After the War

Wartime Saving and Postwar Housing Investment, 1946–1950

NBER Summer Institute, DAE

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July 10, 2019

Research Question

How did the unprecedented accumulation of liquid assets by households during WWII influence the post-WWII economy?

Bigger underlying questions:

- Was the post-WWII boom fueled by the war, and if so, through what mechanisms?
- Did wartime rationing lead to a delayed stimulus from WWII spending?
- Possible interpretation as a behavioral experiment with forced saving

Data and Approach

- I use geographic variation to identify the effects of wartime saving (measured as change in deposit holdings plus bond purchases)
- Because wartime saving may be endogenous, I will instrument for wartime saving using war production spending
- Two data sets:
  - County-level data from *decennial censuses* and *county data books*, aggregated to commuting zones
  - Household data from the *Surveys of Consumer Finance* (1947–1951)

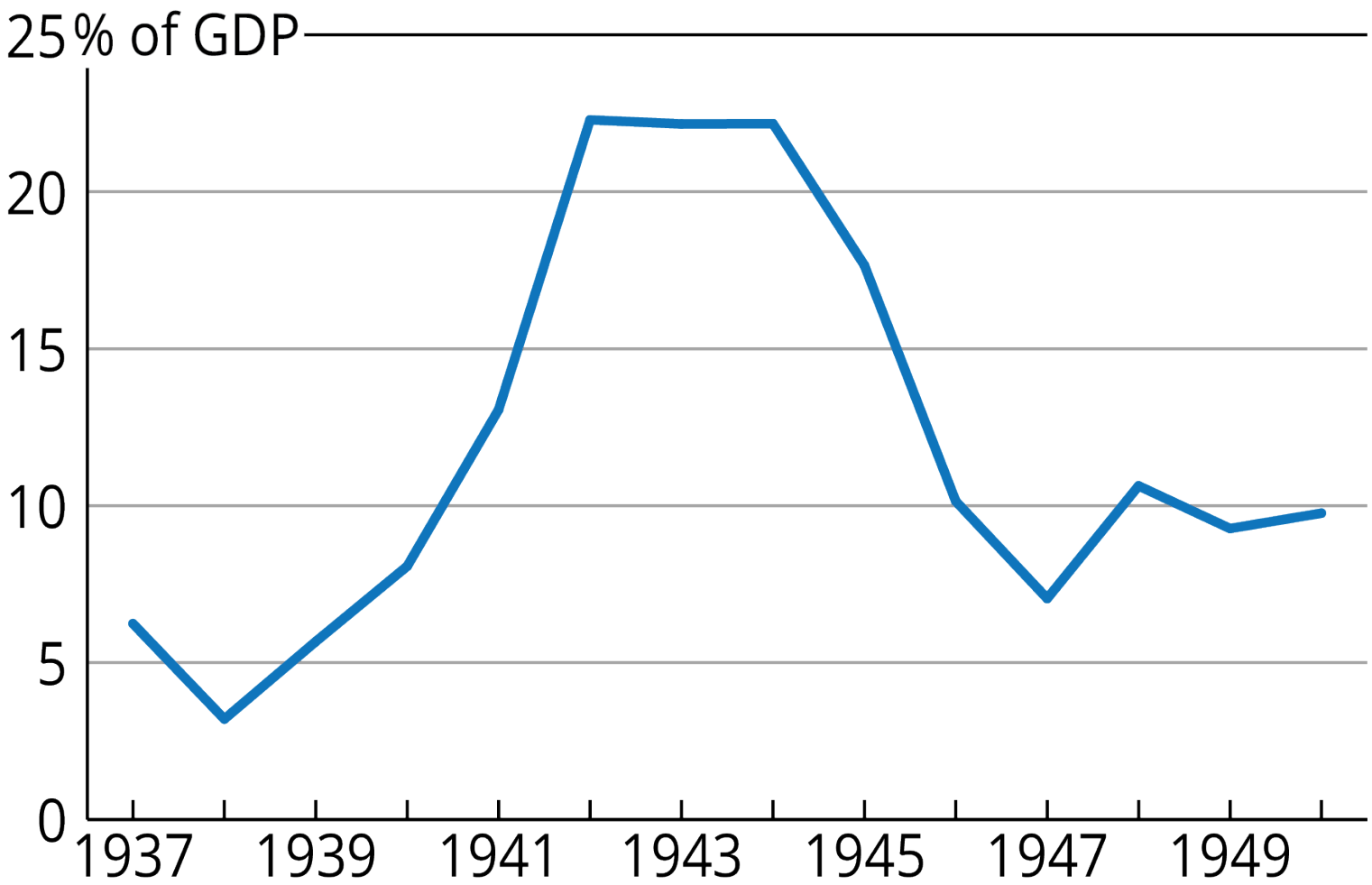
Preview of Results

Wartime saving fueled postwar housing investment:

- A 10% increase in wartime saving is associated with a 2.9–6.2% increase in the number of housing units in a commuting zone over 1940–50
- Increase in the number of housing units is accompanied by increase in housing quality (bathrooms)
- Household data also shows a relationship between wartime saving and recent (postwar) home purchases
- Back-of-the-envelope from CZ data: \$3,000 to \$4,100 in wartime saving associated with each additional housing unit

I. Overview of Wartime Saving

Net Private Saving (United States)



Source: Bureau of Economic Analysis

Motives for Wartime Saving

Excess household saving (relative to trend) averaging 5.1% of GDP per year over 1941–1945

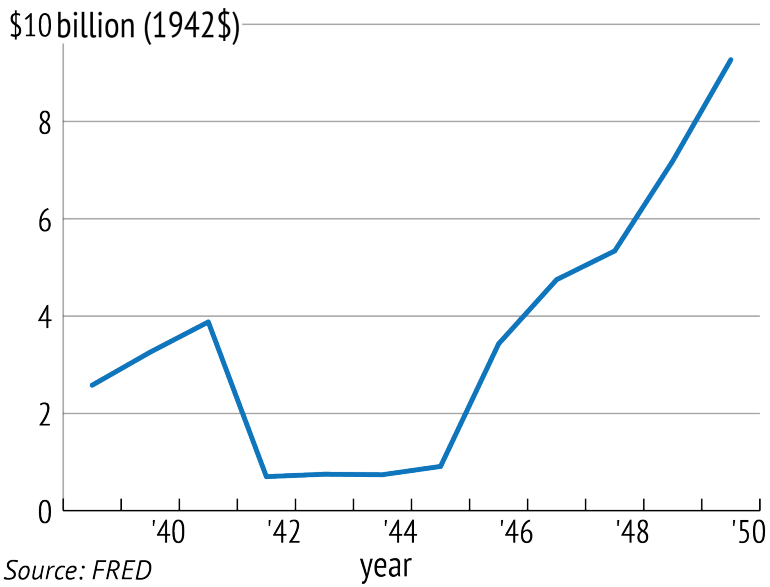
What explains wartime savings behavior?

