UCLA - Econ 102 - Fall 2019 **Last Name:** _____
Instructor: François Geerolf
Final Exam **First Name:** _____
December 13, 2019, 11:30am - 2:30pm
Time Limit: 3 hours

Student ID Number: _____ Signature _____

Final Exam

This final exam contains 21 pages (including this cover page). You can earn 100 points.

Instructions:

1. Print your Last name, First Name, Student ID Number and Signature at the top of this page.
2. The only items which should be on your desk are pencils and/or pens. NO other items are allowed. Place any other item UNDER your desk. Calculators are NOT allowed.
3. Once the exam begins, you are not allowed to leave the room until you hand in your exam.

Good luck ! Budget your time wisely ! (skip the question or even the exercise if you get stuck)

Do not write below this line (Grader use only)

Question	Points	Score
1	60	
2	10	
3	10	
4	10	
5	10	
Total:	100	

60 Multiple Choice Questions (60 points)

1. (60 points) There is only one right answer for each multiple choice question. Mark your answers on the Scantron.

   (1) (1 point) Which of the following makes the spending multiplier larger?
   - A. a reduction in the marginal propensity to consume.
   - B. a small initial trade deficit.
   - **C. a reduction in the marginal propensity to import.**
   - D. a real appreciation.
   - E. none of the above.

   (2) (1 point) Exports will increase when there is:
   - A. an increase in the real exchange rate.
   - B. an increase in domestic output.
   - C. a fall in foreign output.
   - D. all of the above.
   - **E. none of the above.**

   (3) (1 point) If the President of the European Central Bank decides to reduce short-term interest rates unexpectedly, what will happen to the dollar?
   - **A. It will appreciate relative to the euro.**
   - B. It will appreciate relative to the yen.
   - C. It will depreciate relative to the euro.
   - D. It will depreciate relative to the yen.
   - E. None of the above.

   (4) (1 point) In the Keynesian model, which of the following will happen for certain as a result of a tax cut?
   - A. Consumption will decrease.
   - B. Investment will decrease.
   - C. Public saving will fall.
   - D. The trade balance will improve.
   - **E. The trade balance will worsen.**

   (5) (1 point) A rather extreme version of supply-side economics implies that:
   - A. Redistributing income from the rich to the poor reduces government debt.
   - B. Keynesian stimulus is self-financing.
   - C. Tax cuts for the rich are self-financing, because we are on the left side of the Laffer curve.
   - **D. Tax cuts for the rich are self-financing, because we are on the right side of the Laffer curve.**

   (6) (1 point) If the growth rate of y_t after T periods is G, then the average growth rate of y_t per period is:

A. $(1+G)^T - 1$
B. $(1+G)^{1/T}$
C. $(1+G)^T$
D. $(1+G)^{1/T} - 1$
E. none of the above

(7) (1 point) Which of the following makes the tax expenditure multiplier smaller?
A. An increase in the marginal propensity to consume.
B. An increase in the marginal propensity to save.
C. A reduction in taxes.
D. A reduction in government spending.
E. None of the above.

(8) (1 point) Which of the following makes the government expenditure multiplier greater?
A. A decrease in the marginal propensity to consume.
B. A reduction in lump-sum taxes.
C. A reduction in autonomous consumption.
D. A decrease in the marginal propensity to save.
E. None of the above.

(9) (1 point) Which of the following makes the government expenditure multiplier smaller?
A. An increase in the marginal propensity to consume.
B. A reduction in autonomous investment.
C. An increase in the proportional income tax rate.
D. A decrease in the marginal propensity to save.
E. None of the above.

(10) (1 point) In the Keynesian model with endogenous taxes, $T = t_0 + t_1 Y$, under what conditions on the multiplier (M) is a tax cut (a negative Δt_0) self financing?
A. $M \geq t_1$
B. $M \geq \frac{1}{t_1}$
C. $M \geq c_1$
D. $M \geq \frac{1}{c_1}$
E. $M \geq \Delta t_0$

(11) (1 point) In the Keynesian goods model with heterogenous consumers where the rich have a lower propensity to consume than the poor ($\overline{c}_1 < \underline{c}_1$), which of the following will tend to increase the multiplier for a redistributive tax change?
A. An increase in the high-income share of aggregate income.
B. An increase in the high-income share of total population.
C. An increase in the ratio of average income of rich to poor.
D. All of the above.

E. None of the above.

(12) (1 point) The "Treasury View" is the view that:

A. monetary policy mostly affects the economy through corporate borrowing.
B. fiscal policy stimulates output.
C. savings is too high relative to investment.
D. government deficits crowd out private investment.
E. fixed exchange rates stimulate international trade.

(13) (1 point) The "credit channel" of monetary policy affects the economy by:

A. redistributing funds from the private sector to the public sector.
B. increasing the value of safe assets relative to risky assets.
C. easing lending restrictions on banks.
D. redistributing funds from low-MPC creditors to high-MPC borrowers.
E. having the government provide loans directly.

