Revisiting the Life Cycle Squeeze: Differential Rates of Life Cycle Wealth Accumulation Across Deciles

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Abstract

Addressing consumption changes with limited incomes over the course of the family life cycle is referred to as the *life cycle squeeze*. The greatest squeeze is early in the family life cycle when the costs of setting up a household and children are incurred. Economic squeezes during the life cycle should ultimately also be reflected by changes in wealth and rates of accumulation and evidence suggests that this is so. One unexplored aspect of life cycle squeezes is whether their impact varies by wealth rankings. Using census-linked probate wealth data for Ontario in 1892 and 1902 and non-parametric techniques, wealth-age profiles are estimated across wealth deciles. The results show life-cycle behavior is especially driven by behavior at the middle and lower parts of the wealth distribution. Life cycle squeezes are more prevalent in middle and lower deciles of wealth distributions than higher deciles. This suggests the rise of the middle class during the industrial era was an important factor in the spread of life cycle economic behavior. As well, a growing middle class subject to life cycle squeezes may have become an important factor in generating savings, economic growth and business cycle fluctuations.

Revisiting the Life Cycle Squeeze: Differential Rates of Wealth Accumulation over the Life Cycle Across Wealth Deciles.

Introduction

The economic pressure for additional income to meet consumption changes over the course of the family life cycle is known as the *life cycle squeeze.*[1] The greatest squeeze is when the costs of setting up a household and children are incurred but there are also squeezes associated with adolescent children as well as retirement. Occupational and social reference groups can also affect the size and timing of life cycle squeezes. These squeezes can be empirically demonstrated by fluctuations in the rate of wealth accumulation over age.[2]

A relatively unexplored aspect of life cycle squeezes is the role of relative wealth rankings on accumulation rates. Given that the economic importance of children is often greater in lower socio-economic strata[3] and the interplay between children, saving and consumption that results in a life-cycle squeeze more pronounced at lower incomes, one would expect differential squeeze impacts across wealth deciles.[4]

Wealth cross-sections for late nineteenth century Ontario are used to estimate wealth-age profiles. The results suggest that life-cycle behavior is especially driven by behavior at the middle and lower parts of the wealth distribution. After a period of initial decline, the top decile of the wealth distribution is generally characterized by upward sloping wealth-age profiles. Squeezes and life cycle behavior are also more prevalent in middle and lower deciles of the wealth distribution.

The greater prevalence of life cycle saving behaviour in the middle and lower deciles has macroeconomic implications. In nineteenth Canada, estimates suggest that the top ten percent held over 80 percent of all wealth and the bottom 40 percent held almost zero. By 2005, the

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[1] Oppenheimer (1974) originally defined the life cycle squeeze as "the situation where a man's resources are inadequate to meet the needs engendered by the number and ages of his children."

[2] See Di Matteo (1998).

[3] See Lilja and Backlund (2013a, 2013b)

[4] Oppenheimer (1974) found that only in relatively high-level professional, managerial and sales occupations did average earnings peak at the same time family income needs were peaking.

top ten percent in Canada held almost 60 percent of the wealth and the bottom forty percent still zero with the middle deciles holding the remainder.

This suggests the rise of the middle wealth holding classes during the industrial era were an important factor in the development of life cycle economic behavior. Moreover, the growth of the middle class and the effects of life cycle squeezes on the economy were perhaps factors in business cycle fluctuations.

Context: Life-Cycle Behaviour and The Life Cycle Squeeze

Literature on saving and wealth emphasizes the importance of savings motives: namely, life cycle as well as precautionary or bequest motives.[5] Apart from short-term precautionary savings, the main goal of these motives is ultimately the provision of old age support. The bequest motive emphasizes the role of family obligations and inheritances in generating old age consumption whereas the life cycle motive stresses impersonal market relationships and own-use asset accumulation.

The life-cycle model predicts that without a bequest motive, wealth should begin to decline at some age while the presence of a bequest motive should mean that more wealth is held at any age (Hurd, 1997: 926). Along with demographics, whether saving is bequest or life cycle driven has consequences for long-term capital accumulation and economic development along with the distribution of both income and wealth.[6]

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[5] The bequest motive can be defined as the accumulation of assets during productive years in order to provide offspring with an inheritance. Precautionary savings are the accumulation of assets to deal with short-term unforeseen economic events. Life cycle saving is the accumulation of assets during productive years to finance consumption during a period of non-income earning activity. See Ando and Modigliani (1963), Modigliani and Brumberg (1980), Deaton (2005), Bernheim, Schliefer and Summers (1985), Modigliani (1988).

[6] Keynes conveniently summarized the motives for saving as "Precaution, Foresight, Calculation, Improvement, Independence, Enterprise, Pride and Avarice," (Keynes, 1936/1973, 108). The modern literature emphasizes lifecycle and bequest motives. See Davies (1981), King (1985), Modigliani (1988), Kotlikoff (1988), Kessler and Masson (1989), Hurd (1989, 1990, 1997), Bernheim (1991), Arrondel, Perelman and Pestieu (1994), Burbidge and Davies (1994), Menchik (1980), Menchik and David (1983), David and Menchik (1988), Kearl and

Models of bequest behaviour can be classified into either voluntary or accidental categories.[7] Accidental bequests can be viewed as an extension of the life-cycle framework when combined with imperfect information regarding life span. Voluntary bequests, on the other hand can be further subdivided into altruistic, egoistic and exchange motives.[8] Under altruistic bequest motives, a household cares about current consumption as well as the consumption of descendants. Under egoistic motives, parents derive utility from the amount or composition of the bequest rather than the consumption of descendants. Finally, under exchange motives, parents engage in strategic behaviour to obtain services and attention from their children with larger bequests potentially yielding more attention.[9]

The empirical test for the presence of life-cycle saving behaviour is the presence of a hump-shaped wealth-age profile while an upward-sloping or flat wealth-age profile is usually interpreted as evidence of bequest saving behaviour. However, the presence of terminal wealth on its own does not necessarily imply the existence of a bequest motive for with uncertain lifetime, even life cycle savers can die with positive wealth levels.[10]

Life cycle saving behaviour is an important aspect of family economic strategy and behaviour and the events of family life –child rearing in particular – can influence rates of accumulation over the life cycle.[11] Valerie Kincade Oppenheimer (1974, 1982) formulated the concept of the "economic squeeze" which is "the notion of economic

Pope(1983), Gokale et al (2001), Lee (2001), Dynan, Skinner and Zeldes (2002). There is also an economic history literature that has examined the determinants of wealth, property ownership and inequality with various specifications employed. See for example Atack and Bateman (1981), Newell (1980, 1986), Pope (1989), Galenson and Pope (1989), Steckel (1990), Galenson (1991), Haines and Goodman (1995), Herscovici (1993, 1998), Osberg and Siddiq (1993), Ferrie (1994), Gregson (1996) and Di Matteo (1997, 1998), Conley and Galenson (1998), Walker (2000), Steckel and Moehling (2001).

[7] For other recent historical studies of bequests that also provide surveys of bequest motivation, see McGranahan (2009) and Combs (2005).

[8] Laitner and Ohlsson (2001). See also Jousten (2001).

[9] See Bernheim, Schliefer and Summers (1985) for the classic study of strategic bequest behaviour.

[10] Davies (1981) illustrates that a life cycle model with uncertain lifetime and without a bequest motive can account for the presence of terminal wealth.

