

THE WARRING FORTIES: THE ECONOMIC CONSEQUENCES
OF WORLD WAR II

by

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DEDICATION

To Lila

TABLE OF CONTENTS

LIST OF FIGURES	8
LIST OF TABLES	9
ABSTRACT	10
CHAPTER 1 INTRODUCTION	11
1.1 Overview	11
1.2 Historical Background	18
1.2.1 Economic Consequences of America’s Wars	18
1.2.2 Institutions for Mobilization	21
1.3 Literature Review	27
1.3.1 Women’s Labor Force Participation	27
1.3.2 Inequality, Mobility, and Living Standards	31
1.3.3 Postwar Economic Growth and Regional Development	34
1.3.4 The Role of Government	40
1.4 Conclusion	43
CHAPTER 2 ‘YOUR’RE’ IN THE ARMY NOW:’ THE IMPACT OF WORLD WAR II ON WOMEM’S EDUCATION, WORK, AND FAMILY	44
2.1 Introduction	44
2.2 Historical Background	49
2.2.1 Advances in Education Prior to 1940	49
2.2.2 World War II Manpower Mobilization	50
2.3 Data and Empirical Design	53
2.4 Mobilization and Early-Life Education, Work, and Family Formation	59
2.4.1 Results for Educational Attainment	59
2.4.2 Results for Labor Market Outcomes and Family Formation	65
2.5 The Long-Run Impact of Manpower Mobilization	68
2.6 Conclusion	74
CHAPTER 3 WORLD WAR II AND THE INDUSTRIALIZATION OF THE AMERICAN SOUTH	76
3.1 Introduction	76

TABLE OF CONTENTS – *Continued*

3.2	Historical Background	81
3.2.1	Manufacturing in the South until 1929	82
3.2.2	The 1930s New Deal	84
3.2.3	Mobilization for World War II	86
3.3	Empirical Specification	88
3.3.1	Establishment Demand for Locations	91
3.3.2	Estimation	93
3.3.3	Identification	95
3.4	Data and Variable Definitions	98
3.5	Results	101
3.5.1	Sectoral Trends	102
3.5.2	Aggregate Manufacturing	104
3.5.3	Full Model	106
3.5.4	Robustness	109
3.6	The Impact of Additional War Spending	112
3.7	Conclusion	112
CHAPTER 4 WORLD WAR II, MIGRATION, AND THE WAGE STRUCTURE		114
4.1	Introduction	114
4.2	Historical Background	118
4.2.1	Migration	119
4.2.2	The Structure of Wages	120
4.3	Model of Spatial Equilibrium	121
4.4	Empirical Analysis	125
4.4.1	Data and Summary Statistics	125
4.4.2	Regression Specification	127
4.5	Results	130
4.6	Discussion	134
APPENDIX A SUPPLEMENTAL MATERIAL FOR CHAPTER 2		136
APPENDIX B SUPPLEMENTAL MATERIAL FOR CHAPTER 3		138
B.1	Setup	138
B.2	Interaction of Establishment and Location Characteristics	139
B.3	Calculating the Likelihood’s Gradient	139
REFERENCES		143

LIST OF FIGURES

1.1	Female Employment Rate, 1940-1950	13
1.2	Distribution of Log Weekly Wages, 1940-1950	17
1.3	World War II Spending, 1940-1945	25
2.1	High School and College Graduation Rates, 1910-1990	46
2.2	Monthly Inductions and Enlistments into Armed Services	51
2.3	High School Graduation and Mobilization Exposure, 1900-1935	55
2.4	Visual Effect of Mobilization Exposure for Ten States	64
2.5	Returns to High School Completion, 1914-2005	70
3.1	Southern Manufacturing, 1927-1967	89
3.2	Southern War Spending, 1940-1945	90
3.3	World War II and Southern Manufacturing, 1947-1967	97
4.1	Share of Population Living Outside State-of-Birth, 1870-1990	115
4.2	Distribution of World War II Supply Contracts Spending	128

LIST OF TABLES

1.1	Wartime Investment by Sector (in millions)	15
1.2	Fiscal Cost of America's Twentieth Century Wars	20
1.3	GNP, Consumption, and Employment, 1939-1949	22
2.1	Summary Statistics and Determinants of Manpower Mobilization . . .	58
2.2	Mobilization and Female Educational Attainment in 1960	60
2.3	Mobilization and Completed Years of Schooling in 1960	63
2.4	Mobilization and Labor Market Outcomes in 1960	67
2.5	Mobilization, Education, and Labor Market Outcomes in 1970	71
2.6	Later-Life School Attendance of School Age Cohort During WWII . . .	73
3.1	Summary Statistics for Industrial Mobilization	100
3.2	Growth of Southern Manufacturing by Sector	103
3.3	Constant Coefficients Logit for Impact of War Spending	105
3.4	Impact of War Spending by Sector	108
3.5	Robustness for Impact of War Spending by Sector	110
3.6	Average Effect of Additional Spending by Sector	111
4.1	Summary Statistics	126
4.2	Results for Impact of Supply Contracts on Employment, 1940-1950 .	131
4.3	Results for Impact of Supply Contracts on Weekly Wages, 1940-1950	133
A.1	Date Ranges Used to Construct Mobilization Exposure Variable . . .	137

ABSTRACT

This dissertation studies the impact of World War II on the development of the American economy after 1940. Scholars have long-debated the economic consequences of the war, particularly with reference to the macroeconomy and often relying on standard measures of aggregate economic performance. The approach in this dissertation is to study the microeconomic implications of mobilization for World War II. Specifically, the three main chapters address the following questions: What were the human capital costs of the manpower mobilization for young women? Did industrial mobilization promote the growth and diversification of manufacturing in the American South? How much did government spending on supply contracts contribute to migration and the change in the structure of wages between 1940 and 1950?

The first chapter provides an overview of America's twentieth century wars and surveys the literature on the impact of World War II. In the second chapter, I find that greater exposure to manpower mobilization decreased young women's educational attainment initially, with important implications for family formation and labor market performance. From the analysis of the third chapter I conclude that the war led to modest reallocation of manufacturing activity toward high value-added sectors, but the war most likely did not create the modern industrial South. In the final chapter I provide evidence that migration induced by World War II played a role in reshaping the structure of wages during the 1940s. Together, the chapters provide important nuance and revisions to our understanding of World War II.

CHAPTER 1

INTRODUCTION¹

1.1 Overview

Between 1940 and 1945, the United States embarked on the largest mobilization of manpower and matériel in the country's history. Millions of Americans were pressed into military service and billions of dollars in government spending went to field a fighting-force equipped for modern war. The early historical literature on the impact of World War II emphasizes the success of wartime mobilization, the war's contribution to economic growth, and the boon to female entry into paid work (e.g., Gordon, 1969; Chafe, 1972; White, 1980; Vatter, 1985). More recently, scholars have turned to quantifying the costs associated with mobilizing the economy for war, reconverting to peacetime production, and the long-run implications of a substantially expanded role for government in the American economy (e.g., Goldin, 1980; Higgs, 1989; Goldin, 1991; Field, 2011; Rockoff, 2012).

This dissertation examines the relationship between mobilization for World War II and the postwar development of the American economy. In the second chapter I examine the response of young women's human capital investment to manpower mobilization in the early 1940s. The third chapter considers the war's role in regional industrialization, in particular, whether the substantial government spending on supply contracts and new investment in the early 1940s accelerated the transformation of manufacturing in the US South. The final chapter quantifies the migration response to war spending, the effect on wage growth and, ultimately, the contribution to decreased inequality between 1940 and 1950.

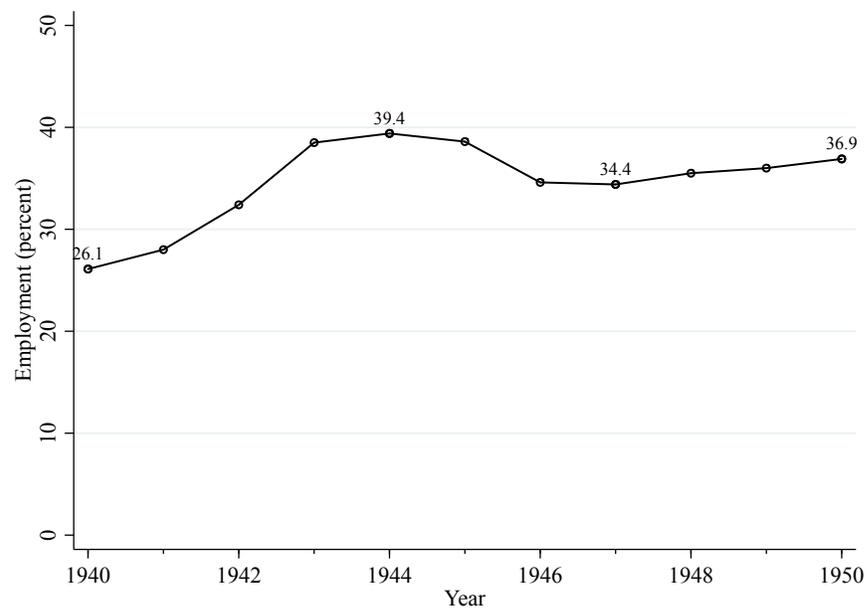
¹A revised version of this chapter is in preparation for *Oxford Handbook of American Economic History* and is co-authored with Price V. Fishback.

Figure 1.1 shows that many women entered the labor force during the war, taking advantage of new employment opportunities and filling the gap left by the 16 million men that enlisted or were inducted into the armed services. Many were employed in industries previously closed to women, but Figure 1.1 also shows that in the immediate postwar years female employment declined and still had not yet reached its wartime peak again by 1950. In addition, the decision to enter paid work led many high school age girls to drop out, obtain less education, and may have had negative consequences for their future earnings. The second chapter uses manpower mobilization under the 1940 Selective Service Act to examine the effect of the war on young women's investment in human capital.

To measure the extent of the decline in educational attainment due to manpower mobilization, I use newly collected annual data on the the number of men inducted and enlisted in each state between 1940 and 1945. I use these data to calculate the exposure of each cohort (i.e., state- and year-of-birth) of young women to manpower mobilization and match this to information from the decennial censuses on the cohort's average educational attainment. The results suggest that a woman who experienced the median exposure to World War II manpower mobilization obtained one less year of schooling in 1960. This effect was concentrated on grades 11 and 12 (i.e., the margin of high school completion) and additional evidence suggest lower educational attainment translated into lower rates of employment and earnings and earlier family formation as of 1960.

By 1970, the educational attainment and labor market outcomes of the women most and least affected by manpower mobilization for World War II converged; the cross-cohort differences in years of schooling, employment, and earnings disappeared. This pattern of findings can be explained by the initially uncertain returns to schooling and work at the end of World War II, followed by rising returns to schooling and work for women over the second half of the twentieth century. Many women were forced out of the labor force or transitioned to new employment as

Figure 1.1: Female Employment Rate, 1940-1950



Source: US Bureau of the Census (1949, p. 63) and US Bureau of the Census (1951, pp. 24, 174).

soldiers returned home and reclaimed manufacturing jobs. In the short-run, there were fewer labor market opportunities for women, particularly those with less education, and the evidence suggests many started families by marrying earlier and having children earlier than they otherwise would have. However, in the long-run, as women learned about the returns to schooling and work, as work by Goldin (2006c) and Fernández (2013) suggests they did, they returned to school and then the labor force.

Taken together the evidence suggests an important role of manpower mobilization for the performance of labor markets and formation of families in the postwar period. First, mobilization imposed costs on the group of young women who were most exposed to the withdrawal of men from the labor force, in terms of lost education, less work, and lower earnings. But, ultimately, these costs were dissipated. Second, and more speculatively, the initial negative effect of the manpower mobilization on women's postwar labor market experience contributed to accelerated family formation and provided an impetus for the dramatic increase in fertility (i.e., the baby boom). Finally, these findings provide additional historical context for the "quiet revolution" and the contribution of World War II.

The third chapter examines the war's impact on the growth of manufacturing in the US South, focusing on the role of industrial mobilization, i.e., investment in new construction and equipment for the war production. Table 1.1 shows overall investment in the South during the war years (Column 1) as well as the extent to which investment flowed to higher wage sectors (columns 2 through 6). In theory, this wartime spending could have been a boon to southern industry: promoting learning-by-doing in modern sectors, moving up the manufacturing value-added chain, and fueling structural transformation. However, scholarly debate has so far not decisively settled whether wartime spending was instrumental in promoting the region's industrialization or whether depreciation during the war years and the mismatch between military and civilian uses limited the beneficial effects in the long-run.

Table 1.1: Wartime Investment by Sector (in millions)

	Total	Transportation	Iron & Steel	Metals	Machinery
Construction	1,958	497	68	159	14
Equipment	2,484	290	102	246	28
Total	4,442	787	170	405	42

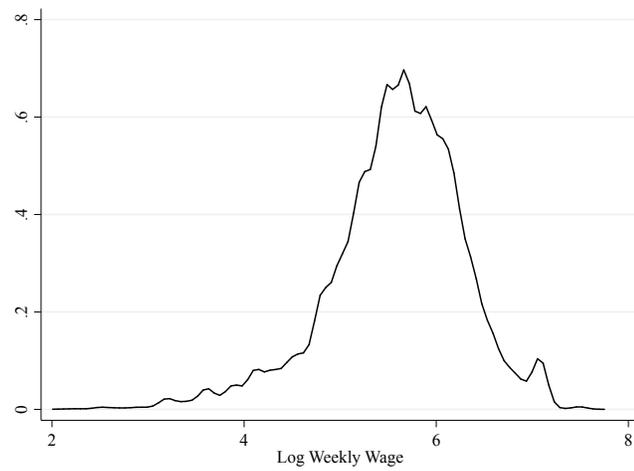
Source: Deming and Stein (1949, p. 11).

Specifically, using newly collected data on the number of manufacturing establishments by two-digit sector and county, matched with the dollar value of war-related government spending at the county-level, I ask: to what extent did mobilization for World War II contribute to industrialization and sectoral diversification in the American South? I model the process of industrialization as one of establishments choosing among locations in the South and borrow a commonly-used methodology in empirical industrial organization to estimate a discrete-choice model of establishments' location decisions. I consider two key variables: the amount of government spending on (i) investment in facilities and equipment and (ii) supply contracts. The model incorporates heterogeneity in location decisions by allowing for distinct effects of investment and contracts and by allowing these effects to vary by sector. This feature of my analysis ensures that I quantify not only growth (or decline) in the total number of establishments but also the diversification of manufacturing (say, away from cotton textiles and toward metals, machinery, and transportation equipment).

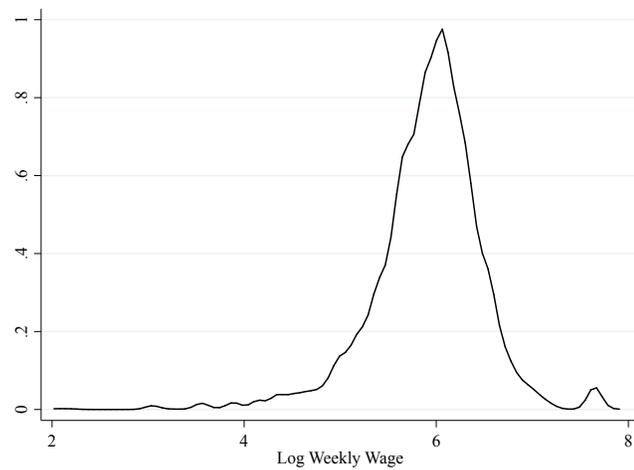
Two main findings emerge from this exercise. First, supply contracts have little medium- or long-run effect on industrialization in the South. This may, perhaps, not be surprising given that the economy was quick to demobilize at the end of the war. Second, investment played a modest role in diversifying manufacturing away from traditionally southern sectors—that also tended to pay low wages—and toward more modern sectors. The results suggest that, on average, war-related investment was beneficial to some communities that attracted an automobile or chemical plant as opposed to a textile plant. However, the relatively small magnitude of the estimates suggest that the war did not substantially alter the trajectory of the region.

In the final chapter I consider the war's effect on migration and the evolution of the wage structure between 1940 and 1950. As Figure 1.2 shows, over this period, the distribution of the wages compressed substantially in response to short-run factors, including the growth of unionization and minimum wage policy, and long-run

Figure 1.2: Distribution of Log Weekly Wages, 1940-1950



(a) 1940



(b) 1950

Notes: The figure shows the log weekly wage distribution for white men aged 18 to 64 in 1940 and 1950.

Source: Ruggles, Alexander, Genadek, Ronald Goeken, and Sobek (2010).

factors, including increased supply of skilled workers and increased demand for unskilled workers (Goldin and Margo, 1992). Despite the attention paid to the Great Compression—the name given to the mid-century narrowing of the wage structure—there has been relatively little work that integrates its causes with World War II, in particular, the large migrations that took place in response to wartime mobilization.

In the context of a simple theoretical model that describes the response of workers' location decisions and wages to labor demand shocks, I quantify the impact of World War II on the spatial equilibrium of the US economy between 1940 and 1950. To measure the shocks induced specifically by World War II, I use government spending on supply contracts from 1940 to 1945. In the empirical analysis, I consider the effect of supply contracts on the relative employment and wages within three groups: gender, race, and educational attainment. The results suggest that mobilization for World War II contributed to worker mobility during the 1940s and in ways that are likely to be important for the narrowing of the wage distribution.

The remainder of this chapter provides (i) historical background on America's wars and institutions developed to mobilize the economy during World War II and (ii) reviews the literature on economic impact of World War II, focusing on women's labor force participation, inequality and living standards, postwar growth and regional development, and the role of government.

1.2 Historical Background

1.2.1 Economic Consequences of America's Wars

One approach to quantifying the overall impact of war on the economy is to sum the rise in government expenditures or outlay associated with the war. However, in practice, this exercise is complicated by the change in circumstances that separate periods of war and peace (Kuznets, 1945). An economy at war demands different types of goods and operates under different constraints. Some war expenditures represent new spending that would not have occurred in the war's absence while

other expenditures replaced civilian purchases and therefore did not reflect a net increase in economic activity. Finally, still other expenditures accrued over longer time horizons in the form of interest payments on wartime debt, and payments to veterans (Goldin, 1980).

The rise in expenditures associated with each war is calculated by first defining the period of war using the years of elevated military spending and summing expenditures in each war year after subtracting expenditures in a normal prewar year. Table 1.2 displays cost estimates for each of America's major twentieth century wars. World War II was the most costly in absolute terms and relative to GDP over the period of conflict. The expenditures on veterans' benefits were also substantial: accounting for half of the direct cost of World War I, one third of World War II and Vietnam, and 15 percent for the Korean War.

The estimates in Table 1.2 do not include all of the costs associated with America's wars. For example, inefficiencies and resource reallocation due to mobilization, wage and price controls, rationing, and the accompanying responses by firms (e.g., the discontinuation of low-profit items, deterioration of quality) may have reduced welfare and are not captured in Table 1.2's cost estimates. In addition, World War II was notable as the first war financed substantially by taxation: nearly one half of expenditures were financed by additional income, corporate, and excess profits taxation compared with 30 percent during World War I. The introduction of new taxes and other wartime fiscal policies altered various margins of labor supply or investment (e.g., in human and physical capital), although the full implications of these changes for long-run growth and welfare are not well understood.

Estimates of gross national product (GNP) and other macroeconomic variables have also been used to assess the consequences of war for the allocation of resources across sectors, the operation of labor markets, and wartime standards of living. In the first column of Table 1.3, estimates of GNP growth between 1940 and 1950 show substantial growth during the war years. In addition, decreased unemployment

Table 1.2: Fiscal Cost of America's Twentieth Century Wars

	Cost during years of active conflict (billions of 2008 dollars) (1)	Cost during years of active conflict as share of average GDP during war (%) (2)	Veterans's benefits (billions of 2008 dollars) (3)	Total cost (billions of 2008 dollars) (4)	Total cost of share of average GDP during war (%) (5)
Spanish-American War (1898-1889)	6.3	1.5	17.9	24.2	5.6
Philippine-American War (1899-1902)	4.9	1.1	7.6	12.5	2.6
World War I (1918-1919)	313.0	43.0	305.7	618.2	82.3
World War II (1937-1947)	3,291.0	185.3	1,373.0	4,664.0	262.5
Korean War (1950-1955)	1,186.0	48.2	215.6	1,401.8	57.0
Vietnam War (1967-1974)	1,697.0	35.3	554.8	2,251.7	46.7
Persian Gulf War (1991)	89.0	1.0	371.9	460.5	5.3

Notes: Estimates for the fiscal costs of twentieth century wars. The war periods are for years in which military spending appeared to be elevated due to participation in war and may not correspond precisely with war's political beginning and end.

Source: Rockoff (2012, Appendix 3, pp. 226-227).

(column 2) and increased per capita consumption (column 3) suggest a positive role for World War II in lifting the economy out of the Great Depression. However, data revisions combined with alternative interpretations of the key macroeconomic series suggest less rapid growth in the private economy and greater pessimism related to improvements in living standards. For example, Kuznets (1945) and Higgs (1992, 1999) document a sharp divergence in the overall and private GNP growth after 1940, while alternative estimates of GNP and per capita consumption expenditures cast doubt on optimistic interpretations of the wartime macroeconomic statistics.

Overall, the direct costs of America's twentieth century wars were large and World War II imposed the greatest strain on the economy with the largest mobilization of human and physical resources in US history. Still, the evidence is mixed on which particular aspects of the war imposed the greatest short- and long-run costs.

1.2.2 Institutions for Mobilization

Prior to 1940 substantial obstacles stood in the way of military and economic preparedness for war. Congress passed a series of neutrality acts in 1935, 1936, 1937, and 1939, in order to limit foreign entanglements. In addition, legislation was also enacted to restrict the use of the "cost-plus" arrangements in government contracting that many observers associated with war profiteering. Finally, the extent of pre-1940 mobilization was also limited by the separation of responsibility for military and economic preparedness among various branches of the defense establishment. Therefore, except for circumscribed efforts centered on surveys of industrial capacity and the development of some links between government and business, by 1940 the United States was unprepared for a large-scale military conflict.

Following events in Europe between April and June of 1940, attitudes toward American rearmament softened. On May 26, President Roosevelt delivered his fireside chat, "On National Defense," and laid out a broad mobilization program "calling upon the resources, the efficiency and the ingenuity of the American manu-

Table 1.3: GNP, Consumption, and Employment, 1939-1949

	Gross National Product (1)	Per Capita Consumption (2)	Unemployment (3)
1939	100.0	100.0	–
1940	109.7	105.4	15.7
1941	128.7	112.2	12.0
1942	145.5	110.2	7.0
1943	160.6	113.3	3.0
1944	172.4	117.8	1.3
1945	171.3	126.4	1.3
1946	156.7	140.7	2.6
1947	153.4	142.7	3.8
1948	160.0	145.6	3.9
1949	156.9	149.6	6.4

Source: See Higgs (1992).

facturers of war material of all kinds.” The National Defense Advisory Commission (NDAC) was established two days later to oversee and coordinate industrial production. Further steps to remove impediments to rearmament were taken in the summer and fall of 1940; acts passed on June 28 and July 2 authorized the use of negotiated, cost-plus-fixed-fee contracts in place of competitive bidding and the Second Revenue Act, passed on October 8, allowed for accelerated depreciation of capital expenditures related to the war effort and eliminated profit limitations on government contracts.

Along with legislative actions to incentivize industrial expansion, various programs were created to finance plant expansion and equipment purchase directly. For example, the Emergency Plant Facility (EPF) program fully reimbursed certified plants over the course of five years and the Defense Plant Corporation (DPC) provided funds for facilities owned by the government and operated by war contractors. Under both programs the firms that operated the facilities during wartime maintained a purchase option after the war concluded. Ultimately, the DPC spent 20 times more than the EPF. It accounted for \$7 billion in expenditures on facilities and equipment, as well as 10 to 13 percent of total US industrial capacity in June 1945. The DPC played an even larger role in key war industries, such as synthetic rubber, aluminum, magnesium, and aircraft.

To speed mobilization further, the NDAC was replaced by the Office of Production Management (OPM) in late 1940, which was subsequently replaced by the War Production Board (WPB) in January 1942. The main impetus for this administrative reshuffling was to achieve a greater centralization of planning and coordination capabilities in order to meet better the demands of military and economic mobilization (Koistinen, 2004, pp. 67-74, 195). Feasibility studies carried out in the early 1940s and then revised throughout the war played important roles in this process. The studies had the dual goals of balancing civilian and military requirements, as well as ensuring sufficient coordination to avoid unbalanced production and idle fac-

ories (Edelstein, 2001). In the end the federal government spent \$17 billion on new facilities and equipment during World War II (over three-quarters of the wartime total of new facilities and equipment) and \$108 billion on prime supply contracts. This shift toward military goods required a substantial reorganization of industry.

Mobilization was accompanied by enormous growth in the size of the military, both as a share of expenditures and in terms of manpower. Total war spending, which is shown in Figure 1.3, increased from \$3.6 billion in 1940 to \$93.4 billion in 1944 (Smith, 1959, p. 7). In addition, on September 17, 1940, Congress placed the Selective Service Act and enabled a dramatic increase in military manpower. By the end of the war, a total of 16 million men had served in the armed forces, 12 million inducted under the selective service law. This growth persisted into the postwar years.

The desire to control inflation led the government to place a number of restrictions on consumption patterns during the war years. The Office of Price Administration (OPA) was established on April 11, 1941 and was strengthened by the Emergency Price Control Act. The new legislation formally empowered a single administrator to set a broad range of controls determined to be “generally fair and equitable.” The OPA’s first action was the General Maximum Price Regulation, effective in May 1942, which fixed a ceiling for prices at their highest level as of March 1942. To overcome the fairness, efficiency, and enforcement problems that arose from freezing individually set prices, the OPA subsequently worked to develop specific controls for industries and products. Still, Rockoff (1984, p. 174-176) notes that price controls did not generally become effective at restraining inflation until they were combined with rationing, enforcement, and wage controls determined by the National War Labor Board.

In response to the boom in military production and the migration to cities that followed the expansion of military production, the federal government took steps to ameliorate the negative consequences, even before the U.S. entered the war. In

Figure 1.3: World War II Spending, 1940-1945



Source: Smith (1959, p. 7).

October 1940, for example, the Defense Housing and Community Facilities and Services Act was adopted. It eventually included provisions to provide funding for housing and other public services to defense areas. In addition, the families of service personnel were provided with small payments and healthcare benefits under the Servicemen's Dependents' Allowance Act of 1942, the emergency maternity program, and the infant care program (Tuttle, 1995). The OPA also used its powers under the 1942 Emergency Price Control Act to roll back rents to prewar levels in the areas most affected by the surge in population during the war years (Mansfield, 1948).