- Patriotism: buying war bonds was a concrete way to help the war effort, support troops overseas, etc.
- Payroll deductions for war bond purchases (tax incentive, high salience) ⇒ high participation More
- Extensive advertising campaign
- Ricardian motive: large public debt increases to pay for war
- Conversion meant durable goods were not produced ⇒ households couldn't buy durables when incomes increased

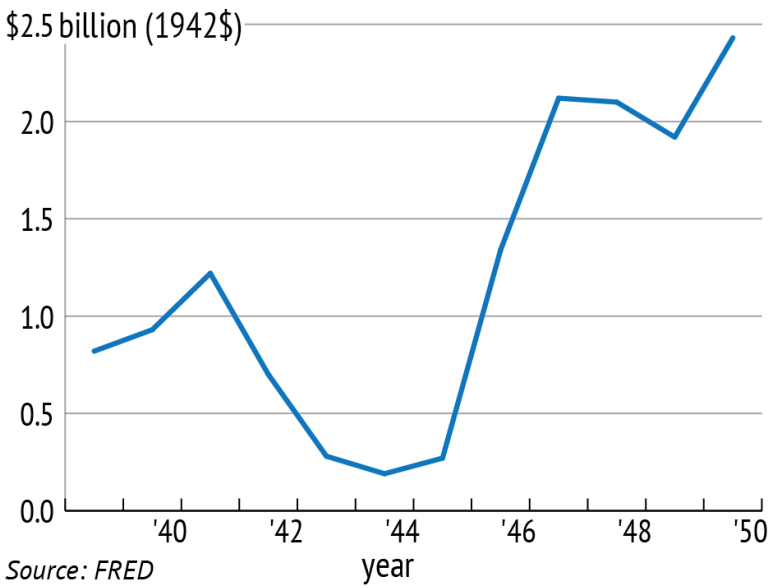
Scale of War Spending and WWII Economy

Binding Constraints on Wartime Durables Consumption

Motor Vehicle Purchases



Household Appliance Purchases



Both figures show aggregate consumer spending for the U.S.

War/Victory Bonds

War bond purchases totaled $49 billion over 1941–1945

- Equivalent to ∼$760 billion in today's dollars
- Represents over 30% of net private saving over 1941–45
- 72% of these bond purchases were Series E bonds, which could *only* be purchased by households
- Extremely broad participation: over 85 million Americans bought war bonds, over 60% of the US population

Deposit Holdings

Deposit holdings increased by almost $60 billion over 1941–1945

- Equivalent to ∼$930 billion in today's dollars
- Represents over 35% of net private saving over 1941–45
- 64% of increase in demand deposits, remainder (36%) in time deposits

Role of Inflation

- Inflation likely eroded the real value of wartime savings, but was not high enough to erase them
- Prices rose 40% between 1945 and 1950
- Higgs (1992) argues that official statistics overstated post-WWII inflation because they understated wartime inflation

II. Data & Naïve Approach

Two Complementary Data Sets

- County-level data from *decennial censuses* and *county data books*, aggregated to commuting zones
  - aggregate effects for geographic areas
  - using CZs reduces noise given firm-level treatments and household-level outcomes Why CZs? Summary Data by CZ
- Household data from the *Surveys of Consumer Finance* (1947–1951)
  - clearer timing: HH data captures only home purchases in/after 1946
  - allows finer controls for demographic variables Summary Data
- wartime saving (or war spending) is only ever measured at the local level

Naïve Approach

Naïve asumption: imagine wartime saving is exogenous. Estimate:

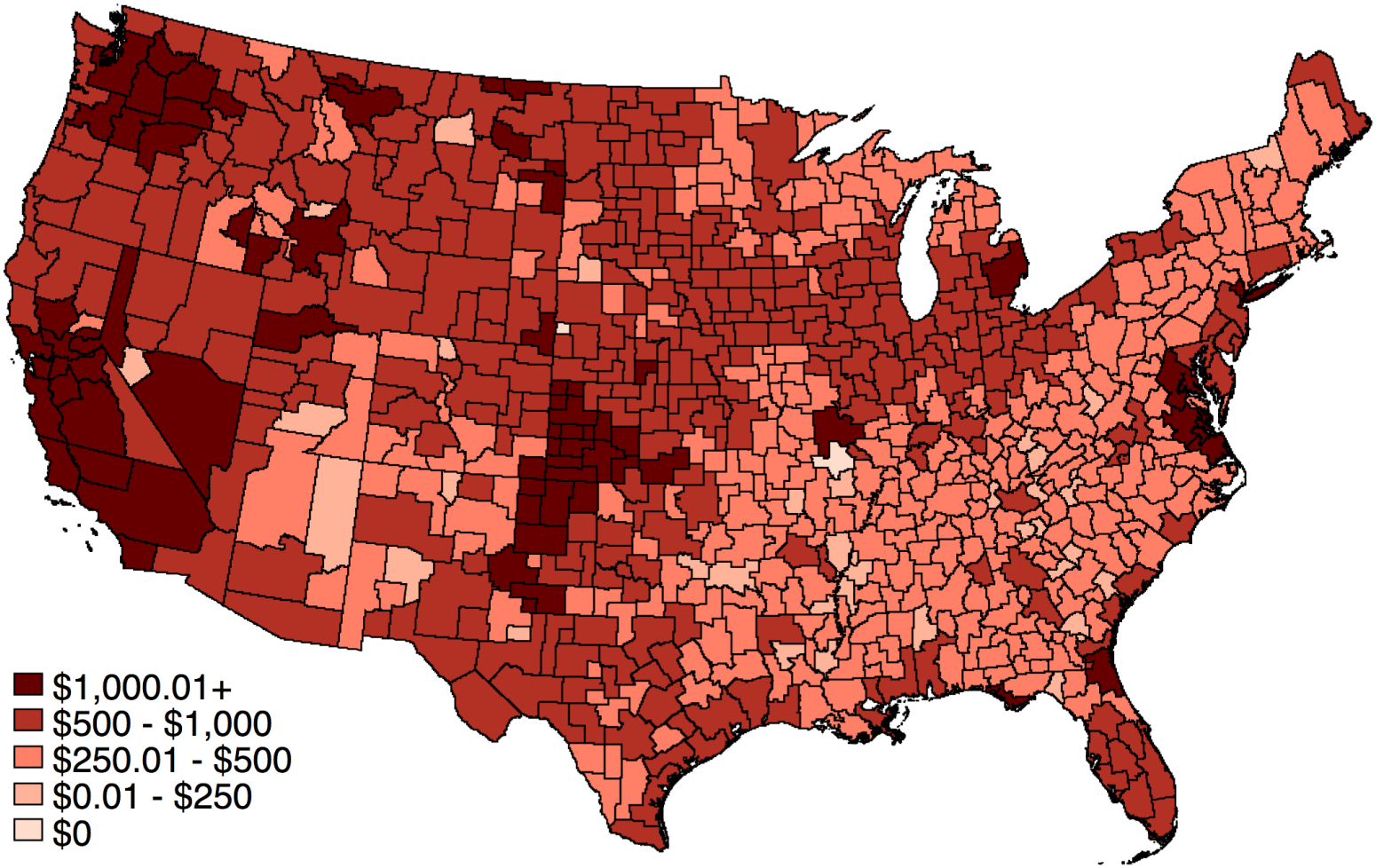
$$y_i = \alpha + \beta w_i + \gamma' X_i + \epsilon_i \tag{1}$$

where

- y_i is outcome y for geographic area i
- w_i is total wartime saving in area i, divided by the county's 1940 adult population (21+)
- X_i is a vector of controls, including:
  - area i's 1939 manufacturing employment rate
  - fraction of area i's population living on rural farms in 1940
  - area's change in population over 1930–940
  - state fixed effects*