(14) (1 point) "Twin Deficits" refer to the idea that:

A. government purchases of imports lead to trade deficits.
B. government deficits lead to more household borrowing.
C. fiscal stimulus often leads to both budget and trade deficits.
D. trade deficits also lead to economy-wide borrowing from abroad.
E. trade deficits tend to occur with currency depreciations.

(15) (1 point) Assume that the overlapping generations model predicts that capital will be under-accumulated. Which of the following modifications to the basic model would move us closer to the golden rule?

A. Adding in a pay-as-you-go public pension system.
B. Adding in a bequest motive to the model.
C. Adding in positive government debt.
D. None of the above.

(16) (1 point) Assume that consumption is given by $C = 200 + 0.7 \cdot Y_d$, $Y_d = Y - T$, $T = 30 + 0.2 \cdot Y$. What is the value of the marginal propensity to save out of disposable income?

A. 0.7
B. 0.56
C. 0.3
D. 0.24
E. 0.14

(17) (1 point) Consider the basic goods market with $C = 200 + 0.8Y_d$, $G = 150$, $T = 0$, $I = 150$. The government wants to increase output to 2800 by changing government expenditure. What should it do to achieve this goal?

A. Cut government expenditure by 300.

B. Raise government expenditure by 300.

C. Raise government expenditure by 60.

D. Raise government expenditure by 210.

E. None of the above.

(18) (1 point) In the neoclassical model of the labor market, an improvement in productivity leads to:

A. a downward shift in the labor demand curve.

B. an upward shift of the labor demand curve.

C. a downward shift of the labor supply curve.

D. an upward shift of the labor supply curve.

E. none of the above.

(19) (1 point) The law of motion for the capital stock in the Solow model:

A. links the capital stock in the next period to the capital stock in the current period.

B. can be used to find the steady state level of the capital stock.

C. is valid only when the saving rate is at the golden rule level.

D. A, B and C are correct.

E. only A and B are correct.

(20) (1 point) Suppose that $c_1 = 0.9$ and that $T = 2 + \frac{1}{3}Y$. All components of aggregate demand are exogenous, except for aggregate consumption. What would be the effect on the *government deficit* of raising government spending by 300?

A. It will increase by 300.

B. It will decrease by 450.

C. It will increase by 50.

D. It will decrease by 700.

E. None of the above.

(21) (1 point) Net exports are equal to:

A. Government spending plus investment plus consumption.

B. Private saving plus public saving minus consumption.

C. Private saving plus public saving minus investment.

D. Exports plus imports.

E. None of the above.

(22) (1 point) According to Romer and Romer, which of the following statements is true about the narrative approach in trying to measure tax multipliers?

A. It studies the motivation for tax changes, and focuses on those changes that were taken for stabilization purposes.

B. This approach studies many tax changes, which averages out other simultaneous potential events to zero.

C. It is transparent and simple, but the results rely on some underlying theoretical assumptions.

D. This method only allows to measure cross-sectional tax multipliers, and does not inform on the aggregate multiplier.

E. None of the above

(23) (1 point) In the Neoclassical labor model (where $f(l) = Al^{1-\alpha}$), if we change α, we will observe the following effect on the (log) labor demand curve:

A. The curve will change its slope.

B. The curve will be shifted.

C. The curve will change its slope and intercept too.

D. The curve won't suffer any change.

E. None of the above.

(24) (1 point) In the overlapping-generations model, where $U = u(c^o_{t+1})$, and increase in taxes on the young people will cause:

A. an increase in K^*, since young people would have to save more to compensate the tax increase.

B. no change in K^*, since the production function has not changed.

C. a reduction in K^*, since young people consume less because of the tax increase.

D. a reduction in K^*, since young people save less because of the tax increase.

E. none of the above.

(25) (1 point) The Laffer Curve relates income tax rates τ to total taxes collected by the government τY. In the context of the neoclassical model, an increase in τ:

A. will reduce τY.

B. will affect τY depending on how credible is the increase in τ.

C. will increase τY.

D. will not affect τY, since people work less and hence the effect on output cancel out the effect on τ.

E. will affect τY depending on the relative value of τ and an optimal τ^*, which is a function of the labor supply elasticity.

