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Economic Crisis and Economic Theory

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Abstract

Two dynamic general equilibrium economies compete in explaining the United States' interwar business cycles. Despite the demand driven contender's slight advantages, the results remain too close to call a clear winner.

1 Introduction

"The amazing lesson from this depression is that no one knows much about the real causes and effects of ANYTHING." W. M. Kiplinger, financial expert.

What caused the Great Depression in the United States? Contrary to the ongoing critique on the Economics profession for not having anticipated the Global Financial Crisis, the macroeconomics community over the past decade has produced extensive work on other major depressions. In particular, in recent years, there has been a resurgence in interest in the Great Depression. This work was initiated by Cole and Ohanian (1999) who have entertained the idea that the economic disaster stemmed from real supply shocks such as

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innovations or changes in regulations. Others like Bordo, Erceg and Evans (2000) have considered monetary factors such as price trends, interest rates and monetary policy. And in Harrison and Weder (2006) and Weder (2001, 2006) a decline in aggregate spending has formed the foundation of analysis.

These varied approaches have two central ideas in common: (i) they apply dynamic general equilibrium modelling, and (ii) they calibrate models and use these calibrated models to generate artificial data that are then compared with actual data.

Nevertheless, there is still no general agreement about the causes of the Great Depression in the United States. This paper contributes to the debate contrasting competing theories of the business cycle. In particular, I am going to examine and compare a real business cycle approach which focusses on supply disturbances with another model which puts shifts in real demand at the centerstage. By running a Fair and Shiller-like (1990) test, some new insights regarding these theories' efficacy to explain US interwar business cycles will be provided.

Before looking at these artificial economies, it is worthwhile to restate some facts about the Great Depression in the United States which will be critical when evaluating the theories. Figure 1 presents US per capita GDP from 1889 to 2006 (original source of data: Kendrick, 1961, Maddison, 1991 and NIPA). The Figure also plots the fitted long run trend and cyclical deviations from this estimated trend. The residuals constitute what is generally understood as business cycle fluctuations. These fluctuations, and the interwar years in particular, are the focus of the present paper. The lower part of Figure 1 shows that GDP per capita fell by about 40 percent from trend between 1929 and 1933 and it suggests that the US economy failed to recover until the outbreak of the Second World War. In fact, (detrended) 1939 GDP was some twenty percent lower than that of 1929 (This tepid recovery turns out to be very problematic to explain.) Furthermore, the US economy experienced another big recession during 1937-38 – the third largest in the 20th century.

In the next three Sections, I will outline how two competing ideas of business cycles are able to account for these Depression facts.

Figure 1 about here

2 Supply shocks

It is well known that the real business cycle model performs fairly well in explaining postwar US business cycles. The idea to look at historical episodes and, in particular, to confront real business cycle theory and the Great Depression stems from Cole and Ohanian (1999). They took a plain vanilla real business cycle model off the shelf and tested the hypothesis of if the Great Depression had been caused by negative technology shocks. Cole and Ohanian's idea is not trivial. Figure 2 plots the path of US total factor productivity (TFP) from 1892 to 1941 (original source of data: Kendrick, 1961). The Figure's lower graph shows the percentage deviations of TFP from the prewar trend. TFP deteriorated after 1928, and from 1929 to 1933, there was a near-twenty percent drop in TFP. Hence, everything boils down to if a drop of this size if sufficient to have created the Great Depression.

Their model is outlined as follows. A representative household has preferences ordered by

$$U = E_0 \sum_{t=0}^{\infty} \beta^t \left[\log c_t + \eta \log(1 - h_t) \right].$$

Here c_t denotes consumption, h_t stands for hours worked and β is the discount factor. $0 < \beta < 1$, $\eta > 0$. Physical capital accumulation is described by

$$k_{t+1} = (1 - \delta)k_t + y_t - c_t$$

where k_t is the capital stock and δ its constant rate of physical depreciation. $0 < \beta < 1$. Finally, firms have access to a constant returns to scale technology

