Abstract

When private incentives are insufficient, a big push by government may lead to industrialization. This paper uses mobilization for World War II to test the big push hypothesis in the context of postwar industrialization in the American South. Specifically, I investigate the role of new manufacturing capital and find that despite a boom in output during the war, mobilization failed to generate the production-side spillovers that facilitate industrialization and lead to regional development in the long-run. The South industrialized in the second half of the twentieth century, but this was not the result of a World War II big push.

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1 Introduction

A big push by government may produce economic growth when private incentives alone are insufficient (Rosenstein-Rodan, 1943; Nurkse, 1953; Murphy, Shleifer, and Vishny, 1989; Azariadis and Stachurski, 2005). For example, in the presence of spillovers from agglomeration, demand, financing, human capital, etc., coordinated investment that facilitates the adoption of increasing returns technology (i.e., industrialization) may be socially beneficial. As a result policymakers use industrial policy, special economic zones, or infrastructure improvements to promote growth across many sectors in regions that lag behind the rest of the country.

Regional disparities in the United States in the first half of the twentieth century and convergence after 1940 provide a useful setting to evaluate the impact of coordinated investment on regional industrialization and catch-up.\footnote{In the South, income per capita was almost 50 percent relative to the North in 1940, but near parity by 1980. Appendix Figure A1 shows the path of regional convergence between 1880 and 1980. Within the South, Alston and Hatton (1991) document an increase in the earnings gap between manufacturing and agriculture during the 1930s.} Empirically, the challenge is to identify the features of policies that lead to big push dynamics. For the United States, recent work examines the role of government in the industrialization of the American South (e.g., Holmes, 1998; Kitchens, 2014; Kline and Moretti, 2014). The efficacy of government intervention crucially depends on whether policy helps overcome barriers to technology adoption (Acemoglu, 1997; Parente and Prescott, 2005) or creates agglomeration economies (Duranton and Puga, 2004; Glaeser and Gottlieb, 2009). In this paper I quantify the effect of government intervention in the South as part of mobilization for World War II.

Between 1940 and 1945, the federal government made investments that
doubled the South’s capital stock (Deming and Stein, 1949). Over 1,500 projects were completed with investment in the region totaling nearly $1.6 billion in 1940 dollars. Relative to the typical prewar southern establishment these facilities were capital and skill intensive, and embodied more advanced technology. In the context of the big push hypothesis, wartime investment provided access to frontier technology that did not rely on local institutions for adoption and financing. In addition, although the historical setting is different in many ways from the subsidies used to promote local economic development today (see Story, Fehr, and Watkins, 2012), large-scale investment and rising wages in the postwar South provide essential elements for testing the efficacy of industrial-type policies and addresses a fundamental question regarding the sources of industrialization in the American South.

In this paper, I focus on whether investment in new facilities during World War II facilitated a big push by creating spillovers that attracted new manufacturing activity in the postwar period. This would have occurred if these facilities embodied new technology and forms of industrial organization relevant for peacetime or if war production helped develop thicker markets for intermediate inputs. The key question is whether wartime gains were long-lasting or ultimately outweighed by the fiscal costs, increased input prices, or disamenities associated with war production.

This paper uses newly digitized information on the value and location of manufacturing facilities constructed in the South between 1940 and 1945. I merge these data with aggregate information on manufacturing as well as detailed establishment data by sector at the county level. These data have two advantages. First, investment in structures is identified separately from
investment in equipment.\textsuperscript{2} This ensures that variation in the size of the war economy is due to facilities that remained in place, not equipment that could be redeployed at the end of the war.\textsuperscript{3} Second, sector-level data on establishments links variation in the size of the war economy locally not only to changes in aggregate manufacturing, but also the reallocation of activity across sectors. This is useful in the context of southern manufacturing, which tended to concentrate in resource-processing industries (e.g., textiles and lumber) prior to World War II.

The empirical analysis compares manufacturing outcomes in southern counties that were more exposed to the construction of new manufacturing facilities as a result of mobilization. The analysis includes prewar characteristics that capture local suitability for industrialization and changes in the southern economy during this period. After conditioning on these variables, counties with differential wartime investment exhibit similar prewar trends. The analysis then quantifies the size of the spillovers for postwar industrialization.

Mobilization for World War II generated substantial economic activity in the southern economy between 1940 and 1945. The South accounted for 32.6 percent of total investment and 13.3 percent of spending on prime contracts. However, from the war’s end until 1960 the results indicate no differential growth in aggregate manufacturing due to World War II. Within manufacturing, I find some evidence for reallocation of activity across sectors; immedi-

\textsuperscript{2}Bateman, Ros, and Taylor (2009) use variation in spending on infrastructure (e.g., roads, schools, water-works, power plants, dams, airfields, and hospitals) during World War II across states. In my empirical analysis, I exploit cross-county variation to focus on the impact of investment in new facilities.

\textsuperscript{3}There is a literature that documents a positive relationship between equipment investment and growth across countries (De Long and Summers, 1991). Within the United States equipment was potentially more footloose, which motivates my focus on investment in structures.
ately following the war the number of establishments in metals, transportation equipment, machinery, chemicals and rubber was higher. Ultimately, these effects were small, which suggests that investment during World War II played a limited role in changing the composition of industrialization.

These findings are consistent with work that emphasizes mismatch between military and civilian uses and high utilization rates during the peak war years (Field, 2011; Higgs, 1987; Rockoff, 2012) and also that wartime production achievements did not translate into growth outside the South (Fishback and Cullen, 2013; Rhode, 2003). In addition, the small magnitude is consistent with evidence that capital redeployed after demobilization from military conflicts sells at large discounts (White, 1980; Ramey and Shapiro, 2001).