(26) (1 point) In the Keynesian open economy model, we can think of movements in the exchange rate, as affecting the marginal propensity to import m_1. In this regard, a depreciation in the real exchange rate would:

A. reduce foreign output, and hence reduce exports.

B. decrease the multiplier of this economy.

C. increase the multiplier of this economy.

D. increase foreign output, and hence increase exports.

E. not affect equilibrium output.

(27) (1 point) Suppose a tightening of monetary policy in the U.S. (increase in the interest rate). In the short run we could observe:

A. A decrease in the nominal exchange rate $E = euro/dollar$.

B. A decrease in the real exchange rate.

C. A decrease in competitiveness and hence an increase in the propensity to import.

D. A decrease in competitiveness and hence an increase in the propensity to export.

(28) (1 point) In the Neoclassical model (as discussed in class), tax cuts for households can increase GDP because:

A. Lower taxes increase households' willingness to spend.

B. Lower taxes increase the productivity of firms.

C. Lower taxes increase labor supply.

D. Lower taxes force the government to reduce wasteful spending.

E. Lower taxes redistribute income to high MPC individuals.

(29) (1 point) According to Ricardian equivalence, raising taxes:

A. Only reduces consumption.

B. Only increases public debt.

C. Leaves consumption unchanged.

D. Leaves public debt unchanged.

E. Both reduces consumption and increases public debt.

(30) (1 point) How is a financial bubble similar in many ways to public debt, and to a pay-as-you-go system?

A. It transfers resources from the old to the young.

B. According to neoclassical economics, it crowds out investment.

C. According to neoclassical economics, it crowds in investment.

D. None of the above.

(31) (1 point) According to Michael J. Burry in "I Saw the Crisis Coming. Why Didn't the Fed?", the following were signs that the 2000s housing boom was unsustainable:

A. Mortgages were offered to riskier borrowers.

B. Homebuyers were really optimistic about house prices.

C. Banks were lending less money to risky borrowers.

D. A, B.

E. None of the above.

(32) (1 point) According to "Two out of three ain't bad.", the United States opposed Keynes' "creditor adjustment" proposition at Bretton Woods because:

A. The U.S. thought that this would be detrimental to free trade.

B. The U.S. was worried about Germany saving too much.

C. The U.S. did not want to cut wages to restore export competitiveness.

D. The U.S. had a large trade surplus at the time.

E. The U.S. negociators did not believe in Keynesian economics.

(33) (1 point) According to "Central bankers' holy grail: The natural rate of unemployment.", the Phillips curve is:

A. a positive relationship between inflation and unemployment.

B. a negative relationship between inflation and unemployment.

C. a positive relationship between investment and savings.

D. a negative relationship between exchange rates and exports.

E. none of the above.

(34) (1 point) According to "The world economy's strange new rules." by The Economist, what are the most important recent failures of the Phillips curve?

A. Despite unprecedently high unemployment during the financial crisis, there was no prolonged slump in inflation.

B. Despite very low unemployment, we have not seen any inflation lately.

C. Governement debt has increased over the last decade.

D. A, B.

E. none of the above.

(35) (1 point) According to the movie "The Big Short", why did banks start lending to riskier borrowers?

A. There were not so many homes and so many people with good enough jobs to buy them.

B. Interest rates were too low for too long.

C. The trade deficit was large.

D. Banks did not have enough liquidity.

E. None of the above.

(36) (1 point) According to the movie "The Big Short", what was required for Mortgage Bonds to fail?

A. That interest rates go down substantially.

B. That millions of Americans don't pay their mortgages.

C. That China depreciates its currency.

D. That Germany reduces its imports from the U.S.

E. none of the above.

(37) (1 point) One of J.M. Keynes' (rejected) proposals at the Bretton Woods conference to manage trade balances following World War II was to:

A. return to the 1800s Gold Standard system.

B. only permit trade with government-approved transactions.

C. impose a penalty rate on assets of surplus (creditor) countries.

D. impose a penalty rate on borrowing by deficit (borrower) countries.

E. create an international trade regulatory agency.

(38) (1 point) Which of the following is the main way Michael Burry (featured in the Big Short) bet against the housing market?

A. By borrowing against housing assets, pledging housing assets as collateral.
B. By purchasing credit default swaps against housing assets (CDS).
C. By selling his portfolio of mortgage backed securities (MBS).
D. By using online betting markets.
E. By buying collateralized debt obligations (CDO).

(39) (1 point) Which of the following is most indicative of high aggregate demand relative to the rest of the world?

A. A large budget deficit.
B. A large trade deficit.
C. Large private savings.
D. High output.
E. None of the above.

(40) (1 point) According to J.M. Keynes, one issue with fixed exchange rate systems such as the Gold Standard was that:

A. they forced the adjustment of balance of trade imbalances onto deficit countries.
B. creditor nations would be reluctant to give up their uncompetitive position.
C. they boosted exports in a time when global trade was contracting.
D. they increased non-exchange rate risks, therefore offsetting the benefits of reduced exchange rate risk.

(41) (1 point) In the standard Solow model, an increase in the savings rate s:

A. Has a positive effect on consumption per capita, by increasing the steady state output per capita.
B. Has a negative effect on consumption per capita, since the share consumed from the steady state output per capita is lower.
C. Has a negative effect on consumption per capita, since it reduces the steady state stock of capital (decreasing returns to scale)
D. Both a. and b. are correct, so we cannot know the total effect without knowing the specific values of the parameters.