$$y_t = z_t k_t^{\alpha} h_t^{1-\alpha}$$

to produce output y_t; z_t is a random variable that shifts the production function, i.e. cyclical TFP. TFP which will be the only driving force in this model. $0 < \alpha < 1$. All markets are perfectly competitive and they clear at all times. Then a series of technology shocks (like the one reported in the lower panel of Figure 2) is fed into the model to generate a sequence of artificial GDP. The real business cycle story encapsulates the first years of the Great Depression fairly well: artificial GDP falls from 1929 through to 1933 and the economy turns around sometime in 1933 before recovering. The predicted free-fall of output is about half as deep as US GDP, hence, a large portion of the Depression can be explained. More problematic, however, is the very tepid recovery of the US economy. The model simply cannot replicate the slow process of recovery: the artificial GDP swiftly returns to trend by 1935. The reason behind this failure is the rapid rise of TFP, which hovers significantly above its long-run average from 1935 onwards (see Figure 2). In the artificial real business cycles economy, this TFP pattern translates into a counterfactual boom during the second half of the thirties. (Monetary models in the footsteps of Friedman and Schwartz, 1963, face a parallel conundrum as is shown by Bordo, Erceg and Evans, 2000, who simulated a sticky price model which suggests that expansionary policies by the Federal Reserve after 1932 should have induced a quickly rebounding economy.) In a view initially formulated by Wanniski (1979), Cole and Ohanian (2004) have moved towards a more agnostic view of what productivity distortions stand-in for. In particular, they analyze the wedges created by institutional changes arising from New Deal cartelization policies, and they suggest that this improves matters as now their model explains much of the second half of the 1930s. Nevertheless, their technology-driven model misses the 1937-1938 recession.

Figure 2 about here

3 Will the real demand shock please stand up?

In this Section, I will approach the Great Depression from a different perspective.[1] My point of departure is Temin's (1976) emphasis on contractions of real aggregate demand beginning with the market crash and continuing through the first years of the thirties. Temin's argument rests on an episodic pattern of consumption which bears no resemblance to that of other recessions. He reports that consumption fell by a whopping 5.4 percent from 1929 to 1930 – a unique fall compared to other economic downturns. For example, during the 1920-1921 recession, consumption had *increased* by 6.4 percent. Temin identifies large negative residuals from estimated Keynesian consumption functions for the onset of the Great Depression, and stresses that investment took similar sudden hits. (Gordon and Veitch, 1986, provide additional support for Temin's position.). In an old-fashioned interpretation, Temin classifies these residuals as the collapse of autonomous spending. Temin's original formulation remains within the confines of the old Keynesian apparatus. In contrast, my model is framed within methodological standards that are set and met by the real business cycle approach. The model applies Temin's interpretation to a fully articulated dynamic general equilibrium framework in which only demand shocks drive economic fluctuations. If the Great Depression was such an equilibrium, the model should be able to replicate the behavior of key macroeconomic aggregates during that time.

The intriguing aspect of this approach is that it takes the basic real business cycle model as a point of departure while considering only one minor

[1] This Section draws on Weder (2001, 2006).

alteration: the representative household has period utility of the form

$$\log(c_t - \Delta_t) + \eta \log(1 - h_t)$$

where Δ_t alters preferences to allow for shifts to the marginal utility of consumption – a taste shock or a real demand shock.[2] The household's optimal plan involves the static condition

$$\eta \frac{c_t - \Delta_t}{1 - h_t} = w_t \tag{1}$$

from which, since data for consumption, hours works and real wage, w_t, are available, a sequence of demand shocks can be backed out (original wage data taken from Hanes, 1996). In fact, this concept is much like the Solow (1957) residual. The dynamics for Δ_t are best described by a low order autoregressive process.

From the Euler equation (1), one is able to identify a series of unusually large pervasive shifts in demand that hit the US economy post-1929. (Weder, 2001, conducted a battery of causality tests and found that neither monetary nor fiscal variables stand behind these disturbances.) These shocks correspond to Temin's account of a drop in aggregate demand. I feed these measured demand shocks into the outlined dynamic general equilibrium model. Figure 3 plots detrended US GDP and the artificially generated output series (1929=100). To show that the model's predictive power is not limited to the Great Depression, I report the complete interwar years of the simulation. A few aspects come to light. First, the size and sequence of shocks can generate a pattern of the model GDP that is not unlike data: the artificial economy is able to account for almost all of the decline in economic activity. Secondly, it is also able to exaggerate a realistic pattern of persistence as both the slow recovery as well as the 1937-38 recessions are replicated. Thirdly, the artificial economy's trough is one year too late – probably the effect of the New Deal. Fourthly, Figure 3 also shows that demand shocks drove a lion's share of the boom during the twenties as well as the 1920-21 Depression. And lastly, but not shown here, Weder (2006) has reported that by adding variable capital utilization and modestly increasing returns to scale in the production technology, the demand-driven model can endogenously replicate most of the path of data TFP. Hence, the real business cycle model is contained as a special part within the demand-driven economy.