Overall, mobilization for World War II did not generate the production-side spillovers that create regional industrial clusters and sustain long-run growth (Jacobs, 1984; Glaeser, Kallal, Scheinkman, and Shleifer, 1992; Saxenian, 1994; Henderson, 2003; Greenstone, Hornbeck, and Moretti, 2010). In the context of developing regions, the findings suggest that government investment in manufacturing capital is less effective in sparking structural transformation than labor market reforms, improvements in health and infrastructure, expansion of education, and increased agricultural productivity (see Alston and Ferrie, 1999; Goldin and Katz, 2008; Humphreys, 2001; Margo, 1990; Rhode and Olmstead, 2008; Wright, 2013).

2 Historical Background

In the antebellum period, rapid economic growth in the South was not accompanied by large-scale industrialization. After 1880, the southern economy changed. A national market emerged to support a growing cotton textile sector, along with other industries closely linked to resource extraction. At-
tracted by local boosterism, mill villages sprang up across the South and rates of urbanization increased (although never to rates comparable to the North). Throughout this period productivity, capital investment, and rates of new technology adoption remained low. As a result a diversified industrial economy that could serve as an engine of growth for the region did not emerge.

In the 1930s, persistent regional inequalities attracted the attention of national policymakers. During the New Deal, legislation was passed to address the regional imbalances. For example, the Agricultural Adjustment Act sought to raise agricultural prices and encourage modernization on the farm and the Tennessee Valley Authority aimed to improve infrastructure and provide cheap access to fertilizer and electricity. Still, in 1938, 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) and on the eve of World War II many observers concluded the South faced fundamental obstacles to economic development.

By the end of the war spending on supply contracts and investment in new facilities and equipment in the South was more than $20 billion. 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 gains were substantial relative to the prewar period. The southern trade magazine, *Manufactures’ Record*, routinely boasted, “South’s expansion breaks all records” (quoted in Schulman, 1991, p. 95). Capital expenditures in the South, which made up roughly one-tenth of the national total in the prewar period, nearly doubled during the war. In total, the South accounted

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4 Figure A2 plots the share of value-added by manufacturing in 1940 against the share of wartime capital expenditures for counties in the South and elsewhere. On average, the South received a share of investment spending greater than what would be predicted by its prewar share of manufacturing activity.
for 23.1 percent of wartime plant construction and 17.6 of expansions (US War Production Board, 1945; Deming and Stein, 1949).

In some industries the South enjoyed a particular boom. 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 synthetic rubber and both were available in the South. And although the iron and steel industry continued to concentrate in the cities of the Upper Midwest, new centers were established along the Gulf Coast. The war created at least temporary clusters in other industries as well (e.g., aircraft in Marietta, Georgia, shipbuilding in Panama City, Florida). In general, wartime expansion accounted for a large portion of newly available manufacturing capacity (Schulman, 1991; Combes, 2001).

The pace of industrial expansion during wartime led one observer to declare that by the end of the war, “The South. . .in January 1945 was no longer the nation’s No. 1 economic problem” (Rauber, 1946, p. 1). In addition, the changes in Figure 1 indicate clear differences. Still, the specific link between mobilization for World War II, increased economic activity during the war, and the growth of manufacturing in the South in the postwar period remains an open question.

3 Theoretical Framework

This paper quantifies the spillovers associated with new facilities construction during World War II. The motivation for the empirical analysis is twofold. First, there is a large literature that provides conditions for big push policies to lead to industrialization (see the survey by Azariadis and Stachurski, 2005). In one class of models, firms face uncertainty about the prospects for
Figure 1: Trends in Aggregate Manufacturing in the US South

A. Establishments
B. Employment
C. Wage Bill
D. Value-Added

Notes: Each panel shows the given variable relative to its value in 1919. The values in Panel C and Panel D are in 2014 dollars.

Source: Data are from Haines (2010).

revenue from industrialization to cover fixed costs. Under the control of a social planner, investment coordinated across many sectors alleviates this uncertainty and industrialization occurs. During the 1940s, the federal government exercised unprecedented control over economy-wide allocation of resources. The empirical question is whether investment during wartime was useful for overcoming the lack of industrialization in peacetime.

Second, coordinated investment may lead to industrialization if it creates agglomeration economies. In my setting, agglomeration-type spillovers may flow from new facilities if they embodied new technology and forms of indus-
trial organization relevant for peacetime or if war production helped develop thicker markets for intermediate inputs. Following the exposition in Hornbeck and Keskin (2015), a simple model illustrates the potential for spillovers between the war and postwar manufacturing.

The model has one manufacturing sector and firms in county $c$ choose labor $N_c$, capital $K_c$, and land $X_c$, to solve the following problem:

$$\max_{N_c, K_c, X_c} f(\omega_c, N_c, K_c, X_c) - p_c^N N_c - p_c^K K_c - p_c^X X_c$$

where $p_c^N$, $p_c^K$, and $p_c^X$ denote the price of labor, capital, and land, respectively. The $\omega_c$ term is a productivity shifter that is county-specific and, in part, depends on the number of new facilities constructed during mobilization for World War II. Manufacturing firms sell their output in international markets (normalized to one) and purchase capital services in international markets so $p_c^K$ is exogenous to local demand. The supply of land is fixed in each county $c$. The number of workers residing in $c$ determines local labor supply and workers’ indirect utility is a function of wages, the cost of housing, and the value of local amenities. Workers are freely mobile across counties.

