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A neoclassical analysis of the Great Recession: a historical comparison

Keisuke Otsu
University of Kent

Florian Gerth
University of Kent

Abstract

In this paper we conduct a quantitative analysis to investigate the pattern of output loss during past banking crisis episodes by comparing the Great Recession, Great Depression and "Inter-Greats" periods. We find that during all periods output does not fully recover after 5 years from the onset of the banking crisis. However, while the output loss during the Great Recession was as large as that during the Great Depression, the output decline was much more gradual during the Great Recession. Moreover, a neoclassical growth model with productivity shocks can account for the Great Recession period extremely well compared to the Great Depression and Inter-Greats periods.

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Contact: Keisuke Otsu - K.Otsu@kent.ac.uk, Florian Gerth - fg93@kent.ac.uk.
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1 Introduction

The recent Great Recession had an undoubtedly large and widespread effect on the world economy characterized by a global banking crisis. In this paper we compare the recession patterns after banking crises during the Great Recession and compare them to past episodes. In particular, we conduct a supply side decomposition of the output decline and a simulation based on a neoclassical growth model.

Several studies have investigated the magnitude of output loss after banking crises. Demirguc-Kunt et al. (2006), Barro (2001), Laeven and Valencia (2013), and Kannan et al. (2009) measure output loss as the forgone output growth after the crises. According to these studies, full recovery is defined as when the output growth rate has returned to the pre-crisis trend growth rate. These studies find that the growth impairment of a banking crisis is up to 10 percentage points and the time to recovery lies between 2 to 5 years.

Cerra and Saxena (2008) and Abiad et al. (2009) measure output loss as the deviation of detrended output level from its per-crisis trend level. Based on this measure, an economy has fully recovered if and only if detrended output returns to its pre-crisis trend level. This definition of recovery requires not only for the growth rate to recover, but even to outperform its pre-crisis performance. These studies find that banking crises have large and persistent effects on output loss and economies seldom regain their output level over a short to medium term horizon. Abiad et al (2009) further decomposes the output loss into its supply-side components and find that employment, capital, and total factor productivity all contributed to the persistent fall in output after banking crises during the 1970-2002 period. In this paper we follow their detrending and decomposition method.

Our main contributions with respect to Abiad et al (2009) are that we, i) extend the sample period to investigate the Great Recession and the Great Depression periods; ii) include hours worked per worker as a production factor to provide a better measure of total factor productivity; iii) simulate a neoclassical growth model following Cole and Ohanian (1999) for various countries during the Great Recession, Great Depression and Inter-Greats periods. We find that total factor productivity played an important role in accounting for recessions following banking crises.

2 Data and Method

In this paper, we compare the banking crisis episodes in the Great Recession period to those in the interwar Great Depression and those in between the two which we call "Inter-Greats". For the Great Recession period we include 21 of the episodes listed in Laeven and Valencia (2013) based on data availability. For the Great Depression period we include 8 of the episodes listed in Bernanke and James (1989) based on data availability. Finally, for the Inter-Greats period we include the 18 episodes studied by Reinhart and Rogoff (2008). The full set of countries and crisis years are listed in Table 1.

Table 1. Banking Crisis Episodes

Great Depression		Inter-Greats		Great Recession	
Country	Year	Country	Year	Country	Year
Austria	1931	UK	1974	UK	2007
Belgium	1931	Germany	1977	US	2007
France	1931	Spain	1977	Austria	2008
Germany	1931	Canada	1983	Belgium	2008
Italy	1931	US	1984	Denmark	2008
US	1931	Iceland	1985	France	2008
UK	1931	Denmark	1987	Germany	2008
Sweden	1932	Norway	1987	Greece	2008
		New Zealand	1987	Hungary	2008
		Australia	1989	Iceland	2008
		Italy	1990	Ireland	2008
		Finland	1991	Italy	2008
		UK	1991	Latvia	2008
		Greece	1991	Luxembourg	2008
		Sweden	1991	Netherlands	2008
		Japan	1992	Portugal	2008
		France	1994	Russia	2008
		UK	1995	Slovenia	2008
				Spain	2008
				Sweden	2008
				Switzerland	2008

