Economics 105: Introduction to Economics

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Problem Set 5 – ANSWER KEY

General Instructions:

I highly encourage you to work with others in the class on these problems, but you need to write up your own answers individually. Please write down the names of all the people with whom you collaborate in completing your submission. There is no limit on how many of your peers you work with. Also remember that Yan is available in her sessions for support.

You may write as much or as little as you wish as long as your answers are complete and address all components of the question. Make sure you label all graphs clearly.

You can draw your graphs by hand or use software like Google Drawing or Excel if you prefer. **However you choose to submit your answers, please organize your work clearly and write legibly.**

Recall that the easiest way to do poorly on these problem sets is to forget to answer or to ignore components of questions. My questions purposefully ask for several components. I recommend crossing off questions as you write up your submissions so you don't forget to answer pieces of my questions. **Make sure to show your work when your answer involves algebra.**

This is due December 9 by the start of class on paper.

The Bryn Mawr College Honor Code applies to this assignment.

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1. Advising a small country on stagnation, growth strategy and macroeconomic challenges

BACKGROUND: You are a consultant for Dalberg, a consulting firm that advises governments in low-income countries on economic policy decisions. Your team has been hired by the Minister of Finance in the of Federal Republic of Smallia to advise the government on several important challenges it is facing in its macroeconomy.

Some background on Smallia is that it is a small country highly dependent on its agricultural sector and oil exports for its economic output. It is a poor country with a low average level of education, a low average standard of living, and a high population growth rate. In order to protect its small domestic industries from being out competed by foreign firms, the country has highly protective policies on foreign imports and technologically advanced products in the country are rare, outside of the fossil fuel sector.

Unlike its neighbor to the north, the Republic of Agrofossilia, Smallia has its own central bank and controls its money supply. It is a stable democracy, but it has been experiencing chronically low rates of economic growth for a long period of time.

The new prime minister (who appointed your client, the Minister of Finance) campaigned on a platform that promised to change this and, in the process, claimed that she would be able to take Smallia's economic growth rate and drastically improve it in a short amount of time. She claims she can get the economy to double in 5 years.

1.a Figure 1 shows Smallia's GDP growth over the past 14 years. Respond to the following: (1) What is the growth rate over this period of time? (2) At this rate, how long will it take the country to achieve the Prime Minister's goal of doubling the economy?

Answer: We can look at Figure 1 to answer this question. The economy of Smallia is 12.5 million in 2000 and let's say 12.63 in 2013. So, in this period of time the economy grew by 12.63 -12.5 = 0.13 million 130,000.00 USD. This is a growth rate of 1.04 percent or 0.08 percent per year (1.04/13). This is quite a low growth rate, especially for a low-income country which typically grows faster than technologically advanced countries.

The economy in 2013 is 12.63 million. So, at this growth rate, how long will it take Smallia to grow to double, 25.26 million. An easy first approximation is to use the "Rule of 72", which says that the time for an economy to double is equal to the following,

$$Time\ to\ Double = \frac{72}{Growth\ Rate} = \frac{72}{0.08} = 900\ years. \quad (1)$$

This is all you had to do to answer this question satisfactorily. Feel free to stop reading this answer here. I proceed for the rest of this section to provide a little bit of a derivation of the Rule of 72 so you know where it comes from.

To provide some more insight into where this "rule" comes from, we can also use basic algebra to proceed and check how close it is to what we get from using the rule of 72. We know the economy grows by 0.08 percent per year and the economy is 12.63 million in 2013 so we'll use that as the starting size of the economy and the growth rate. Note that the economy is growing each year and getting larger, thus algebraically we need to set this up as a process where the economy's size is compounding over time (the growth each year is added to the size from the year before). The way to set this up is,

$$Future\ Value = (Present\ Value) \times (1 + Growth\ Rate)^{Time\ Periods} \quad (2)$$

