1a) Pick a Canadian industry to analyze. Tell us what it is.
        For this assignment, I chose a fast-food service industry - pizzerias. Pizzerias offer both a dine-in area and online pizza delivery services to customers. According to statistics, the pizzeria industry stands for about 10% of the fast-food industry and is a perfectly competitive market with many buyers and over 8000 sellers (restaurants) (Bloom, 2018). It mainly targets the business crowd made up of Generation X and Millennials who enjoy fast food. (Kelly, 2020)

1b) Pick a representative consumer in this industry.
i) What two goods they are choosing between?
        The representative consumer chooses between the number of meals eaten out/ordered online from pizzerias and a composite good (dollar amount spent on the other food consumption).

ii) What is the consumer's income? Exogenous or endogenous? Specify income source and explain your reasoning. Write a budget constraint equation that captures this.
        The representative consumer's income is exogenous. It consists of wages from employment, financial aids from the government, and gain/losses from investments (stock market). For Millennials or Generation Xers, most of them are employed and expected to receive a defined amount of salary regularly while the unemployed receive financial aids from the government. For a representative consumer, I will assume that they have a permanent job and may receive other financial subsidies like Canada Child Tax benefits. I also assume that the representative consumer has income from investments. Thus, their income would be a fixed amount with some variation between people.
        The price of one meal eaten out (x_1)will be 15 CAD after-tax[1], while the cost of the composite good (x_2)will be 1 CAD. F stands for amount of financial aid received. I stands for investment income.

Budget Constraint: $p_1x_1 +\ p_2x_2 = 55000^2 + F + I$

$15x_1 +\ x_2 = 55000 + F + I$

iii) What are the consumer's preferences?
        The Cobb-Douglas function can model the representative consumer's preference. According to statistics, 75% of the consumers in the pizzeria industry will have a pizza at least once a month (Ksabharwal, 2018), meaning that the consumer will spend a fixed share of his income on pizzeria food and other food consumption. The two goods act as imperfect substitutes for consumers. Thus, for a representative consumer, the consumption of pizza does not have a fixed relationship with other consumptions and is not perfectly substitutable with the composite good. With a Cobb-Douglas preference, the MRS will decrease as I move along (down) the Indifference Curves; hence there is a diminishing MRS. Between the two choices of having pizza and other food consumption, consumers have different weights in their minds. Since there is a fixed amount of money to spend, they would choose the best consumption combination that can

[1] https://www.globalprice.info/en/?p=canada/restaurant-prices

[2] http://blog.careerbeacon.com/stats-can-the-highest-and-lowest-paying-jobs-in-canada-for-2018/

bring them the most satisfaction. To expand, as consumers spend more money on pizzas, the additional satisfaction they derive from another pizza meal will decrease.

Utility function: $U = x_1^{0.01} x_2^{0.99}$

- x_1: number of meals from pizzerias
- x_2: dollar amount spent on the other food consumption

The equation means that the consumer will spend 1% of its income on pizzas.

MRS $= -\dfrac{x_1}{99x_2}$. This means the consumer is willing to give up $\dfrac{x_1}{99x_2}$ unit of composite good for 1 pizza meal.

iv) Derive a demand curve for the representative consumer given the information you have chosen in the earlier parts.

$$\max U = x_1^{0.01} x_2^{0.99} \quad s.t. \quad p_1 x_1 + p_2 x_2 = 55000 + F + I$$

$$\mathcal{L} = x_1^{0.01} x_2^{0.99} + \lambda(55000 + F + I - p_1 x_1 - p_2 x_2)$$

$$0 = \frac{\partial \mathcal{L}}{\partial x_1} = 0.01 \frac{x_2^{0.99}}{x_1^{0.99}} - p_1 \lambda$$

$$0 = \frac{\partial \mathcal{L}}{\partial x_2} = 0.99 \frac{x_1^{0.01}}{x_2^{0.01}} - p_2 \lambda$$

$$\Rightarrow \frac{x_2}{99 x_1} = \frac{p_1}{p_2} \qquad \therefore x_2 = 99 x_1 \frac{p_1}{p_2}$$

$$0 = \frac{\partial \mathcal{L}}{\partial \lambda} = 55000 + F + I - p_1 x_1 - p_2 x_2 = 0$$

$$\therefore p_1 x_1 + p_2 \cdot 99 x_1 \frac{p_1}{p_2} = 55000 + F + I \qquad \therefore x_1^* = \frac{55000 + F + I}{100 p_1}$$

$$x_1^* = \frac{55000 + F + I}{100 p_1}$$

1c) Use your work in 1b to derive an industry demand equation.