Preparation for reconversion began relatively early. Just as war production peaked, the War Production Board commissioned a preliminary report to study how and when demobilization should occur (Koistinen, 2004, p. 446). In the summer and fall of 1944 Congress passed the Contract Settlement and Surplus Property acts, which reimbursed contractors for expenses on terminated war contracts and governed the disposal of government-held industrial assets. The legislation also included provisions to protect small businesses and encourage competition (Murray, 1944; Cain and Neuman, 1981). Following the end of the war, many of the wartime controls were removed. The majority of wage and price controls were gone by the end of 1947 and businesses reported improved access to labor and raw materials and expected increased competitiveness in consumer markets in the short-run (Dickson and Lusardi, 1947; Higgs, 1999).

Despite the end of the conflict, the institutions created to oversee the war effort did not disappear entirely. Many of the agencies that played a key role in mobilizing the economy for war were officially defunct by 1945 or shortly thereafter. However, many of their functions were incorporated into existing departments. Moreover, aspects of wartime legislation that was allowed to expire reappeared in new legislation passed in the immediate postwar years (Higgs, 1989, pp. 225-234). As a result, the war years solidified a set of institutions that were dramatically different from those that had existed a half-century earlier.

1.3 Literature Review

The aspects of World War II's effects on the postwar economy that have been studied most by economic historians have been the rise of women's labor participation, the decrease in wage and wealth inequality, the postwar growth miracle, and the changing role of government in American society. Early research emphasized the war's transformative effect in each area: Rosie the Riveter continued to work after the 1940s, hence the war was a watershed for women's increasing participation in paid work; wartime taxation and labor market institutions altered the distributions of wages and wealth and attitudes toward inequality; investment and technological advances during the war spurred postwar growth; and federal policies such as the GI Bill permanently altered the role of government in education and housing finance. Recent studies by economic historians have re-evaluated these claims and, in turn, produced substantial revisions in our understanding of the impact of World War II.

1.3.1 Women's Labor Force Participation

The early literature on women's work and World War II emphasized the war's transformative effect (Chafe, 1972). Prior to 1940, women—particularly married women—faced substantial obstacles to paid work: segregation into low-wage occupations, legal constraints on daily and weekly hours, limited access to union membership, firm personnel policies that barred work for married women, and a workplace ideology dismissive of women (Goldin, 1990). The increased demand for labor due to mobilization for World War II and the sharp decline in the number of men available for civilian work pushed the female labor force participation rate from 27.8 percent in 1940 to 33.8 percent in 1945. As the story goes, the disruptive change led many women to not only enter the labor force en masse during the war, but dramatically altered attitudes toward women in the workplace; thus, the war was the impetus for the continued increase in women's labor force participation throughout the second half of the twentieth century.

However, the view that the war led to sweeping changes in employment opportunities and attitudes toward women faces strong challenges. Female labor force participation increased over the entire twentieth century, steadily until 1930 and more rapidly thereafter. During the 1940s, the employment rate for women increased through the early war years and then decreased sharply after 1945. Patriotism, the mobilization of men for military service, and the accompanying boom in female employment opportunities drew many women into the labor force during the war. Yet, despite their desire to remain at work, women were laid off in large numbers as employers and unions ignored seniority rules and gave preference to men in retention and hiring. More broadly, women also faced pressure to return to their prewar role as homemakers (Anderson, 1981; Campbell, 1984; Milkman, 1987).

Goldin (1991) provided the first quantitative assessment of the war's contribution to rising female labor force participation based on individual data. The data used were unique: surveys conducted in the early 1950s that asked employed women in six cities about various aspects of their employment history, in particular in 1940 and 1944. Focusing on white married women between the ages of 35 and 64 in 1950, Goldin found that the earlier views that the War stimulated women's labor force participation were overstated. Of women working in 1950, over half had also been working in 1940 prior to US entry into the war and before any substantial mobilization had taken place. Among women who had entered paid work during the war years, nearly half exited when the war concluded. Ultimately, wartime entrants comprised only one-fifth of white married women at work in 1950.

Acemoglu et al. (2004) treat states as distinct labor markets and exploits the variation in manpower mobilization across states to estimate the effect of World War II on women's work. The intuition for the approach is straightforward: manpower mobilization was a negative shock to a state's labor supply that induced women to enter the labor force during the war. After controlling for characteristics that may have caused female labor force participation to differ across states even without

differences in manpower mobilization, the study shows that the War had contributed to only modest increases in labor force participation by 1950. Building on this study, Goldin and Olivetti (2013) find that employment gains were concentrated among women with at least a high school degree. Moreover, women with no children during World War II were the most affected by manpower mobilization in 1950. Meanwhile, women with children were the most affected in 1960.

In earlier work, Schweitzer (1980) showed that the increase in women's labor force participation during the war was responsive to their household duties. Single women accounted for half of those working in 1940 and continued to comprise the largest share during the war. In contrast, women with young children were the last group to enter in large numbers: only in the second half of 1943 after firms together with local, state, and federal governments helped to provide child care and other housekeeping services. This infrastructure disappeared at the end of the war and so too did many working mothers.

Using employment records from Ford Motor Company, Kossoudji and Dresser (1992) find evidence that supports the findings of Goldin and Schweitzer. These authors document a pattern of postwar layoffs that is consistent with targeting women over men. As a result, by the start of 1946, only two of the women in their sample of roughly 300 were still working at Ford. This level of attrition does not comport with the generally high job performance ratings received by these women during the war. To explain this pattern, Kossudji and Dresser point to the unwillingness of management and unions to offer the wage and benefits packages perceived as necessary to maintain women in the workplace. Thus, from the vantage point of the late 1940s, the war's contribution to female employment gains was modest.

Nevertheless, over the second half of the twentieth century women's labor force participation increased dramatically. By 1990 the labor force participation rate was 57.5 percent; nearly triple the rate at the beginning of the century. Goldin (2006c) emphasizes the evolutionary nature of the change. In the early decades of

the twentieth century few married women were in the labor force. In subsequent decades the arrival of white-collar jobs and changing attitudes toward women in the workplace fueled the entry into paid work and altered expectations regarding the prospects for participation in the labor force over the life cycle.

Chapter 2 of this dissertation shows that high school age women in states with high rates of manpower mobilization received less education. These women dropped out of school to fill the jobs of men pressed into military service and, on average, received two fewer years of education. Ultimately, differences in educational attainment disappeared in later life, but the evidence suggests a cost in terms lower employment and wages rates along the way.

There is growing evidence that World War II also played some role in changing attitudes towards women's work and women's expectations about their lifetime prospects in the labor market. A 1947 report by the Women's Bureau presents evidence that women's work during the war altered family roles, for example with respect to childcare, meal preparation, and other household responsibilities (Bureau, 1947). However, the study provided no additional information on the attitudes of men and whether altered household responsibilities lasted into the postwar years. Fernández et al. (2004) show that World War II had lasting effects on women's labor force participation through likely changes in the attitudes toward working women of the sons of working mothers. The sons of women more likely to have worked during the war were also more likely to have a working wife.

On balance, World War II did not produce a sharp break in the rise of women's employment. In many cases, women were dismissed from their wartime jobs once the fighting was over and by 1950 women that entered paid work during the war comprised less than one-quarter of overall female employment. Still, World War II did have some effect: modest immediate gains in employment combined with changing attitudes and expectations about women's work eventually led to greater participation and spurred investment in human capital among subsequent genera-

tions. The war did not have the immediate and dramatic effects initially ascribed to it, but may have accelerated changes already underway.

1.3.2 Inequality, Mobility, and Living Standards

During the 1940s, the distributions of earnings and wealth exhibited a strong movement toward greater equality. The decrease in inequality was coincident with the war and the onset of the Great Depression, changes in tax policy, government-imposed caps on earnings, as well as economy-wide structural change stemming from the movement out of agriculture. What role did the war play in shaping the postwar distribution of income and wealth, and what was the war's contribution to changes in mobility and the standard of living?

Goldin and Margo (1992) document the narrowing of the wage distribution between 1940 and 1950 what they term the Great Compression. Focusing on the weekly wages of men, Goldin and Margo present evidence that the move toward greater equality was broad-based: the weekly wage distribution compressed from both above and below the median and differentials due to educational and regional differences were reduced. The 1940s compression took place in the context of structural transformation reflected in the movement out of agriculture and into manufacturing, the development of the US educational system particularly at the high school level, and the accompanying changes in the relative demand for labor of different skills. The effects of government policy during the Great Depression and war years were more short run. In the 1930s and 1940s, government policies were enacted to mitigate the most severe effects of the economic downturn and to limit inflation and prevent the war profiteering that had followed earlier wars.

The Fair Labor Standards Act (FLSA) established a federal minimum wage at 25 cents in 1938 that eventually increased to 75 cents by 1950. The FLSA may have contributed to reduced inequality in the early 1940s, although Seltzer (1997) documents substantial evasion by firms in the southern seamless hosiery and lumber

industries either by dropping out of interstate commerce or simply paying lower (illegal) wages. During World War II, the compression of the wage structure was partially due to increased relative demand for less-educated workers and policies that capped earnings. For example, the National War Labor Board (NWLB) under the authority of the 1942 Stabilization Act restricted wage increases to an additional 40 cents per hour without permission from the NWLB and 50 cents with authorization from one of its regional offices (Rockoff, 1984, p. 119).

To pin down the timing of the compression, Goldin and Margo draw on Bureau of Labor Statistics reports from the late 1930s and 1940s (Goldin and Margo, 1992, pp. 23-32). Using consistent data for 15 industries, they date the compression in the bottom half of the wage distribution to the prewar and war years, while compression in the upper half started during the war and continued after the fighting was over. Ultimately, this pattern suggests that rather than causing the Great Compression, wartime controls reinforced long-run trends that raised the relative demand for less-skilled labor, lowered the returns to schooling, and solidified institutional changes (e.g., increased minimum wage and union membership) that began in the 1930s.

Turning to the effect on top earners, Piketty and Saez (2003) document the sharp drop in top income shares following the onset of World War II. The share of income accruing to individuals above the 90th percentile dropped from 44.4 percent in 1940 to 35.5 percent in 1942 and 31.6 percent by 1944. Kopczuk and Saez (2004) document a similar pattern of decline in top wealth shares due to World War II. These authors stress wage controls along with increased income and corporate tax rates as the initial cause of the decline and explain the failure of top incomes and wealth to recover with increasingly progressive taxation in the postwar period.

Focusing on the determinants of executive compensation, Frdyman and Malloy (2012) provide evidence that the effect of specific regulations arising out of World War II were modest. Between 1940 and 1949, the compensation of corporate officers in 246 firms experienced much slower growth in absolute terms and declined relative

to production workers in the same industry. The authors attribute the change in executive compensation over the 1940s to decreased compensation for the top officers of larger firms and the ability of labor unions to restrict compensation at the highest levels. On the other hand, the effect of direct salary caps imposed during the war and higher tax rates appear modest and did not last beyond the end of the war.

Apart from the war's contribution to changes in the distribution of earnings and wealth, a number of studies examine changes in the circumstances of specific groups over the 1940s. For example, in *An American Dilemma: The Negro Problem and Modern Democracy*, Gunnar Myrdal wrote, "The present War is of tremendous importance to the Negro in all respects" (Myrdal, 1944, p. 409) Indeed, in two studies using data from the 1940 and 1950 decennial censuses, Maloney (1994) and Margo (1995) document the convergence of black and white wages. Blacks benefited from the overall compression of the wage structure as well as race-specific factors such as improvements in access to and the quality of schooling, occupational upgrading, and migration out of the South, played a role (Margo, 1994; Bailey and Collins, 2006). In Chapter 4, I provide evidence of the war's connection to the Great Compression through migration during the 1940s.

During the war years, the scarcity of labor and increased demand for industrial production also opened up employment opportunities previously closed to blacks. Collins (2000) shows that the Fair Employment Practice Committee (FEPC), established by executive order on June 25, 1941, to investigate charges of racial discrimination in war-related industries, did improve employment prospects for blacks in the covered industries. The key evidence is drawn from War Manpower Commission reports that give information on employment by race and the FEPC caseload at the city-level. The ratio of non-white to white employment increased with FEPC activity and this effect survives an instrumental variables strategy to address unobserved city characteristics. In addition, Collins (2001) estimates the wage gains associated with work in war-related industries: a 15 percent wage premium for blacks employed

in defense work relative to otherwise similar blacks in non-defense work.

The overall picture for the change in living standards during the war years and the specific contribution of wartime government policies remains unclear. A large body of evidence indicates a movement toward greater equality in the rewards from work: partially driven by long-run factors and partially due to policies associated with mobilization for war. However, evidence for overall gains in welfare is mixed. For example, Vatter (1985) argues that economic activity was higher during the war than at any point during the Great Depression, while Higgs (1992) reinterprets key macroeconomic variables to suggest that the US economy could not freely consume more guns and butter. Ultimately, the tension between evidence that war policies raised overall economic activity, produced greater equality, or limited consumer choices, awaits more micro-level studies quantifying the size of gains and losses from specific government actions.

1.3.3 Postwar Economic Growth and Regional Development

The difference between economic performance in the United States before and after World War II is striking. Economy-wide, the traditional narrative of growth over the twentieth century emphasizes the build-up and crash during the 1920s, sluggish performance in the 1930s, the boom of the 1940s, and subsequent postwar prosperity fueled by productivity growth due to the mobilization for World War II. A version of this narrative is also used to explain growth at the regional level: in the American South and in states along the Pacific Coast new capital investment and learning-by-doing spurred industrialization. In general, this story suffers from relatively little empirical support and existing evidence that relies mostly on the temporal coincidence between the war in the 1940s and the improvement of macroeconomic aggregates between the 1930s and 1950s. Ultimately, the traditional story does not stand up against straightforward revisions to the macroeconomic data nor does it comport with growing micro-level evidence that mobilization for war did not provide

direct inputs into economic growth and regional development.

Starting with macroeconomic data, many economists and historians have emphasized the role of World War II in the recovery from the Great Depression: mobilization for war coincided with improvements in GNP, unemployment, and per capita consumption (Stein, 1969; Polenberg, 1972; Lebergott, 1984; Vatter, 1985; Winkler, 1986; Bernstein, 1987). Between 1939 and 1945 increased 70 percent and per capita consumption was up nearly 25 percent, while the unemployment rate reached 1.3 percent by the end of the war. The link from the war to gains in these aggregate series is primarily through the build-up in military spending combined with fiscal policy multipliers that spilled over into the civilian economy. As an example, Vernon (1994) argues that over half of the recovery from the 1933 trough occurred between 1941 and 1942, and that war-related fiscal policy explains 80 percent of this growth. Vernon uses a multiplier for government spending of 1.6, which is higher than multipliers obtained in more recent studies. Gordon and Kreen (2010) argue that the U.S. ramped up military spending in July 1940. Their estimate of the multiplier prior to the third quarter of 1941, when the economy did not face capacity constraints, is 1.8, but falls to 0.9 afterward when capacity constraints became binding.

DeLong and Summers (1988) and Romer (1992) argue that a large portion of the recovery was already complete before mobilization for World War II began. De Long and Summers cite government spending's relatively small share of GNP prior to the attack on Pearl Harbor as reason to doubt the war's contribution to the recovery. In their view, five-sixths of the decline in output relative to trend was made up before the government took substantial control over the economy. Romer identifies a monetary policy channel related to an inflow of gold that lowered interest rates and stimulated investment and consumer spending in the second half of the 1930s. In part, the monetary stimulus may have been due to the declaration of war in Europe and the flight of capital from war-torn countries. Still, the macro-evidence on the war's role in the recovery of output is less clear-cut than is typically suggested by

the traditional narrative.

Whether one believes that the Great Depression ended in 1940, 1942, 1944, or 1947 depends on the choice of data series. Nearly all of the macroeconomic discussion has focused on measures of real GDP and thus treats the expansion of military production required to fight an all-out war as equivalent to production of peacetime goods in a normal economy. However, the expenditures on military production along with inductions and enlistments constituted a sacrifice necessary to win the war. High unemployment and relief work at half wages in the 1930s was replaced by high rates of military service during the 1940s. Life on the home front presented considerable challenges as well. Official figures for real private consumption per capita show little change between 1941 and 1944. However, these figures use price series that do not account for the decrease in the quality of consumer goods, and the extra costs of obtaining rationed goods, and the absence of variety (Rockoff, 1984; Higgs, 1992).

Field (2011, pp. 42-78) follows-up reinterpretations of the output data with new estimates of the peak-to-peak total factor productivity (TFP) growth. Annualized TFP growth was high during the two decades prior to World War II, 2.0 percent from 1919 to 1929 and 2.3 percent from 1929 to 1941. In fact, Field's estimates show that productivity growth was faster during the 1930s than at any other point in the twentieth century; the interwar years, not World War II, provided the foundation for postwar prosperity. Productivity gains in manufacturing were particularly dramatic during the 1920s, topping 5 percent per year between 1919 and 1929, and gains in the transport and public utilities sector were strongest during the depression years. In contrast, overall TFP growth was 1.3 percent per year between 1941 and 1948.

Higgs (2004) and Field (2011) both challenge the notion that war-related capital investment and learning-by-doing spurred productivity gains beyond the war years. Higgs emphasizes the composition of wartime capital investment, which was concentrated in non-industrial structures and equipment (i.e., military buildings and

munitions) and accounted for 83 percent of new capital formation in manufacturing. As a result, a substantial portion of the capital investment made during the war had limited peacetime use. Importantly, this conclusion is based on published US government statistics with some adjustments, for example, for greater capital utilization (and hence, greater depreciation) during the war. New studies using equipment-level data (e.g., from postwar surplus property sales) could provide more insight into the value and postwar uses of war-related capital. Nevertheless, evidence from the aerospace industry and demobilization at the end of the Cold War is consistent with substantial costs of redeploying sector-specific capital (Ramey and Shapiro, 2001).

Field (2011, pp. 19-45) focuses on whether wartime learning-by-doing led to improvements that could spillover into productivity gains in the peacetime, civilian economy. Citing a 1952 study by Solomon Fabricant, he notes the low levels of productivity in shipbuilding and airframe production prior to the military buildup and that subsequent growth during the war years was on top of this initially low base. Field also argues that many of the gains in producing military goods came from adopting organizational and technological innovations that were already integrated into the production for civilian goods. Work by Thompson (2001) provides still more reason to doubt the relatively high previous estimates of learning-by-doing in the construction of Liberty ships. Thompson shows that the estimates of Rapping (1965) and Argot et al. are too large and fall by 50 percent after correcting for an omitted variable problem due to mismeasurement in the capital stock.

Finally, Higgs (1999) argues that recovery in the immediate postwar years came as the demobilization occurred and the economy was returned to private hands and Field (2011) concludes that productivity gains stemming from investments made during the 1920s and 1930s were the source of postwar prosperity. There is still considerable work to be done to better understand the relative importance of the forces emphasized by Higgs and Field as well as whether the government's wartime role

in specific industries (e.g., synthetic rubber and aluminum) improved or worsened conditions in the long run. Nevertheless, any benefits of the war still have to be weighed against the substantial costs documented by Goldin (1980), Rockoff (2012), and others.

At the regional level, the traditional story emphasizes government spending and increased industrial activity during the war that later translated into industrialization in the states along the Pacific Coast and in the South. Stein (1990) tells this story for California, and the West more generally. In Nash's view, prior to the war the Western states had served mainly as a repository for natural resources that were transported to and processed in the East. The war provided infrastructure and opportunities to learn new production methods in the form of capital investment and supply contracts in high technology industries (e.g., chemicals, transportation equipment, etc.). Nash attributes the West's success in attracting a disproportionate share of war spending to skillful politicians that were able to pass legislation to ensure that large establishments in the East and Upper Midwest were not able to capture all of the spending on contracts, facilities, and equipment. The result was that the West emerged from the war industrialized and prepared to share in postwar prosperity.

Rhode (2000, 2003) challenges the Nash thesis and argues that World War II was not a watershed event. Rather mobilization for war complemented and reinforced a process of regional change that began earlier; the growth of the population, housing stock, and manufacturing base was already underway by at least the 1920s. For California in particular, much of the spending was concentrated in the manufacture of aircraft and shipbuilding, industries in which the state already had a great deal of experience before the war. Ultimately, the war may have pushed California and the other Pacific Coast states more quickly along the path of greater industrial development. But this likely would have been achieved eventually in any case.

In contrast to California's high-wage economy and prewar experience producing

modern, durable manufactured goods, industry throughout the American South was low-wage and labor-intensive. The traditional story then emphasizes the new industries that followed war spending to the Southern states; thus the war helped to attract more capital-intensive and higher value-added products below the Mason-Dixon line. White (1980, pp. 125-16) writes, “This wave of new plants came to the South because of natural resources, climate, and a labor pool attractive for its size if not always for its skills. . . . During the war, they helped train a managerial group whose entrepreneurial skills were a continuing asset to the South and acquainted many of the rural poor with an alternative way of life.”

In addition, Bateman, Ros, and Taylor (2009) find evidence that public investments during the Great Depression and World War II facilitated a region-wide “big push.” However, similar to revisionist arguments for the war’s impact on California, Robert Lewis argues that the war did very little to transform the Southern economy. Southern manufacturing lacked the strong linkages between firms typically required for spillovers from, for example, government spending to produce region-wide benefits. Industrial activity expanded during the war years, but this was a detour into sectors that would shrink or disappear by the late 1940s (Lewis, 2007). Chapter 3 provides evidence consistent with a limited impact of World War II on the South’s aggregate manufacturing growth; the main effect was through a modest reallocation of industrial activity to higher value-added sectors.

Overall, the evidence suggests that mobilization for World War II was not responsible for recovery from the Great Depression and its effect on regional development was muted. Fishback and Cullen (2013) confirm these results from macroeconomic and regional case studies. Using county-level data these authors find little growth in economic activity due to war-related supply contracts and capital investment. Still, more studies are needed that connect the specific aspects of the command economy during World War II to theories of macroeconomic and regional growth. In addition, more detailed data are required to shed light on, for example, the postwar value of

war-related capital investment, the extent of wartime technological advances and their applicability to the civilian economy, and the relevance of federal government spending for the regional economic development.

1.3.4 The Role of Government

By the mid-1940s, the US economy had been significantly reshaped by the events of the previous two decades. First, a build-up and bust of the stock market in the late 1920s, followed by a prolonged Great Depression and the New Deal, and finally the massive mobilization for a modern war fought on two fronts. Over this period a new set of institutions emerged that was solidified in the immediate postwar years and continued to affect the interactions between people, firms, and government for the remainder of the twentieth century.

On August 18, 1945, President Harry S. Truman issued Executive Order 9599, which directed Federal agencies “to move as rapidly as possible without endangering the stability of the economy toward removal of price, wage, production, and other controls and toward the restoration of collective bargaining and the free market” (see of the Budget, 1972, p. 491). However, while many agencies disappeared, others remained in place or had their functions subsumed into newly created or surviving agencies. Higgs (2006, pp. 49-54) and Koistinen (2004, pp. 514-516) argue that the remaining wartime institutions combined with the concentration of supply contracts and capital investment among a few firms to create the postwar military-industrial complex. In contrast, Wilson (2010, 2011) argues that wartime institutions and their postwar counterparts did more to constrain the actions of the firms under their purview, rather than simply working to their benefit.

Overall, the change in the role of the federal government in American life was sweeping. The first peacetime draft was instituted in the fall of 1940 and did not end until more than three decades later. The 1941 Lend-Lease Act initially provided aid to Britain and other nations to combat the advance of the Axis powers.

Ultimately, this would serve as the foundation for alliances that would last for many decades. Income taxation was extended to virtually every employed individual from the factory worker previously not taxed at all to the wealthiest Americans with a long history of paying taxes but at much lower rates. During the war years, the government grew in size and scope. The war created 42 million new taxpayers and wartime mobilization programs dwarfed in expenditures and control their New Deal counterparts. And through these actions the changes wrought by the years of war continued to shape the postwar US economy.

Through the 1946 Employment Act, Congress declared the power and responsibility of the federal government to promote a broad range of social goals from competition and production among firms to individual employment and purchasing power. Similar concerns were expressed in the 1944 Surplus Property Act, the legislation governing the transfer of war-related government-held industrial assets to private hands, with conflicting evidence regarding the success of attempts to discourage monopolistic practices. For example, a 1946 study by the Smaller War Plants Corporation concluded that the disproportionate share of contracts and capital investment obtained by the largest firms during the war led to increased concentration of assets and employment (Corporation, 1946, p. 49). Louis Cain and George Neumann document the concentration of the postwar sale of war plants to their operators during the war. Studies by Morris Adelman and the Federal Trade Commission suggested little impact of the transfer of war-related assets on overall concentration (Cain and Neuman, 1981, cited in).

There are still more instances in which mobilization continued to the effect peoples' lives even after the fighting was over. Fetter (2013) as well as earlier work by Friedman and Stigler (1946) documents a rise in homeownership during the 1940s due to wartime rent control. Unable to raise rents, landlords removed their properties from the rental market. As a result, homeownership rates increased by 10 percentage points between 1940 and 1945, or about half of the increase between

1940 and 1960.

The 1944 Servicemen's Readjustment Act was another vestige of the war years that played a role in postwar life. The Act, popularly known as the GI Bill, provided unprecedented federal support to veterans of World War II and later wars. Soldiers serving at least 90 days or discharged with a disability received \$500 in educational benefits plus a stipend of \$65 per month for single men and \$90 for married men. Bound and Turner (2002) and Stanley (2003) document substantial gains in college completion due the GI Bill: between 0.15 and 0.52 additional years of schooling. In addition, Stanley finds that the gains were concentrated among veterans from families with higher socioeconomic status, while Bound and Turner (2003) show that educational gains accrued only to black veterans born outside the South. The GI Bill also provided veterans with subsidies for home purchase lower interest rates and higher loan-to-value allowance and Fetter finds that these benefits explain one quarter of the increase in homeownership among the affected cohorts between 1940 and 1960 (Fetter, 2013).

World War II expanded the role of government in American life. Some wartime programs disappeared, while others remained in place for decades after the war's end. Out of the wartime agencies that governed the disbursement of contracts and new capital investment grew what President Dwight D. Eisenhower would later call the military-industrial complex. The fiscal and manpower demands of the mobilization would also see unprecedented expansions of the tax base and military conscription that would continue long after the war was over. In addition, the war led to dramatic changes in higher education and the US housing market; the GI Bill expanded the opportunities for many men to attend college and own homes. Page (2007) and Larsen et al. (2011) document the effect of the GI Bill's educational benefits on assortative marriage and intergenerational transfer of the schooling gains. All this suggests the long reach of mobilization for World War II into the second half of the twentieth century.

