Economics 602
Macroeconomic Theory and Policy
Problem Set 8
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1. **Consolidated Government Budget Constraint.** Suppose that at the beginning of period *t*, $M_{t-1} = 100$ and the government has to repay 10 *nominal* units in government bonds (our usual one-period, FV = 1 bonds). In period *t*, the fiscal authority (Congress) decides to spend 190 *nominal* units in government spending, collect 180 *nominal* units in taxes, and instructs the Treasury to raise 20 *nominal* units by issuing new (one-period, FV = 1) bonds (that is, the Treasury is ordered to raise 20 nominal units by selling bonds, not ordered to sell 20 bonds).
    a. Under this scenario, can the monetary authority decide to expand the money supply (i.e., can it choose $M_t > M_{t-1}$)? Briefly explain why or why not, or, if it is not possible to determine, explain why it cannot be determined.
    b. Under this scenario, is the monetary authority active or passive? Briefly explain.

2. **Unpleasant Monetarist Arithmetic[1].** Consider a **finite** period economy, the final period of which is period T (so that there is no period $T+1$) – every agent in the economy knows that period T is the final period of the economy. In this economy, the government conducts both fiscal policy (engaging in government spending and collecting taxes) and monetary policy (expanding or contracting the money supply). **The timing of fiscal policy and monetary policy will be described further below.** The economy has now arrived at the very beginning of period T, and the period-T consolidated government budget constraint is
$$M_T - M_{T-1} + B_T + P_T t_T = (1+i_{T-1})B_{T-1} + P_T g_T ,$$
where the notation is as follows:

    - M_t is the **nominal** money supply at the end of period t;
    - B_t is the **nominal** quantity of government debt outstanding at the end of period t (i.e., a **positive** value of B_t here means that the government is in **debt** at the end of period t);
    - t_t is the **real** amount of lump-sum taxes the government collects in period t (and there are no distortionary taxes);
    - i_{t-1} is the **nominal** interest rate on government assets held between period $t-1$ and t, and it is **known with certainty in period** $t-1$**;**
    - g_t is the **real** amount of government spending in period t;
    - P_t is the nominal price level of the economy in period t.

[1] This problem is based on a classic work in macroeconomic theory by Thomas Sargent and Neil Wallace ("Some Unpleasant Monetarist Arithmetic," Federal Reserve Bank of Minneapolis *Quarterly Review*, Vol. 5, 1981).

Thus, once period T begins, the economic objects yet to be determined are t_T, g_T, M_T, and B_T. How P_T is set is described more fully below.

a. Compute the numerical value of B_T? Show any important steps in your computations/logic.

The remainder of this question is independent of part a. **For the remainder of this question, suppose that for some reason $B_T = 0$ -- the fiscal authority is committed to this decision about bonds and will never deviate from it**. Also suppose for the remainder of this question that $i_{T-1} = 0.10$, $B_{T-1} = 10$ (i.e., the government is in **debt** at the beginning of period T, given the definition of B_t), $P_{T-1} = 1$ (notice the time subscript here), and $M_{T-1} = 10$.

The timing of fiscal policy and monetary policy is as follows. At the beginning of any period t, the monetary authority and the fiscal authority **independently** decide on monetary policy (the choice of M_t) and fiscal policy (the choices of t_t and g_t), respectively.

Finally, in parts b and c, suppose that the nominal price level is flexible (i.e., it is not at all **"sticky").**

b. Suppose the fiscal side of the government decides to run a **primary real fiscal surplus of** $t_T - g_T = 9$ in period T. Also suppose that the monetary authority chooses a value for M_T which when coupled with this fiscal policy implies that there is **zero inflation** between period $T-1$ and period T. Compute numerically **the real value of seignorage revenue** the government earns in period T, clearly explaining the key steps in your computations/logic. Also provide brief economic intuition for **why** the government needs to generate this amount of seignorage revenue in period T?