During World War II manufacturing productivity increased due to wartime investment. After the war, capital owned by the government was sold off to private firms—usually at a discount—and firms redirected inputs toward output for consumer markets. In the absence of consumption disamenities or agglomeration spillovers, the increase in productivity due to mobilization for World War II increases labor demand and, correspondingly, wages and housing costs. Alternatively, the war may have led to deterioration in the quality of hospitals, schools, etc., and therefore offset the gains in productivity. The war may also have generated spillovers from improvements in worker training,
intermediate input markets, transportation, and technology, that continued to benefit manufacturers in the postwar period. As a result, wages may increase further to compensate for a decline in the value of consumption amenities or despite rising local input prices in response to the lasting benefits from the war economy.

To summarize the impact of mobilization for World War II, consider the change in manufacturing profits in the short run by taking the total derivative of profits with respect to war-related facilities construction assuming that firms are price takers and pay all inputs their marginal product:

$$\frac{d\Pi_c}{d\text{invest}_c} = \left( \frac{\partial f}{\partial \omega_c} \times \frac{\partial \omega_c}{\partial \text{invest}_c} \right) - \frac{\partial p^N_c}{\partial \text{invest}_c} N^* - \frac{\partial p^X_c}{\partial \text{invest}_c} X^*$$

(1)

The first term on the right-hand side of the equation above captures the net of the positive effects that work through improvements in worker training, intermediate input markets, transportation, and technology, and the negative effects that result from the deterioration of the quality of infrastructure, hospitals, schools, etc.

The last two terms capture the effect of direct changes in local input prices. The empirical analysis quantifies the size of spillovers from new facilities construction during World War II using data on aggregate manufacturing, the number of establishments and employment by sector. In addition, I also consider whether mobilization affected wages in manufacturing and the cost of housing.

To the extent that wartime investment facilitated a big push, I expect to see gains in the aggregate manufacturing outcomes as well as changes in the sectoral composition of manufacturing. Since I find no evidence of growth
in manufacturing activity due World War II, I provide evidence for reasons wartime mobilization did not lead to industrialization. In particular, I emphasize the role of control over the allocation of investment, the concentration of investment among a few firms, and the mismatch between technology relevant for military versus civilian uses.

4 Empirical Framework

4.1 Data

The data for the empirical analysis are drawn from several sources. First, county-level information on aggregate manufacturing, wholesale and retail trade, and the housing sector is taken from Haines (2010). In particular, I make use of information on manufacturing value-added, employment, and the number of establishments for manufacturing in 1919, 1929, 1939, 1947, 1954, and 1958. Similarly, for the wholesale and retail sectors I use information on total sales, employment, and establishments over the same period. Second, I digitized county-level information on the number of establishments by manufacturing sector from various years of the Census of Manufactures as well as the Industrial Market Data Handbook of the United States.

Third, I collected data on the location of investment in structures from War Manufacturing Facilities Authorized through December 1944 by State and County published by the War Production Board. These data provide the most comprehensive view of individual investment projects during mobilization for World War II. In particular, the fact that the data end in December 1944 is not too concerning since most new construction was already planned or underway by this time and these are included in War Manufacturing Facilities. These data also indicate whether the source of financing was directly public or private. Even when new establishments received financing directly from the
private sector, the owner still benefited from indirect government subsidies due to, for example, accelerated depreciation. For this reason, although the main results aggregate both types of investment, later in the paper I show the results for public and private investment separately as robustness.

Finally, to construct a measure of prewar manufacturing capacity related to military production I use the Industrial Mobilization Plan collected by Fishback and Cullen (2013). These data give the number of establishments assigned to each branch of the military in the event of war mobilization plans set up in the 1930s from the US Joint Army and Navy Munitions Board (1938). As additional county-level controls, I include information from 1940 on population density, the share of population living urban area as well as the foreign and African-American population shares from Haines (2010).

The empirical analysis uses counties in the southern states, which include Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, and Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. I include counties with at least one manufacturing establishment in each sample year, which results in a balanced panel of 1,074 counties. Figure 2 shows the city of each establishment constructed as part of mobilization for World War II overlayed on the 1920 county boundaries. The total number of investment projects in the South during World War II were 1,658. The map in Figure 2 indicates at least one facility was located in each state: Texas had the most at 437 and Delaware had the fewest at 35. For the empirical analysis I construct a county-level variable (invest\(_c\)) equal to the aggregate value of investment in 1940 dollars in each county \(c\).

\(^5\) I use Horan and Hargis (1995) to account for county border changes over time.
4.2 Specification and Identification

The empirical analysis quantifies the relative size of spillovers from investment in structures due to mobilization for World War II. Specifically, I regress a manufacturing outcome, $Y_{ct}$, for county $c$ and year $t$ on the total value of investment in new manufacturing facilities constructed during World War II:

$$
\ln Y_{ct} = \alpha_c + \alpha_{st} + \beta_t \ln(\text{invest}_c) + \Gamma_t X_c + \epsilon_{c,t}
$$

The variable $\text{invest}_c$ is interacted with year effects for each postwar year in the sample to trace out changes over time in the impact of World War II. This specification identifies investment in structures separately from investment in equipment that could be redeployed at the end of the war. I also examine the potential for non-linear effects of wartime investment due, for example, to
the fact that larger, coordinated investments on the part of government may facilitate technology sharing, learning, worker training, and the development of thicker input markets. In addition, I present robustness checks that control for other aspects of World War II mobilization and New Deal policies.

