

A Life Course Perspective on U.S. Income Inequality

An Age-Period-Cohort Analysis

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Abstract

The United States continually has one of the highest levels of income inequality in the Western world. When trying to understand the evolution of income inequality, most studies have focused on age and period characteristics, neglecting cohort effects and preventing researchers from obtaining a comprehensive understanding of income inequality across the life course. This study explores income inequality within the United States through a detrended age-period-cohort model that allow for the simultaneous analysis of the three characteristics to better understand their impacts on income distribution. This study utilizes United States income data from the Luxembourg Income Study (LIS): specifically, data on U.S. disposable household income from 1965–2020, with 100,000–200,000 individual observations for each year contained in 20,000–70,000 households. The results of the study indicate that age effects are rather significant, and individuals in the 40–55-year age group have the most significant advantage. Birth cohorts from 1915–1929 have the largest income advantage over other cohorts. Period characteristics show negative income effects around the 1970s recessions and the 2007–2009 recession. The findings of this study support the idea that one's position within the life course affects their income level and the income inequality they experience. In the case of the U.S., one's age matters more than one's position within a birth cohort. The early stages of the life course present the highest levels of income inequality, as younger individuals are considerably disadvantaged in comparison, and only move toward stabilization or advantage when they approach middle-age.

Keywords: age-period-cohort, income inequality, economic shocks

Introduction

Within the last half-century, income inequality has become increasingly more prevalent in more developed countries around the world. As its prevalence increases, the field of research surrounding the phenomenon has increased reciprocally. Income inequality and its causes and consequences have been the topic of global economic conferences and scholarly publications both in the U.S. (e.g., Lin & Tomaskovic-Devey, 2013; Piketty & Saez, 2003; Stiglitz, 2013; Stiglitz, 2015) and international context (e.g., Chancel et al., 2021; Milanovic, 2016; Nolan et al., 2014), publications from international organizations (e.g. OECD, 2008; OECD, 2011; OECD, 2015; International Monetary Fund, n.d.; United Nations, n.d.), and speeches from some of the world's most prominent global figures, from Pope Francis to the World Economic Forum. Conversations on income inequality focus not only on its existence, both within and between countries, but seek to understand its consequences for individual citizens, nations, and the global economy. Recent research focusing on the consequences of income inequality has covered both the directly understood consequences associated with higher levels of income inequality, namely poverty and material deprivation (Polacko, 2021), as well as the more implicit consequences related to social outcomes, the spillover effects that have a negative influence on social cohesion, health, mortality, and more (Deaton, 2013; Kawachi & Kennedy, 1997; Stiglitz; 2013). The study of income inequality has broad importance across the world and only continues to become more vital with the persistence of high levels of inequality in more developed countries.

This study focuses on the evolution of income inequality within the U.S. to gain a better understanding of income dynamics and more accurately explain the distribution of rising income inequality in the United States. There is considerable literature on the distribution of income

inequality in the United States, but this literature tends to focus strictly on income dynamics with respect to age and economic period (Gornick & Milanovic, 2023; Gornick et al., 2022; Smeeding, 2006; Scharrer, 2025). While the focus on age and period characteristics have generated important conclusions about the shape and dynamics of income inequality across the U.S., these two characteristics are not able to paint a full picture as to how income inequality is structured across the U.S. population and how income inequality is differentially experienced across U.S. demographics.

This paper focuses on the role of cohort effects, alongside the role of age and period characteristics, to better grasp the full picture of income dynamics within the U.S. There have been studies on the role of cohorts with the U.S.; Deaton and Paxson (2001) have studied the relationship between income inequality and mortality across American cohorts, Heikkuri and Schief (2023) have studied income inequality in the context of population aging and cohort differences, Hungerford (2020) and Kitov and Kitov (2013) have studied intra-cohort effects in income inequality, and Huggett et al. (2011) consider cohorts in the context of sources of lifetime inequality. While these studies have resulted in important findings regarding the effect of birth cohort on income inequality, they have mainly studied cohorts from an isolated perspective, not considering the role of cohorts with respect to age and period, but instead studying cohorts alongside one of these characteristics alone; in the U.S. context, cohort characteristics are often studied alongside age characteristics, while period characteristics are not considered.

Cohort effects have been traditionally ignored within the literature due to the identification problem present when looking at age, period, and cohort characteristics simultaneously; these three characteristics share a linear relationship, $period - age = cohort$, thus utilizing two of the three characteristics in a model implies the third (Lim & Zeng, 2016; Yang & Land, 2013). Despite the difficulties present in assessing cohort effects, the focus on cohorts has grown in recent years as researchers recognize the considerable empirical benefits present in cohort analyses. Cohort studies allow researchers to better understand how cohorts are differentially affected by temporal trends due to differences in life-stage and aging when approaching or interacting with time-related trends or historical events (Elder Jr., 1998; Elder Jr. et al., 2003; Elder Jr. & George, 2015; Yang & Land, 2013).

In the context of this paper and the study of income inequality, cohort effects, specifically inter-cohort dynamics, can help to better explain the structure of income inequality and the way that cohorts are distinctively affected by historic economic events or economic shocks. Using novel age-period-cohort methods and a life-course perspective on income inequality, this paper seeks to answer the question of how income trends and inter-cohort dynamics within the U.S. are affected by economic shocks.

Framework of Analysis

The Theoretical Study of Income Inequality

While income inequality has been relatively consistent over the last century, the way it has been studied has shifted as the understanding of causes, trajectories, and consequences has developed among economists and social researchers. In this section, I will trace these developments through

differing theoretical approaches that represent turning points in the study of U.S. income inequality.

The first statistically driven theory on the concept of economic growth and income inequality was crafted by Simon Kuznets (Piketty, 2014). The ‘Kuznets curve,’ and the theory behind it, posits that after industrialization and the movement to advanced stages of capitalism, income inequality will naturally fall; the theory described a reverse U-shaped curve that depicted the rise of income inequality during the industrial period to its ultimate peak, and the subsequent decrease in levels of income inequality in a post-industrial era of the advanced capitalistic state (Kuznets, 1955; Piketty, 2014). The ‘Kuznets curve’ earned significant attention in the field of income inequality due to its position as the first statistically derived model of income inequality and its relatively positive depiction of the future of post-industrial, developed states (Piketty, 2014). Eventually, as income inequality did not naturally decrease, researchers began looking for other ways to explain and examine its continuous rise.

To explain the distribution of global income and global income inequality, Christoph Lakner and Branko Milanovic developed a global growth incidence curve (GIC) to track cumulative growth rates across percentiles of global income distribution (Lakner & Milanovic, 2016). Their GIC became known as the ‘Elephant Curve’ due to its shape resembling an elephant with a raised trunk (Milanovic, 2016). The curve shows the relative percentage gain in real income for all percentiles of global income holdings and paints a picture of the disparities present in more developed countries, such as the U.S.; while the middle classes in the U.S. experience low levels of income growth and remain relatively static in their median location within global and national

measures of income distribution, those within the top 1% continue to earn and thus continue to widen the gap in earnings and perpetuate elevated levels of income inequality (Milanovic, 2016; Lakner & Milanovic, 2016).

Around the time of Milanovic's work on global income distribution and inequality in the context of increasing globalization, Thomas Piketty came out with his work *Capital in the Twenty-First Century*. Piketty sought to explain the decrease in inequality in more developed countries from the late 1920s to 1980, and the subsequent increase in inequality from the 1980s well into the 21st century (Piketty, 2014). The explanations for these trends over the last century are rooted in the idea that, first, the large-scale decrease witnessed was unusual and due to worldwide circumstances, not, as Kuznets had posited, as simply a natural reaction to increasing industrialization. And second, the increase after 1980 belongs to the state of capitalism that much of the world currently exists under (Kuznets, 1955; Piketty, 2014; Milanovic, 2016). Discussing the trends further, economic scholars suggest that the circumstance of war in the 20th century, regarding the political forces behind the war, the economic factors related to financing the war, and concurrent ideological movements, helped to compress income inequality (Milanovic, 2016; Piketty, 2014). War mobilization and economic interventions brought U.S. income inequality to its lowest levels in the period from 1950 to 1980. At the end of this period, the 1980s saw a considerable increase in inequality that has persisted into the 21st century. Piketty's argument is that this state of high inequality is the natural consequence of living under capitalism, and is to be expected, in perpetuity, outside of unusual circumstances that precipitate decreases in inequality (war, economic crashes, etc.) (Piketty, 2014).

In response to Piketty's assertion that the high state of income inequality is to be expected as a byproduct of the capitalistic infrastructure most of the world exists under, researchers have sought new solutions and circumstances that might bring forth a decrease in inequality. In *The Great Leveler*, Walter Scheidel argues that inequality "never dies peacefully" and is always accompanied by violent shocks that make way for a more equal future (Scheidel, 2017). The violent shocks discussed are called the "four horsemen" by Scheidel and speak to the four circumstances that have helped to decrease levels of inequality across history. These four conditions are mass mobilization warfare, transformative revolution, state failure, and lethal pandemics (Scheidel, 2017). These four horsemen help to further flesh out the unusual circumstances prompting decreased inequality discussed by Piketty (2014) and force those who study the state of inequality to consider how, or perhaps more accurately, if, income inequality can be decreased without the presence of great violence.

The research methods and theoretical approaches discussed in the preceding paragraphs help to illustrate the history of income inequality studies, both in the U.S. and globally, and provide a picture of where the field is at today in an era of increasing income inequality across more developed countries.

