Econ 105: Final Examination ~ Postmortem

Partial Answers

Part I: Answer SIXTEEN (only 16) of the following 20 questions. 80 points

1. The demand function for wheat is $q_d = 400 - 100p$. The supply function is $q_s = 100p$.
    a. What is the equilibrium price of wheat? What quantity will be sold?
        $400 - 100p = 100p$ yields $p = \$2$ and hence $q_d = q_s = 200$
    b. If the government requires producers to pay a tax of $1.00 on each unit that they sell, what price will the consumers have to pay for each item that they purchase?
        $q_s = 100(p_c-1) = 400 - 100p_c$, where p_c is the price paid by the consumer, gross of the tax. So $200p_c = 500$ or $p_c = \$2.50$; the producer receives $p_p = p_c - \$1.00 = \$1.50$ and $q = 150$.
    c. How much consumer surplus will be lost as a result of the tax?
        $\Delta CS = (\$2.50-\$2.00) \times (200+150)/2 = \$87.50$

2.   The demand function for corn is $q = \frac{1}{2} \, p^{-1/3}M^{2/3}$, where q is quantity sold, p is price, and M is income.
    a. How much corn will be demanded if the price is $8 and income is $64?
        Since $8^{-1/3} = \frac{1}{2}$ and $64^{2/3} = 16$, $q = \frac{1}{2} \, \frac{1}{2} \, 16 = 4$
    b. What is the price elasticity of demand for corn? Explain.
        Since $\partial q/\partial p = -1/3 \, \frac{1}{2} \, p^{-1/3-1}M^{2/3} = -1/3 \, q/p$, $\eta = - \partial q/\partial p \; p/q = 1/3$

3. Mary is a utility maximizer who consumes goods X_1 and X_2 at prices p_1 and p_2 from income M; i.e., her budget constraint is $M = p_1X_1 + p_2X_2$. Her utility function is $U(X_1,X_2) = 2X_1^{0.5} + X_2$.

    a. Determine Mary's demand function showing the quantity of X_1 she purchases as a function of prices p_1 and p_2 and income M.
        Since $X_2 = M/p_2 - (p_1/p_2)X_1$, substituting into $U(X_1,X_2) = 2X_1^{0.5} + X_2$ yields $U^*(X_1) = 2X_1^{0.5} + M/p_2 - (p_1/p_2)X_1$. Now $dU^*(X_1)/dX_1 = X_1^{-0.5} - (p_1/p_2) = 0$, impling $\sqrt{X_1} = p_2/p_1$ or $X_1 = (p_2/p_1)^2$.

    b. If $p_1 = \$1$, $p_2 = \$2$ and $M = \$10$, how much X_1 and X_2 will she purchase? How much utility will she enjoy?
            $X_1 = (2/1)^2 = 4$, $X_2 = (10-4)/2 = 3$ and $U = 2 \times 4^{1/2} + 3 = 7$.

    c. If the price of X_1 increases to $p_1 = \$2$, but still $p_2 = \$2$ and $Y = \$10$, how much X_1 and X_2 will Mary purchase? How much utility will she enjoy?
            $X_{12} = 2/2 = 1$ & $x_2 = (10-2)/2 = 4$; $U = 2 + 4 = 6$.

    d. By how much would Mary's income have to increase in order to enable her to enjoy the same level of utility after the increase in p_1 as that which she enjoyed before the inflation?

Substituting the demand functions for X_1 and X_2 into the utility function yields the "Indirect Utility Function:" $U = 2p_2/p_1 + M/p_2 - (p_1/p_2)(p_2/p_1)^{1/2}$ showing the maximum utility attainable from the specified income and prices. From this we readily obtain the Expenditure Function showing the minimum income that will suffice to yield a specified level of utility given prices: $M = p_2[U - 2p_2/p_1 + (p_1/p_2)(p_2/p_1)^{1/2}]$

For the specified prices, this reveals that an income of $M = 12$ is required to restore $U = 7$, or a 20% raise!

4. Max started his own software business in January of 1999. He purchased $20,000 worth of equipment with a useful life of 5 years. His supplies cost $50,000. His labor costs were zero. But because he worked 12 hour days, doing all the work himself, he managed to sell $100,000 worth of software his first year!

   a. The accountant will subtract from the $1,000,000 receipts the $50,000 of supplies and $20,000/5 of depreciation, leaving profits of $46,000.

   b. The true costs include the opportunity cost of owner-supplied labor and capital. If the owner's time is worth $10.00 per hour and he works 3,000 hours per year, the labor is worth $30,000. Also, if Max had put the $20,000 in the bank at 5% instead of investing in equipment he would have earned $1,000 in interest. So economic profit is only $46,000-$30,000-$1,000 = $15,000. [This assumes that the accounting depreciation was an accurate representation of the true decline in value of the machine.]

   c. What are the major factors distinguishing accounting from economic profit? The opportunity cost of owner-supplied labor, capital and other resources. Also accelerated depreciation, inventory accounting procedures and other tax avoidance techniques are neutralized in calculating *economic* profit.

