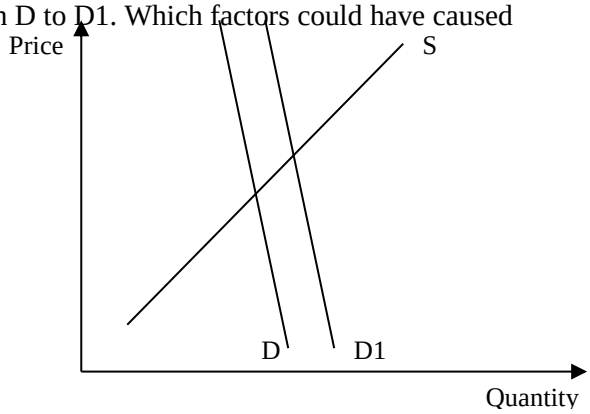
IB - Managerial Economics
Session 4 – Demand theory & Pricing Methods

1. **It is necessary** to distinguish shifts of demand and supply curves from the shifts taking place along these curves. In the appropriate columns of the table, mark the effect of each of the factors listed, taken as constant when plotting the demand and supply curves relative to the price:

Change in the determinant	Shifts of demand curve	Shift along demand curve	Shift of supply curve	Shift along supply curve
Change in prices of substitute goods	……X…….	…….	…….	……X…….
Application of new production technology	…….	……X…….	……X…….	…….
Product comes into fashion	……X…….	…….	…….	……X…….
Change in income	……X…….	…….	…….	……X…….
Change in production costs	…….	……X…….	……X…….	…….

2. **In the graph,** the demand curve for fountain pens shifted from position D to D1. Which factors could have caused this shift?



a) decrease of prices of substitutes of fountain pens
b) <u>fall in prices of complementary products</u>
c) decrease in the prices of raw materials used for the production of pens
d) <u>decrease in consumer incomes (pen as inferior good)</u>
e) reduction of VAT
f) decrease in consumers' incomes (pen as a normal good)
g) <u>advertising of pens</u>

3. **What kind of phenomena** would you expect in the coffee market, where there was a sharp drop in supply caused by bad harvests? Do you think that the income of coffee growers will be reduced or increased?

4. **Suppose that** the price of oil falls. How will this affect the demand curve for coal: a) in the short term; b) in the long run? What will happen to the price of oil substitutes as a result of a drop in its price?

5. **The demand function** for good X is given by the equation:

Qdx = 12 + 2I + 4Py – 2Px

Where:
Qdx – quantity of demand for X product, I – income , Px – price of X, Py – price of Y product

How will the demand for good X change, if the income of consumers increase on average by PLN 75, while the price of good decrease by PLN 1.5?

$Q2 = 12 + 2 (I + 75) + 4P_Y – 2 (P_x - 1,5)$
$- Q1 = 12 + 2 (I \quad) + 4P_Y – 2 (P_x \quad)$
$\Delta Q = \quad 2 \times 75 \quad - 2 \times (-1,75) = 153$

Ans: Demand for good X will increase by 153 units.

6. **The demand function** for good X is given by the equation:

   Qdx = 25 + 1,5I - 5Py – 2Px

   a) How will the demand for good X change, if the price of it increase by PLN 1,5 and the price of Y increases by PLN 2?
   b) What types of goods are X and Y?

Ans: Demand for good X will increase by 13 units. Goods X & Y are substitutes.

7. **The price of** a daily newspaper was PLN 2.14. Demand for this newspaper is given by the equation:

   Q = 1000 - 80P

   At a given price (containing 7% tax on goods and services), the market was balanced.

   1. How has the situation in this market changed when the tax on goods and services charged to the newspaper increased to 8%?
   2. Please provide the price before tax, after tax, determine the nature of the market imbalance and estimate changes in the total revenues of the publisher.