Since consumers with different levels of income will react similarly to the demand shock (e.g. income), but with varying degrees, I will assign all of them to the same demand curve as derived in 1b for simplicity.

$$x_1^* = \frac{55000 + F + I}{100 p_1}$$

There are many consumers, and the industry demand will be the summation of individual demand due to perfect competition. For the number of consumers in the pizzeria industry, I approximate it by

$$51.24\% \times 35881659 \times 91.83\% \times 10\% \approx 1680000$$

- 51.24%: the percent of Generation X and Millennials in Canada in 2018[3]
- 35881659: Canada's population in 2018[4]
- 91.83% = 100% - 8.17%: amount of people who eat fast food
  (Statista Research Department, 2018)
- 10%: pizzeria industry weight in the total fast food industry (Bloom, 2018)

$$X^D = \frac{16800(55000 + F + I)}{P}$$

[3 & 4] https://www.indexmundi.com/canada/demographics_profile.html

1d) In this setting, what will be the impact of COVID-19 on industry demand? Is this a long-run or short-run effect? Explain your reasoning.

In this setting, COVID-19 will cause a short-run income shock on the industry demand. For the representative consumers, the virus will stop them from going to work, and some companies have started to lay off employees since the economy has slowed down (Restaurants Canada, 2020). Consequently, their wage will decrease sharply though the government has carried out the COVID-19 Economic Response Plan[5] and reduced interest rates to stimulate the economy. Since the outbreak of coronavirus, the S&P/TSX has fallen by 516 points, and the Canadian dollar has also depreciated (Ericaalini, 2020). With panic and uncertainty spread among investors, the bearish market has increased losses. Given these impacts, the overall income of pizzeria's consumers has decreased, leading to the income effect. As an inferior good, with real income decreases, consumer demand will increase for inexpensive foods like pizzas. However, since going out will increase the potential exposure to the virus, people will choose to stay at home and decrease the number of dine-ins. Not all dine-ins will transfer to take-outs and online orders either because people will try to limit potential risks (The Financial Post, 2020). Thus, in-store demand will drastically decrease while there will be a rise in online food delivery, which cannot offset the losses. Since the market is perfectly competitive, and all consumers will react similarly to the income shock, so the industry demand will decrease accordingly. Furthermore, there won't be a shock on preference as people won't change their taste because of the virus. The virus won't make an impact on the long-run industry demand as I assume that the virus will be controlled in a short period and the market will go back to normal in the long run.

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[5] https://www.canada.ca/en/department-finance/economic-response-plan.html

Reference

Bloom, R. (2018, April 21). Pizza chains seek bigger piece of pie. Retrieved from https://www.theglobeandmail.com/report-on-business/pizza-chains-seek-bigger-piece-of-pie/article18213837/

Dinning and drinking prices in Toronto and Canada. (2017, July 11). Retrieved from https://www.globalprice.info/en/?p=canada/restaurant-prices

Ericaalini. (2020, March 18). Coronavirus: TSX, Wall Street drop at the open despite stimulus news. Retrieved from https://globalnews.ca/news/6694766/coronavirus-tsx-wall-street-drop-at-the-open-despite-stimulus-news/

Harris, P. (2019, November 1). Stats Can: The highest (and lowest) paying jobs in Canada for 2018. Retrieved from http://blog.careerbeacon.com/stats-can-the-highest-and-lowest-paying-jobs-in-canada-for-2018/

Kelly, E. (n.d.). The Canadian Pizza Market. Retrieved from https://www.speedlinesolutions.com/blog/the-canadian-pizza-market

Ksabharwal. (2018, April 30). Demand for authenticity and innovation sweep the Canadian pizza segment. Retrieved from https://www.restobiz.ca/demand-authenticity-innovation-sweep-canadian-pizza-segment/

Restaurants Canada. (2020, April 2). COVID-19 has cost Canadian food service 800,000 jobs since March 1. Retrieved from https://www.canadianpizzamag.com/covid-19-has-cost-canadian-food-service-800000-jobs-since-march-1/

Statista Research Department. (2018, October 8). Canada - average fast food consumption per week 2016-2018. Retrieved from https://www.statista.com/statistics/561254/canada-average-fast-food-consumption-per-week/