For the supply side decomposition, we assume a detrended per capita Cobb-Douglas production function

$$\widehat{y_t} = \widehat{A_t}\widehat{k_t}^{\theta} (e_t h_t)^{1-\theta} \tag{1}$$

where $\widehat{y}$ and $\widehat{k}$ are detrended per capita output and capital stock, e is per capita employment, h is hours worked per worker, and $\widehat{A}$ is total factor productivity respectively. The capital income share θ is set equal to 1/3 throughout this paper.[1] Following Abiad et al (2013) we detrend output and capital with the average per capita annual output growth rate between $t = -10$ to $t = -3$ where $t = 0$ corresponds to the year of the banking crisis.[2]

In order to assess the magnitude of the crises, we measure the level of each variable as their log deviation from their level at the year prior to the crisis $t = -1$. The decomposition of output deviation is:

$$\widetilde{\widehat{y_t}} = \widetilde{\widehat{A_t}} + \theta\widetilde{\widehat{k_t}} + (1-\theta)\widetilde{e_t} + (1-\theta)\widetilde{h_t},$$

where

$$\widetilde{x_t} = \ln x_t - \ln x_{-1}.$$

Data of all variables for the Great Depression period is from Klein and Otsu (2013). For the Inter-Greats and Great Recession periods, data of output, capital stock, and employment are from Penn World Tables while data for hours worked is from OECD statistics.[3] Since the Penn World Tables data ends in 2011, we extrapolate the data set up to 2013 for the Great Recession period using data from OECD Statistics.

[1] Gollin (2002) shows that after appropriate adjustment, income share of capital is roughly 1/3 in most countries in the sample.

[2] We prefer this linear detrending method as it does not remove medium term fluctuations like Exponential, Band-Pass and Hodrick-Prescott filters do and it allows country specific variations in the trend growth rates. We conduct a sensitivity analysis using a common 2% linear growth trend for all samples and find that the main results of the paper hold.

[3] Exceptions are hours in Iceland, Latvia, and Spain in which case we used Conference Board TED data accessed through macrobond.

3 The Great Recession and Supply-Side Decomposition

3.1 The Great Recession

We first focus on the Great Recession period and investigate the recovery after the banking crises. Figure 1 plots the mean output deviation from trend and its 95% confidence interval for countries that went through banking crises during the Great Recession. Period 0 refers to the data the banking crisis has taken place. The confidence intervals are computed from bootstrapping with 10000 draws. This figure clearly shows that detrended output declined after the outbreak of the banking crisis. The drop of output was largest in the year after the banking crisis and the decline continues to date without any signs of recovery.

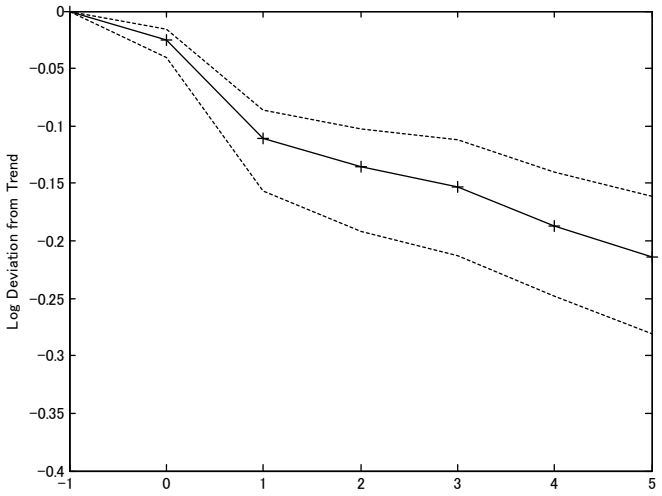

Figure 1: Output during the Great Recession

Figure 2 plots the mean and bootstrapped confidence intervals of detrended per capita capital stock, per capita employment, hours worked per worker and total factor productivity. Capital stock gradually declined after the banking crisis occurred and fell 7% below the pre-crisis level over 5 years. Employment temporarily increased on the onset of the banking crisis and

then gradually declined by 5% relative to the pre-crisis level over 5 years. Hours worked declined mildly compared to capital and employment with a 2.5% drop relative to the pre-crisis level over five years. The variation of the decline in hours across countries is much smaller compared to capital and employment leading to a narrow confidence interval. Finally, total factor productivity sharply drops immediately after the banking crisis and shows no sign of recovery.