Figure 3 about here

[2] See also Baxter and King (1991) and Hall (1986).

4 Supply versus demand

So far this analysis has followed the existing literature and has simply evaluated success via "aesthetic R^2s". We have seen that there appears to be support for both approaches, so this Section will apply a test that aims to discern model performances. Here I follow Fair and Shiller (1990) who check the forecasting ability of various econometric models by evaluating the information content of endogenous model output through the lens of a regression.

Table 1 about here

In particular, I apply their test to assess the information contained in the supply-driven and in the demand-driven models' forecasts. It is well known that time series econometrics allows data to be distinguished in atheoretical ways. For example, modelling aggregate output as a low-order autoregressive or moving-average process generates reasonable fits. Now, if any of the two theories bear anything unique about the US economy, they must bestow some advantages relative to atheoretical time series models. I implement this investigation by estimating equations of the following form

$$\ln y_t^{\mathrm{US}} = \alpha + \sum_{i=1}^{n} \beta_i \ln y_{t-i}^{\mathrm{US}} + \sum_{i=0}^{h} \gamma_i \ln y_{t-i}^{\mathrm{m}} + \epsilon_t.$$

Here y_t^{US} denotes linearly-detrended per capita US GDP (20th century trend) and y_t^{m} stands for simulated model output. The idea behind conducting these tests is that by adding output from the models to the regression, one obtains a measure of to what extent supply and demand shocks respectively provide additional informational content. I begin with the autoregressive model. Data covers 1919-1941. A lag length of $n = 1$ was chosen since other lags are not significant (t-statistics in parentheses):

$$\ln y_t^{\mathrm{US}} = \underset{(1.12)}{0.514} + \underset{(8.60)}{0.882} \ln y_{t-1}^{\mathrm{US}}.$$

Table 1 shows that the time series model explains over 79 percent of the variation in output one year hence. So, to what extent do the model realizations provide additional informational content? Table 1 reports that both considered models contain incremental explanatory power on output. The standard errors of the regressions fall, and the probability that the explanatory power is produced by pure chance is essentially nil (see the p-values of the F-statistic and the log likelihood ratio in Regressions 2 and 3). If anything there exists a slight advantage in favor of the demand driven model:

$\overline{R}^2$ rises by more (i.e. the informational content appears to be larger), and actual lagged US output is no longer significant at the fourteen percent level.

Next, I next add both models simultaneously to the regression. This is reported in Regression 1 in Table 2. Again, both models contribute significantly as indicated by the t-statistics (since actual data would no longer be significant, I have omitted it). However, if I consider the Twenties (Regression 2) and Thirties (Regression 3) separately, the picture changes somewhat. It now appears that the Roaring Twenties were predominantly driven by demand shocks: the real business cycles' regression coefficient becomes negative and insignificant. Finally, a mix of supply and demand shifts can explain almost all of the Great Depression ($\overline{R}^2$ approaches one in Regression 4).[3] Overall, this analysis suggests that both supply and demand driven models contribute to our understanding of the Great Depression.

Table 2 about here

5 Conclusion

There exists still no general agreement about the causes of the Great Depression in the United States. In this paper two dynamic general equilibrium economies compete in explaining the US interwar business cycles. The analysis remains inconclusive with respect to which theory performs better; it is too close to call a clear winner.