Empirical Investigations of U.S. Income Inequality & Economic Shocks

While the theoretical approaches discussed up to this point help to paint a broad picture of patterns of income inequality globally, and within the U.S., empirical studies on the evolution of income inequality in the U.S. help to more specifically describe the structure of U.S. income inequality across time. From 1980 to 2018, U.S. income inequality rose 39%, placing U.S. levels

of inequality well above those of its peer countries and demonstrating a growing concentration of income, wealth, and resources for those at the top (Amaral et al., 2019; Horowitz, et al., 2020). There have been numerous studies conducted to trace the causes and consequences of this growth in inequality. Piketty and Saez' (2001) work "Income Inequality in the United States," studied income and wages using individual tax returns and found that top wage earners are increasingly pulling away from the pack (Fix, 2018). Kuhn et al. (2020) used Survey of Consumer Finances data to trace trends in income and wealth inequality across time and different demographic factors, confirming high levels of income inequality, and a dominance in income shareholding at the top, to the detriment of the American middle class. Piketty, Saez, and Zuchman (2018) combine these two measures of income, working with a combination of tax, survey, and national accounts data, to find that while average national income has increased among the U.S. population, so too have income disparities, with inertia for those in the lower 50% and exponential growth for those at the top. Piketty et al. (2018) additionally address the distribution of income across age groups and time periods.

The research focus of this paper is how different points of the economic cycle, namely economic shocks, affect cohorts differently across the life course. For this research, the economic shocks being covered pertain to periods of recession within the U.S. as defined by the National Bureau of Economic Research (NBER; National Bureau of Economic Research, n.d.). Currently, there are eight documented recessions within the period of observation from 1965–2020. For the purposes of this research and discussing the most prominent economic shocks within the observation period, the recessions studied will be the recession of 1970 and following recession

from late 1973–1975, the 1980 recession and following recession from 1981–1982, the 1990 recession, the 2001 recession, and the recession from 2007–2009.

These various periods of recession have diverse causes and consequences. The recessions of the 1970s pertained to the oil crisis and oil embargos against the U.S. and were additionally characterized by stagflation, or the simultaneous experience of slow growth, high unemployment, and inflation within an economic system (Zarnowitz & Moore, 1977; Liu, 2023). The recessions of the 1980s related to fighting inflation and were caused primarily by a tightening of monetary policies (Sablik, 2013). The recession in 1990 dealt with widespread labor market deterioration across major occupational groups as numerous key durable goods industries experienced simultaneous contractions (Gardner, 1994; Singleton, 1993). The recession in 2001 is often called the dot-com bubble burst and pertains to the period of recession precipitated by unprecedented growth in the 1990s of the dot-com industry (Kliesen, 2003). The final recession, from 2007–2009, is known as the Great Recession and is consistently deemed the most devastating economic crisis in the U.S. since the Great Depression (Institute for Research on Labor and Employment, 2018).

There have been studies on the relationship between economic shocks and income inequality that find notable correlations between the two. Bodea et al. (2021) find that economic crises related to currency, banking, inflation, and domestic debt increase income inequality both in the short-term and the long run. Pereira da Silva et al. (2022) share that after recessions, income inequality tends to increase more rapidly. Piketty and Saez (2013) echo the rapid increase in post-recession periods, specifically mentioning the pulling away of top income distributions. The relationship

between economic shocks and income inequality generally indicates that economic shocks increase income inequality – the question is to what extent that influence, and increase, differs across cohorts.

Inequality Across the Life Course

To better understand the structure of income inequality and its consequences, this study seeks to explore income inequality from a life course perspective that considers the social context of individuals. The life course theory discussed and utilized within this work discusses the effects of an individual's age, periodic location, and birth cohort. These three factors help to locate an individual within time. Age relates to the stage of life one may be in and the timing of transitional events within one's life, period relates to the context one is currently in, and birth cohort relates to the historical context one belongs to (Elder Jr. et al., 2003; Giele & Elder Jr., 1998).

Age effects have been studied rather broadly and there is an established understanding that individuals of different ages will experience life transitions differently due to the experiences and resources they bring to the table (Elder Jr. et al., 2003). Historically, birth cohorts have been less widely studied but have been gaining traction in recent years as researchers utilize cohort effects to better understand social change and how different historical events differentially affect cohorts; each cohort approaches the historical event from a different stage of life or age, changing the ways in which the period of time may affect them (Elder Jr. et al., 2003; Elder Jr. & George, 2015). In the context of the study of income inequality, cohort effects, specifically inter-

cohort dynamics, can help to better explain the structure of income inequality and the way that cohorts are distinctively affected by historic economic events, or economic shocks.

While there is extensive data about income distribution in the U.S., there is considerably less information on the role of birth cohorts within unequal income distribution. The current literature studying cohort effects, or generational effects, has primarily focused on aggregate data, detailing relative differences in economic position between cohorts (Smeeding & Sullivan, 1998) or studying the effects of cohorts through the lens of intergenerational mobility (Bloome, 2015; Corak, 2013). Additional U.S. studies in the cohort context have focused on intra-cohort effects (Hungerford, 2020, 2022) or looked at the effects of inter-cohort differences in income on social outcomes (Zheng et al., 2022).

The utilization of age-period-cohort models that allow for the simultaneous and differentiated analysis of the effect of these three characteristics on income inequality, alongside the use of the life course perspective as a means of understanding inequality through one's social context and historical location, uniquely position this analysis within the lens of previous literature and as an additive study that enhances the current literature on income inequality across the life course and the effect of cohorts in the development and perpetuation of income inequality. This study seeks to address the gap in the literature on the role of cohorts in U.S. income distribution and to provide a more robust explanation for the mechanisms driving income inequality within the U.S.

In applying the life course perspective, this study focuses more heavily on the role of cohorts, specifically looking at the relationship between income distribution and economic shocks. The

main question this study seeks to answer is how the income trends and inter-cohort dynamics of the U.S. are affected by economic shocks.

Hypotheses

With respect to the aims of this study, and in line with literature on cohort dynamics and economic shocks, the expectation is that cohort and period effects will be more significant than age effects (Karonen & Niemelä, 2020; Escalonilla et al., 2022; Chauvel, 2013; Chauvel & Schröder, 2014; Freedman, 2017). While it is still expected that age characteristics will have a noticeable effect, as U.S. data has shown that Americans consistently reach their income peak between the ages of 45-55, spending the first half of their time within the labor force working up to this point (U.S. Bureau of Labor Statistics), there is a question as to if it is solely an individual's age that produces this trend (Ozhamaratli et al., 2022), or if the trend of the inverse U-curve of age in the U.S. can better be explained by educational attainment (Tamborini et al., 2015), demographic shifts (Freeman, 1979), or, as considered in this study, an individual's birth cohort and temporal entry into the labor force (Güvenen et al., 2017; Freeman, 1979).

Because of the inconclusive nature of the explanation for age characteristics, there is still an expectation that the role of age may be suppressed upon the addition of control variables. With respect to period characteristics, the economic shocks described previously had considerable negative effects on the economy at their various points, and the expectation is that at these points of economic shock, there will be considerable negative income deviations. Regarding cohort, as this study seeks to better understand the role of cohorts specifically, the expectation is that there will be significant advantages in income experienced by certain cohorts.

H1: Cohort and period characteristics will have the strongest effects on income. Age will demonstrate noticeable, but lesser effects.

H2: Age effects will be explained, or suppressed, by control variables.

H2a: The introduction of education into the controlled model will significantly suppress age-based income deviations.

H2b: The introduction of labor force status into the controlled model will suppress age-based income deviations, although at a smaller level than education.

Previous research on the effect of cohort membership on one's earnings, and on income inequality more broadly, has shown that the 'baby boomers' (born from 1946-1964) have experienced the greatest benefit from their birth cohort. The rhetoric within the U.S. more informally, and the results provided within research done on birth cohorts in the context of the U.S. and other more developed countries, is centered around the advantaged position that 'baby boomers' hold against other generations. Chauvel and Schröder (2014) found that cohorts born between 1945 and 1955 are the most advantaged cohorts across all welfare regimes and almost all LIS countries. Chauvel and Schröder (2015) additionally found that those around the "baby boomer" birth cohort had systematic advantages when compared to other cohorts. This generation benefitted from educational expansion, high levels of employment, and a favorable labor market. Freedman (2017) found in the U.S., as well as in other countries, that younger generations, when compared to those within the 'baby boomer' generation, had fewer earning

opportunities. In addition to the systematic advantages found in the literature, research has also found systematic disadvantages for younger individuals, indicating that ‘millennials’ and other younger cohorts are generally less well-off (Gale et al., 2020; Kurz et al., 2019). In line with this research, I hypothesize similar results regarding the privileged position of the ‘baby boomer’ generation in U.S. income distribution.

H3: Belonging to the ‘baby boomer’ cohort will have a larger effect on income compared to belonging to other birth cohorts.

Data and Methods

Data

The data utilized for this research will be the Luxembourg Income Study’s (LIS) United States income data. The United States data from the LIS comes from the U.S. Bureau of Labor Statistics (BLS) and the U.S. Census Bureau, specifically from the Current Population Survey (CPS) and Annual Demographic Supplement (ADS). The CPS is a rotating panel survey, and the ADS is a cross-sectional survey. The LIS contains data from 1963–2022 for the US, and I will be utilizing the set from 1965–2020 which encompasses 55 years that can be divided evenly in the five-year increments necessary for the detrended age-period-cohort method (APCD). The data contains 100,000–200,000 individual observations for each year, contained in 20,000–70,000 households.

The entire sample of U.S. data from 1965–2020 from the LIS contains 9,183,236 observations; the analytical sample contains 6,198,841 observations and only includes individuals who had

data available for all dependent and control variables. The sample was further restricted by age to ensure the data was harmonized across the 55-year period. While all individuals 15 and above responded to questions regarding labor participation, their income was less consistent, and these individuals generally do not hold consistent jobs. For these reasons, individuals under 20 years old were dropped from the analytical sample. Individuals above the age of 85 were also excluded from the sample as this was the maximum age present across the 55-year observation period. The analytical sample is 52.9% female with an average age of 45.56 ($SD=16.71$).

