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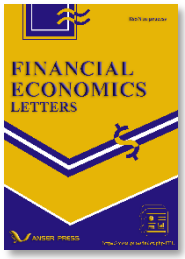

Government deficit and "The World's smallest macroeconomic model" by Paul Krugman

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ABSTRACT

In his "The World's smallest macroeconomic model" (Krugman (1999)), Paul Krugman argued that under the assumption of price rigidity, a shortage of money supply leads to underemployment or recession, so increasing money supply can eliminate underemployment and restore full employment. But, how do we increase the money supply? I will show that we need a government deficit to increase the money supply in order to restore full employment from recession. Also, I will show that in a growing economy, if people hold money, a government deficit is necessary to maintain full employment under constant price or inflation. A government deficit is not only effective in pulling the economy out of recession, it is even necessary for continued growth without inviting either recession or inflation. The government deficit in this paper represents the difference between government expenditures and government revenues. When the difference is positive, we say that the government has a deficit. This paper seeks to explore theoretically and normatively the role of government deficits in achieving and maintaining full employment in a growing economy without causing inflation, using a very simple model by Krugman.

KEYWORDS

Budget deficit; Full employment; Price rigidity; Growth

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1. Introduction

In his "The World's smallest macroeconomic model" (Krugman(1999)), Paul Krugman, using a very simple macroeconomic model, argued that under the assumption of price rigidity, a shortage of money supply leads to underemployment or recession, so increasing money supply can eliminate underemployment and restore full employment. He also says that these arguments may be the implications of the famous following remark by J. M. Keynes;

Unemployment develops, that is to say, because people want the moon; — men cannot be employed when the object of desire (*i.e.* money) is something which cannot be produced and the demand for which cannot be readily choked off. There is no remedy but to persuade the public that green cheese is practically the same thing and to have a green cheese factory (*i.e.* a central bank) under public control. (Keynes (1936) Chapter 17)

Murota (2017), citing Krugman (1999), presents an analysis of long-run stagnation due to deficient aggregate demand using money-in-the-utility-function model based on Ono's model (Ono(1994, 2001)). He proposes generous unemployment benefits to reduce unemployment. But, my interests are more basic and I am interested in government deficits in general. The government deficit in this paper represents the difference between government expenditures on public investment, education and other programs and government revenues from taxes and social insurance contributions. When the difference is positive, we say that the government has a deficit. This paper seeks to explore theoretically and normatively the role of government deficits in achieving and maintaining full employment in a growing economy without causing inflation, using a very simple model by Krugman.

I have two questions about the arguments by Krugman.

- How do we increase the money supply?

I will prove that we can increase the money supply by creating a government deficit and thereby overcome the recession and restore full employment.

- What is needed to maintain and sustain full employment in a growing economy at stable price or inflation?

On this issue as well, we show that a government deficit is effective in achieving full employment at stable price or inflation. If the price is not constant and is expected to increase, we need a government deficit whose nominal value is larger than that with constant price to maintain full employment. Or, we can say that the larger government deficit induces inflation.

The famous Lerner's functional finance theory (Lerner (1944)) does not consider whether to run a government surplus or deficit to be meaningful in and of itself, but rather believes that fiscal policy should be used to achieve a state of near full employment while avoiding inflation as much as possible. This paper follows Lerner's functional finance theory, using a simple macroeconomic model by Krugman. Please refer to Forstater (1999) about Lerner's functional finance theory.

The purpose and intent of this paper is to argue that government deficits are not a temporary anomaly, but a very normal and enduring situation, at least in the major countries. Therefore, the pursuit of balanced government budgets by unnecessarily reducing government deficits and government debt in the name of sound finances is an obstacle to the stable growth of each country's economy.

In the next section I review Krugman's model. In Section 3 I analyze a government deficit for full employment under the price rigidity. In Section 4 I consider a government deficit in a growing economy. In Section 5 I present an empirical evidence. Section 6 is a concluding section. In the appendix I will analyze the case of issuing government bonds in place of money.

The accumulation of government deficits is government debt. It is often said that government debt must eventually be repaid, but this is not true. Unless one is clearly aware of the destruction of the nation or the extinction of the human race and decides how to live in retrospect, there is no need to assume that the government debt will be repaid. What is important is to maintain as close to full employment as possible without causing excessive

inflation and to achieve stable growth.

2. Krugman' model

We consider the following simple model of the economy. There is only one good, produced at constant returns to scale by the single factor of production, labor. One unit of labor produces one unit of the good, and the price level and the wage rate must be the same, and can be referred to with a single symbol, P. There is also only one asset, money. Agents start the current period with M units of money, and end with M' after spending on consumption and earning the wage.

The model of consumers' behavior is the so-called money-in-the-utility-function model. As Krugman said, "the utility of money presumably reflects its usefulness in providing future consumption; but we sweep this implicit dynamic problem under the rug". The agents derive utility both from consumption and from the expected purchasing power of the money they hold at the end of the period.