[11] For a discussion of the study of the family and the complexities of social change, see Hareven (1991).

pressures for additional income in families, aside from that provided by the husband" (Oppenheimer, 1982: 5).

Economic squeezes originate from an imbalance between the desire to consume market goods, the economic resources available and the cost of market-produced goods. These pressures vary across age but usually are greatest early in the life cycle when households incur the expense of setting up a household. Moreover, occupation and social position can influence economic squeezes because of earnings impact as well as providing the lifestyle models for consumption.

The periods of peak expense are referred to as the "early adulthood squeeze," the "middle adulthood squeeze" and the "retirement squeeze". In early adulthood, a young couple engages in household formation and childbearing but earnings are relatively low. By middle adulthood, earnings have often peaked and yet there are now more costly adolescent children. Then there is the retirement squeeze, which occurs once individuals cease working and must finance their consumption without a work income.[12]

Oppenheimer's analysis dealt with mid-20th century America but a body of historical literature exploring aspects of the economic life cycle in Europe and North America has arisen. Taken together, this historical literature supports the existence of economic squeezes and a more complex economic life cycle.

Lilja and Backlund (2013a) note that findings for the period of industrialization up to 1900 are generally in accord with models of life-cycle squeezes. In pre-industrial Europe, life cycle squeezes have been noted for the self-employed by Schwartz (1988), Subacchi (1993 and Jutte (1994). Recently, using probate inventories for three towns in Sweden in the 1820s, Lilja and Backlund (2013b) also find squeezes were common before industrialization but that there were differences

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[12] According to Oppenheimer (1974, 1982), differences in career earnings across occupations can influence the severity and timing of these squeezes. For example, in high level professional occupations, the first squeeze is more stressful because of the steep age-earnings profile while for manual labor, the second squeeze is more stressful because the onset of adolescent children coincides with an age-earnings profile that has flattened out. In order to deal with these squeezes, families can engage in coping strategies which include postponing marriage, delaying children, having children provide family income, having wives work to supplement income as well as family migration in pursuit of better opportunities.

across social groups with the model of a life cycle squeeze more applicable to workers than master artisans.

In Canada, Bouchard and de Pourbaix (1987) constructed a population register for the Saguenay region of Quebec to study family life courses emphasizing demographic and occupational factors rather than life cycle saving behaviour. Gaffield (1979, 1982) and Bradbury (1979, 1982) also documented family economic strategies in the rural economy of Ontario and urban Montreal respectively focusing mainly on how families worked together as economic units but again with no explicit reference to the life-cycle. With the exception of Di Matteo (1998), which looks at differential rates of wealth accumulation over the life cycle using nineteenth century micro-data, much of the Canadian historical work has linked family behavior to the concept of economic strategies rather than the life cycle.

For the United States, a more dynamic historical view of the life cycle emerges in work for the colonial era. Using probate inventories for colonial Connecticut, Jackson Turner Main (1983) maintains that material needs and wants of people differ as they age, marry and form families. While the concept of an economic squeeze is not explicitly described, Main chronicles how marriage and children changed the requirements for a standard of living.

While young children were not particularly burdensome, "more considerable increases occurred as the older children entered the teens, partly from sheer numbers as the cost per teenager rose, and above all because the parents must now consider impending marriages" (Main 1983: 160).[13] As well, Haines (1979, 1985) finds that family savings are quite small when families had children below age 15 but then increased once they were older. Lewis (1983) relates fertility to life cycle saving

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[13] There is little explicit evidence available regarding the cost of raising children in the 19th century. However, an interesting example from 19th century Ontario emerges from the probate records. Edith Adelaide Durham (Wentworth County Will No. 1821) died intestate at age 19 and her stepfather Charles Braithwaite filed the following statement of expenses: "expenses incurred in the care, maintenance, clothing and schooling of Edith Adelaide Durham from the year 1875 to June 1881, 312 weeks, at $1.50 per week $468 paid for medical attendance and medicine $200 cash to her in sundry small sums $50." The sum of these expenses was $718, which suggests the average annual expense of rearing female adolescent children (net of the medical costs) was about $86 per annum. This is a major sum given that a laborer such as a moulder could expect to earn about $400 per annum in the 1880s in Ontario.

in a life-cycle model that treats children as assets as assets from the viewpoint of parents as uses it to explain the increase in nineteenth century U.S. saving rates. Lewis finds that between 1830 and 1900, about one quarter of the rise in the US saving rate can be attributed to a decline in the dependency rate.

Ransom and Sutch (1986) argued that the nineteenth century was the period when America made the transition from target-bequest to life cycle saving – that is, the motive for wealth accumulation shifted from a desire to preserve the family farm in order to provide an inheritance for offspring in return for old age support to the desire to amass a stock of more liquid assets to finance old-age consumption independent of offspring. Using evidence from labour force surveys of industrial workers in Michigan and Maine, they found a decline in the savings rates of older workers and a hump-shaped profile indicative of life cycle saving.

Gratton and Rotondo (1991), using late 19th century cost of living surveys undertaken by the Bureau of Labor Statistics, found that per capita family expenditures were highest in the 25-34 and 50-59 age group. The margin between income and expenditure was narrow for young households but the surplus grew, even as the income of the primary earner slips in middle age, because other income sources become available to supplement family income (Gratton and Rotondo 1991: 350).

One could argue that using contributions from working children, as the head of the household moved into middle age, was an attempt to mitigate the effects of the second economic squeeze. Gratton (1996: 49-50) notes that when sons and daughters reached working age, families experienced positive changes in their economic status. Gratton (1996: 51) estimated that in 1890 households headed by men aged 40 to 44 saw children contribute 17% of household earnings. Meanwhile for those where the household head was aged 60 to 64 it was 31%.

Robinson (1993), using a longitudinal sample drawn from the 1860 Federal census and followed for 20 years, chronicled the methods in which 19th century families in Indianapolis attempted to generate income to supplement or replace a primary income earner. The results also reinforce the presence of economic squeezes due to the presence of children. Robinson found that families had wives and children seek employment or take in boarders as they moved through the most

financially stressful stage of the life cycle - when the largest number of children lived at home.

Rotella and Alter (1993), using the 1889-90 Bureau of Labor Statistics cost of living survey, found wages earned by children played a central role in late 19th century family economic strategies with life cycle patterns of saving and debt varying by industry and the income from children. The evidence suggests that families used borrowing and saving to smooth consumption over the life cycle as the earning capacity of the family changed.

Families where potential income exceeded expenditures, were often large families with husbands past their earning peak. As well, children's income as a percentage of family income often varied across occupational groups. For example, in the 50 to 59 year age category, children accounted for approximately 15 percent of family income in households headed by bar ironworkers and 45 percent in those of cotton workers.

Steckel (1996) used a national census sample of nearly 1600 male headed households matched from the 1860 to the 1850 manuscript census to examine the age at which children left home. Steckel found that children were "clearly integral to the production and consumption of family services as indicated by patterns of departure" with later-born children tending to remain longer to care for elderly parents. While Steckel notes a downward trend in the age of departure during the 19th century due to changing occupational structure (male children of non-farmers left earlier than those of farmers) he found the average age of departure was 26.5 years for men and 22 years for women. These results also suggest that parents relied on children for some economic support during the latter portion of their life cycle.