1.4 Conclusion

The end of World War II in the United States was followed by prolonged growth and the emergence of a middle class at home as well as newfound economic and military leadership abroad. The views that the war was instrumental in ending the Great Depression and underwriting the postwar “golden age” contrast with growing evidence that the war was much more costly than originally thought. This suggests that we are still early in the process of reconciling a quantitative economic history of mobilization and its consequences with the experience of the people that lived through those years. This dissertation provides a new set of facts that further illuminate the war’s long-run impact.

CHAPTER 2

'YOUR'RE' IN THE ARMY NOW:' THE IMPACT OF WORLD WAR II ON WOMEN'S EDUCATION, WORK, AND FAMILY¹

*Education has been ever in the Nation's service. But in these days of total war that service has a new significance. 'You're in the Army now' is no cliché—it is an expression of national necessity.*²

2.1 Introduction

World War II interrupted the schooling of many young women and men. Prior to the outbreak of the war, educational attainment in the United States increased steadily from at least the turn of the century. In 1910, fewer than 10 percent of 17 year-olds graduated from high school, by 1940 that number was more than 50 percent and increased still further to 70 percent by 1990. Immediately following US entry into the war, high school graduation rates decreased sharply, falling back to their levels in the early 1930s, as depicted in Panel (a) of Figure 2.1. The increase in male college completion rates following World War II, shown in Panel (b) of Figure 2.1, and the role of the 1944 Servicemen's Readjustment Act (popularly known as the GI Bill) has received considerable attention from economists. Less attention has been paid to the sharp decrease in high school completion rates for women and the potential

¹This chapter appears in the March 2014 issue of the *Journal of Economic History*.

²The quotation is from an essay written by Paul V. McNutt, chairman of the War Manpower Commission, for the first issue of the US Office of Education publication *Education for Victory* on March 3, 1942 (quoted in Kandel, 1948, p. 24). McNutt made no particular reference to the sacrifices of young women or men, however, Kandel notes the many policies put in place to accommodate and encourage working youth and that many of these programs were specific to young women.

adverse effects on education, work, and family formation. In short, the triumphant image of Rosie the Riveter may not capture the full costs associated with wartime work, particularly in light of evidence that employment gains for women during the 1940s were temporary (Schweitzer, 1980; Anderson, 1981; Campbell, 1984; Milkman, 1987; Goldin, 1991; Kossoudji and Dresser, 1992).

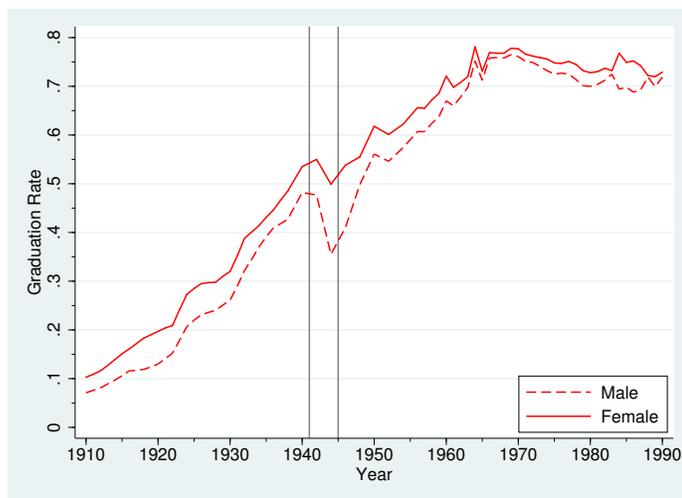
In this chapter, I examine the effect of manpower mobilization during World War II on the educational attainment of the high school age cohort of women in the early 1940s. The hypothesis is that women in this cohort were attracted by the new employment opportunities in sectors typically dominated by men and, as a result, left high school before graduating. Many of the jobs that women performed during the war did not require a high school degree (e.g., in manufacturing), however, some of these women were forced to leave these jobs at the wars end and others left voluntarily. Thus, the experience gained during the war came at the expense of education that would have increased wages in clerical, sales, and professional sectors, where female employment increasingly concentrated in the postwar period (Goldin, 1990). Despite the ability to tradeoff schooling for work and higher wages during wartime,³ after the war women in this cohort were left with less education and limited prospects in sectors in which they had recently acquired experience.

Previous research has focused on the educational gains of men due to the GI Bill or the cost of mobilization in Europe.⁴ However, the mechanisms for the war to alter the educational attainment of European and American youth were very different.

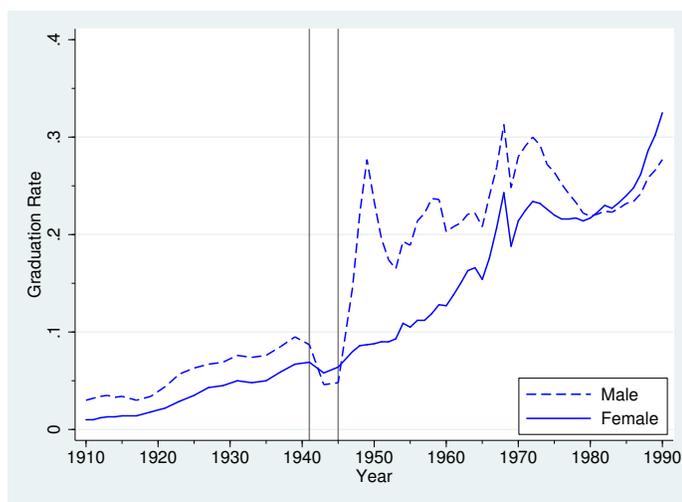
³Mulligan (1998) presents evidence that a variety of factors should have decreased pecuniary incentives to work during World War II. Still, the large decrease in school attendance during the war suggests a tradeoff between education and rewards of some kind, either pecuniary or non-pecuniary.

⁴See, for example, Bound and Turner (2002) and Stanley (2003) for the effect of the GI Bill on male education, Fetter (2013) for the effect on homeownership, and Angrist and Krueger (1994) for the impact of veteran status on male earnings. For Europe, Ichino and Winter-Ebmer (2004) the war's cost in terms of the education attainment and, ultimately, earnings of German and Austrian youth.

Figure 2.1: High School and College Graduation Rates, 1910-1990



(a) High School



(b) College

Notes: Panel (a) shows the total number of public and private high school graduates by gender divided by half the number of 17 year-olds. Panel (b) shows the total number of bachelor's degrees awarded by gender divided by half the number of 23 year-olds. The vertical lines in each panel mark the years of the official US participation in World War II.

Source: Goldin (2006b) and Goldin (2006a). The number of high school graduates and 17-year-olds are from series Bc259, Bc260, and Bc263. The number of college graduates and 23-year-olds are from series Bc572-574.

In Europe, the destruction of schools, the military service of fathers, and a higher probability of military service among school age children limited opportunities to obtain more education directly. In contrast, in the United States, the wars effect was through pressure on civilian labor markets, the ramp-up in industrial production, and increased military manpower requirements.⁵ Despite the formal urging of policy-makers, many high school age youth dropped out to enlist in the military or take advantage of labor market opportunities. Since women did not have access to the GI Bill, except the relative few that served formally (e.g., in the WAC or WAVES), and many male youth would later gain access to the GI Bill through service in Korea, I focus on quantifying the effect of World War II manpower mobilization on young womens educational attainment.

To do this, I exploit the large reduction in male labor supply due to voluntary enlistments and inductions under the 1940 Selective Service Act. In contrast to previous studies that use only the cross-state variation in manpower mobilization (e.g., Acemoglu, Autor, and Lyle, 2004; Fernández, Fogli, and Olivetti, 2004), I collect annual counts of enlistments and inductions for each state between 1940 and 1945, which I use to calculate exposure to mobilization for World War II by state- and year-of-birth. Thus, I am able to compare the educational attainment of female cohorts born in states with differential manpower mobilization as well as cohorts within states with differences in exposure to mobilization over time.

Consistent with the decrease in high school graduation during the war, I find that female cohorts more exposed to mobilization had lower educational attainment in 1960. This effect is concentrated among the share of women completing grades 11 and 12, which is in line with the large rise in the labor force participation of women in these age groups during the war. In addition, I find that compared to their

⁵In this way, the United States in the early 1940s resembles the natural resource booms analyzed by Black, McKinnish, and Sanders (2005) and Emery et al. (2012) and new factory openings examined by Atkin (2012). In each case, rising wages reduced investment in human capital by inducing young people to drop out of school and enter paid work.

counterparts in cohorts unaffected by mobilization, these women were less likely to be employed and had lower earnings in 1960. I also find that greater exposure to mobilization is associated with decreased age at first marriage and increased fertility. The decrease in employment and wages is not surprising given the lower educational attainment of women in these cohorts, but suggests some revision to work by Acemoglu, Autor, and Lyle that instead emphasizes the role of increased labor market competition. Furthermore, the change in family formation suggests a link between the labor market outcomes of these women and the onset of the postwar baby boom.

In the final section of the chapter, I turn to whether the effects of exposure to manpower mobilization were permanent. Traditional life-cycle models of human capital accumulation predict that the greatest portion of human capital is obtained early in life (Ben-Porath, 1967). However, alternative models show why individuals may reenter school later in life, for example, after changing jobs, changes in the value of leisure over the life-cycle, or relaxed credit constraints (Wiess, 1971; Ryder, Stafford, and Stephen, 1976; Wallace and Ihnen, 1975). For the postwar period, Davis and Bumpass (1976) find that many women returned to school later in life. Within this group, additional schooling was concentrated among those near the completion of a degree (either high school or college). In light of these results, I repeat my analysis for education, labor market outcomes, and fertility, in 1970 and find that differences due to mobilization disappear. This suggests an important role for education obtained after 1960, which helped these women overcome the adverse effects of World War II. I also provide evidence that women of high school age during World War II did in fact return to school after the wars end.

These findings are consistent with theoretical and empirical work that emphasize the role of learning about the returns to work and schooling (Altonji, 1993), particularly in the context of the rise of womens labor force participation in the second half of the twentieth century (Fernández, 2013). This is the case particularly

between 1960 and 1980, which Goldin (2006c) identifies as a key period of changing expectations about the prospects for work due to a variety of factors, among them rising education levels.

2.2 Historical Background

2.2.1 Advances in Education Prior to 1940

From 1910 to 1940, high school graduation rates in the United States increased almost continuously. This increase in educational attainment was rapid and followed the improvement in the elementary school infrastructure in the nineteenth century as well as being a response to high returns to skill from the antebellum period onward. As a result, by 1940, the median 18-year-old was a high school graduate although significant regional differences persisted into the second half of the twentieth century (Margo, 2000; Goldin and Katz, 2008).

The large differences in high school graduation rates between regions had myriad causes: from restricted access due to racial discrimination throughout the South to limited investment in secondary school infrastructure because a large industrial base maintained demand for relatively low-skilled labor. Goldin and Katz (2008) argue that regions with high income levels, say (but not exclusively) from agriculture, and a manufacturing sector that was not too large or too high-wage encouraged high rates of high school completion.

Prior to the outbreak of World War II, the first slowdown occurred during World War I and was concentrated among men, but mobilization of the eligible male population was much lower than during World War II and did not noticeably affect female graduation rates. The second slowdown followed briefly from the onset of the Great Depression, but graduation rates recovered quickly and continued to increase over the remainder of the 1930s. Nevertheless, on the eve of US entry into World War II America was still learning to graduate from high school. As a result, uncertain expectations about the future value of education—the return to a high school com-

pletion relative to 9th grade decreased during the 1940s (Goldin and Katz, 2008, p. 85)—together with a small change in the opportunity cost of schooling could lower the incentive to obtain more education.

2.2.2 World War II Manpower Mobilization

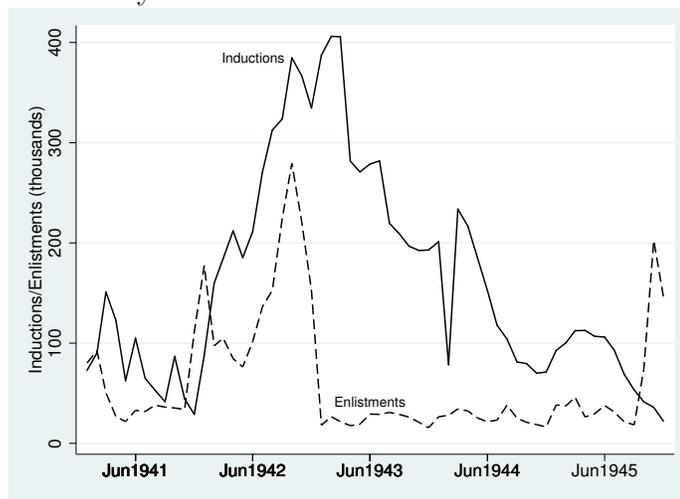
The Selective Service Act was enacted on September 16, 1940, and initiated the largest mobilization of manpower for war in US history. The draft was held in six registrations beginning in October 1940 and led to more than half of the male population aged 18 to 45 in 1940 serving in World War II. However, the national mobilization rate hides considerable variation at the state level: the lowest and highest overall mobilization rates range from about 40 to 55 percent. In addition, as shown in Figure 2.2, there was substantial variation in the rollout of mobilization over time, with significant enlistments prior to 1942, inductions peaking nationally in late 1943, and large additions to the armed forces up through 1944.

The differences in the mobilization rate across states and over time reflect differences in the demographic and economic characteristics that draft boards considered in granting deferments as well as changes in manpower demands over the war years. Upon registration, men filled out a questionnaire including name, age, race, marital status, place of birth, state of residence, and employment status. This information was used to classify men into four broad categories: (i) available for training and service, (ii) temporary deferment because of occupation, (iii) deferment because of dependency, and (iv) deferment for miscellaneous reasons (US Selective Service System, 1945).⁶ In general, these criteria changed over the war years in the direction of providing fewer official avenues for men to avoid service.

To meet manpower requirements, the military issued requisitions to the Director

⁶Miscellaneous deferments were granted for men aged 38 and older (later changed under the Tydings amendment), prior military service, government officials and nationally important civilian employment, ministers and students of divinity, aliens not acceptable for training or service, and those deemed physically, mentally, or morally unfit.

Figure 2.2: Monthly Inductions and Enlistments into Armed Services



Notes: The figure shows the number of inductions (solid) and enlistments (dash) in each month between January 1941 and December 1945. The sharp decrease in inductions in February 1944 is due to initiation of a pre-induction physical examination. The initial call of 280,400 was reduced to 130,431 by the Navy and War Departments (US Selective Service System, 1948, p. 26).

Source: National monthly inductions and enlistments are from Volume II of *Quotas, Calls, and Inductions* (US Selective Service System, 1948, p. 32-33).

of Selective Service, which were then translated into monthly calls for inductions. Calls were calculated by taking a states share of the national quota multiplied by the militarys requisitions for a given month. State quotas were set using the number of men available for military service adjusted for deferments granted and the number already serving. Calls were subject to some administrative adjustments to reflect changes in regulations, for example, governing occupational deferments. However, these adjustments were relatively minor (US Selective Service System, 1948).

The draft together with the increased demand for industrial production led a large number of women to enter paid work during World War II; female labor force participation increased from 27.8 percent in 1940 to 33.8 percent in 1945. However, at the end of the war, the female labor force participation rate decreased sharply and by 1950 still had not surpassed its wartime peak. Goldin (1991) provides evidence based on retrospective surveys that many of the women employed after the war were already working in December 1941 and less than half those that entered during the war remained in 1950.

The war's short-run effect on employment was not confined to white women; black men also experienced employment gains due to industrial manpower requirements and anti-discrimination legislation (Collins, 2001). In addition, high-school and college-age males and females increased participation in paid work. For example, the labor force participation rate of females aged 14 to 19 rose from 19.9 percent in 1940 to 41.8 percent in 1944 (Goldin, 1991, p. 742). The increase in the labor force participation of young females was partly due to an increase in part-time work. However, over two-thirds of high school age females in the labor force in 1944 were not attending school at all (US Bureau of Labor Statistics, 1945, p. 8). This increase in full-time work among school age youth is consistent with the precipitous decline in high school graduation rates in the first half of the 1940s.

The sharp drop in enrollment between 1940 and 1943—totaling around 1 million students did not go unnoticed. In some areas, school administrators responded to

the decreased enrollment with formal work-study programs that allowed students to attend school for part of the day and work the other part. The extent of the problem was highlighted in a statement issued by the superintendent of schools in New York City:

The number of vacation work permits issued to high school students has increased tenfold since the outbreak of the war. The number of permanent work permits has tripled. There is serious danger that many of the holders of these permits will be tempted by high wages to continue in their jobs rather than return to school. (quoted in Kandel, 1948, p. 86)

Partially in anticipation of the strain war mobilization would place on local resources, the federal government provided funding to build or maintain schools in cities receiving the largest allocation of war contracts. In addition, the US Office of Education, Childrens Bureau, War Manpower Commission, the Office of War Information, along with parents, school administrators, and employers worked together through local Go-to-School Drives to encourage students to stay in school, either full-time or part-time (Kandel, 1948).

The substantial decline in rates of high school completion suggests that the efforts by parents and school officials were unsuccessful. However, the continued expansion of the US education system in the early postwar period suggests that women had the opportunity to return to school following the end of the war. The goal of the empirical analysis is to determine how mobilization affected the education, work, and family formation of high school age women during World War II and then to assess to what extent the effects were permanent.

2.3 Data and Empirical Design

I combine two data sources to examine how manpower mobilization affected the educational attainment of the high-school-age cohort of native-born white women

during World War II. First, I use the Integrated Public Use Microdata samples of the 1960 and 1970 censuses (Ruggles, Alexander, Genadek, Ronald Goeken, and Sobek, 2010) to calculate average educational attainment by year-of-birth and state-of-birth. In each census year, I restrict the sample to native white women born between 1900 and 1935 to ensure comparisons are between cohorts with similar access to schooling over time. In addition, I drop all individuals born in Alaska and Hawaii, which did not officially join the United States until 1959, as well as Washington, DC. The solid line in Panel (a) of Figure 2.3 shows the mean high school graduation rate for each cohort and the dashed lines indicate variation (i.e., mean plus/minus one standard deviation) across states for a given birth year.

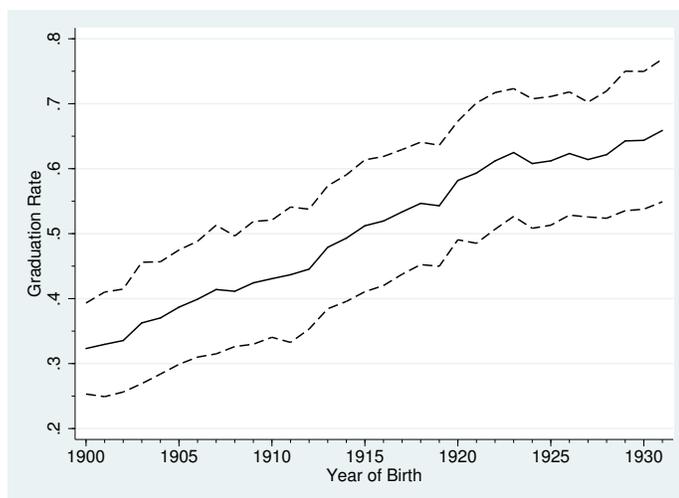
I also collected data on manpower mobilization from the *Quotas, Calls, and Inductions* volumes of the Special Monographs of the Selective Service, which provide information on the number of inductions and enlistments annually and total registrants in each state between 1940 and 1945. I use the enlistment and induction counts to construct a measure of manpower mobilization by summing the number of inductions and enlistments that a cohort in a given state is exposed to during high school age and dividing by a states total registrants. To be precise, the mobilization rate for a cohort born in state s in year c is equal to the total inductions and enlistments during the years the cohort was between the ages of 14 and 18,

$$\mathbf{mobilization}_{sc} = \frac{\sum_{t=14}^{18} \text{inductions}_{s,c+t} + \text{enlistments}_{s,c+t}}{\text{registrants}_s}$$

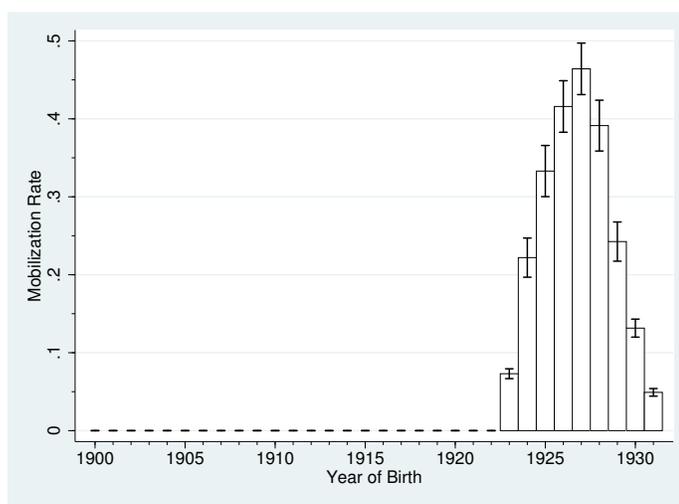
Panel (b) of Figure 2.3 shows the mean and standard deviation of $\mathbf{mobilization}_{sc}$ for each year-of-birth c from 1923 to 1931; for the remaining birth years $\mathbf{mobilization}_{sc}$ is equal to zero. The appendix provides additional details on sources and variable construction.

There are three notable features in Figure 2.3. First, there is considerable cross-state variation in both educational attainment and mobilization, as indicated by the standard deviation in each birth year. Second, there are substantial differences in exposure for the cohorts born between 1923 and 1931: the mean of $\mathbf{mobilization}_{sc}$

Figure 2.3: High School Graduation and Mobilization Exposure, 1900-1935



(a) High School Graduation



(b) Manpower Mobilization

Notes: The solid line in Panel 2.4(a) is the cross-state mean high school graduation rate of US-born white females for each year-of-birth and the dashed line is the graduation rate plus or minus one standard deviation. Each column in Panel 2.4(b) is the cross-state mean mobilization exposure in a given birth year and error bars denote one standard deviation above or below the mean.

Source: The high school graduation rates in Panel 2.4(a) are from the 1960 IPUMS census microdata (Ruggles et al., 2010). The mobilization rates in Panel 2.4(b) are from the *Special Monographs of the Selective Service* (US Selective Service System, 1948).

is 0.08 for the cohort born in 1923, increases to 0.46 for those born in 1927, and falls back to 0.05 for the 1931 cohort. Third, the pace of growth of the high school graduation rate slowed substantially after 1923 as cohorts were increasingly exposed to manpower mobilization for World War II.

The estimation approach incorporates both the cross-state and cross-cohort variation in manpower mobilization. Specifically, I consider regressions of the form:

$$Y_{sc} = \beta \mathbf{mobilization}_{sc} + \phi_s + \phi_c + f_s(c) + \epsilon_{sc} \quad (2.1)$$

where Y_{sc} is mean years of schooling for women born in state s and year c . Constructed as the sum of inductions and enlistments (normalized by total registrants), the $\mathbf{mobilization}_{sc}$ variable is interpreted here as the reduction in labor supply due to the withdrawal of men from the labor force following the 1940 Selective Service Act. One concern is that unemployment was still high following the Great Depression—estimates range between 9.5 and 14.6 percent in 1940 (Margo, 1993, p. 43)—and many men enlisting or inducted did not come directly from paid work. Still, the large variation in $\mathbf{mobilization}_{sc}$ captures considerable differences in able-bodied men available to work in each state s as well as differences in the magnitude of mobilization across the c cohorts.

The remaining variables control for changes in labor demand or other factors that affected women's labor supply decisions, are potentially correlated with manpower mobilization and educational attainment, and therefore bias the estimate of β . Specifically, state fixed effects, ϕ_s , capture time-invariant characteristics that draft boards used to grant deferments or reject registrants for military service and were directly related to changes in labor demand. For example, industry, marital and parental status, and race, were all factors explicitly considered by draft boards and potentially correlated with average cohort educational attainment in a particular state.

To illustrate the relationship between state characteristics and mobilization, the first two columns of Table 2.1 present summary statistics for state characteristics in

1940 stratified by the overall mobilization rate (i.e., high vs. low) between 1940 and 1945. Column 3 of Table 2.1 presents the results of the overall mobilization rate regressed on state demographic and economics characteristics. The most important predictors of the mobilization rate are the share in farming and the share in defense-related industries.⁷ This is expected given the initial emphasis the Selective Service placed on balancing military manpower requirements with the need for high levels of industrial output and maintaining food supplies. The share that are fathers, married, and black do not show up as significant.

Returning to equation (2.1), cohort fixed effects control for changes in labor demand and supply that similarly affected all individuals in the same cohort. For example, technological advances that raised or lowered the demand for particular skills or national business cycle conditions at the time a cohort entered the labor force. Finally, a state-specific time trend, $f_s(c)$, controls for the fact that educational attainment tended to increase over time but at different rates across states. The trend terms also adjust for cohort-specific labor demand shocks during the war years that were correlated with $\mathbf{mobilization}_{sc}$. In the results presented below, $f_s(c)$ is approximated with a second-order polynomial in year-of-birth (i.e., $\theta_s c$ and $\theta_s c^2$).

The identifying assumption is that manpower mobilization did not respond to deviations of female educational attainment from the state-specific trends. This would be violated if, for example, the Selective Service explicitly considered the rates at which recent female cohorts completed high school during the war years when determining inductions. The administrative history indicates that, in general, inductions were set mechanically through a formula based primarily on the pool of available men. Some discretion was exercised by local draft boards based on idiosyncratic factors. The time invariant component of these factors is controlled for through state fixed effects. Finally, standard errors are clustered on state-of-birth

⁷I follow Goldin (1991) in classifying metals, machinery, transportation equipment, chemicals, petroleum and coal products, and rubber products as war-related.

Table 2.1: Summary Statistics and Determinants of Manpower Mobilization

	Overall Mob. Rate:		(3) OLS
	(1) Low	(2) High	
Share Fathers	0.440 [0.026]	0.434 [0.040]	0.291 (0.263)
Share Married	0.621 [0.045]	0.610 [0.040]	-0.0194 (0.205)
Share Black	0.144 [0.148]	0.033 [0.058]	-0.040 (0.049)
Share Farmer	0.110 [0.042]	0.057 [0.036]	-0.649 (0.187)
Share Defense	0.025 [0.026]	0.029 [0.021]	-0.441 (0.174)
obs. (<i>state</i>)	24	24	48

Notes: The overall mobilization rate is the number of inductions and enlistments divided by total registrants between November 1940 and December 1945. Each characteristic is the share of males aged 18 to 44. Columns 1 and 2 show the mean and standard deviation (in brackets) of each characteristic stratified by whether the state is a “high” (≥ 0.47) or “low” (< 0.47) mobilization state. In Column 3, robust standard errors are reported in parentheses.

Source: State-level characteristics from 1940 IPUMS census sample (Ruggles et al., 2010). The mobilization rate is from the *Special Monographs of the Selective Service* (US Selective Service System, 1948).

to allow for serial correlation across cohorts born in the same state.