(42) (1 point) According to Greg Mankiw's November 2008 New York Times article, what were the main factors that were holding back consumption in 2008?

A. Low consumer confidence and "wait and see" behavior.
B. Consumers increasing saving in anticipation of tax increases.
C. Rising health care costs reducing consumers' disposable income.
D. Rising interest rates making it harder for consumers to borrow.
E. None of the above.

(43) (1 point) Why was J.M. Keynes wrong about the "euthanasia of the rentier"?

A. Lower interest rates caused by a glut of savings will also tend to increase investment, and hence GDP and the incomes of the rich.

B. Lower interest rates caused by a glut of savings also reduce mortgage and debt repayments of the rich, offsetting lost interest income.

C. Lower interest rates caused by a glut of savings allow the government to run large deficits which are used to finance offsetting tax cuts for the rich.

D. The glut of saving tends to increase asset prices, which increases the wealth of the rich.

(44) (1 point) According to the Economist's article on Say's law, what would pose a problem for Jean-Baptiste Say's view that "general gluts" could not occur?

A. If people produced goods in order to store value, it would interrupt the flow of goods on which Say's vision relies.

B. Sometimes producers in some sectors may produce too many goods.

C. Because it takes time for producers to transition between sectors, there will be some unemployment during these transitions.

D. The British had a lot of failed ventures in East Asia.

E. None of the above.

(45) (1 point) According to the required readings, Robert J. Barro believes that Keynesian economics doesn't work mostly because:

A. the increased debt it requires burdens the government, and increases the likelihood of default.

B. governments tend to be inefficient, and give too much money to the wrong group of people.

C. government spending will crowd out an equal amount of private spending.

D. government welfare programs reduce the incentives to work.

E. none of the above.

(46) (1 point) In Google Sheets, which built-in function did we use in Problem Set 1 to linearize the logarithm of GDP?

A. LINEARIZE.

B. FORECAST.

C. EXP.

D. LOG-LINEARIZE.

E. LOG.

(47) (1 point) What is Paul Krugman's main argument against Ricardian Equivalence, in his June 2015 blog post?

A. Because people aren't perfectly rational and forward looking, a dollar increase in government spending will not cause an equal fall in consumption spending.

B. Because government spending can provide many useful public goods, private consumption and government spending are imperfect substitutes.

C. Because the US dollar is a reserve currency, the problems that affected countries such as Greece don't apply.

D. All of the above are true.

(48) (1 point) In the two-period consumption model, by how much does utility vary in total, when the consumer saves one more unit of income?

A. $u'(c_0)$

B. $(1+r)\beta u'(c_1) - u'(c_0)$

C. $(1+r)\beta u'(c_1)$

D. $u'(c_0) - (1+r)\beta u'(c_1)$

E. None of the above.

(49) (1 point) In his August 2019 article in Foreign Policy, Simon Tilford argues that "Germany produces far more than it consumes, because the country saves far more than it invests." Why is this argument incomplete?

A. The reason is that everything depends on everything else in macroeconomics. For example, if government spending decreases, then we simultaneously generally get a recession, lower private saving, higher public saving, with an ambiguous effect on total saving, while investment falls as well.

B. The imbalance between saving and investment, which results from a negative aggregate demand shock, depends heavily on the propensity to import, which itself depends on competitiveness.

C. Both of the above answers are correct.

D. None of the above answers are correct.

(50) (1 point) Based on your reading of the Economist's July 2017 article, which of the following was not given as a reason for Germany's large current account surpluses?

A. Germany saves more than it invests.

B. An agreement between unions and business in favor of wage restraint which keeps competitiveness high.

C. Low levels of public investment.

D. A desire by the government to accumulate foreign exchange reserves.

E. All of the above are true.

(51) (1 point) During the early 2000s, Adjustable Rate Mortgages (ARMs) were introduced and encouraged. Based on your understanding of the credit channel you would expect that this innovation would:

A. reduce household borrowing as mortgages are riskier, and interest rates can rise.

B. make household spending more sensitive to changes in the Fed Funds rate, as household's disposable incomes are now directly influenced by the Fed.

C. make house prices less sensitive to changes in the Fed's interest rates.

D. all of the above are true.

E. none of the above are true.

(52) (1 point) The main rationale for imposing a revenue tariff according to Keynes is to:

A. Punish foreign firms for destabilizing the domestic economy.

B. Increase the proceeds of the government.

C. Reach the golden rule level of capital accumulation.

D. Accelerate the technological progress of the domestic economy.

E. Substitute away from foreign goods, towards national goods, in order to boost domestic output and employment.

(53) (1 point) What are the two countries used by Robert Barro as examples of countries that did well macroeconomically despite restricting their government spending and committing to a balanced budget?