Ans:

b. $P_{bt} = 2.00$, $P_0 = 2.14$, $P_1 = 2.16$,
Due to the increase in P => Demand < Supply (Surplus),
Change in TR using P_{bt} as this is the price for the producer => $\Delta TR = TR_2 – TR_1 = (Q_2 \times P_{bt}) - (Q_1 \times P_{bt}) = \Delta Q \times P_{bt}$
Q_1 and Q_2 are calculated using the demand equation and as a result $\Delta Q = -1,6$
Therefore $\Delta TR = -3,2$

8. **Suppose that** GM's Smith estimated the following regression equation for Chevrolet automobiles**:**

Qc=100.000-100Pc+2.000N+50I+30Pf -1.000Pg+3A+40.000PI

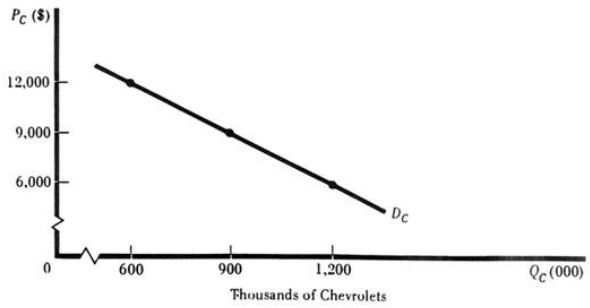
Where:
Qc= quantity demanded per year of Chevrolet automobiles
Pc= price of chevrolet automobiles, in dollars
N= population of the US, in millions
I= per capita disposable income, in dollars
Pf= price of ford automobiles, in dollars
Pg= real price of gasoline, in cents per gallon
A=advertising expenditures by Chevrolet, in per dollars per year
PI= credit incentives to purchase Chevrolets, in percentage points below the rate of interest on borrowing in the absence of incentives.

a) Indicate the change in the number of Chevrolets purchased per year (Qc) for each unit change in the dependent or explanatory variables.
b) Find the value of Qc if the average value of Pc= 9000$, N= 200 million, I= 10000$, Pf=8000$, Pg=80 cents, A= $200.000 and if PI=1
c) Derive the equation for demand curve for Chevrolets and (d) plot it.

Ans:

a) If:
   Pc ↗ by 1 USD, then demand ↘ by 100 (-100)
   N ↗ by 1 mln, then demand ↗ by 2000 (+2000)
   Etc…..
b) Qc = 900.000
c) Qc = 1.800.000 – 100Pc

d) To derive the demand curve for Chevrolets (Dc), substitute the hypothetical values of $12,000, $9,000, and $6,000 for Pc into the equation of the demand curve found in part c). This gives, respectively, Qc=600,000, Qc=900,000 and Qc=1,200,000. Plotting these price-quantity values, get the demand curve for Chevrolets, Dc.



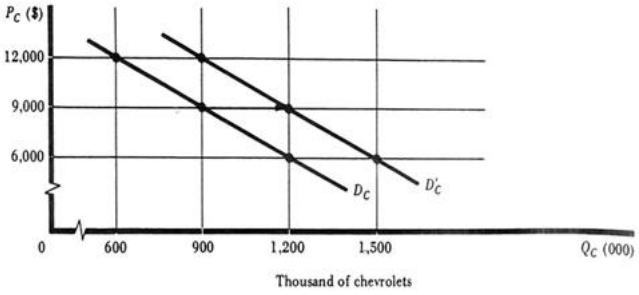
9. **Starting** with the estimated demand function for Chevrolets given task 8 (above), assume that the average value of the independent variables changes to N= 225 million, I= 12.000$, Pf=10.000$, Pg= 100 cents, A=250.000$ and PI= 0 (i.e. incentives phased out).

a) Find the equation of the new demand curve for Chevrolets
b) plot this new demand curve Dc' and on the same graph, plot the demand curve Chevrolets Dc, found in problem 8d
c) what is the relationship between Dc and Dc' ? What explains this relationship?