The dependent variable for this study will be disposable household income. Disposable household income (DHI) is defined as the “sum of cash and non-cash income from labour, income from capital, income from pensions (including private and public pensions) and non-pension public social benefits stemming from insurance, universal or assistance schemes (including in-kind social assistance transfers), as well as cash and non-cash private transfers, less the amount of income taxes and social contributions paid” (Luxembourg Income Study, n.d.-a). The DHI provided by the LIS has been adjusted for inflation and equivalized for use within this study. To adjust for inflation, I calculated the real DHI utilizing the consumer price index (CPI) given by the LIS. The reference year for this adjustment is 2017, which is the most recent year of deflator information from the LIS. The equation for this calculation is

$$Real\ DHI = \frac{Nominal\ DHI}{CPI} \times 100$$

The DHI was equivalized using the square root scale of equivalization. This method of equivalization was chosen as it is the method utilized by the LIS to equivalize their data when

calculating and exporting their own key figures and indicators on poverty and inequality from the collected microdata (Luxembourg Income Study, n.d.-b.). In utilizing the equivalization method, the disposable income variable becomes a proxy variable for independent disposable income; each individual in the household receives the same equivalized income value, but the value more accurately reflects individual-level income as opposed to universally assigned household income values. The equation for the square root scale of equivalization is:

$$\textit{Equivalized Income} = \frac{\textit{DHI}}{\sqrt{\textit{Number of Household Members}}}$$

Figure 1 below shows the distribution of adjusted and equivalized income for age, period, and cohort profiles.

Figure 1. Age, Period, and Cohort Profiles



I will be using educational level, occupational position, race/ethnicity, and labor market status as the control variables for this analysis. The educational level utilizes a six-category classification. The categories are: less than primary school, lower secondary school or less (including primary school), upper secondary school, bachelor’s degree or short-cycle tertiary education, master’s degree, and doctoral degree. For use in the APCD model, the variable will be coded into six separate dummy variables, one for each of the categories.

Occupational position uses the ten-category ISCO occupational categorization. The categories are: elementary occupations (ISCO-9, ILO Skill Level-1), armed forces occupations (ISCO-0, ILO Skill Levels-1, 2, & 4), plant and machine operators and assemblers (ISCO-8, ILO Skill Level-2), craft and related trades workers (ISCO-7, ILO Skill Level-2), skilled agricultural, forestry, and fishery workers (ISCO-6, ILO Skill Level-2), service and sales workers (ISCO-5, ILO Skill Level-2), clerical support workers (ISCO-4, ILO Skill Level-2), technicians and associate professionals (ISCO-3, ILO Skill Level-3), professionals (ISCO-2, ILO Skill Level-4), and managers (ISCO-1, ILO Skill Levels-4 & 3). This variable is coded as a continuous variable, ordered by ILO skill level. The higher the value of the variable, the higher the skill level of the occupation.

For the variable addressing ethnic/racial origin, the response options varied from three possible classifications to twelve possible classifications during different years across the observation period. To harmonize the data in the most accurate way, the ethnic/racial classifications were broken into five categories: White, Black, American Indian, Asian/Hawaiian/Pacific Islander, and mixed race (also containing the 'other' category utilized in various year intervals). This does limit the identification of individuals by combining adjacent categories, but it is the most accurate way to utilize data that has been collected through different responses over the observation period. For use in the APCD model, the variable will be coded into five separate dummy variables, one for each category.

Labor market status is a four-category variable. The four categories are: employed, unemployed, retired, and not in labor force. For use in the APCD model, the variable will be coded into four separate dummy variables, one for each category.

I will additionally be using unemployment rate as a control and will be obtaining regional, age-group-based unemployment rates. The unemployment rate was calculated for all fourteen five-year age group divisions, from ages 15-85, across nine different geographical regions within the United States. The U.S. Census Bureau, for statistical purposes, utilizes a nine-category geographic division system to divide the 50 U.S. states (Centers for Disease Control and Prevention, n.d.). The breakdown of which states are included in each of the nine regions is included in the appendix (Appendix 1), but the nine regions are as follows: New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, and Pacific. The variable for the unemployment rate is a continuous variable containing the calculated unemployment rates across regions and age groups.

Table 1. Descriptive Statistics

Dependent variables			
		Mean	Std. Dev
Disposable income		43,464.62	51,692.41
Adjusted disposable income		38,766.61	34,420.24
Logarithmic disposable income		10.20	1.06
Logarithmic adjusted disposable income		10.30	0.81
Independent variables			
		Percent (%)	Total
Gender	Women	52.88	3,277,890
	Men	47.12	2,920,951
Education	Less than primary	1.76	108,915
	Lower secondary or less	19.25	1,192,991
	Upper secondary	45.79	2,838,272
	Bachelor's degree or Short-cycle tertiary	25.18	1,560,580
	Master's degree	7.26	450,201
	Doctoral degree	0.77	47,876
Labor Force Status	Employed	63.34	3,922,071
	Unemployed	2.18	134,996
	Retired	11.80	730,791
	Not in Labor Force	22.68	1,404,542
Occupational Position	Elementary occupations	9.06	355,749
	Armed forces occupations	0.91	35,606
	Plant and machine operators and assemblers	9.96	391,067
	Craft and related trades workers	11.47	450,473
	Skilled agricultural, forestry, and fishery workers	1.61	63,393
	Service and sales workers	12.44	488,449
	Clerical support workers	13.41	526,562
	Technicians and associate professionals	11.57	454,531
	Professionals	16.39	643,585
	Managers	13.20	518,275
Ethnic/Racial Origin	White	84.04	5,209,741
	Black	10.25	635,268
	American Indian	0.83	51,475
	Asian/Pacific Islander	3.33	206,586
	Mixed Race	1.54	95,771
Region	New England	8.20	508,004
	Middle Atlantic	12.91	800,127
	East North Central	13.83	857,378
	West North Central	9.40	582,712
	South Atlantic	16.78	1,039,867
	East South Central	5.47	339,225
	West South Central	9.29	575,583
	Mountain	9.71	601,642
	Pacific	14.43	894,303
		Mean	
Age		45.56	16.71
Unemployment Rate		3.29	1.17

The Age-Period-Cohort Problem

The lack of literature surrounding cohorts is rooted largely in the empirical difficulties associated with measuring cohorts due to the linear relationship between age, period, and cohort: $age + cohort = period$; utilizing two of the three characteristics in a model implies the third (Lim & Zeng, 2016). The inability of assessing all three of these effects at the same time has prevented us from obtaining a comprehensive understanding of the true impacts of income inequality across the life course. This study aims to focus on income inequality from a life course perspective in order to better understand the role that birth cohorts play in impacting life course outcomes, as growing research is beginning to establish the understanding that generational differences in income are significant (Chauvel & Schröder, 2015; Smeeding & Sullivan, 1998; Karonen & Niemelä, 2020). To do this, the study will utilize age-period-cohort (APC) methods that allow for the assessment of all three variables at the same time. APC methods present the opportunity to separately parse out the effects of age, period, and cohort on income distribution. Currently, there is considerable literature surrounding the use and advancement of novel APC methods (Chauvel, 2011; Chauvel, 2012; O'Brien, 2015; Yang & Land, 2013). In the age-period-cohort tradition, significant work has been done to assess cohort differences in economic outcomes. Researchers have used age-period-cohort models to assess inter-cohort differences in specific countries, for example, Finland (Karonen & Niemelä, 2020) and Spain (Escalonilla et al., 2022), as well as to assess differences in cohort effects across countries and welfare regimes (Chauvel, 2013; Chauvel & Schröder, 2014; Freedman, 2017). The researchers have established various methods to accurately account for these three variables, and I will be using the age-period-cohort detrended method described and utilized by Chauvel in his work (2011; 2012).

Detrended Age-Period-Cohort Method

This study utilizes a detrended age-period-cohort model (APCD; Chauvel, 2011; Karonen & Niemelä, 2020). Because of the collinearity of age, period, and cohort, this separate method must be applied so that the effects of all three can be analyzed within the same analysis and their independent effects can be parsed out separately from one another. The APCD model operates by separating linear trends and fluctuations to identify which categories of age, period, and/or cohort diverge significantly from their linear trends. The periods being studied in the APC model will correlate with periods of economic shocks in the U.S., as defined by the NBER and discussed previously (National Bureau of Economic Research, n.d.).

For this specific research, the fluctuations from the linear trend will show income changes for different age, period, or cohort categories relative to the linear trend. The APCD model is depicted in the set of equations and parameters below.

$$\left\{ \begin{array}{l} y^{apc} = \alpha_a + \pi_p + \gamma_c + \alpha_0 \text{rescale}(a) + \gamma_c \text{rescale}(c) + \beta_0 + \sum_j \beta_j x_j + \varepsilon_i \\ \left\{ \begin{array}{l} \sum_a \alpha_a = \sum_p \pi_p = \sum_c \gamma_c = 0 \\ \text{Slope}_a(\alpha) = \text{Slope}_p(\pi_p) = \text{Slope}_c(\gamma_c) = 0 \\ \min(c) < c < \max(c) \end{array} \right. \end{array} \right.$$

