• 8.1 looks at the two contradictory forces that have ultimately led to war in human history.
• 8.2 examines the previous literature on the impact of war on the postwar economy according to the ‘War Construction view’ and the ‘War Destruction view’.
• 8.3 presents the importance of technology for the course of the postwar economy.
• 8.4 presents the results of empirical analysis to determine why some countries experience postwar growth while others do not.
• 8.5 draws out the implications of study results for research and development policy.
• 8.6 Summary
• 8.7 References
‘War Destruction view’

War has a negative effect on postwar economic growth.

There are two basis for this view:

- War distorts the economy negatively and exogenously (Thorp, 1941; Wright, 1943; Higgs, 2004).
- Destruction of human and material resources during war has a negative effect on postwar economic growth (Murdoch and Sandler, 2002; Kang and Meernik, 2005).
‘War Construction view’

War has a positive effect on postwar economic growth.

The pioneering work: Organski and Kugler (1977)

- They analyzed how much the economic status after the First and Second World Wars deviated from economic growth trends before the war periods.

- They found that defeated nations underwent greater economic recession than victorious nations immediately after war, but achieved faster economic recovery and eventually resumed their full prewar rates of economic development more quickly than victorious nations.

- They named this postwar resurrection ‘the Phoenix Factor’.
‘War Construction view’

Later studies attempted to find factors that could explain why the ‘Phoenix Factor’ occurs.

There are two explanations for ‘Phoenix Factor’:

- ‘Phoenix Factor’ is caused by the destruction of political structures (Olson, 1982).
  
  → The destruction of the groups, which control the economic distribution of resources, enabled the smooth distribution of resources, which became a driving force behind fast economic growth.

- ‘Phoenix Factor’ is caused by economic destruction (Kugler and Arbetman, 1989)
  
  → The industrial facilities with old technologies were destroyed by war, after the war, the latest technology was used for the machinery, which increased production capacity.
Two conflicting results with regard to the effects of War

Some studies find the effect of war on the postwar economy to be negative (Kang and Meernik, 2005; Thorp, 1941), whereas others find it to be positive (Kugler and Arbetman, 1989; Olson, 1982; Organski and Kugler, 1977).

Faced with these results, two responses are possible:

- Take the view that there will always be some unpredictable external circumstance that renders it impossible to determine in advance whether the effect of war will be positive or negative,
- Or take the view that there is some underlying, as yet unidentified, factor that can be used to explain why war sometimes yields positive, and other times negative, effects.

→ We pursue the second line of thinking.
The accumulation of technological strengths

Previous literatures has already suggested that the accumulation of technological strengths may be an important factor on post-war growth:

- Olson (1982) mentions that the technological strength of the US is an exception to his argument that political destruction is the cause of the ‘Phoenix Factor’.

- Kugler and Arbetman (1989) note the introduction of new technology due to the destruction of industrial facilities.

- Abramovitz (1986) explains the prolonged manifestation of the accumulation of technological strength during war in the economy by appeal to social capabilities.
The Purpose of Empirical Analysis

To provide evidence that the technological strengths and industrial production capability accumulated during war are the efficient cause of the ‘Phoenix Factor’.

We address the following research questions:

- Q1: Does the technological strengths and industrial production capability that a nation accumulates during war have a significant impact on post-war economic growth?
- Q2: How does the destruction experienced during war affect postwar economic Growth?

Empirical models based on growth theory is used to answer these questions.
Regression Model

Regression model is based on Barro model.

\[
\frac{\ln(y_i(t)) - \ln(y_i(0))}{t} = \alpha \ln(y_i(0)) + \beta X_i + \gamma Z_i + \varepsilon_i
\]

- The model has been used as the baseline for much of growth econometrics (Durlauf et al., 2005)
- It was also used by Barro and Lee (1994), Koubi (2005), and Kang and Meernik (2005) to examine the relationship between war and postwar economic growth.
- Left-hand side: The growth rate of per-capita GDP
- Right-hand side: Variables that influence the economic growth rate. (\(X_i\) and \(Z_i\))
8-4 Empirical Analysis

Regression Model

We rewrite the equation to include war variable as follows:

\[ r(t, t + k) = \alpha \times X(t, t + k) + \beta \times W + \varepsilon(t, t + k) \]

- \( r(t, t + k) \): The dependent variable, which represents the average growth rate over a period of \( k \) years after World War II that begins \( t \) years after the end of the war in 1945.
- \( X \): The standard major variables that are used in the literature on economic growth. (These capture the accumulation of material and human capital, convergence factors, and the inefficiency of government)
- \( W \): The war variables which reflects the effect of war on economic growth
Sample Sets

Final sample of countries used in the analysis

- We conducted an empirical analysis of the effect of World War II, a war of industrialized nations, on the postwar economic growth of these nations.