Substituting in what we know yields,

$$2 \times 12.63 = 25.26 = 12.63 \times (1 + 0.0008)^{Time\ Periods} \quad (3)$$

We need to rearrange this for the "Time Periods" variable now. I'll work through this slowly since some of you might not be familiar with log rules. First, we divide both sides by 12.63 to get,

$$2 = (1.0008)^{Time\ Periods} \tag{4}$$

Next, we take the natural log of both sides of the equation,

$$\ln(2) = \ln\left(1.0008^{Time\ Periods}\right) \tag{5}$$

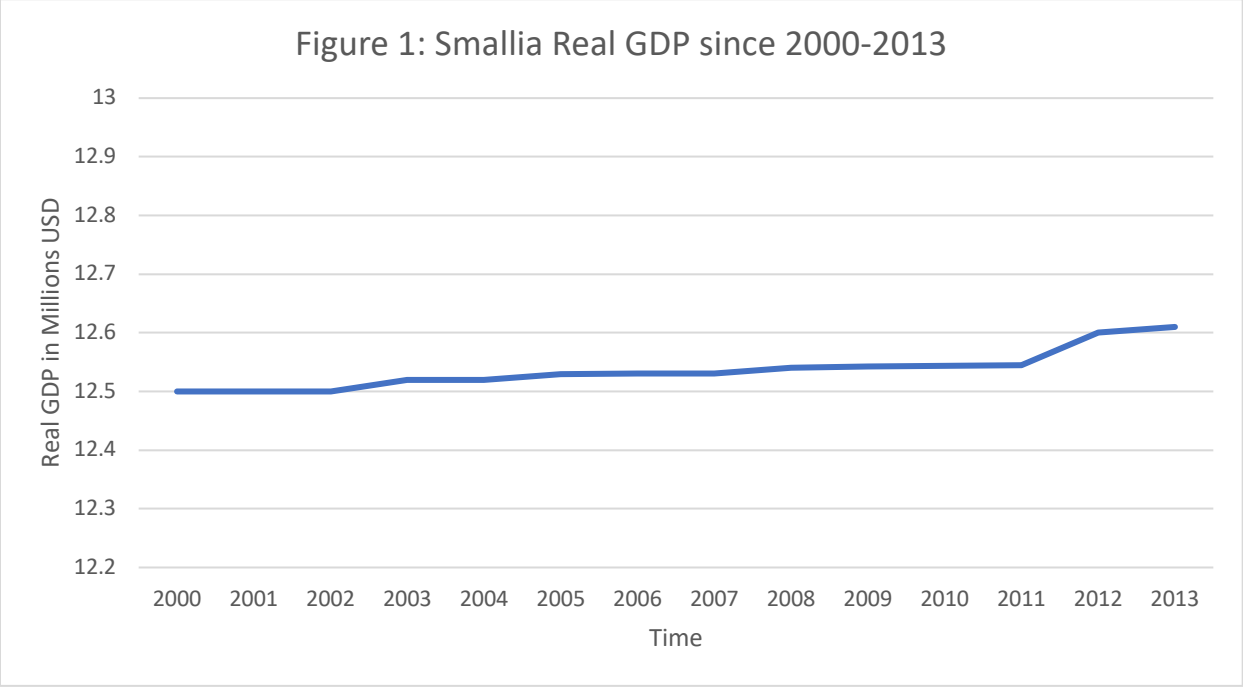
Now a handy feature of taking logs of a value that has an exponent is the following rule: $ln(x^y) = yln(x)$*. So,*

$$\ln(2) = (Time\ Periods)\ln(1.0008) \tag{6}$$

We're almost there. Dividing both sides by $\ln(1.0008)$ *results in,*

$$\frac{\ln(2)}{\ln(1.0008)} = \frac{0.693}{0.0008} = 867 = Time\ Periods. \tag{7}$$

This is pretty close to what we got from the Rule of 72. However, it is still off by 33 years. Why? Note that equation 7 is just the Rule of 72 except we're using the more accurate number 69.3. So why use 72 instead of 69.3? Well it's just because 72 has many integer divisors and the calculation is easier to make in your head for more growth rates than 69.3. The more accurate calculation for the doubling of an economy assuming a constant growth rate is 69.3/Growth Rate.



1.b As mentioned above, Smallia is poor. Although it has a strong democracy, it has weak court systems and corruption is a serious problem among local officials at the municipal level. The education system is very poor. Many teachers do not show up to work and most students leave school by the time they are 14 years old to work on subsistence producing farms. Many school buildings do not have electricity and the educational curriculum the schools use does not teach any science courses because almost no school in the country has laboratories. While the formal sector of the economy is quite small, the informal economy (businesses that are not registered and do not pay taxes) is quite large and there is a notably high level of people starting their own informal businesses.

The Minister of Finance thinks that the reason behind the low growth rate for the country is that rich countries are not giving enough foreign aid to Smallia, and that her staff's time would be best spent lobbying rich countries to increase their foreign aid transfers to Smallia.

Respond to the following: (1) In a short email of one or two paragraphs written for the Minister of Finance, diagnose the factors contributing to Smallia's growth rate. (2) Articulate whether you agree, disagree, or partially agree with the Minister of Finance's position that low foreign aid is the reason behind the low growth rates in the country. (3) Explain your reasoning and justify your position.