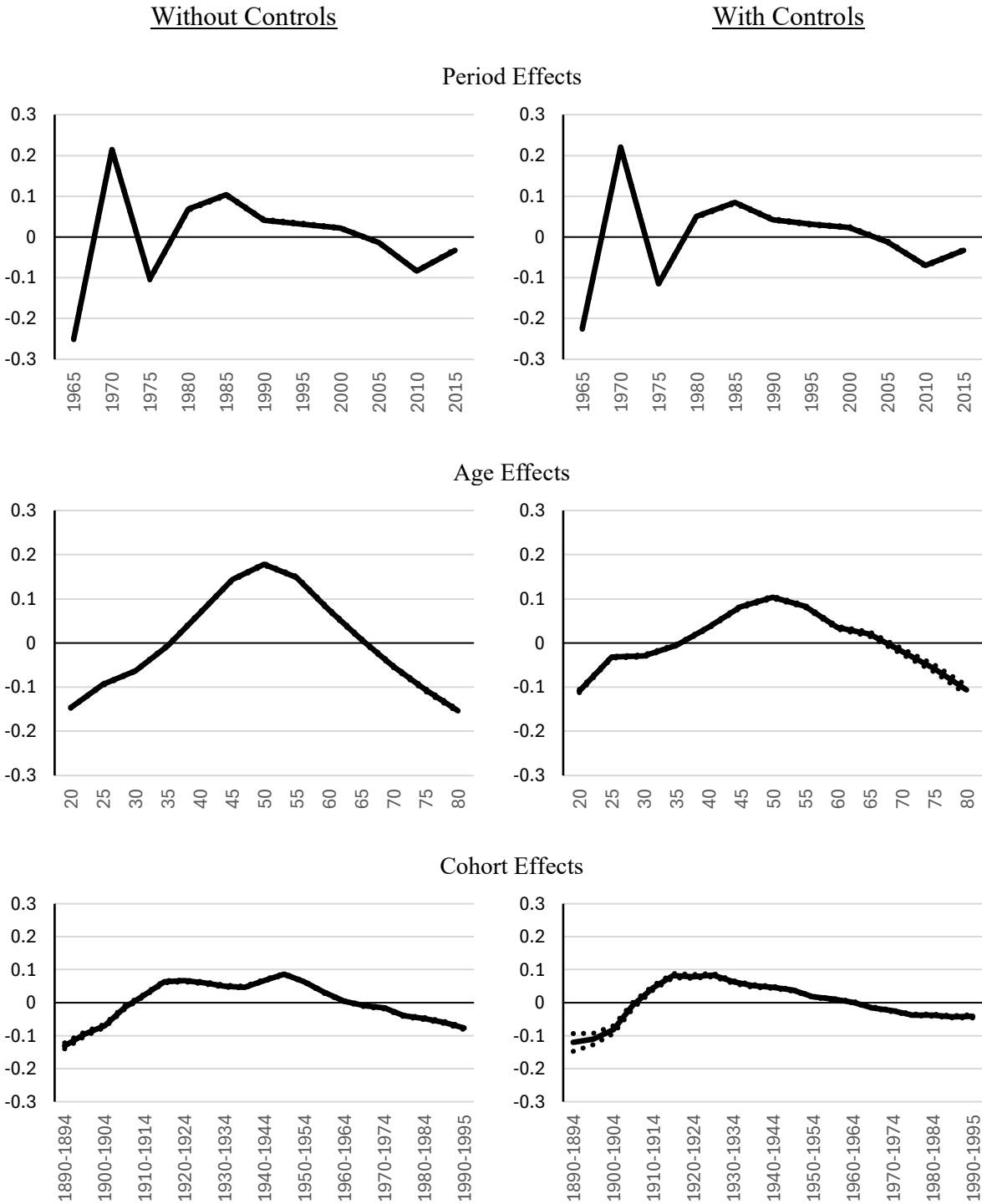
In the equation, y^{apc} refers to the dependent variable while a , p , & c refer to the independent variables of age (a), period (p), and cohort (c). The age, period, and cohort effects are denoted by, α_a the coefficient representing non-linear age changes, π_p the coefficient for period-specific effects, and γ_c the coefficient for detrended cohort effects. The general intercept of the equation

is given by β_0 and the control variable coefficients are given by $\beta_j x_j$. The rescale functions for a and c rescale the indexes for age and cohort so that the age and cohort coefficients, α_0 and γ_c , are standardized in a scale from -1 to 1; the rescale functions absorb the linear trend. To deal with the identification problem of the age, period, cohort relationship, the linear part of the model is constrained to zero-sum and zero-slope parameters that can be compared against a decomposition of a , p , and c that contain fluctuations of a , p , and c . If any coefficient demonstrates a significant difference from the zero-slope constrained coefficient, then this APCD model will show the variations and, thus, the differences in the age, period, and/or cohort from the expected linear trend (Chauvel, 2011; Karonen & Niemelä, 2020).

Results

Figure 2 shows the results of the APCD analysis. The column on the left shows the APCD results in an uncontrolled analysis. The column on the right shows the APCD results when the controls of education, occupation, race/ethnicity, labor market status, and regional, age-based unemployment rate are added. There were additional models run that included one control variable at a time, and these models were used to determine which control variables had the most significant impact on the model. These models are located Appendix 2.

Figure 2. Age, Period, and Cohort Effects



Looking first at period effects, the period effects depicted fall in line with the periods of economic shock and recession discussed at the beginning of this paper. The shape of the period effects model is maintained across both the controlled and uncontrolled analyses. The lowest coefficient in the model occurred in 1965, and incomes rose rapidly following this point. There is a significant peak in income around 1970, with incomes around this period deviating positively from the linear trend by over 20 percent. From this highest peak comes a significant dip in incomes as the line crosses the linear trend and a second low point of deviation from the linear trend, a 10 percent deviation, around 1975. This lines up with the periods of recession in the 1970s. After 1975, incomes started to rise again, crossing the linear trend in 1980, and reaching a positive deviation from the linear trend of about 10 percent in 1985. From 1985 to a little after 2000, incomes stay above the linear trend. The linear trend is crossed again in the negative direction, around 2001, falling until the third low point of the model occurs around 2010, in line with the Great Recession. After this point, incomes start to trend in the positive direction but do not cross the linear trend again during the period of observation.

Moving to age effects, there were significant age effects in both the uncontrolled and controlled analyses, although as expected, the effects are suppressed, to an extent, in the controlled analysis. Even with the introduction of controls, though, there are significant age effects present that must be considered. At the age of 50, incomes deviate positively from the linear trend by almost 10 percent. There are also significant negative deviations from the trend for those below the age of 40 and above the age of 70. The age coefficient reaches its lowest points at ages 20 and 80, showing a negative deviation of roughly 10 percent from the linear trend at both points. The most disadvantaged age groups and the most advantaged age group each differ by around 10

percent from the linear trend. When the models were considered with individual controls, the introduction of labor force status (Appendix 2c) brought the advantage of 50-year-olds from around an 18 percent positive deviation in the uncontrolled model to around a 10 percent positive deviation. The introduction of occupational position (Appendix 2d) brought the advantage of 50-year-olds from around an 18 percent positive deviation in the uncontrolled model to around a 9 percent positive deviation. When labor force status and occupational position are introduced into the model at the same time (Appendix 2f), the deviation drops another percentage point, placing 50-year-olds at a deviation of around 8 percent, roughly 10 percentage points less than the uncontrolled model.

The cohort effects yielded unexpected results. The uncontrolled model shows two ‘humps’ of positive deviation from the linear trend. The first deviation holds from the uncontrolled model to the controlled model, with a relative positive deviation of between 5 and 7 percent for cohorts from 1915-1939. The second deviation exists only in the uncontrolled model and occurs around the ‘baby boomer’ generation. The positive deviation begins at around a 6 percent deviation for those born from 1940-1944, reaches a maximum model peak of almost 10 percent for those born from 1945-1949, and moves back to the linear trend, crossing the trend at around the cohort 1960-1964. When controls are added to the model, this second deviation disappears, leaving only a positive deviation of just under 10 percent for the older cohorts from 1915-1929. The ‘baby boomer’ advantage disappears specifically when education (Appendix 2a) is added to the model, indicating that when controlling for education, the advantage held by these cohorts becomes non-existent.

Conclusion

Period Effects

The results of this study indicate a few interesting specificities regarding the distribution of income inequality in the U.S., the role of cohorts within this distribution, and the relationship between different cohorts and periods of economic shock. The first characteristic of the model to discuss, the period characteristic, demonstrates a pattern of advantage and disadvantage in line with the patterns of economic upturns and downturns discussed within the paper. The periods of recession are in line with periods of negative deviation from the linear trend while the periods of economic upturn after the recessions are in line with positive deviations from the linear trend.

In contrast with literature finding increased levels of income inequality in post-recession periods (Bodea et al., 2021; Pereira da Silva et al., 2022; Piketty & Saez, 2013), U.S. incomes rose, and income inequality declined as the periodic coefficients began to increase immediately after all three of the lowest periodic income points. Specifically looking at the increase after 1975 and 2010, two of the indicated recession periods, we see incomes rising towards the linear trend, crossing the line in 1980, only five years after the low point of 1975, and moving in a positive direction towards the linear trend from 2010 onwards.

With reference to the 1975 recession, Zarnowitz and Moore (1977) discuss a rather quick recovery period, as compared with previous economic cycles, and credit the initial recovery to consumer spending and the later recovery to a tax cut in May of 1975. As a result of the tax cut, real wages increased and real disposable income increased significantly (Zarnowitz & Moore, 1977), an increase that is accurately charted by the periodic coefficients in the APCD model.

The discussion of the rise in incomes after the Great Recession is a bit more inconclusive. Most research has found that income inequality has increased significantly in the aftermath of the Great Recession (Smeeding, 2012; Perri & Steinberg, 2012; Institute for Research on Labor and Employment, 2018; Zewde & Crystal, 2021). At the same time, there have been notable differences in findings when different types of income and different distributions of earners are considered. While earnings inequality increased during and after the Great Recession, disposable income inequality did not increase at the same rate, namely for those in the lowest 20 percent of the income distribution. The absence of an increase in disposable income inequality can be linked to government programs, specifically unemployment benefits and programs such as the Earned Income Tax Credit program (Perri & Steinberg, 2012; Petev & Pistaferri, 2012). For those at the top of the income distribution, their share of the income increased significantly, their spending habits may have helped the economic recovery, and their income growth accounts for much of the gain in income during the twenty-first century and in the post-recession period (Smeeding, 2012; Bakker & Felman, 2015). The income growth demonstrated after the recession could be due to stability at the low end of the income distribution and subsequent increase at the high end of the income distribution, while income inequality increased for the middle-income distribution, where much of the country lies, increases and stability in top and bottom incomes helped to contribute to recovery and the appearance of growth in a post-recession period.