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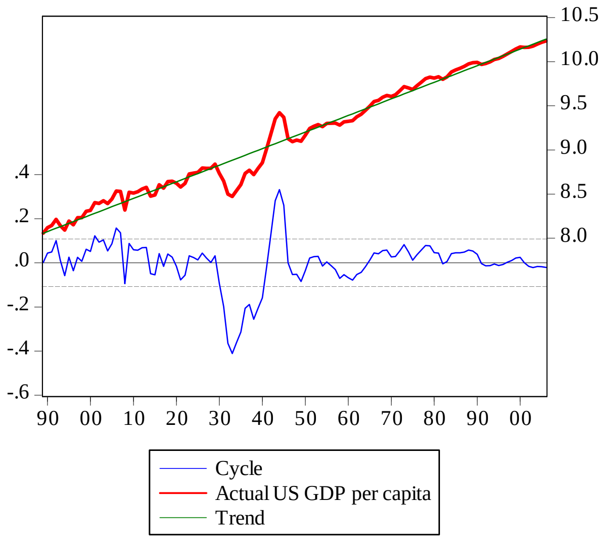

Figure 1: US per capita GDP, 1889-2006, logarithmic scale The lower part of the Figure shows the deviations from constant time trend.

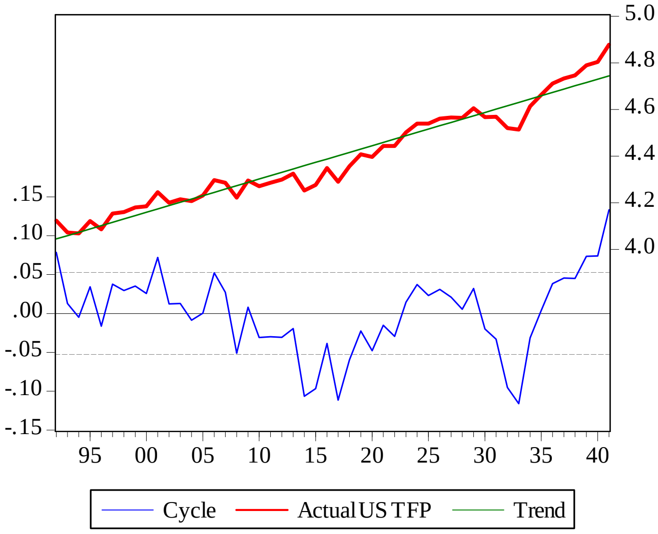

Figure 2: US TFP, 1892-1941, logarithmic scale The lower part of the Figure shows the deviations from constant time trend.

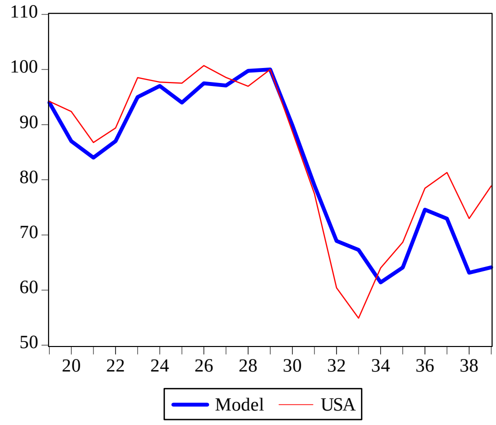

Figure 3: Artificial and US GDPs (detrended, 1929=100).

Table 1 Regression results ($h = 0$)						
Regression	Variable	Coefficient (t-value)	$\overline{R}^2$	S.E.R.	F-statistic (variable)	Log likelihood ratio
1	-	-	0.794	0.0697	-	-
2	y_t^{RBC}	0.475 (3.55)	0.857	0.0543	0.0024	0.0008
3	y_t^{Demand}	0.662 (3.44)	0.871	0.0551	0.0031	0.0011

S.E.R. = standard errors of regression, last two columns test for redundant variables: test statistics are the F-statistic and the Log likelihood ratio (χ^2); probability values reported.

Table 2
Regression results ($h = 0$)

Regression	Variable	Coefficient (t-value)	$\overline{R}^2$	S.E.R.	F-statistic (variable)	Log likelihood ratio
1	y_t^{RBC}	0.429 (4.46)	0.932	0.0397	0.0002	0.0001
	y_t^{Demand}	0.837 (13.36)			0.0000	0.0000
2	y_t^{RBC}	−0.108 (−0.54)	0.687	0.0216	0.5992	0.5250
	y_t^{Demand}	0.727 (11.98)			0.0112	0.0022
3	y_t^{RBC}	0.547 (12.24)	0.982	0.0172	0.0000	0.0000
	y_t^{Demand}	0.676 (16.36)			0.0000	0.0000