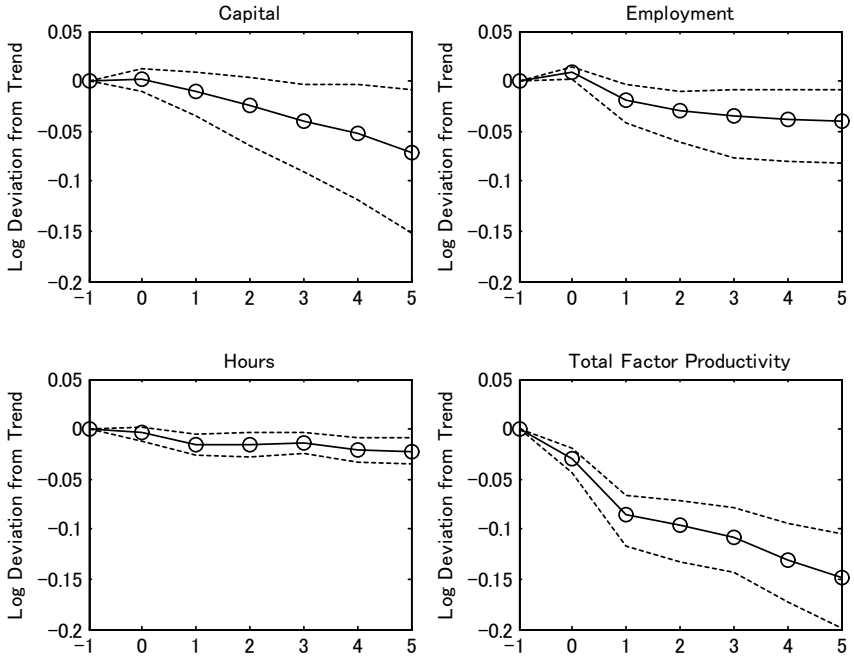

Figure 2: Decomposition of the Great Recession

3.2 The Past vs the Present

Next, we compare the Great Recession to past banking crisis episodes. Figure 3 compares the output decline during the Great Recession period to those during the Great Depression period and Inter-Greats period. The upper panel plots the mean and bootstrapped confidence interval of the output

during the Great Depression period and the mean output of the Great Recession period. This shows that the initial output drop during the Great Recession period was smaller compared to that during the Great Depression at a 95% confidence level. However, since two years after the banking crisis, the mean output decline of the Great Recession period enters the confidence interval. The lower panel shows that the initial output drop during the Great Recession period was at a similar level as that of the Inter-Greats period. However, since one year after the banking crisis, the mean output decline of the Great Recession period significantly exceeds that of the Inter-Greats period at the 95% confidence level.

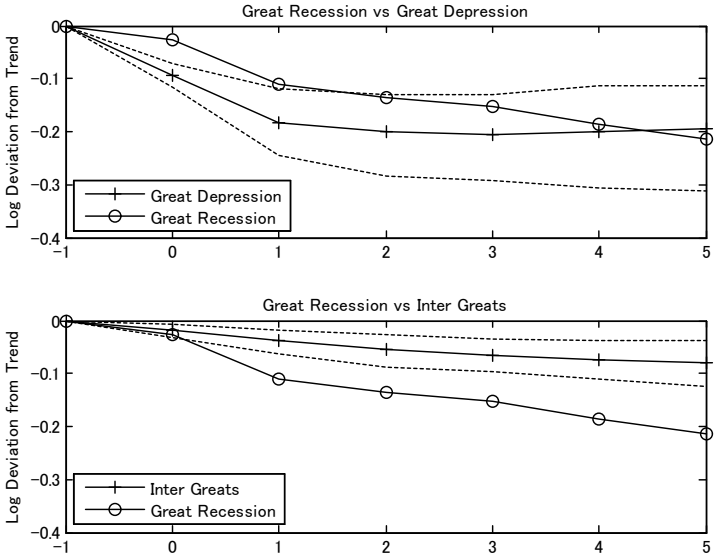

Figure 3: Output Compared to Past Crises

Figure 4 compares the production factors during the Great Recession period to those during the Great Depression period. Capital stock does not fall as much in the Great Recession period than in the Great Depression period. Employment during the Great Recession period significantly exceeds that during the Great Depression period for the first 2 years after the banking

crisis and gradually converges to the Great Depression level. Hours worked during the Great Depression have a temporary decline followed with a recovery while that during the Great Recession declines gradually. Total factor productivity drops slightly more rapidly in the Great Depression period than in the Great Recession period but overall the magnitude of decline is very similar.