* Multi-state CZs are assigned to states according to which state contains the largest city in the CZ

Variation in Saving Across Commuting Zones



estimated per capita saving during WWII, in thousands of 1950 dollars

Wartime Saving, Housing, and Durables

	# Housing Units (HU)	% HU w/ modern bathrooms	% HU w/ modern fridge	# Cars registered
Wartime saving	0.294***	0.113***	0.110**	0.0140**
	(0.0403)	(0.0240)	(0.0536)	(0.00658)
1939 mfg employment	0.0148	0.0402	0.0910	-0.00642
	(0.0698)	(0.0258)	(0.0597)	(0.0211)
% pop rural farm 1940	-0.299***	-0.0645*	0.0324	0.0728***
	(0.0549)	(0.0378)	(0.0743)	(0.0128)
1941 deposits	-0.0417	-0.00439	-0.0196	-0.0260***
	(0.0490)	(0.0152)	(0.0750)	(0.00881)
Population change '30–'40	0.00269***	0.000314**	-0.000286	-0.000172**
	(0.000959)	(0.000137)	(0.000396)	(6.59e-05)
# Housing Units '40	0.986***			
	(0.00771)			
HU w/ modern bathrooms '40		0.748***		
		(0.0449)		
HU w/ electric fridge '40			0.707***	
			(0.0824)	
# Cars registered '39				0.806***
				(0.0324)
Observations	761	761	761	761
R-squared	0.992	0.950	0.770	0.912

Data come from the decennial censuses and the County Data Books. 1941 bank deposits were provided by Paul Rhode, 1939 car registrations by Paul Rhode and Josh Hausman. Population, employment, liquid assets, and car registration variables are measured as fractions of the adult population in the nearest decennial census year. The inverse hyperbolic sine transformation is used for all dollar amounts and measurements not bounded by [0,1]. State fixed effects estimated but not shown. Standard errors

Obvious Problem

Wartime Saving may be endogenous

$\Rightarrow$ Solution: instrument for saving

III. Instrumenting for Wartime Saving

Proposed instrument: war spending

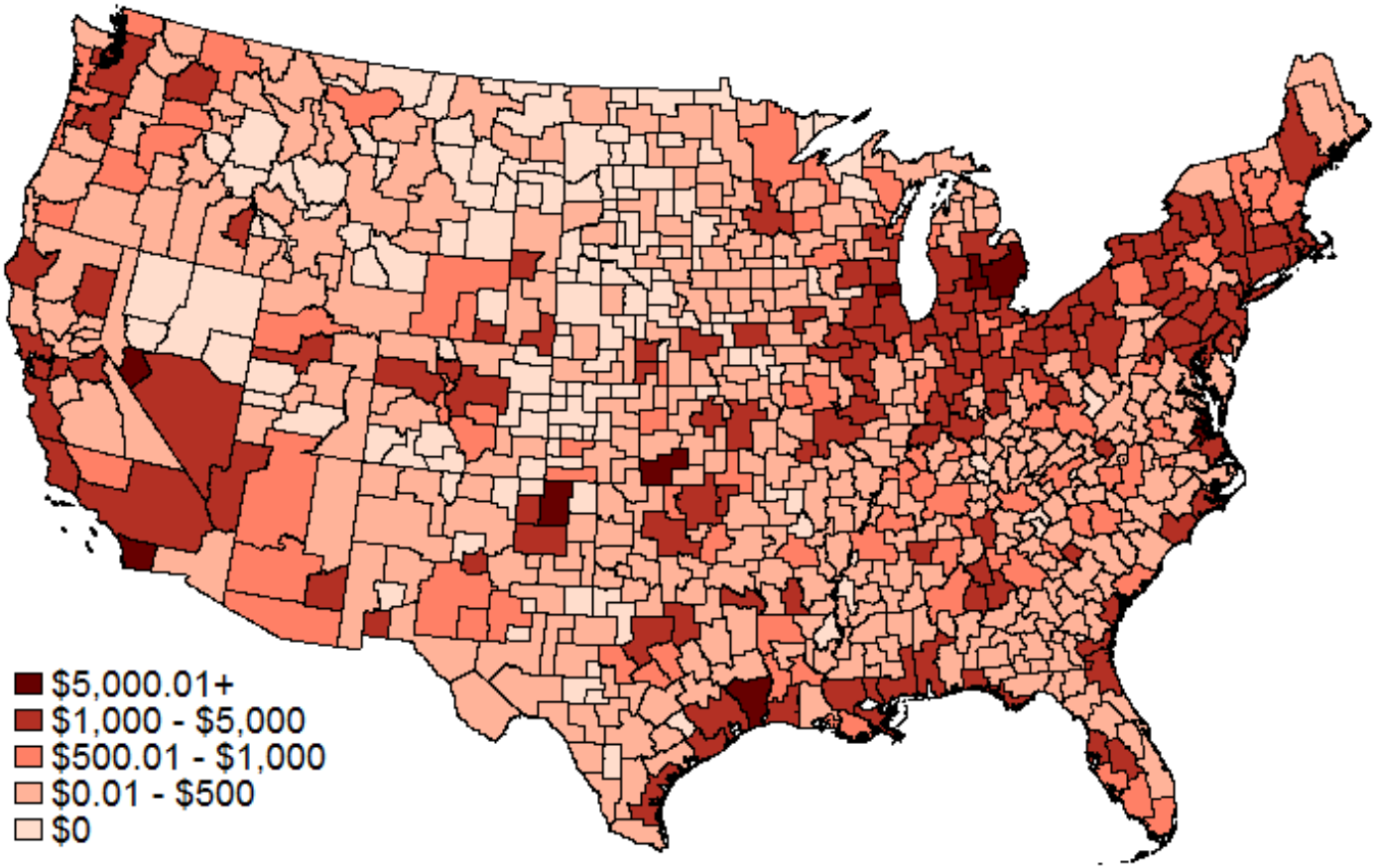
War spending is correlated with wartime saving, but much less influenced by household characteristics and decisions