The utility function is assumed to take a specific form:

$$U = (1-s)\ln C + s\ln\left(\frac{M'}{P^e}\right), \qquad 0 < s < 1. \tag{1}$$

C is the consumption. P^e is the expected price level. However, consumers are assumed to have static expectations, so that

$$P^e = P.$$

Employment is L units of labor. Then, the budget constraint for the people is

$$C + \frac{M'}{P} = L + \frac{M}{P}.$$

By the first order conditions for utility maximization, we get

$$C = (1-s)\left(L + \frac{M}{P}\right),$$

and

$$\frac{M'}{P} = s\left(L + \frac{M}{P}\right).$$

$1-s$ is the propensity to consume. If the money supply is constant, then

$$M' = M,$$

and

$$\frac{M}{P} = s\left(L + \frac{M}{P}\right).$$

This means

$$P = \frac{1-s}{s}\frac{M}{L},$$

or

$$M = \frac{s}{1-s} PL.$$

Denote the employment under full employment, or labor supply, by L_f. Now let us introduce some rigidity of the price. Murota (2017) presented an argument about price rigidity or wage rigidity. He considers nominal wage stickiness attributed to union wage setting[1]. He assumes that labor unions are concerned not with a rise in real wages but with that in nominal wages because of money illusion. For Krugman's model the nominal wage stickiness is more appropriate than the real wage stickiness. However, Krugman said "never mind why the price and the wage are sticky. It comes from overwhelming empirical evidence." Anyway, I assume that the price (wage) level is fixed above the level consistent with full employment, so that real balances M/P are too low. Formally, we assume

$$P > \frac{1-s}{s} \frac{M}{L_f},$$

or

$$M < \frac{s}{1-s} PL_f.$$

They mean

$$L < L_f.$$

Therefore, under the price rigidity insufficient money supply induces insufficient demand for the good for full employment. If the money supply is increased to M' which satisfies

$$M' = \frac{s}{1-s} PL_f,$$

then

$$L = L_f,$$

and full employment is restored.

But, how do we increase the money supply. Let's consider that in the next section.

3. Government deficit for full employment under the price rigidity

We introduce the government expenditure G and the tax T. The budget constraint for the consumers is

$$C + \frac{M'}{P} = L_f + \frac{M}{P} - T.$$

Then, the consumption and the money holding are

$$C = (1-s)\left(L_f + \frac{M}{P} - T\right), \tag{2}$$

and

[1] Greiner (2013) and Raurich, Sala, Sorolla (2006) considerred real wage stickiness attributed to union wage setting.

$$\frac{M'}{P} = s\left(L_f + \frac{M}{P} - T\right). \tag{3}$$

The equilibrium condition for the good market is

$$C + G = L_f. \tag{4}$$

By (2) and (4),

$$(1-s)\left(L_f + \frac{M}{P} - T\right) + G = L_f. \tag{5}$$

From (3) and (5), we obtain

$$G - T = \frac{M'}{P} - \frac{M}{P}. \tag{6}$$

This is the government deficit. Therefore, we have shown the following result.

Proposition 1

Under the price rigidity, the increase in money supply required to restore full employment from recession can be achieved through a government deficit.

Or a government deficit is necessary to restore the economy from recession to full employment. The conclusion calls for a government deficit, but there are two main ways to run a government deficit: increase spending and decrease taxes. If society's needs call for the enhancement of public capital, it may be desirable to increase fiscal spending, and if society's needs call for the support of people's consumption, it may be appropriate to reduce taxes.

Graphical representation

Assume that T and $\frac{M}{P}$ are given. For now, let us assume that employment is not necessarily full employment, denoted by L. Then, (2) and (4) are rewritten as

$$C = (1-s)\left(L + \frac{M}{P} - T\right),$$

and

$$C + G = L.$$

From them

$$L = \frac{(1-s)\left(\frac{M}{P} - T\right) + G}{s} \tag{7}$$

Under the constant price to achieve full employment, G must be a value that satisfies the following equation.

$$L_f = \frac{(1-s)\left(\frac{M}{P} - T\right) + G}{s}. \tag{8}$$

This is the multiplier property of the government expenditure. From this

$$G = sL_f - (1-s)\left(\frac{M}{P} - T\right). \tag{9}$$

Denote it by G_f. On the other hand, from (6)

$$\frac{M'}{P} = G_f - T - \frac{M}{P}.$$

This is the real money supply we need for full employment. In Figure 1, I depict the value of (7) with $G = 0$ by $\bar{L}$.

$$\bar{L} = \frac{1-s}{s}\left(\frac{M}{P} - T\right).$$

The line $\bar{L}A$ depicts (7). Its slope is $\frac{1}{s}$. L_f is the value of (8) with $G = G_f$.

