refers to college or association degree*, bachelor_or_higher* means having a bachelors degree or higher, *creditconstraint* stands for credit constraint and *finlit* for financial literacy, *risk-aversion* stands for someone that is risk averse, *risk-seeking* for someone that seeks risk, ε is the error term. In 4.3 and 4.4, the variables in the equation will be explained extensively.

Following the literature, fertility affects wealth through adjusted saving behavior. When households save more, this implies that they accumulate more wealth. As individuals become caregivers for children, their saving behaviors may shift in one of two ways. On one hand, they may increase their savings to adequately provide for their children's needs. On the other hand, they may decrease their savings due to the added expenses associated with raising children. As there is no consensus on which effect dominates it is interesting to examine what happens with saving levels and saving behavior. The same control variables are applied to both regressions. The regression equation for saving levels is as follows:

$$\begin{aligned} Saving = \beta_0 + \beta_1 fertility + \beta_2 age + \beta_3 married\_lwp + \beta_4 no\_high\_school \\ + \beta_5 high\_school\_GED + \beta_6 college\_associate + \beta_7 bachelor\_or\_higher \\ + \beta_8 Hispanic + \beta_9 Black + \beta_{10} female + \beta_{11} income + \beta_{12} employed \\ + \beta_{13} entrepreneur + \beta_{14} creditconstraint + \beta_{15} finlit \\ + \beta_{16} risk\_aversion + \beta_{17} risk\_seeking + \varepsilon \end{aligned}$$

(7)

The dependent variable *Saving* stands for total value of savings accounts held by household. The regression equation for saving behavior is as follows:

$$\begin{aligned} Saving\_reason \\ &= \beta_0 + \beta_1 fertility + \beta_2 age + \beta_3 married\_lwp + \beta_4 no\_high\_school \\ &+ \beta_5 high\_school\_GED + \beta_6 college\_associate + \beta_7 bachelor\_or\_higher \\ &+ \beta_8 Hispanic + \beta_9 Black + \beta_{10} female + \beta_{11} income + \beta_{12} employed \\ &+ \beta_{13} entrepreneur + \beta_{14} creditconstraint + \beta_{15} finlit \\ &+ \beta_{16} risk\_aversion + \beta_{17} risk\_seeking + \varepsilon \end{aligned}$$

(8)

Saving_reason stands for motives for saving, could also be referred to as saving behavior. The following motives for savings are examined in separate regressions, education, family, home, purchases, retirement, liquidity/the future, investment, no particular reason.

4 Data

This chapter presents the data used in this empirical research. The dataset that is used is data from the Survey of Consumer Finances (SCF) 2019. The chapter is organized as follows: first, the SCF will be described, followed by an overview of the dependent, independent and control variables. The chapter concludes with a first look at the data.

4.1 The Survey of Consumer Finances

The SCF is a triennial survey conducted by the Federal Reserve Board that provides detailed information on the financial and demographic characteristics of households from the United States. This dataset was chosen because it contains detailed information households' saving motives, demographic characteristics such as the number of children, and wealth, making it well-suited for assessing the effect of fertility on wealth. In the survey, saving motives are obtained by a question in which households can indicate their saving motives. Bricker et al. (2016) states that the SCF is a nationally representative sample of households of all ages in the United States. De Nardi (2008) argues that the SCF is able to provide a more accurate measure of household’s wealth holdings in comparison to other datasets. She argues that this is the case because the SCF oversamples rich households by including a list sample drawn from tax records and because a national area probability sample is applied. This is agreement with Maroto (2018), in this paper it is mentioned that the SCF dataset is one of the strongest wealth datasets in the United States. A disadvantage of the SCF is that the survey does not follow households over time. This means that I am not able analyze at how the aging of children affects wealth in a specific household, also this makes it impossible to include lagged wealth levels. The federal reserve provides access to two datasets of the SCF, the Full Public Dataset and the Summary Extract Public Dataset. For this thesis, I have chosen to use the Summary Extract Public Data from the SCF. The Summary Extract Public Data contains all the variables that are relevant to the research question, thus choosing this dataset is not at the expense of potential control variables. Multiple imputation has been applied to the dataset. Therefore, the sample consists of a total of 28,885 observations in spite of that only 5,777 households were interviewed. In paragraph 4.2 I will elaborate more on the multiple imputation method.

4.2 Weights and multiple imputation

The SCF dataset includes a weighting variable. In survey datasets, weighting is commonly used. Using a weighting could possibly reduce selection bias. Selection bias occurs when the households selected for the survey is not representative of the population of interest (in this case: population of the United States). Weighting the data adjusts for this bias by assigning a weight to each observation in the sample, which reflects the probability of that observation being selected in the survey. In the regression-analysis of this paper I will use the weighting variable in order to adjust the sample data to be more representative of the households of the United States.

