



The long-run effects of government spending on structural change: Evidence from Second World War defense contracts

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HIGHLIGHTS

- We study the long-run effects of WWII defense spending on structural change.
- Wartime spending led to labor reallocation across sectors in war production centers.
- Structural change contributed to the long-term population growth in those regions.

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ABSTRACT

This paper studies the long-run effects of the largest government spending program in U.S. history – Second World War defense spending – on structural change in local economies. We link a dataset of war supply contracts with economic data at the county level spanning from 1930 to 2000. Using counties that received no defense spending as a comparison group and controlling for prewar characteristics, we find that wartime defense spending led to sustained reallocation of labor to manufacturing and other non-agricultural sectors in war production centers, contributing to the long-term population growth in those regions.

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1. Introduction

In this paper we exploit cross-sectional variation in the single largest public spending program in U.S. history – World War II (WWII) defense spending – and estimate its long-run effects on structural change in local economies.¹ We link a dataset of war supply contracts during WWII with data on the long-run growth of U.S. counties from 1930 to 2000. Using regions that obtained few or no defense contracts as a control group and controlling for prewar economic and geographic features, we find that defense spending led to sustained gains in employment in manufacturing and other non-agricultural sectors, contributing to the long-term population growth in war production centers.

We contribute to the economic history literature on the effects of war spending programs. Fishback and Cullen (2013) examine the medium-term effects of wartime spending on local economic development between 1939 and 1958, while (Fishback and Jaworski, 2016) focus on the longer term from 1960 to 2000. They found that war activities were correlated with faster population growth but not with per capita income or median house values in local economies. Different from those studies, we investigate the mechanism underlying the population growth effects by analyzing the long-run impacts of war expenditures on structural change in local economies. We also contribute to the literature on how place-based policies shape economic geography. Related to our paper is (Kline and Moretti, 2014), who study the long-term effects of a regional program, the Tennessee Valley Authority (TVA), on local economic development. Compared to the TVA, the government program we examine was much larger in scale.

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¹ Expenditures on defense contracts and infrastructure reached nearly 50 percent of gross domestic products at its peak.

Table 1
Summary statistics of pre-WWII regional characteristics.

| | Treated counties | Control counties |
|--------------------------------|------------------|------------------|
| 1930 characteristics | | |
| Log population | 9.904 | 9.453 |
| Log employment | 8.888 | 8.41 |
| Log number of houses | 8.441 | 7.981 |
| Log average manufacturing wage | 1.725 | 1.686 |
| Manufacturing employment share | 0.077 | 0.037 |
| Agricultural employment share | 0.475 | 0.584 |
| % White | 0.856 | 0.87 |
| % Urban | 0.223 | 0.088 |
| % Illiterate | 0.056 | 0.055 |
| % Whites foreign born | 0.041 | 0.044 |
| Log average farm value | 5.546 | 5.369 |
| % households owning radio | 0.241 | 0.232 |
| Max elevation (meters) | 2223.545 | 2390.087 |
| Elevation range (max–min) | 1516.308 | 1422.421 |
| Changes 1920–1930 | | |
| Log population | 0.045 | 0.002 |
| Log employment | 0.095 | 0.056 |
| Log number of houses | 0.085 | 0.046 |
| Log average manufacturing wage | 0.196 | 0.171 |
| Manufacturing employment share | –0.029 | –0.026 |
| Agricultural employment share | –0.046 | –0.038 |
| Number of observations | 869 | 1105 |

Note: The treated counties correspond to those that received WWII war supply contracts whose value exceeds \$50,000. To better balance the treated and control groups, we drop counties whose pre-WWII characteristics yield a predicted probability of treatment higher than 95% or lower than 5%. All monetary values are in constant 2000 USD.

2. Data

We digitized the universe of WWII supply contracts greater than \$50,000 from volumes originally issued by the Civilian Production Administration (formerly the War Production Board). These data include all contracts greater than \$50,000 issued between June 1940 and September 1945. Our measure of government defense spending for this study is the aggregate monetary value of war supply contracts and facility projects in each county during that period. Fig. 1 shows the geographic distribution of wartime defense spending per capita across counties, which shows considerable cross-sectional variation.