Geographic Determinants of War Spending:

- Contracts placed by military, largely ignoring local economic performance narrative evidence
- War spending systematically assigned to urban areas with existing manufacturing capacity
  correlations manufacturing employment map rural farm population map

$\Rightarrow$ Control for pre-war manufacturing, fraction of population on rural farms

Variation in War Spending Across Commuting Zones



per capita war contract spending, in thousands of 1950 dollars

War Spending Predicts Wartime But Not Post-WWII Asset Accumulation

	E-Bond Purchases		Bank Deposits		
	1944	1949	1944	1949	1956
War spending	0.0405***	0.000688	0.0483***	-0.0197	0.00515
	(0.00458)	(0.00101)	(0.0138)	(0.0123)	(0.0126)
1939 mfg employment	-0.0867	-0.00965	-0.313***	-0.133	-0.0957
	(0.0647)	(0.0155)	(0.105)	(0.107)	(0.111)
% pop rural farm 1940	-0.138*	-0.0418***	-0.150	-0.0825	-0.338*
	(0.0711)	(0.0144)	(0.168)	(0.169)	(0.174)
Population change '30–'40	-0.000495**	-0.000302***	-0.000770	-0.00146**	0.00144**
	(0.000214)	(8.93e-05)	(0.000553)	(0.000719)	(0.000609)
1941 deposits			0.888***	0.816***	0.822***
			(0.199)	(0.211)	(0.195)
Observations	761	761	761	761	761
R-squared	0.438	0.655	0.790	0.720	0.723

Data come from the decennial censuses and the County Data Books. 1941 bank deposits were provided by Paul Rhode. Population, employment, liquid asset, and car registration variables are measured as fractions of the adult population in the nearest decennial census year. The inverse hyperbolic sine transformation is used for all dollar amounts. State fixed effects estimated but not shown. Standard errors are clustered by state.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

IV Results

	# Housing Units (HU)	% HU w/ modern bathrooms	% HU w/ electric fridge	# Cars registered
Wartime saving	0.615***	0.160**	0.0286	0.0188
	(0.230)	(0.0802)	(0.0524)	(0.0166)
1939 mfg employment	-0.00832	0.0357	0.0581	-0.0143
	(0.110)	(0.0314)	(0.0627)	(0.0222)
% pop rural farm 1940	-0.162**	-0.0865*	0.0536	0.0803***
	(0.0816)	(0.0498)	(0.0670)	(0.0127)
Population change '30 –'40	0.00335***	0.000452**	-0.000314	-0.000140**
	(0.00113)	(0.000177)	(0.000336)	(6.22e-05)
1936 deposits	0.156**	0.0630*	0.0459*	-0.00672
	(0.0703)	(0.0338)	(0.0247)	(0.00671)
# Housing Units '40	0.972***			
	(0.0138)			
HU w/ modern bathrooms '40		0.648***		
		(0.131)		
HU w/ electric fridge '40			0.747***	
			(0.102)	
# Cars registered '39				0.781***
				(0.0455)
First Stage F-Stat	40.51	31.20	29.24	36.45
Observations	761	761	761	761
R-squared	0.988	0.944	0.767	0.910

Data come from the decennial censuses and the County Data Books. 1941 bank deposits were provided by Paul Rhode, 1939 car registrations by Paul Rhode and Josh Hausman. Population, employment, liquid asset, and car registration variables are measured as fractions of the adult population in the nearest decennial census year. The inverse hyperbolic sine transformation is used for all dollar amounts. State fixed effects estimated but not shown. Standard errors are clustered by state.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

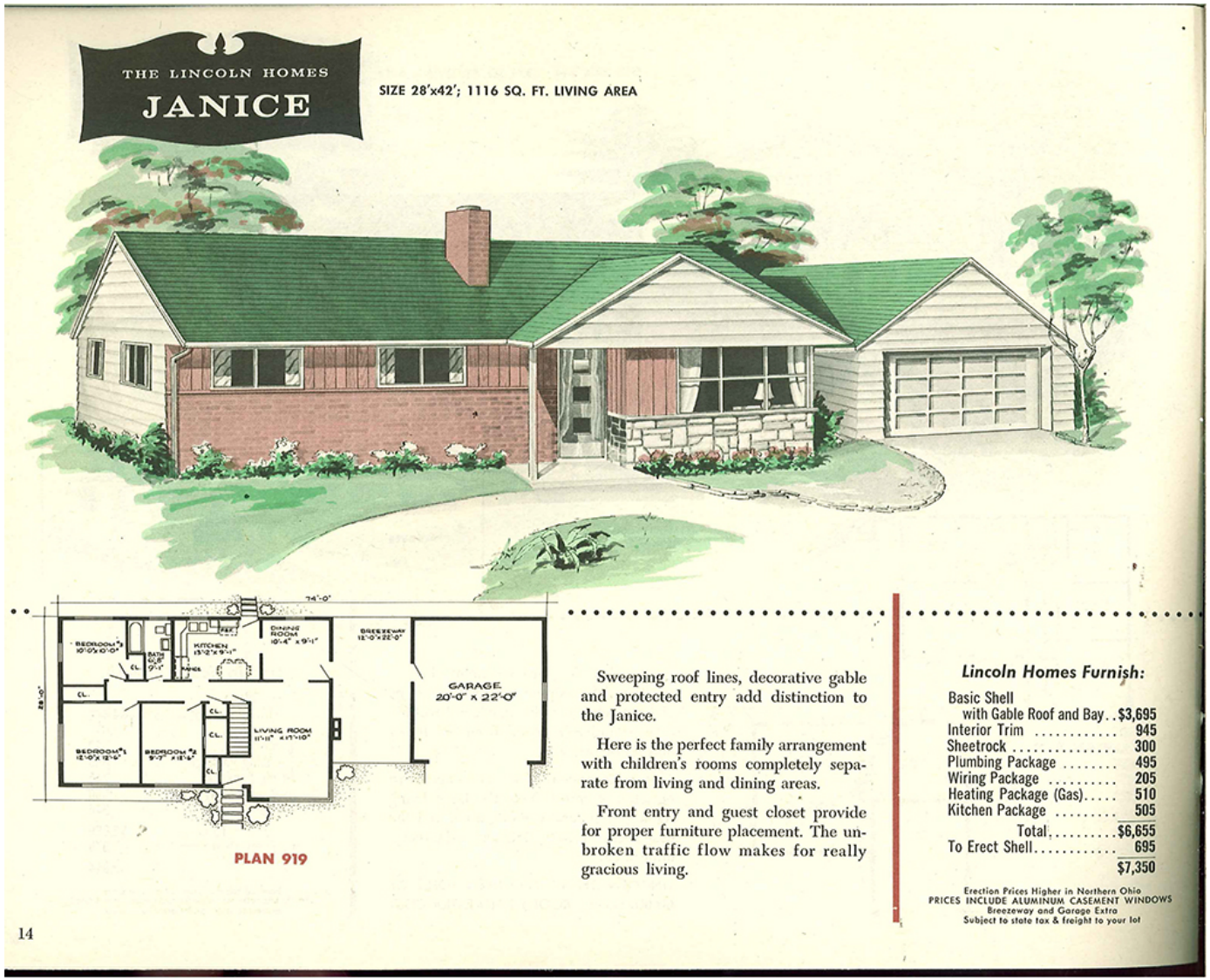
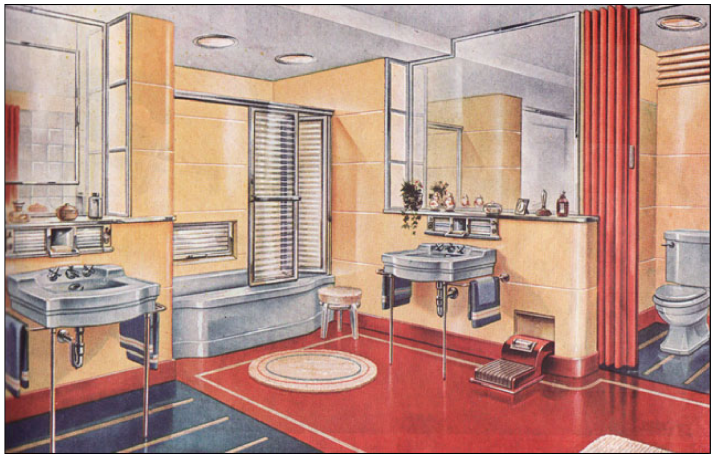