A. Japan and South Korea.

B. Portugal and Greece.

C. The U.S. and Canada.

D. Germany and Sweden.

E. Greece and Germany.

(54) (1 point) Which statement is most likely to be made by Robert Barro?

A. The incidence of increased military expenditures during war periods is solid evidence in favor of the efficiency of Keynesian policies.

B. An empirically plausible estimate of the Keynesian multiplier is well below one.

C. A good policy recommendation to battle recessions is to redistribute income from rich to poor, because the poor have higher marginal propensities to consume.

D. Ricardian Equivalence is unlikely to hold in reality because consumers are unaware about future taxes and government programs.

E. The success of Keynesian policy stems from the fact that the government is better at managing resources than markets.

(55) (1 point) Why did Bruce Bartlett argue that "Keynes was really a conservative" in the Forbes article?

A. Because Keynes actually was very rich, and opposed to more taxation.

B. Because Keynes made a lot of money from his stock market investments.

C. Because Keynes was trying to save capitalism.

D. Because Keynes really liked the United States.

E. None of choices above is correct.

(56) (1 point) When Jean-Baptiste Say was writing, which country was being accused of saving too much?

A. China

B. The U.K.

C. France.

D. The U.S.

E. Germany.

(57) (1 point) According to the Solow growth model, what are the effects of government deficits on the U.S. economy?

A. They reduce the private saving rate.

B. They lead to lower steady-state output.

C. They increase the private saving rate.

D. They lead to higher steady-state output.

E. None of the above.

(58) (1 point) According to the Keynesian-cross analysis, if the marginal propensity to consume is 0.6 and government expenditures and autonomous taxes are both increased by 100, equilibrium income will rise by:

A. 0.

B. 100.

C. 150.

D. 250.

E. 300.

(59) (1 point) In the basic Keynesian model, where $C = c_0 + c_1(Y - T)$, $I = \bar{I}$, $G = \bar{G}$ and $T = \bar{T}$, consumers will only purchase goods if they have positive income.

A. True if $c_0 = 0$.

B. True: they always consume a fraction of their disposable income and save the rest.

C. False: they will adjust consumption according to their risk aversion.

D. False: if the marginal propensity to consume is positive, then it implies that agents will consume a positive amount of goods regardless of their income.

E. None of the above.

(60) (1 point) The marginal propensity to save in the Keynesian model:

A. Is constant.

B. Depends on income.

C. Depends on taxes.

D. Is the marginal propensity to consume plus one.

E. None of the above.

Exercise 1: The Neoclassical Growth Model (10 points)

2. (10 points) Consider the standard Solow growth model. We assume that the economy's production function is $Y = F(K, L) = K^{1/4}L^{3/4}$. Assume no population growth.

   (a) (1 point) What is the name of this production function?

   Solution: This production function is called a Cobb-Douglas production function.

   (b) (1 point) Show that this production function has constant returns to scale.

   Solution: This production function has constant returns to scale because if you double all inputs, you get twice as much output:

   $$F(2K, 2L) = (2K)^{1/4}(2L)^{3/4} = 2 \cdot K^{1/4}L^{3/4} = 2F(K, L)$$

   (c) (2 points) For a given saving rate, s, and depreciation rate, δ, derive an expression for capital per worker in the steady state. Give the intermediate steps.

   Solution: At the steady-state, we know that saving sY^* equals depreciation δK^*, which implies given $Y^* = K^{*1/4}L^{3/4}$ that:

   $$sY^* = s(K^*)^{1/4}L^{3/4} = \delta K^*.$$

   After some algebra, we get capital per worker in the steady state:

   $$sL^{3/4} = \delta(K^*)^{3/4} \quad \Rightarrow \quad \left(\frac{K^*}{L}\right)^{3/4} = \frac{s}{\delta} \quad \Rightarrow \quad \boxed{\frac{K^*}{L} = \left(\frac{s}{\delta}\right)^{4/3}}.$$

   (d) (2 points) Derive an expression for output per worker in the steady state. What is it equal to if $s = 24\%$ and $\delta = 3\%$?

   Solution: Using that: $Y^* = K^{*1/4}L^{3/4}$, we can get the intensive form of the production function, as output per worker being a function of capital per worker:

   $$\frac{Y^*}{L} = \left(\frac{K^*}{L}\right)^{1/4} \quad \Rightarrow \quad \boxed{\frac{Y^*}{L} = \left(\frac{s}{\delta}\right)^{1/3}}.$$

   The numerical application gives:

   $$\frac{Y^*}{L} = \left(\frac{s}{\delta}\right)^{1/3} = \left(\frac{0.24}{0.03}\right)^{1/3} = 8^{1/3} = 2.$$

   (since $2^3 = 8$)

(e) (2 points) Give an expression for consumption per worker in the steady state. What is it equal to if $s = 24\%$ and $\delta = 3\%$?