2.4 Mobilization and Early-Life Education, Work, and Family Formation

2.4.1 Results for Educational Attainment

The results from estimating equation (2.1) are presented in Table 2.2. The first column, based on cohorts born between 1915 and 1931, includes state and cohort fixed effects as well as a state-specific second-order polynomial in year-of-birth. The subsequent columns examine the robustness to alternative samples and control variables: column 2 adds additional cohorts born between 1900 and 1914; column 3 adds cohorts born until 1935; column 4 restricts the sample to cohorts born between 1923 and 1931 (i.e., cohorts for which $\mathbf{mobilization}_{sc}$ is strictly positive). Column 5 drops the sixteen southern states⁸ and column 6 adds the state compulsory attendance and child labor laws applicable to each cohort at age 14 as control variables.⁹ The estimates are stable across alternative samples (columns 2 through 5) and when control variables for compulsory attendance and child labor laws are included (column 6).

The coefficient estimates in Table 2.2 imply a substantial negative impact of manpower mobilization on educational attainment. The median of the mobilization exposure distribution (including cohorts with zero exposure) is 0.135. Therefore, the coefficient in column 1 implies that a cohort at the median exposure obtained 0.163(= 0.135×1.211) fewer years of schooling compared to cohorts with no exposure

⁸The southern states are Delaware, Virginia, Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Texas, Kentucky, Maryland, Oklahoma, Tennessee, and West Virginia.

⁹The compulsory attendance and child labor laws were constructed as in Acemoglu and Angrist (2000). The data files were downloaded from <http://econwww.mit.edu/faculty/acemoglu/data/aa2000> and include information on the maximum age for school enrollment, the minimum age to dropout, the minimum schooling before dropping out, the minimum age and schooling to obtain a work permit.

Table 2.2: Mobilization and Female Educational Attainment in 1960

	(1)	(2)	(3)	(4)	(5)	(6)
mobilization_{sc}	-1.211 (0.534)	-1.096 (0.443)	-0.964 (0.390)	-1.339 (0.635)	-1.143 (0.767)	-0.952 (0.494)
add cohorts born 1900-1914	no	yes	no	no	no	no
add cohorts born 1932-1935	no	no	yes	no	no	no
only cohorts born 1923-1931	no	no	no	yes	no	no
excl. southern states	no	no	no	no	yes	no
add CA & CL laws	no	no	no	no	no	yes
obs. (<i>state</i> × <i>cohort</i>)	816	1535	1008	432	561	816

Notes: The dependent variable is mean cohort years of schooling in 1960. All specifications include state-of-birth and cohort fixed effects as well as a state-specific second-order polynomial in year-of-birth. Column 2 adds additional cohorts born between 1900 and 1914. Column 3 adds additional cohorts born between 1932 and 1935. Column 4 restricts the sample to cohorts born between 1923 and 1931. Column 5 excludes the southern states and column 6 adds the state compulsory attendance and child labor laws in effect when each cohort was age 14 as control variables. In all columns, observations are weighted by the number of women in *cohort* × *state* cells. Standard errors (in parentheses) are clustered on state-of-birth.

Source: Cohort data are constructed from the 1960 IPUMS census sample (Ruggles et al., 2010). The mobilization rate is from the *Special Monographs of the Selective Service* (US Selective Service System, 1948). State compulsory attendance and child labor laws are from Acemoglu and Angrist (2000).

to mobilization. This corresponds with one student dropping out two years early to work during wartime for every ten men joining the armed forces through inductions or enlistments.¹⁰

The youth who left school to enter paid work were employed in a variety of sectors. Among women aged 14 to 19 in 1944 and not attending school the largest share (40.7 percent) were employed in manufacturing, followed by 19.9 percent in finance and service, and 16.8 percent in retail trade.¹¹ The result was substantially more young women in employment in 1944 than 1940, particularly in manufacturing. The pattern of wartime employment for men not attending school was more stable: male employment for those aged 14 to 19 was more evenly split between manufacturing (28.6 percent) and agriculture (45.0 percent), which differed less from the prewar pattern (US Bureau of Labor Statistics, 1945). Overall, changes in the employment patterns of young men and women between 1940 and 1944 suggest that much of the increase in manufacturing employment in the early 1940s was due to young women dropping out of school to enter work.

To see how the war affected the distribution of education, Table 2.3 presents the results for the effect of mobilization on the share of a cohort completing at

¹⁰First, for simplicity I assume that additions to the armed forces (i.e., inductions or enlistments) correspond with job openings one-to-one. Second, I assume that high school dropouts completed two fewer years of schooling based on estimates in Table 2.3 that show mobilizations effect was concentrated on completing grades 11 and 12. Therefore, if each student that dropped out during World War II obtained two fewer years of schooling and enough job openings occurred such that everyone in a given cohort was able to work during the war, then a cohorts mean years of schooling would fall by two years. On the other hand, if one student dropped out two years early for every ten new job openings then average cohort years of schooling would fall by $0.2 (= 2/10)$, which is similar to the 0.163 figure reported in the text. These figures are consistent with US Bureau of Labor Statistics (1944a, p. 272) estimates that the high school age female cohorts comprised approximately 10 percent of wartime job openings available to women.

¹¹The remaining women were employed in agriculture (4.5 percent) and other sectors (18.1 percent), including forestry and fishing, mining, construction, transportation, communication, public utilities, wholesale trade, and government.

least a given grade level. Specifically, each column contains the coefficient on **mobilization**_{sc} from a regression where the outcome is the share in a cohort completing at least $g \in (8, 9, \dots, 16)$ years of schooling. The results indicate that mobilization primarily lowered the share completing 11 and 12 years of schooling. For lower and higher grades the estimates are economically small and not statistically significant.

To see the effect of mobilization on high school graduation rates in particular states, Figure 2.4 plots the fitted values from a version of equation (2.1) for the ten states with the highest overall mobilization rate. The cohorts born after 1922 are exposed to manpower mobilization and have lower high school graduation rates than previous cohorts. This is consistent with the concentration of the increase in full-time work among young women more than 16 years old and, therefore, with mobilization primarily affecting high school, not college, completion (US Bureau of Labor Statistics, 1945, p. 9).

Goldin (1998) notes the decrease in the high school graduation rate of both females and males, and suggests a similar cause of the decline across gender. It was not only that young men joined the military and women did not, although this played some role. Rather, both young men and women were attracted into work by the change in labor market conditions. In the case of young women, many were able to obtain work in industries that in the absence of the war and large-scale mobilization would have been closed to female workers. At war's end, many of these women would indeed be forced to leave work in war industries, a repeat of women's post-WWI experience (Greenwald, 1980).

Interestingly, there are no similar effects of manpower mobilization on the educational attainment of African-American women. This is most likely due to the lower rates of high school completion among blacks in this period. By 1940, access to education had advanced enough that many whites made the decision to obtain additional schooling on the margin of completing high school. In contrast, blacks

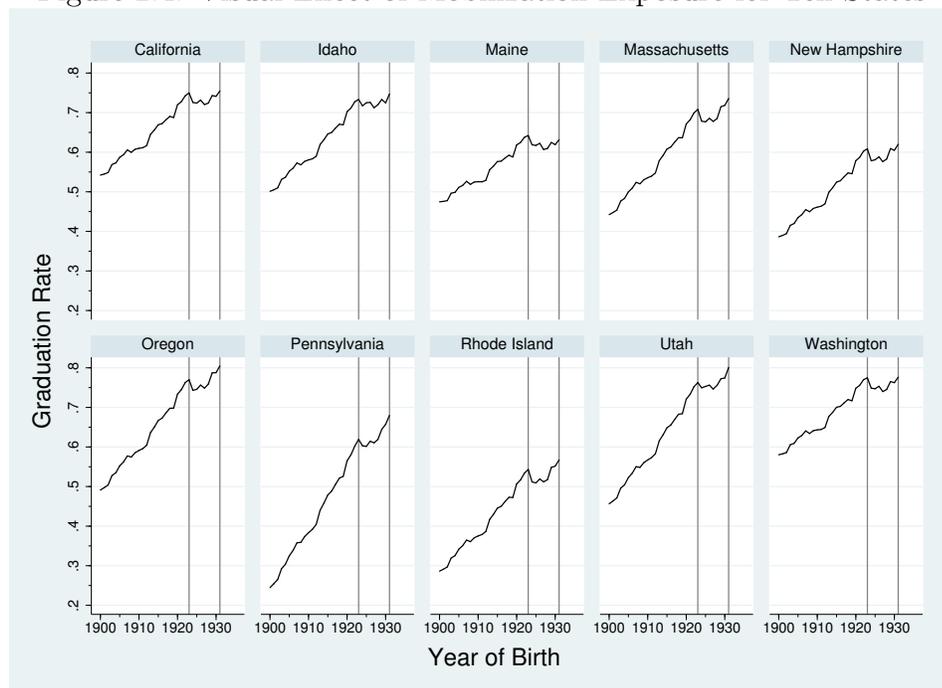
Table 2.3: Mobilization and Completed Years of Schooling in 1960

	Completed Years of Schooling (g):								
	8	9	10	11	12	13	14	15	16
mobilization_{sc}	-0.083 (0.049)	-0.103 (0.068)	-0.192 (0.110)	-0.279 (0.114)	-0.329 (0.091)	-0.057 (0.086)	-0.074 (0.063)	-0.012 (0.070)	-0.019 (0.055)

Notes: Estimates from a modified version of equation (2.1) in text. Each column is from a separate regression in which the dependent variable is the share in a cohort completing at least g years of schooling by 1960. All specifications include state-of-birth and cohort fixed effects as well as a state-specific second-order polynomial in year-of-birth. In all columns, observations are weighted by the number of women in $cohort \times state$ cells. Standard errors (in parentheses) are clustered on state-of-birth.

Source: See Table 2.2 sources of details.

Figure 2.4: Visual Effect of Mobilization Exposure for Ten States



Notes: Vertical lines denote cohorts with year-of-birth between 1923 and 1931 (inclusive). These cohorts have positive mobilization exposure.

Source: See text.

completed high school at roughly half the rate of whites over this period and obtained, on average, between two and three fewer years of schooling (Goldin and Katz, 2008, p. 23). Thus, when mobilization for World War II increased labor market opportunities for young women, many white women elected to drop out, while many black women had already reached their highest level of schooling.

2.4.2 Results for Labor Market Outcomes and Family Formation

Several authors have highlighted the extent of women's postwar employment problems. For example, Anderson (1981, pp. 162-164) concludes that many women intended or hoped to keep working after the war was over. At the same time, a 1944 survey of Washington State manufacturers suggested that postwar layoffs would be concentrated among women. This conclusion is consistent with evidence presented by the US Bureau of Labor Statistics (1944a) that many women anticipated staying in the labor force and the findings of Kossoudji and Dresser (1992) that women accounted for a disproportionate share of layoffs at Ford Motor Company. In addition, Kossoudji and Dresser found that the women likely to have the fewest outside employment opportunities were particularly exposed to postwar layoffs.

Ultimately, there is little direct evidence on the postwar labor market prospects and family decisions of the young women that left high school early to enter wartime work.¹² For evidence on the effect of mobilization on labor market outcomes in 1960, the first three columns of Table 2.4 presents estimates from a version of equation (2.1) in which the dependent variable is one of three cohort labor market outcomes in 1960: employed share, average weeks worked in the previous year conditional on employment, and (log) average weekly wage conditional on employment. The cohorts most affected by mobilization had a smaller share employed in 1960 (column

¹²From retrospective surveys carried out by Palmer (1954) and Goldin (1991), I find that among women working in 1950, high school age women from the early 1940s that worked in war-related industries in 1944 were less likely to have graduated from high school. Their wages in 1950 were only lower as a result if they were unable to keep their defense sector job.

1), did not work fewer weeks (column 2), and earned less (column 3). This is consistent with these less educated female cohorts experiencing lower rates of employment and earning lower wages due to higher exposure to mobilization for World War II.

In order to examine this channel, columns 4 and 5 report the results from OLS and IV regressions of the log weekly wage on average years of schooling, where the mobilization variable is used as an instrument in Column 5. Interestingly, the IV estimate is larger than the OLS estimate. The size of the difference may be partially due to the correlation between unobserved factors affecting cohort earnings and the mobilization variable. However, following Card (2001), this may also reflect the fact that mobilization primarily altered the schooling decisions of those with relatively high returns. The potential biases suggest caution when interpreting these results. Still, this finding is consistent with the results reported later that differences in educational attainment and labor market outcomes disappeared between 1960 and 1970 as these women, recognizing the gains from more education, returned to school.

In addition, while Acemoglu, Autor, and Lyle emphasize the causal link between increased labor market competition and lower female wages in the postwar period, my findings suggest an alternative interpretation. In particular, lower postwar earnings, at least among younger women, were partially due to the direct effect of less education among labor market participants as a result of their greater exposure to the mobilization. Goldin and Olivetti (2013) also note that educational attainment mattered for the type of wartime work obtained by women and their postwar employment prospects. Among women 25 to 44 in 1951, 80 percent of those with a high school degree or more worked in white-collar jobs in 1944, while 75 percent of those with less than a high school degree worked in blue-collar occupations during the war. These patterns persisted, with a trend toward work in service occupations replacing work in manufacturing.

The last two columns of Table 2.4 presents the results from estimating equation (2.1) using the average age at first marriage and the average number of children

Table 2.4: Mobilization and Labor Market Outcomes in 1960

	Labor Market:					Family:	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Emp.	Weeks	Wage	Wage	Wage	Marr.	Child
mobilization_{sc}	-0.221 (0.085)	-3.461 (3.707)	-0.339 (0.187)			-1.315 (0.659)	0.511 (0.230)
education_{sc}				0.069 (0.014)	0.238 (0.101)		

Notes: The outcome in column 1 is the share employment in a given cohort. In column 2, the outcome is cohort average weeks worked in the previous year conditional on employment. In columns 3 through 5, the outcome is the (log) average weekly wage conditional on working at least 40 weeks in the previous year. In columns 6 and 7, the outcomes are cohort average age at first marriage and number of children ever-born in 1960, respectively. All specifications include state-of-birth and cohort fixed effects as well as a state-specific second-order polynomial in year-of-birth. In all columns, observations are weighted by the number of women used to calculate the dependent variable. Standard errors (in parentheses) are clustered on state-of-birth.

Source: See Table 2.2 sources for details.

ever-born in 1960 as the dependent variable. Column 6 shows that greater exposure to mobilization is correlated with a lower age at first marriage and column 7 shows that greater exposure is associated with higher fertility. These estimates may not capture the causal effect of mobilization on family formation and fertility, since higher rates of mobilization may be correlated with additional public services (e.g., child care) and housing construction that occurred during the war and remained in place once the war was over. Still, these and other services, which targeted high mobilization areas in order to relieve the worst effects of large-scale mobilization, provided the infrastructure that facilitated earlier entry into marriage and higher fertility.

The findings for family formation and fertility are in line with a large literature that emphasizes the contribution of changes in labor market competition to the postwar baby boom (Butz and Ward, 1979; Doepke, Hazan, and Maoz, 2012). In the immediate aftermath of the war, women faced competition from men returning home from the war. In addition, female cohorts that reached childbearing age after the end of the war also had to compete with women that were able to retain their wartime jobs. As a result, women who came of age in the 1940s and 1950s decreased their supply of labor to the market, moved more rapidly into marriage, and increased their fertility. This effect may also reflect changes within the household as rising husbands earnings, due to education obtained through the GI Bill and improved economic conditions, facilitated greater specialization in market and non-market work. Importantly, to the extent that education played a role in these labor market, marital, and family decisions, my findings highlight the impact of World War II mobilization on the lives of these young “Rosies.”

2.5 The Long-Run Impact of Manpower Mobilization

The previous section documents a pattern of lower educational attainment, employment, and earnings as well as altered family formation decisions for the high school

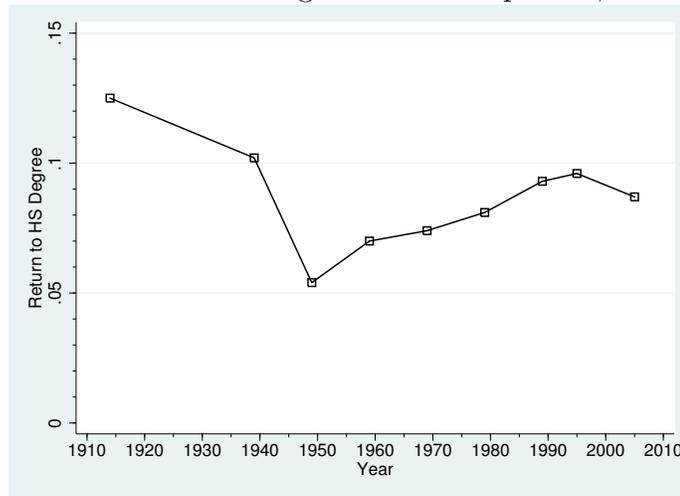
age cohort of white females during World War II. My argument is that these effects were driven by differences in the exposure to manpower mobilization by state- and year-of-birth. Goldin and Katz (2008, p. 84) provide estimates of the returns to high school completion (relative to nine years of schooling) for males between 1914 and 2005, which are reproduced in Figure 2.5. If male and female returns to schooling move together, the fall in the return to high school completion between 1939 and 1949, suggests one reason why the schooling gap between the war and non-war female cohorts was not eliminated by reinvestment in education immediately after the end of war: the gains from high school completion were relatively low. After 1960, however, the return to high school completion began a steady increase that continued until 1995 and may have incentivized a return to school among some women. In addition, improved access to reliable contraception throughout the 1960s allowed married women to limit later-life fertility (Bailey, 2010).

Table 2.5 presents estimates of equation (2.1) using the 1970 census to calculate education and labor market outcomes: column 1 shows the results for cohort high school graduation rate, column 2 the results for cohort mean years of schooling, and columns 3 through 5 for employment, weeks worked, and earnings, respectively.¹³ In the first column, the coefficient on mobilization shows that the gap in high school graduation rates across cohorts is reduced to a third of its 1960 level and the gap in years of schooling is cut in half; neither estimate is statistically different from zero. The subsequent columns confirm that the differences in labor market outcomes and the number of children ever-born also disappear.¹⁴ This suggests that catch-up

¹³The evidence on the change in education between the 1960 to 1970 censuses and, below, from the National Fertility Survey should be interpreted with the caveat that individuals with less education may be more likely to report a higher, incorrect level of schooling as educational attainment in the overall population rises. For my results, this would imply less convergence in cohort educational attainment and that the effects of World War II were more persistent.

¹⁴Results using the change in given outcome between 1960 and 1970, similarly suggest that growth was relatively higher among cohorts more exposed to manpower mobilization.

Figure 2.5: Returns to High School Completion, 1914-2005



Notes: The figure shows returns to high school completion relative to nine years of school for males with between 0 and 20 years of potential work experience.

Source: Returns to high school completion are from Goldin and Katz (2008, p. 84).

Table 2.5: Mobilization, Education, and Labor Market Outcomes in 1970

	Education:		Labor Market Outcomes:			Family:
	(1)	(2)	(3)	(4)	(5)	(6)
	HS Grad	Years	Employed	Weeks	Wage	Child
mobilization_{sc}	-0.092	-0.587	-0.136	-2.444	-0.024	-0.215
	(0.097)	(0.532)	(0.084)	(3.387)	(0.164)	(0.323)

Notes: The outcomes in the first two columns are cohort high school graduation rate and mean years of schooling, respectively. In columns 3 through 5, outcomes are cohort share employed, cohort weeks worked conditional on employment, and (log) average weekly wage conditional on working at least 40 weeks in the previous year. In column 6, the outcome is number of children ever-born in 1970. All specifications include state-of-birth and cohort fixed effects as well as a state-specific second-order polynomial in year-of-birth. In all columns, observations are weighted by the number of women used to calculate the dependent variable. Standard errors (in parentheses) are clustered on state-of-birth.

Source: Cohort data are constructed from the 1970 IPUMS census sample (Ruggles et al., 2010). The mobilization rate is from the *Special Monographs of the Selective Service* (US Selective Service System, 1948).

in educational attainment among the female cohorts most exposed to manpower mobilization translated into better labor market outcomes, with no difference in completed fertility by 1970.

This is consistent with a broad pattern of women returning to school later in life (Westoff and Ryder, 1970; Davis and Bumpass, 1976). For evidence that women did return to school after dropping out during World War II, Table 2.6 tabulates information from the decennial censuses and the 1970 National Fertility Survey. In particular, I report the share of the high school age cohort of white women during World War II that reported attending school in the 1950 and 1960, and the share completing their last year of schooling after 1960. Comparing column 1 of the first two rows in Table 2.6, the share of the war cohort still attending school is higher in 1950 than in 1960. The subsequent columns, which tabulate the share attending school by birth year, show that school attendance in 1950 was most common among the youngest in the war cohort. Still, more than two percent of women born between 1926 and 1931 reported attending school in both 1950 and 1960.

The third row of Table 2.6 is calculated from a question in the 1970 National Fertility Survey (“In what year did you last attend high school or college?”) and indicates that 15.8 percent of women who were high school age during World War II reported completing their highest level of schooling after 1960. The last row shows the share that answered “yes” to the question: “Do you intend to return to school in the future?” For women in the war cohort, 10.6 percent indicated a desire to obtain more schooling after 1970. This evidence, although it does not directly link women's wartime experience to the extent and timing of postwar school attendance, suggests that a large number of women who could have left school during World War II, did return to school later in life.

Table 2.6: Later-Life School Attendance of School Age Cohort During WWII

	(1) All	Year-of-Birth:		
		(2) 1923-25	(3) 1926-28	(4) 1929-31
1950 Share Attending School (IPUMS, 1950)	0.044	0.012	0.024	0.100
1950 Share Attending School (IPUMS, 1960)	0.018	0.006	0.022	0.025
Share Attending School After 1960 (NFS, 1970)	0.158	–	–	–
Share Intending More School After 1970 (NFS, 1970)	0.106	–	–	–

Notes: The first two rows show the share of the high school age cohort during World War II that reported attending school in 1950 and 1960 censuses. The first column shows the share for all birth years. The next three columns show school attendance share also stratified by birth years. The last two rows report the share of women born between 1926 and 1930 that reported attending school after 1960 and the share intending more school after 1970 from the 1970 National Fertility Survey.

Source: For the first two rows, the school attendance data are constructed from the 1950 and 1960 IPUMS census sample (Ruggles et al., 2010). For the second two rows, answers are tabulated from the 1970 National Fertility Study (Westoff and Ryder, 1970).

2.6 Conclusion

A striking feature of Americas human capital century is the sharp drop in high school graduation rates among both men and women during World War II and the subsequent increase in male college completion rates following the GI Bill. While much attention has been paid to the effect of the GI Bill on the college completion of veterans, there is little work that quantifies the extent of the decline in the educational attainment of women, whether the decline was permanent, and the broader impact on female labor market outcomes and family formation decisions.

In this chapter, I show that the disruption caused by World War II was large and had real consequences in terms of education, work, and family formation. Specifically, I document lower levels of educational attainment among women exposed to manpower mobilization for World War II during their normal years of high school attendance. The impact of the war was large in 1960—at the median exposure rate the effect was equivalent to one woman dropping out of school two years early for every ten new men inducted (or enlisted) into the military—and was accompanied by lower employment and earnings. These findings comport with the dramatic increase in female employment, particularly among those of high-school-age, during the war and their subsequent exit from the relatively lucrative jobs in manufacturing at the wars end. In addition to lower rates of labor force participation and earnings, women with greater exposure to mobilization were quicker to start families in the immediate postwar period.

I then show that cross-cohort schooling converged and that the gap from exposure to mobilization was gone by 1970. This is consistent with work by Davis and Bumpass (1976) who find that many women in the postwar period returned to school after marriage. Using the 1950 and 1960 decennial censuses and 1970 National Fertility Survey, I present evidence specific to the war cohort of women that is consistent with many of these women returning to school later in life. This finding also fits the broad pattern of steadily rising returns to schooling and the

quiet revolution taking place as women learned about the returns to work over the second half of the twentieth century.

CHAPTER 3

WORLD WAR II AND THE INDUSTRIALIZATION OF THE AMERICAN
SOUTH

3.1 Introduction

Convergence in industrial structures drives international and regional income convergence (Hanna, 1959; Kuznets, Miller, and Easterlin, 1960; Williamson, 1965; Krugman and Venables, 1995; Kim, 1998; Caselli and Coleman, 2001). Convergence is delayed where barriers to technology adoption or restrictions on the mobility of labor and capital persist, preventing the transition out of agriculture or the reallocation of manufacturing activity toward higher value-added sectors. On the eve of World War II, the American South was more industrialized than at any point since the Civil War. Yet, in 1940, after more than a half century of manufacturing growth, incomes in the region still lagged behind the rest of the country. The South's failure to industrialize along northern lines helps explain its laggard economic performance through the first half of the twentieth century.¹ In the 1940s, mobilization for World War II intervened and billions of dollars in government spending flowed to the South. In the subsequent decades, the region's manufacturing became more diversified and expanded. Per capita incomes that were less than 70 percent of the national average in 1940 were near parity by 1980.

In this chapter, I examine the contribution of World War II to industrialization in the South after 1940. Specifically, I consider the impact of two types of war

¹Barro and Sala-i-Martin (1992) and Mitchener and McLean (1999) provide an overview of patterns in US regional convergence since the late nineteenth century. In the context of the American South, Bateman and Weiss (1981) and Wright (1986) discuss the pre- and post-Civil War decades, respectively.

spending: supply contracts for military goods and investment to build or expand industrial capacity. The war provided demand and capital to the southern economy, which may have helped the region industrialize. I test this claim and find that war spending can explain only a small portion of the South’s aggregate postwar growth of manufacturing. However, I also find substantial differences in the effect of war spending across sectors. In particular, for textiles there is little effect of either type of war spending. For metals, machinery, and transportation equipment, activity increased with capital investment, but not supply contracts. Thus, while at the aggregate level the war had little impact, government spending did facilitate the reallocation of manufacturing activity toward higher value-added sectors.

The empirical analysis uses a discrete-choice model of establishment location decisions. I estimate the model using newly collected data on the number of establishments in each two-digit sector across counties in 12 southern states between 1927 and 1967. I aggregate counties to approximate labor market areas and address spillovers between establishments that may have extended beyond county borders.^{2,3} In addition, the model allows for random coefficients, which capture sector-level heterogeneity in the effect of war spending. This is particularly relevant in the context of the American South, which industrialized rapidly after the Civil War but concentrated in low value-added sectors. Indeed, the focus of recent research on the effect of government policy on *aggregate* manufacturing activity (Kitchens, 2012; Kline and Moretti, 2014) and an older literature that emphasizes the shift from agriculture to manufacturing (Matsuyama, 1991; Kim, 1998; Caselli and Coleman, 2001),

²Formally, I aggregate counties based on the “commuting zone” concept defined by the Economic Research Service. I use the 2000 definitions for which .shp files are available, however, results are not sensitive to using alternative definitions for earlier years. In the exposition below, I will use the term “location” to refer to the commuting zones within the South.