Answer: The following is an example of an appropriate response.

"Dear Your Excellency the Minister of Finance for the Federal Republic of Smallia:

While I agree with your position that the international community could be doing more to support Smallia's effort to increase economic growth, I disagree with the position that small foreign aid flows are the core driver of the low growth rate in the country. The consensus among economists is that growth is related to underlying structural features of the economy, especially an economy's ability to develop technology that allows it to enhance its production processes and become more efficient over time.

There are several conditions in Smallia that are holding it back from achieving its technological potential. First, the population of the country currently has a very low level of overall education. This is due to a poorly run education system where teachers frequently do not show up for work on time and the curriculum does not teach science courses. This has resulted in a drastic undersupply of engineers, and technical experts that could help Smallia improve its technological potential. Additionally, Smallia currently has protectionist policies in place that keeps high-tech products from more advanced economies out. Smallia could benefit greatly by reducing these barriers and allowing these products in to the country improving local firms' chances of imitating certain technologies.

Economists also believe that robust growth is the product of strong institutions which incentivize innovation and business activity and entrepreneurialism on the part of citizens. There are likely

ways to improve the institutional arrangements in the country to incentivize innovation and growth. It appears that Smallia has a strong culture of entrepreneurial activity as evidenced by its high rate of business growth in the informal sector. The fact that the formal sector is relatively small despite high levels of entrepreneurialism, and the high rate of corruption in the lower courts suggests Smallia could improve its growth rate through institutional reforms addressing corruption, and regulation in the formal economy."

1.c Smallia's Minister of Industry argues that Smallia needs to take advantage of its extremely low wage rate to produce cheap exports to the richer countries. To do this, he says that the country should get rid of its restrictions of foreign imports, and if it does this, the richer countries will reciprocate and allow for more imports from Smallia.

He argues that gaining access to markets in the US and western Europe will mean the country can access higher world prices for the products that Smallia produces and will be able to grow through those exports. Respond to the following: (1) Adapt the AS/AD model to illustrate how gaining access to higher world prices can result in a trade surplus to illustrate the Minister's point. (2) What mechanism would need to come into effect for sustained increased economic growth to occur? (3) Depict this within your adaptation of the AS/AD model. (Hint: Look at Figure 37-4 (C) in Colander for a framework to appropriate for your analysis of this question.)

Answer: This is essentially asking you to model the situation of the "Rest of the World" from our class session on structural stagnation. We can think of this as a situation where after dismantling the protectionist policies in the country, Smallia is able to now sell tradable goods it can produce very cheaply abroad at a higher price than what people pay domestically.

Note that this does not operate as a pure mirror image of the situation in the richer country that we modelled in class. This is a tough question that really throws you in the deep end of the AS/AD model and asks you to adapt it in a way that is quite challenging. As a result, I will be flexible on the grading.

If you recall the discussion from class, the low world price acted as a price ceiling essentially because no consumer in a rich country would ever buy a more expensive domestic item when they could access a cheaper foreign version. We can begin this by thinking of accessing the foreign markets as resulting in an increase in net exports. This shifts the AD curve from AD_1 to AD_2.

rGDP expended domestically is therefore Y_1^* and the total rGDP is Y_{Total}^*. Exports are therefore $Y_{Total}^* - Y_1^*$. This is the trade surplus. Think about what also might be happening with globalization. More openness of information means more technology transfer between Smallia and its more technologically advanced trading partners. This means that the country will gain production efficiency, resulting in a rightward shift in the both the SRAS and LRAS. Therefore, the price level in the long term stays the same, at P^* while the country grows in both short-run and long-run production capacity. Figure A.1 illustrates this below.