In the SCF dataset, the multiple imputation method is applied 5 times. The multiple imputation method is a statistical technique used to handle missing data by creating multiple imputed datasets based on the observed data. As the method is applied 5 times, this means that missing data is imputed 5 times and hence, each household has 5 different observations in the dataset. These 5 observations are called implicates. In the survey, 5,777 households were interviewed. The imputation method being applied 5 times results in the fact that there are 28,885 observations. When analyzing the dataset, two types of error need to be accounted for (Federal Reserve, 2019). The first type is the multiple imputation error. Without correcting for multiple imputation, the estimated standard error of a statistic tends to be smaller than the true standard error. This implies that without correcting for multiple imputation p-values are estimated smaller than they truly are. Furthermore, there should be accounted for sample variability error. This variation arises due to the fact that different samples are likely to produce different estimates of the population parameter, simply due to chance. Sampling variability can be estimated by a set of bootstrap replicate weights. The federal reserve provides publicly access to a replicate weight file. In 2015, Pence developed the SCFCOMBO program for analyzing all five replicates in the SCF data, which addresses both the issues of multiple imputation and sample variability error. In my analysis I will use this program to obtain valid estimates and standard errors.

In the Summary Extract Public Dataset the original weighting variable is divided by five. This is done because of the 5 imputations. Herewith, it is possible to calculate basic descriptive statistics. However, I want to conduct linear regression methods and hence I use all imputations (as argued in the previous paragraph). If I want to use the SCFCOMBO package and apply the weighting variable as well, I need to recreate the original weighting variable. That is, equation 9:

$$WGT0 = \mathrm{WGT} * 5 \tag{9}$$

Having acquired the original weighting variable, the sum of the weights reflects the number of households in the United States in 2019. The sum of the weights is 128,642,430.25373.

4.3 Dependent and independent variables

The dependent variable is net household worth. This paragraph first explains how net household worth is defined. Net worth is calculated by subtracting total debt from total assets. Total assets consists of total financial assets: all types of transaction accounts (liquid assets, e.g. savings accounts), certificates of deposit, directly held pooled investment funds, saving bonds, directly held stocks, directly held bonds, cash value of whole life insurance, other managed assets, quasi-liquid retirement accounts, other miscellaneous financial assets. To get from total financial assets to total assets, non-financial assets are added. Non-financial assets are vehicles, primary residence, residential property, net equity in non-residential real estate, business and other miscellaneous non-financial assets. Total debt consists of: debt secured by primary residence (mortgages, home equity loans), debt secured by other residential property, other lines of credit, credit card balances after last payment, installment loans (e.g. education and vehicle loans) and other debt (for example loans against pensions or life insurance).

Additionally, to net household worth, savings and saving behavior is chosen as a dependent variable. Doing this analysis is of academic interest because fertility affects household's wealth through saving (behavior). The saving variable is defined as the amount of money on a household' s savings account. Saving behavior consists of 8 variables, each variable reflects a motive to save. Each household in the survey has indicated what their saving motives are. The respondents could opt for the following motives: education, family, home, purchases, retirement, liquidity/the future, investment or no particular reason. The saving motive for education is defined by including both saving for the education of household members, hence this motive includes saving for children's education as well besides saving for the household's head only. The reason to save motive for family refers to saving for the financial security of family members. This could include saving for expenses related to their health care or general financial support. Then, the independent variable of this research is fertility. Fertility is defined by the number of children born or conceived in a household. Moreover, I will also examine having children or not as an independent variable. In these models, the number of children in a household is not taken into account.

4.4 Control variables

In this empirical analysis, I control for several variables in order to isolate the effect of fertility on wealth. Control variables are used to account for other factors that may influence household's wealth besides fertility. Control variables are variables that both affect the independent (fertility) and dependent (household's net worth) variables. Omitted variable bias occurs when the right control variables are not included in the analysis. This is because the omission of relevant variables leads to biased results. Hence, the regression results could under or overestimate the effect of fertility on wealth. In the regression-analysis of this paper several control variables are included.

The first control variable is *age*. It is a logical and well-established conclusion in academic literature that wealth ownership varies with age (Shorrocks, 1975). Age is likely to influence savings behavior and portfolio choices, and subsequently one's household' s wealth.

The next control variable is the binary variable *married_LWP (living with partner)*. Rodriguez et al. (2002) find that household's wealth levels vary with marital status. In addition to influencing wealth, the state of being married or living with a partner has also been showed to have a consequential impact on fertility (Yamokoski & Keister, 2006).

Subsequently, I control for education by including dummies. According to Rodriguez et al. (2002), education level both affects fertility and wealth. The following dummies are included: no high school diploma, high school degree or general education diploma (GED), some college or associate degree and bachelor's degree or higher. In addition, ethnicity is also included as a control variable in this analysis. Dummies for the reference person of the household being *Black* or *Hispanic* are included. Furthermore, *gender* is included as a control variable. In the literature, there is a consensus that being female in combination with not being married is negatively associated with wealth (Schmidt & Sevak, 2006; Yamokoski & Keister, 2006). *Income* is positively related to wealth and thus included as well (Bricker et al, 2014). Income is defined as total household income in previous calendar year (2018 in case of this paper).

