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Stock market booms in economies damaged during World War II

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ABSTRACT

Some studies find that real equity prices in economies damaged during World War II tended to rise sharply at the beginning of actual damage taking place during the war. This paper introduces an empirically plausible degree of persistence from the impact of World War II and demonstrates that stock market booms in economies damaged during the war are consistent with an equilibrium model of asset pricing.

1. Introduction

Barro et al. (2010) argue that empirically observed disasters tend to unfold over multiple periods. They also demonstrate that persistent disasters generate stock market booms in standard power utility models, as in Barro (2006). Although they conclude such stock market booms are counterfactual, some studies find that real equity prices in economies damaged during World War II tended to rise sharply at the beginning of the war (Jorion and Goetzmann, 1999; Oosterlinck, 2010).[1] This implies that stock market booms accompany severe falls in per capita real GDP and consumption. Given that WWII persisted for about five years, war-derived stock market booms are qualitatively consistent with an equilibrium model of asset pricing. In this paper, we demonstrate that war-derived stock market booms are both quantitatively and qualitatively consistent with an equilibrium model of asset pricing.

Using simple fixed effects estimation, we begin by specifying the impact on per capita real GDP and consumption and the real stock price index on economies damaged during WWII. We then introduce disaster persistence into the models proposed by Barro (2006), variants of the Lucas (1978) model of an exchange economy, and derive a closed form solution to equity prices. Finally, we compute the equilibrium equity prices based on the estimated properties of per capita real GDP and consumption in these countries and compare the computed equilibrium equity prices and the estimated equity prices. We conclude that the estimated stock market booms are generated from the models we consider.

This paper is organized as follows. Section 2 uses fixed effects estimation to characterize the paths of per capita real GDP and consumption and real stock price indexes in economies damaged during WWII. Section 3 incorporates disaster persistence in Barro's (2006) disaster model, followed by calibration exercises. Section 4 offers a conclusion.

2. Empirical facts

2.1. Data and summary statistics

The empirical tests employ the per capita real GDP data in Maddison (2003) and the per capita real consumption data in Barro and Ursúa (2008). Following Jorion and Goetzmann (1999), the real stock price index data is drawn from the *Index*

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[1] As explained in Section 2, 5 countries out of 7 where real stock price index data are available experienced an appreciation in their stock price index at the beginning of WWII.

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Table 1
Summary statistics of net growth rates of per capita real GDP and consumption, real stock price index, and nominal interest rates: 1933–1950.

	Observations	Groups	Mean	S.D.	Min	Max
Per capita real GDP	429	26	0.02	0.10	−0.58	0.66
Per capita real consumption	300	18	0.02	0.11	−0.35	0.49
Real stock price index	377	26	0.02	0.24	−0.79	1.18
Nominal interest rates	178	13	0.03	0.02	0.001	0.14

Note: (1) "S.D." denotes standard deviation. (2) Our sample set contains Australia, Austria, Belgium, Canada, Czechoslovakia, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Mexico, Poland, Portugal, Romania, Spain, Sweden, Switzerland, UK, and USA. Sample set of Nominal bill rates excludes Austria, Czechoslovakia, Denmark, Finland, Greece, Ireland, Mexico, New Zealand, Norway, Portugal, Spain, and Sweden from above sample set. (3) Sample period of nominal interest rates restricted to between 1933 and 1947 due to data availability.

Numbers of Industrial Shares deflated by *Index Numbers of Wholesale Prices* collected first by the League of Nations and later by the United Nations.[2] In addition, we employ *Money Market Rates* collected first by the League of Nations and later by the United Nations as nominal interest rates.

Table 1 provides summary statistics of the data set representing the 26 OECD countries in the League of Nations' *Statistical Yearbook*. Our sample period is from 1933 to 1950. The Appendix provides additional details. As shown, the means and standard deviations of the growth rates were 0.02 and 0.10 for per capita real GDP, 0.02 and 0.11 for per capita real consumption, 0.02 and 0.24 for the real equity price indexes, and 0.03 and 0.02 for the nominal interest rates. Consequently, the growth rates of real stock prices were more volatile than both per capita real GDP and consumption.

We choose the "damaged countries" following the definition in Barro (2006, Table I, pp. 828–829). Table 2 includes the growth rates of per capita real GDP and consumption and the real stock price indexes in the economies damaged during WWII.[3] These are the countries included in Barro (2006, Table I, pp. 828–829). Most of these countries also have real stock price index data available, with the exception of Denmark, while Japan experienced an appreciation in its stock price index at the beginning of the war. These characteristics are suggested by Jorion and Goetzmann (1999, Table 3, p. 970).

2.2. Fixed effects estimation

Our objective is to capture the behavior of per capita real GDP and consumption and real stock prices of the economies damaged during WWII, as presented in Table 2. Thus, we estimate the following fixed effects model:

$$dY_{i,t} = \beta_0^Y + \sum_{\tau=1}^{6} \beta_\tau^Y \times WWII_{i,\tau} + Year_t + \alpha_i^Y, \tag{1}$$

where Y is *GDP*, *Cons*, and *Stock*, respectively. The dependent variables, $dGDP_{i,t}$, $dCons_{i,t}$, and $dStock_{i,t}$, are the net growth rates of the series of per capita real GDP, consumption, and stock prices of country i in year t, respectively. The independent variable $WWII_{i,\tau}$ is "an actual damage dummy variable", which takes a value of 1 when t corresponds to τ years after the beginning of the actual damage to per capita real GDP in country i. Therefore, we interpret β_τ^Y as the changes in the growth rates of Y τ years after the beginning of the disaster. The countries (i) and the period (τ) of the actual damage dummy are listed in Table 3. β_0^Y is the constant term, $Year_t$ are dummies for the year, and α_i^Y are the fixed effects terms. In addition to the above, we include nominal interest rates as an independent variable in our stock price model.

2.3. Results

Table 4 presents the estimation results of Eq. (1). According to Table 4, we find that the growth rates in per capita real GDP in damaged economies displayed negative values for the 5 years of the war (−0.19, −0.22, −0.09, −0.03, and −0.05 corresponding to years 1–5). In particular, the coefficients for years 1–3, and 5 are statistically significant. We also find that the growth rates of per capita real consumption take negative values for 3 years (−0.13, −0.17, and −0.04). Of these, the coefficients for years 1 and 2 are statistically significant. However, the estimated coefficients for real stock price growth take positive values for 3 years immediately after the start of the damages (in order, 0.20, 0.07, and 0.08). The coefficient for year 1 is statistically significant at the 5% level.[4]

The eighth and ninth columns in Table 4 provide the results of the fixed effects model with nominal interest rates. We find that the coefficient of nominal interest rates is positive and statistically significant at the 10% level. This implies that the declines in the nominal bond price caused by the anticipated inflation increased real stock prices. Therefore, we confirm

[2] In terms of the stock market data collected during WWII, Dimson et al. (2002) provide the total returns on equity, not stock price indexes. Because our interest lies in stock prices not stock returns during WWII, we employ stock price index data following Jorion and Goetzmann (1999).

[3] The UK experienced aerial bombardment and a serious decline in consumption growth between 1940 and 1941 (−9%). However, the growth rate of GDP did not take a negative value, so we exclude the UK from the sample of damaged countries.

[4] In supplementary material, we estimate coefficients of the fixed effects models in Eq. (1) for the various sample periods. Then we confirm that the positivity and statistical significance of the estimated coefficients, β_1^{Stock}, are fairly robust, even though the sample set is very small.