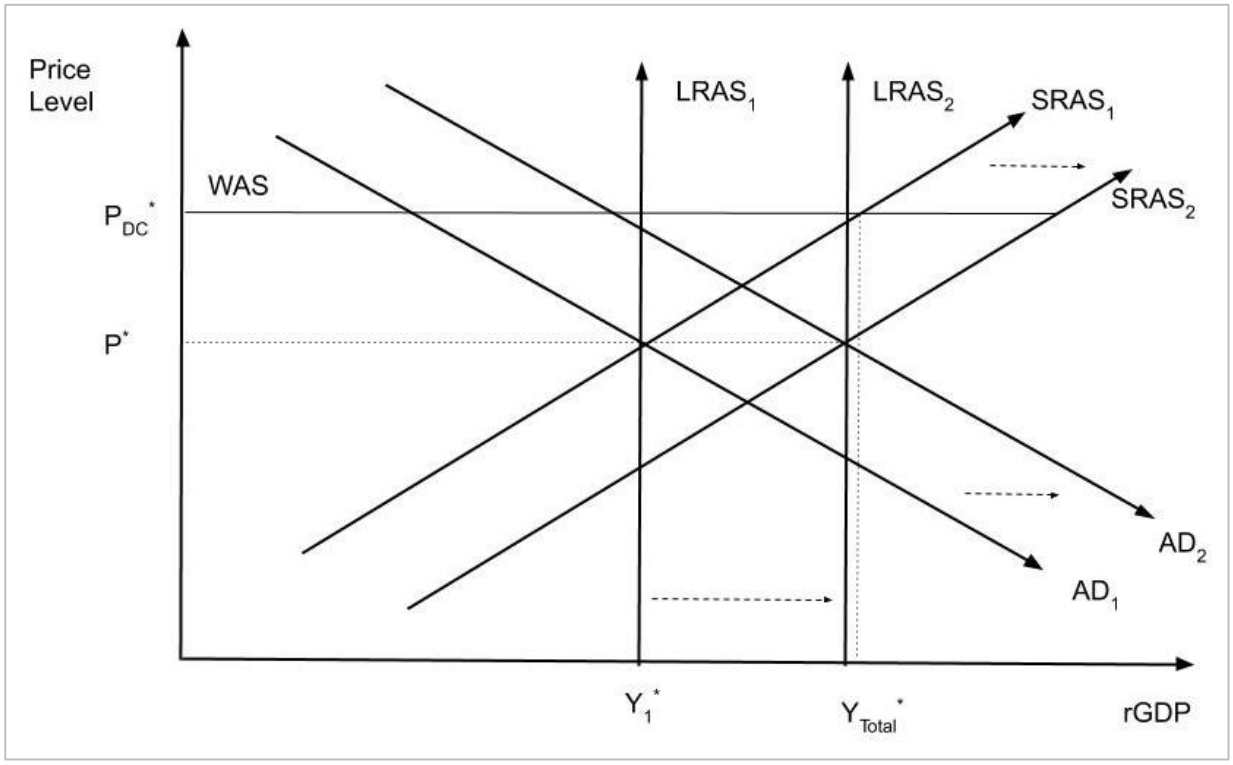


Figure A.1: Smallia's Macroeconomic Response to Dismantling Protectionism

1.d Because Smallia has been trying for years to increase the growth rate in the economy, the Central Bank has been buying treasury bonds from the government. Respond to the following: (1) Why would the government believe that this would be a successful way to increase growth through increased investment? (2) Would this help or hurt (or do nothing to) the Minister of Industry's plan to grow through exports? (Hint: consider the effect of expanding the money supply on exchange rates. Look at Figure 37-5 in Colander.)

Answer: Buying debt from the government is a way the central bank intervenes in the economy to influence the interest rates in the country. The Fed in the US does this through targeting a certain interest rate in the Fed Funds rate. Buying government debt effectively increases the amount of money in the hands of the banks and expands the money supply. This reduces interest rates and increases investment, shifting the AD curve out, resulting in short-term growth.

This increase in the money supply would also make Smallia's currency less expensive relative to the currencies of its trading partners. We don't cover exchange rates in depth in this class but intuition from supply and demand analysis is all that you need to figure this out.

An exchange rate is just the price of a currency in another currency. Let's look at supply and demand for Smallia's currency in terms of a major trading partner (let's say the US for concreteness in our example. Figure A.2 depicts the supply and foreign demand for Smallia's

currency in US dollars, which is the exchange rate (ER). If Smallia increases its money supply as described, supply of its currency shifts out to the right as shown. This lowers the exchange rate in USD from ER_1 to ER_2. Smallia's products are now less expensive to American consumers because it takes fewer dollars to buy the same amount of Smallia's currency!