Equation 2 includes controls for prewar differences in county characteristics that may predict differential growth in the postwar period. The vector $X_c$ includes indicators for the number of facilities allocated under the Industrial Mobilization Plan. In particular, as part of preparation prior to the outbreak of World War II, war planners surveyed industrial capacity relevant for military production in the event of sudden mobilization. The survey gives the number of existing plants that would be fully or partially allocated for war production. That is, the survey indicates war-related capacity that existed (and would have continued to exist) in the absence of mobilization for World War II. Controlling for allocations under the Industrial Mobilization Plan enforces comparisons across counties with a similar prewar baseline and the variable of interest in equation 2 ($\text{invest}_c$) captures the effect of new investment due to World War II.

In addition, $X_c$ includes population density and the African-American, foreign, and urban shares of the county population in 1940. All characteristics are interacted with year fixed effects to allow for their impact to change over time. First differencing equation 2 controls for county characteristics that are time-variant. This will capture natural advantages such as access to natural resources as well as features of the transportation network that are fixed over the sample period. State-year effects control for unobserved differences at

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6For example, in addition to ports and inland waterways, the vast majority of the railroad network was fixed by the early 1920s. So to the extent that market access or access to other types of infrastructure were fixed over the sample period, county fixed effects adjust for these differences. Moreover, to avoid attributing regional development that followed the
the state level that impact regional industrialization. This is important in
the postwar period in the South where changes in state policy, e.g., following
the passage of Taft-Hartley in 1947, played a substantial role in the growth of
manufacturing (e.g., Holmes, 1998).

Table 1 presents summary statistics for the aggregate manufacturing
outcomes used in this study. Each column of Panel A shows the results from
regressing a manufacturing outcome (in log) measured in 1939 on the value
of World War II investment (in log). The results reveal differences between
counties in terms of prewar manufacturing and the extent of mobilization for
World War II. County fixed effects, state-year fixed effects, and controls for
allocations under the Industrial Mobilization Plan and 1940 county character-
istics included in equation 2 adjust for these differences. Importantly, Panel
B of Table 1 compares the prewar trends across counties, which show no sta-
tistically significant differences for any outcome. These results support the
validity of the postwar comparisons that are the focus of this paper.

To be clear, the identifying assumption is that in the absence of new facil-
ity investment during World War II, relative changes across southern counties
would have followed their prewar trajectory. In practice, this assumption is
violated if war planners decided the placement of new facilities with domes-
tic goals in mind. The discussion of the mobilization program by Koistinen
(2004), in particular, the centralized control in the military rather than the
civilian bureaucracy, suggests the location of new facilities was not motivated
by economic development objectives. Instead, planners aimed to maximize
production of standardized and relatively high quality products. In this case,
the concern is that characteristics correlated with planners’ ability to achieve

interstate highway system, Civil Rights, etc., with World War II, I end my analysis by the
1960s.
### Table 1: Prewar Differences by World War II Investment

<table>
<thead>
<tr>
<th></th>
<th>Est.</th>
<th>Emp.</th>
<th>Wage Bill</th>
<th>Value-Added</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>A. Prewar Levels</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln(invest&lt;sub&gt;c&lt;/sub&gt;)</td>
<td>0.0572</td>
<td>0.1155</td>
<td>0.1105</td>
<td>0.1054</td>
</tr>
<tr>
<td></td>
<td>(0.0101)</td>
<td>(0.0196)</td>
<td>(0.0200)</td>
<td>(0.0200)</td>
</tr>
<tr>
<td>B. Prewar Changes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln(invest&lt;sub&gt;c&lt;/sub&gt;) × t</td>
<td>0.0004</td>
<td>0.0017</td>
<td>0.0013</td>
<td>0.0013</td>
</tr>
<tr>
<td></td>
<td>(0.0004)</td>
<td>(0.0012)</td>
<td>(0.0013)</td>
<td>(0.0011)</td>
</tr>
</tbody>
</table>

**Notes:** The table presents differences across counties in terms of prewar aggregate manufacturing characteristics. Panel A shows the level difference in 1939 by the amount of World War II investment. The estimates in each column come from the same regression, which includes state fixed effects and county characteristics. Panel B shows the trend difference in 1919, 1929, and 1939 by the amount of World War II investment. The estimates in each column come from the same regression, which includes state-year and county fixed effects as well as county characteristics. Standard errors (in parentheses) are clustered at the county level. The number of sample counties is 1,074.

**Source:** For a description of the data and variables included as county characteristics see text of Section 4.1.

these objectives were also correlated with growth potential. Controls for industrial capacity that existed prior to 1940 and surveyed by the Industrial Mobilization Plan ensure that my estimates capture the effect due to actual mobilization.