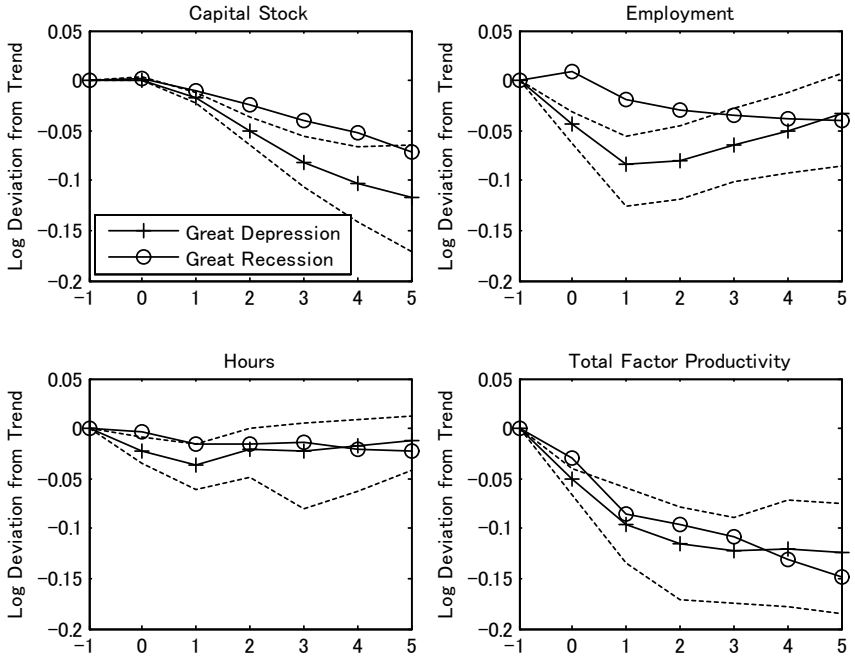

Figure 4: Decomposition Compared to the Great Depression

Figure 5 compares the production factors during the Great Recession period to those during the Inter-Greats period. Capital stock, employment and hours during the Great Recession decline slightly more than that those during the Inter-Greats period. Nonetheless, the Great Recession period means lie within the confidence intervals of the Inter-Greats period for all variables. Total factor productivity, however, declines much more during the Great Recession period than that during the Inter-Greats period.

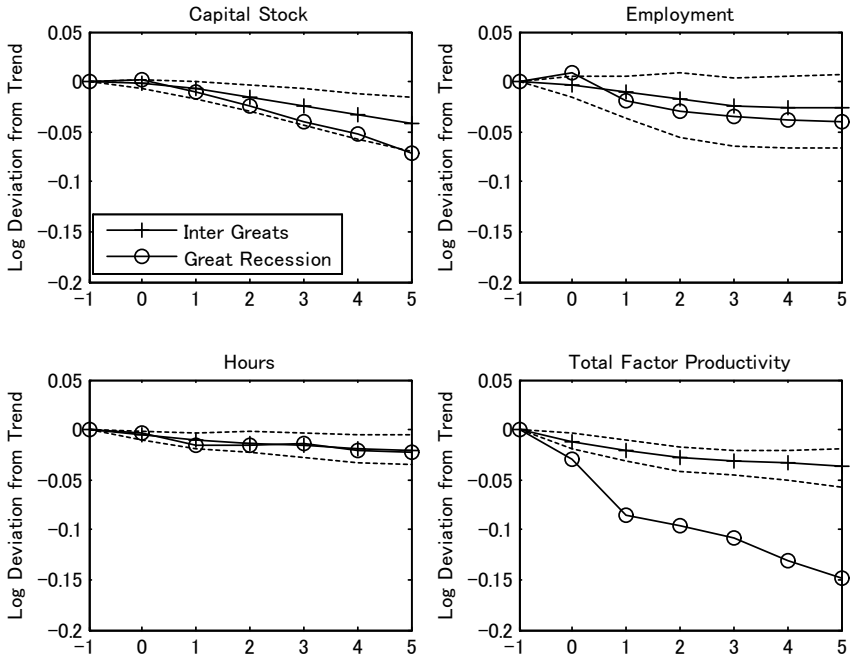

Figure 5: Decomposition Compared to the Inter-Greats

In sum, we find that the decline of detrended output during the Great Recession is much larger than that during the Inter-Greats period mainly due to the large decline in total factor productivity. Furthermore, the output decline during the Great Recession is as large as that during the Great Depression whereas it occurs more gradually due to the slower adjustment of capital and employment.