Most recently, Richard Sutch (2015) continues his work on wealth acquisition and inherited wealth in the United States and finds an abundance of evidence for life-cycle saving and much less support for a bequest motive (even among the wealthy). Wealth holding was significant among working class families late in their work life and a wealth age-profile for 1870 using data from the 1870 U.S. Census shows a distinct hump-shape characteristic of life cycle saving behaviour. Moreover, the hump-shape was more pronounced at the 25th percentile suggesting that lower wealth families ran down their savings at a more rapid rate.

Taken together, these studies illustrate life-cycle economic behavior on the part of families, which via the interaction of consumption and income should ultimately manifest itself through saving and wealth accumulation. If there are economic squeezes during the life cycle, then these periods of economic stress should be reflected by wealth over the life cycle and therefore the wealth-age profile can be examined for evidence of economic squeezes.

Based on Oppenheimer's work, one would expect to see a squeeze in early adulthood, another in middle adulthood and finally a retirement squeeze. During these squeezes, one would expect to see either a halt in the rate of growth of wealth, that is a flattening out of the profile, or even a decline, as wealth is run down in an effort to maintain consumption in the face of restricted resources.

Data

The data consists of 7156 census-linked probated decedents from all counties and districts of Ontario, Canada for the years 1892 (3,515) and 1902 (3,641). Of these, 5,250 or 73 percent were male decedents. The data set was constructed from the probate records of the county surrogate courts and the 1891 and 1901 Census of Canada. [14] Probate was an institutional arrangement that transferred property from the dead to the living thereby making the inventory and valuation of property very important. The executor of the estate (or administrator in intestate cases) conducted the inventory[15] legally in response to a request by a legatee or creditor but in practice was done voluntarily without the compulsory summons (Howell 1880: 325-326). [16] The

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[14] Sources for the data set were: (1) Public Archives of Ontario, Surrogate Court Wills, 1892, 1902 and (2) Public Archives of Canada, Census of Canada, 1891,1901 Manuscripts.

[15] Intestates are decedents without a will.

[16] According to Howell's (1880: 325-326) *Probate, Administration and Guardianship* "The inventory should contain a statement of all the goods, chattels, wares and merchandize, as well moveable as not moveable, which were of the person deceased at the time of his death within the jurisdiction of the court. A proper inventory should enumerate every item of which the personal estate consisted, and should specify the value of each particular. But unless by order of court, or in obedience to a citation, an inventory does not set forth the goods and chattels in detail." It should be noted that real estate was usually recorded net of

inventory provided wealth estimates grouped into sixteen categories[17] allowing for separate estimates of real estate, financial assets and personal property.

Construction of the data set commenced by recording onto standardized data collection forms those estates probated in the years 1892 or 1902 with linking to census returns in order to obtain additional information.[18] The census tracing procedure used the name of the deceased, the occupation (if provided), marital status, the spouse's name (if any) and the names of children mentioned in the probate records as the variables to determine a match.   Those individuals who died prior to the taking of the census or were non-Ontario residents with property in one of the counties were omitted from the census tracing procedure.[19]

For 1892, a total of 4,925 estates were taken down of which 4,236 were traceable and 3,515 successfully traced for a success rate of 83 percent. For 1902, a total of 4,969 estates were taken down of which 4,233 were traceable and 3,646[20] successfully traced for a success rate of 86 percent. When the males are extracted from the data set, there are

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any mortgages outstanding so that the wealth figure used in this paper is a measure of net wealth.

[17] The inventory categories were:(1) Household goods and furniture, (2) Farm implements, (3) Stock in trade, (4) Horses, (5) Cattle, (6) Sheep and Swine, (7) Book Debts and Promissory Notes, (8) Moneys secured by mortgage, (9) Life Insurance, (10) Bank stocks and other shares, (11) Securities, (12) Cash on hand, (13) Cash in bank (14) Farm produce, (15) Real estate, (16) Other personal property.

[18] For a full account of data collection, see Di Matteo (1997).

[19] Some of these omitted probated decedents were residents of other provinces of Canada, the United States and Britain but with property in Ontario. Other omitted individuals were Ontario residents who died before the taking of the census (in April) and therefore would not have been recorded in the Census schedule of the living. There often was a lag between the date of death and the probating of the estate. For example, in some intestate cases, time was expended searching for a will. As well, there were sometimes complicated intestate estates with incomplete administrations. For example, an individual could die intestate and the surviving spouse apply for administration of the estate and in turn die leaving the administration incomplete. If there were no surviving children or none resident in the immediate vicinity, it could take many months to apply for probate and settle the estate.

[20] Five of these individuals did not have age recorded and therefore for analysis, the final number for 1902 is 3641.

2,691 males in 1892 and 2,559 males in 1902.[21] There are some differences between those individuals who could be located in the census and those who could not. In general, those who could not be located in the census were more likely to be female, had lower average wealth and were also less likely to own real estate.[22]

There are potential limitations to the use of probate records that should be acknowledged.[23] First, probated decedents may not best represent the general population as they are of higher socio-economic status; however, this paper focuses on the probated decedents themselves, making the problem of selection bias limited.[24] Another related issue is that probate wealth data may be affected by whether the individuals died unexpectedly or had been ill a long time and run down their assets but cause of death information was not available in the probate records and other sources are not reliable for this time period.[25]

Second, estate taxes may provide incentives for an executor or administrator to underestimate inventoried wealth but in Ontario the presence of estate taxes provided little reason to underestimate the value of the estate for most decedents. There were no succession

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[21] The proportion of male decedents declined substantially over time reflecting greater property ownership by women The Married Women's Real Estate Act, 1873, allowed married women to dispose of real estate as if unmarried. The Married Woman's Property Act, 1884, enabled a women to dispose of any real or personal property as if unmarried. See also Inwood & Ingram (2000), Baskerville (1999) and Di Matteo (2013).

[22] For example, for Wentworth County in 1892, of the final set of census linked probated decedents, 72.7 percent were male, 76.0 percent were testate, 78.6 percent reported owning real estate and average wealth was $9716. For those who could not be traced successfully, 62.8 percent were male, 74.4 percent were testate, 60.5 percent reported owning real estate and average wealth was $6852.

[23] Discussions of Ontario probate records as historical sources of data are contained in Elliott (1985: 125-32) and Osborne (1980: 235-47). See also Siddiq and Gwyn (1991: 103-117).

[24] When studying the wealth holding of the general population, an attempt can be made to adjust the data for potential biases using the estate multiplier technique. See Siddiq and Gwyn (1991: 103-17), and Di Matteo and George (1992: 453-483).