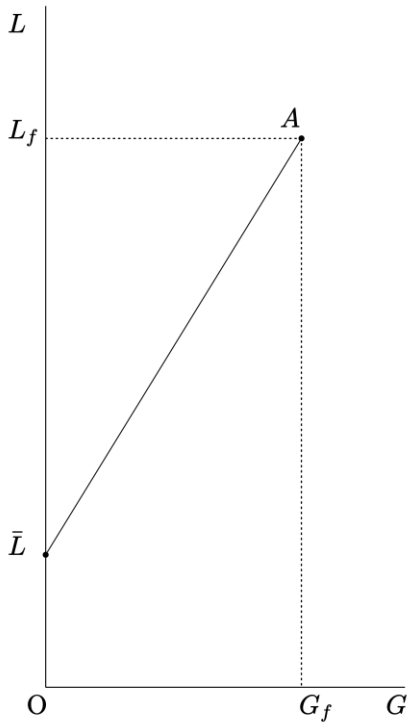

Figure 1. Government expenditure for full employment.

4. Government deficit in a growing economy under full employment

Next I consider a growing economy under full employment with or without inflation expectations. The reason for growth can be population growth, technological progress, or anything else. The real growth rate is

$$0 < n < 1.$$

The point is that the real money holding at the end of the period should be

$$\frac{M'}{P^e} = (1+n)\frac{M}{P}.$$

P^e is the expected price in the next period. M' is the nominal money holding at the end of the period. Then, the nominal growth rate is

$$(1+n)\frac{P^e}{P}-1.$$

The budget constraint for the consumers is

$$C+\frac{M'}{P^e}=L_f+\frac{M}{P}-T.$$

The consumption and the money holding are

$$C=(1-s)\left(L_f+\frac{M}{P}-T\right), \tag{9}$$

and

$$\frac{M'}{P^e}=s\left(L_f+\frac{M}{P}-T\right). \tag{10}$$

The market equilibrium condition is

$$C+G=L_f. \tag{11}$$

By (9) and (11),

$$(1-s)\left(L_f+\frac{M}{P}-T\right)+G=L_f. \tag{12}$$

From (10) and (12), we obtain

$$G-T=\frac{M'}{P^e}-\frac{M}{P}=n\frac{M}{P}.$$

What this formula means is that the real values of government spending and taxes must be determined so that the real value of the government deficit is equal to the real money holdings at the beginning of the period times the growth rate. The real value of the government deficit required to maintain full employment is independent of inflation expectations. Its nominal value is

$$P^e(G-T)=M'-\frac{P^e}{P}M>P(G-T)\quad \text{if}\quad P^e>P.$$

Thus, under an inflation expectation we need a larger nominal government deficit than under a static expectation. We have shown the following result.

Proposition 2

In a growing economy, the increase in money supply required to maintain full employment under constant price can be achieved through a government deficit. The real value of the government deficit should be equal to the real money holdings at the beginning of the period times the growth rate, and it does not depend on the rate of expected inflation. But, under an inflation expectation we need a larger nominal government deficit than under a static expectation.

We can also say that a government deficit is necessary to maintain full employment under constant price, and that the larger government deficit induces inflation.

5. Empirical evidence

The purpose and intent of this paper is to argue that government deficits are not a temporary anomaly, but a very normal and enduring situation, at least in the major countries. Therefore, the pursuit of balanced budget by unnecessarily reducing government deficit and government "debt" in the name of sound finances is an obstacle to the stable growth of each country's economy.

Table 1. Government deficit (% of GDP).

	Average	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Canada	-2.41	-3.9	-4.7	-3.3	-2.5	-1.5	0.2	-0.1	-0.5	-0.1	0.4	0	-10.9	-4.4
France	-4.88	-7.2	-6.9	-5.2	-5	-4.1	-3.9	-3.6	-3.6	-3	-2.3	-3.1	-9	-6.5
Germany	-0.69	-3.2	-4.4	-0.9	0	0	0.6	1	1.2	1.3	1.9	1.5	-4.3	-3.7
Italy	-3.96	-5.1	-4.2	-3.6	-2.9	-2.9	-3	-2.6	-2.4	-2.4	-2.2	-1.5	-9.7	-9
Japan	-6.18	-9.7	-9.1	-9	-8.2	-7.6	-5.6	-3.7	-3.6	-3.1	-2.5	-3	-9.1	-6.2
United Kingdom	-6.31	-10.1	-9.2	-7.4	-8	-5.4	-5.6	-4.6	-3.3	-2.5	-2.3	-2.5	-13.1	-8
United States	-8.53	-13.1	-12.4	-11	-9.2	-5.8	-5.2	-4.6	-5.4	-4.4	-6.1	-6.7	-14.9	-12.1
China	-0.01	1.1	2.2	1.5	1.3	0.6	0.6	-0.6	-1.1	-1.4	-2	-2.3		
Average	-4.12	-6.40	-6.09	-4.86	-4.31	-3.34	-2.74	-2.35	-2.34	-1.95	-1.89	-2.20	-10.14	-7.13

Table 1 shows government deficits in recent years for several representative nations (from OECD Economic Outlook, 2023). Doesn't this table show that government deficits are very typical?