5. Albert's company sells its output on a competitive market. It has total cost function $C(q) = 1,000 + 10q^2$.

   Fixed costs are 1,000, average costs are $C(q)/q = 1000/q + 10q$, and marginal cost is $dC/dq = 20q$. Since $d(C/q)/dq = -1000q^{-2} + 10 = 0$ unless $q = 10$, average costs are minimized at this level of output. $C(10)/10 = 200$ is minimum average total cost – this is the break even price. The shut down price is zero – this is the minimum value of average variable cost. With free entry and exit, the long run equilibrium price will be $200. At this price $q(200) = 10,000-200 = 9,800$ is the level of industry output. In the long-run there will be $9,800/10 = 980$ firms in the industry, each producing 10 units of output.

6. A monopolist facing the demand function $q = 15 - p/2$ has total cost function $C(q) = 100 + 10q$.

   a. How much should the monopolist sell to maximize profit? What price will maximize profits? [Hint: $p(q) = 30 – 2q$ is the inverse demand function.]

   Since $\pi = 30q – 2q^2 – 100 – 10q$, $d\pi/dq = 20 – 4q$. Therefore, a profit maximizing firm will produce $q = 5$ units of output and the price will be $p = 30 – 2\times5 = 20$. Profit will be $–100$, so the firm will shut down in the long run.

   b. As French Engineer Emil Dupuit pointed out a century ago, price must be set equal to marginal cost in order to maximize the sum of profit plus consumer surplus. Therefore, $MC = 10 = p$ and $q = 10$. Consumer surplus is $S_c = (30-10)\times10/2 = 100$. $\pi = 100 – 150 = -50$.

c. Suppose the manufacturing process generates pollution that costs $2.00 per unit of output. How are your answers to question a affected. How does it change your answer to b, assuming the objective is to maximize the sum of profits plus consumer surplus less pollution costs?

The firm should produce where marginal production cost plus marginal pollution cost equals price. This implies $p = 12$, $q = 9$ and $C_s = (30-12) \times 9/2 = 81$. $R = 108$, $C = 190$, $C_{pollution} = 18$ – shut down that chimney!

7. The Kaiser Pharmaceutical Corporation's $1 billion investment has paid off. It has developed a wonderful new drug. It will cost Kaiser $100 to produce and distribute an annual dose, over and above the development costs. That is to say, the total cost function is $C(q) = \$1$ billion $+ \$100q$, where q is the number of patients receiving the treatment. The marketing department estimates that a price of $250 will maximize profits from the drug with annual sales of 1,000,000 units.

Since the demand curve is linear, so is the marginal revenue curve, but it is twice as steep. As may easily seen with an appropriate graph, the demand and marginal revenue curves both go through point <0,400>. Assuming that the demand curve for the product is linear, what price would maximize the sum of consumer surplus plus profit? As may be easily seen on a graph, with constant marginal cost the monopoly output of 1,000,000 is only half the quantity that would be required to equate price with marginal cost of $100.

Kaiser would make $10 per unit off the generic drug, except in so far as this bled from sales of the full price drug. Kaiser may worry that a consumer group might ship the drug into the Untied States.

8. In December 1982, the Civilian Labor Force was 110,962 and employment was 99,055. What was the level of unemployment and what was the unemployment rate?

   $LF - E = 110,962 - 99,055 = 11,907 = U$. $UR = U/LF = 11907/110,962 = 10.7\%$

9. The seasonally unadjusted unemployment rate increased from 9.1% in May to 9.8% in June of 1982, but the seasonally adjusted rate remained unchanged at 9.5%. What accounts for the discrepancy between the seasonally unadjusted and the seasonally adjusted rate? Which rate is most useful in appraising current economic conditions?

   The unadjusted data is the result obtained directly from the monthly Current Population Survey. The unadjusted data is masagaged by the Bureau of Labor Statistics Census X11-ARIMA program in an attempt to filter out regular month-to-month movements (such as the December shopping season and the influx of students into the work force when school is out in the spring) so as to leave a time series which more accurately indicates changing current economic conditions.

10. In year 2010, your salary is $100,000 and the price index (2000=100) stands at 150. In year 2011, your salary is $110,000 but the price index now stands at 160. Are you better off, economically speaking, in year 2011 or in year 2010? Explain.