4 The Great Recession through the Lens of a Neoclassical Growth Model

In this section, we simulate a neoclassical growth model to replicate the crises periods following the Cole and Ohanian (1999) exercise for the US

Great Depression. The model is based on a social planner's optimization problem

$$\max E_0 \sum_{t=0}^{\infty} \beta^t \left[\Psi \log \widehat{c}_t + (1-\Psi)\log(1-l_t)\right]$$

$$sub.to\ \widehat{A_t}\widehat{k_t}^{\theta} l_t^{1-\theta} = \widehat{c}_t + \widehat{k_{t+1}} - (1-\delta)\widehat{k}_t$$

where $\widehat{c}$ and l are detrended consumption and total hours worked $l = eh$, respectively.[4] We assume the following stochastic process for productivity shocks

$$\widetilde{\widehat{A_t}} = \rho \widetilde{\widehat{A_{t-1}}} + \varepsilon,$$

where ε is an i.i.d. shock. We set the parameters values at levels consistent with the literature as listed in Table 2.[5]

Table 2. Parameter Values

θ	β	δ	Ψ	ρ
1/3	0.96	0.06	0.30	0.90

Figure 6 shows the simulation results of output fluctuation from the model taking the total factor productivity series for each period as given. For the Great Depression period, the model significantly understates the drop of output during the initial periods. For the Inter-Greats period, the model significantly understates the output drop during the later period. Finally, for the Great Recession period, the model does extremely well in accounting for the initial drop in output while it slightly understates the decline in output during the later periods.

5 Conclusion

In this paper, we compare the banking crisis episodes during the Great Recession to those during the Great Depression and "Inter-Greats" periods by decomposing the supply-side effects. We find that output has not recovered to their pre-crisis trend levels after 5 years from the onset of banking crises

[4] Notice that we cannot distinguish between hours and employment in a standard neoclassical growth model. Total hours worked is normalized so that the sum of labor and leisure equals to one.

[5] We conduct a sensitivity analysis on the parameter θ since this not only affects the model but also directly affects the measurement of total factor productivity. We find that the results with $\theta = 0.4$ are similar to those presented in this paper.

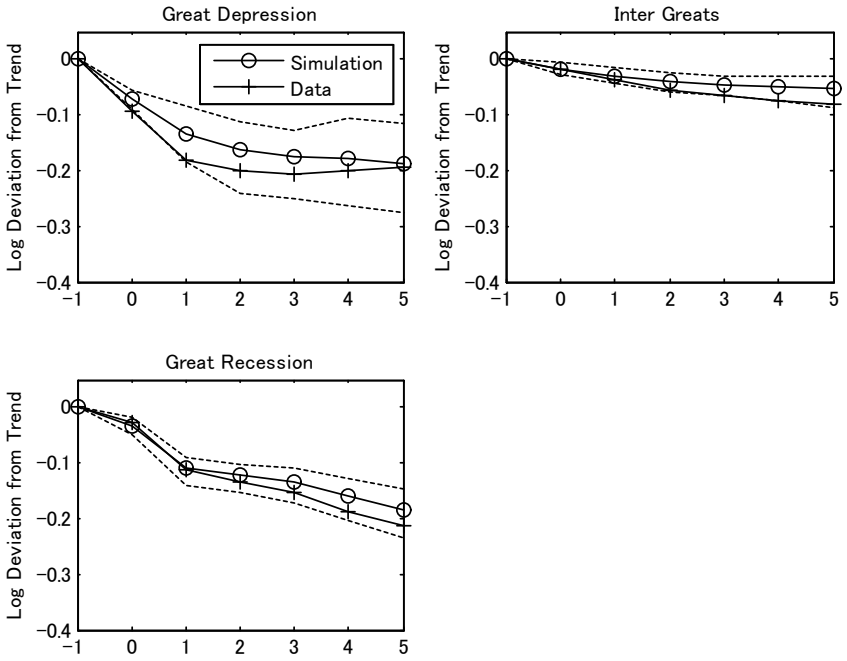

Figure 6: Simulation Results

during all periods. In terms of the magnitude, the output decline during the Great Depression and Great Recession were more than twice as large as that during the Inter-Greats period due to the dramatic decline in total factor productivity. Furthermore, while the magnitudes of the two are comparable, output decline in the Great Recession period was more gradual than that in the Great Depression period due to the slower adjustments in capital and employment. Finally, a neoclassical growth model with productivity shocks can account for the output decline during the Great Recession well compared to those during the Great Depression and "Inter-Greats" periods. Our results encourage future studies on the Great Recession to focus on why productivity fell so dramatically after the onset of the banking crises.

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