Subsequently, *employment* is included. Rodriguez, et al (2002) stresses that employment status is a determinant of wealth inequality. The variable is constructed from the working categories variable in the dataset. The working categories variable consists of working for someone else, self-employed/ partnership, retired/ disabled (students fall into this group), not working. In addition, this analysis also includes a binary variable for *entrepreneurship*. This variable is also constructed from the working categories variable. Cagetti and De Nardi (2006) found that entrepreneurship is a determinant of wealth accumulation. Possibly, this variable could also affect fertility.

Cagetti and De Nardi (2006) also found that borrowing restrictions leads to a decrease in wealth concentration, therefore a *credit constraint* variable is included. Credit constraint is binary variable constructed according to the following question: "In the past twelve months, has a particular lender or creditor turned down any request you (or your {husband/wife/partner}) made for credit, or not given you as much credit as you applied for?" Another control variable is *financial literacy* because financial knowledge is established as a determinant of wealth inequality (Lusardi et al., 2017). The SCF included a series of questions pertaining to financial knowledge. The respondent's score for financial literacy is determined by the number of correct answers provided. As the number of correct answers increases, the score for financial literacy also increases.

The last control variables added to the regression relates to heterogeneity of preferences. The literature section of this thesis showed that heterogeneity of preferences is an important determinant of wealth. Hence, I control for *risk-aversion* and *risk-seeking*. These variables are constructed by a question of the SCF in which respondents are asked: "Which of the following statements comes closest to the amount of financial risk you (and your partner) are willing to take when you save or make investments?" The statements respondents could opt where 1. Take substantial financial risks expecting to earn substantial returns 2. Take above average financial risks expecting to earn above average returns 3. Take average financial risks expecting to earn average returns and 4. Not willing to take any financial risks. In the dataset, if the respondents answered 1, the respondent is marked as risk seeking. If the respondent answered 4, this person is marked as risk averse.

The addition of above specified control variables has proven to be valuable in this empirical research. This was tested by conducting multiple regressions of fertility (number of children) as a function of net worth and adding each control variable separately. The results of these analyses show that the inclusion of each control variable made a notable impact on the estimation of the fertility coefficient. This suggest that the control variables have a substantial effect on the relationship between fertility and net worth. By accounting for these variables, the bias in the estimation for the coefficient of fertility decreases.

4.5 A first look at the data

The variable net worth is characterized by the presence of large outliers. As presented in Table 4.1, the mean level of unweighted worth is 13,458,400 dollars, the minimum wealth level is -955,500 dollars and the maximum net worth is 1,967,000,000 dollars. One striking aspect is the substantial discrepancy between the means for the unweighted and weighted net worth. When net worth is weighted, the mean decreases from 13,458,400 dollars to 746,821 dollars. This illustrates the importance of weighting in this data. Without weighting, the average net worth of households in the United States would be reported as being more than 13 million dollars, which is clearly illogical and not representative of the population. The weighting process helps to adjust for any bias in the sample and provides a more accurate representation of the population.

Table 4.1 Descriptive statistics for net worth (unweighted and weighted)

Variables	Obs	Weight	Mean	Std. Dev.	Min	Max
Net worth (weighted)	28,885	643,212,155	746,821	5612,721	-955,500	1,967,000,000
Net worth	28,885		13,458,400	78371,209	-955,500	1,967,000,000

The variable net worth is characterized by the presence of large outliers. To be able to form a readable histogram that gives an insight into the data, the households with wealth levels below -400,000 dollars and above 4,000,000 dollars have been excluded. The histogram in Figure 4.1 shows the distribution of net worth.

Figure 4.1 Distribution of net worth among households (excluding weight and outliers)