The Financial Post. (2020, March 18). 'Everyone is just kind of in shock': Restaurateurs look into the abyss as COVID-19 shutdowns take hold. Retrieved from https://www.canadianpizzamag.com/everyone-is-just-kind-of-in-shock-restaurateurs-look-into-the-abyss-as-covid-19-shutdowns-take-hold/

2a) Pick a representative firm in this industry. For this firm, answer the questions below.
i) What good does the firm produce?
        It produces and serves pizza as the main product.

ii) What two inputs does the firm use?
        The firm uses capital and labor as two inputs of production.

iii) Write an equation that captures the firm's production function.
        The firm's production function is a Cobb-Douglas one. Two inputs act as imperfect substitutes for the firm. As a food producer, the firm will need to purchase material and pay rent with capital and labor to monitor and make pizzas. The inputs are not perfectly substitutable since the firm needs both to complete a meal. They do not have to be used in fixed proportion as the firm can achieve the same output by increasing capital and decreasing labor and vice versa.
        Production function: $Q = 10L^{0.4}K^{0.6}$

- L: labor used in production
- K: capital used in production

        The production function has a constant return to scale. When the firm increases all inputs, it will get an output increased by the proportional amount.

iv) What is the market structure? Is the firm a price-taker or a price setter in the output and input markets? Explain your reasoning briefly.
        The pizzeria industry is a perfectly competitive market with many buyers (consumers) and many sellers (pizza producers). Firms will act as a price-taker in the output market. Since pizza production does not require sophisticated labor, the firm will serve as a price-taker in the input market as well.

v) Derive the firm's cost function. Explain your reasoning briefly.

        $C = 10000 + 7.3x + 0.0005x^2$
- $MC = 7.3 + 0.001x$
- $AVC = 7.3 + 0.0005x$
- $ATC = \frac{10000}{x} + 7.3 + 0.0005x$

        The fixed cost for the representative firm is high since it has to provide large areas for in-person dining and pay for equipment. The firm has an increasing marginal cost function. As the number of products increases, the cost of one additional product will rise. As there is a limited working hour for employees, when the amount of pizza produced reached the maximum in the given time, there would be overtime pay. The minimum average variable cost is 7.3, and the minimum average total cost is 13.6. In the short run, firms will stay in the industry if the market price is higher than 7.3. In the long run, firms will continue to produce if the market price is higher than 13.6. The cost functions derived above are for one branch of the firm.

vi) Derive a supply curve for the representative firm given the information you have chosen in the earlier part.
        $P = MC = 7.3 + 0.001x$
        $x^S = 1000P - 7300$
        The derived supply curve above is for one branch of the firm.

2b) Use your work in 2a to derive an industry supply equation. Does it differ in the long-run or short-run?

In the short run, the number of firms is fixed. Thus, the short-run industry supply is the summation of firm supply. According to statistics, there are over 8000 pizza restaurants in Canada, so I used 8000 as the total amount of restaurants in Canada. (Bloom, 2018)

$$X^S = 8000000P - 58400000$$

In the long run, firms can enter and exit the market freely. Firms will enter if the profit in the market is larger than 0 or exit if the profit is less than 0. For simplicity, I will assume that all firms in this perfectly competitive market are identical because the production process and inputs for the pizzeria industry are similar. Thus, the cost function for each firm is the same. When the market reaches the long-run equilibrium, the profit in the industry would be 0. The supply equation will be the same, while the number of firms could increase or decrease. It would be the summation of supply from the new number of restaurants in Canada. From my calculation, the supply equations are similar in the short-run and long-run with after-tax prices in the market.

2c) In this setting, what will be the impact of COVID-19 on industry supply? Is this a long-run or short-run effect? How do you define long run here? Be clear and specific about the channels.

In this setting, COVID-19 will cause a shortage in both labor and material, thus resulting in a decrease in supply. For firms, employees may demand more breaks to limit their exposure to the potential harm from the virus, given the decreased number of customers in this unusual situation. They may also require higher wages to compensate for their increased risk of working. The self-isolation policy has increased the difficulty of working as well. Hence, there will be a rise in labor costs and deliveries of raw materials would also likely be slower due to the virus. As it is impossible to make a meal without materials, the output will be limited by the unsteady supply of raw materials. Firms also need to purchase additional cleaning supplies to prevent the virus from contaminating food or affecting the employees.