Image Source: MBJ Collection

Post-War Bathrooms



Briggs, 1945; Crane, 1949; Briggs, 1947

What can we learn from SCF data?

46% (7,106) of households in the SCF own their own home.
Of those:

- 11% (776) had bought their home *in the past year*
- 10% (577) lived in a newly constructed house
  (Note: intersection is roughly 3% of homeowners)

SCF data is a useful check because it captures post-WWII housing purchases only

Housing Results from SCF Data

	OLS			IV		
	Home bought past year	Home built new	Current mortgage	Home bought past year	Home built new	Current mortgage
Wartime saving	0.0117	0.00595	0.579	0.109***	0.118**	2.195
	(0.0173)	(0.0166)	(0.551)	(0.0409)	(0.0498)	(1.385)
Wage income	0.0156***	0.0116***	0.496***	0.0142***	0.00997***	0.473***
	(0.00333)	(0.00296)	(0.0750)	(0.00352)	(0.00302)	(0.0760)
WWII veteran	0.0223***	0.00236	0.439***	0.0228***	0.00358	0.441***
	(0.00536)	(0.00436)	(0.161)	(0.00523)	(0.00451)	(0.163)
Head of household	0.0254***	0.0107	0.364	0.0246***	0.00973	0.324
age 25-34	(0.00796)	(0.00727)	(0.553)	(0.00778)	(0.00694)	(0.553)
Head of household	0.0184**	0.00768	-0.784	0.0175**	0.00654	-0.836
age 35-44	(0.00870)	(0.00679)	(0.568)	(0.00886)	(0.00721)	(0.568)
Head of household	-0.00598	0.00499	-2.824***	-0.00691	0.00437	-2.860***
age 45-64	(0.00802)	(0.00680)	(0.549)	(0.00802)	(0.00685)	(0.550)
Head of household	-0.0289***	0.0105	-4.025***	-0.0302***	0.00885	-4.088***
age 65+	(0.00874)	(0.00854)	(0.576)	(0.00865)	(0.00863)	(0.575)
First Stage F-Stat				11.12	11.60	11.26
Observations	15,058	12,419	4,236	15,058	12,419	4,236
R-squared	0.017	0.081	0.220	0.008	0.067	0.213

Data come from the Surveys of Consumer Finance from 1947–1951. The inverse hyperbolic sine transformation is used for all dollar amounts. Standard errors are clustered by location. Race, education, dummy for zero wage, 1939 county manufacturing employment, city size, survey year, and farm share of population are estimated but not shown. Omitted category is head of household age $<$ 25. *** p$<$0.01, ** p$<$0.05, * p$<$0.1