Data on county characteristics come from a variety of sources as used in Kline and Moretti (2014), including the Census of Population and Housing and Agricultural Census. Table 1 shows summary statistics of key economic and geographic variables for our study. Treated counties correspond to those that received war supply contracts valued more than \$50,000, whereas the rest of the country is the control group. Treated counties were more densely populated and had higher manufacturing employment. This is not surprising because war supply contracts were allocated to companies based primarily on production speed (Fishback and Cullen, 2013), and thus counties with a larger manufacturing base possessed a comparative advantage in obtaining the funds. It is, therefore, important to control for prewar characteristics across regions when analyzing the impact of wartime spending on sectoral development.

3. Econometric model

To identify the long-term effects of wartime spending on the structural change in the local economy, we compare economic outcomes of treated counties with those of control counties with similar prewar characteristics. Specifically, we estimate the following regression model:

$$y_{i,t} - y_{i,t-1} = \alpha + \beta \text{Treat}_i + X_i \gamma + \delta_s + (\epsilon_{i,t} - \epsilon_{i,t-1}), \quad (1)$$

where $y_{i,t} - y_{i,t-1}$ is the change between period t and $t + 1$ in the relevant dependent variables at county i such as population, the number of houses, employment across sectors (agricultural, manufacturing, and other non-agricultural), and average manufacturing wages. Treat_i is an indicator for “treatment” counties that received war supply contracts whose total value exceeds \$50,000, X_i is a vector of prewar regional characteristics, and δ_s are state fixed effects. β is the coefficient of interest.

Similar to the analysis of the TVA by Kline and Moretti (2014), we control for a rich set of 27 variables related to pre-WWII economic, social, demographic, and geographical characteristics in 1920 and 1930. These covariates account for pre-war differences not only in levels between treated and control counties but also in trends.² To better balance the treated and control groups, we drop counties whose pre-WWII characteristics yield a predicted probability of treatment higher than 95% or lower than 5%.³

4. Results

4.1. Placebo test

We first conduct a placebo test by estimating the “effects” of defense spending on 1900–1930 changes in population, housing units, employment in agricultural, manufacturing, and other non-agricultural sectors, and manufacturing wages. This test attempts to detect whether, conditional on the control variables, the outcome variables exhibit differential trends before WWII across treated and control counties. Because that time period predates WWII, a finding of significant effects would indicate selection biases. The results in Table 2 show no statistically or economically significant effects on all outcome variables, suggesting that our control variables capture the bulk of selection biases. Of course, this test is based on only observable characteristics and cannot completely rule out the possibility that treated counties possess some unobservable features that may affect their economic development. It is reassuring, however, that we find no significant effects across all outcome variables.

4.2. Long-run effects

Table 3 estimates the long-run effects of WWII spending on the growth of population, housing units, employment in agricultural, manufacturing, and other non-agricultural sectors, and manufacturing wages. The table shows the impacts on decadal changes in these outcomes between 1930 and 2000, six decades after the war ended and wartime spending subsided. Column (1) shows that counties that received war supply contracts experienced a population growth rate (per decade) that was 2.5% higher than control counties. The faster population growth in treated regions is reflected in the more rapidly increasing (by 2.2%) stock of housing units, as shown in column (2). The results in population growth and housing units are consistent with the findings in Fishback and Jaworski (2016). Columns (3)–(5) investigate the underlying mechanism via the effects of war spending

² Specifically, the covariates include a quadratic in 1920 and 1930 log population and interactions; 1920 and 1930 urban share; 1920 and 1930 log employment; a quadratic in 1920 and 1930 agricultural employment share; a quadratic in 1920 and 1930 manufacturing employment share; 1920 and 1930 log wages in manufacturing; dummies for 1920 and 1930 wages in manufacturing or trade being missing; 1920 and 1930 farm values, owner-occupied housing values and rental rates; a quadratic in 1920 and 1930 white share; the share of the population age 5 or above that are illiterate in 1920 and 1930; the 1920 and 1930 share of whites who are foreign-born; the 1930 share of households with a radio; the 1930 unemployment rate, maximum elevation, and elevation range.

³ As a robustness check, we also do so for 90%/10% cutoffs and find the results to be highly similar.