c. Suppose the monetary authority sticks to its monetary policy (i.e., its choice of M_T) you found in part b above. However, the fiscal authority decides instead to run a primary real fiscal surplus of $t_T - g_T = 8$. Compute numerically **the real value of seignorage revenue** the government must earn in period T **as well as the inflation rate between period $T-1$ and period T.** Clearly explain the key steps in your computations/logic. **In particular, why is real seignorage revenue here different or not different from what you computed in part b?**

In part d, assume the nominal price level is "completely sticky" – that is, the nominal price level never varies from one period to the next.

d. With "complete stickiness" of the price level, is a monetary policy that sets the level of M_T you found in part b consistent with a fiscal policy that sets a real fiscal surplus of $t_T - g_T = 8$ as in part c? In other words, can those policies work simultaneously? Explain carefully why or why not, using any appropriate mathematical or logical arguments.

e. Reviewing the scenarios posed in parts b, c, and d, address the following question in a brief discussion: what is the role of fiscal policy in determining the inflation rate and/or the nominal price level in the economy? If possible, connect your remarks to the debate between the RBC view and the New Keynesian view. (Note: there is no single correct

answer here, but if you conducted the analysis above correctly, there is a generally correct theme that emerges. Also note that you are **not** simply being asked to summarize the results above, but rather to try to draw some bigger-picture insight.)

3. **The Dynamics of Fiscal Policy.** President Obama and his primary economic advisers have planned to put in place large fiscal stimuli over the next few years. The precise details of the fiscal stimulus are still to be worked out, but they include **both tax cuts as well as increased government spending in the next few years**.

It is early 2009, and the new administration has just recently been seated. At the beginning of 2009, the lifetime consolidated budget constraint of the government is:

$$\frac{B_{2008}}{P_{2009}} = (t_{2009} - g_{2009}) + \frac{t_{2010} - g_{2010}}{1 + r_{2010}} + \frac{t_{2011} - g_{2011}}{(1 + r_{2010})(1 + r_{2011})} + \frac{t_{2012} - g_{2012}}{(1 + r_{2010})(1 + r_{2011})(1 + r_{2012})} \cdot$$

Line 1: PDV of fiscal deficits

$$+ sr_{2009} + \frac{sr_{2010}}{1 + r_{2010}} + \frac{sr_{2011}}{(1 + r_{2010})(1 + r_{2011})} + \frac{sr_{2012}}{(1 + r_{2010})(1 + r_{2011})(1 + r_{2012)}} + \ldots$$

Line 2: PDV of seignorage

The notation here is as in Chapter 15: t denotes real lump-sum tax collections, g denotes real government spending, sr denotes real seignorage revenue, r denotes the real interest rate, B denotes nominal (one-period) government bonds, and P denotes the nominal price level of the economy (i.e., the nominal price of one basket of consumption). Subscripts indicate time periods, which we will consider to be calendar years. Note, of course, the ellipsis (…) in each line of the above equation.

As indicated above, the first line of the right-hand-side is the present discounted value of all fiscal deficits the government will ever run starting from 2009 onwards, and the second line of the right-hand-side is the present-discounted value of all seignorage revenue that will ever result from the monetary policy actions of the Federal Reserve starting from 2009 onwards.

The primary economic advisers to President Obama are Treasury Secretary Timothy Geithner, National Economic Council Chairman Lawrence Summers, and Council of Economic Advisers Chairwoman Christina Romer.

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In addressing each of the following issues, no quantitative work is required at all; the following questions all require only conceptual analysis. Each issue should be addressed in no more than three or four sentences.

a. Geithner, because of his background as President of the New York Federal Reserve, implicitly advocates that no matter what fiscal policy actions the new administration takes, they should be designed in such a way as to have no effects on the conduct of monetary policy whatsoever. If this is so, what type of fiscal policy – a Ricardian fiscal policy or a non-Ricardian fiscal policy – does Geithner advocate? **Briefly explain.**

b. The less even-keeled that he is, Summers' comments sometimes seem to imply that the fiscal stimulus measures should **not** take into account any consequences they may have for the conduct of monetary policy. If the combination of tax cuts and government spending that ultimately pan out over the next few years follow Summers' advice, what are likely to be the consequences for the Federal Reserve's monetary policy in 2009 and beyond? **In particular, will the Fed likely have to expand or contract the nominal money supply? Briefly explain.**

c. The objective academic macroeconomist that she is, Romer typically points outs in her remarks that because fiscal policy plans (for both taxes and government spending) will almost surely be revised as the years unfold (that is, fiscal policy plans adopted in 2009 can be revised in later years), it may be impossible to know beforehand what the eventual consequences for monetary policy of a particular fiscal policy action adopted at the start of 2009 might be. Use the government budget constraint presented above to interpret what Romer's statements mean.