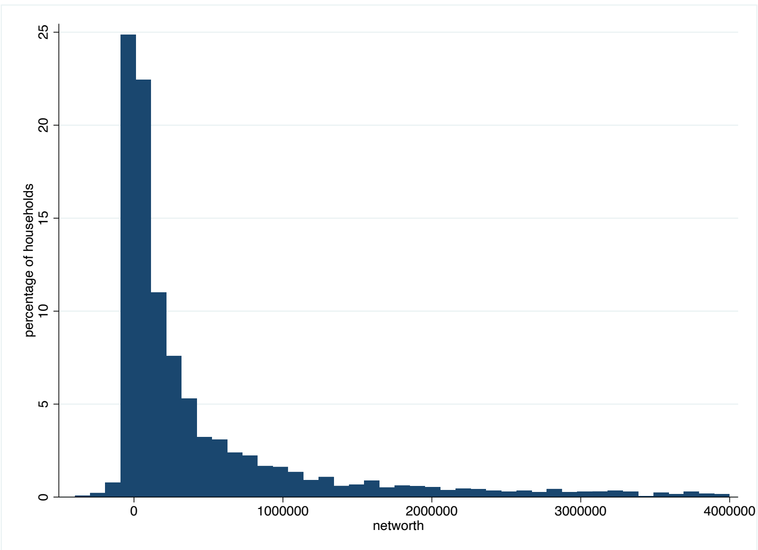


Table 4.2 shows the descriptive statistics of the independent variables. On average, households save \$14,295.14, with a large standard deviation of \$79,687.65, indicating a wide distribution of savings behavior. The highest amount of savings reported was \$28,000,000. Table 4.3. shows the descriptive statistics of the control variables. The average age of the reference person is 51.73 years old, with a standard deviation of 17.50, indicating a relatively wide age range. The majority of households are married or living with another person, with approximately one-third having a college or associate degree, and another one-third having a bachelor's degree or higher. Black households make up approximately 15.65% of the sample, with Hispanic households comprising 10.93%. Almost 69% of households are employed. Around 10.70% of households report being credit constrained.

Table 4.2 Descriptive statistics independent variables (weighted)

Variable	Obs	Weight	Mean	Std.Dev.	Min	Max
Fertility	28885	643212155	.7223702	1.106547	0	7
Saving	28885	643212155	14295.14	79687.65	0	28000000
Saving for education	28885	643212155	.0551043	.2281876	0	1
Saving for family	28885	643212155	.0606538	.2386982	0	1
Saving for home	28885	643212155	.0510995	.2202046	0	1
Saving for purchases	28885	643212155	.1124152	.3158821	0	1
Saving for retirement	28885	643212155	.2843188	.4510972	0	1
Saving for liquidity/ the future	28885	643212155	.381074	.4856591	0	1
Saving for investment	28885	643212155	.0177076	.1318889	0	1
Saving for no particular reason	28885	643212155	.007742	.0876489	0	1

Table 4.3 Descriptive statistics control variables (weighted)

Variable	Obs	Weight	Mean	Std.Dev.	Min	Max
Age of reference person	28885	643212155	51.72544	17.501	18	95
Married or living with person	28885	643212155	.5604644	.4963392	0	1
No high school	28885	643212155	.1072253	.3094049	0	1
Highschool or GED	28885	643212155	.2448393	.4299993	0	1
College or associate degree	28885	643212155	.2846868	.451273	0	1
Bachelor's degree or higher	28885	643212155	.3632485	.4809439	0	1
Hispanic	28885	643212155	.1093039	.3120255	0	1
Black	28885	643212155	.156523	.3633567	0	1
Female	28885	643212155	.2695431	.4437301	0	1
Income	28885	643212155	106251.1	458986.9	0	704,000,000
Employed	28885	643212155	.6874449	.4635427	0	1
Entrepreneur	28885	643212155	.5791393	.4937058	0	1

Credit constraint	28885	643212155	.1070189	.3091426	0	1
Financial literacy	28885	643212155	2.168081	.8650786	0	3
Risk-averse	28885	643212155	.3923794	.4882889	0	1
Risk-seeking	28885	643212155	.0397815	.1954488	0	1

Figure 4.2 shows the distribution of the number of children among the households in the sample. The number of children is referred to as fertility in Table 4.2. Approximately 60% of households surveyed do not have any children, while 16% have one child and 14% have two children.

Figure 4.2 Distribution of the number of children among households

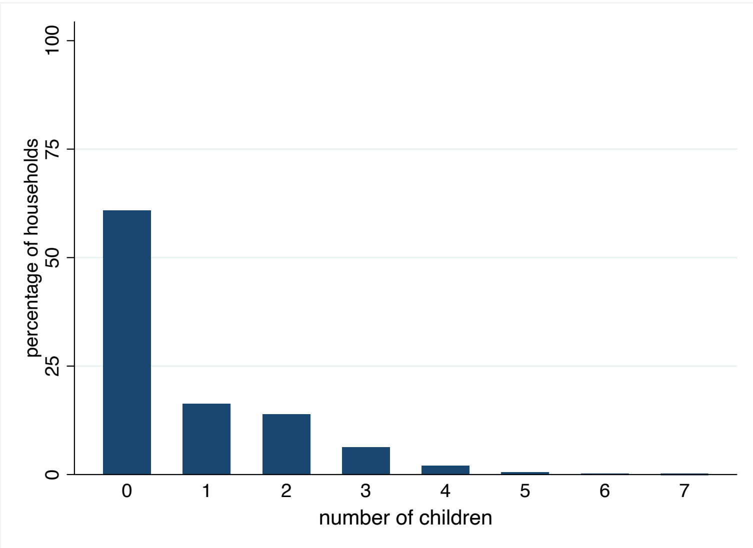
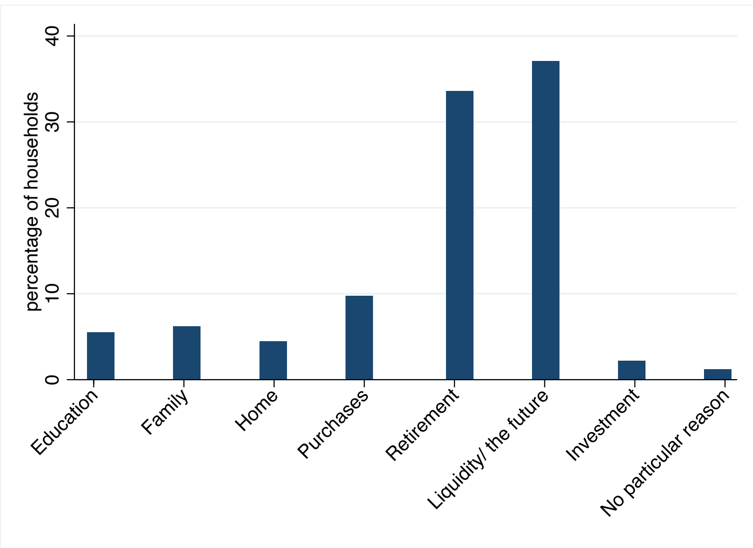