Ans:

a) Qc = 2.100.000 – 100 Pc
b) New demand curve Dc' and original demand curve Dc from task 8
c) constant term in Dc' (2.100.000) exceeds the constant for Dc (1.800.000) => shift to the right

- Dc' is shifted to the right in relation to the Dc, what means that changes in independent variables result in greater demand for Chevrolets at each price level.
- Increase in variables causing shift to the right (N, I, Pf, A) exceeds the effect of all forces that cause the demand curve shift to the left (Pg, PI)



10. **Mark** which goods are characterized by elastic demand and which are inelastic

Good	Elastic demand	Non-elastic demand
1. Bread	…….	……X…….
2. Theatre	……X…….	…….
3. Trips abroad	……X…….	…….
4. Electricity and gas	…….	……X…….
5. Catering services	……X…….	…….
6. Milk and milk products	…….	……X…….
7. Clothes	……X…….	…….

11. **The demand** for good X is sensitive to price changes. The price elasticity index is -1.2. Good X is strongly correlated with good Y, and the combined elasticity index is 2.
    a) How will the demand for good X change if its price increases by 5% and the price of Y decreases by 2%?
    b) What types of goods are X and Y?

Ans:

a) Ep = -1.2, Exy = 2

$Ep = \%\Delta Qx / \%\Delta Px \Rightarrow \%\Delta Qx_p = Ep * \%\Delta Px = -6$

$Exy = \%\Delta Qx / \%\Delta Py \Rightarrow \%\Delta Qx_y = Exy * \%\Delta Py = -4$

$\%\Delta Qx = \%\Delta Qx_p + \%\Delta Qx_y = -10$

b) X and Y are compliments

12. **Airlines offer flights** in two classes: economic and business. The price elasticity of the demand for flights by plane is 0.18 and 0.38 depending on the class. The increase in airline operating costs resulted in a 15% increase in ticket prices in both classes.

    a) Which price elasticity of demand refers to the economy class and which to the business class? Why?
    b) What will be the impact of the increase in prices of tickets on their sale?

Ans: a) $Ep_1 = 0{,}18$ => economy class, $Ep_2 = 0{,}38$ => business class

b) $\%\Delta Qe = -0{,}18 * 15 = -2{,}7\%$
$\%\Delta Qb = - 0{,}38 * 15 = -5{,}7\%$
$\%\Delta Qx = \%\Delta Qe + \%\Delta Qb = -8{,}4\%$

13. The Ice Cream Parlor is the only ice cream parlor in Smithtown. Michael, the son of the owner, has just come back from college, where he majors in business administration. In his course in managerial economics, Michael has just studied demand analysis, and he decides to apply what he has learned to estimate the demand for ice cream in his father's parlor during his summer vacation. Using regression analysis, Michael estimates the following demand function:

QI= 120-20PI

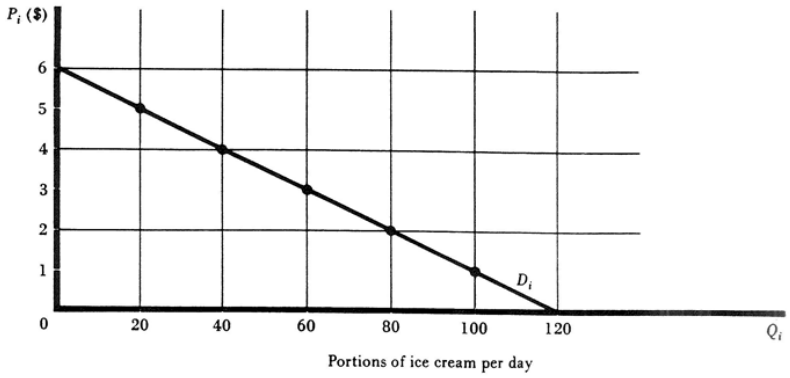
Where subscript I refers to ice cream portions served per day in his father's parlour, and PI is the dollar price. Michael then sets out

a) derive the demand schedule for ice cream and plot it,
b) find the point price elasticity of demand at each dollar price from P= \$6 to P=\$ 0
c) find the arc price elasticity of the demand at each dollar price, (i.e. between P= \$6 and P=\$5, P= \$5 to P=\$4 and so on). Show how Michael would get his results.

Ans: a) derive the demand schedule by substituting different prices

Table 1

Pi (\$)	6	5	4	3	2	1
Qi	0	20	40	60	80	100



b) Michael finds the ***point price elasticity of demand (Ep) at each price*** by applying the following formula

$Ep = (\Delta Qx / \Delta Px) \times (P/Q) \Rightarrow \quad \Delta Qx / \Delta Px =$ a (derivative $d(Q)P = -20$.