### 5 Results

#### 5.1 Aggregate Manufacturing Outcomes

This section presents the results for postwar manufacturing growth. The panels of Table 2 show alternative specifications of equation 2 for manufacturing establishments (column 1), employment (column 2), wage bill (column 3), and value-added (column 4). In Panel A, the estimated effects with only year fixed effects indicate substantial differences before and after World War II so that a 10 percent increase in war-related investment is associated with be-
Table 2: Impact of World War II on Manufacturing

<table>
<thead>
<tr>
<th></th>
<th>Est.</th>
<th>Emp.</th>
<th>Wage Bill</th>
<th>Value-Added</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. controls: $\alpha_t$</td>
<td>0.069</td>
<td>0.128</td>
<td>0.140</td>
<td>0.148</td>
</tr>
<tr>
<td>$\ln(\text{invest}_c) \times \text{post}_t$</td>
<td>(0.007)</td>
<td>(0.011)</td>
<td>(0.011)</td>
<td>(0.011)</td>
</tr>
<tr>
<td>B. controls: $\alpha_c$, $\alpha_t$</td>
<td>-0.002</td>
<td>-0.006</td>
<td>-0.004</td>
<td>0.002</td>
</tr>
<tr>
<td>$\ln(\text{invest}_c) \times \text{post}_t$</td>
<td>(0.002)</td>
<td>(0.004)</td>
<td>(0.003)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>C. controls: $\alpha_c$, $\alpha_{st}$</td>
<td>-0.003</td>
<td>-0.007</td>
<td>-0.005</td>
<td>0.000</td>
</tr>
<tr>
<td>$\ln(\text{invest}_c) \times \text{post}_t$</td>
<td>(0.002)</td>
<td>(0.003)</td>
<td>(0.002)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>D. controls: $\alpha_c$, $\alpha_{st}$, $\mathbf{X}_c$</td>
<td>-0.001</td>
<td>-0.003</td>
<td>-0.003</td>
<td>0.001</td>
</tr>
<tr>
<td>$\ln(\text{invest}_c) \times \text{post}_t$</td>
<td>(0.001)</td>
<td>(0.002)</td>
<td>(0.003)</td>
<td>(0.003)</td>
</tr>
</tbody>
</table>

Notes: Each panel gives the results of estimating a version equation (2). The columns contain the results for different manufacturing outcomes: establishments (column 1), employment (column 2), wage bill (column 3), and value-added by manufacturing (column 4). Panel A includes year fixed effects. Panels B through D add county fixed effects, state-year fixed effects, and prewar county characteristics interacted with year effects, respectively. Standard errors (in parentheses) are clustered at the county level. The years included are 1919, 1929, 1939, 1947, 1954, and 1958. The number of sample counties is 1,074.

Source: For a description of the data and variables included as county characteristics see text of Section 4.1.

between a 0.6 and 1.5 percent increase across all outcomes. Panel B adds county fixed effects to focus on within-county deviations. This reduces the magnitudes to be economically small, statistically insignificant, and suggests that even without restricting comparisons to counties in the same state (Panel C) and including additional controls for prewar county characteristics (Panel D), war-related investment cannot explain the postwar growth of southern manufacturing observed in Figure 1. Moreover, the decrease in standard errors moving from Panel A to Panel D rule out even modest effects of war-related
Figure 3: Impact of World War II on Manufacturing by Year

A. Establishments

B. Employment

C. Wage Bill

D. Value-Added

Notes: Each panel plots the coefficients on $\beta_t$ from equation 2 for different manufacturing outcomes: establishments (Panel A), employment (Panel B), wage bill (Panel C), and value-added (Panel D). The dashed lines in each panel give the 90 percent confidence interval.

Source: Data are from Haines (2010).

The estimates in Table 2 reflect the average effect over the entire postwar sample period. These estimates may confound costly transition from the war years to 1947 with subsequent growth. To examine differences in the effect of war-related investment over time, Figure 3 shows the changes in each year based on estimating equation 2 and plotting the $\beta_t$ coefficients. The estimated changes provide some evidence for costly transition out of the war: the growth
in establishments, employment, the wage bill, and value-added is negative from 1939 to 1947. This is consistent with the literature regarding the pace of postwar reconversion and the mismatch between mobilization for war and peacetime industrialization (Koistinen, 2004; Higgs, 2006; Field, 2011; Rockoff, 2012).

However, the results for manufacturing growth in subsequent years show that industrialization did not follow in 1954 and 1958. For all outcomes the magnitudes of the estimated coefficients are small and statistically insignificant at the 10 percent level. Overall, the change in the number of establishments and employment does not reflect agglomeration to take advantage of learning across firms or thicker labor markets; changes in the aggregate wage bill do not indicate shifts in the composition of the manufacturing workforce; and changes in value-added reveal no moving up the value-added chain in the intermediate run. In terms of the mechanisms described in Section 3, the magnitudes in Table 2 and Figure 3 provide no evidence for World War II as a source of production-side spillovers for postwar industrialization.

So far, the log-log specification of equation 2 imposes a constant elasticity between investment and the manufacturing outcomes. This assumption may confound any differences across the distribution of outcomes and investment. For example, small amounts of investment have little effect on industrialization, while large-scale investment facilitates a big push. To examine this hypothesis, Figure 4 gives the results for local polynomial regressions of the growth in manufacturing value-added in each postwar year on war-related investment and year fixed effects.\footnote{For the panels of Figure 4, I drop counties for which World War II investment was equal to zero. The panels in Figure 4 look very similar when these counties are included.} That is, in terms of the included control variables this specification is similar to Panel B of Table 2. In each case,
Figure 4: Distribution for the Impact of World War II on Value-Added by Year

A. 1947

B. 1954

C. 1958

Notes: Each panel shows a local polynomial regression of growth of manufacturing value-added from 1939 to 1947 (Panel A), 1947 to 1954 (Panel B), and 1954 to 1958 (Panel C) on World War II investment and year fixed effects.

Source: For a description of the data see the text of Section 4.1.

there is no relationship between value-added and war-related investment at any point in the distribution.