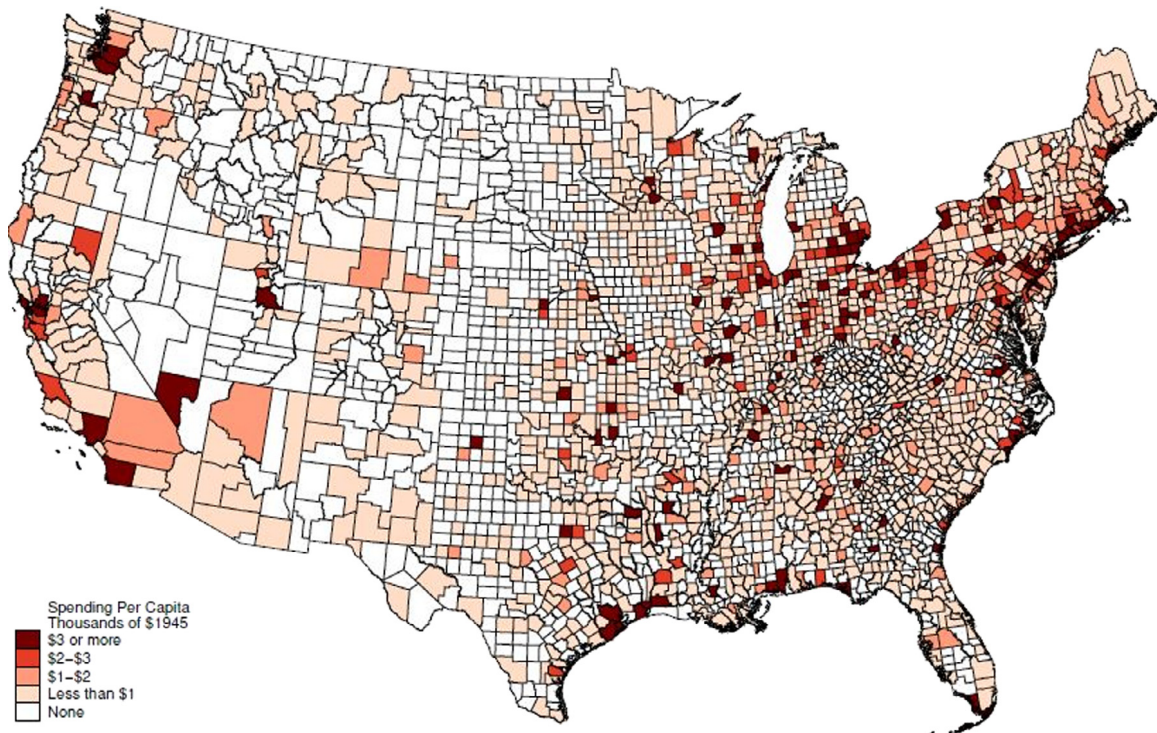


Fig. 1. Geographic distribution of county-level defense spending.

Table 2
Decadalized impact on growth rate of outcomes, 1900–1930.

| Outcome | Pop. | House | NO. Ag. Emp. | Manuf. Emp. | Other Emp. | Manuf. Wage |
|----------|-------------------|-------------------|------------------|------------------|-------------------|------------------|
| Estimate | −0.009 (0.006) | −0.010 (0.006) | 0.000 (0.008) | 0.015 (0.020) | −0.006 (0.010) | 0.005 (0.004) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| State FE | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 1822 | 1822 | 1805 | 1246 | 1796 | 1797 |

Note: This table shows a placebo test for the treatment effect on the growth rate between 1900 and 1930 (defined as the log difference between 1930 and 1900 levels divided by three) of population, the number of houses, average manufacturing wage, agricultural employment, and manufacturing employment. The treated counties correspond to those that received WWII war supply contracts whose value exceeds \$50,000. To better balance the treated and control groups, we drop counties whose pre-WWII characteristics yield a predicted probability of treatment higher than 95% or lower than 5%. As a robustness check, we also do so for 90%/10% cutoffs and find the results to be highly similar. Standard errors are clustered at the state level: * significance at 10% level, ** at 5%, *** at 1%.

on structural change in local economies. The defense program did not appear to have affected agricultural employment in the long term, whereas it increased manufacturing employment by 1.7% per decade and other non-agricultural employment by 2.6%. The sustained effect on the growth in manufacturing may be due to the fact that plants once producing military supplies during the war were converted to civilian purposes after the war ended, or that the massive scale of defense contracts raised the productivity in the manufacturing sector in treated regions via agglomeration forces. These positive effects may also spill over to other non-agricultural sectors such as services. There is little evidence, however, that wartime defense spending changed manufacturing wages significantly. Although an expansion of the manufacturing sector in treated regions raised labor demand, the increased labor supply might have kept the wage unchanged compared to control regions. Taken together, our results suggest that WWII spending had a sizable impact on structural change, leading to substantial

