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Rating for government debt and economic stability

Kenichi Tamegawa *

Faculty of Literature and Social Sciences, Yamagata University, 1-4-12 Kojirakawa-machi, Yamagata-shi, Yamagata 990-8560, Japan

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ABSTRACT

In this study, we incorporate a credit rating scheme for government debt into a standard dynamic general equilibrium model. We then analyze the relationship between a credit rating system and economic stability. The main result demonstrates the existence of an unstable rating system. Such a system would be generated by information asymmetries between rating agencies and government stances regarding debt. We also find that if the sensitivity of credit ratings to debt-to-GDP ratio is high, then it could lead to economic instability in the sense that this ratio explodes.

1. Introduction

Owing to the economic recession caused by the 2008 financial crisis, many countries were compelled to create a large fiscal deficits. Such deficits, financed by issuing government bonds, have brought about fiscal crises in some countries in the eurozone.

Under these circumstances, government debt needs to be rated appropriately. Market participants generally use the information provided by rating agencies and invest in debt securities. With regard to a credit rating system, we can imagine the following scenario. Suppose that the rating system becomes unnecessarily severe. Then, the interest rates of the debt rise through the imposition of a risk premium. This increase in interest rates leads to economic recession, which increases the debt. Thus, the credit rating of the debtor declines again. If this cycle continues, the economy becomes unstable.

This study examines whether the above scenario is valid in a dynamic stochastic general equilibrium (DSGE) model. In other words, we consider the following question: Is there a rating system that leads to economic instability, and if so, how is it described within a DSGE framework? Many studies have discussed the stability or sustainability of government debt. In particular, several empirical works including Hamilton and Flavin (1986), Hakkio and Rush (1991), Trehan and Walsh (1991), and Bohn (1998) have focused on the debt accumulation equation. Daniel and Shiamptanis (2013) have recently investigated debt stability in the European Monetary Union by considering the fiscal limit, which is defined as the point at which the

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E-mail address: tamegawa@human.kj.yamagata-u.ac.jp

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government cannot collect additional tax and cannot implement additional expenditure. The above-mentioned studies econometrically investigate the sustainability of government debt through unit root tests or cointegration tests with the associated time series data. In contrast, to calculate the time path of the debt, Ball, Elmendorf, and Mankiw (1998) assume that economic growth and interest rates follow a certain exogenous stochastic process.

In our view, interest rates for government debt are determined by a general equilibrium, and thus stability needs to be analyzed within a general equilibrium framework. Although recent research shares our viewpoint (for example, Sakuragawa and Hosono (2010) investigated debt stability numerically in Japan with a DSGE framework), a general equilibrium approach is rarely used in comparison with partial equilibrium methods.

A novel feature of our study is that we incorporate a simple rating scheme for government debt into a standard DSGE model. With this additional component, we can analyze the relationship between the credit rating system and economic stability. To state our result, we define a rating system as unstable if it leads credit rating agencies to respond in ways that create a debt explosion. Our main result indicates the existence of such an unstable rating system. This system's dynamics reflect asymmetric information between rating agencies and government stances regarding debt. In presenting this finding, we can show that if the sensitivity of credit ratings to debt-to-GDP ratio is high, then this could lead to economic instability in the sense that this ratio explodes. We also show the structure of the unstable rating system as a closed-form representation. Furthermore, we present an empirical method showing how our theory could be tested.

The rest of the paper is organized as follows: Section 2 develops the DSGE model, while Section 3 states our main result. Section 4 conducts simple empirical analyses to demonstrate how our theory is applied. Finally, Section 5 concludes our paper.

2. The model

In this section, we set up the DSGE model to investigate the relationship between a credit rating system for government debt and economic stability. We assume an economy with firms, households, and a government. For analytical simplicity, we omit capital stock.

2.1. Firms

Suppose that competitive firms produce final goods using the following production function:

$$Y_t = Z_t (h_t)^{\alpha},$$

$$0 < \alpha < 1,$$

where Y_t denotes the real output; Z_t, the deterministic growth factor with $\frac{Z_t}{Z_{t-1}} = \gamma > 1$; and h_t, hours worked. Firms employ labor such that profits $Y_t - w_t h_t$ are maximized, where w_t represents real wage rate. The excess profits are distributed to households. Note that the number of employees is normalized to unity for all t.

2.2. Households

Households receive wages and excess profits from firms as well as income gains from financial assets. In our economy, the only financial assets are government bonds. After households pay a lump-sum tax, they use their disposable income to purchase final goods and bonds. Thus, we can define the budget constraint for households as follows:

$$B_{t+1} = 1_t R_{t-1} B_t + Y_t - C_t - T_t, \tag{1}$$

where B_t denotes a government bond; R_t, the gross real interest rate; C_t, the real consumption; and T_t, the real tax. The indicator function 1_t is defined as

$$1_t = \begin{cases} 1 \text{ if the government at time } t \text{ has not defaulted} \\ \quad 0 \qquad\qquad \text{otherwise} \end{cases}$$

De-trending Eq. (1) by dividing both sides by growth factor Z_t and assuming that the temporal utility function is $\log c_t + \theta \log(1 - h_t)$, our maximization for households is expressed as follows:

$$\max\ E_0 \sum_{t=0}^{\infty} \beta^{-t} \log c_t + \theta \log(1 - h_t),$$

$$\text{s. t. } \gamma b_{t+1} = 1_t R_{t-1} b_t + y_t - c_t - t_t,$$

$$1_0 = 1,$$

where β represents households' subjective discount rate and the lowercase letters denote the relevant variable divided by