Figure 4.3 illustrates the primary motivation for savings among households. The data represented in the graph indicates that the most households prioritize saving for retirement or for the future/liquidity.

Figure 4.3 Distribution of main reason to save among households



5 Results

This section reports the results of the empirical research. For conducting this research, ordinary least squares (OLS) techniques are employed. A specification of the regression equations can be found in the methodology section. All the regression results in this analysis are obtained by using SCFCOMBO (Pence, 2015).

Table 5.1 shows the results of analyzing fertility (number of children) and having children on net worth. The first column shows the estimates for fertility on net worth without controls, the second column shows the estimates with controls. Both models show a positive coefficient, implying a positive effect of having children on net worth. The coefficient without controls is 8,791. This decreases to 745.7 when the control variables are added to the model. The p-value is 0.763 for the model without controls and the same model with controls gives a p-value of 0.984. This means we cannot interpret these estimates as these estimates are not statistically significant. Looking at the models in which the dummy having children is taken as independent variable, it becomes visible that there is a negative effect of having children on wealth estimated. Hence there is a discrepancy between having children, that has a negative effect on net worth and the number of children, that has a positive effect on net worth. The coefficient for the model of having children without controls is -56,885, this decreases relatively much to -86,975. The p-values for the models in which the number of children is not taken into account, show 0.205 (excluding controls) and 0.165 (including controls). These values are still not significant and hence we cannot interpret the negative coefficient indicating a decrease in wealth when having children. Nonetheless, the regression analysis revealed statistically significant results for several variables that were included as controls in the models.

In both models, significant control variables with a positive effect on net worth are age, bachelor's degree or higher, female, income, being employed, financial literacy and being risk-seeking. The positive relationship between age and net worth may be due to a longer accumulation of wealth over time, as older individuals typically have more time to save and invest. Being a female has a positive effect on net worth. It should be noted that this is in contrast with the literature. The results for income are consistent with established literature, indicating a positive impact of income on wealth. The magnitude of the coefficient of income might seem relatively low at first sight, namely around 5,9 dollars. Nevertheless, this is not the case because when income increases by 1, household net worth increases by 6 dollars on average. It should be noted that income can increase by much larger numbers than most control variables, especially dummies that take only 0 or 1. Furthermore, financial literacy appears to be positively associated with net worth, the reasoning behind this could be that individuals who are better equipped to manage their finances may be more likely to accumulate wealth. Also, the results suggest that risk-taking behavior is positively associated with net worth. This may be due to the fact that individuals who are more willing to take risks may be more likely to invest in higher-return assets which can lead to greater wealth accumulation over time. The coefficient for married or living with a person is only statistically significant in the model of having children or not (column 4). According to this model, if the households head is living with a person or married, their net worth increases on average with 187,424 dollars. Moreover, there are variables that show negative significant coefficients on wealth in both models. Following the results, being Black leads on average to a decrease in net worth of approximately 140,000 dollars. Secondly, being an entrepreneur decreases on average net worth with a surprisingly high amount of 1,402,000 dollars. Furthermore, being risk-seeking decreases net worth with 267,186 dollars in the model of fertility and 264,585 dollars in the model of having children or not.