Additionally, some firms may choose to close all of their restaurants directly. Although 2a) has said that the number of firms is fixed in the short run, firms may still leave over safety concerns and reopen after the outbreak. In Ontario, the government shut down all in-person dining areas to reduce the spread of the virus (Canadian Pizza, 2020). Overall, there would be a short-term rise in costs and policy effects, leading to a decline in firm supply. Due to perfect competition, the short-term industry supply, which is the summation of firm supply, will also decrease. In the long run, supply will increase and go back to normal conditions after the outbreak is controlled and will no longer cause large-scale panic. I defined the long run here as the future market after the virus outbreak.

Reference

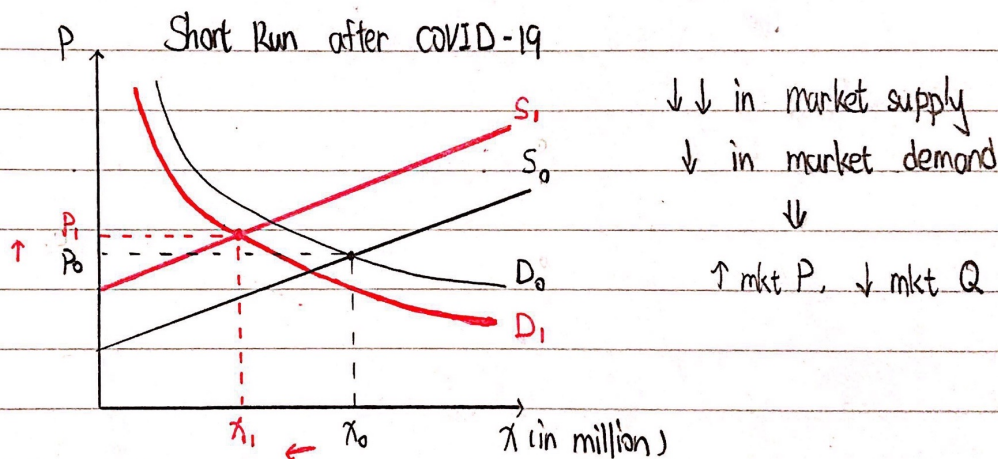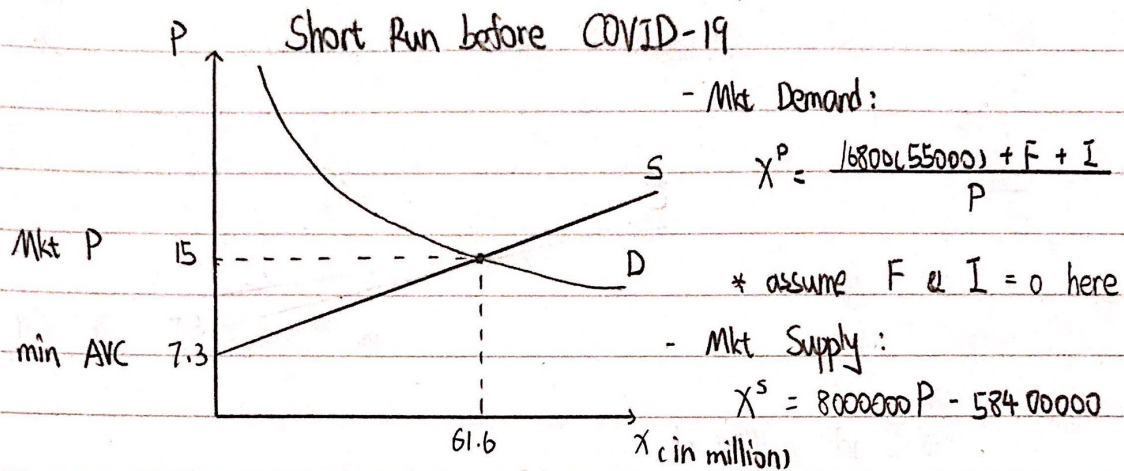Bloom, R. (2018, April 21). Pizza chains seek bigger piece of pie. Retrieved from https://www.theglobeandmail.com/report-on-business/pizza-chains-seek-bigger-piece-of-pie/article18213837/

Canadian Pizza. (2020, March 27). Ontario premier orders closure of all non-essential businesses. Retrieved from https://www.canadianpizzamag.com/ontario-premier-orders-closure-of-all-non-essential-businesses/

Ying Xiong (1004845885)

3.