IV. Evidence for Mechanism

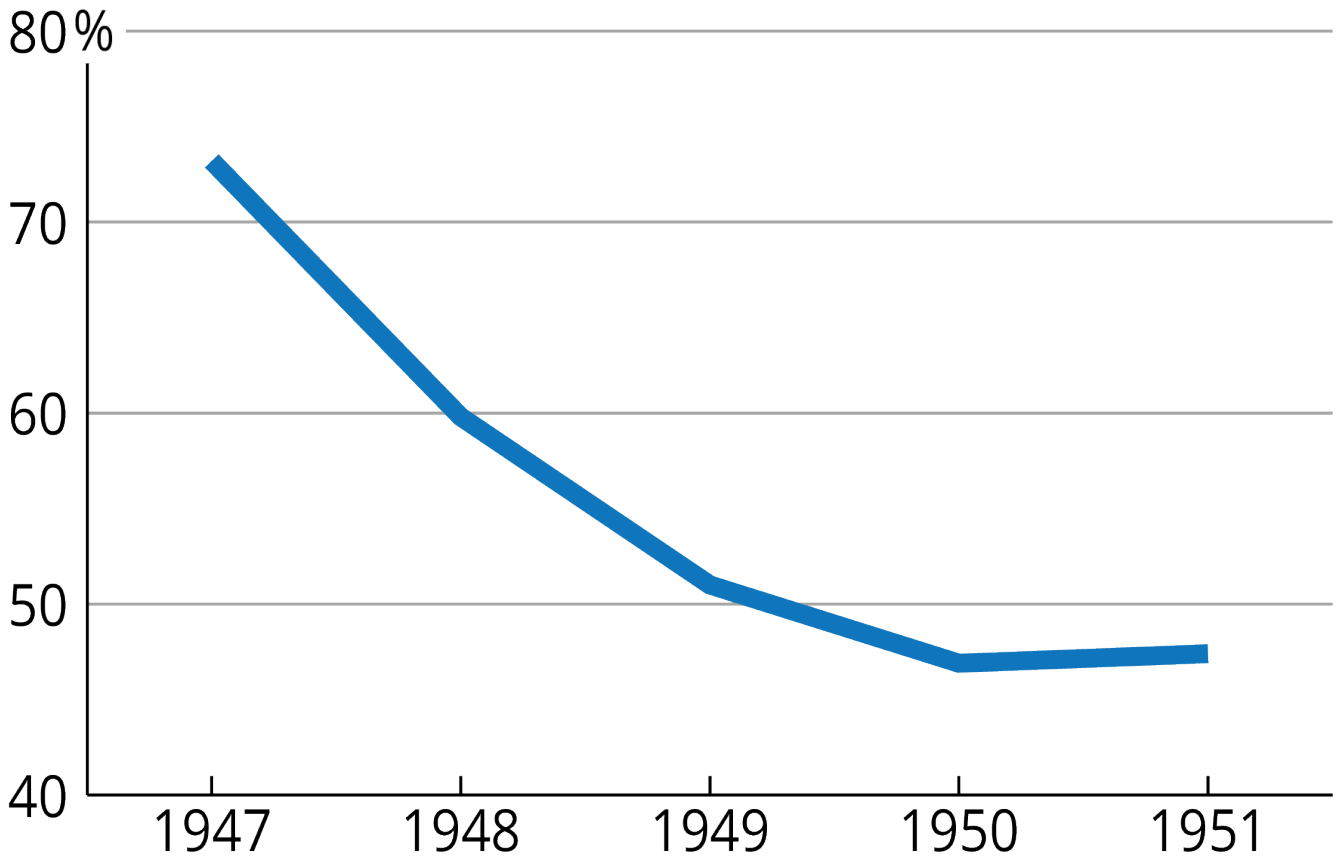
Considerable Turnover in Bond Ownership

45% (by value) of all issued E-bonds had been redeemed by 1950

- Bond purchases continued at roughly 40% of their wartime high from 1944–45
- New sales slightly outpaced redemptions (likely by design)
- Bonds could also be sold—i.e. ownership could be transferred—but not observable in aggregate data

Growing Concentration of Bond Ownership

Fraction of households holding A-F bonds drops from 73% in 1947 to 47% in 1950–51



Source: Surveys of Consumer Finance

Link btwn Decreased Bond Holdings and Home Purchases

	Decrease A-F holdings	Decrease A-F holdings	Decrease A-F holdings
Bought car in past year		0.0365***	
		(0.00732)	
Bought house in past year			0.169***
			(0.0160)
Black	-0.0308***	-0.0272**	-0.0269**
	(0.0115)	(0.0121)	(0.0115)
Wage income	0.00771*	0.00485	0.00546
	(0.00396)	(0.00429)	(0.00435)
Zero wage	0.0396	0.0162	0.0176
	(0.0339)	(0.0370)	(0.0376)
WWII veteran in household	0.0276***	0.0265***	0.0241***
	(0.00722)	(0.00703)	(0.00794)
Head of household age 25-34	0.00997	0.00699	0.00358
	(0.00960)	(0.0102)	(0.0103)
Head of household age 35-44	0.0127	0.0106	0.00741
	(0.0108)	(0.0113)	(0.0115)
Head of household age 45-64	0.00637	0.00257	0.00381
	(0.0110)	(0.0117)	(0.0117)
Head of household age 65+	-0.0337***	-0.0324***	-0.0326***
	(0.0106)	(0.0121)	(0.0117)
Observations	15,995	14,845	15,058
R-squared	0.033	0.036	0.045

Data come from the Surveys of Consumer Finance from 1947–1951. The inverse hyperbolic sine transformation is used for all dollar amounts. Standard errors are clustered by location. Education, 1939 county manufacturing employment, city size, survey year, and farm share of population are estimated but not shown. Omitted category is head of household age < 25.

V. Conclusion

Summary of Findings

- A 10% increase in wartime saving is associated with a 2.9–6.2% increase in the number of housing units in a commuting zone over 1940–50
- Household data also shows a relationship between wartime saving and recent (postwar) home purchases
- Back-of-the-envelope from CZ data: \$3,000 to \$4,100 in wartime saving associated with each additional housing unit (average home price in SCF is \$8,052, mortgages common)

Thank you!