In the context of the big push hypothesis, government intervention may not lead to industrialization for several reasons. For example, investment may be too concentrated among a few firms or sectors due to limited coordination. Tabulations of the investment data by company indicate that investment was highly concentrated. In the South, the top 15 companies, including Proctor & Gamble, DuPont, Douglas Aircraft, Alcoa, and Reynolds among others, re-
ceived 40 percent of all investment in structures; the median company received only $44,000 relative to upwards of $80 million for companies in the top ten percent of investment recipients. This suggests that despite providing a sizable shock to the South, large gains from mobilization were limited to a few firms.

In addition, World War II investment may have been too specific to military production or utilized to the point of near complete depreciation as a result of two- or three-shift runs during the mobilization period (Higgs, 2006; Field, 2011; Rockoff, 2012). This is consistent with the substantial discounts tabulated by White (1980, p. 104) that were applied to the sale of surplus property in the postwar period: his estimates as a share of initial spending range between 12 and 50 percent. This is also in line with evidence from Ramey and Shapiro (2001) for the reallocation of capital following a downturn in the aerospace industry in the 1990s due to demobilization from the Cold War.

Combes (2001) describes the efforts on the part of local politicians that led to the opening of a Bell Aircraft plant in Marietta, Georgia, in early 1942. The plant, which manufactured B-29s during the war, grew from 1,179 employees to 17,094 by the end of 1943 and eventually reached an employment peak above 20,000. In part, the tremendous growth of manufacturing reflected in this and other accounts of the wartime South (see Schulman, 1991) helped reinforce the view of structural transformation fueled by World War II investment. In the case of Bell Aircraft in Georgia and other newcomers to advanced manufacturing across the South, the war appeared to bring demand and training for new skills. Nevertheless, despite attempts to find a postwar use for the plant, $60 million in payroll disappeared and the building was converted to

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*From the investment data, this plant cost $36.8 million in 1940 dollars.*
storage for military surplus.

The plant in Marietta eventually housed operations for the production of the Lockheed C-130, C-141, and C-5, although “in contrast to a successful private sector manufacturer, the Marietta plant looks more like a mission-oriented federal laboratory...” (Combes, 2001, p. 39). The evidence so far suggests that the limited usefulness of the Marietta plant for peacetime industrialization applied to investment across the South. At the end of the war, the majority of production reverted to sale in private markets (i.e., not government procurement). In the absence of demand through government contracts, local entrepreneurs elected to return to prewar activities in non-manufacturing sectors and the influence on aggregate manufacturing in the long-run was limited.9

5.2 Robustness

Table 3 examines the robustness of the main results for aggregate manufacturing outcomes. Panel A of Table 3 reproduces the results from Panel D of Table 2. The remaining panels add controls for for the value of AAA spending, the whether a county was in the TVA service territory, the value of World War II spending on supply contracts, and the number of military bases, respectively, each interacted with a postwar dummy variable.

Prior to World War II, the onset of the Great Depression hit southern agriculture and industry hard. The price of cotton and other agricultural commodities plummeted and, as a result, farm incomes in 1929 were at their lowest level in three decades (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

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9I present evidence for the growth of non-manufacturing sectors in Section 5.4.
### Table 3: Robustness for Impact of World War II on Manufacturing

<table>
<thead>
<tr>
<th></th>
<th>Est. (1)</th>
<th>Emp. (2)</th>
<th>Wage Bill (3)</th>
<th>Value-Added (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. main result</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \ln(\text{invest}_c) \times \text{post}_t )</td>
<td>-0.001</td>
<td>-0.001</td>
<td>-0.003</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.005)</td>
<td>(0.007)</td>
<td>(0.007)</td>
</tr>
<tr>
<td><strong>B. control for AAA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \ln(\text{invest}_c) \times \text{post}_t )</td>
<td>-0.001</td>
<td>-0.001</td>
<td>-0.003</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.005)</td>
<td>(0.007)</td>
<td>(0.007)</td>
</tr>
<tr>
<td><strong>C. control for TVA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \ln(\text{invest}_c) \times \text{post}_t )</td>
<td>-0.001</td>
<td>-0.002</td>
<td>-0.003</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.005)</td>
<td>(0.007)</td>
<td>(0.007)</td>
</tr>
<tr>
<td><strong>D. control for WWII contracts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \ln(\text{invest}_c) \times \text{post}_t )</td>
<td>-0.001</td>
<td>0.001</td>
<td>-0.003</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.005)</td>
<td>(0.007)</td>
<td>(0.008)</td>
</tr>
<tr>
<td><strong>E. control for military bases</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \ln(\text{invest}_c) \times \text{post}_t )</td>
<td>-0.001</td>
<td>-0.002</td>
<td>-0.002</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.005)</td>
<td>(0.006)</td>
<td>(0.007)</td>
</tr>
<tr>
<td><strong>F. public vs. private</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \ln(\text{public}_c) \times \text{post}_t )</td>
<td>0.001</td>
<td>0.011</td>
<td>0.006</td>
<td>0.007</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.005)</td>
<td>(0.004)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>( \ln(\text{private}_c) \times \text{post}_t )</td>
<td>-0.002</td>
<td>-0.008</td>
<td>-0.008</td>
<td>-0.002</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.005)</td>
<td>(0.009)</td>
<td>(0.010)</td>
</tr>
</tbody>
</table>

**Notes:** Each panel gives the results of estimating a version of equation 2. The columns contain the results for different manufacturing outcomes: establishments (column 1), employment (column 2), wage bill (column 3), and value-added by manufacturing (column 4). Panel A reproduces the main results from Panel D of Table 2 and the remaining panels show estimates of equation 2 controlling for the value of AAA spending (Panel B), whether a county was in the TVA service territory (Panel C), the value of World War II spending on supply contracts (Panel D), and the number of military bases (Panel E), respectively, each interacted with a postwar dummy variable. Panel F shows the results of including investment by the source of financing separately. All columns include county fixed effects, state-year fixed effects, and prewar county characteristics interacted with year effects. Standard errors (in parentheses) are clustered at the county level. The years included are 1919, 1929, 1939, 1947, 1954, and 1958. The number of sample counties is 1,074.