³Ellison and Glaeser (1997) provide evidence that spillovers (i.e., due to natural advantages) likely travel outside of a particular county in the United States, but not outside of a state. The size of geographic unit utilized in this chapter is also in line with Duranton and Overman (2005), who find that spillovers between three-digit industries travel between 80 and 140 kilometers.

misses the reallocation of activity within manufacturing toward higher value-added sectors.

To estimate the model, I assume that establishments observe the characteristics of all locations and choose the southern location (or outside option, i.e., elsewhere in the United States) that maximizes profit. In the spirit of Berry, Levinsohn, and Pakes (2004), I follow Train and Winston (2007) to estimate the model in two steps. In the first step, I use maximum likelihood to estimate the heterogeneous response to each type of war spending by sector. In the second step, I use a simple fixed effects regression to estimate the mean effects of supply contracts and capital investment across all sectors.⁴

To identify the model I exploit two sources of variation. First, deviations from sector-specific trends in the profitability of manufacturing identify the effect of war spending across sectors. Similarly, deviations from location-specific trends identify the mean effect of spending. Relying on these sources of variation ensures that my estimates do not reflect the long-run growth or decline of a particular sector or location. In addition, I also present results that control for policies enacted under the New Deal (e.g., Agricultural Adjustment Administration, Tennessee Valley Authority) and discuss how the war interacted with other changes occurring in the US economy (e.g., African-American migration from the South, the Cold War defense build-up).

This chapter contributes to several literatures. First, among economists and economic historians there is considerable debate over the importance of war-related spending for postwar economic growth. Gordon (1969) calculates that World War II-era investment contributed 33 percent to the manufacturing capital stock between 1940 and 1945. In contrast, Barro (1981) estimates a multiplier of less than

⁴The link between the first and second steps is the contraction mapping due to Berry, Levinsohn, and Pakes (1995) embedded in the maximum likelihood routine that I use to recover the mean profitability for each location-year observation, which serves as the dependent variable in the second step.

one on government purchases during the war years.⁵ More recently, economic historians have emphasized the high costs of conversion and reconversion, the rapid depreciation of wartime capital, and the mismatch between military technology and production for civilian markets (Higgs, 1989; Field, 2011; Rockoff, 2012; Fishback and Cullen, 2013). My findings suggest that wartime capital investment was more valuable, at least within the South, than is typically recognized. However, it is worth noting that these findings are in the context of the Cold War and, therefore, may reflect the effect of further build-up in defense spending. Indeed, for demobilization in the aerospace industry following the end of the Cold War, Ramey and Shapiro (2001) find that defense-related capital sold at a substantial discount, with an average estimated replacement cost around 28 cents on the dollar.

Second, the chapter adds to the literature that examines the political and economic aspects of development in the South during the twentieth century. Cobb (1982), Schulman (1991), and Alston and Ferrie (1999) analyze the changing relationships between local, state, and federal governments and the implications for southern economic development since the Civil War. Wright (1986, 2013) emphasizes the role of the post-Civil War labor system in explaining southern backwardness before 1930 and the impact of the New Deal, World War II, and civil rights revolution in bringing about the South's economic integration.⁶ Kline and Moretti (2014) and Kitchens (2012) evaluate the New Deal-era Tennessee Valley Authority (TVA), which sought to provide electricity to underserved areas in the South, and find null or modest effects on overall manufacturing activity.⁷ My approach differs from these

⁵Ramey (2011) provides a survey of the literature on fiscal multipliers that includes many instances of increased war- or defense-related spending.

⁶In addition, Whatley (1985) analyzes the slow adoption of mechanization in southern agriculture and finds support for the hypothesis that the structure of labor market institutions retarded progress. Holmes (1998) finds, on average, that there is more manufacturing activity in southern states with pro-business laws (e.g., right-to-work laws) relative to northern states without these laws over the postwar period.

⁷In a cost-benefit calculation in the context of a spatial equilibrium model, Kline and Moretti

authors by allowing for sector-level heterogeneity in the effect of World War II. This is crucial in the context of the American South, where aggregate growth may reflect new types of manufacturing (e.g., metals, machinery, or transportation equipment) or continued specialization in low value-added industries. For World War II, Bateman, Ros, and Taylor (2009) examine the effect of government expenditures in the South at the *state* level. This chapter uses disaggregated data on war spending by type and manufacturing activity by sector, which more accurately reflect the geographic scope for spillovers.

This chapter also provides evidence relevant for models of the “big push” in development economics (Rosenstein-Rodan, 1943; Nurkse, 1953). In particular, if the externalities from capital investment were large enough, then war spending may have spurred industrialization that was otherwise privately unprofitable. This would be the case, for example, in the presence of knowledge spillovers between firms or workers, coordinated investments in facilities and equipment that link the private return to investment and total investment at the local level, or shared intermediate input markets (e.g., Romer, 1986; Murphy, Shleifer, and Vishny, 1989; Foster and Rosenzweig, 1995; Jones, 2011). My results suggest there is little evidence for this mechanism in the American South during and after World War II. However, my findings on the change in the composition of southern manufacturing induced by the war suggest a positive, though modest, role for the postwar convergence in industrial structures.⁸

Finally, a large literature estimates discrete-choice models of industrial locations decisions (Carlton, 1983; Bartik, 1985; Head, Ries, and Swenson, 1995; Head and Mayer, 2004).⁹ In line with recent work, this chapter uses panel data to control

(2014) find that the direct benefits of the TVA compensated for the program’s cost. However, on the whole, the manufacturing gains due to the TVA in some areas were canceled out elsewhere.

⁸This is consistent with the reverse trend in the United States since the 1980s, where deteriorations in value-added per worker were matched by increased income inequality (Spence and Hlatshwayo, 2011).

⁹Apart from the literature on industrial location choice, following Rosen (1979) and Roback

for unobserved, time-variant characteristics of locations. The work of Rothenberg (2012) is most closely related to this chapter. He estimates a multi-region model of trade that quantifies the contribution of transportation infrastructure improvements to the dispersion of Indonesian manufacturing. While previous work has examined the connection between market access (e.g., road quality, new or cheaper forms of transportation) and regional manufacturing activity, I focus on World War II spending, which added \$6.1 billion to the South's capital stock between 1940 and 1945.

3.2 Historical Background

The end of the Civil War was followed by a revolution in the southern economy and, after 1870, the region industrialized rapidly, although not along lines in the North a half century earlier. Taking advantage of the region's abundant supplies of labor and natural resources, industry concentrated in a few low value-added products (e.g., cotton textiles, lumber goods). As a result, income per capita in the South lagged behind the rest of the country and, by 1940, had reached only roughly 70 percent of the national average. After 1940, regional incomes converged and, in 1980, the South was near parity with the rest of the country.¹⁰ This section provides an overview of manufacturing growth in the South until World War II, federal government policies aimed at developing the region during the 1930s, and the South's role in industrial mobilization for war. In part, I argue that while the southern economy experienced a second wave of industrialization after 1940, World War II alone could not have produced the transformation that eventually occurred.

(1982), there is considerable research that applies discrete-choice models to individual location decisions in order to quantify the value of different amenities at the city- or neighborhood-level (Bayer, Ferreira, and McMillan, 2007; Kennan and Walker, 2011a; Diamond, 2012).

¹⁰Estimates of regional income convergence are taken from Mitchener and McLean (1999). Income per capita in the South was 54-56 percent of the national average in 1880, 64-67 percent in 1940, and 90-96 percent in 1980.

3.2.1 Manufacturing in the South until 1929

In the antebellum period, rapid economic growth in the South was not accompanied by large-scale industrialization. Southern per capita incomes grew at 1.7 percent per year—compared to the national rate of 1.4 percent—between 1840 and 1860 (Fogel and Engerman, 1974, p. 248), but the value of manufacturing capital and output was still less than one-fifth the value in the North by 1860 (Wright, 1978, p. 110). Many historians have proposed explanations for the South's failure to industrialize: from the region's comparative advantage in export agriculture (e.g., cotton as well as sugar, rice and tobacco) to barriers to capital investment erected by the slave economy.¹¹ After 1880, the southern economy began to change. A national market emerged to support a growing cotton textile sector, along with other industries closely linked to resource extraction (e.g., lumber and wood products, tobacco).

Between 1880 and 1920, total value-added by manufacturing in the South grew at a rate of 6 percent per year, fueled primarily by the rapid expansion of cotton textiles and wage rates that were half the level of those in some northern states. In one state, North Carolina, the value of manufacturing goods exceeded that of agricultural products by 1900. Attracted by local boosterism, mill villages sprang up across the South and rates of urbanization increased (although they were never comparable to rates in the North). Still, increased prosperity did not follow the transformation of industry. Productivity remained low and so too did capital investment and new technology adoption. Throughout this period, the South failed to create a dynamic, diversified industrial economy that could serve as the region's engine of growth (Wright, 1986; Carlton and Coclanis, 2003).

The South faced many obstacles during its first wave of industrialization. As

¹¹Bateman and Weiss (1981) found that average rates of profit around 20 percent, which was substantially higher than elsewhere in the country, were not enough to attract new investment to drive the expansion of industry. They and other authors attributed this to the conservative (or risk-averse) ideology of the southern planter class.

in the antebellum period, however, the lack of access to capital remained a key constraint on the growth and diversification of industry. Textile mills were, for the most part, funded locally (e.g., 80 to 90 percent of spindles had southern owners) and usually in small amounts. The region's other large sector, lumber and wood products, contributed little to local economic development because establishments were temporary and moved on once the supply of timber was exhausted. With little interest from outside the region, southern industry could only accumulate capital gradually over time through the reinvestment of profits (Cobb, 1984; Wright, 1986). The South, therefore, did not create the clusters of economic activity that stimulated demand for innovation and could have led to the birth of new industries; the process that fueled the growth first in the Northeast and then across the Upper Midwest (Lamoreaux and Sokoloff, 2001). In addition, the South failed to adopt new technologies, such as the labor-saving devices used in New England textile mills or the mechanized sawmills of the Pacific Northwest. The 1920s—whether from the changes induced by World War I (e.g., migration to the North) or competition from other US regions—revealed the vulnerability of an economy so narrowly specialized in a few low wage, low value-added industries.

Throughout the 1920s, employment conditions in the South worsened, particularly for unskilled workers. Southern farm wages stagnated relative to the North and, by 1929, were lower in most states than they had been at the turn of the century (Wright, 1986, p. 204). Still, agricultural labor markets remained intact; some wage labor departed for southern cities or the North, but most tenants remained on plantations. In manufacturing, workers with experience in industry moved to the North, first to take advantage of the boom during World War I and then rising wages throughout the 1920s.¹² In the South, higher manufacturing wages prevailed until 1929, but at the expense of declining employment as firms began to improve

¹²Collins and Wanamaker (2014) find that migration was particularly self-improving for African-Americans, driving a substantial portion of the black-white convergence in economic status. However, this process did relatively little to improve conditions in the South.

their productivity through, for example, mechanization. In the 1930s, economic conditions in the South attracted the attention of New Deal policymakers aimed at reforming agriculture and modernizing industry.

3.2.2 The 1930s New Deal

The onset of the Great Depression hit southern agriculture and industry hard. The price of cotton fell from 16.8 cents per pound in 1929 to 5.6 cents in 1931. Similarly, the price of tobacco decreased from 18.3 to 8.2 cents per pound over the same period. As a result, southern farm incomes, which were already at their lowest level in three decades in 1929, decreased still further throughout the early 1930s (Schulman, 1991, p. 14, footnote 48). In addition, high rates of unemployment among industrial workers and persistent regional wage differentials attracted the attention of national policymakers. Starting in 1933, legislation was passed to address the regional imbalances: the Agricultural Adjustment Act (AAA) to reduce crop production and therefore raise commodity prices through payments to farmers; the Tennessee Valley Authority (TVA) to improve infrastructure and provide cheap access to fertilizer and electricity; and the National Industrial Recovery Act (NIRA) to raise employment and wages.

The AAA was enacted on May 12, 1933, with the initial goal of raising agricultural prices. Between 1932 and 1935, the price of cotton nearly doubled while acreage decreased by almost 30 percent. The recovery of prices was not accompanied by a recovery of employment: a 25 percent decline in tenants between 1935 and 1940 was only matched by a 14 percent increase in wage laborers (Schulman, 1991, pp. 17-18).¹³ This contributed to a fundamental reorganization of southern agriculture that played out fully over the subsequent decades. Mechanization replaced

¹³Depew, Fishback, and Rhode (2014) show that the employment losses due to the AAA were not shared equally by race and economic status; African-American and white sharecroppers and African-American tenants were more likely to be displaced.

labor in pre-harvest cotton operations, which reversed previous trends toward a large number of tenants distributed among smaller sized farms and began to breakdown landlord-tenant paternalism (Alston, 1981; Sorensen, Fishback, and Kantor, 2008). During World War II, this change in southern labor markets became important as industrial mobilization increased the demand for labor.

The TVA and NIRA followed the AAA on May 18 and June 16, respectively. The TVA provided federal funding for a number of public works projects throughout the Tennessee River Valley. Initially, the Authority focused on improving navigable waterways and providing low-cost fertilizer to boost agricultural productivity. In fact, TVA officials took the Great Depression as a warning against industrialization. Rather than a push into heavy manufacturing fueled by cheap electricity generated from dams built along the Tennessee River and its tributaries, until the late 1930s and early 1940s the TVA sought to attract more small industry (e.g., hosiery, textile, and lumber mills) that would provide employment for surplus agricultural labor (Schulman, 1991, p. 35). Only after the outbreak of World War II, did the TVA begin to pursue a policy based on a close link between electricity, industrialization, and economic growth.

The passage of the NIRA made possible codes, enforced by the National Recovery Administration (NRA), that regulated prices, wages, hours, and other aspects of employment and competition. The codes were initially a response to macroeconomic instability and so-called “cut-throat competition” that led to deteriorating work conditions and idle industrial capacity. Ultimately, the codes’ effects were larger on low-wage industries than high-wage industries and, therefore, larger in the South relative to the North. For six industries, hourly earnings in the South increased between 2.3 and 13.5 percent relative to the North.¹⁴ The codes were declared

¹⁴This is the difference-in-difference estimate of (log) hourly earnings in the North and South for the pre- and post-NRA years in the furniture, iron and steel, cotton goods, paint and varnish, lumber, and tobacco industries. The data for this calculation come from Wright (1986, p. 217, Table 7.7).

unconstitutional by the Supreme Court in 1935, but essential aspects were revived with the minimum wage established by the Fair Labor Standards Act (FLSA) of 1938.¹⁵

More generally, the NIRA and other New Deal policies reflected an assessment of the South that rooted the region's failure to industrialize in the persistence of labor-intensive agricultural practices and the large share of manufacturing employment in low value-added industries. By 1938, President Roosevelt writing in the preface to the *Report on Economic Conditions of the South* declared the region, "the Nation's no. 1 economic problem" (US National Emergency Council, 1938). Many observers subsequently concluded that on the eve of World War II, the South still had not addressed fundamental aspects of its economic underdevelopment.

3.2.3 Mobilization for World War II

Planning for mobilization for World War II grew out of the failure of mobilization during the First World War. Shortly after the United States entered the conflict in April 1917, the pace of mobilization slowed dramatically due to the inexperience of civilian and military planners, the small share of appropriations devoted to planning activities, and the lack of attention to procurement requirements (Smith, 1959, pp. 36-38). As a result, overlapping demands for inputs related to war production led to price inflation, contracts that could not be filled, and goods wasted. In response, planning for the next conflict began early in the interwar period, including the passage of the National Defense Act on June 14, 1920, to ensure "the adequate provision of the mobilization of material and industrial organization essential for wartime need" (National Defense Act, 1920, 764). By the time war broke out again in Europe in 1939, the United States had acquired considerable capacity to mobilize,

¹⁵Seltzer (1997) documents differential adjustment paths in the hosiery and lumber industries following the FLSA. Hosiery establishments substituted capital for labor and replaced old with new machinery, while lumber mills initially decreased employment before World War II boosted demand and prevented absolute employment losses.

manage, and fight a modern war.

The results were impressive. Between 1939 and 1945, American manufacturers produced over 300,000 aircraft, 6,000 military ships and merchant vessels, nearly 90,000 tanks and 350,000 trucks, as well as 6.5 million rifles and 40 billion bullets, to equip 16 million servicemen (Klein, 2013, pp. 515-516). Still, mobilization proceeded slowly at first. For example, in 1939 and 1940, toolmakers were putting out fewer than 25,000 pieces of equipment per year and the rate of production actually decreased near the end of 1941 (Klein, 2013, pp. 65-66, 265).¹⁶ After the attack on Pearl Harbor in December 1941 the pace of mobilization accelerated and by the end of 1942 the majority of new war plants were built or construction was underway. Roughly half of the facilities producing for the war were located in the most industrialized areas of the Northeast and Upper Midwest to accommodate the large quantity and a relatively high quality of goods required. However, for a variety of reasons, including patronage, security, congestion, weather, and the availability of labor, raw materials and land, other regions (e.g., the South and West) also received a substantial portion of spending on contracts and capital (Koistinen, 2004, p. 298)

By the end of the war total spending on supply contracts in the South was \$14.7 billion and \$6.1 billion on capital investment.¹⁷ Although the South as a whole received less than other regions and southern cities received a smaller share than Detroit, Buffalo, Chicago, and Los Angeles, the war spurred economic activity and new capital formation that dwarfed the existing stock. The southern trade magazine, *Manufactures' Record*, routinely boasted, "South's expansion breaks all records" (Schulman, 1991, p. 95). Capital expenditures in the South, which made up roughly one-tenth of the country's total in the prewar years, nearly doubled during the war. In total, the South accounted for 23.1 percent of wartime plant

¹⁶To put the extent of the war-created demand in context, "two of three war factories built by the government and operated by Studebaker, for example, each required 3,488 pieces of equipment; the third need 13,000 machines" (Klein, 2013, p. 65).

¹⁷All figures are in current year dollars.

construction and 17.6 of expansions (US War Production Board, 1945; Deming and Stein, 1949, pp. 10-11).

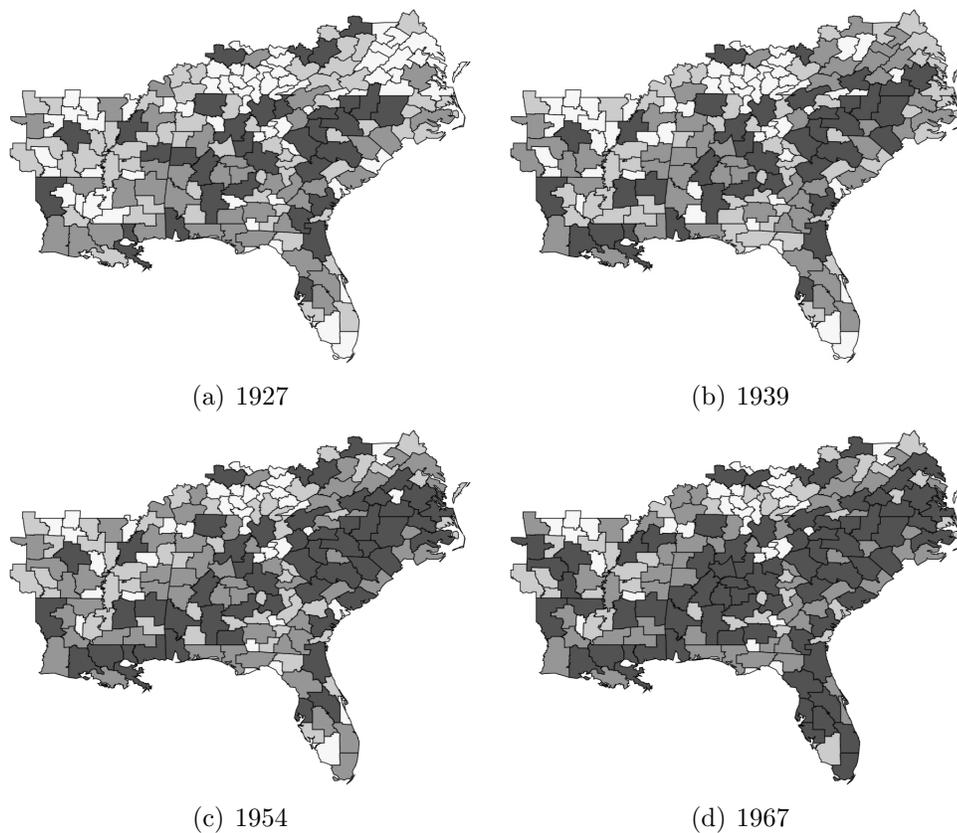
In a few industries the South enjoyed particular success. The region dominated synthetic rubber and developed new competencies in steel and non-ferrous metals. Combat in the Pacific had cut off most supplies of natural rubber; alcohol and petroleum were necessary inputs into the synthetic rubber and both were readily available in the South. And although the iron and steel industry continued to concentrate in the cities of the Upper Midwest (i.e., Pittsburgh, Chicago, Detroit), new centers were also established along the Gulf Coast. The war created clusters in other industries as well: aircraft in Marietta, Georgia, and shipbuilding in Panama City, Florida. In many areas throughout the South, the wartime expansion accounted for the vast majority of the newly available manufacturing capacity (Schulman, 1991; Combes, 2001; Colten, 2001).

As Figure 3.1 shows, many southern locations with very little manufacturing activity in the prewar years had experienced substantial growth by 1967. Before 1940, manufacturing concentrated in North Carolina and scattered pockets throughout the rest of the South. After the war, the South was transformed; manufacturing spread throughout Georgia, Florida, Alabama, Louisiana, and Mississippi. Many of these areas also received substantial war-related spending, as depicted in Figure 3.2. The goal of the empirical analysis discussed in the next section is to assess the effect of war spending on postwar industrialization. In particular, I focus on whether the war encouraged growth in sectors not traditionally located in the South and, therefore, whether the war reinforced or reversed existing trends in the southern economy.

3.3 Empirical Specification

The empirical analysis quantifies the effect of two types of government spending during World War II on industrialization in the American South between 1927 and

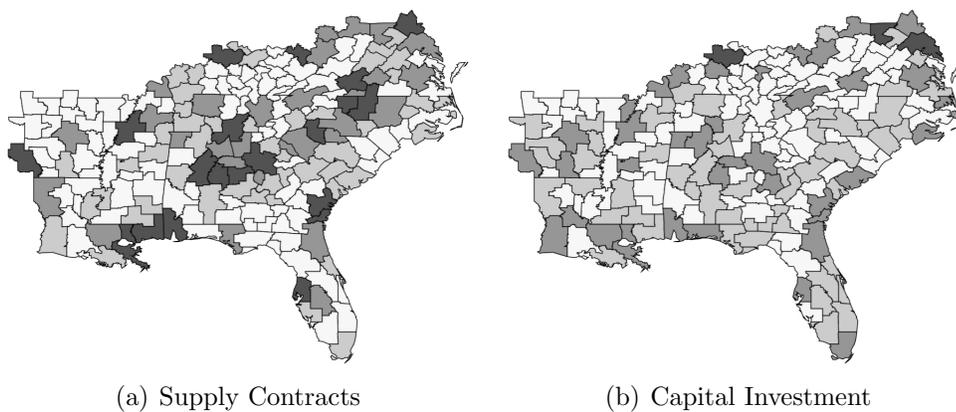
Figure 3.1: Southern Manufacturing, 1927-1967



Notes: The variable plotted is $\ln(s_{ct}) - \ln(s_{0t})$, where s_{ct} is the share of all establishments in location c in year t and s_{0t} is the share of establishment located in the rest of the country in year t . The variable captures relative manufacturing activity in a southern location relative to the US total. Darker shades indicate more manufacturing activity, lighter shades indicate less.

Source: See text, Section 3.4.

Figure 3.2: Southern War Spending, 1940-1945



Notes: The variable plotted is the amount of war spending of each type normalized by the location's area. Darker shades indicate more war spending, lighter shades indicate less.

Source: See text, Section 3.4.

1965. I assume that manufacturing establishments choose to locate in the southern location that maximizes profits relative to the outside option of choosing to locate elsewhere in the United States. I allow the effect of war spending to vary by sector. The estimation then incorporates information on both the share of establishments in each location and sector identifiers for all establishments, similar to Berry, Levinsohn, and Pakes (2004). The empirical analysis yields mean and heterogeneous effects of each type of war spending, which I use to calculate the overall effect on textiles and apparel, furniture and lumber goods, metals, machinery, transportation equipment, and a group that includes all other manufacturing sectors.¹⁸

The empirical analysis is similar to recent work that evaluates the impact of historical place-based policies in the American South (Kitchens, 2012; Kline and Moretti, 2014). A key difference is my use of information on the location decisions of manufacturing establishments by sector. As I show, estimates that treat all manufacturing establishments identically mask important differences in the effect of war spending across sectors. In addition, using only aggregate data results in unrealistic substitution patterns. In the remainder of this section, I describe the model of establishment location decisions, estimation, and identification in greater detail.

3.3.1 Establishment Demand for Locations

Formally, in each year t , establishment i chooses the location, $c = 0, 1, \dots, C$ that maximizes profit given by:¹⁹

$$\pi_{ict} = \sum_j war_c^j \times d_{post} \times \alpha_{it}^j + trend_t \times \rho_{it} + \xi_{ct} + \varepsilon_{ict} \quad (3.1)$$

¹⁸The “other” group includes food, paper and related products, printing and publishing, rubber products, leather products, chemicals, petroleum products, and stone, clay, glass products.

¹⁹In practice, I analyze a balanced panel of locations, all of which have at least one manufacturing establishment in every year between 1927 and 1967.

where war_c^j is the amount of war spending of type $j \in (\text{supply, capital})$ in location c interacted with a dummy variable equal to one if year t is a postwar year. $trend_t$ is a linear trend that captures changes in the value of a southern location (i.e., $c = 1, \dots, C$) relative to a non-southern location (i.e., $c = 0$).²⁰ This trend captures changes over time in the relative value of choosing a southern location versus locating elsewhere in the United States.

The term ξ_{ct} captures all the remaining unobserved location characteristics, which may vary over time. These include natural advantages, such as proximity to a body of water, availability of natural resources, climate, and other factors that make a location more (or less) valuable to manufacturing. ξ_{ct} may also capture agglomeration economies due to input-output linkages, labor market pooling, or technology spillovers (Marshall, 1890). In practice, I decompose ξ_{ct} into a portion common to all counties in a given year, a fixed portion over time in a given location, and a portion that follows a location-specific trend. Finally, ε_{ict} is a random shock to establishment profits that is assumed to be *i.i.d.* from a type I extreme value distribution.