    Measured in year 2000 dollars, your salary in year 2010 was with $100,000/1,50 = $66,666. Your salary in year 2011 is worth $110,000/1.60 = $68,750 in year 2000 dollars; this is slightly better than the preceding year.

11. In year 2010, you take out a 25-year mortgage at 6% annual interest on a $300,000 house. You are committed to making monthly payments of $1,932 until year 2035.

a. If it turns out that prices rise at 4% per annum over the life of the mortgage, the real *ex post* rate of interest (i.e., the nominal rate of 6% corrected for inflation) will be approximately 6% - 4% = 2%.

b. If house prices rise at the same rate as the general price level it would be worth about $1.04^{25}\$3000 = \$799,000$. Note that with 4% inflation, prices will double approximately every 70/4 = 17.5 years.

12. If the unemployment rate were to increase from 4% to 6%, would you expect GDP to decline by about 2%? Why or why not?

   Okun's Law suggests that $\Delta Y/Y \approx 2.5\Delta U \approx 2.5\times(6\%\text{-}4\%) = 5\%$

13. In 1998 GDP was equal to about $8,500 billion but disposable income was only $6,000 billion. What are the major factgors explaining this $2,500 billion gap?

   The gap between GDP and disposable income is accounted for by depreciation, taxes, and corporate retained earnings (corporate savings), which are partially offset by transfer payments (veteran benefits, welfare, social security).

14. If humanitarian instincts were to induce the United States to lend $5 billion to earthquake victims in Turkey and Armenia, assuming that the funds were spent on goods and services from America, would stimulate the U.S. economy. The extra exports would have a multiplier effect on the level of US GDP of approximately $5 billion $\times 2.7 =13.5$ billion!

15. In Simpleland, $Y = C + I + G + X - M$, $C = 2/3Y_d$, and $Y_d = \frac{3}{4} Y$. Suppose that I = $80 billion, X = $30 billion , and M = $10 billion. Determine the level of Y, Y_d and C.

   $C = 2/3 \frac{3}{4} Y = \frac{1}{2} Y$. Hence, $Y = \frac{1}{2} Y + (I+X-M+G) = 2\times110 = 220$

16. IsLand is exactly like SimpleLand, with but one exception. All the equations and magnitudes are the same, except that investment is $I = 100 - 200r$.

   a. If the rate of interest is 10% = 0.10, $I(0.1) = 80$ so why still equals 220

   b. If the Fed cuts the interest rate to 5%, $I(0.05) = 90$ and $Y = 2\times120 = 240$.

17. Suppose the demand function for money in IsLmLand is $M_d = 100 + Y/2 - 2000r$.

   a. If the Fed wishes to establish an interest rate of 5% and Y = 1,000, the Fed would have to induce the banking system to create $M_s = 500$.

   b. If the reserve requirement is 10%, the banks would have to hold reserves of 50 = 10% demand deposits.

18. The Fed can try to increase the quantity of money in circulation by purchasing government securities on the open market or by reducing the discount rate. On rare occasion, it has also changed the required reserve ratio.

19. Suppose inflation has gotten completely out of hand in Never Never Land. Prices are rising at more than 10% per annum! Some distinguished university experts assert that the Fed should aggressively cut the money supply in order to stop the inflation while other scholars proclaim that this would be exactly the wrong thing to do because it would generate unemployment. The Fed decides not to engage in any open market operations or to take any other steps to stop the inflation. However, with a fixed nominal money supply, rising prices will tend to reduce the

purchasing power of the money in circulation. The reduction in the real money supply ppushes the LM curve to the left. This in turn pushes up interest rates, which discourages investment spending, provided the Fed does indeed hold the line and not let the money suppy expand.

20. In 1999 farmers sold 4,000,000 bushels of apples at $4.00 per bushel. In 1998 they sold only 3,000,000 bushels at a price of $6.00. Calculate the (arc) price elasticity of demand.
    $\Delta q/q = (4-3)/3 = 1/3$; $\Delta p/p = (\$4-\$6)/\$6 = 1/3$. Therefore, $\eta = \Delta q/q \div \Delta p/p = 1$. (The calculation is somewhat ambiguous because quite different numbers could be obtained by utilizing the average of the two prices and quantities rather than the first year's in the denominator.) This is the arc elasticity, computed from the change in price under the hopeful assumption that nothing else changed. The arc elasticity may be the best way to proceed to estimate elasticities when there are not enough observations to estimate the demand function.

Part II: 20 points) Write a brief essay explaining the most intriguing and surprising economic aspects of the Economics of World War II (Dec 7, 1941, August 14th, 1995).
    Most answers correctly identified the role of the multiplier.
    The intricacies of how the war was financed is challenging for first semester students of economics. The Fed purchased government securities on the open market. This increased the reserves of the banking system, which made it possible for the banks to buy still more government securities.