1. a. The conditions indicate that we should consider the IS-MP model, since the central bank is following a monetary policy rule for the interest rate, not targeting the money supply. Under the new monetary policy rule, every given level of output, other things held constant, is associated with a lower target real interest rate set by the central bank. Thus the described change in the monetary policy rule is reflected in the IS-MP model as a downward shift of the MP curve. In the new equilibrium, output is higher and the real interest rate is lower: \( Y_1 > Y_0, r_1 < r_0 \).

b. The conditions indicate that we should consider the IS-LM model, since the central bank is targeting the money supply rather than following an interest rate rule. If the central bank raises its target for the money stock it means that the money supply in the economy increases from \((M/P)^S_0\) to \((M/P)^S_1\) and, hence, for any given level of output, the nominal interest rate is lower (below left graph). Assuming that expected inflation is unaffected, the LM curve shifts downwards, resulting in higher equilibrium output and a lower equilibrium real interest rate: \( Y_1 > Y_0, r_1 < r_0 \).

c. When the government increases taxes and increases government spending by equal amounts we are dealing with a balanced budget fiscal policy. We already know from class that an increase in \( G \) shifts the planned expenditure line up and a tax increase shifts the line down. However, we need to assess where the planned expenditure line shifts on net. We start by using the Keynesian
cross diagram: first, an increase in G shifts the planned expenditure up by exactly ΔG since 
\[ E = C(Y-T) + I(r) + G \]. Secondly, the tax increase enters the planned expenditure through the 
consumption function \( C(Y-T) \). Since we assume that the marginal propensity to consume is less 
than 1 (remember: this is the reason why the planned expenditure line has a slope lower than 1) 
the tax increase \( \Delta T = \Delta G \) shifts the planned expenditure line down by less than the increase in G 
shift the line upwards. On net, the planned expenditure line shifts up. This shift corresponds to a 
rightwards shift of the IS curve in the IS-MP diagram (IS to IS'). In equilibrium, real output is 
higher, \( Y_2 > Y_0 \), and the real interest rate is higher, \( r_2 > r_0 \). Notice that the increases in output in 
equilibrium \( Y_2 \) is lower than the increase coming solely from the upwards shift of the planned 
expenditure line due to fiscal policy. The central bank “works against” the fiscal policy by 
increasing the real interest rate (a movement along the MP curve). In the absence of the central 
bank policy output would have been at \( Y_1 \) (new IS curve at old real interest rate) in the IS-MP 
diagram. In the Keynesian cross the increase in r shifts the planned expenditure line downwards 
to \( E_2 \).

2. a. With this change in the consumption function, \( C = C(Y-T, r) \), we still have a downward-
sloping IS curve, since increases in r still reduce planned expenditures. (An increase in r 
now lowers consumption as well as investment, so the IS curve is flatter.) The increase in G 
shifts the planned expenditure curve up (from \( E_0 \) to \( E_1 \), left graph), and thus the IS curve 
shifts out (from IS_0 to IS', right graph). Both the real interest rate and output rise: \( Y_2 > Y_0 \),
$r_2 > r_0$. Since consumption is now a positive function of output but a negative function of the real interest rate, consumption could rise, fall, or remain the same. Absent more information, one cannot say more. For example, if the effect of $r$ on $C$ is extremely small, the model is very close to our usual one, and so the increase in $G$ raises $C$. On the other hand, suppose the effect of $Y-T$ on $C$ is very small and the effect of $r$ is not. Then the effect through the increase in $r$ dominates, and so $C$ falls.

b. As before, we continue to have a downward-sloping IS curve, because increases in $r$ still reduce planned expenditures. Thus an increase in $G$ still raises both $Y$ and $r$. But since $C^A$ depends only on the real interest rate, we know that it falls, and since $C^B$ depends only on disposable income, we know that it rises. Without additional information, we do not know if the rise in $C^B$ is greater than or less than the fall in $C^A$.