Short Run before COVID-19

P

S

Mkt P   15

D

min AVC 7.3

61.6

x (in million)

- Mkt Demand:

$$x^D = \frac{16800(55000) + F + I}{P}$$

* assume F & I = 0 here

- Mkt Supply:

$$x^S = 8000000 P - 58400000$$

Short Run after COVID-19

P

S_1

S_0

P_1
P_0

D_0

D_1

x_1 ← x_0

x (in million)

↓↓ in market supply
↓ in market demand
⇓
↑ mkt P, ↓ mkt Q

· Given my setup, the COVID-19 will not affect the market
equilibrium in the long run. I assume that the virus will be
controlled in the upcoming future and the market supply / demand
will be same as original market.

Long Run Before/After COVID-19

P

ATC
13.6

S

D

50.4

x
(in million)
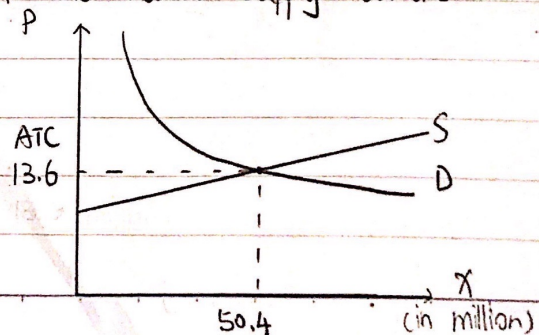
4. Assume your setting is given by your choices in questions 1-3. If the government wants to minimize the impact of COVID-19 on your chosen industry, what policy would you recommend and why?

- **Objective**:

With COVID-19 negatively influencing both demand and supply for the pizzeria industry, the government should focus on minimizing the firms' losses. Given the calculations above, the virus would result in a small increase in price and a tremendous decrease in quantity transacted in the market. Through this proposal, the government can keep as many firms in the market as possible so that it can reduce the potential economic slowdown if there is a sluggish recession.

- **Proposal**:

I propose that the government should distribute money to firms monthly to cover their different additional costs. To be specific, the money would be used to purchase raw materials for food or develop delivery channels such as contactless delivery and e-takeout. Firms would declare their extra costs spent on these and the government would pay for those unexpected spending.

- **Mechanism**:

The proposal will impact both the demand and supply side of the pizzeria industry. Given the setting from previous questions, the demand in the market should rise since pizzas are inferior goods, and there is a reduction in real income. However, it dropped in reality over anxieties regarding the virus (The Financial Post, 2020). The market supply decreased because of the unusual jump in costs as well as the self-isolation and closure policy (Canadian Pizza, 2020).

With the proposal, there will be increases on both sides. Firms will receive enough money to enhance the situation. Since the government will cover costs, more restaurants will stay in the market and make contributions to the economy. Hence, industry supply will rise from fewer restaurants exiting the industry and more materials available for production. After the introduction of new delivery channels to reduce concerns over the virus, consumers will panic less and accordingly increase their demand for pizzas. Ideally, the demand would rise and be even higher than before.

- **Impact on equilibrium**:

With increases in both the market demand and supply in the short run, the market price will drop, and quantity will rise by a substantial amount. Although prices may still be higher and volume transacted may be lower than under normal conditions, it would be a considerable improvement for the industry compared to the equilibrium before the proposal. Since I assume the virus would be controlled in the upcoming future, the market will gradually return to normal; thus, the proposal will not affect the long-run market equilibrium.

- **Pros and cons**:

Given my setup, the market demand is abnormal from the uncertainty of the virus, and the market may end up in a vicious cycle where price keeps increasing and demand keeps decreasing. My proposal can indirectly alleviate concerns in the market and effectively increase supply to match adjusted demand. Retaining firms in the industry helps boost the economy after the virus is under control. Moreover, money is distributed reasonably to companies, which would achieve the result and minimize the government's costs. Potential problems with this proposal are

that the government cannot estimate the duration of COVID-19 and may overspend, leading to

deficits. Consumers' moods are also not predictable, and thus the increase in demand may be less

than anticipated.

(word count: 499)

Reference

Canadian Pizza. (2020, March 27). Ontario premier orders closure of all non-essential businesses. Retrieved from https://www.canadianpizzamag.com/ontario-premier-orders-closure-of-all-non-essential-businesses/

The Financial Post. (2020, March 18). 'Everyone is just kind of in shock': Restaurateurs look into the abyss as COVID-19 shutdowns take hold. Retrieved from https://www.canadianpizzamag.com/everyone-is-just-kind-of-in-shock-restaurateurs-look-into-the-abyss-as-covid-19-shutdowns-take-hold/