[25] A noted scholar of Ontario's civil registration of vital events statistics writes that: "For years after 1869 Ontario's civil registration of vital events was unsatisfactory. Although its legislative provisions surpassed Quebec's, Ontario was less successful in obtaining registrations...the registrar-general estimated that registrations for 1870 captured only a fifth of the province's deaths..." By 1893, reported death rates for municipalities ranged from 26 to 2 per thousand. See Emery (1993: 32-34).

duties in Ontario until July 1, 1892 when the *Succession Duty Act* (Statutes of Ontario, 55 Vict., Cap. 6, 1892) came into effect, and even then the Act allowed for numerous exemptions.[26]

A final concern is the extent of *inter vivos* transfers, meaning that an unknown portion of wealth may have been transferred during life and unaccounted for by the probate records. However, generally, the property liable to duty was quite comprehensive and after 1896, it included property vested jointly with interest to survivor. The Succession Duty Act applied even to property "voluntarily transferred by deed, grant or gift made in contemplation of the death of the grantor or bargainor, or made or intended to take effect, in possession or enjoyment after such death..."[27] if they were made in the 12 months preceding death. Moreover, after 1896, *donatio mortis causa* , that is, goods and possessions delivered in apprehension of death, were also clearly defined as property liable to duty. [28] Such transfers are considered a problem if estate taxes present an obstacle to terminal wealth transmission but the evidence for Ontario suggests that they should not be given the generous exemptions.[29]

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[26] The Succession Duty Act did not apply: (1) To any estate the value of which, after payment of all debts and expenses of administration, does not exceed $10,000; nor (2) To property given, devised or bequeathed for religious, charitable or educational purposes; nor (3) To property passing under a will, intestacy or otherwise, to or for the use of the father, mother, husband, wife, child, grandchild, daughter-in-law, or son-in-law of the deceased, where the aggregate value of the property of the deceased does not exceed $100,000 in value. Revisions to the Act in 1897 (Revised Statutes of Ontario (1897), Cap. 24) kept the $100,000 exemption value but it was later reduced to $50,000 in 1907 (5 Edw.VII, c.6, s.6) which is well after the period of these two cross-sections.

[27] A report on the Succession Duty Act in the Welland Tribune (April 1, 1892: 2) asserted that: "The act provides for evasion by transfers before death, although the fear of revival makes such attempts very rare."

[28] There is a drop in average other personal property in Ontario between 1892 and 1902 that is quite large but can be attributed to outliers. For example, in the four Niagara region counties in 1892, Wentworth County reports the two largest amounts of other personal property $66,500 by Thomas Myles, a coal merchant, and $23,522 by Jacob Zingsheim, a furniture manufacturer. These two individuals represent almost half the average value of other personal property in 1892. The maximum amount in 1902 in these four counties is $15,000 reported by one Thomas Bates, a brewer.

[29] Another view is that for the purposes of studying wealth, an *intervivos* transfers is in principle really no different than choosing to consume one's wealth in some other way in the period prior to death.

Summary statistics for the data are presented in Table 1. The average age of the probated decedents rose slightly between 1892 and 1902 from 61.2 to 61.7 years.[30] For the data set as a whole, 73.4 percent were male, 44.2 percent were urban residents, 43.7 percent were employed as farmers, 72.6 percent were testate (had a will), and 75.6 percent reported living children. The average number of children was 2.78. Average wealth was 6,871 dollars with an average of 3,002 dollars in real estate and 3,042 dollars held as financial assets.[31] Between 1892 and 1902, the average value of financial assets grew while the average value of real estate held declined.

In terms of its distribution, wealth was quite unequally held. A division employed by Piketty (2014: 237-270) is employed which divides the decedents into the top 1%, the next 9%, the next 40% and finally the bottom 50% - essentially the top (10%), middle (40%) and bottom (50%) of the distribution. When the data is combined across the two years, the top 10 percent of the wealth distribution own 56.9 percent of the wealth (with the top 1 percent owning 25 percent) while the next 40 percent own 34.2 percent and the bottom half only 8.9 percent of the wealth.

Wealth-Age Profiles & Analysis

Non-parametric[32] estimates of wealth-age profiles are done using Locally Weighted Scatterplot Smoothing (LOWESS).[33] Locally Weighted Scatterplot Smoothing (LOWESS) is a non-parametric curve fitting method which starts off with a local polynomial least squares fit and then attempts to make the estimate more robust by using weights from

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[30] It should be noted that 61 percent of the decedents were aged 60 years and older.

[31] Financial assets are items (7)-(13) in the probate inventory and are: (7) Book Debts and Promissory Notes, (8) Moneys secured by mortgage, (9) Life Insurance, (10) Bank stocks and other shares, (11) Securities, (12) Cash on hand, (13) Cash in bank

[32] An alternative that has emerged to parametric techniques in the estimation of wealth-age profiles is non-parametric estimation. Non-parametric estimation attempts to deal with both the inadequacies of functional form as well as the inadequacies of the data with respect to outliers. See Ullah (1988), Haerdle (1991) and Yatchew (1998, 2003). The non-parametric approach provides a versatile method for exploring data relationships, provides predictions without reference to a fixed parametric model and is useful for dealing with outliers.

[33] See Cleveland (1979, 1985, 1993).

the local neighborhood around the observation point.   Given a scatterplot (X_i, Y_i), i=1,....n, the fitted value at X_k is the value of a polynomial fit to the data using weighted least squares where the weight is large if X_i us close to X_k and small if it is not.   In fitting a LOWESS curve, the crucial choices to be made are the smoothing parameter and the degree of the fitted polynomial (Cleveland 1979, 1993).[34]

Figures 1a and 2a present average LOWESS smoothed results for wealth by age and estimates of the average annual growth rate of wealth by age category for all of the probated decedents.[35] Figures 1b and 2b repeat the process for male decedents only. The results are presented for the 0.2 and 0.5 bandwidths with the former being less smoothed and showing greater variability with respect to age. Both profiles for all decedents show steep rates of ascent from age twenty with the 0.5 peaking close to age 70 while the 0.2 reaches multiple peaks between ages 60 and 80. The results are similar for males only. These figures are supportive of life-cycle saving behavior in general but the rate of wealth decrease after peak wealth is rather low and also supportive of a bequest motive.

When average annual growth rates by age category are presented, evidence of a life-cycle squeeze is not entirely evident. For all decedents, for the 0.2 results, the age 20-29 grouping sees an average annual wealth accumulation rate of 7.3 percent, which then declines to

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[34] The mathematical details of constructing LOWESS estimates are available in Cleveland (1979), Cleveland (1993, 100-101) and Haerdle (1991, 192-193). The smoothing parameter ranges from between 0 and 1 while the degree of the polynomial can be linear or quadratic. The choice of the smoothing parameter and the degree of the polynomial are choices based on a combination of judgment and trial and error. The smoothing parameter is essentially a bandwidth over which the locally weighted regression is to be estimated with larger smoothing parameters associated with greater smoothing. For example, if the smoothing parameter is 0.2, 20 percent of the observations form the neighborhood around the local point to be estimated. Ideally one should try to pick a value of the smoothing parameter that is as large as possible without distorting patterns in the data. As for the degree of the polynomial, Cleveland (1979: 833) argues that the linear polynomial strikes a balance between the advantage of being computationally simpler and the need for flexibility to reproduce patterns in the data.

[35] The LOWESS profiles were estimated using the micro-data but the smoothed values were then averaged by year to generate the visual profiles in order to generate a wealth-age profile rather than a wealth-age scatterplot. STATA 13 was the estimation package.

4.1 percent in the 30-39 year group, then rises to 5.2 percent for ages 40-49 and then declines to 0.7 in the age 50-59 age category. Meanwhile, the 0.5 results show steadily declining accumulation rates. The results for males are parallel.

However, these results are for all the decedents and it may be more useful to separate out decedents with and without children. Figures 3 and 4 present average LOWESS smoothed results for wealth by age as well as estimates of the average annual growth rate of wealth by age category only for probated decedents with children. The results are again presented for both the 0.2 and 0.5 bandwidths and this time show more distinct evidence of a life cycle squeeze.

When the narrower bandwidth results are examined, there is negative growth in wealth accumulation during the age 20 to 29 period – a key time for family formation. Wealth accumulation rates then recover with averages of 2.2 percent in the 30-39 bracket and 4.0 percent in the 40 to 49 year age group before plummeting to 0.6 percent in the period linked to a second life-cycle squeeze – age 50-59. After a brief recovery during the 60 to 69 year age group the life cycle squeeze sets in with declining average growth rates.