- We defined three analysis sample sets based on the following criteria.
  - World War II Actors: The countries that participated in the World War II
  - World War II Winners/Losers: The countries that participated in the war are divided into Winners and Losers.
  - World War II Industrial Powerhouses: The countries that generated 10,000 GW/hour or more and also produced 2,000,000 metric tons or higher of iron ore between 1936 and 1945
The 20 countries were used as analysis samples and the period from 1950 to 1960 was chosen as the target period.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average growth rate</td>
<td>The average growth rate over a particular Period</td>
<td>World Table Version 5.6 (PWT 5.6)</td>
</tr>
<tr>
<td>Dummy, 1955-60</td>
<td>Dummy variable for 1955~60</td>
<td></td>
</tr>
<tr>
<td>Ln(GDP)</td>
<td>The initial per capita GDP</td>
<td>World Table Version 5.6 (PWT 5.6)</td>
</tr>
<tr>
<td>I/Y</td>
<td>Real Investment share of GDP (%)</td>
<td>World Table Version 5.6 (PWT 5.6)</td>
</tr>
<tr>
<td>G/Y</td>
<td>Real Government share of GDP (%)</td>
<td>World Table Version 5.6 (PWT 5.6)</td>
</tr>
<tr>
<td>SST</td>
<td>The average years of secondary schooling in the total population</td>
<td>Barro and Lee (2010).</td>
</tr>
<tr>
<td>Industrial Powerhouses</td>
<td>Dummy variable denoting industrial powerhouses</td>
<td>Mitchell (1980)</td>
</tr>
<tr>
<td>TDP</td>
<td>The total military dead of all causes per population</td>
<td>Clodfelter (2002)</td>
</tr>
<tr>
<td>BDP</td>
<td>The number of total battle deaths per population</td>
<td>Clodfelter (2002)</td>
</tr>
</tbody>
</table>

Independent variables
## 8-4 Empirical Analysis

### Estimation Results

<table>
<thead>
<tr>
<th>Table 8-1</th>
<th>Estimation Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Variable</strong></td>
<td><strong>Model 1</strong></td>
</tr>
<tr>
<td></td>
<td>Coefficient</td>
</tr>
<tr>
<td>Constant</td>
<td>0.1204</td>
</tr>
<tr>
<td>Dummy, 1955-60</td>
<td>0.1177</td>
</tr>
<tr>
<td>Ln(GDP)</td>
<td>-0.0111</td>
</tr>
<tr>
<td>I/Y</td>
<td>0.0005</td>
</tr>
<tr>
<td>G/Y</td>
<td>-0.0009</td>
</tr>
<tr>
<td>SST</td>
<td>-0.0074</td>
</tr>
<tr>
<td>Industrial Powerhouses</td>
<td>0.0143</td>
</tr>
<tr>
<td>TDP</td>
<td>0.0009</td>
</tr>
<tr>
<td>BDP</td>
<td></td>
</tr>
<tr>
<td>R² (period, number of obs.)</td>
<td>0.9141 (1950-1955, 20)</td>
</tr>
</tbody>
</table>
The estimation results related to the economic variables match those of the general empirical analysis of economic growth (Barro and Lee, 1994), except for the initial level of secondary education.

- A country’s initial income $\ln(\text{GDP})$ has a negative effect on economic growth, which supports conditional income convergence.
- Physical capital $(I/Y)$ had a positive effect on economic growth.
- Government spending $(G/Y)$ had a negative effect on economic growth.
- Initial level of secondary education $(SST)$ had a negative effect on economic growth.
Q1 : Does the technological strengths and industrial production capability that a nation accumulates during war have a significant impact on post-war economic growth?

A1 : The technological strengths and industrial production capability accumulated during war does have a positive impact on post-war economic growth.