d. If, later this year after the new fiscal plans are (supposedly) clarified further, the nominal price level of the economy behaves as shown in the following diagram on the next page (the price level, *P*, is plotted on the vertical axis), which of the following is the most relevant explanation: the fiscal theory of the price level, the fiscal theory of inflation, or the financial accelerator mechanism? **Briefly justify your answer.**

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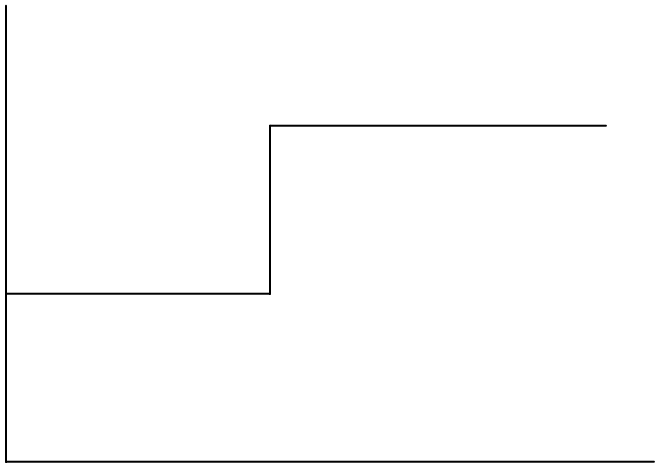

June 2009 Time

4. Greece and Long-Run Fiscal (In)Solvency. The current European economic and sovereign debt crisis has put into sharp focus one of the main challenges of enacting a **single** currency zone (the euro zone, or the euro area, as it is officially called) and hence a **single monetary policy** among (17) sovereign countries, but **without** enacting a **single fiscal policy** across those countries. Consider specifically the case of Greece, which is the most highly indebted country (in terms of percentage of its GDP – the Greek government's debt is roughly 150% of Greek GDP) in the euro area. (Throughout the rest of this problem, the terms "single-currency zone," "euro zone," and "euro area" are used interchangeably.)

In this problem, you will apply the Fiscal Theory of the Price Level (FTPL) studied in Chapter 15 to the analysis of fiscal policy in a single-currency zone. In studying or applying the FTPL, the condition around which the analysis revolves is the present-value (lifetime) consolidated government budget constraint (GBC). Recall that, starting from the beginning of period t, the present-value consolidated GBC is

$$\frac{B_{t-1}}{P_t} = \sum_{s=0}^{\infty} \frac{t_{t+s} - g_{t+s}}{\prod_{s=1}^{\infty}(1+r_{t+s})} + \sum_{s=0}^{\infty} \frac{sr_{t+s}}{\prod_{s=1}^{\infty}(1+r_{t+s})},$$

in which all of the notation is just as in Chapter 15.

You are given three numerical values. First, suppose that B_{t-1} = €340 billion (which roughly corresponds to what the Greek government's total nominal debt is at present). Second, assume that $\boldsymbol{t_t - g_t = -}$ **€20 billion (note the minus sign** – this value roughly corresponds to Greece's fiscal balance in the third quarter of 2011). Third, the Greek nominal price level **in period t-1 is P_{t-1} = 1** (which is a normalization).

Due to its high indebtedness, Greece was under the spectre of default and possible exit from the single-currency zone. To avoid these dramatic adverse consequences, Greece was compelled (by other European governments) to make strict fiscal adjustments as well as other reforms to stabilize the rapid increase in government debt.

