

Problem Set 8: Macroeconomic Policy

Due April 27/28

A) Public Goods: During the reign (27 BC-14 AD) of Gaius Julius Caesar Octavianus Imperator Divi Filius Augustus, the estimated population of Rome was one million people, with an average income *per capita* of 1 sestertius (say, \$1 at today's prices) a day. Suppose that you are advising Marcus Vipsanius Agrippa on the renovation/construction of the aqueducts of Rome—the Aquae Appia, Anio, Claudia, Marcia, Julia, and Virgo, and perhaps more. Suppose that the value of the system of aqueducts to the average Roman, in sesterces per day, is given by the table to the right:

Aquae Romae

Number of Aqueducts	Total Value per Roman per Day
0	0.0000
1	0.2500
2	0.3125
3	0.3403
4	0.3559
5	0.3659
6	0.3728
7	0.3779
8	0.3819
9	0.3849
10	0.3874

Suppose that the interest rate used to properly amortize the cost of renovating the aqueducts is 5%/year, and that depreciation—the cost of keeping the aqueducts in good repair—is an additional 5%/year, so that the total amortization cost of investing in aqueducts is 10%/year.

1. With 365 days/year, what is the annual value of the first aqueduct to the average Roman? How much, at a 10%/year amortization rate, is the average Roman's willingness to pay for one aqueduct?

2. What is the annual value of 10 aqueducts to the average Roman? How much, at a 10%/year amortization rate, is the average Roman's willingness to pay for ten aqueducts?

3. With 1 million Romans and at a 10%/year, what is the maximum willingness-to-pay of the entire population of Rome for one aqueduct? For ten aqueducts?

4. Suppose that renovating each aqueduct costs 10,000,000HS. How many aqueducts should Marcus Vipsanius Agrippa use his *imperium* to command that they be renovated/constructed? What is the optimum number of aqueducts?

5. What are the overall benefits and costs if M. Vip. Agrippa commands the renovation/ construction of the optimum number of aqueducts? What is the benefit/cost ratio?

6. In a first-century BC Rome where the average wage is only 3HS/day, how can it possibly be worthwhile spending such unbelievably large amounts of money—the total pay for an entire legion of soldiers for three years—on building stone ditches to carry water from upstream to the city of Rome?

B) Macro Policy: The level of real potential output in the United States in 2022 might be \$19 trillion, it might be \$20 trillion, and it might be \$21 trillion. Suppose that the Keynesian multiplier is 3, that private-spending flows are such that $c_o+I_o+NX = \$4.5$ trillion, and that even the most expansionary Federal Reserve policy cannot push the long-term risky real interest rate r below zero.

1. What should the government set real government purchases at in 2022 if potential GDP will be \$19 trillion?

2. What should the government set real government purchases at in 2022 if potential GDP will be \$20 trillion?

3. What should the government set real government purchases at in 2022 if potential GDP will be \$21 trillion?

4. Suppose the government is uncertain about what the level of real potential GDP will be, but has to choose the level of government purchases in advance. Suppose further that the Federal Reserve does not have to set monetary policy until after the value for government purchases G has been chosen—and the Federal Reserve will not have to choose its monetary policy until after it learns what the level of potential output in 2022 will be. What level of G should the government choose?

5. In October 2015 Governor of the Federal Reserve Lael Brainard said: “The downside risks... argue against prematurely taking away the [low-interest rate] support that has been so critical.... These risks matter more than usual because the ability to provide additional accommodation if downside risks materialize is, in practice, more constrained than the ability to remove accommodation more rapidly if upside risks materialize. The asymmetry in risk management stems from the combination of the likely low current level of the neutral real interest rate and the effective lower bound.... We have considerably greater latitude to adjust the path of policy in response to inflation that exceeds current forecasts than we have to provide additional accommodation in response to additional adverse [spending] shocks...” What is she saying here?

6. Why wasn't your answer to (4): “A government uncertain about what the level of real potential GDP will be that has to choose the level of government purchases in advance should act as if real potential output is relatively low and let the Federal Reserve take on the burden and lower interest rates if it learns that the level of potential output will be high”?

Econ 1: Spring 2016: U.C. Berkeley

C) Basic Micro: The population of Berkeley is roughly 100,000—and the average Berkeley resident buys one latte a day at an average price per latte of \$4.

1. Suppose that the maximum willingness-to-pay for a latte in Berkeley is \$14 and that the daily demand for lattes is linear—a straight line. What is the equation for the demand curve?

2. Suppose that it is easy and cheap to open a cafe to make lattes, so that there are no fixed costs, and there are neither increasing nor decreasing returns to scale. What do you think the supply curve for lattes would be?

3. What is the equilibrium price? What is the equilibrium quantity?

4. What is the consumer, producer, and total surplus?

5. What is the contribution of the latte business in Berkeley to GDP?

6. Suppose the city of Berkeley grants a monopoly right to sell lattes and all drinks that are close substitutes for lattes to a single monopoly—the Berkeley Monopoly Cooperative. What price would it set for lattes? How many would it sell? How much consumer and producer surplus would be generated?