The next step was to examine the life cycle accumulation of probated decedents with children categorized by their relative wealth position – that is, those in the top 10 percent of the wealth distribution, the next 40 percent and finally the bottom fifty percent. The annual average LOWESS smoothed wealth age profiles using a 0.2 bandwidth are presented in figures 5A to 5C and the average annual rate of growth by age group presented in Figure 6.

The most important observation that can be made is that the wealthiest individuals in the data set are truly different from everyone else in terms of their lifetime wealth accumulation patterns. The top 10 percent exhibit periods of increase and decrease in their wealth over the course of their life cycle but there is not a hump-shaped curve indicative of life cycle behavior. While wealth declines appear to mark the earlier years in the life cycle, after age 40, the trend is of increasing wealth subject to fluctuations.

A hump-shaped wealth-age profile is most pronounced for the next 40 percent of the wealth distribution. Wealth for this segment of the wealth distribution rises quickly reaching a peak in the mid 60s and then begins a steep decline though there appears to be a small rebound after age 80. As for the bottom 50 percent, wealth rises but at a reduced

rate after age 30 and peaks at about age 60 and then declines gently afterwards.

Figures 5A-5C and Figure 6 suggests that of the three wealth groups, it is only the next 40 percent – what is essentially a middle wealth holding class – that exhibits the best examples of both life-cycle and life-cycle squeeze behavior. The wealth levels of the top 10 percent in their LOWESS profile never fall below $31,000 – an amount that is 4.5 times the average for the data set. The fluctuations exhibited can be more likely the result of fluctuations in asset allocation decisions and investment returns rather than any type of life-cycle pattern of behavior. As for the bottom 50 percent, their pattern of accumulation seems to be simply to accumulate and hold. Their wealth levels are quite low and peak at $1,401 dollars – an amount that is only 20 percent of the average wealth in the data set.

The middle wealth group has average annual growth rate patterns by age category that fall into the pattern one might expect of life cycle squeezes. There is declining wealth during the family formation stage of the 20-29 age category and accumulation afterwards with declining rates of accumulation after age 50 one might expect from the adult child and retirement squeezes. This suggests that the growth of the middle wealth holding classes in the twentieth century would also have fostered more life-cycle saving behavior and made the effects of life-cycle squeezes more important to the economy and perhaps played a role in economic fluctuations.

As demonstrated in Table 1, the top 10 percent of decedents owned 57 percent of private wealth while the middle 40 percent owned 34 percent. Of course, this wealth distribution is still relatively "egalitarian" for the nineteenth century given it is based only on those who have reported wealth. If estate multiplier estimates for Ontario in 1892 based on Wentworth County are used, the top 10 percent owned 83 percent of wealth, the next 40 percent 17 percent and the bottom 50 percent owned zero assets.[36] The share of the top 10 percent and the distribution in general for Wentworth County was quite similar to other countries during this time period.[37]

As the nineteenth and twentieth centuries progressed, one of the features was a growing middle class and a shift in wealth distribution

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[36] Di Matteo and George (1992).
[37] See Roine and Waldenstrom (2014).

that saw the wealth share of the top 10 percent decline while that of the middle 40 percent increase while that of the bottom fifty percent did not change substantially. In Canada by 1984, the top 10 percent owned 51.8 percent of wealth, while the next 40 percent owned 42.8 percent of wealth and the bottom 50 percent 5.4 percent.[38]

The result of a larger wealth holding middle class with a growing share of wealth means that life-cycle behavior and life cycle squeezes would have become more important in terms of their effects on the macro economy as the twentieth century progressed. It is generally well established that savings rates rise with income with savings rates often negative for those in the lower part of the income distribution.[39]

Models of economic growth point to savings and savings rates as major determinants of economic growth and macroeconomic fluctuations.[40] Savings in turn are intertwined with demographic factors making age factors important determinants of economic growth with economic growth accelerating when large portions of the population reach life cycle peaks of savings.[41] Indeed, cross-country regressions have found that aggregate savings rates are lower when the population share of the elderly or children is high.

The growth of a middle wealth holding class during the course of the twentieth century would have been a factor in boosting savings rates and propelling economic growth rates. Indeed, for Canada, the savings rate grows dramatically during the course of the twentieth century accompanying the growth of the middle wealth and income classes. As Figure 7 shows, the implied savings rate[42] was generally below 15 percent of GNP until the first decade of the twentieth century and then rose to above 20 percent after 1945.

Demographic factors such as changes in cohort size would have also led to fluctuations in savings rates as assorted cohorts moved through the three life-cycle squeezes thereby affecting savings and

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[38] Morissette and Zhang (2006). For example in 1890, the wealth share of the top 10 percent in France was 84.7 percent while in the United States it was 72.2 percent.
[39] Deaton (2005: 95).
[40] See Solow (1956), Mankiw, Romer and Weil (1992), Rebelo (1991), Ehrlich and Lui (1991) and Romer (1990).
[41] See Malmberg (1994: 291).
[42] The implied savings rate is calculated by taking the ratio of gross fixed capital formation to GNP and subtracting the ratio of capital inflow to GNP. See Urquhart (1988).

wealth accumulation rates. Much of the economic history of the twentieth century in terms of business cycle fluctuations in savings rates and growth rates could be ascribed to the interaction between demographics and life cycle saving behavior.

Conclusion

Census-linked probate wealth data for Ontario in 1892 and 1902 and non-parametric techniques are used to estimate wealth-age profiles across wealth deciles. Hump-shaped wealth age profiles are demonstrated for all decedents, as well as male decedents only and decedents with children. However, rates of decumulation after peak wealth are not very large and the result is also supportive of bequest type saving behavior.

When the wealth-age profiles are estimated by taking wealth levels into account, the results showing life-cycle type behavior over wealth are driven by behavior at the middle and lower parts of the wealth distribution but especially in the middle. Life cycle squeezes are also more prevalent in the middle deciles of wealth distributions than higher deciles.

This suggests the rise of the middle class during the industrial era was an important factor in the spread of life cycle economic behavior and a factor in the growth of aggregate saving rates. As well, a growing middle class subject to life cycle squeezes and demographic changes in cohorts proceeding through the life cycle may have become factors in driving economic growth as well as business cycle fluctuations.