The random coefficients, α_{it}^j and ρ_{it} , capture the heterogeneous effect of war spending and differences in the relative value of locating in a southern location due to individual establishment characteristics. That is,

$$\begin{aligned}\alpha_{it}^j &= \bar{\alpha}^j + \sum_l z_{it}^l \alpha^{jl} + \eta_{it}^j \times \sigma^j \\ \rho_{it} &= \bar{\rho} + \sum_l z_{it}^l \times \rho^l\end{aligned}\tag{3.2}$$

Each z_{it}^l is an identifier for two-digit sector l of establishment i in year t . The random coefficients allow for a mean effect that is common to all establishments ($\bar{\alpha}^j$ and $\bar{\rho}$), variation due to observed establishment characteristics (α^{jl} and ρ^l), and, in the case of each type of war spending, variation due to unobserved establishment character-

²⁰The value of the outside good is normalized to zero, so that estimates capture the relative profitability of southern to a non-southern location.

istics (σ^j). Unobserved characteristics are assumed to come from a standard normal distribution. In principle, z_{it}^l could include any observed characteristics. However, for this chapter, data availability constrains z_{it}^l to only include identifiers for each establishment's two-digit sector.

To obtain the full model, I substitute the equations in (3.2) into equation (3.1), which gives:

$$\pi_{ict} = \delta_{ct} + \sum_{j,l} war_c^j \times d_{post} \times z_{it}^l \times \alpha^{jl} + \sum_j war_c^j \times d_{post} \times \eta_{it}^j \times \sigma^j + \sum_l trend_t \times z_{it}^l \times \rho^l + \varepsilon_{ict}, \quad (3.3)$$

$$\text{where } \delta_{ct} = \sum_j war_c^j \times d_{post} \times \bar{\alpha}^j + trend_t \times \bar{\rho} + \xi_{ct} \quad (3.4)$$

δ_{ct} captures the portion of profits that is common to all establishments choosing location c in year t , so that variation in equation (3.4) is fixed at location-year level. The interactions with war spending in equation (3.3) capture the intuition that the preference for each type of war spending may vary with observed ($\sum_{j,l} war_c^j \times d_{post} \times z_{it}^l \times \alpha^{jl}$) and unobserved ($\sum_j war_c^j \times d_{post} \times \eta_{it}^j \times \sigma^j$) establishment characteristics. In particular, α^{jl} gives an estimate of sector l 's preference for type- j war spending and σ^j gives the standard deviation of the preference for type- j war spending. The term $\sum_l trend_t \times z_{it}^l \times \rho^l$ allows the value of choosing a southern location relative to a non-southern location to vary by sector. This captures the idea expressed in Section 3.2 that sectors were growing differentially in the South (relative to the North) over the sample period.

3.3.2 Estimation

Equations (3.3) and (3.4) neatly summarize the two steps of estimation. In the first step, I use maximum likelihood and the contraction mapping due to Berry, Levinsohn, and Pakes (1995) to estimate $\theta = [\alpha^{jl}, \sigma^j, \rho^l]$ and solve for δ_{ct} subject to the constraint that the actual and predicted aggregate establishment shares in each

location c and year t are equal. First, I combine the assumption that ε_{ict} follows a type I extreme-value distribution with profit-maximizing establishments to obtain an expression for the probability that establishment i 's choice is location c in year t :

$$P_{ict} = \int \frac{\exp(\delta_{ct} + \sum_{j,l} \text{war}_c^j \times d_{post} \times z_{it}^l \times \alpha^{jl} + \sum_j \text{war}_c^j \times d_{post} \times \eta_{it}^j \times \sigma^j + \sum_l \text{trend}_t \times z_{it}^l \times \rho^l)}{\sum_{d=0}^C \exp(\delta_{dt} + \sum_{j,l} \text{war}_d^j \times d_{post} \times z_{it}^l \times \alpha^{jl} + \sum_j \text{war}_d^j \times d_{post} \times \eta_{it}^j \times \sigma^j + \sum_l \text{trend}_t \times z_{it}^l \times \rho^l)} f(\eta) d\eta \quad (3.5)$$

where the integral is over the distribution of unobserved establishment characteristics, $f(\eta)$, which I approximate with 100 scrambled Halton sequence draws from a standard normal distribution.²¹ To form the likelihood used in the estimation, I take the sum of the log of the probability in (3.5) over all establishments and years.

In practice, the number of δ_{ct} 's to estimate is equal to the number of locations multiplied by the number of years. Therefore, a full search over δ_{ct} is computationally time-consuming. To reduce the size of this problem, I follow Berry, Levinsohn, and Pakes (2004) and Train and Winston (2007) and use the contraction mapping in Berry, Levinsohn, and Pakes (1995). I first obtain an estimate of θ using maximum likelihood and an initial guess of δ_{ct} . For each estimate of θ , I choose the δ_{ct} to set the actual share of establishments in each location c and year t equal to the predicted share. Specifically, at each iteration τ , the contraction mapping updates δ_{ct}^τ as follows:

$$\exp(\delta_{ct}^{\tau+1}) = \exp(\delta_{ct}^\tau) \times \frac{s_{ct}}{\hat{s}_{ct}}$$

where s_{ct} is the actual share of establishments that choose location c in year t and $\hat{s}_{ct} = \int_z \int_\eta Pr_{ict}(z, \eta; \theta, \delta_{ct}(\theta)) f(\eta) f(z) d\eta dz$ is the predicted location share.

In the second step, I use the estimates of δ_{ct} as the dependent variable in a linear regression to recover the mean effect of supply contracts and capital investment.

²¹Train and Winston (2007, p. 1482) note that Halton draws that “has coverage properties that are superior to pseudo-random draws.”

Equation (3.4) is augmented to control for year and location fixed effects as well a location-specific time trend. That is,

$$\hat{\delta}_{ct} = \sum_j war_{ct}^j \times d_{post} \times \bar{\alpha}^j + trend_t \times \tau_c + \xi_c + \xi_t + \xi_{ct} \quad (3.6)$$

Observations are weighted by the number of establishments in location c in each year t . Note that because the location-specific trend is perfectly correlated with the simple trend in equation (3.4) the latter is not included in the above regression. Estimates of the sector-specific effect of each type of war spending combine the estimates from the first and second steps described above. In the appendix, I discuss how to calculate the sector-specific effects as well as details for computing standard errors.

3.3.3 Identification

The main concern with endogeneity is that war spending was allocated to areas with different potential to industrialize. Outside the South, civilian and military planners showed considerable preference for large firms in the traditionally industrial areas of the Northeast and Upper Midwest. This was mostly related to the demand for large quantities of reliable, standardized goods and, therefore, the need to take advantage of existing industrial capacity, particularly early in the mobilization process. Koistinen (2004) notes a number of concerns (e.g., patronage, security, weather, and congestion) that eventually led war spending to flow to the country's less industrialized regions, including the South. If planners continued to allocate spending in order to maximize production in these regions then estimates of the effect of war spending would be biased upward and biased downward if planners targeted areas with less manufacturing activity.²² Previous empirical work has paid little attention to these sources of bias when examining the effect of World War II.

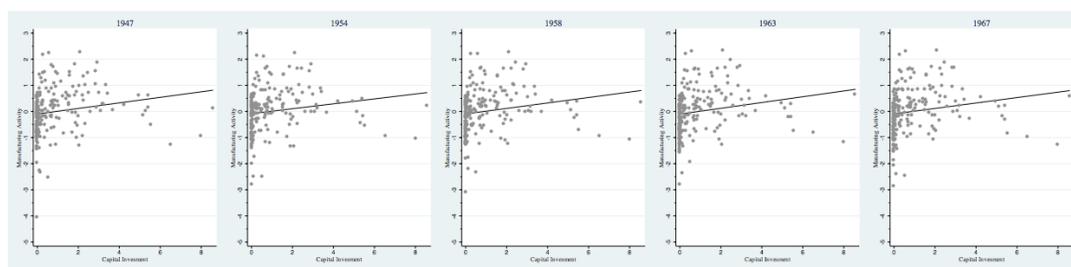
²²According to Smith (1959) and Koistinen (2004) the former is the more likely source of bias.

More generally, the classic identification problem that arises in this setting is a correlation between the unobserved characteristics of a location in a particular year and the variables of interest. Indeed, Figure 3.3 shows that observations for pre- and post-war manufacturing activity are essential to avoid misattributing the effect of war spending to a location's fixed industrial potential (e.g., due to natural advantages) or preexisting trends (e.g., due to agglomeration). Moving from Panel A to Panel B shows the results of controlling for a location fixed effect in a simple regression of manufacturing activity on war-related capital investment. To address this source of endogeneity, in the second step of the empirical analysis I include controls for location fixed effects and location-specific trends. This ensures that the mean effect of each type of war spending is identified from deviations from the long-run growth or decline of manufacturing in a location.

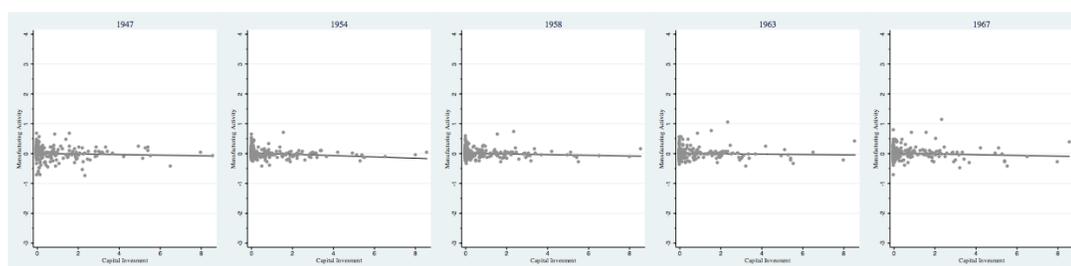
A related concern is that war spending was more (or less) likely to be allocated to sectors that were growing (or declining) over time for reasons unrelated to industrial mobilization. As a result, estimates for the effect of war spending by sector would capture, for example, the growth of metals and machine tool producers or the decline of textiles. In the first step of the empirical analysis, I include sector-specific time trends to ensure that the heterogeneous effects of supply contracts and capital investment are identified from deviations from the long-run trend in a particular sector. This addresses the concern that national-level trends are driving my results, but does not control for unobserved shocks to establishment profits at the location-sector level.

One final concern is that the postwar comparison between locations that received more or less war spending is contaminated by establishments competing for, for example, capital investment. If receiving war spending causes an entrepreneur to locate elsewhere in the South then measured differences between locations will be biased toward zero. This would be the case if new establishments were concerned about congestion or other types of negative externalities (e.g., competition for in-

Figure 3.3: World War II and Southern Manufacturing, 1947-1967



(a) without location fixed effect



(b) with location fixed effect

Notes: Each point in the scatter diagram is the residual manufacturing activity in a southern commuting zone relative to the rest of the country plotted against the amount capital investment (divided by the commuting zone area in square miles) in a given year. In Panel A, the residual is calculated from a regression that controls for year fixed effects and the amount of supply contract spending (divided by the commuting zone area in square miles). In Panel B, the residual is from a regression that includes a CZ fixed effect as well as year fixed effects and the amount of supply contract spending.

Source: See text, Section 3.4.

puts). More generally, the locations chosen by civilian and military planners for war spending may not have possessed the characteristics to make producers competitive in peacetime markets. I provide evidence for the robustness of my results in Section 3.5.4 that control for the presence of a military base and uses only the variation in war spending due to patronage.

3.4 Data and Variable Definitions

I apply the model to the location decisions of manufacturing establishments before and after World War II. Data on the spatial distribution of all manufacturing establishments are available in the summary tables for the Census of Manufactures (CoM) for 1939, 1947, 1954, 1958, 1963, and 1967 (US Bureau of the Census, various years). I draw on two additional sources, the *Market Data Handbook of United States* and the *Industrial Market Data Handbook of the United States*, for the same information in 1927 and 1935 (Stewart, 1929; Holleran and Davis, 1939).²³ In each year, for all counties in Alabama, Arkansas, Georgia, Florida, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Virginia, Tennessee, and West Virginia,²⁴ I collected information on the number of establishments in each two-digit sector.²⁵ I use information on the total number of establishments in the United States to construct the outside option of locating in a non-southern location.

For the empirical analysis, I collected information on over 1,000 counties in 12

²³The underlying source for the data are the CoM manuscripts for individual establishments. Prior to 1939, the county-, sector-level data were tabulated and published separately by the Department of Commerce. The data for 1927 come from Table 8 of the *Market Data Handbook of United States*; for 1935 from Table 3 of *Industrial Market Data Handbook of the United States*; for 1947, 1954 and 1958 from Table 7 and for 1963 and 1967 from tables 8 and 9, respectively, of the CoM.

²⁴Texas is excluded because its wartime investment was primarily in resource extracting sectors, not manufacturing.

²⁵The classification of sectors roughly follows the Standard Industrial Classification scheme, however, due to changes over time some sectors are grouped together.

southern states. I aggregated county-level data into 203 “commuting zones” as defined by the Economic Research Service (ERS).²⁶ The commuting zone (CZ) concept is intended as a spatial delineation of local labor markets without the constraint of a minimum population threshold. The included CZs are fully contained within one of 12 southern states listed above. The only requirement for inclusion in the sample is that a CZ must have at least one manufacturing establishment (in any sector) in each year analyzed. In practice, this restriction retains all but one of the potential CZs and results in 203 CZs covering the the southern United States. Establishments from outside the South are included in the outside option.

Table 3.1 presents summary statistics on the size and amount of each type of war spending for the 203 commuting zones used in the empirical analysis. The average commuting zone is 2,661 square miles, which is large enough to accommodate spillovers between nearby establishments and small enough for many of the spillovers to remain within the geographic unit analyzed. Studies using more recent data provide some evidence on the scope of spatial spillovers. For the United States, Ellison and Glaeser (1997) note that spillovers within county appear to be stronger than between nearby counties, but the evidence also suggests scope for spillovers beyond a county’s borders. In Britain, Duranton and Overman (2005) provide additional evidence that spillovers travel up to 100 miles. The geographic unit used in this chapter (i.e., the commuting zone) appropriately incorporates the idea that spillovers may extend beyond a county.

The main variables used in the empirical analysis are the value of war supply contracts and war-related capital investment (in current year dollars), which are drawn from Haines (2010). On average a commuting zone received \$72.8 million in supply contracts and \$29.9 million in capital investment. For the empirical analysis, I normalize both war spending variables by dividing by the location’s size (in square

²⁶I use the .shp files for the definition of commuting zones in 2000. My results are note sensitive to using the definition in 1980, the earliest year for which the ERS constructed commuting zones.

Table 3.1: Summary Statistics for Industrial Mobilization

	Mean	S.D.	Min.	Max.
Area (miles ²)	2,661	1,350	180	6,794
Supply Contracts (\$ millions)	72.8	244.1	0	3,068.1
Capital Investment (\$ millions)	29.9	48.4	0	379.0

Notes: Summary statistics are computed for the 203 sample commuting zones.

Source: See text, Section 3.4.

miles). Figure 3.2 contains maps showing the spatial distribution of the war spending variables. The raw correlation between them is high, 0.655, but leaves substantial variation to exploit in the estimation.

I check the robustness of my main result to alternative specification that include the presence of other New Deal programs: the Agricultural Adjustment Act (AAA) and the Tennessee Valley Authority (TVA). Data on the amount of all AAA spending between 1933 and 1936 were collected by Fishback, Kantor, and Wallis (2003). Data on whether a location had access to electricity provided by the TVA are due to Kitchens (2012). In addition, I also use information on the location of army and navy bases constructed during World War II to control for potential effects of the war that did not come through industrial mobilization. In particular, the construction of a military base may have led to improvements in, for example, transportation infrastructure that increased market access.

3.5 Results

In this section, I present sector-specific estimates for the effect of each type of war spending (i.e., supply contracts and capital investment) from the full model. First, I describe the trends and composition of southern manufacturing by sector and show the results from estimating a simple model in which there is no differentiation of manufacturing establishments by sector. These results highlight the importance of allowing the effect of war spending to vary by sector and the differential growth of sectors due to the ongoing structural transformation of the southern economy. I also show that controlling for other government spending and programs during the 1930s and 1940s does not alter the interpretation of these results. In the following section, I show how the model estimates translate into an overall effect and change the sectoral composition of southern manufacturing with an increase in each type of war spending.

3.5.1 Sectoral Trends

In the four decades between 1927 and 1967, the size and composition of southern manufacturing changed dramatically. The first two columns of Table 3.2 show the sectoral makeup of manufacturing for the entire South in 1927 and 1967. Column 3 shows the 10-year growth rates for all southern manufacturing and by sector over the same period. The share of US manufacturing establishments located in the South grew, on average, 4.6 percent per decade so that by 1967 the South accounted for 17.6 percent of the country's manufacturing establishments (up from 12.1 percent in 1927). In addition to the increasing share of manufacturing establishments choosing to locate in the South, there were substantial changes in the sectoral composition of southern manufacturing.

Among the traditionally southern sectors, the textile share of southern manufacturing establishments increased slightly from 8.8 percent to 9.7 percent over the sample period while the share of lumber goods establishments increased from 28.9 to 35.9 percent. This fits broadly with a postwar construction boom dependent on timber products and the more limited role for textiles, which began during the 1920s and 1930s. The share of metal goods establishments increased from 2.6 percent to 6.3 percent between 1927 and 1967, machinery expanded dramatically from 3.8 percent to 7.9 percent, and transportation equipment, which accounted for less than 1 percent of all southern establishments in 1927 was more than 2.3 percent by 1967. The expansion of metals, machinery, and transportation equipment, in particular, in the postwar period have been associated with wartime investments in these sectors. Finally, sectors comprising the "other" groups declined over the sample period, but there are some important changes. The share of establishments in stone and clay products (including concrete) increased and so too did chemicals and petrochemicals, while the share of food products decreased.

Overall, Table 3.2 points toward a more diversified manufacturing base in the South. However, the narrative in Section 3.2 and Table 3.2 make clear that this

Table 3.2: Growth of Southern Manufacturing by Sector

	Share, 1927 (1)	Share, 1967 (2)	Growth, 1927-67 (3)
Textiles	8.8	9.6	1.1
Lumber	28.9	35.9	2.7
Metals	2.6	6.3	10.9
Machinery	3.8	7.9	9.1
Transportation Equipment	0.1	2.3	38.9
Other	55.3	37.8	-4.7

Notes: Columns 1 and 2 show the share of manufacturing establishments in each sector within the South in 1927 and 1967. Column 3 shows the 10-year growth rate within each sector in South. The “other” group in the last row includes food, paper and related products, printing and publishing, rubber products, leather products, chemicals, petroleum products, and stone, clay, glass products.

diversification took place over many decades and began *before* World War II. In the empirical analysis, I take care to control for sector-specific trends so that my estimates reflect only the additional effect of war spending and not growth already underway by 1941.

3.5.2 Aggregate Manufacturing

Table 3 presents results from estimating a version of the model that does not include the differential effect of war spending across sectors. That is, establishments still choose the location that maximizes profit but the effect of location characteristics is not allowed to vary across sectors. The estimating equation is given by:

$$\ln(s_{ct}) - \ln(s_{0t}) = \sum_j war_c^j \times d_{post} \times \bar{\alpha}^j + trend_t \times \tau_c + \xi_c + \xi_t + \xi_{ct}$$

where s_{ct} is the share of establishments choosing southern location c in year t and s_{0t} is the share choosing a non-southern location in year t . As in the full model discussed in Section 3.3, the superscript $j \in (\text{supply}, \text{capital})$, indexes the two types of war spending. This specification also includes location and year fixed effects as well as a location-specific linear time trend to control for time-invariant location characteristics (e.g., historical natural advantages) that make some locations more attractive for manufacturing, common shocks to all southern locations (e.g., the rise of the Sunbelt), and smooth changes in a location's share of overall manufacturing due to ongoing structural transformation. A causal interpretation of $\bar{\alpha}^j$ requires that ξ_{ct} be uncorrelated with war_c^j .

In all columns of Table 3.3, the effect of supply contracts on manufacturing growth is economically small and statistically insignificant, therefore, in the remainder of this subsection I focus my discussion on the estimates for the effect of capital investment. In Column 1, which includes only year fixed effects, the effect of capital investment is positive and statistically significant. The specification in Column 1 is most similar to earlier evidence presented in support of a positive role for

Table 3.3: Constant Coefficients Logit for Impact of War Spending

	(1)	(2)	(3)
Supply Contracts	-0.00071 (0.00397)	-0.00195 (0.00194)	0.00064 (0.00113)
Capital Investment	0.05949 (0.03849)	-0.03057 (0.01288)	-0.02986 (0.01290)
Fixed Effects	t	c, t	c, t
Location Trend	No	No	Yes

Notes: The dependent variable is $\ln(s_{ct}) - \ln(s_{0t})$, where s_{ct} is the share of all establishments in location c in year t and s_{0t} is the share of establishment located in the rest of the country in year t . All regressions are run on the sample of 203 southern commuting zones. Standard errors clustered on the commuting zone are in parentheses.

World War II in industrializing the South. In particular, scholars have emphasized the high levels of postwar manufacturing activity in areas that received substantial wartime investment, without noting prewar differences (McLaughlin and Robock, 1949; Deming and Stein, 1949; Tindall, 1967; White, 1980; Cobb, 1984; Schulman, 1991; Bateman, Ros, and Taylor, 2009).

The remaining columns add location fixed effects (Column 2) and location-specific time trends (Column 3) to control for differences in manufacturing activity across locations and changes that are part of pre-existing trends. The estimates from these specifications are roughly half the magnitude of Column 1 and negative. This suggests the importance of using pre- and post-war observations in order to avoid confounding the effect of war spending with unobserved location characteristics. More importantly, as Table 3.2 suggests, there were substantial differences in the experience of southern manufacturing by sector and the estimates in the last two columns of Table 3.3 provide no evidence on the war's contribution to the reallocation of manufacturing activity across sectors. In the next subsection, I present estimates that allow the effect of war spending to vary by sector and control for pre-existing sector-specific trends.

3.5.3 Full Model

Table 3.4 presents the results for the effect of each type of war spending from the full model, which includes controls for sector- and location-specific time trends. Columns 1 through 6 show the effect of war-related supply contracts and capital investment for a particular sector. Column 7 gives the estimate for the standard deviation of the unobserved preference for each type of war spending. The estimates in Column 7 are small and statistically insignificant, which suggests that the sector identifiers capture a substantial portion of the variation in establishments' preference for war spending. The sector identifiers should be interpreted as embodying not only the output of certain types of goods, but also sector-specific technology and input use as well as

endowments of managerial talent and compatibility with industrial mobilization. The remainder of the discussion will focus on the sector-specific estimates in the first six columns of Table 3.4.

The estimates for the effect of war supply contracts on each sector in Table 3.4 are small and statistically insignificant. In general, this is consistent with the view that supply contracts provided only short-run stimulus to southern industry, and that reconversion was relatively rapid and mostly complete by the end of 1940s. However, the estimates for the effect of capital investment suggest an important role for World War II that has not been emphasized in the literature. In all six sector groups the effect of capital investment is positive and statistically significant. The smallest estimate is for textiles (Column 1) and is consistent with the war having little direct impact on this sector both because textiles was a large sector in the South prior to World War II and because little war-related capital investment was used to construct or expand textile factories. In the remaining sectors the magnitude for the effect of capital investment is larger (columns 2 through 6).

The effect of capital investment is largest for lumber goods and the sector that comprise the “other” group. This is at least partially due to the wartime and postwar construction booms, for which lumber and stone products (included in the “other” sector) were used as inputs. In addition, the effect on the “other” group may be at least partially driven by the effect on the chemicals sector, which was an important wartime industry and was to a large extent located in the South. This would include, for example, synthetic rubber which was not commercially viable in the United States before the war but expanded following the scarcity of natural rubber supplies in the later 1930s and substantial government investment. More broadly, chemicals, like metals and machinery, were important inputs into other industrial processes integral to the war effort.

For the sectors most closely related to the war effort (i.e., metals, machinery, and transportation equipment) the effect of war capital investment was smaller than the

Table 3.4: Impact of War Spending by Sector

	textiles	lumber	metals	machinery	transportation equipment	other	std. dev.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Supply Contracts	-0.00054 (0.08470)	0.04658 (0.07670)	0.05454 (0.05430)	0.02888 (0.08230)	0.04439 (0.04470)	0.04874 (0.11977)	0.00210 (0.00431)
Capital Investment	0.04035 (0.01895)	0.27176 (0.10993)	0.16270 (0.08084)	0.14160 (0.07894)	0.23238 (0.09231)	0.28326 (0.12830)	0.00143 (0.00244)

Notes: Columns 1 through 6 contain sector-specific estimates for the effect of each type of war spending. Column 7 is the estimate of standard deviation of the preference for war spending. The “other” group in Column 6 includes food, paper and related products, printing and publishing, rubber products, leather products, chemicals, petroleum products, and stone, clay, glass products. Details for constructing these estimates are in the appendix.

effect for lumber goods but larger than the effect for textiles. This effect is due to the substantial *new* investment in these sectors and suggests that industrial mobilization played some role in diversifying manufacturing activity within the South. In Section 3.6 I show the impact of war spending on the growth and composition of southern manufacturing from increasing each type of war spending. Specifically, I provide estimates of the number of establishments gained or lost overall and in each sector due to war spending. In the next subsection, I briefly discuss the robustness of my results to controlling for other government actions during the 1930s and 1940s that may have altered the course of industrialization.

3.5.4 Robustness

The estimates in Table 3.5 mirror the estimates in Table 3.4, except that I control for the dollar value of federal spending under the Agricultural Adjustment Act between 1933 and 1936 (Panel A), whether a location had access to electricity provided by the Tennessee Valley Authority (Panel B), and the presence of a World War II military base (Panel C) in the second step of estimation. Federal grants through the AAA was an attempt to increase farm prices by taking land out of production and accelerate structural transformation. The TVA was aimed more directly at providing cheap electricity to underserved areas in the South and thereby facilitating the expansion of southern manufacturing.²⁷ Finally, new military bases during World War II were accompanied by improvements in transportation infrastructure (e.g., local roads and highways) that may have benefited manufacturing or provided a source of postwar demand for industrial goods. The results in Table 3.5 suggest the including controls for these programs does not alter the interpretation of the results.

²⁷Recent evidence suggests that TVA was less successful in this regard than contemporary advocates of the Authority would have admitted (Kitchens, 2012; Kline and Moretti, 2014).