Growing inequality in the U.S. tends to mean a rapid increase in incomes by the top distribution and a lack of increase for everyone else. These findings may mean that disposable income is not the best method to analyze U.S. income inequality, or it may indicate that further emphasis needs

to be placed on the income development and stratification of middle-income distributions. Additionally, if government benefits, transfers, and programs helped to maintain disposable income for those at the low end of income distribution, then maybe these policies can be considered and adapted in ways that benefit and target the specific income trends of those middle-incomes.

Age Effects

For age characteristics, the controlled and uncontrolled models differ in the percentage deviation in incomes for individuals around 50 years of age, but both models show a low point in income around 20, a rise in income from this low point until the age of 50, and a subsequent decrease in income after 50 until around 80 years of age. These findings demonstrate the trend of age-based earning in the U.S and indicate where the highest incomes lie in age-based income distribution.

The U.S. Census reports that median household income was highest for the age group of 45-54, in line with historical trends, and that the incomes for this group increased by 4.9% from 2022 to 2023 (Guzman & Collar, 2024). While the advantage of those around 50 years old decreased when the controls of labor force status and occupation were added to the model, the advantage was still present, indicating that the effect of age in the U.S. is a significant one. Young workers' incomes when they enter the labor force negatively deviate from the linear trend by roughly 10 percent, placing them at a significant disadvantage from other age groups. While incomes eventually reach and cross the linear trend, this does not occur until the age of 35, and it takes an additional 15 years to reach the highest point of advantage.

On the older side of the age distribution, individuals cross the linear trend towards negative deviations at the age of 65, which is around the U.S. retirement age. Individuals to the age of 85 were kept in the model because retirement, pension schemes, and age requirements differ significantly across groups, and some individuals work well into their 70s or older out of necessity or due to a lack of adequate retirement savings.

Education did not affect the model at all, but labor force status and occupation did, meaning that the position one holds is more vital than the education one receives. While educational experience influences the position or occupation one can attain, the occupation itself holds more power than the educational background. The various age findings indicate that the path of U.S. incomes has a pattern, and one works their way up to the advantaged position as they move across the life course.

Cohort Effects

As pertains to the focal point of this study, the cohorts, the findings were not exactly in line with what was expected. The expectation was that ‘baby boomers’ would hold the highest advantage compared to other cohorts, but when controlling the model, this was not the case. While the ‘baby boomers’ held an advantage when no controls were considered, after the introduction of controls, specifically the control of education, their advantage went away, leaving only an advantage for the 1915–1929 cohorts. While the significant advantages held by the 1915–1929 cohorts are important to note, they prove less crucial to our understanding of current income distribution as most of these cohorts are out of the labor force, and most likely deceased.

The findings of no significant advantage for ‘baby boomer’ cohorts contradict the literature supporting the idea that some cohorts are “born to pay” for other cohorts, namely that younger cohorts are born to pay for older ones (Chauvel & Schröder, 2014, 2015; Kotlikoff, 1992; Longman, 1987). The findings do, however, fall in line with some of the cohort studies that look at inter-cohort differences across welfare regimes. Chauvel and Schröder (2015) found that in the U.S., there was relative equality across cohorts and the cohorts had equal shares of income and economic growth. Freedman (2023) finds that the U.S. and other liberal welfare regimes are less impacted by inter-cohort differences and Freedman (2017) argues that despite some of the advantages that may be held by older cohorts, younger generations are beginning to catch up. While the lack of considerable cohort advantage is surprising, it is not necessarily a bad thing. Nor does it fail to provide us with useful information about the U.S. income distribution.

Regarding disadvantages in the model, we see that younger cohorts are becoming more disadvantaged as the line continues to trend in a negative direction below the linear trend. This means that while none of the cohorts in the labor force today are holding significant advantages, many of the cohorts are experiencing disadvantages as they enter the labor market.

These disadvantages could be due, in part, to the rise in precarious work (Kalleberg, 2011; Witteveen, 2017), growing difficulties in the school to work transition (Kalleberg, 2020), cohort size and the ratio of prime age adults to labor market entrants at the time of entry (Macunovich, 1999; Korenman & Neumark, 2000), and recessions, which will be discussed further below.

Both the age model and the cohort model demonstrated that younger individuals are at a disadvantage when compared to older cohorts and older individuals, indicating that younger individuals may be facing significant barriers as they enter the labor market.

As pertains to cohorts and their relationship with economic shocks, it would be expected that cohorts entering the labor market around the periods of recession would suffer from the negative conditions and low employment levels, but this was not necessarily the case. The cohorts who should have been most negatively impacted by these recessions are the cohorts from 1947-1952 (reach the age of 23 during the 1970-1975 recession period) and the cohorts from 1985-1987 (reach the age of 23 during the 2008-2010 recession period), yet both cohorts remain relatively close to the linear trend, with the first set of cohorts hovering just above the line and the second set hovering just below. The negative deviation from the linear trend of around 3 percent for the cohorts from 1985-1987 does indicate some possible negative effect of the recession on incomes, but the result is not as distinct. This indicates that the relationship between cohorts and economic shocks is not as pronounced as had been previously thought, and as has been demonstrated in other work (Freedman, 2023, 2017; Escalonilla, 2022; Chauvel & Schröder, 2014, 2015; Karonen & Niemelä, 2020). The main finding from the cohort analysis is that younger cohorts are continually worse off, although not to a particularly large degree. The trend for younger cohorts continues in the negative direction though, which may suggest that as each successive cohort comes of age and enters the labor force, their disadvantage relative to other cohorts increases.

Discussion

The goal of this study was to develop a more nuanced understanding of income distribution and economic shocks through the context of age, period, and cohort characteristics, looking more specifically at how income trends and inter-cohort dynamics are shaped by economic shocks. At

the outset of this paper, I hypothesized that there would be significant findings regarding the effects of cohort belonging and period on income. I further hypothesized that the cohort at the largest advantage would be the ‘baby boomers.’ I had expected that age would not have as significant of an impact on income and that the effect would be suppressed with controls of education and labor force status. The results of the study found that these hypotheses were not all accurate. With respect to cohorts, the advantage in income existed in some of the oldest birth cohorts, not within the ‘baby boomer’ cohort range. Additionally, the results showed that some of the youngest or newest cohorts were the most disadvantaged. Regarding period, the expectation held that period would have a significant effect on income. Incomes fell during recession periods, and in a unique finding, they rose immediately following recessions showing a decrease in income inequality and increase in incomes during immediate post-recession recovery periods. Finally, the results surrounding age effects were the most surprising. The U.S. age-income relationship can be depicted by an inverse U-shape, where individuals are at a disadvantage in incomes from the ages of 20 to 35, reach their peak income advantage at around the age of 50, and subsequently experience decreasing advantage as they move into old age. The age trend held even when controls were considered.

The findings of this study indicate the negative impact of recessions on incomes and income inequality and the relative disadvantage of young individuals as they enter the labor force. Additionally, the study indicates that the U.S. labor market and income distribution differs from other countries. The use of the life course perspective within this study painted a picture of income trajectories in the long run, with the findings on the age-income relationship providing a better understanding of the trajectory of earnings across the life course as individuals move

through the labor market. While cohort effects were not the most significant, the findings still provide evidence for the role of birth cohort, showing a more disadvantaged position of the newest cohorts. The combination of these findings allows for a new understanding of potential life course outcomes of the newest entrants into the labor force, understanding the disadvantage faced by one's age and the combined disadvantage faced by belonging to the newest cohorts. In identifying these differences and understanding U.S. income distribution at a deeper level, researchers and policymakers can start to identify solutions that can mitigate the disadvantages of younger individuals. If successive cohorts experience further disadvantage and the age curve in the U.S. prevents individuals from reaching an advantaged income position until they have spent roughly 30 years in the labor force, then different policies should be developed to help mitigate the cumulative disadvantages faced by these individuals.