Solution: Consumption per worker C^*/L in the steady state is a fraction $1-s$ of output per worker, therefore:

$$\frac{C^*}{L} = (1-s)\frac{Y^*}{L} = (1-s)\left(\frac{s}{\delta}\right)^{1/3}.$$

The numerical application gives:

$$\frac{C^*}{L} = (1-s)\frac{Y^*}{L} = \frac{76}{100} * 2 = \frac{152}{100} = 1.52.$$

(f) (2 points) Derive the consumption-maximizing saving rate. Show the intermediate steps.

Solution: Note again, that increasing the saving rate has two opposing effects on consumption per worker. On the one hand, it reduces consumption per worker, mechanically because $(1-s)Y^*/L$ is reduced when s is greater if Y^*/L is fixed. On the other hand, raising the saving rate raises output per worker in the steady-state, since $Y^*/L = (s/\delta)^{1/3}$ as shown before. So on net, it's not clear whether raising the saving rate boosts consumption in the steady-state, or lowers it, depending on which of these two forces dominate.

This looks like a complicated problem, fortunately the mathematics take care of all of that for us. The consumption-maximizing saving rate is such that the level of steady-state consumption per capita C^*/L is maximized. Therefore, the saving rate must maximize:

$$\max_s \quad (1-s)s^{1/3} = s^{1/3} - s^{4/3}$$

Setting the derivative to zero (using $(s^a)' = as^{a-1}$ for $a = 1/3$ and $a = 4/3$):

$$\frac{1}{3}s^{-2/3} - \frac{4}{3}s^{1/3} = 0 \quad \Rightarrow \quad \boxed{s = \frac{1}{4} = 25\%}.$$

Comment: you should have gotten the same if you maximized $(1-s)\left(\frac{s}{\delta}\right)^{1/3}$ instead.

Exercise 2: The Paradox of Thrift (10 points)

3. (10 points) Consider the closed economy goods market model where consumption is linear in disposable income with $C(Y_D) = c_0 + c_1 Y_D$, disposable income is income minus taxes, government spending and taxes are exogenous and equal to G and T respectively, and investment depends on output according to the Keynesian investment function, through $I = b_0 + b_1 Y$.

   (a) (2 points) Solve for equilibrium output.

Solution: Total aggregate demand Z in the closed economy is given by:

$$\begin{aligned} Z &= C + I + G \\ Z &= c_0 + c_1(Y - T) + b_0 + b_1 Y + G \\ Z &= c_0 + b_0 - c_1 T + G + (c_1 + b_1) Y. \end{aligned}$$

Thus, using $Z = Y$:

$$\boxed{Y = \frac{1}{1 - c_1 - b_1} (c_0 + b_0 - c_1 T + G)}$$

   (b) (2 points) Assume that there is a fall in autonomous spending given by $\Delta c_0 < 0$. Show that there is a direct effect on private saving of the change in autonomous spending as well as an indirect effect. What is the sign of the direct effect? (Hint: the direct effect is $\Delta(-c_0)$)

Solution: We have that private saving is equal to:

$$\begin{aligned} S &= Y - T - C \\ &= Y - T - (c_0 + c_1(Y - T)) \\ &= -c_0 + (1 - c_1)(Y - T) \end{aligned}$$

This allows to decompose into a direct and an indirect effect:

$$\boxed{\Delta S = \underbrace{\Delta(-c_0)}_{\text{direct effect}} + \underbrace{\Delta\left[(1 - c_1)(Y - T)\right]}_{\text{indirect effect}}}$$

Note that the indirect effect is also equal to $(1 - c_1)\Delta Y$, since taxes are assumed to be fixed. This was an equally valid answer to the computation of the indirect effect.

Obviously, since $\Delta(-c_0) > 0$, the direct effect is positive. There is a straightforward economic interpretation: a decrease in consumption leads to an increase in saving.

(c) (2 points) What is the value of the indirect effect, as a function of the change $\Delta c_0 < 0$?

Solution: From the above equation, a given change in $\Delta c_0 < 0$ leads to decline in output given by:

$$\Delta Y = \frac{\Delta c_0}{1 - c_1 - b_1}$$

This allows to calculate the magnitude of the indirect effect.

$$\begin{aligned} \Delta \left[(1 - c_1) (Y - T) \right] &= (1 - c_1) \Delta Y \\ &= (1 - c_1) \frac{\Delta c_0}{1 - c_1 - b_1} \\ \Delta \left[(1 - c_1) (Y - T) \right] &= \frac{1 - c_1}{1 - c_1 - b_1} \Delta c_0. \end{aligned}$$

(d) (2 points) Compute the total effect of the change $\Delta c_0 < 0$ on private saving S (direct + indirect effect).