Table 2. Government debt (% of GDP).

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Canada	104.5	107.4	111.1	113.7	107.8	108.6	114.4	115.4	111.8	109.8	111.9	146.1	134.1
France	97.6	101	103.8	111.9	112.5	120.2	120.8	123.7	122.9	120.7	123.1	145.9	138.1
Germany	78	87.3	86.3	88.7	84.1	83.9	79.8	77	72.4	69.2	67.6	78.4	77.4
Italy	125.5	124.3	117.2	135.4	143.2	155.6	156.9	154.6	152	146.9	154.2	183.1	172.5
Japan	199.4	204.4	218	226.6	229.7	234.4	233.3	231.4	230.3	234.2	234.8	257	256
United Kingdom	78.7	89.2	103.2	107.4	103.3	113.3	112.6	119.6	119.4	116	118.8	151.2	142.6
United States	115.4	125.3	130.5	132.3	135.8	135.5	136.9	138.8	135.4	137.3	136.1	159.9	148.1

Table 2 shows government debt (also from OECD Economic Outlook, 2023, no data for China). The accumulation of government deficits is government debt, but if full employment and stable growth can be achieved without causing high rates of inflation, then the government debt need not and should not be eliminated through taxation. Unless people are deciding their current actions in anticipation of the destruction of the nation, the extinction of the human race, etc., the government debt need not be repaid and may be accumulated.

6. Concluding remarks

I have shown the following two results.

- Under the price rigidity, the increase in money supply required to restore full employment from recession can be achieved through a government deficit.
- In a growing economy, the increase in money supply required to maintain full employment under constant price or inflation can be achieved through a government deficit. The real value of the necessary government

deficit does not depend on the rate of expected inflation. But, under an inflation expectation we need a larger nominal government deficit than under static expectations.

A government deficit is not only effective in pulling the economy out of recession, it is even necessary for continued growth without inviting either recession or inflation.

During the last 10 to 20 years, Japan has not been able to easily boost its economy and increase its growth rate despite low interest rates while continuing to run government deficits. This can be attributed to the fact that Japan has not necessarily been spending enough despite the apparent government deficit, and to the fact that the consumption tax hike was implemented even though the economy was still recovering. In my opinion, the current Japanese people's propensity to consume is so small that even a modest fiscal deficit may not solve the demand shortage. However, this is a subject for future research.

Although called government debt, government bonds are assets just like money, and their creditworthiness is equal. The difference between them is whether they earn interest or not. Therefore, money should be issued instead of government bonds, and government bonds should not be regarded as debt.

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Conflict of interest

The author claims that the manuscript is completely original. The author also declares no conflict of interest.

Appendix

A1. Government debt and Debt-GDP ratio in a growing economy.

In this appendix, I consider the case where financial assets are held not in money but in interest-producing government bonds in a growing economy with a government deficit. As before, I denote the holdings of government bonds at the beginning and end of the period by M and M', respectively. The interest rate is denoted by r ($0<r<1$). The budget constraint for the consumers is

$$C + \frac{M'}{P^e} = L_f + (1+r)\frac{M}{P} - T.$$

The consumption and the bond holding are

$$C = (1-s)\left[L_f + (1+r)\frac{M}{P} - T\right], \tag{13}$$

and

$$\frac{M'}{P^e} = s\left[L_f + (1+r)\frac{M}{P} - T\right]. \tag{14}$$

By the market equilibrium condition (11),

$$(1-s)\left[L_f + (1+r)\frac{M}{P} - T\right] + G = L_f. \tag{15}$$

From (14) and (15),

$$G - T = \frac{M'}{P^e} - (1+r)\frac{M}{P},$$

or

$$G - T + r\frac{M}{P} = \frac{M'}{P^e} - \frac{M}{P}.$$

In a steady-state growth path, the following equation must hold

$$G - T + r\frac{M}{P} = n\frac{M}{P}.$$

This implies that the real value of the government deficit, including interest payments, equals the increase in real government bond outstanding. At the beginning of the period the debt-GDP ratio is

$$(1+r)\frac{M}{PL_f}.$$

At the beginning of the next period, it is

$$(1+r)\frac{M'}{P^e(1+n)L_f} = (1+r)\frac{M}{PL_f}. \tag{16}$$

It is constant under full employment. The larger the value of s, or the smaller the propensity to consume $(1-s)$, the larger M is, so then the value of (16) is also large.

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