Table 3.5: Robustness for Impact of War Spending by Sector

	textiles	lumber	metals	machinery	transportation equipment	other
	(1)	(2)	(3)	(4)	(5)	(6)
<i>A. Agricultural Adjustment Act</i>						
Supply Contracts	-0.00197 (0.08471)	0.04515 (0.08470)	0.05311 (0.08470)	0.02745 (0.08471)	0.04296 (0.08470)	0.04731 (0.11977)
Capital Investment	0.05378 (0.01621)	0.28519 (0.01485)	0.17613 (0.01498)	0.15503 (0.01544)	0.24581 (0.01416)	0.29669 (0.01499)
<i>B. Tennessee Valley Authority</i>						
Supply Contracts	-0.00197 (0.08471)	0.04515 (0.08470)	0.05311 (0.08470)	0.02745 (0.08471)	0.04296 (0.08470)	0.04731 (0.11977)
Capital Investment	0.05378 (0.01621)	0.28519 (0.01485)	0.17613 (0.01498)	0.15503 (0.01544)	0.24581 (0.01416)	0.29669 (0.01499)
<i>C. World War II Military Base</i>						
Supply Contracts	-0.00168 (0.08470)	0.04544 (0.08470)	0.05340 (0.08470)	0.02774 (0.08470)	0.04325 (0.08470)	0.04760 (0.11976)
Capital Investment	0.05666 (0.01619)	0.28807 (0.01482)	0.17901 (0.01496)	0.15791 (0.01541)	0.24869 (0.01413)	0.29957 (0.01497)

Notes: Each panel contains sector-specific estimates for the effect of each type of war spending after controlling for the program specified in the panel heading in the second step. Panel A controls for the amount of spending under the Agricultural Adjustment Act, Panel B controls for access to electricity provided by the Tennessee Valley Authority, and Panel C controls for the presence of a military base after 1940. The “other” group in Column 6 includes food, paper and related products, printing and publishing, rubber products, leather products, chemicals, petroleum products, and stone, clay, glass products. Details for constructing these estimates are in the appendix.

Table 3.6: Average Effect of Additional Spending by Sector

	textiles	lumber	metals	machinery	transportation equipment	other
	(1)	(2)	(3)	(4)	(5)	(6)
Supply Contracts	-0.02	0.07	0.03	0.06	0.05	0.02
Capital Investment	0.13	0.53	0.32	0.34	0.37	0.54

Notes: Columns 1 through 6 contain the average effect of an additional \$10 million of each type of war spending. The “other” group in Column 6 includes food, paper and related products, printing and publishing, rubber products, leather products, chemicals, petroleum products, and stone, clay, glass products.

3.6 The Impact of Additional War Spending

Table 3.6 shows the average effect of increasing each type of war spending by \$10 million on the number of establishments in 1967. The estimates for supply contracts in Table 3.4 are statistically insignificant so the discussion in this section will focus on the effect of capital investment. In general, the results are consistent with a modest overall effect of capital investment—the total number of establishments increased by less than one percent—and there was some reallocation toward metals, machinery, and transportation equipment. In particular, an additional \$10 million increases the number of establishments in metals by 0.32, in machinery by 0.34, and in transportation equipment by 0.37, on average. The effects are small, but economically meaningful given the size of these sectors in the South prior to the outbreak of World War II.

3.7 Conclusion

Industrial mobilization for World War II led to substantial spending on supply contracts and capital investment in the American South. Prior to the war, southern manufacturing concentrated in low value-added sectors and many observers credited the war with promoting the region's industrial growth and shift to higher value-added sectors and eventual convergence with North. In this chapter, I estimate a discrete-choice model of establishment location decisions to test the claim that war spending explains the South's postwar industrialization. I depart from earlier work by using disaggregated data on the location of all establishments in each two-digit manufacturing sector and by considering the effect of supply contracts and capital investment separately. This allows me to examine the reallocation of manufacturing activity across sectors as well as the growth of overall manufacturing.

I find little evidence that supply contracts encouraged new manufacturing growth, however, I find some evidence that spending on capital investment con-

tributed to a modest reallocation of manufacturing away from textiles and toward metals, machinery, and transportation equipment. This suggests that war-related capital investment was more valuable than some pessimistic interpretations of industrial mobilization have allowed, particularly in sectors not previously located in the South. My estimates are based on deviations from sector- and location-specific trends and therefore do not reflect the long run growth (or decline) of a particular sector or location. Translating estimates from the full model into an average effect suggests that an additional \$10 million of capital investment in each location increased the number of establishments by less than one percent of the total in 1967.

Overall, the effects I find in this chapter suggest that war-related government spending cannot explain the convergence in industrial structures between 1940 and 1980 and, therefore, that explanations for the convergence of US regions must look elsewhere. My findings do not preclude a role for other aspects of military mobilization, in particular, the defense build-up during the Cold War, in explaining the postwar industrial growth of the South. However, these factors should be considered together with the revolution in race relations, postwar migration patterns, and state and local government efforts at industrial promotion.

CHAPTER 4

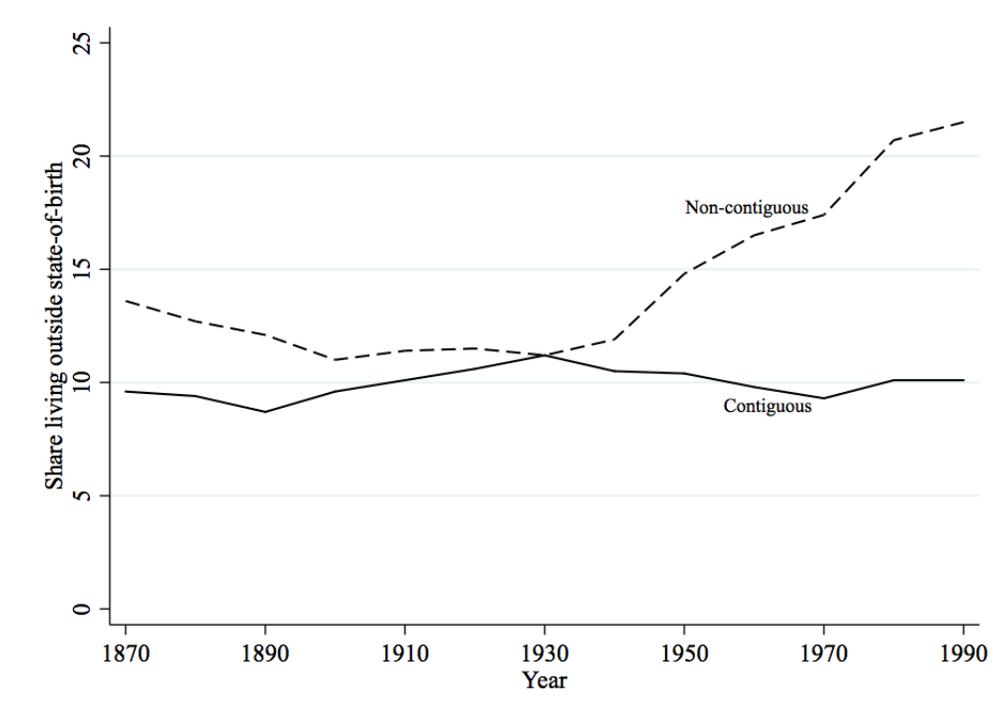
WORLD WAR II, MIGRATION, AND THE WAGE STRUCTURE

4.1 Introduction

The 1930s and 1940s produced the most egalitarian distribution of wages and wealth in the United States in the entire twentieth century (Goldin and Margo, 1992; Piketty and Saez, 2003; Kopczuk and Saez, 2004). In addition, the 1940s were also a period of substantial labor mobility as mobilization for World War II and ongoing structural transformation reallocated workers across regions and sectors (Kim, 1995; Heim, 2000). Indeed, as Figure 4.1 shows, after 1940 the share of the population living outside their state-of-birth and in a state not neighboring their state-of-birth increased substantially. For the decades since the 1970s, recent research emphasizes the connection between mobility and inequality through the concentration of high-skilled workers in cities (Diamond, 2012; Baum-Snow and Pavan, 2013).

In their seminal work on the Great Compression, the term given to the narrowing of the wage distribution at mid-century, Goldin and Margo (1992) document a substantial decrease in inequality among white men. From 1940 to 1950 the variance of the distribution of log wages fell by one-fifth, with a similar decrease in the difference between the 90th and 10th percentiles of the distribution. Moreover, the reduction was broad-based: occurring above and below the median as well as within and between regions, industries, and occupations. Goldin and Margo credit the increasing supply (and decreasing price) of skilled workers, the rising value of the minimum wage, and other institutional changes (e.g., unionization) with sustaining the compression for several decades after the end of World War II. A similar pattern of declining inequality has been documented among African-Americans (Maloney, 1994; Margo, 1995; Bailey and Collins, 2006).

Figure 4.1: Share of Population Living Outside State-of-Birth, 1870-1990



Notes: This figure shows the share of the population living outside their state-of-birth in neighboring (solid) or non-neighboring (dash) states.

Source: Ferrie (2006)

In this chapter, I focus on World War II-induced migration as a key mechanism for the changes in the wage structure. Specifically, the chapter provides an explanation for the reallocation of workers across regional labor markets due to industrial mobilization in the first half of the 1940s. I quantify the employment and wage effects of mobilization for different groups and, in this way, contribute to a growing literature that links migration and the wage structure—but in a period in which it narrowed rather than widened.

I use a spatial equilibrium model to formalize the relationship between World War II supply contracts, wages, and worker mobility. In the model, government spending on supply contracts between 1940 and 1945 generates shocks and workers' responses are allowed to vary by gender, race (white or non-white), and education (high school graduate or not). In the estimation, I exploit variation in the distribution of supply contracts across State Economic Areas (SEAs)¹, while controlling for time-invariant differences in local labor market conditions by group (e.g., technology, discrimination) as well as broad changes in conditions affecting labor supply across regions during the 1940s (e.g., selective service, expansion of education).

The conceptual experiment that motivates the model is one in which locations are randomly assigned different amounts of war-related government spending. The spending induces a reallocation of workers across cities in response to a differential shock. Two effects are potentially at work. First, locations with a (relative) abundance of supply contracts experience an increase in the demand for workers and hence an increase in wages. Second, workers reallocate across locations until the marginal worker is indifferent. This, in turn, alters the spatial distribution of labor supply. Depending on the responsiveness of workers (and wages) from different groups the new equilibrium wage structure will narrow, widen, or stay the same. I simplify the empirical analysis by dividing the economy into a number of

¹State Economic Areas (SEAs) are sub-state conglomerations of counties that are constructed based on shared economic characteristics. I exclude the territories of Alaska and Hawaii from the empirical analysis, and use the 467 SEAs for the United States between 1940 and 1950.

groups (i.e. within gender, race, and education level) and comparing changes in employment and wages within these groups.

My results show that World War II contributed to worker mobility between 1940 and 1950 in ways that are likely to be important for the structure of wages. The effect of a one standard deviation increase in government spending on supply contracts was to increase the relative employment of women (relative to men) by 1.5 percent, non-whites (relative to whites) by 9.5 percent, and high school graduates (relative to non-high school graduates) by 4.7 percent. Moreover, the impact of supply contracts on wages indicate that labor markets were able to absorb large increases in employment, while maintaining their original wage levels, particularly at the lower end of the distribution. This provides a mechanism for migration to change the wage structure and, taken together, the findings suggest a role for World War II in the 1940s Great Compression.

These findings also provide historical context for rising inequality in the United States in the last few decades, in which mobility has been more subdued or concentrated among high-skilled workers (Glaeser and Gottlieb, 2008; Moretti, 2011). Indeed, both Goldin and Katz (2008) and Lindert and Williamson (2012) emphasize the long-run factors contributing to income inequality in the United States, with some attention paid to the role of regional differences and shocks. For the more recent period, Topel (1986) provides evidence that mobility costs may have been high, while other research attributes the immobility of low-skilled workers to the lower incidence of adverse demand shocks through falling housing prices and rising social transfers (Gelbach, 2004; Glaeser and Gyourko, 2005; Kennan and Walker, 2010; Notowidigdo, 2013). This chapter is also related to research linking migration decisions to skill-level (Wozniak, 2010; Kennan and Walker, 2011b; Malamud and Wozniak, 2012) and, more broadly, to a variety of local economic outcomes (Roback, 1982; Cullen and Levitt, 1999; Boustan, Fishback, and Kantor, 2010).

In addition to the “pull” factors due to World War II that attracted migrants

to new employment opportunities, a number of “push” factors were also at work. In particular, permanent changes in the organization of agricultural production in the Midwest and South contributed to the substantial reallocation of employment toward non-farm work and from rural to urban areas (Boustan, 2009; Hornbeck, 2012). In the context of this chapter, “push” and “pull” factors are interpreted as working together to affect individuals’ location decisions and the distribution of the rewards from work.

4.2 Historical Background

The early 1940s brought a dramatic mobilization of the country’s resources for war, including \$108 billion in federal government spending on supply contracts. The large amount of spending that flowed to local economies caused substantial dislocation. To take advantage of high wages due to increased demand for industrial production, workers moved from rural areas in the South and Midwest to cities as well as to the North and Midwest. In California, for example, the population increased by half a million people between the late 1930s and early 1940s (Los Angeles Times, October 24, 1941), and similar changes have been documented for other regions (Wright, 1986; Goldman, 2007).

In addition, the wage structure narrowed substantially over the same period. Between 1940 and 1950 the variance of log weekly wages decreased by one fifth and the difference between the 90th and 10th percentiles decreased by a similar magnitude. The reduction in inequality occurred throughout the entire wage distribution as the narrowing was present above and below the median, across different levels of education and experience, for blue and white collar workers, as well as between and within regions. Goldin and Margo (1992) give weight to both short- and long-run factors, including the relative increase in the demand for low-skilled workers during and following World War II, the strength of unions throughout the 1950s, and increased supply of skilled workers.

4.2.1 Migration

Prior to 1940 interstate migration in the United States was constant with around one quarter of the population living outside their state-of-birth (see Figure 4.1). During the 1930s, structural change began to erode the existing spatial equilibrium (Kim, 1995; Heim, 2000). Improvements in agricultural productivity released labor from work on farms (Rhode and Olmstead, 2008), while natural disasters promoted out-migration or other adjustments in the distribution of the population across US regions (Boustan, Kahn, and Rhode, 2012; Hornbeck, 2012; Hornbeck and Naidu, 2014). In addition, New Deal policies also played a role through the Agricultural Adjustment Act and the generosity of New Deal relief policies (Alston, 1981; Whatley, 1985; Fishback, Horrace, and Kantor, 2006; Boustan, Fishback, and Kantor, 2010).

In many ways, the 1940s accelerated processes already underway. During the war, the industrialized areas in the Upper Midwest and along both coasts gained substantially in terms of population, while the Great Plains and southern states experienced net out-migration. Specifically, California, Maryland, Michigan, Ohio, and Washington were among the largest gainers and Alabama, Georgia, Missouri, South Carolina, and Wisconsin were among the largest losers (US Bureau of Labor Statistics, 1944b).

The substantial population growth of some areas was also associated with urbanization and the expansion of manufacturing (Michaels, Rauch, and Redding, 2012). As the demand for industrial production increased throughout the early 1940s, firms sought first to hire locally available labor from the pool of unemployed or underutilized workers. However, the dual demands of military manpower and industrial mobilization constrained the supply of labor in some areas so that firms looked to recruit workers from other areas, while government agencies worked to ensure that this process was as orderly as possible (Klein, 2013).

To avoid the problems that followed the end of World War I, planning for demobi-

lization began before the Second World War was over. One aspect of demobilization concerned the cancellation of war contracts and the deceleration of industrial production; another aspect had to do with the return of men from overseas and where they would eventually settle. The pressure that this would ultimately place on labor markets was at least partially ameliorated by planning that took place starting in 1944 as well as the voluntary withdrawal of some groups from the labor force (e.g., school age teenagers, the elderly, and some women). In this chapter, I consider adjustments to the spatial equilibrium that took place over the entire 1940s decade.

4.2.2 The Structure of Wages

Throughout the 1940s, substantial growth in average earnings was accompanied by a narrowing of the wage structure. Between 1940 and 1950, the variance of the log weekly wage distribution fell from 0.313 to 0.241 and the difference between the 90th and 10th percentiles of the distribution decreased from 1.414 to 1.060 (Goldin and Margo, 1992). During the war years, the wage growth of manufacturing operatives outpaced that of clerical workers and, similarly, the growth in compensation for non-salaried workers was larger than for salaried executives (Goldin and Margo, 1991; Frdyman and Malloy, 2012)

Various groups also benefited from changes to the wage structure during the 1940s. For example, for African-American men, Maloney (1994) and Margo (1995) identify occupational upgrading, internal migration, and gains in educational attainment as specific factors contributing to the more general trend toward the narrowing of the wage structure. In addition, Bailey and Collins (2006) attribute wage gains of black women to an increasing demand for their labor, particularly in the formal sector. Collins (2001) finds that employment prospects among African-Americans were improved during the war with the help of anti-discrimination policies (e.g., the Fair Employment Practice Committee), and these gains did not dissipate with reconversion.

Still, much of the evidence linking mobilization for World War II with migration and the compression of the wage distribution is anecdotal. One such example, is Henry Kaiser's shipyard in Richmond, California, which employed workers from outside the area and paid higher wages. One story says that workers were attracted to the shipyards or similarly high-paying jobs along the coasts or in the North and away from work in agriculture. However, a formal system of wage controls and some restrictions on worker mobility cut against generalizability of this story for the rest of the economy. In addition, adjustments to the constraints of wartime may have occurred through channels other than migration. For example, innovations in production processes that were meant to accommodate the constraints of wartime economized on the need for skilled labor and increased the demand for the unskilled (Klein, 2013). The spatial equilibrium model in the next section shows the impact of World War II on different types of workers through shocks induced by mobilization. The empirical analysis then quantifies the relationship between World War II, migration, and the evolution of the wage structure.

4.3 Model of Spatial Equilibrium

In this section, I derive a spatial equilibrium model that guides the empirical analysis. To simplify, I assume that there are two locations (a and b) and two types of workers (H and L). Workers participate in a single housing market in each location, but are hired by different firms and are assumed not to be substitutes in production. An equilibrium of the model is a configuration in which the marginal worker of each type is indifferent across locations. The model in this section follows the exposition of Moretti (2011).

The indirect utility of workers is determined by earnings (w), the rental price of housing (r), local amenities A , and individual preferences (ϵ). The subscript t indexes year. Specifically, the indirect utility of worker i of type- H in location c is

given by,

$$U_{ict}^H = w_{ct}^H - r_{ct} + A_{ct}^H + \epsilon_{ict}^H$$

Similarly, the indirectly utility for type- L workers is,

$$U_{ict}^L = w_{ct}^L - r_{ct} + A_{ct}^L + \epsilon_{ict}^L$$

Regardless of type, workers face the same price for housing; this ensures that a shock directly affecting one type of worker will have indirect effects on all workers through its impact on the housing market. All workers have access to the same amenities but may value these amenities differently.² These differences in the value of amenities for type- H and type- L workers are captured by A_c^H and A_c^L , respectively. Finally, idiosyncratic preferences are type-specific and drawn from (potentially) different distributions. To obtain closed-form solutions, I assume that the (relative) taste of a over b for each type of worker is:

$$\begin{aligned}\epsilon_{iat}^H - \epsilon_{ibt}^H &\sim U[-s_H, s_H] \\ \epsilon_{iat}^L - \epsilon_{ibt}^L &\sim U[-s_L, s_L]\end{aligned}$$

In this simplified setting, I assume that the two types of workers work in different firms³ and that all firms produce a single good y , which is sold in a perfectly competitive market so that price can be normalized to 1. In each city, the two firms make use of technologies that have a Cobb-Douglas form and constant returns to scale. That is, the firm employing type- H workers produces according to,

$$\ln y_{ct}^H = X_{ct}^H + \alpha N_{ct}^H + (1 - \alpha) K_{ct}^H$$

²Type- H workers may utilize different aspects of the transportation infrastructure. For example, one type of worker may be more likely to use infrastructure related to the personal automobile while the other type relies on publicly-provided transportation (e.g., bus).

³This assumption says that the two types of workers are not (even) imperfect substitutes, but does not change the qualitative implications of the model.

and the firm employing type- L workers according to,

$$\ln y_{ct}^L = X_{ct}^L + \alpha N_{ct}^L + (1 - \alpha) K_{ct}^L$$

X_{ct}^g is location- and skill-specific productivity shifter, where $g \in (H, L)$. N_{ct}^g is the (log) number of workers of each type and K_{ct}^g is the (log) amount of capital, which is available at all locations at a single price.

Finally, the supply of housing is described by,

$$r_c = z + k_c N_c$$

where the number of housing units is assumed to be equal to the number of workers and the exogenously determined elasticity of housing supply is given by k_c .

Now consider the effect of a change in the relative demand for type- L workers at location b due to a change the relative productivity of type- L workers: $X_{b,t+1}^L = X_{bt}^L + \Delta$ and the remaining features of the economy are held constant (i.e., no change to the productivity type- H workers in b , no changes to the productivity of any workers in a , and amenities are the same between year t and year $t + 1$). In the context of the early 1940s, Δ may be positive or negative depending on whether the changes in demand due to industrial mobilization for World War II tended to favor type- L or type- H workers and the distribution of government spending.

This shock to the productivity of type- L workers in b leads to a change in the distribution of these workers across locations. Specifically, the change in the number of type- L workers is equal to

$$N_{b,t+1}^L - N_{bt}^L = \frac{\Delta N_t ((k_a + k_b) N_t + 2s_H)}{2\alpha(k_a N_t (s_H + s_L) + k_b N_t (s_H + s_L) + 2s_H s_L)}$$

There also is a change in the number of type- H workers, which is given by:

$$N_{b,t+1}^H - N_{bt}^H = -\frac{\Delta N_t^2 (k_a + k_b)}{2\alpha(k_a N_t (s_H + s_L) + k_b N_t (s_H + s_L) + 2s_H s_L)}$$

And together these changes imply a change in the total population between a and b

$$(N_{b,t+1}^H + N_{b,t+1}^L) - (N_{bt}^H + N_{bt}^L) = \frac{\Delta N_t s_H}{\alpha(k_a N_t (s_H + s_L) + k_b N_t (s_H + s_L) + 2s_H s_L)}$$

In this simplified version of the model, the adjustment of type- L workers is larger in absolute value than the adjustment of type- H workers, so that the population of b will unambiguously increase (decrease) if the shock to the productivity of type- L workers is positive (negative).

In addition, as workers sort across locations in response to the change in type- L workers' productivity, real wages adjust until the marginal worker is indifferent across locations. Specifically, the change in real wages for type- L workers in b is given by:

$$(w_{b,t+1}^L - r_{b,t+1}) - (w_{bt}^L - r_{bt}) = \frac{\Delta(k_a N_t s_L + k_b N_t s_L + k_a N_t s_H + 2s_H s_L)}{\alpha(k_a N_t (s_H + s_L) + k_b N_t (s_H + s_L) + 2s_H s_L)}$$

The sign of the change in a is the same, but the magnitude is smaller:

$$(w_{a,t+1}^L - r_{a,t+1}) - (w_{at}^L - r_{at}) = \frac{\Delta s_H k_a N_t}{\alpha(k_a N_t (s_H + s_L) + k_b N_t (s_H + s_L) + 2s_H s_L)}$$

Type- H workers are hurt by the change in the productivity of type- L workers. Since type- H and type- L workers cannot be substituted for one another, the entire effect is transmitted through the housing market, where the inflow of type- L workers to b increases competition for the available housing. Similar reasoning implies that the change in real wages of type- L workers in a is the opposite of those in b . The empirical analysis is limited by the absence of data on housing prices so that the focus is on weekly wage unadjusted for the cost of housing. If the two types of workers were (imperfect) substitutes this would dampen the migration response to some extent, but also lead to greater competition in the labor market and hence lower nominal wages.

The key predictions from this model relate to migration and the evolution of wages in response to a productivity shock. In the empirical analysis, the goal is to quantify the effect of World War II on different types of workers, particularly on the changes in employment and wages. Specifically, I focus on three categories: race, education, and gender. The historical narrative provides some guidance. For example, we know that the war led to substantial migration and increased the relative

employment of African-Americans and women. Still, there is little empirical work quantifying the impact of government spending during World War II on changes in the spatial equilibrium of the US economy.

4.4 Empirical Analysis

4.4.1 Data and Summary Statistics

The data for this chapter are drawn from two sources. Information on wages and employment come from the Integrated Public Use Microdata (IPUMS) census samples for 1940 and 1950 (Ruggles, Alexander, Genadek, Ronald Goeken, and Sobek, 2010). In each year, I first restrict the sample to all individuals aged 18 to 65 living and born in the contiguous United States (i.e., excluding Alaska and Hawaii). I drop individuals living in group quarters or working in agriculture using the *ind1950* and *occ1950* variables. I also drop individuals for whom information on income and weeks worked is not available. I then use the *sea* variable to assign the remaining individuals to one of the $c \in (1, \dots, 467)$ State Economic Areas (SEAs). Finally, I calculate the weekly wage for each individual by dividing the total wage and salary income by the total number of weeks worked in the previous year; total employment is taken as the number of individuals working in each SEA.⁴

Table 4.1 shows summary statistics for employment and weekly wages in each census year as well as the change between 1940 and 1950. Employment and weekly wages are also tabulated separately by gender, race, and educational attainment. Overall, the first row of Table 4.1 shows that the weekly wage increased by 27 percent between 1940 and 1950. The remainder of the table shows that weekly wages increased within all of groups. For both females and non-whites, the two groups that experienced the most rapid growth in weekly wages, employment also

⁴All figures are converted to year 2000 dollars using Consumer Price Index (CPI) available at <http://data.bls.gov/cgi-bin/cpicalc.pl>. In addition, I apply sample weights when calculating employment and wages by location and group.

Table 4.1: Summary Statistics

	Employment:			Weekly Wage (in \$2000):		
	(1) 1940	(2) 1950	(3) Δ 1940-50 (%)	(1) 1940	(2) 1950	(3) Δ 1940-50 (%)
<i>A. All</i>	52,580	74,177	0.41	301	381	0.27
<i>B. Gender</i>						
Male	36,638	51,259	0.40	346	428	0.24
Female	15,942	22,918	0.44	193	267	0.38
<i>C. Race</i>						
White	47,491	66,830	0.41	321	397	0.24
Non-White	5,796	9,324	0.61	183	259	0.42
<i>D. Education</i>						
Non-HS Grad	32,368	40,783	0.26	274	355	0.30
HS Grad	20,211	33,394	0.65	351	420	0.20

Notes: Data from 467 SEAs were used to calculate the summary statistics. For the non-White group in Panel C, the number of SEAs used was 410 and 368 in 1940 and 1950, respectively.

Source: Ruggles et al. (2010).

expanded substantially. This provides at least suggestive evidence that increased competition from demographically similar workers did not inhibit wage growth. This is consistent with growth in employment (partially through migration) contributing to the narrowing of the wage distribution.