3. a. Suppose the red curve in the left diagram below is the “true” demand curve you want to estimate. First, we need to think about how we would actually identify $b$: we would need some variation in blueberry prices and quantities. Where would this variation come from? For example, in some months farms are very productive in producing blueberries so there is a lot of supply. We would shift the supply curve right. Alternatively, in some months consumers make a lot of blueberry pies so demand is high in these months. We would shift the demand curve up. We will only get variation in prices and quantities if there are shocks to supply and/or demand. Secondly, remember that the blueberry prices and quantities are equilibrium outcomes. The prices are determined by the positions of the supply and demand curves. If the variation in monthly blueberry prices and quantities comes from shocks to the supply of blueberries and no shocks to the demand (left diagram), you can trace out the demand curve perfectly and the residuals are small (here actually zero). You will find a positive $b$ (or negative slope, remember the minus!). However, suppose now there are shocks to the demand of blueberries, say people like blueberries in February but not in March, then the equilibrium outcomes you observe are along the supply curve for blueberries (right diagram). You can see from that diagram that when the residual in the blueberry demand curve, $e_t$, is high, like with demand curve $D_1$, the price for blueberries is high, like $P_1$. When the residual is small (or negative), like with demand curve $D_3$, the price for blueberries is low, like $P_3$. We can conclude that there will be a systematic positive correlation $e_t$ and $\ln P_t$ if some variation in prices and quantities is coming from demand shocks. As a result, if you tried to estimate $b$ by running an OLS regression of $\ln Q_t$ on a constant and $\ln P_t$, you would get a biased estimate of the elasticity of demand.
b. Based on the answer to part a, we can directly conclude that we would use $X$ as an instrument because we are interested in the variation in blueberry prices that is due to exogenous shocks to the supply of blueberries. Remember the conditions for a “good” instrument: 1. Instrument needs to be correlated with the price of blueberries. 2. Instrument is not systematically correlated with residual $e_t$. For example, the weather in blueberry-growing areas is certainly correlated with the price of blueberries because bad weather shifts the supply curve left and good weather right. The second condition is likely to be satisfied because the weather in blueberry-growing areas is unlikely to be systematically correlated with shocks to the demand for blueberries (especially if most demand is outside those areas). And indeed, the problem states that $X$ is not systematically correlated with factors that shift demand—that is, with $e$. The instrument would isolate the part in the variation of blueberry prices that is solely due to shifts in the supply curve (or weather) so we can trace out the demand curve like in the left panel above.

4. False. If the Federal Reserve had undertaken the expansionary policies described in the problem as the result of flipping a coin or for some other reason unrelated to other things happening in the economy, this would be a legitimate experiment for learning about the effects of policy. In that case, the fact that output plummeted would have been a piece of evidence that expansionary monetary policy does not raise real output.

But, of course, that isn’t what happened: the Fed undertook the policies precisely because it saw other things going on (the bursting of the housing bubble, the collapse of Lehman Brothers, …) that it thought would have catastrophic consequences for real output if it did nothing. Thus, it is possible that without the implemented monetary stimulus measures, the decline in output could have been even more dramatic than it actually was. Absent information about the counterfactual behavior of the economy – that is, about what would have happened to output without the expansionary monetary policy – the correlation between money and output in this episode reveals almost nothing about the causal effects of monetary policy.

5. The first table gives the name of the variables used in the analysis, the websites that were used to download them and their primary sources. As you can see, certain variables (RGDP
and RRI) were obtained directly from the website of the government department responsible for producing them, while UR was downloaded from an online database (FRED) that gathers in a single place several primary sources. The variable UR could have been downloaded directly from the website of the BLS, the government department responsible for producing it. Some of you may have tried to access all series through the online database FRED, but it is a bit tricky to find. However, FRED also has all three series.

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Downloaded from</th>
<th>Primary Source</th>
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<tr>
<td>RGDP</td>
<td>Real GDP</td>
<td>BEA.gov, Table 1.1.3</td>
<td>U.S. Department of Commerce: Bureau of Economic Analysis</td>
</tr>
<tr>
<td>RRI</td>
<td>Real Private Residential Fixed Investment</td>
<td>BEA.gov, Table 1.1.3</td>
<td>U.S. Department of Commerce: Bureau of Economic Analysis</td>
</tr>
</tbody>
</table>

The table below gives the results of the analysis.

<table>
<thead>
<tr>
<th>Periods</th>
<th>RGDP*</th>
<th>UR</th>
<th>RRI*</th>
<th>RGDP**</th>
<th>RRI**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1958Q1-1960Q1</td>
<td>6.13</td>
<td>-1.2</td>
<td>15.96</td>
<td>5.95</td>
<td>14.80</td>
</tr>
<tr>
<td>1975Q1-1977Q1</td>
<td>4.68</td>
<td>-0.8</td>
<td>20.70</td>
<td>4.57</td>
<td>18.82</td>
</tr>
<tr>
<td>1982Q1-1984Q1</td>
<td>5.01</td>
<td>-0.9</td>
<td>26.82</td>
<td>4.89</td>
<td>23.76</td>
</tr>
<tr>
<td>2009Q2-2011Q2</td>
<td>2.18</td>
<td>-0.2</td>
<td>0.31</td>
<td>2.16</td>
<td>0.31</td>
</tr>
</tbody>
</table>

* as measured by conventional percentage growth at an annual rate  
** as measured by log approximation

The numbers support the claim that the recovery from the Great Recession was particularly slow: the growth in real GDP and the decline in unemployment were much smaller than in the three other recoveries. They also support the claim that private residential investment did not play its usual role in driving the recovery. It grew much more slowly than in the other recoveries; and, in contrast to the other recoveries, it grew more slowly than overall GDP rather than much faster.

6. Answer a)

7. Answer c)

8. Answer a)