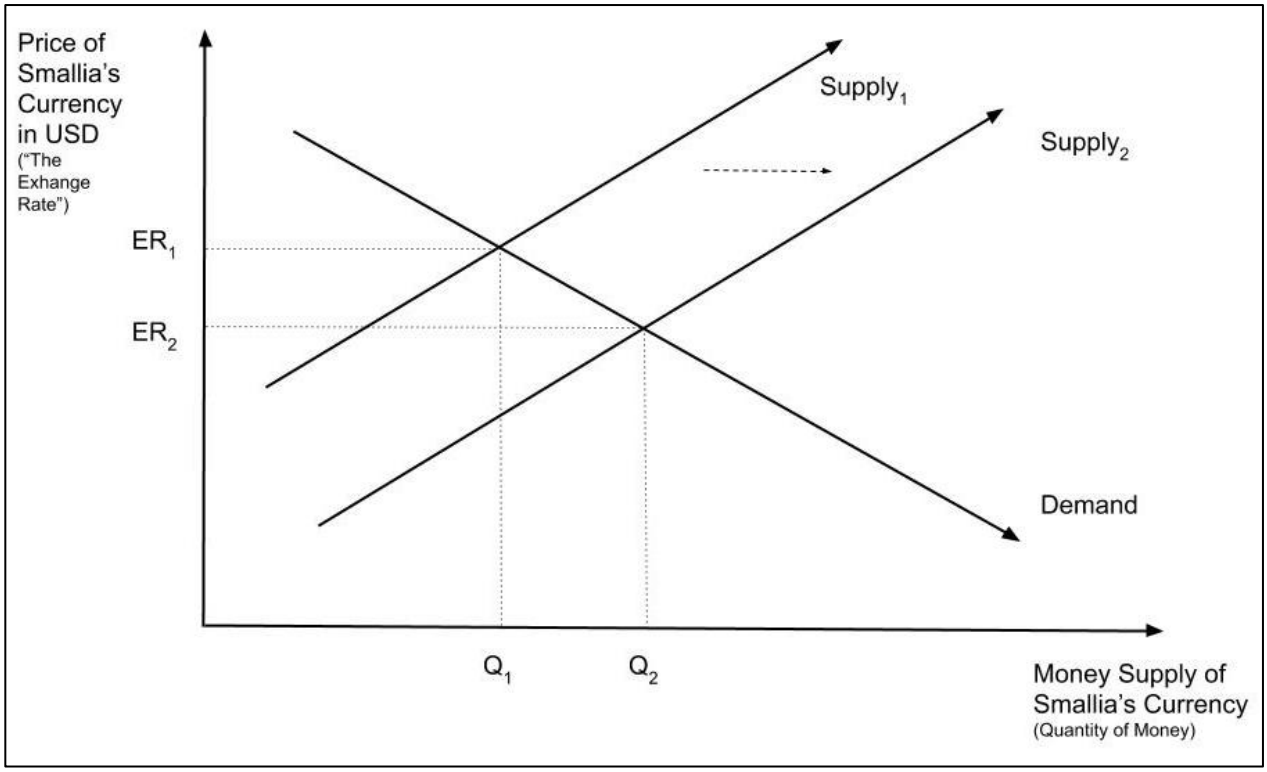


Figure A.2: Effect of Money Supply Increase on Exchange Rates

Going back to the picture in Figure A.1, this essentially boosts up the P_{DC}^* relative to the domestic price even further than before. This should increase exports again pushing out the AD curve to AD_3.

Based on the way I drew this, the Minister's plan would result in some amount of inflation and overheating of the economy as production pushed out to Y_{RE}^* in the short term. So based on this analysis, it would help the Minister's plan but only in the short term and it would come at the cost of inflation. I have shown all of this in Figure A.2.

However, it is easy to consider a scenario where this wouldn't be the case. If there is still progress to be made as Smallia accesses technology from abroad then we could think about this as simply replicating what we saw happen in 1.c. The LRAS curve would shift right and the SRAS curve would shift right again resulting in short-term and long-term economic growth. This would unequivocally help the Minister's plan.

This generates an obvious question: How does one know which state of the world we are in the one where the LRAS and SRAS still have room to shift right or the one where they are stuck? Well, that is a really tough question. To the extent it is even answerable (many would probably argue that a precise answer on a question like this is impossible) it requires analytical approaches that you'll see in advanced classes on international economics, macroeconomics, development economics and econometrics. I hope this provides a little bit of a sense of where the limits of these models in ECON 105 are and where to head if you are interested in the more complicated questions that they generate.