Note: in some of the analysis below, you will need to make use of the **geometric summation** result from basic mathematics. A brief description of the geometric summation result: suppose that a variable x is successively raised to higher and higher powers, and the infinite sequence of these terms is summed together, as in

$$x^0 + x^1 + x^2 + x^3 + x^4 + ...$$
$$= \sum_{s=0}^{\infty} x^s$$

(in which the second line compactly expresses the infinite summation using the summation notation Σ). This sum can be computed in a simple way according to

$$\sum_{s=0}^{\infty} x^s = \frac{1}{1-x}.$$

This expression is the geometric summation result (which you studied in a pre-calculus or basic calculus course), which you will need to apply in some of the analysis below.

a. In a single-currency zone (such as the euro area), monetary policy is carried out by a "common" central bank (which is the European Central Bank in the euro area). A consequence of this is that

individual countries – in particular, Greece – **cannot** print their own money (despite the fact that there **is** a Bank of Greece). What is the implication of this for **Greece's** seignorage revenue? **And,** how would this impact Greece's present-value GBC? Explain as clearly as possible, including, if needed, any mathematical analysis.

b. Suppose that Greece commits to stay in the single-currency zone and to carry out all necessary fiscal adjustments to ensure its present-value GBC is satisfied. Suppose that the real interest rate is constant in every period at five percent ($r = 0.05$) and that the nominal price level in period t will remain $P_t = 1$ (note this is the period-t price level, not the period t-1 price level).[2] Suppose Greece carries out its fiscal adjustments in period t, **and** (to simplify things a bit) Greece will keep the new fiscal surplus (or fiscal deficit) **constant** at that level in **all** subsequent time periods. **What is the numerical value of the fiscal surplus (or fiscal deficit) in order to ensure that the present-value consolidated GBC from part a is satisfied? That is, what is the numerical value of ($t - g$)? Be clear about the sign and the numerical magnitude of ($t - g$).** Present your economic and/or mathematical logic; and provide brief economic explanation.

c. Re-do the analysis in part b, assuming instead that $r = 0.025$. **Compare the conclusion here with the conclusion in part b,** providing brief economic explanation for why the conclusions do or do not differ.

d. Under a more realistic view, suppose that Greece still commits to stay in the single-currency zone and to make some, but not all, of the required fiscal adjustments that you computed in part b (perhaps because of "political constraints" that we are leaving outside the analysis). To make it concrete, suppose that Greece is able to run a fiscal surplus of only **€5 billion** in every period (i.e., $t - g$ = €5 in every time period). If the real interest rate is five percent ($r = 0.05$), compute the **numerical value of P_t** to ensure that the present-value consolidated GBC is satisfied. **Be clear about your logic and computation to arrive at the result;** and provide brief economic explanation.

e. Re-do the analysis in part d, assuming instead that $r = 0.025$. **Compare the conclusion here with the conclusion in part d,** providing brief economic explanation for why the conclusions do or do not differ.

f. Assume that Greece decides (against the collective wisdom of other European governments) to **leave** the single-currency zone. Once having left the euro zone, instead of making a serious fiscal adjustment, Greece prefers to cover its debt burden through seignorage revenue, while keeping the fiscal balance **unchanged (in every time period into the future) at $t - g$ = – €20 billion** (note the minus sign). Suppose that the required seignorage revenue is kept at the same level in **all** subsequent years, and assume that $r = 0.05$ **(which suppose cannot be affected by monetary policy)**. **Address the following three questions:**

i) How much (per-period) seignorage revenue would Greece need generate in order to keep its prices at $P = 1$ in period t and for every period beyond t?

[2] And note that what is relevant here is the **real** interest rate, **not** the **nominal** interest rate, which had shot up in Greece to about 25% in October 2011. The reason why **real** interest rates, not nominal rates, matter most directly is that markets' expectations of inflation for Greece (if Greece did indeed exit from the euro zone) was near 20%.

ii) What are the implications of this particular monetary and fiscal (and, ultimately, political) policy on Greece's own future (i.e., period *t* and beyond) inflation rate?

iii) What is the theoretical difference between the analysis in this question and the analysis conducted in parts b and c, **and** with the analysis conducted in parts d and e?