Solution: Therefore, the total effect on saving is:

$$\begin{aligned} \Delta S &= \Delta(-c_0) + \Delta \left[(1 - c_1) (Y - T) \right] \\ &= -\Delta c_0 + \frac{1 - c_1}{1 - c_1 - b_1} \Delta c_0 \\ \Delta S &= \frac{b_1}{1 - c_1 - b_1} \Delta c_0 \end{aligned}$$

It is a paradox, because a fall in consumption leads to a decrease in saving.

(e) (2 points) Why is the result in the previous question (d) a paradox?

Solution: This phenomenon is a paradox (of thrift, or of saving) because a fall in consumption $\Delta c_0 < 0$, whose direct impact on private saving is to increase it, leads to a decline in private saving because of the reduction in output it leads to.
This is explained by the fact that the indirect effect more than offsets the direct effect.
Overall, efforts to save more are self-defeating in this model.

Exercise 3: Aggregate Demand Spillovers (10 points)

4. (10 points) Consider an open economy where consumption is given by $C(Y_D) = 10 + (2/3) \cdot Y_D$, investment is given by $I = 8 + 0.1Y$, government spending is given by $G = g_0$, taxes are given by $T = 10 + (1/4) \cdot Y$, and imports and exports are given by $M = 0.3Y$ and $X = 0.3Y^*$ respectively, where Y^* denotes foreign output.

   (a) (2 points) Solve for equilibrium output in the domestic economy, given Y^*. What is the multiplier in this economy?

Solution: Total aggregate demand Z is:

$$\begin{aligned} Z &= C + I + G + X - M \\ &= 10 + \frac{2}{3}\left(Y - 10 - \frac{1}{4}Y\right) + 8 + 0.1Y + g_0 + 0.3Y^* - 0.3Y \\ Z &= 0.3Y + \frac{34}{3} + g_0 + 0.3Y^*. \end{aligned}$$

Setting $Y = Z$ gives:

$$\boxed{Y = \frac{340}{21} + \frac{10}{7}g_0 + \frac{3}{7}Y^*}.$$

Therefore, the multiplier is $10/7 \approx 1.43$ since:

$$\Delta Y = \frac{10}{7}\Delta g_0 \approx 1.43 \Delta g_0.$$

   (b) (2 points) If we were to close the economy - so exports and imports were identical and equal to zero - what would the multiplier be? Why would the multiplier be different in a closed economy?

Solution: If we were to close the economy, then demand would be:

$$\begin{aligned} Z &= C + I + G \\ Z &= 0.6Y + \frac{34}{3} + g_0. \end{aligned}$$

Therefore, the multiplier is 2.5 since $\Delta Y = 2.5\Delta g_0$.
In a closed economy, the multiplier is much higher, because all the increase in income feeds domestic demand. (Since openness is large, there is a substantial difference between the open and the closed economy.)

   (c) (2 points) **From now on, you may keep fractions for numbers, since you do not have a calculator.** Assume that the foreign economy is characterized by

the same equations as the domestic economy (with asterisks reversed). Use the two sets of equations to solve for the equilibrium output of each country.

Solution: Symmetrically, we have: $Y^* = \frac{340}{21} + \frac{10}{7}g_0^* + \frac{3}{7}Y$. Therefore:

$$Y = \frac{340}{21} + \frac{10}{7}g_0 + \frac{3}{7}Y^* = \frac{340}{21} + \frac{10}{7}g_0 + \frac{3}{7}\left(\frac{340}{21} + \frac{10}{7}g_0^* + \frac{3}{7}Y\right)$$
$$Y = \frac{10 \cdot 340}{7 \cdot 21} + \frac{10}{7}g_0 + \frac{3 \cdot 10}{7 \cdot 7}g_0^* + \frac{9}{49}Y.$$

Therefore:

$$Y = \frac{7^2}{40}\left(\frac{10 \cdot 340}{7 \cdot 21} + \frac{10}{7}g_0 + \frac{3 \cdot 10}{7 \cdot 7}g_0^*\right) = \frac{85}{3} + \frac{7}{4}g_0 + \frac{3}{4}g_0^*.$$

This gives output Y, and symmetrically foreign output Y^*:

$$\boxed{Y = \frac{85}{3} + \frac{7}{4}g_0 + \frac{3}{4}g_0^*} \qquad \boxed{Y^* = \frac{85}{3} + \frac{7}{4}g_0^* + \frac{3}{4}g_0}.$$

(d) (2 points) What is the multiplier in each country now? Why is it different from the open economy multiplier in part (a)?

Solution: The multiplier is now given by $7/4 = 1.75$ since $\Delta Y = \frac{7}{4}\Delta g_0$. This is higher than $10/7 \approx 1.43$. The reason is that increasing G in the home economy increases imports from the foreign economy and therefore, output in the foreign economy, which in turn increases demand for exports in the home economy.

(e) (1 point) What is the multiplier for a coordinated increase in government spending, such that $\Delta g_0 = \Delta g_0^*$?