**Source:** For a description of the data and variables included as county characteristics see text of Section 4.1.
in 1933, several pieces of legislation was passed to ameliorate problems arising from the economic downturn. For example, the Agricultural Adjustment Act (AAA) sought to reduce crop production and raise commodity prices through payments to farmers, while the Tennessee Valley Authority (TVA) worked to improve infrastructure and provide cheap access to electricity.

These policies along with technological change contributed to a reorganization of the southern economy that played out fully over the subsequent decades. For example, mechanization replaced 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 relations (Alston, 1981; Whatley, 1983). Throughout the 1930s 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). After the outbreak of World War II the TVA began to pursue a policy based on a close link between electricity, industrialization, and economic growth. As a result, it is important to control for differences in New Deal policy across southern counties that may also be correlated with differences in war-related investment. Panels B and C of Table 3 show after that including the value of AAA spending and access to electricity through the TVA, the results for the effect of investment are unchanged.

In addition to differences in New Deal policy, other aspects of mobilization for World War II may have played a role in the postwar growth of man-

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10 Structural transformation in the 1930s, including the contribution of other New Deal policies, natural disasters and the expansion of secondary education have received attention in the literature (e.g., Caselli and Coleman, 2001; Fishback, Horrace, and Kantor, 2005; Hornbeck and Naidu, 2014).

11 Kitchens (2014) and Kline and Moretti (2014) study the impact of TVA on manufacturing growth in the postwar period.
ufacturing. In particular, Schulman (1991) emphasizes government spending on supply contracts and the construction of military bases. Panels D and E of Table 3 add these variables and the results indicate no difference in the interpretation of the effect of investment. Finally, the results to this point treat investment as homogenous. However, across projects the direct source of financing was either public or private, which may indicate investments that were more (public) or less (private) subject to coordination and oversight.\textsuperscript{12} The results in Panel F allow the effect of investment to vary by the source of financing. Although there is some evidence that public investment led to gains aggregate manufacturing outcomes, the magnitudes tend to be economically small and only the coefficient with employment as the outcome is statistically significant.

5.3 Manufacturing Establishments by Sector

In the absence of aggregate manufacturing growth it is important to rule out more subtle changes in the composition of manufacturing establishments by sector. Particularly in the American South where industrial development prior to 1940 was concentrated in resource-processing industries (e.g., textiles, lumber products). In this context, although the previous results suggest that World War II did not create immediate or medium-run gains at the aggregate level, it may have led to the reallocation of establishments toward higher value-added sectors.

To assess the impact of war-related investment across manufacturing sectors, each column of Table 4 shows the results from regressions of the (log) number of manufacturing establishments in a given sector. Overall, there is

\textsuperscript{12}Deming and Stein (1949, p. 3, 12) describe how both privately and publicly financed project ultimately received some form of government subsidy indirectly through the accelerated depreciation provisions of the 1940 Second Revenue Act or directly.
Table 4: Impact of World War II on Establishments by Sector

<table>
<thead>
<tr>
<th>Sector</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ln(invest, t) × post, t</td>
<td>-0.0001</td>
<td>-0.0011</td>
<td>-0.0028</td>
<td>-0.0002</td>
<td>0.0047</td>
<td>0.0016</td>
</tr>
<tr>
<td>(0.0022)</td>
<td>(0.0025)</td>
<td>(0.0026)</td>
<td>(0.0019)</td>
<td>(0.0032)</td>
<td>(0.0020)</td>
<td></td>
</tr>
<tr>
<td>rubber</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln(invest, t) × post, t</td>
<td>0.0035</td>
<td>-0.0023</td>
<td>-0.0005</td>
<td>0.0100</td>
<td>0.0055</td>
<td>0.0061</td>
</tr>
<tr>
<td>(0.0019)</td>
<td>(0.0017)</td>
<td>(0.0027)</td>
<td>(0.0030)</td>
<td>(0.0029)</td>
<td>(0.0026)</td>
<td></td>
</tr>
</tbody>
</table>

Notes: The dependent variable in each column is the number of establishments in a given sector (in log) plus one. All columns include county fixed effects, state-year fixed effects, and prewar county characteristics interacted with year effects. Standard errors (in parentheses) are clustered at the state level. The years included are 1935, 1939, 1947, 1954, and 1958. The number of sample counties is 1,074.

Source: For a description of the data and variables included as county characteristics see text of Section 4.1.

little evidence that investment during World War II changed the composition of southern manufacturing during this period. The estimated magnitudes for metals, transportation equipment, machinery, chemicals and rubber are statistically significant, but economically small: moving from a county at the 25th percentile to a county at the 75th percentile of the distribution of war-related investment increases the number of establishments in these sectors from 1 to 3 percent.\(^{13}\)

These sectors represented a small share of southern manufacturing prior to the outbreak of World War II and expanded after 1940. The estimated effects are consistent with their role in the war effort (Deming and Stein, 1949). Importantly, these results suggest that despite the war’s limited role in regional development in the South and elsewhere, investment and government demand...
may have played a role in the growth of narrow industries. For example, this appears to have been the case in aluminum, synthetic rubber, and the mass production of aircraft, among others (Koistinen, 2004).