At Pi=\$6, Ep = -20(\$6/0) = -infinite
At Pi=\$5, Ep = -20(\$5/20) = -5
At Pi=\$4, Ep = -20(\$4/40) = -2
At Pi=\$3, Ep = -20(\$3/60) = -1
At Pi=\$2, Ep = -20(\$2/80) = -1/2
At Pi=\$1, Ep = -20(\$1/l00) = -1/5
At Pi=S0, Ep = -20(\$0/120) = -0

(c) Michael finds the ***arc price elasticity of demand (Ep) between each two consecutive price levels*** by applying the following formula, where a = - 20 (as in part b) and the numbers 2 and 1 refer to the new and original price and quantity, respectively, or vice-versa.

$Ep = a * (Pi_2+Pi_2) / (Qi_2+Qi_1)$

Between Pi=$6 and Pi=$5, Ep = -20($6+$5)/(0+20) = -11
Between Pi=$5 and Pi=$4, Ep = -20($5+$4)/(20+40) = -3
Between Pi=$4 and Pi=$3, Ep = -20($4+$3)/(40+60) = -1.4
Between Pi=$3 and Pi=$2, Ep = -20($3+$2)/(60+80) = -0.71
Between Pi=$2 and Pi=$l, Ep = -20($2+$1)/(80+100) = -0.33.
Between Pi=$1 and Pi=$0, Ep = -20($1+$0)/(l00+120) = -0.09.

14. **The coefficient of** income in a regression of the quantity demanded of a commodity on price, income, and other variables is 10.
    a) calculate the income elasticity of demand for this commodity at income of $ 10.000 and sales of 80.000 units.
    b) What would be the income elasticity of demand if sales increased from 80.000 to 90.000 units and income rose from $ 10.000 to 11.000? What type of good is this commodity?

Ans:

a) $EI = (\Delta Q / \Delta I) * (I/Q) \Rightarrow \%\Delta Q / \%\Delta I$

Coefficinet a = dQ(I) = $(\Delta Q / \Delta I) = 10$

Thus, with income of $l0,000 and sales of 80,000 units, EI= l0 * (l0,000/80,000) = 1.25.

b) Change of price => arc elasticity formula

EI = (Q2-Q1/I2-I1) * (I2+I1/Q2+Q1) or $EI = a * (I_1 + I_2) / (Q_1 + Q_2)$

EI = 1.24.

If EI > 0 => the good is normal, and if EI > 1 => the good is a luxury.

15. **The coefficient of the price of gasoline** in the regression of the quantity demanded of automobiles (in millions of units) on the price of gasoline (in dollars) and other variables is -14.
    a) calculate the cross price elasticity of demand between automobiles and gasoline at the gasoline $ 1 per gallon and sales of automobiles of 8 (million units).
    b) What would be the cross price elasticity of demand between automobiles and gasoline if sales of automobiles declined from 8 to 6 with an increase in the gasoline price from $ 1 to $ 1.20 per gallon?

Ans:

a) The estimated coefficient of Py in the regression of Qx on Py and other explanatory variables is -14 =>
a = -14 = dQx(Py)
Exy = $\%\Delta Qx / \%\Delta Py$ or Exy = a * Py / Qx

Exy = -14 * (1/8) = - 1.75 => Automobiles and gasoline are fairly strong complements.

b) Changes in variables = > arch elasticity formula

Exy = (Qx2-Qx1)/ (Py2 - Py1) * (Py2 + Py1) / (Qx2 + Qx1) = -1.57

16. The management of the Mini Mill Steel company estimated the following elasticities for a special type of steel: Ep = -2, EI = 1, EXY= 1.5 and X refers steel and Y refers aluminium. Next year the firm would like to increase the price of the steel it sells by 6 percent. The management forecasted that income will rise by 4 percent next year and that the price of aluminium will fall by 2 percent.

a) If the sales this year are 1.200 tons of the steel, how many tons can the firm expect to sell next year?
b) by what percentage must the firm change the price of steel to keep its sales at 1.200 tons next year?

