

**USC FBE DEPARTMENT SEMINAR**  
*presented by Lee Ohanian*  
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12:00 noon – 1:30 pm, **Room: HOH-601K**

# Accounting for the World War II Economy in a Neoclassical Model

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## Accounting for World War II Macroeconomy

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Textbook view - wartime fiscal shock created the wartime boom

But disagreement about appropriate theoretical framework to study episode

Some argue that neoclassical growth model is useful framework

Others argue large departures from the model are required to account for wartime boom

But there is no systematic, quantitative study of this issue

Consequently, lots of open questions about this debate

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## Key Questions for Neoclassical Model

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(1) What are successes and failures of neoclassical model for WWII?

(1a) Can we plausibly account for boom in fully articulated model?

(1b) Are other model variables consistent with wartime data?

(2) Impact of other shocks? (draft, taxes, elimination of New Deal policies...)

(3) Regarding potential failures, what modifications should be pursued?

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## **Our Approach**

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We address questions using model with wartime spending, tax, draft, productivity shocks

Conduct sequence of experiments which feed in subsets of wartime shocks into model

Compute approximate equilibrium numerically

Graphically compare model time series and actual time series

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## Goals

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(1) Assess how well model accounts for wartime economy in response to all shocks

WWII is good lab for testing model because fiscal change is large & exogenous

(2) Understand impact of each individual shock

Enhance our understanding of the impact of different shocks

Main finding:

Model largely accounts for quantities and prices in response to 1941-1946 shocks

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## **Presentation Outline**

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Literature Review

Present data on the shocks

Model economy

Present results from experiments

Conclusion

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## **Arguments that Neoclassical Model does not Account for WWII**

Skepticism about neoclassical predictions for output and its components, employment, and factor prices

Rotemberg and Woodford (1989, 1992) question whether model is consistent with wartime pre-tax wages (no WWII simulation)

Mulligan (1998) and Eichenbaum et al (2002) question whether model can jointly account for employment and post-tax wages in WWII and other large fiscal shocks (no WWII simulation)

Baxter and King (1993) question whether model can generate large wartime boom (no WWII simulation)

Blanchard and Perotti (2003) question whether model is consistent with impact of large fiscal shock on consumption (no model simulation or WWII data; VAR analysis)

Systematically evaluating these questions requires model that can be simulated in response to shocks

On to the model!

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## Shocks and Other Model Inputs

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Government spending, draft, income taxes, productivity shocks

G accounts for 83% of trend output in 1944

Military accounts for 11% of working age population in 1944

Labor taxes almost double, capital taxes rise by 50%

Productivity: about 8% above normal during World War II

Postwar state - allow for possibility of Depression

Abstract from rationing and monetary/Fed factors

Markov process governs evolution of the state



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## Model Economy

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Preferences

$$U(c, l) = \ln(c) + \psi \ln(1 - l)$$

Representative Family's Problem

$$\max E \sum_{t=0}^{\infty} \beta^t \{(1 - a_t)U(c_{ct}, l_{ct}) + a_t U(c_{dt}, \bar{l})\} N_t$$

Subject to:

$$(1 - a_t)c_{pt} + a_t c_{dt} + i_{pt} + b_{t+1} =$$
$$(1 - \tau_{kt})(r_{pt} - \delta)k_{pt} + (1 - \tau_{lt})w_t(1 - a_t)l_{ct} + R_t b_t + T_t$$

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## Model Economy, ctd.

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Technology operated by competitive firm

$$z_t F(K_{pt}, K_{gt}, A_t L_{pt}) = z_t (A_t L_{pt})^{1-\theta} K_t^\theta$$

Significant wartime government investment (GOPO)

$$K = (\alpha K_p^\rho + (1 - \alpha) K_g^\rho)^{\frac{1}{\rho}}$$

$$K_{i,t+1} = (1 - \delta) K_{i,t} + I_{i,t}$$

Government Spending

$$G_t = C_{gt} + I_{gt} + a_t N_t w_t \bar{l}$$

Government budget

$$G_t + R_t B_t = B_{t+1} + \tau_{kt} (r_{pt} - \delta) K_{pt} + \tau_{lt} w_t L_{pt} + r_{gt} K_{gt}$$

Standard RCE definition

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## Parameterization

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Standard parameter values

$\beta$	$\psi$	$\delta$	$\theta$	$\rho$	$\alpha$
0.96	2.25	0.06	0.36	1	0.5

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## Measurement

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Output: real GDP less military wages

Consumption: Nondurables and service

Investment: Total private and consumer durables

Government: Expenditures less military wages

Pre-tax capital rental price: Marginal product of capital

Pre-tax wage: Marginal product of labor & mfg wage

Labor input: Hours worked (Kendrick)

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## Stochastic Specification

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Need stochastic process generating wars like WWII

State of economy,  $S$ , is 6-tuple:  $S_t, t = 1941, \dots, 1946$

First, consider case without possibility of postwar Depression

$S_{1941}$  is observed 1941 realization, ...,  $S_{1946}$  is observed 1946 realization

Economy starts with  $S_{1941}$

Denote probability of transiting from date  $i$  to date  $j$  as  $\phi_{ij}$

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## Simulating Wars

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Draw  $\phi_{ij}$  from uniform distribution

Generate lots of length T simulations

Keep realizations that have following properties:

Frequency of a war occurring is 70-130% of US frequency

Duration of war is between 70-130% of World War II

Frequency of years in wars is 70-130% of US frequency

Also examine perfect foresight version of the model

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## **Findings of Benchmark Model**

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Begin with benchmark model:

Stochastic model with all shocks, no probability of postwar depression

Model time series patterns very similar to actual time series

Deviations:

Model labor initially a bit higher than actual labor

Model wage higher after War

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## **Contributions of Individual Shocks**

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Take benchmark model, and change one factor

Draft unchanged from 1941, rest same as benchmark

Labor tax unchanged from 1941, rest same as benchmark

Capital tax unchanged from 1941, rest same as benchmark

Productivity unchanged from 1941, rest same as benchmark

Government spending unchanged from 1941, rest same as benchmark

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## Sensitivity Experiments

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(1) Benchmark, and add in possibility of postwar Depression

Probabilities of entering Depression from Gallup-Roper surveys

Depression is low productivity state (use 1930s productivity)

(2) Benchmark, and add in capacity utilization

Kydland-Prescot model - utility cost of working

Both intensive and extensive margins vary

(3) Benchmark, with perfect foresight

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## **Conclusion**

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Neoclassical model is useful for understanding WWII economy

Output boom (Baxter&King)

Consistent with WWII wages & employment (Mulligan, Rotemberg-Woodford)

Deviations relative to theory

Model employment somewhat too high early on

Model wage somewhat too high after the war.

We have abstracted from New Deal initial conditions

New Deal policies restricted employment, raised wages