5.4 Population, Housing, and Wholesale and Retail Trade

Table 5 shows the results of replacing the left-hand side of equation 2 with measures of population, the cost of housing, available housing units, and activity in the wholesale and retail sectors. Columns 1 and 2 indicate positive and statistically significant increases in total and black population due to war-related investment, although the magnitudes were small: the change in investment implied by the interquartile range gives total and black population increases of 3.0 and 2.1 percent, respectively. This difference suggests a stronger migration response among whites and is supportive of the idea that southern elites were able to maintain agricultural labor supply, even during mobilization (Wright, 1986; Alston and Ferrie, 1999). The results in columns 3 through 5 indicate little change in the number of available non-farm units. Columns 4 and 6 point toward no change in the value of owner-occupied units or monthly rent.

Columns 7 through 12 of Table 5 show the results for wholesale and retail trade. From columns 7, 9, and 11, the war’s effect on wholesale was limited. The effects on the retail sector in columns 8, 10, and 12, are positive and, for employment and sales, statistically significant. Still, the relative magnitudes are small. In the context of a spatial equilibrium model, increases population without offsetting decreases in wages or increases in housing prices suggest increases in local productivity. Thus, the results of this paper suggest that gains in local productivity following World War II are due to growth in non-manufacturing sectors as opposed to industrialization.
Table 5: Impact of World War II on Non-Manufacturing Outcomes

<table>
<thead>
<tr>
<th>Population:</th>
<th>Owned:</th>
<th>Rented:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (1)</td>
<td>Units (3)</td>
<td>Units (5)</td>
</tr>
<tr>
<td>Black (2)</td>
<td>Value (4)</td>
<td>Rent (6)</td>
</tr>
<tr>
<td>ln(war_c) \times post_t</td>
<td>0.010</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>Establishments:</td>
<td>Employment:</td>
<td>Sales:</td>
</tr>
<tr>
<td>Wholesale (7)</td>
<td>Retail (8)</td>
<td>Wholesale (9)</td>
</tr>
<tr>
<td>ln(war_c) \times post_t</td>
<td>0.010</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.009)</td>
</tr>
</tbody>
</table>

Notes: The dependent variable in each column is a non-manufacturing outcome (in log). Columns 1 and 2 use total and black population; Columns 3 and 4 use the number of units and value of owned dwellings; Columns 5 and 6 use the number of units and contract rent for rented dwellings; the remaining columns use the number of establishments, employment, and value of sales in wholesale and retail, respectively. All columns include county fixed effects, state-year fixed effects, and prewar county characteristics interacted with year effects. Standard errors (in parentheses) are clustered at the state level. The years included in columns 1 through 6 are 1929, 1939, 1949, and 1959; the years included in columns 6 through 12 are 1929, 1939, 1948, and 1958. The number of sample counties is 1,074.

Source: For a description of the data and variables included as county characteristics see text of Section 4.1.

6 Conclusion

What is the role of economic policy in regional development? In the presence of barriers to technology adoption or the absence of incentives to undertake risky investment, a big push on the part of government may help resolve existing market failures and facilitate industrialization. This paper examines the big push hypothesis in the context of large-scale government investment in the American South during World War II.

Prior to 1940 the development of the South lagged behind the rest of the country. Mobilization for World War II stimulated demand for industrial goods and infused the region with substantial investment in manufacturing.
Using newly digitized data on the location and value of investment, I find no evidence of growth in manufacturing activity due to World War II. These findings are in line with evidence for the impact of the war outside of the South and consistent with the idea of specificity for capital redeployed from military uses. The war did lead to a modest reallocation for establishments across industries, but this had not increased manufacturing value-added by 1960. Population increased in counties that received more war-related investment and non-manufacturing sectors expanded. These factors may have partially contributed to convergence between southern and non-southern states.

In contrast to the siting of large plants studied more recently (Greenstone, Hornbeck, and Moretti, 2010) or electrification under the Tennessee Valley Authority (Kline and Moretti, 2014), government investment during World War II did not generate the production-side spillovers that lead to industrialization and sustain long-run growth. The South industrialized in the second half of the twentieth century, but this was not the result of a big push. Instead, changes to labor markets and agriculture, improvements in health and infrastructure, expansion of education are more likely explanations for the region’s industrialization.
References


Carl Kitchens. The Role of Publicly Provided Electricity in Economic De-
velopment: The Experience of the Tennessee Valley Authority, 19291955.


US Joint Army and Navy Munitions Board. *Industrial Mobilization Plan:*


A Additional Figures & Tables

Figure A1: Income Per Capita in Southern and Non-Southern States

Notes: The figure shows income per capita for southern (solid) and non-southern states (dash) from 1890 to 1980.
Notes: Each point indicates a county with given share of value-added by manufacturing in 1939 and given share of war-related investment. The solid (empty) dots indicate counties from southern (non-southern) states; solid (dashed) lines indicate the best linear fit through the southern (non-southern) dots. Counties with more than 0.5 percent of 1939 value-added or war-related investment are dropped; the figure looks similar when these counties are included.

Source: Data on the value-added by manufacturing in 1939 and wartime investment are drawn from Haines (2010).