Ans:

(a) Ep = -2 & firm increased the price of steel by 6 percent => sales would change by (- 2)*(6%)= **-12%**
EI= l & increase in income of 4 percent => sales would increase by (1)*(4%) = **4%**
Exy = 1.5, & reduction in the price of aluminium of 2 percent = > sales will go down by (1.5)* (-2) = **-3%**
The net effect of all changes: -12%+4%-3%= **-11% =>** a net decline in the sales of the firm

Thus, the steel sales of the firm next year would be l,200 - (l,200)*(-11%) = 1,200 – 132 = 1,068 tons.

(b) By themselves (i.e., without any increase in the price of steel), the increase in income and the reduction in the price of aluminium would result in a 1 percent increase in the steel sales of the firm (4% - 3% = 1%)
Thus, in order to keep sales unchanged, the firm can only increase the price of steel so that, by itself, it would reduce the demand for steel by 1 percent.
Since the price elasticity of demand of the steel is -2, the firm can only increase the price of the steel by 0.5%
$\%\Delta Qx = Ep * \%\Delta Px + Ei * \%\Delta QI + Exy * \%\Delta Py$
$0 = -2 * \%\Delta Px + 4\% - 3\%$
$\%\Delta Px = 0{,}5\%$

17. The research department of the Corn Flakes Corporation (CFC) estimated the following regression for the demand of the cornflakes it sells.

QX= 1.0-2.0 PX+ 1.5I+0.8PY-3.0PM+1.0A

Where QX=sales of CFC cornflakes, in millions of 10-ounce boxes per year
PX= the price of of CFC cornflakes, in dollars per ounce box
I= personal disposable income, in trillions of dollars per year
PY = price of competitive brand of cornflakes, in dollars per 10- ounce box
PM = price of milk, in dollars per quart
A= advertising expenditures of CFC cornflakes, in hundreds of thousands of dollars per year.

This year, PX= 2, I=4, PY = 2.50, PM = 1 and A=2.

a) calculate the sales of CFC cornflakes this year;
b) calculate the elasticity of sales with respect to each variable in the demand function;
c) estimate the level of sales next year if CFC reduces Px by 10 percent, increases advertising by 20 percent, I rises by 5 percent, PY is reduced by 10 percent, and PM remains unchanged.
d) By how much should CFC change its advertising if it wants its sales to be 30 percent higher than this year?

ANS:

a) Qx = 1.0 - 2.0(2) + 1.5(4) + 0.8(2.50) - 3.0(1) + 1.0(2) = 4 => The CFC would sell 4 million boxes this year.

b) The elasticity of demand for CFC corn flakes with respect to each variable:
Ep = -2 * (2/4) = -l ; **EI**= 1.5 * (4/4) = 1.5; **Exy** = 0.8 * (2.50/4) =0.5; **Exm** = -3.0 * (1/4) = -0.75 ; $\mathbf{E_A}$ = 1.0 * (2/4) = 0.5

c) $\%\Delta Qx = Ep * \%\Delta Px + Ei * \%\Delta QI + Exy * \%\Delta Py + Exm * \%\Delta Pm + E_A * \%\Delta P_A$
$\%\Delta Qx = 22{,}5\%$ => $Qx_2 = Qx_1 + \%\Delta Qx = 4.9$ => The CFC would sell 4.9 million boxes of its corn flakes next year.

e) Expected $\%\Delta Qx = 30\%$ => $Qx_3 = 5{,}2$ => What should be an additional increase in advertising expenditures to reach sales of 5,2 instead of 4,9? $\%\Delta A_1 = ??$
$E_A = a * (\%\Delta Qx/\%\Delta A_1)$ => $\%\Delta A_1 = a * (\%\Delta Qx/E_A)$

Additional increase in advertising expenditures : $\%\Delta Qx = 30\% - 22{,}5\% = 7{,}5\%$ => $\%\Delta A_1 = 1 * (7{,}5/0{,}5) = 15\%$

The additional advertising expenditures should be increased by 15% or should increase by 30.000 dollars (15% * 200.000)