- Industrial Powerhouses experienced greater postwar economic growth rates than other actors. (* See the positive coefficient of a dummy for Industrial Powerhouses)
Answer to The Research Question

Q2 : How does the destruction experienced during war affect postwar economic growth?

A2 : The destruction of war had a positive effect on postwar economic growth.

- The destruction suffered by actors in World War II had a positive effect on postwar economic growth (* See the positive coefficients of BDP and TDP variables)

- The estimation results are relevant to Koubi’s (2005) findings and consistent with the ‘war construction view’. 
Main Findings

The results show that a major cause of the Phoenix Factor is the technological strengths and industrial production capability.

- Those countries that accumulate technological strengths and industrial production capability experience strong postwar economic growth,
- Those that do not accumulate technology do not experience postwar economic growth.
Technological strengths and industrial production capability

What we call the accumulation of technological strengths and industrial production capability comprises the overall accumulation of industrial and technological capacities at the state level, including:

- the innovation of science and technology through R&D;
- the diffusion of technology and improvement of management efficiency through the maximization of industrial production;
- the research, technology, and industrial manpower cultivated in the course of the accumulation.
The characteristics of the agricultural economy in a pure agricultural society ensure that production decelerates and growth slows (Kim et al., 2010).

The output decreases successively compared to input, and the farm has no incentives for surplus production beyond the levels required for survival.

Even if a central planner forces increased production, marginal productivity tends toward zero, and the desires of the state or the ruler for greater wealth and power can only be satiated by wrestling more farmland and manpower from others, and this in turn can only be achieved by war.
In the commercial economy of an agricultural society, the creation of goods can accelerate in the short term through expansive reinvestment. But demand will eventually become stagnant because agricultural products have little elasticity with respect to the demand for them.

Wars will continue, now intended to deprive trade routes and commercial supremacy from competing nations.

War in an agricultural society is a negative sum game, because the whole mankind is made worse off by it.
Industrial society

The characteristics of an industrial society are that short-term production decreases successively, while the creation of goods and economic growth accelerates (Kim et al., 2010).

Industrialized society requires increasing production and occupying larger markets because the geometric increase of output compared to input acts as the incentive for entrepreneurs and capitalists to pursue more production.

Increasing production requires ever greater access to raw materials and sources of energy, but resources are limited.

When a country’s desire for resources exceeds its own capacity to supply them, they will need to be acquired from other areas → The result is war.

Other countries searching for markets will go to war to secure the markets.
Knowledge-based Society

The knowledge-based society will be led by intellectual productive elements, such as information and technology, rather than material productive elements, such as resources and energy.

If so, humankind can maintain its expansive reproduction by concentrating efforts on international cooperation in domestic R&D instead of fighting to steal limited material resources from abroad.

Market demand will also expand multi dimensionally along anti-aging and life-extending technologies, culture, art, hobbies, and entertainment.

When market demand becomes diversified and grows multi-dimensionally, it will be possible to promote complementary cooperation without exclusive competition or conflict.
The results of this study show that the accumulation of technological strengths and industrial production capability caused rapid post-war economic growth in industrial societies.

It also suggests the possibility that humankind can continue with economic growth and prosperity in peace, without war, if there are international orders and treaties.

These orders and treaties would ensure companies and countries concentrate on R&D and the production of products and services in their specialized fields by mobilizing all capacities they have in a knowledge-based society, in which there will be less need for conflict over productive elements and market dominance.
8.6 Summary

- The effect that war has on the economy has long been investigated, but the results of these investigations do not provide conclusive answers. (The ‘War destruction view’ vs. ‘War construction view’)
- This study was designed to look for the possibility of minimizing social costs, and pursuing warless peace and prosperity in the future by investigating the causes and effects of the ‘War Construction view’ more thoroughly.
- We propose a new and promising explanation of what happens to the economy following war: the course of the postwar economy is a consequence of the industrial technology accumulated and the cultivation of engineers during the war.
- We investigate this explanation for nations involved in World War II during the period 1950–60 by utilizing econometric models.
- We find that the technological strength and industrial production capability that a nation accumulated during the war is an important factor for economic growth.
8.7 Reference

8.7 Reference

- Olson, M., 1982. The rise and decline of nations(Yale University Press New Haven, CT).
8.7 Reference