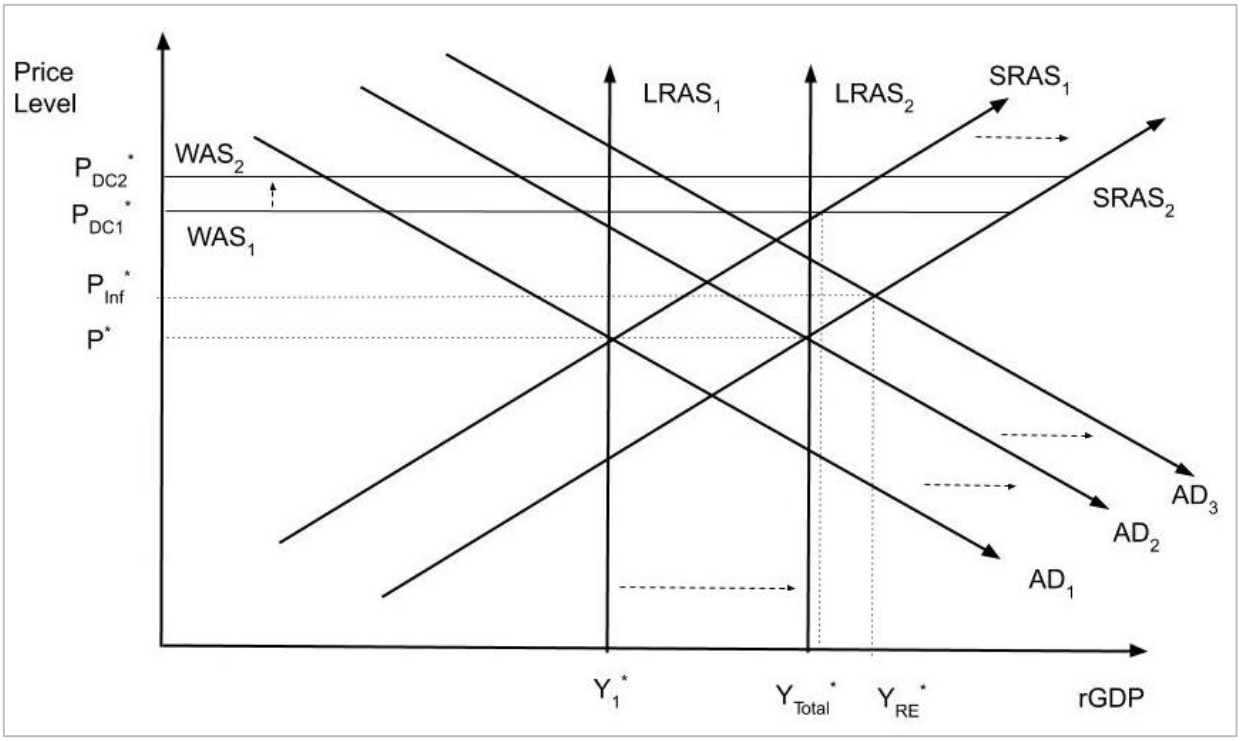


Figure A.3: Macroeconomic Response to Decreasing Exchange Rate and Dismantling of Protectionism

1.e Smallia's central bank operates the same as the Federal Reserve in the US. Inflation in Smallia is 4.23 percent, and desired inflation is 2 percent and deviation from potential output is 10 percent. Respond to the following: (1) What would the Taylor rule suggest Smallia should target as the interest rate in the economy (by "interest rate" I mean Smallia's equivalent of the Federal Reserve's Federal funds rate)?

Answer: The Taylor rule is an approximation of how the Fed responds to deviations in the inflation rate from the target inflation rate. The formula for the targeted Fed Funds rate is the following,

$$Target\ Fed\ Funds\ Rate$$
$$= Target\ Inflation\ Rate + Current\ Inflation$$
$$+ 0.5(Current\ Inflation - Target\ Inflation)$$
$$+ 0.5(Percent\ Devaition\ in\ GDP\ Growth\ from\ Target) \quad (8)$$

Substituting in what we know, we obtain,

$$Target\ Fed\ Funds\ Rate = 2 + 4.23 + 0.5(2.23) + 0.5(10)$$
$$= 12.345\ Percent \quad (9)$$

Note that while the Taylor Rule is often referenced and important to know, it is really best understood as a rough approximation of what the central bank will do as evidenced in Figure 29.4 in Colander.

1.f Respond to the following: (1) What is something else the central bank could do to affect the money supply besides open market operations?

Answer: The central bank could also intervene to change the reserve requirement. This would allow banks to lend more and would make the effects of the money multiplier more dramatic. It could also lower the discount rate which would make it cheaper for banks to borrow from the Fed.

This would result in more lending from the central bank to commercial banks and would increase the amount of money available to commercial banks to lend. Another way the central bank could intervene is through quantitative easing actions, which is simply the purchasing of private debt (as opposed to Government debt) on the private market.