Table 5.1 Linear regression results for fertility and having children on household's net worth

Net worth	**Model with independent variable fertility excluding controls**	**Model with independent variable fertility including controls**	**Model with independent variable having children or not excluding controls**	**Model with independent variable having children or not including controls**
Fertility	8,791 (29,162)	745.7 (36,604)		
Having children			-56,895 (44,869)	-86,975 (62,611)
Age		16,311*** (2,670)		15,789*** (2,616)
Married or living with person		154,710 (105,097)		187,424* (106,589)
No high school		9,241 (122,815)		13,045 (128,115)
Highschool or GED		-3,288 (123,090)		-3,777 (129,938)
College or associate degree		-20,914 (122,647)		-21,364 (127,723)
Bachelor's degree or higher		352,159** (178,818)		350,642* (180,105)
Hispanic		-43,167 (51,941)		-34,696 (50,356)
Black		-143,268*** (35,725)		-139,476*** (35,313)
Female		83,868* (46,469)		103,909** (47,750)
Income		5.982*** (1.843)		5.984*** (1.843)

Employed		1.171e+06***		1.182e+06***
		(215,179)		(216,142)
Entrepreneur		-1.402e+06***		-1.401e+06***
		(164,220)		(165,670)
Credit constraint		-81,780		-74,637
		(55,133)		(54,944)
Financial literacy		91,103***		89,019***
		(31,653)		(31,388)
Risk-averse		-267,186***		-264,585***
		(79,884)		(79,864)
Risk-seeking		452,601*		456,601*
		(243,145)		(243,881)
Constant	740,471***	-1.033e+06***	768,806***	-1.002e+06***
	(21,212)	(198,350)	(21,295)	(197,364)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In order to gain a deeper understanding of the discrepancy between having children (negative effect on net worth) and the number of children (positive effect on net worth), another regression is performed. This regression examines dummies for the number of children on net worth. In Table 5.2 the results of this regression are presented. For the purpose of clarity, the controls are not included in the table, but they were included in the regression. When looking at the regression results (Table 5.2), it is striking that the effect on net worth is positive or negative, depending on the number of children. This implies that there is a non-linear relationship between the quantity of children in a household (Figure 5.1). The regression results, as presented in Table 5.2, indicate that on average, having one child (compared to having no children), will lead to a decrease in net worth of 150,604 dollars. Having two also impacts net worth negatively according to the results. However, the magnitude of this negative effect is comparatively smaller; on average, the presence of two children leads to a decrease of 108,133 dollars in the net worth of a household. When looking at households with three children, the results indicate that having three children leads on average to an increase in net worth of 25,506 dollars. This finding supports the aforementioned non-linear relationship between fertility and net worth. The results indicate that having four children leads to the largest positive effect on net worth. On average, if a household has four children (compared to no children) their wealth increases with 385,823 dollars. The results show a decrease in the effect of having children again on wealth after four children. On average, having respectively 5 or 6 children compared to not having children leads to a decrease in net worth of 423,081 dollars and 246,819 dollars. It is striking that the effect on wealth increases again when households have 7 children. It should be noted that only the estimates for 1 children and 5 children are statistically significant. Therefore, it cannot be stated with certainty that there is evidence for a non-linear relationship as only these results attain statistical significance.

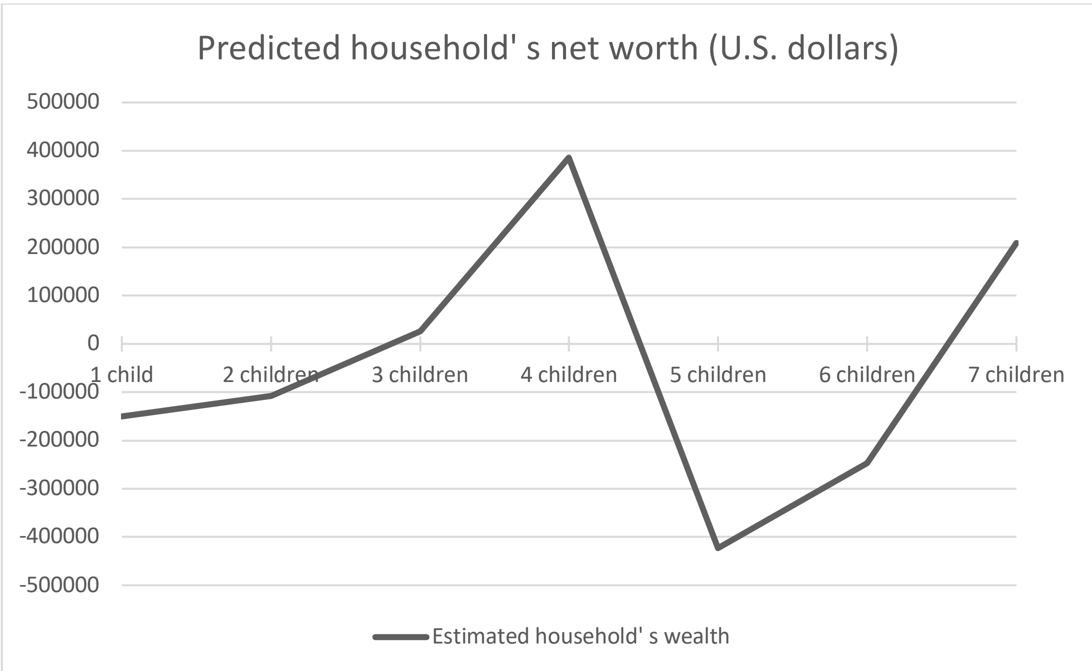
Nonetheless, a significant difference is observed between wealth levels as the number of children varies.