Table 1
Summary Statistics for Wealth Data

Variable	1892	1902	ALL
N	3515.00	3641.00	7156.00
Average Age	61.17	61.72	61.45
Percent Male	76.56	70.28	73.37
Percent Urban	42.11	46.25	44.21
Percent Farmer	46.49	41.01	43.70
Percent Testate	73.00	72.12	72.55
Percent With Children	78.58	72.70	75.59
Average Number of Children	3.34	2.87	2.78
Percent Married	61.08	58.23	59.63
Percent Single	11.27	13.32	12.31
Average Wealth	7427.42	6334.46	6871.00
Average Real Estate	3468.31	2551.25	3001.71
Average Financial Assets	2988.80	3093.53	3042.09
Percent Reporting Real Estate	74.40	70.26	72.29
Percent Reporting Financial Assets	69.64	77.20	73.49
Wealth Share of Top 1%	26.06	23.25	25.00
Wealth Share of Next 9%	32.30	31.90	31.88
Wealth Share of Next 40%	32.80	35.77	34.19
Wealth Share of Bottom 50%	8.84	9.08	8.93

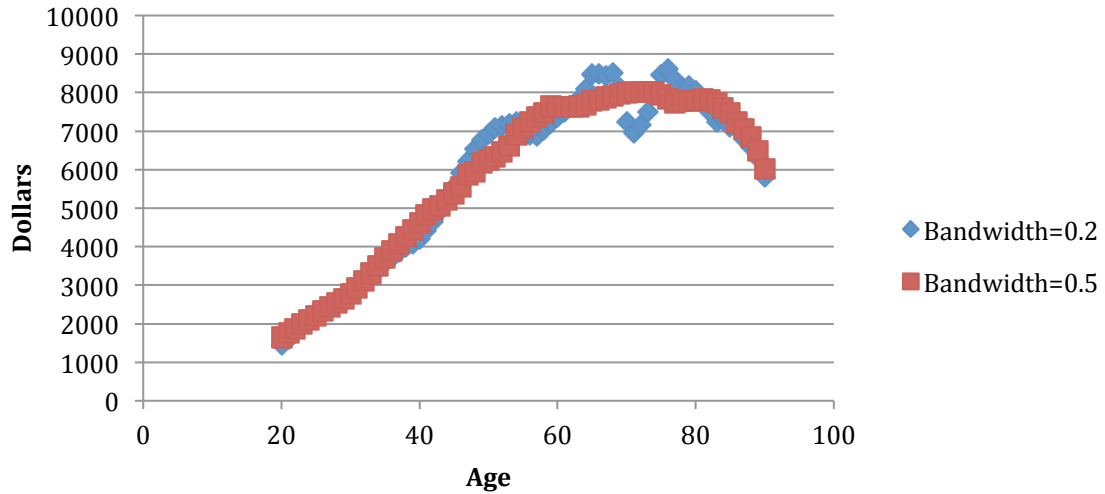**Figure 1a: All Decedents, Average LOWESS Smoothed Wealth by Age**

Figure 1b: Male Decedents, Average LOWESS Smoothed Wealth by Age
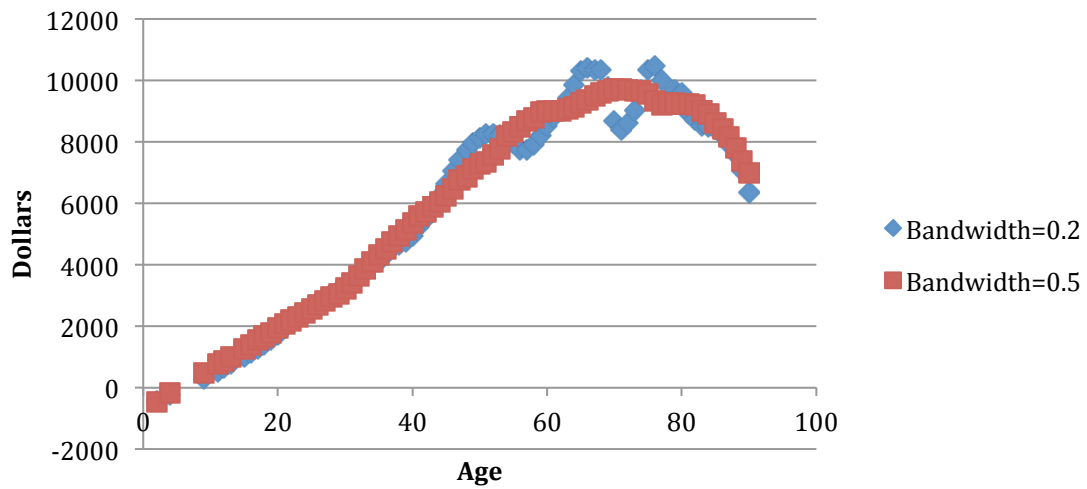
Figure 2a: Average Annual Growth Rate (%) by Age Category of LOWESS Smoothed Wealth, All Decedents
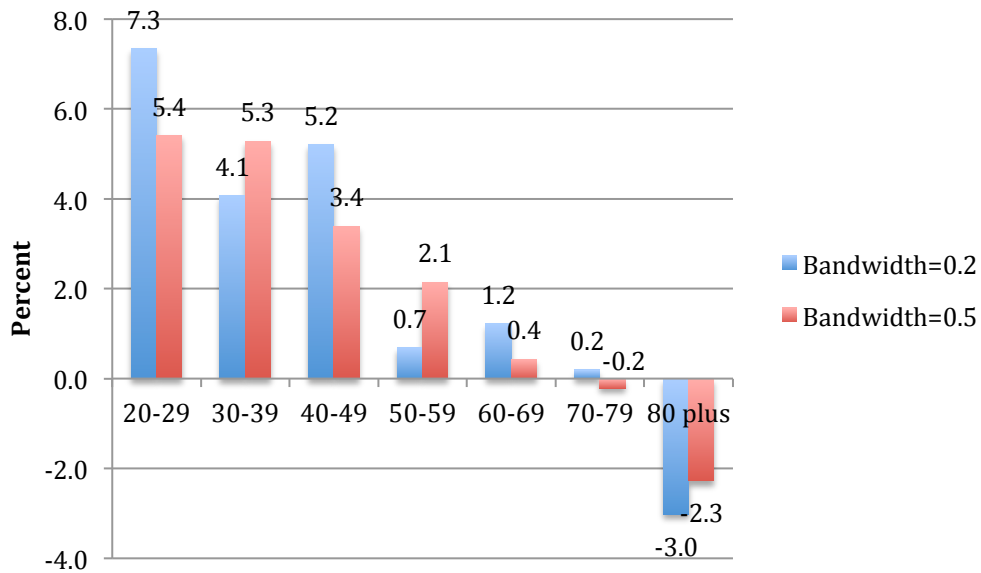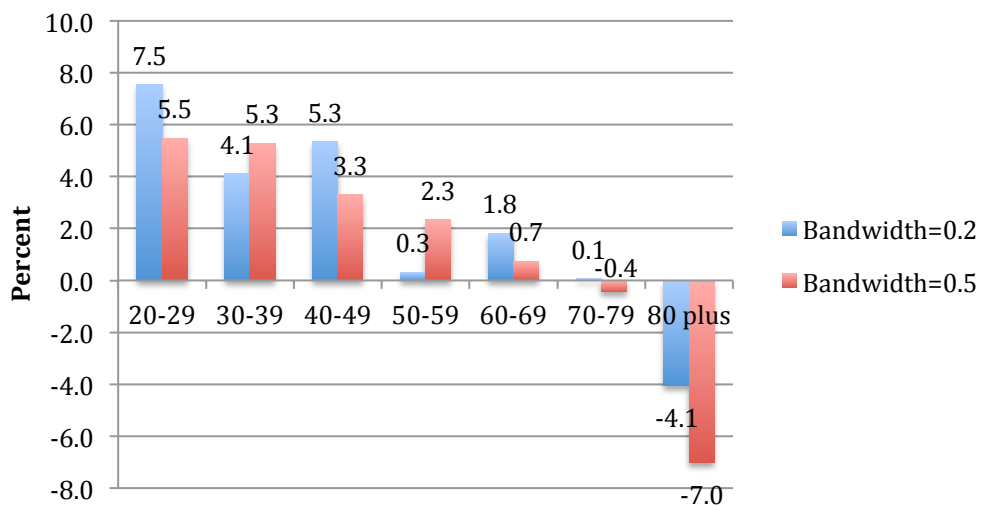