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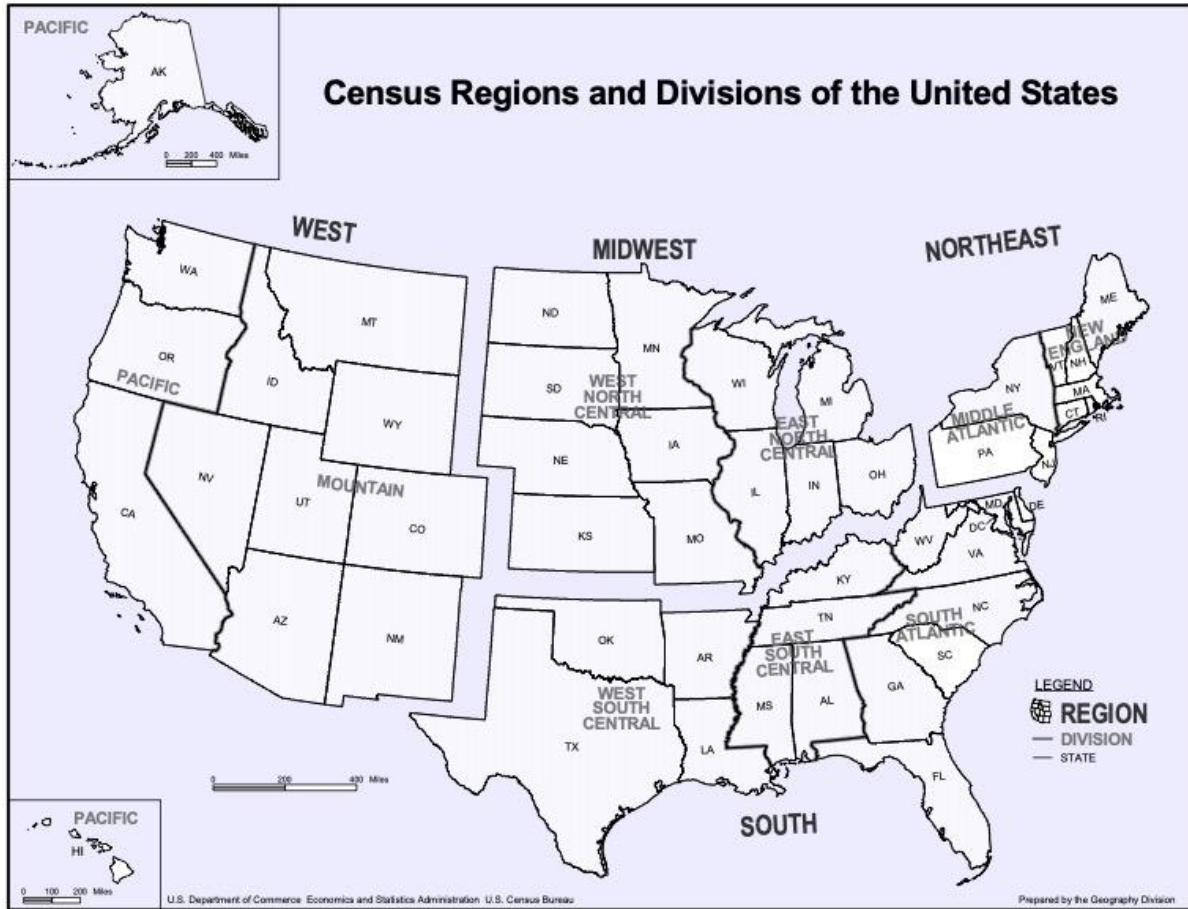
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Appendix 1. Census Regions and Divisions of the United States



Division 1: New England

- Connecticut
- Maine
- Massachusetts
- New Hampshire
- Rhode Island
- Vermont

Division 2: Middle Atlantic

- New Jersey
- New York
- Pennsylvania

Division 3: East North Central

- Indiana
- Illinois
- Michigan
- Ohio

Division 4: West North Central

- Iowa
- Kansas
- Minnesota
- Missouri
- Nebraska
- North Dakota
- South Dakota

Division 5: South Atlantic

- Delaware
- District of Columbia
- Florida
- Georgia
- Maryland
- North Carolina
- South Carolina
- Virginia
- West Virginia

Division 6: East South Central

- Alabama
- Kentucky
- Mississippi
- Tennessee

Division 7: West South Central

- Arkansas
- Louisiana
- Oklahoma
- Texas

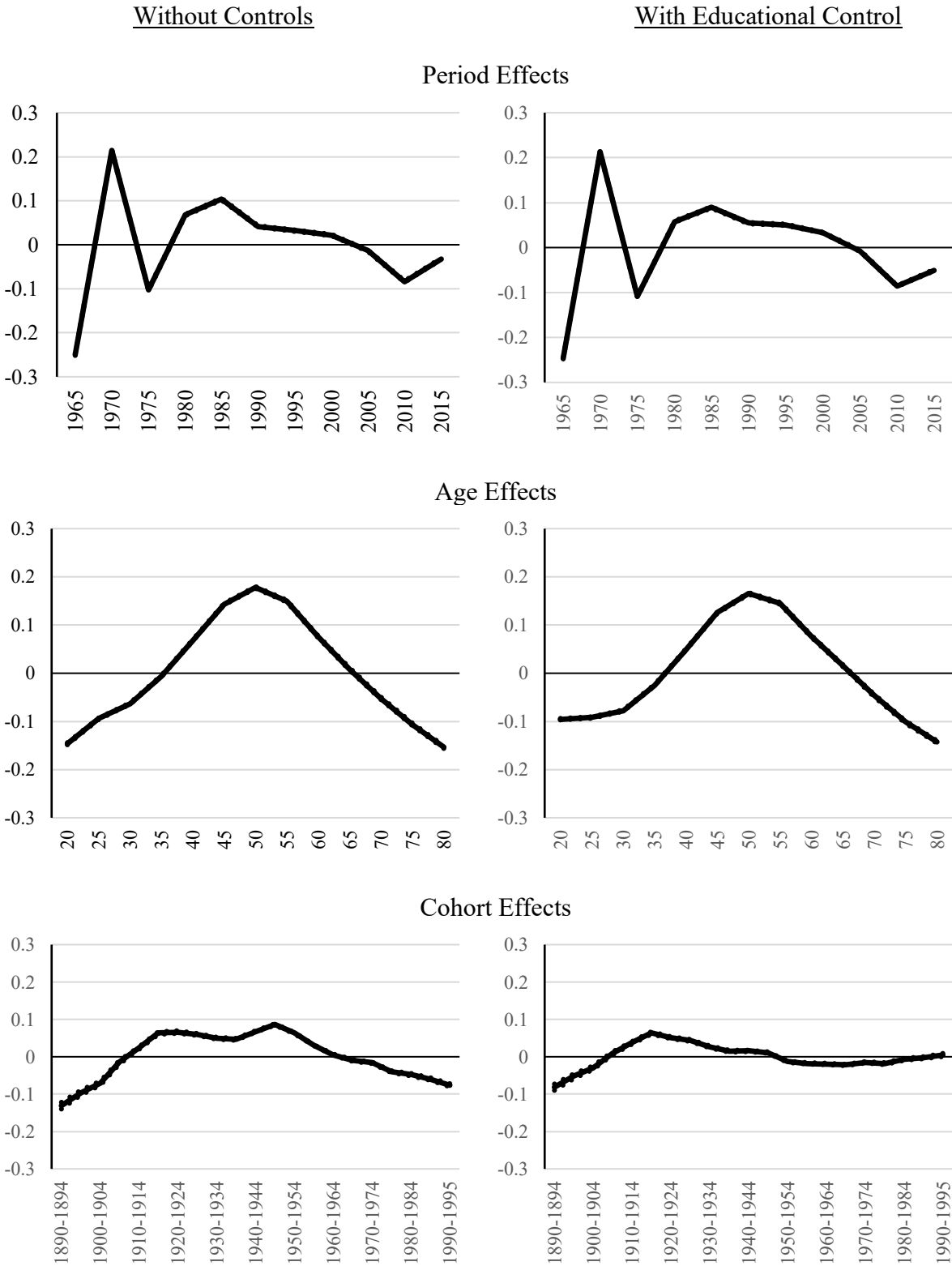
Division 8: Mountain

- Arizona
- Colorado
- Idaho
- New Mexico
- Montana
- Utah
- Nevada
- Wyoming

Division 9: Pacific

- Alaska
- California
- Hawaii
- Oregon
- Washington

Appendix 2a. Model with Educational Control Only

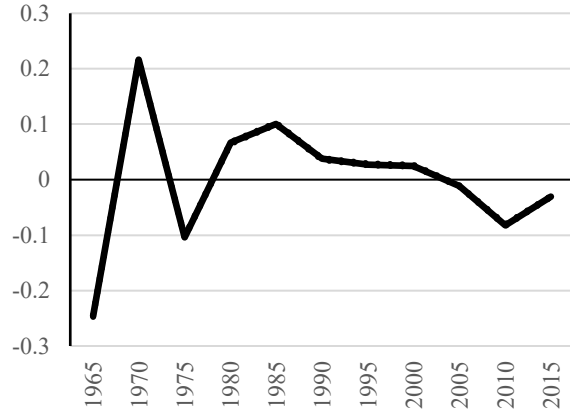
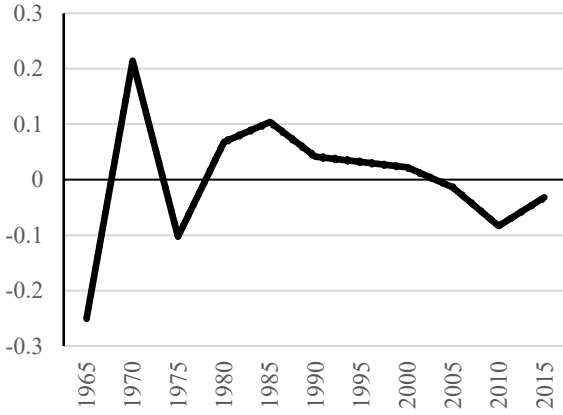


Appendix 2b. Model with Race/Ethnic Control Only

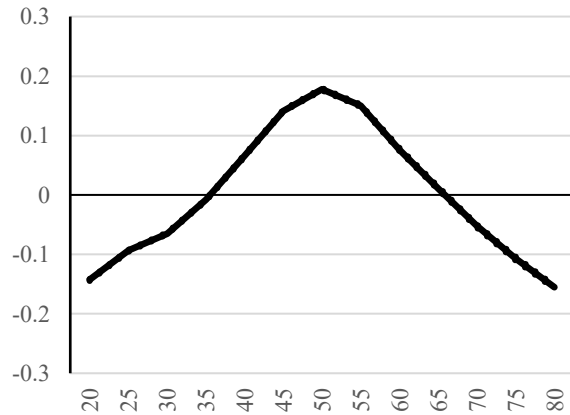
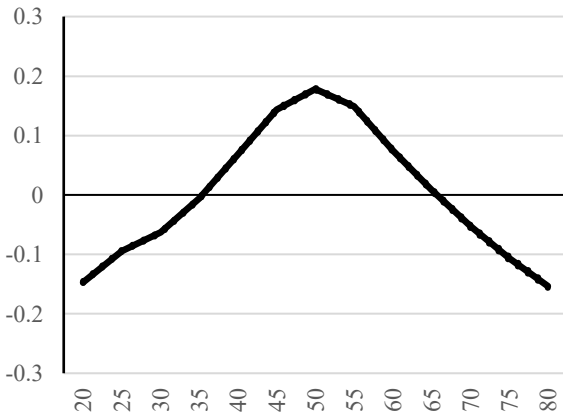
Without Controls