Table 5.2 Regression results of dummies for number of children on household's net worth (including controls)

Net worth	
1 child	-150,604***
	(39,006)
2 children	-108,133
	(90,542)
3 children	25,506
	(130,942)
4 children	385,823
	(423,967)
5 children	-423,081**
	(164,577)
6 children	-246,819
	(173,165)
7 children	209,507
	(197,307)
Controls	
Constant	-1.169e+06***
	(209,462)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 5.1 Predicted household's net worth ($) by number of children



In addition to employing net worth as the dependent variable, an alternative examination is conducted utilizing savings as the dependent variable. Table 5.3 shows the linear regression results for fertility and having children on household's level of saving, excluding and including control variables.

Contradictory to the analysis on net worth, this analysis reveals significant effects of fertility. The model of fertility on savings, excluding controls (first column 5.3) presents a coefficient of 1,475. When control variables are included this coefficient increases to 2,265. Meaning that as the number of children increases with one, on average savings increase with 2,265 dollars. The p-value reported for the model without controls is 0.005, the p-value decreased to 0.001 after adding controls. The model where the independent variable is the dummy having children does indicate a coefficient of 3,361 (excluding controls) and 4,970 (including controls). The p-values are respectively 0.010 and 0.001. Hence, the coefficients for fertility in the models in Table 5.3 could be interpreted as statistically significant. Furthermore, the following controls have a significantly positive effect on savings according to the regression results in Table 5.3: age, married or living with a person, having a bachelor's degree, income, financial literacy. And these have a significantly negative effect on savings: Hispanic, Black, entrepreneur, credit constraint and risk-seeking. Both ethnicity variables negatively affect one household's savings, being Hispanic is associated with a decrease of 3,067 dollars in savings, while being Black suggests a decrease of 4,975 dollars in savings (on average). Further, individuals who are classified as risk-seeking exhibit a negative effect on savings, with an average decrease of around 6,848 dollars in savings in both models. A reasoning behind this result could be that these individuals may be more willing to take risks with their money, potentially leading to lower savings.

Table 5.3 Linear regression results for fertility and having children on household's saving

Savings	**Model with independent variable fertility excluding controls**	**Model with independent variable fertility including controls**	**Model with independent variable having children or not excluding controls**	**Model with independent variable having children or not including controls**
Fertility	1,475***	2,265***		
	(524.7)	(654.6)		
Having children			3,361***	4,970***
			(1,296)	(1,538)
Age		220.3***		214.2***
		(45.26)		(45.08)
Married or living with person		4,020*		3,970*
		(2,294)		(2,314)
No high school		-2,426		-1,484
		(4,102)		(4,295)
Highschool or GED		648.5		1,287
		(4,305)		(4,404)
College or associate degree		-192.5		477.1
		(4,280)		(4,515)
Bachelor's degree or higher		8,840*		9,507*
		(4,901)		(4,933)

Hispanic		-3,067**		-3,046**
		(1,273)		(1,243)
Black		-4,975***		-4,982***
		(1,919)		(1,900)
Female		741.1		565.2
		(1,771)		(1,795)
Income		0.0356*		0.0356*
		(0.0194)		(0.0194)
Employed		4,137		4,076
		(4,227)		(4,192)
Entrepreneur		-6,918**		-7,049**
		(3,377)		(3,378)
Credit constraint		-6,276***		-6,330***
		(1,036)		(1,031)
Financial literacy		2,570***		2,558***
		(752.1)		(749.6)
Risk-averse		-7,499		-7,525
		(5,457)		(5,438)
Risk-seeking		-6,847***		-6,850***
		(1,507)		(1,503)
Constant	13,230***	-7,671	12,997***	-8,101
	(852.8)	(5,875)	(894.8)	(5,900)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The final part of this analysis involves conducting regression analyses to explore the relationship between fertility and the seven saving motives. The following reasons to save are examined: education, family, home, purchases, retirement, liquidity and entrepreneur (Table 5.4). Fertility impacts saving for education, family and home positively. The number of children has a negative impact on the saving motives purchases, retirement, liquidity/ the future and investment. The effect of fertility is the largest for education. This can be explained by the fact that caregivers will save for the education of their children. After the motive to save for education, the number of children in a household has the strongest influence on the motive to save for family. This observed result is a logical outcome, given that the size of a family increases as a household gets more children. Lastly, fertility leads to the fact that households save more for a home. Possibly because the presence of children in a household often leads to an increased need for space and a larger living environment. As families grow, they may require more room to accommodate their growing number of family members. Fertility has the largest negative impact on savings for retirement, followed by liquidity/ the future, purchases and investment. Plausibly, due to increased expenses, households with more children have less money left to save for these types of saving.