For information on the spatial distribution of government spending on supply contracts during World War II, I draw on data compiled by the Inter-University Consortium for Political and Social Research under *Historical, Demographic, and Social Data: The United States, 1790-2002* series (Haines, 2010). In particular, I use information on all major war supply contracts distributed between June 1940 and September 1945 at the county level. A wide variety of products were called for in these contracts including, for example, ordnance and aircraft as well as steel and textile goods. I aggregate the county-level data to the SEA-level using the definitions constructed by Bogue (1951) based on counties that had similar economic characteristics in 1950. The map in Figure 4.2 shows the distribution of supply contract spending at the SEA-level.

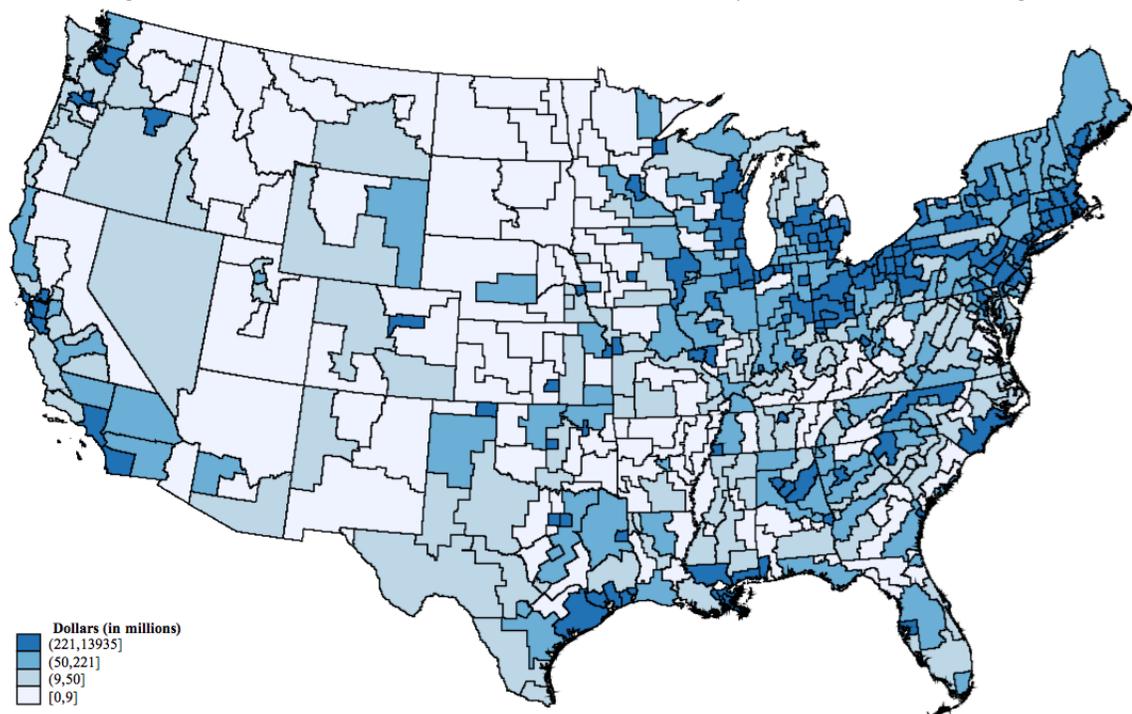
The mean of SEA-level supply contract spending is \$386 million, but there is substantial variation across SEAs. The regions receiving the largest share of supply contract spending were the Northeast and the upper Midwest around the Great Lakes. In the South, urban areas, for example, Atlanta and Birmingham, received a substantial amount of spending and so too did areas along the Atlantic and Gulf coasts, particularly to carry out shipbuilding. In the West, spending was concentrated around four cities: Seattle, San Francisco, Los Angeles, and San Diego.

4.4.2 Regression Specification

To quantify the impact of shocks due to World War II on migration and wages, I consider the following ordinary least squares regression,

$$Y_{gct} = \theta_{gc} + \theta_{gt} + \beta_g \mathbf{contracts}_c \times \mathbf{1}\{t = 1950\}_t + \varepsilon_{gct} \quad (4.1)$$

Figure 4.2: Distribution of World War II Supply Contracts Spending



Notes: This figure shows the distribution of government spending on supply contracts during World War II across State Economic Areas, specifically between June 1940 and September 1945. The shading in the map indicates quartiles of spending on supply contracts.

Source: The map is derived from county-level data on government spending on supply contracts during World War II from Haines (2010).

where g , c , and t index groups, SEAs and years, respectively. The outcome variable, Y_{gct} , is the average of log weekly wage or log of total employment for group g in SEA c in year t . θ_{gc} and θ_{gt} are group-level fixed effects for SEAs and years. SEA fixed effects control for group-specific permanent differences in labor market conditions affecting wages or employment and time fixed effects capture common shocks due to business cycle fluctuations. The main variable of interest is the interaction between the dollar value of World War II supply contracts (i.e., $\mathbf{contracts}_c$) and an indicator for whether the year is pre- or post-war (i.e., $\mathbf{1}\{t = 1950\}_t$). The $\mathbf{contracts}_c$ variable is normalized so that β_g measures the effect of a one standard deviation increase in supply contracts spending.

For the results reported in the next section, I consider the effect of supply contracts within gender, race, and education groups. That is, I run the regression in equation (4.1) separately for (i) males and females, (ii) white and non-white, or (iii) high school graduates and non-high school graduates.⁵ In this way, the fixed effects in (4.1) capture group-specific determinants at the SEA- and year-level. For example, differences in discrimination or technology across SEAs that are constant over time that influence the relative demand for labor within gender, race, or education groups are held constant. In addition, for all regressions I report standard errors clustered on SEAs and the wage regressions are weighted by employment so that β gives the effect on an individual's wage.

Interpreting β_g as the causal effect of supply contracts requires that $E[\varepsilon_{gct}|\theta_{gc}, \theta_{gt}] = 0$. This condition is violated if, for example, in allocating supply contracts military planners targeted SEAs where the *growth* in average weekly wages or employment was on a differential trend due to the effects of the Great Depression or technological change at the local level. The lack of an instrument for supply contracts suggests caution when interpreting the results reported below

⁵More specifically, if gender is the group then $g = (\text{male}, \text{female})$, if race is the group then $g = (\text{white}, \text{non-white})$, and if education is the group then $g = (\text{high school}, \text{non-high school})$.

causally. However, fixed effects control for differences in the level of the average weekly wage or employment, which is important in the context of the labor shortages that arose during war (i.e., supply contracts were allocated to SEAs with large pools of unused labor). In addition, Koistinen (2004) and Klein (2013) argue that objectives related to local economic development received relatively little weight in the planning stages of mobilization and this persisted until at least the middle of 1944.

4.5 Results

The first two columns of tables 4.2 and 4.3, respectively, report the results from estimating equation (4.1) with the log of employment and the average weekly wage as the outcomes. The third column reports the difference in the log of the respective outcome variable for the groups in the first two columns. In each table, Panel A gives the results by gender, Panel B the result by race, and Panel C the results by education level. Before proceeding to a discussion of the group-specific results, the results for the cross-section of SEAs provide a useful benchmark. In particular, between 1940 and 1950, the effect of a one standard deviation change in the value of supply contracts on employment is not statistically or economically significant (*coef.* = 0.001, *s.e.* = 0.008); but the effect for wages is significant (*coef.* = -0.018, *s.e.* = 0.007) and implies that a one standard deviation increase in the value of supply contracts led to a 1.8 percent decrease in the average weekly wage.

The results in Table 4.2 for employment show only a weak correlation between supply contracts and male (Panel A) or white (Panel B) employment. However, the results for female and non-white employment growth are both statistically significant. From Column 3, a one standard deviation increase in supply contracts is correlated with a 1.5 percent increase in female relative to male employment and 9.5 percent increase in the employment of non-whites relative to whites. A causal interpretation of these results suggests that SEAs which received a relatively larger

Table 4.2: Results for Impact of Supply Contracts on Employment, 1940-1950

	(1)	(2)	(3)
A. By Gender			
	Male	Female	Male/Female
$\mathbf{contracts}_c \times \mathbf{1}\{t = 1950\}_t$	-0.003 (0.008)	0.012 (0.012)	-0.015 (0.007)
B. By Race			
	White	Non-White	White/Non-White
$\mathbf{contracts}_c \times \mathbf{1}\{t = 1950\}_t$	-0.011 (0.008)	0.082 (0.033)	-0.095 (0.025)
C. By Education			
	HS	Non-HS	HS/Non-HS
$\mathbf{contracts}_c \times \mathbf{1}\{t = 1950\}_t$	0.027 (0.011)	-0.020 (0.009)	0.047 (0.011)

Notes: The outcome variable the log of employment in each group (columns 1 and 2) or the difference in the log of employment for the groups in the first two columns (column 3). See notes for Table 4.1 for further details.

Source: Ruggles et al. (2010) and Haines (2010).

share of supply contracts absorbed larger increases in the employment of females (relative to males) and non-whites (relative to whites).

The magnitudes for the effect on women, in particular, are consistent with research showing that the substantial increase in female employment due to World War II was not entirely dissipated by 1950 (Goldin, 1991; Acemoglu, Autor, and Lyle, 2004). For non-whites, the size of the effect is much larger and consistent with substantial mobility in response to war mobilization. Hsieh, Hurst, Jones, and Klenow (2013) consider differences in the occupations held by men, women, and non-whites in the postwar United States and find that convergence in the structure of employment significantly contributed to the overall growth of output per capita. My findings are consistent with occupational mobility having a geographic component, although more research on this connection is needed.

The employment results by education level (in Panel C) imply an increase in the employment for high school graduates relative to non-high school graduates due to World War II: a one standard deviation increase in supply contracts is associated with 4.7 percent increase in (relative) employment. In the context of the war years, these results suggest that some skill-biased technological change may have followed from receiving supply contracts. This is in line with labor shortages during the war leading firms to adopt production processes that economized on the need for unskilled labor and used skilled labor relatively more intensively.

An example from the wartime machine tool industry is instructive. Bill Jack of Cleveland collaborated with Doehler Die Casting on a new method to produce castings:

Doehler sent one of its top engineers to Cleveland, where, after poring over blueprints for a few weeks, he found ways to adapt every part in the job to die casting. The shell that covered the starter's motor, for example, weighted 3.08 pounds before machining when sand-cast but 2.03 pounds die cast, a savings in aluminum of nearly one third. (Klein,

Table 4.3: Results for Impact of Supply Contracts on Weekly Wages, 1940-1950

	(1)	(2)	(3)
A. By Gender			
	Male	Female	Male/Female
$\mathbf{contracts}_c \times \mathbf{1}\{t = 1950\}_t$	-0.009 (0.005)	-0.018 (0.005)	0.009 (0.006)
B. By Race			
	White	Non-White	White/Non-White
$\mathbf{contracts}_c \times \mathbf{1}\{t = 1950\}_t$	-0.007 (0.004)	-0.012 (0.014)	0.005 (0.024)
C. By Education			
	HS	Non-HS	HS/Non-HS
$\mathbf{contracts}_c \times \mathbf{1}\{t = 1950\}_t$	-0.008 (0.005)	-0.015 (0.004)	0.005 (0.007)

Notes: The outcome variable the log of the average weekly wage in each group (columns 1 and 2) or the difference in the log of the average weekly wage for the groups in the first two columns (column 3). See notes for Table 4.1 for further details.

Source: Ruggles et al. (2010) and Haines (2010).

2013, p. 528)

In addition to the materials saved, the overall cost of castings were halved through similar (or greater) reductions in man- and machine-hours.

Moving to the results for average weekly wages in Table 4.3, none of the estimates for relative growth of average weekly wages (Column 3) are statistically or economically significant. For females and non-whites, the negative sign of the coefficients is consistent with the greater employment growth documented in Table 4.2, but in neither case is the change relative to the other group significant. The results by education level suggest that even though SEAs with a large share of supply contracts experienced a relative increase in the number of high school graduates, their average weekly wage rate was ultimately unaffected.

4.6 Discussion

The results in this chapter suggest an avenue through which World War II may have altered the structure of wages. First, females and non-whites experienced substantial gains in employment in response to mobilization during the 1940s: a one standard deviation increase in supply contracts is associated with 1.5 percent increase in the employment of women (relative to men) and 9.5 percent increase in the employment of non-whites (relative to whites). Moreover, these shifts in employment patterns were not reflected in substantially decreased wages. This provides scope for World War II to have reallocated low wage workers in 1940 to higher wages jobs in 1950 (see Table 4.1).

Second, the war years as well as particular SEAs that received a larger share of supply contracts appear to have increased the use of skilled labor substantially, while at the same time providing them steady compensation: the employment of high school graduates (relative to non-high school graduates) increased a statistically significant 4.7 percent as a result of a one standard deviation increase in supply contracts, while the (relative) average weekly wage increase a statistically

insignificant 0.5 percent.

Importantly, the supply of human capital was expanding during this period. Indeed, Goldin and Margo (1992) emphasize this factor in their explanation for the Great Compression. In addition, structural transformation was reshaping agriculture in the South and Midwest, which had important implications for cities and other regions. In extensions to this chapter, I will consider (i) the role of the increase in human capital together with the increase in migration, focusing on veterans' resettlement in areas different from where they were born at the end of the war and (ii) the role of the reorganization of farms and agricultural labor markets as well as the Dust Bowl and other environmental catastrophes. It is likely that World War II interacted with these factors in important ways.

APPENDIX A

SUPPLEMENTAL MATERIAL FOR CHAPTER 2

The main data sources used in the empirical analysis are the IPUMS samples of the decennial censuses from 1960 and 1970 (Ruggles, Alexander, Genadek, Ronald Goeken, and Sobek, 2010) and the *Special Monographs of the Selective Service*. The census samples are used to construct education and labor market outcomes for cohorts defined by state-of-birth and year-of-birth. I drop all individuals not born in the United States as well as individuals born in Alaska, Hawaii, and Washington, DC. I further restrict the census samples to white females born between 1915 and 1931, and not living in group quarters. In some cases, as robustness checks, I also use white females born 1900 to 1914 or those born 1932 to 1935.

The education outcomes are constructed from the IPUMS variable *higraded*. I first calculate completed years of schooling for each individual using *higraded* and then use years of schooling to compute cohort averages. Labor market outcomes are constructed from the variables *empstat*, *wkswork2*, and *incwage*. Employment is defined as *empstat* equal to 1. The variable *wkswork2* is intervalled, so I use the midpoint of each interval to calculate a continuous measure of weeks worked. The weeks worked measure is constructed conditional on *empstat* equal to 1. The weekly wage rate is calculated by dividing *incwage* by the constructed weeks worked variable, conditional on at least 40 weeks worked. Finally, age at first marriage is calculated from *agemarr*, conditional on *marst* indicating a woman was married, and the number of children ever-born is calculated using *chborn*.

The measure of exposure to mobilization is calculated from the total number of registrants, monthly induction counts, and periodic enlistment data, and the by state tabulated in the *Quotas, Calls, and Inductions* volumes of the Selective

Table A.1: Date Ranges Used to Construct Mobilization Exposure Variable

Exposure Year:	Inductions:	Enlistments:
1941	Nov. 1940 - Dec. 1941	As of Dec. 8, 1941
1942	Jan. 1942 - Dec. 1942	Dec. 9, 1941 - Dec. 1, 1942
1943	Jan. 1943 - Aug. 1943	Dec. 2, 1942 - Sep. 1, 1943
1944	Sep. 1943 - Dec. 1944	Sep. 2, 1943 - Dec. 1, 1944
1945	Jan. 1945 - Dec. 1945	Dec. 2, 1944 - Sep. 1, 1945

Service monographs. All data are tabulated in Volume II of *Quotas, Calls, and Inductions*. The number of registrants is from the first, second, third, fifth, and sixth registrations, which included all registrants below the age of 45 through December 31, 1945 (p. 1). Inductions are the number of inductions in each month between November 1940 and December 1945 (pp. 43-63). Enlistment data are the number of enlistments as of December 1941 until September 1945 (pp. 126-134).

For each year the Selective Service was in place I sum the number of inductions and enlistments in that year. Table A.1 shows the date ranges for inductions and enlistments used to calculate the mobilization exposure variable in each year. Two features of Table A.1 are noteworthy. First, inductions in November and December of 1940 are included in the exposure variable for 1941. Monthly induction data were only available starting in July 1941. Before July, inductions were tabulated as the sum between November 1940 and June 1941. Second, exposure in 1943 and 1944 is not based on the calendar year because enlistment data were only available as of September 1, 1943, whereas in the other years enlistment data was available as of December 1. This measurement issue is not problematic since inductions accounted for the vast majority of new additions to the military after 1942 (US Selective Service System, 1948, pp. 32-33).

APPENDIX B

SUPPLEMENTAL MATERIAL FOR CHAPTER 3

B.1 Setup

To examine industrialization in the American South, I estimate a random-coefficients discrete choice model of establishment location decisions. Each establishment i chooses the location c that maximizes profit in year t . For each establishment i , I draw $R = 100$ scrambled Halton from a standard normal distribution to also allow random establishment characteristics to determine the location choice probabilities. Given draws of η_{it}^j and the assumption that ε_{ict} follows a type I extreme value distribution, establishment i chooses location c in year t with a probability given by:

$$P_{ict} = \frac{\exp(\delta_{ct} + \sum_{j,l} \text{war}_c^j \times d_{post} \times z_{it}^l \times \alpha^{jl} + \sum_j \text{war}_c^j \times d_{post} \times \eta_{it}^j \times \sigma^j + \sum_l \text{trend}_t \times z_{it}^l \times \rho^l)}{\sum_{d=0}^C \exp(\delta_{dt} + \sum_{j,l} \text{war}_d^j \times d_{post} \times z_{it}^l \times \alpha^{jl} + \sum_j \text{war}_d^j \times d_{post} \times \eta_{it}^j \times \sigma^j + \sum_l \text{trend}_t \times z_{it}^l \times \rho^l)} \quad (\text{B.1})$$

where the outside option of choosing in a non-southern location is normalized to zero and

$$\delta_{ct} = \sum_j \text{war}_c^j \times d_{post} \times \bar{\alpha}^j + \text{trend}_t \times \bar{\rho} + \xi_{ct}$$

Estimation is based on commuting zone-level data on the number and sector of all manufacturing establishments in 12 southern states as well as the total number of establishments in the United States. Therefore, I observe the aggregate probability each commuting zone is chosen as well as the sector of each establishment.

I use a two-step estimator based on Berry, Levinsohn, and Pakes (2004) and applied by Train and Winston (2007), Langer (2012), and Rothenberg (2012). First,

estimate $\theta = [\alpha^{jl}, \sigma^j, \rho^l]$ via maximum likelihood and using the contraction mapping from Berry et al. (1995) to pick the δ_{ct} 's that set actual and predicted location shares equal for each estimate of θ . Second, use the estimates δ_{ct} from the previous step to estimate $\bar{\alpha}^j$ and $\bar{\rho}$ with a linear regression.

B.2 Interaction of Establishment and Location Characteristics

To ensure that the the δ_{ct} 's recovered in the first step reflect the *mean* profitability of location c in year t and not the profitability of the excluded sector, z_{it}^l is the demeaned indicator for sector l . That is, let $l = 1, \dots, L, L+1$ index sectors, where $L+1$ denotes the excluded sector and d_{it}^l be an indicator equal to one if establishment i is in sector l . Then z_{it}^l is defined in the following way,

$$z_{it}^l = \begin{cases} 1 - \frac{1}{N_t} \sum_i^{N_t} d_{it}^l & \text{if establishment } i \text{ in year } t \text{ is in sector } l \\ -\frac{1}{N_t} \sum_i^{N_t} d_{it}^l & \text{otherwise} \end{cases}$$

where N_t is the total number of establishments in year t . Note that z_{it}^l is identical for establishments in the same sector in same year, but changes over time to reflect the growth or decline of a particular sector l .

To construct sector-specific estimates for the effect of war spending, I start by defining the probability that a given establishment i belongs to sector l over all postwar years, p^l . Then sector-specific estimates are given by:

$$\kappa^{jl} = \begin{cases} \bar{\alpha}^j + \alpha^{jl} p^l - \sum_l \alpha^{jl} p^l & \text{if } l = 1, \dots, L \\ \bar{\alpha}^j - \sum_l \alpha^{jl} p^l & \text{if } l = L + 1 \end{cases}$$

I use the delta method to calculate standard errors for κ^{jl} .

B.3 Calculating the Likelihood's Gradient

Since η_{it}^j is unobserved, the unconditional probability that establishment i chooses location c is given by integral over the expression in (B.1):

$$P_{ict} = \int \frac{\exp(\delta_{ct} + \sum_{j,l} war_c^j \times d_{post} \times z_{it}^l \times \alpha^{jl} + \sum_j war_c^j \times d_{post} \times \eta_{it}^j \times \sigma^j + \sum_l trend_t \times z_{it}^l \times \rho^l)}{\sum_{d=1}^C \exp(\delta_{dt} + \sum_{j,l} war_d^j \times d_{post} \times z_{it}^l \times \alpha^{jl} + \sum_j war_d^j \times d_{post} \times \eta_{it}^j \times \sigma^j + \sum_l trend_t \times z_{it}^l \times \rho^l)} f(\eta) d\eta$$

where $f(\eta)$ is the joint density unobserved characteristics. Simulation is used approximate this integral, which cannot be computed analytically. I approximate this integral by taking the sum over $R = 100$ scrambled Halton sequence draws from a standard normal distribution:

$$\begin{aligned} \hat{P}_{ict} &= \frac{1}{R} \sum_{r=1}^R \frac{\exp(\delta_{ct} + \sum_{j,l} war_c^j \times d_{post} \times z_{it}^l \times \alpha^{jl} + \sum_j war_c^j \times d_{post} \times \eta_{it}^j \times \sigma^j + \sum_l trend_t \times z_{it}^l \times \rho^l)}{\sum_{d=1}^C \exp(\delta_{dt} + \sum_{j,l} war_d^j \times d_{post} \times z_{it}^l \times \alpha^{jl} + \sum_j war_d^j \times d_{post} \times \eta_{it}^j \times \sigma^j + \sum_l trend_t \times z_{it}^l \times \rho^l)} \\ &= \frac{1}{R} \sum_{r=1}^R P_{ict} \end{aligned}$$

Then the negative of the simulated log-likelihood is given by:

$$SLL(\theta, \delta_{ct}(\theta)) = - \sum_i^N \ln \left(\frac{1}{R} \sum_{r=1}^R P_{ict}^* \right)$$

which I minimize, where the “*” denotes the location c actually chosen by establishment i . Note that I estimate the model using manufacturing establishments in 203 southern commuting zones between 1927 and 1967. This means that establishments are only included if their commuting zone is chosen in every year for which I have data; establishments that choose a location elsewhere in the United States are included in the outside option.

I use maximum likelihood to choose values of θ at each iteration. Given an estimate of θ , I calculate predicted location shares:

$$\hat{s}_{ct}(\theta, \delta_{ct}(\theta)) = \frac{1}{N_t} \frac{1}{R} \sum_{i=1}^{N_t} \sum_{r=1}^R \frac{\exp(\delta_{ct} + \sum_{j,l} war_c^j \times d_{post} \times z_{it}^l \times \alpha^{jl} + \sum_j war_c^j \times d_{post} \times \eta_{it}^j \times \sigma^j + \sum_l trend_t \times z_{it}^l \times \rho^l)}{\sum_{d=1}^C \exp(\delta_{dt} + \sum_{j,l} war_d^j \times d_{post} \times z_{it}^l \times \alpha^{jl} + \sum_j war_d^j \times d_{post} \times \eta_{it}^j \times \sigma^j + \sum_l trend_t \times z_{it}^l \times \rho^l)}$$

I then solve for the vector of δ_{ct} that set predicted and actual location shares equal using the contraction mapping due to Berry, Levinsohn, and Pakes (1995):

$$\exp(\delta_{ct}^{\tau+1}) = \exp(\delta_{ct}^{\tau}) \times \frac{S_{ct}}{\hat{S}_{ct}}$$

This approach helps reduce the number of parameters to search over in the maximum likelihood step, however, due to the dependence of δ_{ct} on θ some additional work is required when calculating likelihood gradient, which is used to compute standard errors. In particular, since δ_{ct} is estimated conditional on θ , I need to take care to account for the fact that changing θ changes δ_{ct} :

$$\frac{dSLL(\theta, \delta(\theta))}{d\theta} = - \sum_{i=1}^N \left[\frac{\frac{1}{R} \sum_{r=1}^R \frac{dP_{ict}^*}{d\theta}}{\frac{1}{R} \sum_{r=1}^R P_{ict}^*} \right] \quad (\text{B.2})$$

where

$$\frac{dP_{ict}^*}{d\theta} = \frac{\partial P_{ict}^*}{\partial \theta} + \frac{\partial P_{ict}^*}{\partial \delta} \times \frac{\partial \delta_{ct}}{\partial \theta} \quad (\text{B.3})$$

The first term from (B.3) is given by:

$$\frac{\partial P_{ict}^*}{\partial \alpha^{jl}} = P_{ict}^* z_{it}^l \left(\text{war}_c^j \times d_{post} - \sum_{c=1}^C P_{ict}^* \text{war}_c^j \times d_{post} \right)$$

where the derivatives with respect to σ^j , and ρ^l are defined similarly.

The second term in (B.3) is equal to:

$$\frac{\partial P_{ict}^*}{\partial \delta} = \begin{cases} P_{ict}^*(1 - P_{ict}^*) & \text{if } i \text{ chooses location } c \text{ in year } t \\ -P_{ict}^* P_{ict} & \text{otherwise} \end{cases}$$

Finally, the third term in (B.3) is calculated using implicit differentiation to account for the fact that δ_{ct} changes when θ changes. Start from the fact that actual minus predicted location shares are equal:

$$\begin{aligned} s_{ct} - \hat{s}_{ct} &= 0 \\ \implies -\frac{d\hat{s}_{ct}}{d\theta} &= 0 \\ \implies \frac{\partial \hat{s}_{ct}}{\partial \theta} + \frac{\partial \hat{s}_{ct}}{\partial \delta} \times \frac{\partial \delta}{\partial \theta} &= 0 \\ \implies \frac{\partial \delta}{\partial \theta} &= - \left(\frac{\partial \hat{s}_{ct}}{\partial \delta} \right)^{-1} \frac{\partial \hat{s}_{ct}}{\partial \theta} \end{aligned}$$

where

$$\frac{\partial \hat{s}_{ct}}{\partial \delta} = \sum_{i=1}^{N_t} \left(\frac{1}{R} \sum_{r=1}^R \frac{\partial P_{ict}^*}{\partial \delta} \right)$$
$$\frac{\partial \hat{s}_{ct}}{\partial \theta} = \sum_{i=1}^{N_t} \left(\frac{1}{R} \sum_{r=1}^R \frac{\partial P_{ict}^*}{\partial \theta} \right)$$

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