Solution:

$$\Delta Y = \frac{7}{4}\Delta g_0 + \frac{3}{4}\Delta g_0^* = \frac{10}{4}\Delta g_0 = 2.5\Delta g_0.$$

The multiplier for a coordinated increase in government spending is 2.5. This is also the closed economy multiplier, which is intuitive.

(f) (1 point) Is the multiplier then higher or lower than in the previous question? What is the economic intuition?

Solution: The multiplier is higher. If government spending is coordinated, then aggregate demand leakages through imports are compensated by more exports from abroad, coming from the foreign economy's own stimulus (e.g. the G20).

Exercise 4: The Neoclassical Labor Market (10 points)

5. (10 points) Consider the neoclassical labor market model. On the demand side, we assume a Cobb-Douglas production function for $f(l)$, such that: $f(l) = A \cdot l^{1-\alpha}$. On the supply side, we assume a linear utility for consumption as well as a power function of disutility for work $U(c, l) = c - B \cdot l^{1+\epsilon}/(1+\epsilon)$.

   (a) (2 points) Assume that the price of consumption is p, and that the wage is w. Derive the labor demand curve assuming that firms maximize their profits $pf(l) - wl$.

Solution: We solve:

$$\max_l \quad pf(l) - wl = \max_l \quad pAl^{1-\alpha} - wl$$

This implies:

$$pA(1-\alpha)l^{-\alpha} = w \quad \Rightarrow \quad \boxed{\frac{w}{p} = A(1-\alpha)l^{-\alpha}}.$$

This is a labor demand curve: a (negative) relationship between the real wage and the quantity of employment.

   (b) (2 points) Derive the labor supply curve assuming that workers' budget constraint is given by $pc = wl$ (you can use whichever of the 4 methods you prefer).

Solution: Let us replace out c in the utility function using the budget constraint and the maximize over l:

$$\max_l \quad \frac{w}{p}l - B\frac{l^{1+\epsilon}}{1+\epsilon}$$

This implies:

$$\boxed{\frac{w}{p} = Bl^{\epsilon}}.$$

   (c) (2 points) Calculate the equilibrium quantity of labor l.

Solution: Equating the two above expressions, to find the intersection of the labor demand curve and the labor supply curve allows to find:

$$A(1-\alpha)l^{-\alpha} = Bl^{\epsilon} \quad \Rightarrow \quad \frac{A(1-\alpha)}{B} = l^{\epsilon+\alpha}$$
$$\Rightarrow \quad l = A^{1/(\epsilon+\alpha)}(1-\alpha)^{1/(\epsilon+\alpha)}B^{-1/(\epsilon+\alpha)}.$$

(d) (2 points) Calculate the equilibrium real wage w/p.

Solution: Substituting in either of the labor supply or labor demand curves, for example the labor supply curve:

$$\begin{aligned}\frac{w}{p} &= Bl^{\epsilon} \\ &= BA^{\epsilon/(\epsilon+\alpha)}(1-\alpha)^{\epsilon/(\epsilon+\alpha)}B^{-\epsilon/(\epsilon+\alpha)} \\ \frac{w}{p} &= A^{\epsilon/(\epsilon+\alpha)}(1-\alpha)^{\epsilon/(\epsilon+\alpha)}B^{\alpha/(\epsilon+\alpha)}\end{aligned}$$

(e) (2 points) We consider a fall in log productivity $\Delta \log A$, where log is the natural log. What is the change in log employment $\Delta \log(l)$, and the change in the log real wage $\Delta \log(w/p)$, as a function of $\Delta \log A$?

Solution: Taking natural logs of the expression in question 3:

$$\log l = \frac{1}{\epsilon+\alpha}\log A + \frac{1}{\epsilon+\alpha}\log(1-\alpha) - \frac{1}{\epsilon+\alpha}\log B$$

This implies that the change in log employment is:

$$\boxed{\Delta \log l = \frac{\Delta \log A}{\epsilon+\alpha}}.$$

Taking natural logs of the expression in question 4:

$$\log\left(\frac{w}{p}\right) = \frac{\epsilon}{\epsilon+\alpha}\log A + \frac{\epsilon}{\epsilon+\alpha}\log(1-\alpha) + \frac{\alpha}{\epsilon+\alpha}\log B$$

This implies that the change in the log real wage is:

$$\Delta \log\left(\frac{w}{p}\right) = \frac{\epsilon \Delta \log A}{\epsilon+\alpha}.$$

These two formulas show that when there is a fall in log productivity, both employment and the real wages fall. How much they fall depends on parameters ϵ, α, which were here left unspecified. As you know, $1/\epsilon$ is the labor supply elasticity, so if labor supply is totally inelastic ($\epsilon = +\infty$) then you don't get any effect on employment, and you just have a rise in the real wage by exactly the amount that productivity has risen.