Table 5.4 Linear regression results for fertility on household's motives to save (including controls)

Motives to save	**Education**	**Family**	**Home**	**Purchases**	**Retirement**	**Liquidity/ the future**	**Investment**

Fertility	0.0400***	0.00994***	0.00867***	-0.00666*	-0.0176***	-0.0126***	-0.00366**
	(0.00384)	(0.00300)	(0.00326)	(0.00368)	(0.00492)	(0.00439)	(0.00155)
Controls							
Constant	0.0631***	0.154***	0.174***	0.245***	-0.175***	0.454***	0.0511***
	(0.0226)	(0.0250)	(0.0215)	(0.0298)	(0.0381)	(0.0629)	(0.0129)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

6 Conclusion

In this paper, an analysis with an experimental design in order to examine how fertility affects household's net worth was conducted. The purpose of this research is to determine the importance of incorporating fertility into life cycle models as the Bewley-model that are used to estimate the distribution of wealth. The examination of the role of fertility in these models is motivated by the need to understand the dynamic and complex processes that shape wealth inequality.

The findings presented in the result section show a positive coefficient for fertility on net worth (745.7) and a negative coefficient for the binary variable of having children (-86,975) on net worth. However, both coefficients are not statistically significant. The control variables, age, bachelor's degree, income, being employed, financial literacy and risk-seeking do have a significant positive impact on wealth. The results show significant negative effects of Black, entrepreneur and risk-aversion on wealth. Furthermore, the results section presents an analysis of the dummies of the number of children in a household, ranging from 1 to 7, and their effect on the household's net worth. The analysis reveals that having one child has a statistically significant negative effect on net worth, with an average decrease of 150,604 dollars. Additionally, households with five children show a statistically significant negative effect on net worth, with an average decrease of 423,080 dollars. Also, the effects of fertility and having children are examined on household's savings. There are statistically significant results for both independent variables. The findings show that as fertility increases with one (i.e. one more child is living in the household), average savings increases by 2,265 dollars. Having children compared to not having children increases savings on average with 4,970 dollars. Furthermore, age, being married or living with a person, having a bachelor's degree, having a higher income and having higher levels of financial literacy is positively related to a household's level of savings. Conversely, being Hispanic or Black, being an entrepreneur, experiencing credit constraints and being classified as risk-seeking has a negative impact on savings according to the results.

Furthermore, a regression was conducted to provide insight into the relationship between fertility and saving motives. The results reveal that fertility has a positive impact on saving for education, family, and home, while having a negative impact on saving for purchases, retirement, liquidity/future, and investment. The strongest influence of fertility is observed on the motive to save for education, which is plausibly due to the fact that caregivers tend to save for their children's education. Fertility also has a significant impact on saving for family, as the size of the family increases with more children. Furthermore, fertility leads to households saving more for a home. Fertility has the largest negative impact on savings for retirement, followed by liquidity/future, purchases, and investment. The increased expenses associated with having more children may leave households with less money to save for these types of savings.

The results of this study apply to the population of the United States. Nonetheless, I expect that similar results will be found for Western Europe and other developed countries. When interpreting the results of this paper, a number of limitations must be taken into account. The first limitation is that this research does not include the ages of children. One the best sources for data on household’s wealth (the SCF) was chosen, but unfortunately this dataset does not include the ages of children. Secondly, the dataset does not follow households over time and therefore the variable lagged net worth of household could not be retrieved and hence not employed as a control variable. Not including this control variable could bias the findings of this paper as current wealth level is likely correlated with past wealth levels (Maroto, 2018). Moreover, it is likely that the number of children in a household is correlated with past wealth levels, as wealth level is to be expected a determinant of individuals decision-making to become parents. Considering this mechanism, reverse causality could bias the estimated results, as not only could fertility affect wealth, but also wealth could affect fertility. To solve this problem, a good instrumental variable (IV) can help. Finding an IV went beyond the scope of my thesis but could be done in future research. Furthermore, it should be noted that pregnant households are not included in this research. Expecting to expand the household with children could already influence individuals’ reasons to save. Moreover, the findings of this paper indicate that a potential non-linear relationship exists between the number of children and household’s wealth. Future investigations could be conducted to verify the existence of this non-linear relationship and to examine the potential reasons behind it, if indeed this non-linear relationship does exist.

Overall, the results do not show significant results for the effect of fertility and having children on net worth, but most of the control variables do have a significant effect on wealth. Also, the analysis does reveal significant negative effects of fertility on net worth for households with one or five children. On the other hand, the results do show positive significant effects of fertility and having children on household’s saving levels. Furthermore, fertility has a positive influence on saving for education, family, and home, while having a negative impact on saving for purchases, retirement, liquidity/future, and investment. In sum, the results of this research do indicate a relationship between fertility, savings and wealth. Consequently, it is recommended that further research in this field, a Bewley-model is constructed in which fertility is included. Subsequently, it should be examined if this Bewley-model better fits the actual wealth distribution (than without including fertility). This thesis posits that fertility plays a crucial role in determining wealth and savings, and hence it is expected that the incorporation of fertility as an endogenous variable in the model will result in improved estimations of the distribution of wealth.

7 Reference list

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