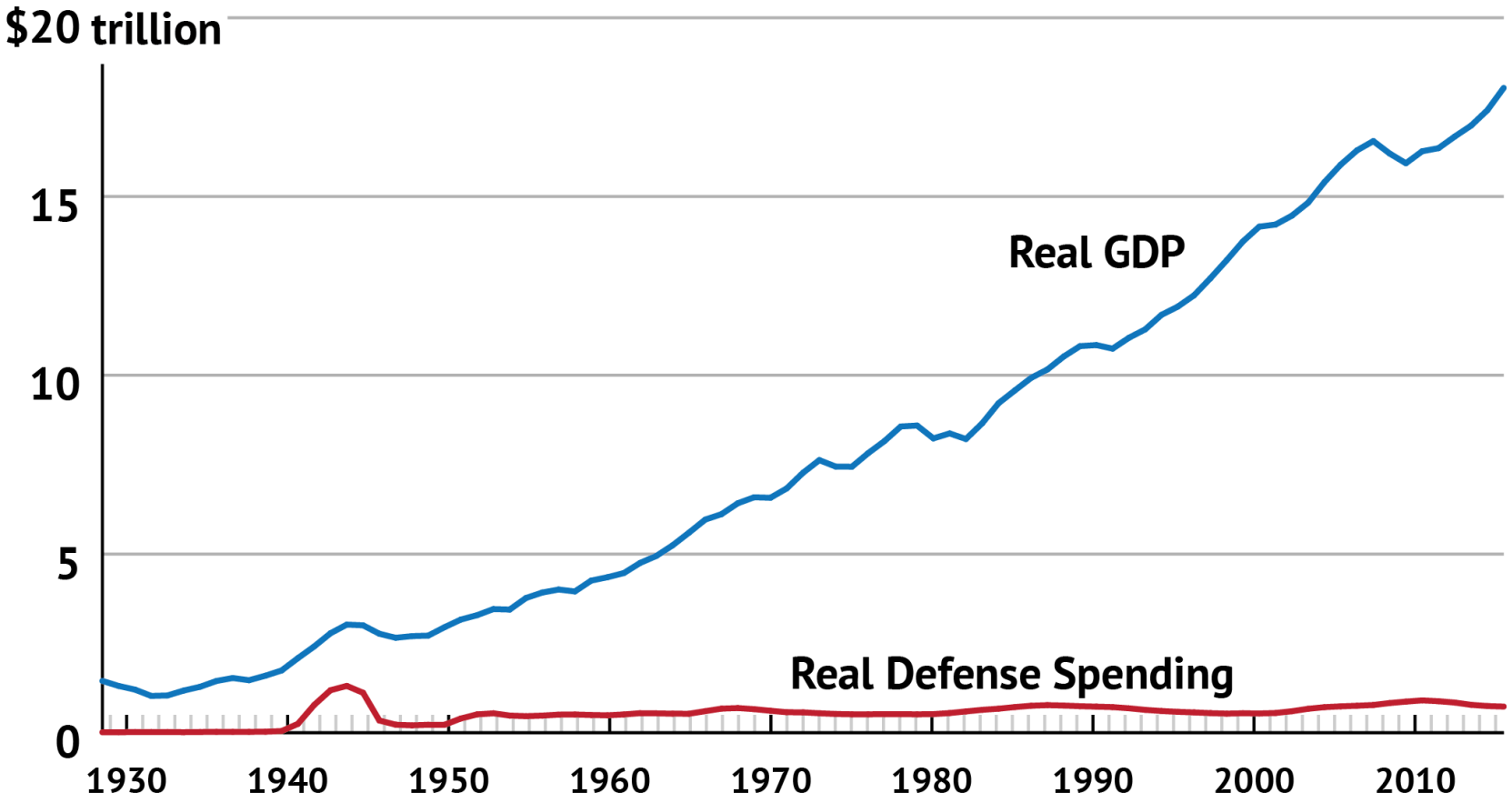
Backup Slides

Some stylized facts on the U.S. economy in WWII graph Back

- In nominal terms, the U.S. spent $340 billion on national defense over 1940-1945 (around $5.7 trillion in today's dollars)
- Nominal GDP:
  - $103 billion in 1940
  - $228 billion in 1945
- Real GDP grew by more than 75% over this period, at an average annual rate of 11.8%
- Total non-farm employment (CES) grew from 32.4 million in 1940 to 40.5 million in 1945
- Percentage of adult population counted as employed in the CES rose from 32.7% in 1940 to 38.5% in 1945, with a peak of 41.3% in 1943

Sources: BEA, BLS, Census

World War II: the Largest Fiscal Shock of the 20th Century



Back

Payroll Deductions for War Bond Purchases

Back

- Over 27 million workers participated (over 40% of the workforce)
- Aggregate deductions totaled 8-10% of participants' pay (varying over time)
- Implemented at firm level, anecdotally concentrated at large firms
- Extremely high participation at implementing firms: over 95% of employees at large firms such as General Motors and International Harvester participated at the height of the war

Summary Data: Commuting Zones

Back

By Commuting Zone (N = 761)

	mean	SD	min	%25	median	%75	maximum
1940 Population	172,993	491,034	1,005	28,969	69,223	153,638	9,504,398
1940 Adult Population	109,859	334,574	600	16,807	40,333	92,651	6,495,334
% Urban Population, 1940	29.1%	21.6%	0%	13.2%	26.9%	42.2%	100%
% Population Rural Farm, 1940	41.3%	18.6%	0%	27.3%	41.6%	55.4%	88.6%
Manufacturing Emp Rate, 1940	10.0%	9.32%	0.2%	2.8%	7.1%	14.1%	45.5%
Retail Sales, 1939	$254	$101	$45	$174	$249	$326	$599
Retail Sales, 1948	$784	$238	$133	$602	$816	$953	$1,624
E-Bonds, 1944	$174	$115	$28	$108	$157	$211	$1,480
E-Bonds, 1949	$42	$32	$3	$20	$32	$54	$245
Bank Deposits, 1941	$516	$364	$0	$311	$439	$618	$4,621
Bank Deposits, 1944	$924	$465	$ 0	$618	$852	$1,148	$4,889
Bank Deposits, 1949	$957	$432	$0	$632	$943	$1,205	$4,485
Auto Registrations, 1947	202	75.4	32.1	145	205	249	710
Refrigerators, 1940	28.8%	13.3%	3.7%	18.4%	26.6%	37.5%	69.3%
Refrigerators, 1950	69.0%	14.8%	0%	59.3%	71.9%	80.4%	93.6%
Bathrooms, 1940	32.2%	18.4%	2.3%	17.3%	29.2%	43.4%	91.2%
Bathrooms, 1950	44.6%	18.4%	5.4%	29.0%	43.8%	57.9%	89.9%
War Spending (per capita)	$1,333	$2,682	$ 0	$22	$397	$1,527	$43,470
Wartime Saving	$587	$312	$0	$379	$517	$712	$2,623

All data come from the 1940 Census and/or City and County Data Books. All dollar amounts reported in 1950 dollars and rounded to the nearest dollar. The manufacturing employment rate is the number of workers employed in manufacturing divided by the county labor force (age 14+). Retail sales, E-Bonds, bank deposits, and war spending are all measured per (adult) capita. Auto registrations are shown as rates per 1000 population. For ease of interpretation, the inverse hyperbolic sine transformation is not applied to summary data.

Summary Data: SCF Households

Back

	SCF 1947-1951, pooled	1950 Census
Black	7%	10%
WWII veteran	24%	28%
Age 18-64	89%	90%
Age 65 plus	11%	10%
Less than high school	42%	66%
High school	38%	28%
College	21%	6%
Rural	15%	36%
Homeowner	46%	55%

Unit of Analysis: Commuting Zones

Back

Aggregate to commuting zones (CZs) from county-level data from *Censuses*, *City and County Data Book*

Why?

Spillovers tend to increase as geographic units shrink.

CZs have several specific advantages over counties:

- War spending is treatment of *firms*, but main mechanism is *households*
- People more likely to live/work/shop in same CZ than same county
- Reduces noise from household relocations to another county within a CZ
- CZs still cover entire U.S.

Correlations between Spending and Pre-War Outcomes

- Correlation between war spending and 1940 manufacturing employment rate is 0.55
- Correlation between (per capita) war spending and 1940 population is 0.50
- Correlation between war spending and fraction of 1940 population residing on rural farms is -0.57