With Race/Ethnic Control

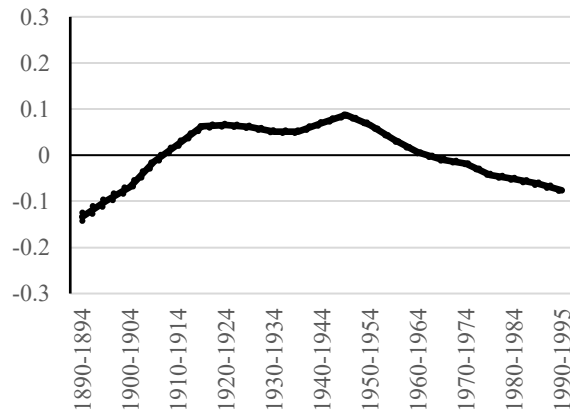
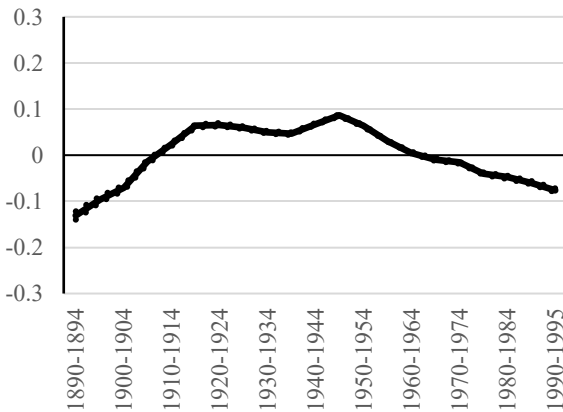
Period Effects



Age Effects



Cohort Effects

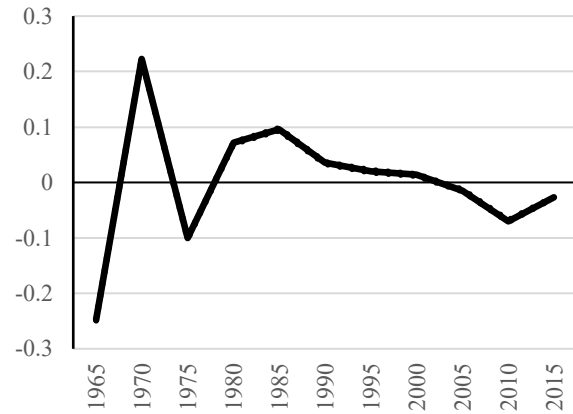
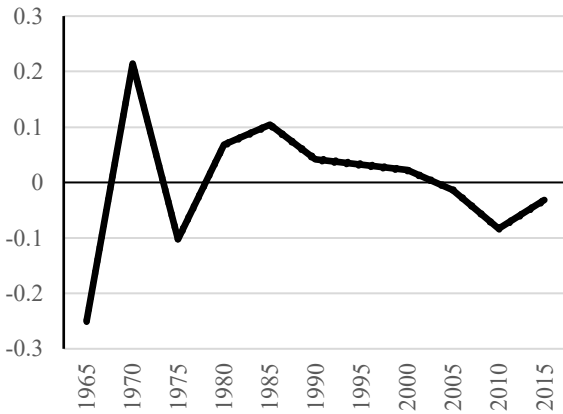


Appendix 2c. Model with Labor Force Status Control Only

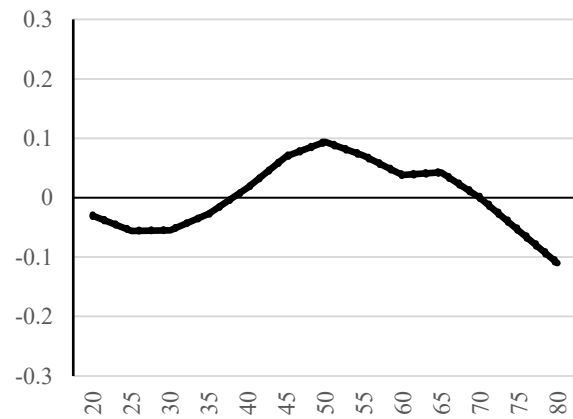
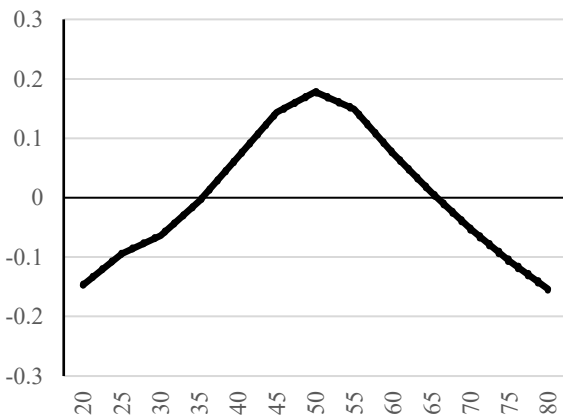
Without Controls

With Labor Force Status Control

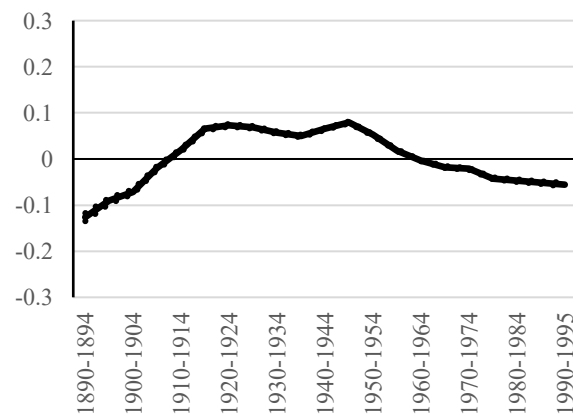
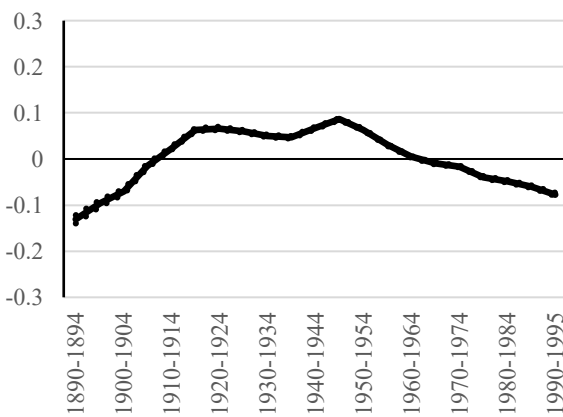
Period Effects



Age Effects



Cohort Effects

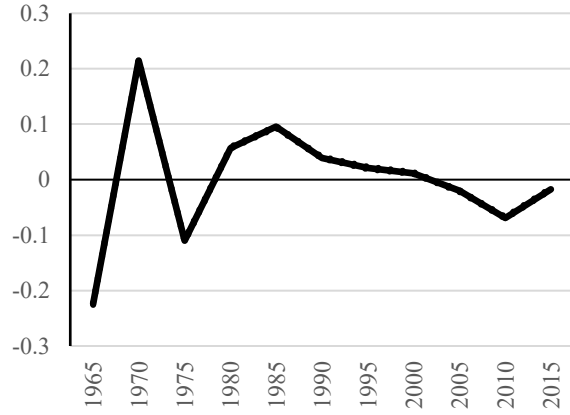
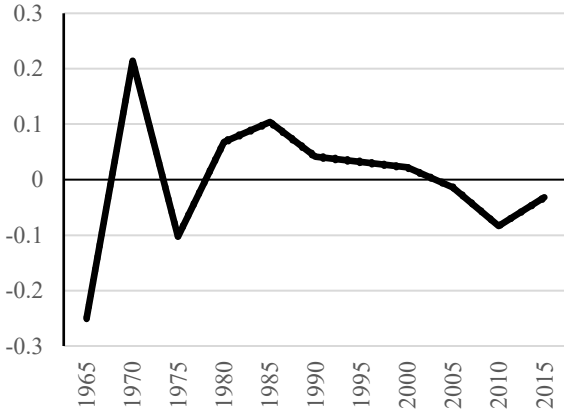


Appendix 2d. Model with Occupational Control Only

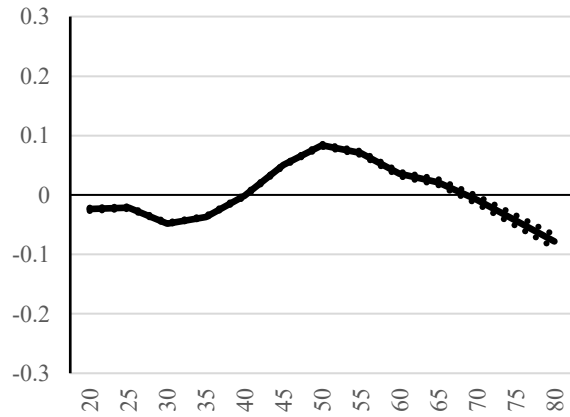
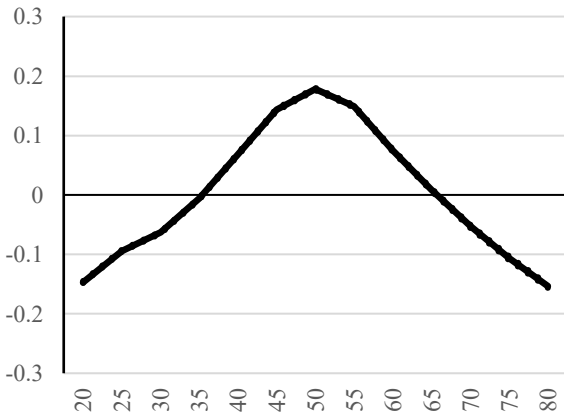
Without Controls