Figure 2b: Average Annual Growth Rate (%) by Age Category of LOWESS Smoothed Wealth, Male Decedents

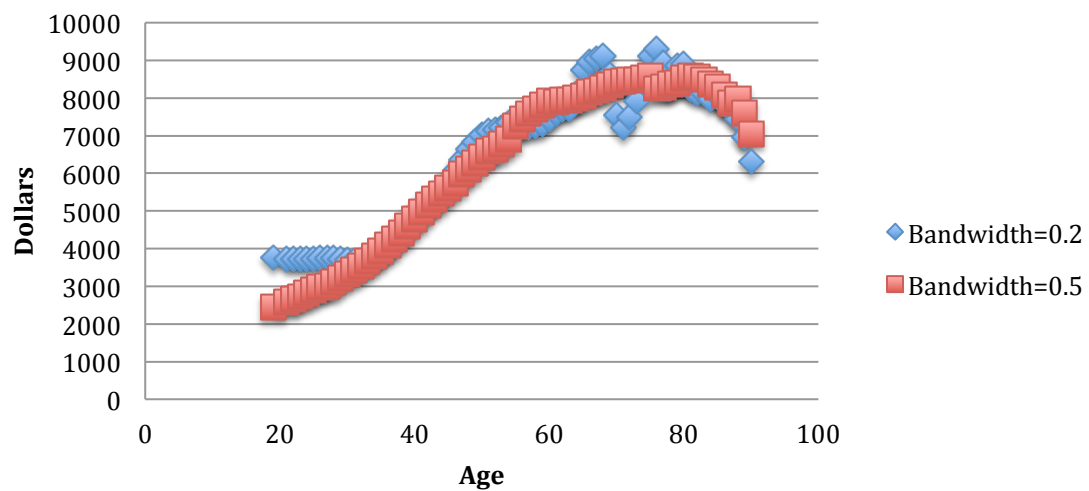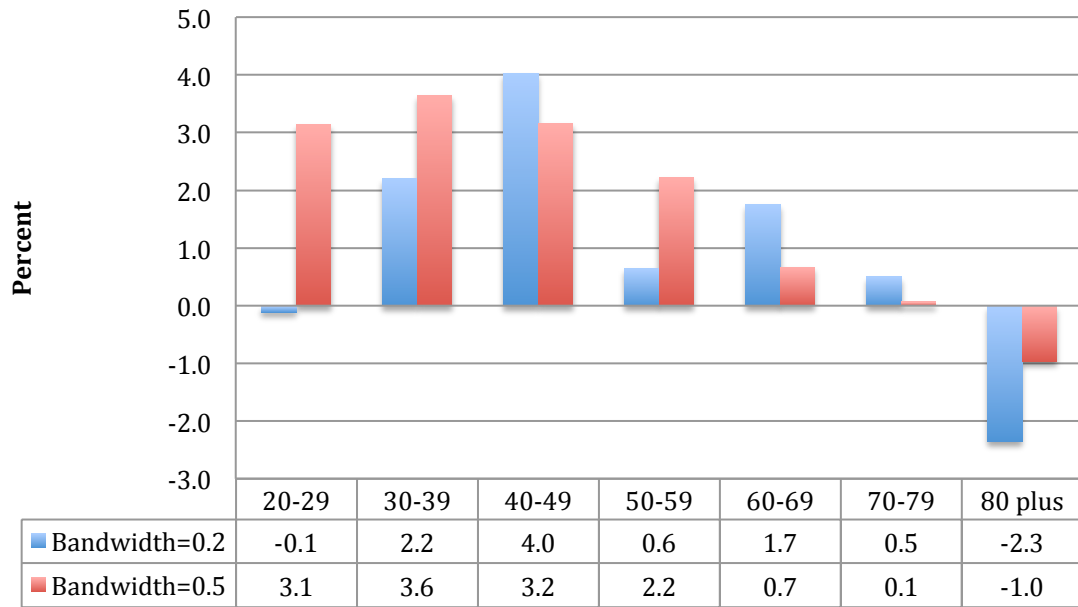**Figure 3: Decedents with Children, Average LOWESS Smoothed Wealth by Age**

Figure 4: Average Annual Growth Rate of LOWESS Smoothed Wealth, Decedents with Children
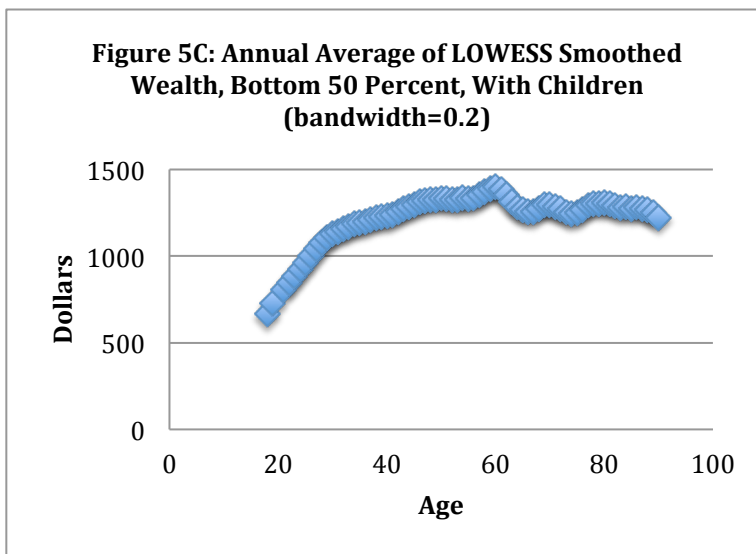
	20-29	30-39	40-49	50-59	60-69	70-79	80 plus
Bandwidth=0.2	-0.1	2.2	4.0	0.6	1.7	0.5	-2.3
Bandwidth=0.5	3.1	3.6	3.2	2.2	0.7	0.1	-1.0

Figure 5A: Annual Average of LOWESS Smoothed Wealth, Top 10 Percent, With Children (bandwidth=0.2)

Figure 5B: Annual Average of LOWESS Smoothed Wealth, Next 40 Percent, With Children (bandwidth=0.2)