Back

Determinants of Contract Placement

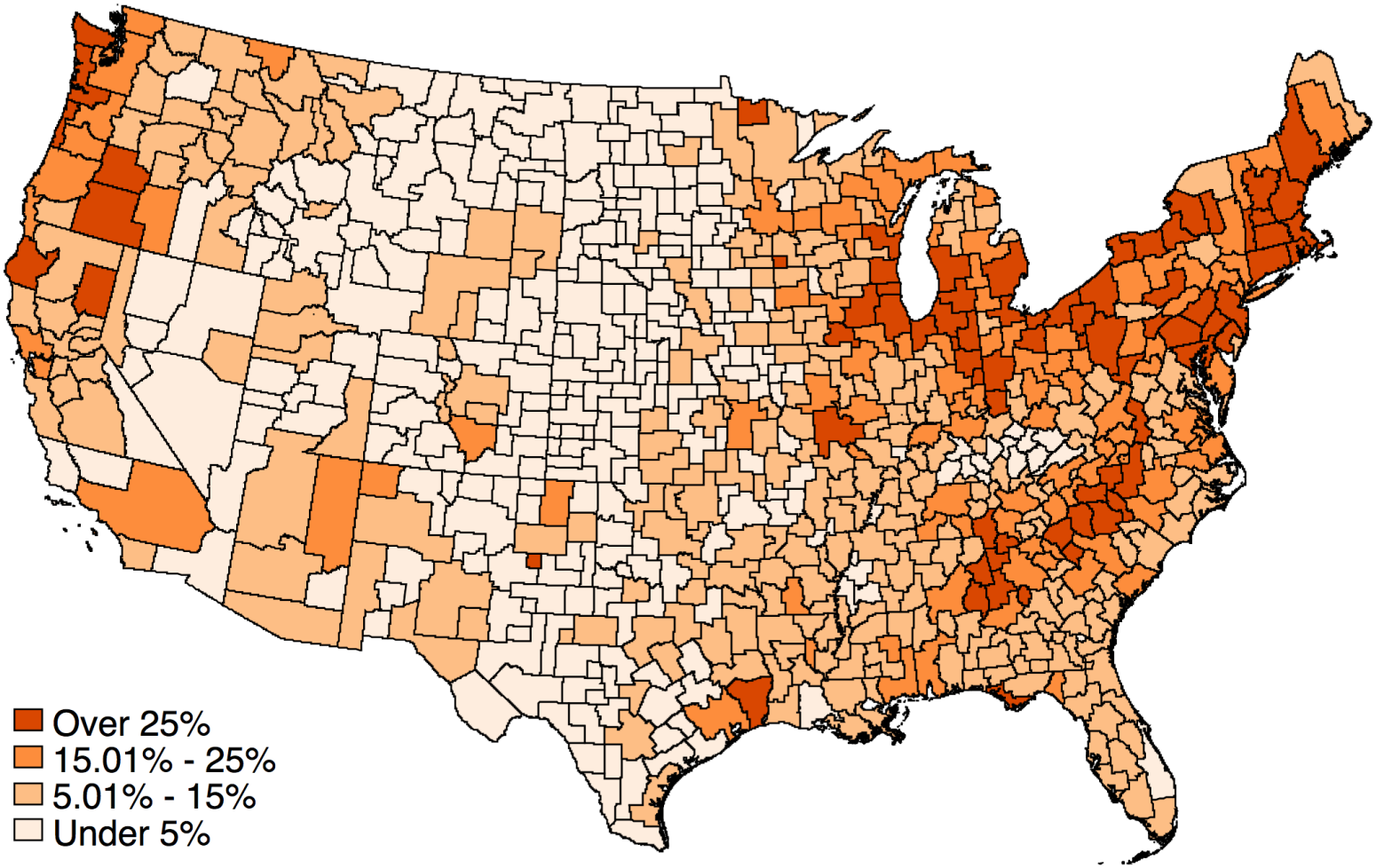
Back

Contracts placed by military, for whom local economic performance was not an important consideration:

> *The impact of [efforts to place contracts according to available labor supply] on actual procurement practice, however, was not large. Among the reasons were the traditional independence of the procurement services, preoccupation with price and delivery considerations, reluctance to give up customary sources of supply, reluctance to give up a facility which may then be taken over by a competing procurement branch, and the absence of any continuous policing by Army Service Forces headquarters of compliance*
>
> — *Bureau of the Budget*, 1946

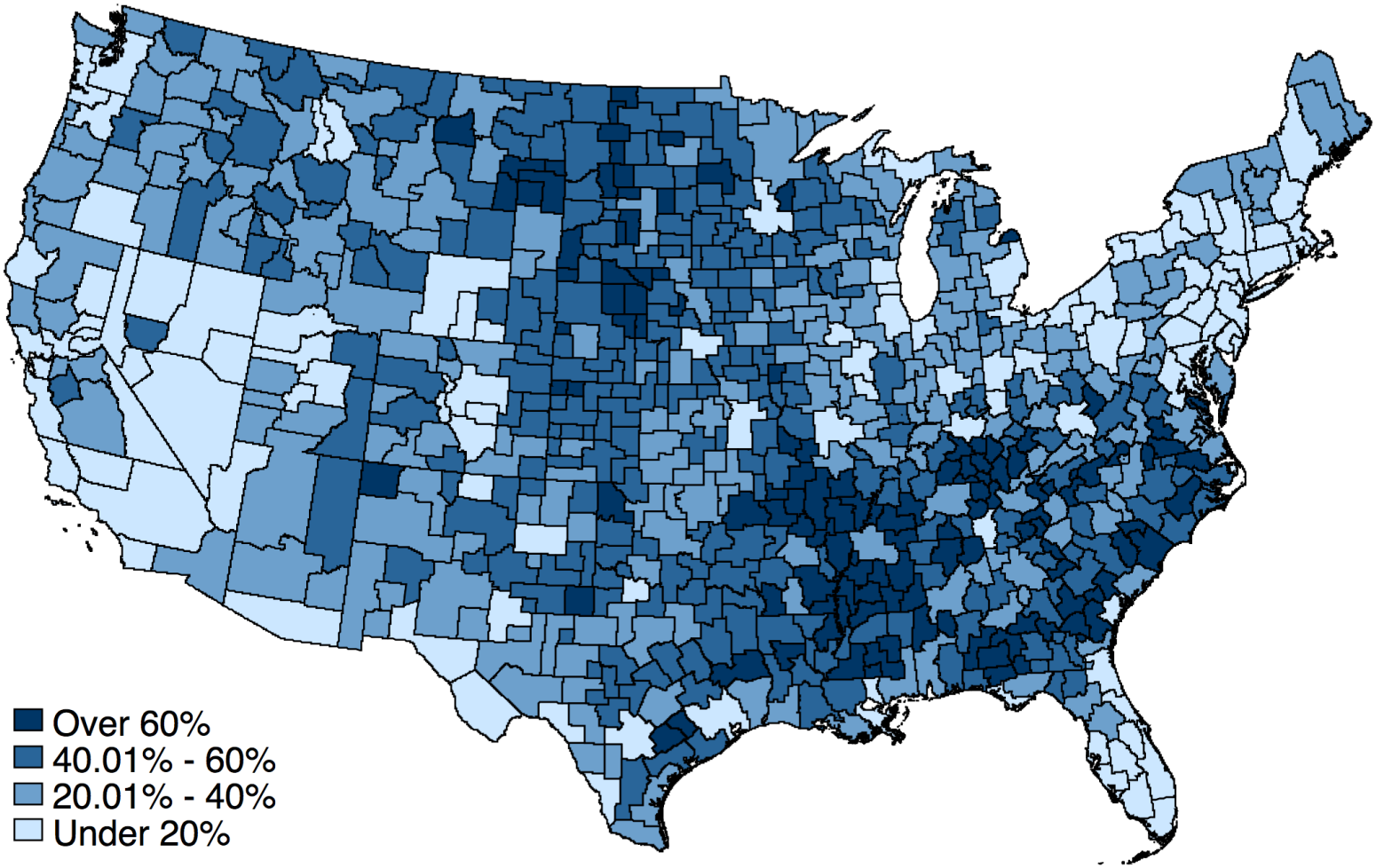
Variation in Pre-War Manufacturing Employment

Back



Manufacturing employment relative to total labor force 14+, 1940

Rural Farm Population Shares, 1940 Back



Fraction of population living on rural farms, 1940