Table 3
Decadalized impact on growth rate of outcomes, 1930–2000.

| Outcome | Pop. | House | NO. Ag. Emp. | Manuf. Emp. | Other Emp. | Manuf. Wage |
|----------|---------------------|---------------------|------------------|--------------------|---------------------|------------------|
| Estimate | 0.025*** (0.005) | 0.022*** (0.005) | 0.006 (0.004) | 0.017** (0.007) | 0.026*** (0.005) | 0.002 (0.002) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| State FE | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 1974 | 1974 | 1974 | 1974 | 1973 | 1237 |

Note: This table shows the treatment effect on the growth rate of outcome variables between 1930 and 2000 (defined as the log difference between 2000 and 1930 levels divided by seven). The treated counties correspond to those that received WWII war supply contracts whose value exceeds \$50,000. To better balance the treated and control groups, we drop counties whose pre-WWII characteristics yield a predicted probability of treatment higher than 95% or lower than 5%. As a robustness check, we also do so for 90%/10% cutoffs and find the results to be highly similar. Standard errors are clustered at the state level: * significance at 10% level, ** at 5%, *** at 1%.

reallocation of labor to manufacturing and other non-agricultural sectors in war production regions.

4.2.1. Effects by period

Table 4 shows the impacts of wartime defense spending on structural change in local economies by period: 1930–1960 and 1960–2000. The differences in the estimated effects between the two periods are striking. In the earlier period the 10-year growth rate of population and number of houses were 3.3% higher in regions that obtained wartime defense contracts than the rest of the country. In the later period those estimates drop to 1.8%. Also noteworthy is the estimated effect on employment across sectors over the two periods. In the 1930–1960 period, the decadal growth rate of agricultural employment was 1.4% slower in treated regions, while the rates were 5.2% and 4% higher for the employment in manufacturing and other non-agricultural sectors, respectively. This evidence suggests that in the two decades immediately following WWII there was a reallocation of labor from agriculture to manufacturing and other non-agricultural sectors. The reduction of the growth rate of agricultural employment in

Table 4
Decadalized impact on growth rate of outcomes by period.

| Outcome | Pop. | House NO. | Ag. Emp. | Manuf. Emp. | Other Emp. | Manuf. Wage |
|--------------|---------------------|---------------------|--------------------|---------------------|---------------------|--------------------|
| A: 1930–1960 | | | | | | |
| Estimate | 0.033*** (0.006) | 0.028*** (0.006) | −0.014* (0.008) | 0.052*** (0.018) | 0.040*** (0.007) | 0.009** (0.004) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| State FE | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 1974 | 1974 | 1974 | 1972 | 1974 | 1693 |
| B: 1960–2000 | | | | | | |
| Estimate | 0.018*** (0.005) | 0.017*** (0.005) | 0.020** (0.009) | −0.010 (0.007) | 0.016** (0.006) | −0.004 (0.004) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| State FE | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 1974 | 1974 | 1974 | 1972 | 1973 | 1156 |

Note: This table shows the treatment effect on the growth rate of outcome variables by periods (1930–1960 and 1960–2000). The treated counties correspond to those that received WWII war supply contracts whose value exceeds \$50,000. To better balance the treated and control groups, we drop counties whose pre-WWII characteristics yield a predicated probability of treatment higher than 95% or lower than 5%. The standard errors are clustered at the state level: * significance at 10% level, ** at 5%, *** at 1%.

treated regions was regained in the 1960–2000 period, making the overall long-run effect negligible, as shown in Table 3. While the increases in the employment growth in manufacturing and other non-agricultural sectors were mostly concentrated in the earlier period, those gains were sustained in later decades long after the war ended (they rose slightly further for other non-agricultural sectors). In terms of manufacturing wages, we find only a small effect of about 1% in the earlier period, which dissipated in the later part of the 20th century.

5. Conclusion

This paper estimates the long-term impacts of WWII defense spending on structural change in local economies in the U.S. We find that wartime expenditure had long-lasting effects on the reallocation of labor to manufacturing and other non-agricultural sectors in war production centers, contributing to the long-run population growth in those regions.

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Conflict of interest

The authors declare no conflict of interest.

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