Figure 5C: Annual Average of LOWESS Smoothed Wealth, Bottom 50 Percent, With Children (bandwidth=0.2)
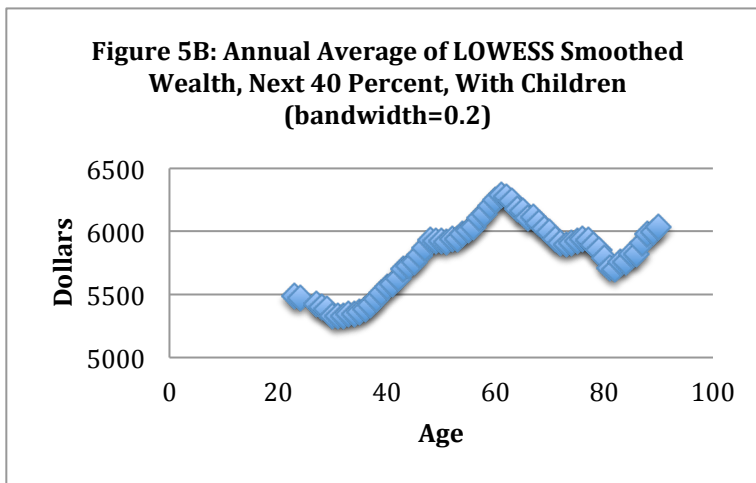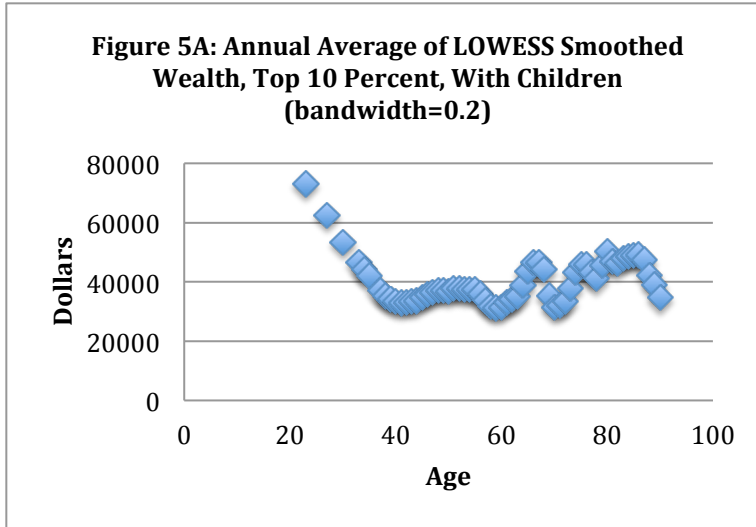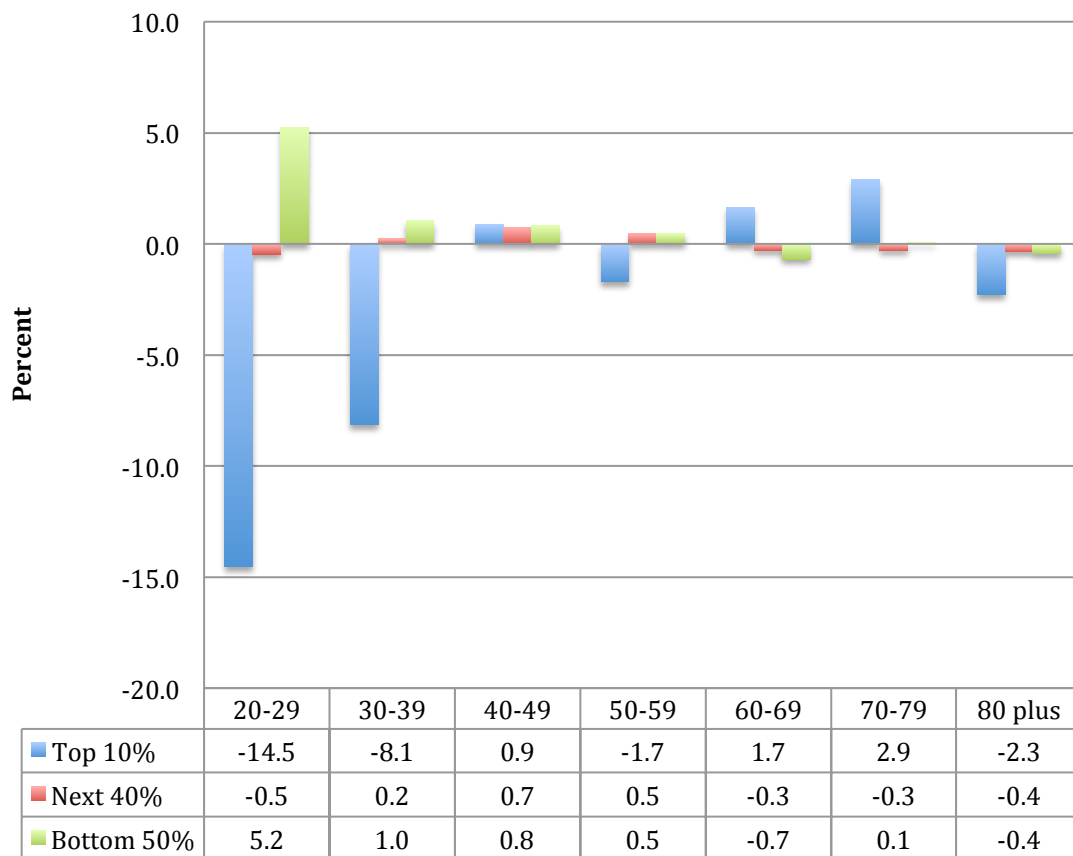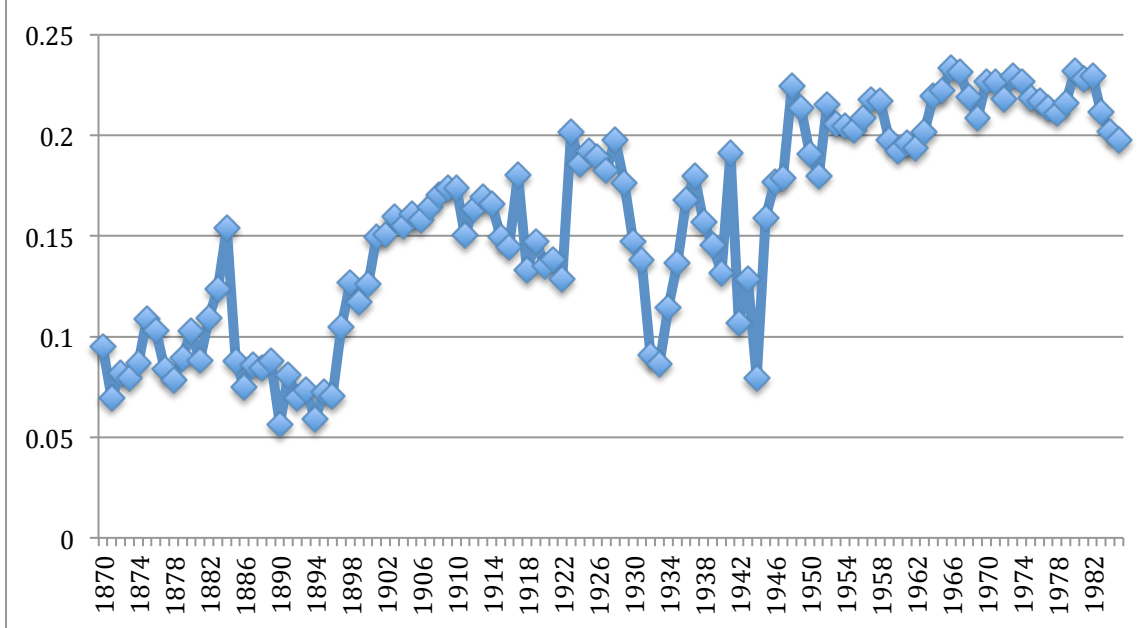
Figure 6: Annual Average Rate of Growth of LOWESS Smoothed Wealth by Age Category By Wealth Group for Decedents with Children (bandwidth=0.2)

	20-29	30-39	40-49	50-59	60-69	70-79	80 plus
Top 10%	-14.5	-8.1	0.9	-1.7	1.7	2.9	-2.3
Next 40%	-0.5	0.2	0.7	0.5	-0.3	-0.3	-0.4
Bottom 50%	5.2	1.0	0.8	0.5	-0.7	0.1	-0.4

Figure 7: Implied Saving to GNP Ratio, Canada 1870-1985 (Source: Urquhart (1988))

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