With Occupational Control

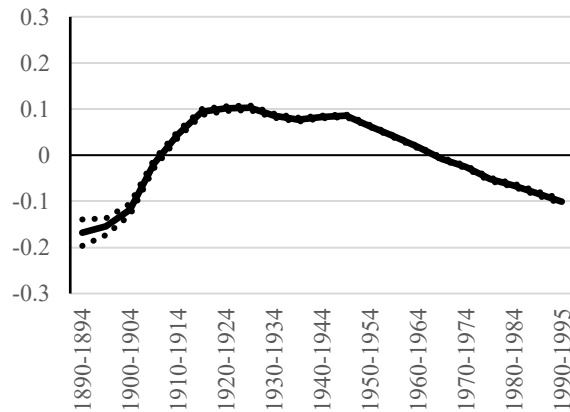
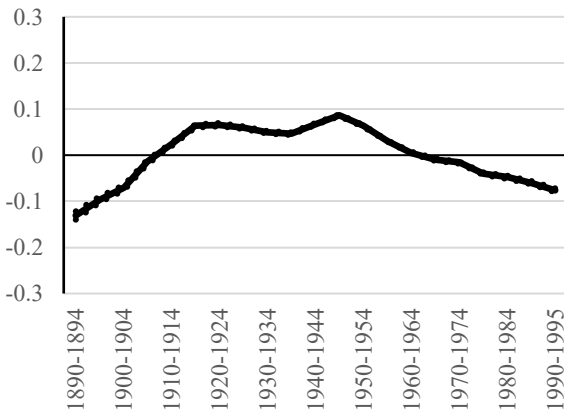
Period Effects



Age Effects



Cohort Effects

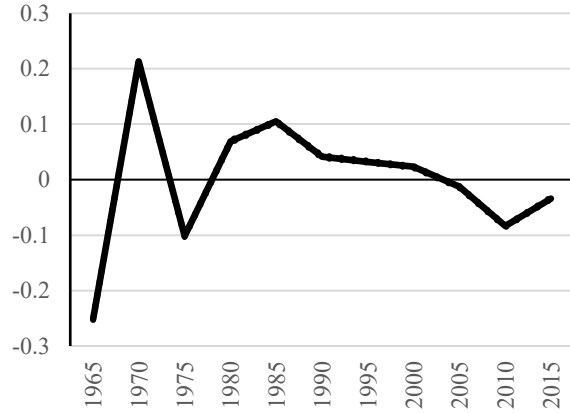
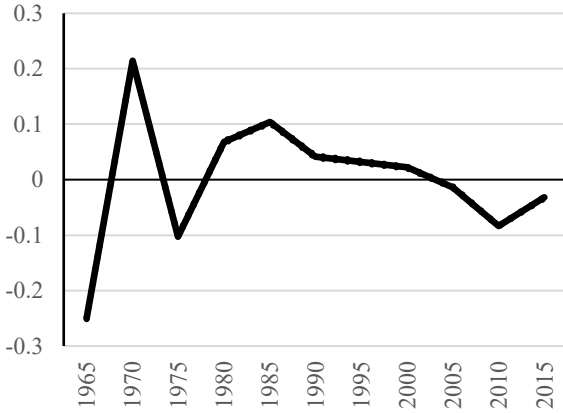


Appendix 2e. Model with Unemployment Rate Control Only

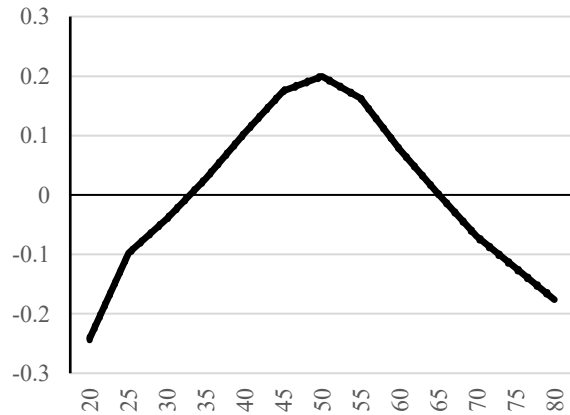
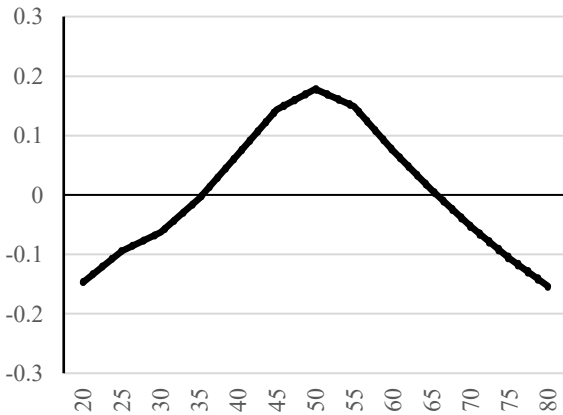
Without Controls

With Unemployment Rate Control

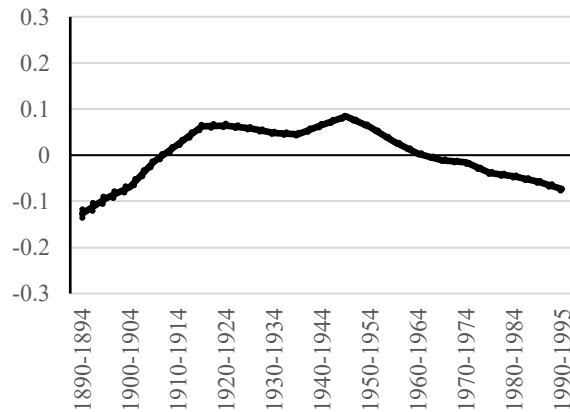
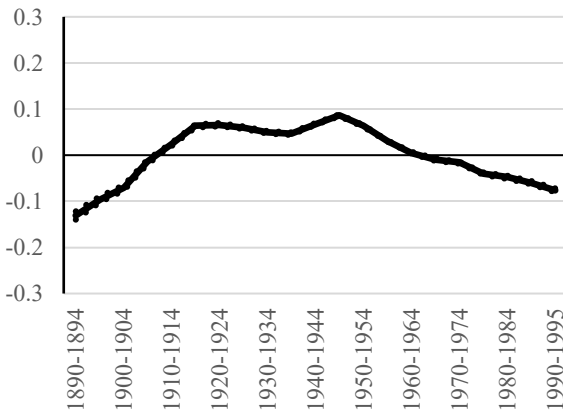
Period Effects



Age Effects



Cohort Effects

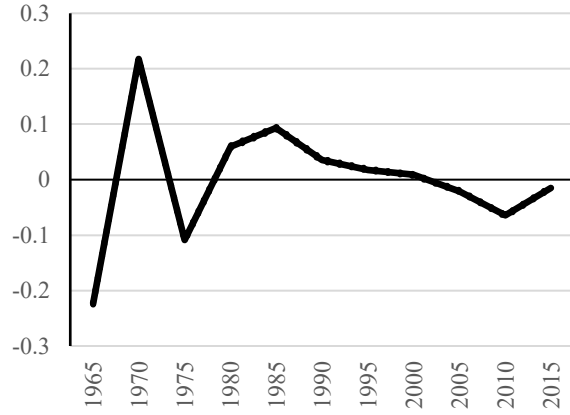
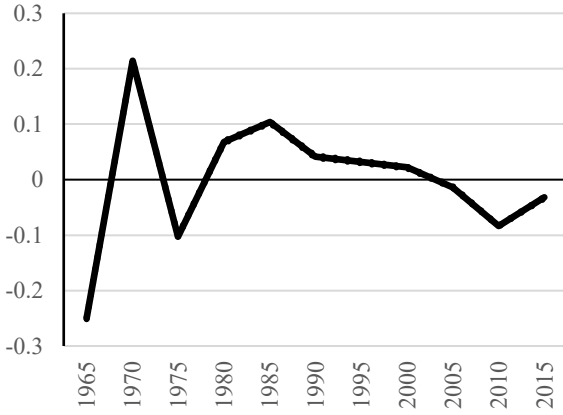


Appendix 2f. Model with Labor Force Status and Occupational Controls Only

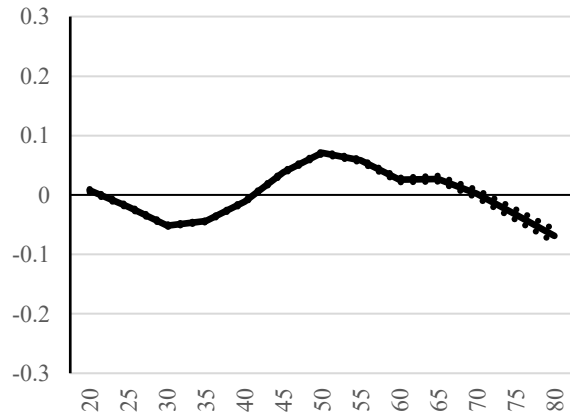
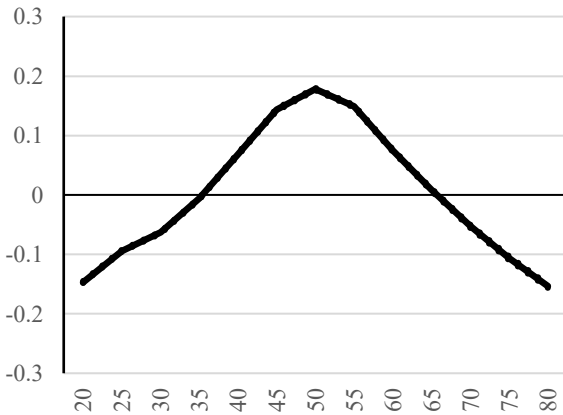
Without Controls

With Labor Force and Occupation Control

Period Effects



Age Effects



Cohort Effects

