2024 ACJC H1 Economics Prelim Case 1

Question 1: Food Security and Challenges

Table 1: Global Food Commodity Prices

The Food and Agriculture Organisation Food Price Index (FFPI) is a measure of the monthly change in international prices of a basket of food commodities. The table below shows the five commodity groups – food, meat, dairy, cereal, vegetable oil and sugar. Their respective price index is the average price indices over 2017 to 2022.

	Food Price Index	Meat Price Index	Dairy Price Index	Cereal Price Index	Vegetable Oil Price Index	Sugar Price Index
2017	98.0	97.7	108.0	91.0	101.9	99.1
2018	95.9	94.9	107.3	100.8	87.8	77.4
2019	95.1	100.0	102.8	96.6	83.2	78.6
2020	98.1	95.5	101.8	103.1	99.4	79.5
2021	125.8	107.9	119.6	131.2	164.9	109.3
2022	144.7	118.8	149.5	154.7	187.8	114.5

Source: Food and Agriculture Organization of the United Nations

Extract 1: Why are global food prices near an all-time high?

Higher global food prices are contributing to a wider trend of increased cost-of-living in both advanced and emerging economies. The annual rate of inflation worldwide is 9.2%, driven by a surge in energy as well as food prices.

Prior to the Russia-Ukraine war, droughts and Covid-19 restrictions have driven up global food prices. The price hike worsens after the war, as the combined supply from both Russia and Ukraine is around 30% of global wheat exports and around a fifth of the world's maize supply. To make matters worse, farming activities, including irrigation and transportation of agricultural machinery, rely heavily on energy sources like diesel and natural gas. Therefore, rising energy prices directly translate to higher production costs, ultimately reflected in food prices. At the same time, due to longer lifespan, the world's population has grown exponentially over the last few decades.

The increased chaos in global food markets has led to a new problem: food protectionism. Some governments have clamped down on exports of staples including grains and cooking oil to safeguard supplies for domestic consumption. Apart from export quotas, threat of domestic social unrest has led to other forms of export restrictions such as taxes and outright bans. These policies have a severe impact on the developing countries that depend on international markets for food imports.

Source: World Economic Forum, 12 May 2022

Extract 2: A sustainable food system for Singapore and beyond

Singapore is vulnerable to supply shocks and disruptions as the country imports more than 90 per cent of its food. For greater resilience, the government has set a "30 by 30" goal – to be able to produce 30 per cent of the country's nutritional needs by 2030.

With climate change posing challenges to food production, Singapore's agri-food industry sees the need to devote more resources to local food production despite Singapore's limited land space. As the country journeys towards her "30 by 30" goal, carving out land spaces and innovation technology will be key enablers.

To boost local food production, the government has expanded the Agri-food Cluster Transformation (ACT) Fund to cover more types of food and technology. To encourage innovation through Research and Development (R&D) projects in areas like improving the disease resistance and nutritional quality of crops and fish, the Singapore Food Story R&D programme was launched in 2019. Since then, 40 projects have been given funding.

Source: Singapore Food Agency, 11 November 2022

Extract 3: What is the problem with meat production and consumption?

Despite the recent popularity of plant-based diets, the world is on track to consume more meat, largely due to population growth and consumers regarding meat consumption as an important part of their diet. To meet the rising demand, farmers are rearing more livestock. However, rearing livestock accounts for more than one-third of global greenhouse gas emissions. Greenhouse gas emissions can be harmful as it contributes to climate change and global warming. Fresh water is also necessary for the rearing of livestock and as of now, more than 70% of the world's fresh water has been used up. Sources of fresh water include melted icebergs, natural precipitation such as rainfall and groundwater found in rivers and lakes. While rainfall precipitation may top up the earth's supply of fresh water, scientists are worried about the impact of the worsening global warming on the future supply of fresh water.

The trajectory of meat consumption has left both environmentalists and economists very concerned. Rearing of livestock can take years and is subjected to weather elements, which means production may not always meet demand. This has an impact on cost-of-living, especially for countries where meat is a staple part of their diet.

Source: Various

Extract 4: Is meat tax the only way?

In several countries, vocal and opinionated environmentalists are proposing a meat tax. However, while there is a general acknowledgement of the need to reduce meat consumption and production for environmental reasons, the validity of a tax on meat is far less clear.

Imposing a meat tax would mean further reducing the affordability of meat for low-income households who may already struggle to purchase meat. The environmental impact of meat production also varies considerably across farming practices – not all farming practices are necessarily bad for the environment, especially sustainable farming. As such, opponents of a meat tax have proposed several alternative policies:

1. Subsidising healthier food choice

To drive down consumption of meat, consumers should be able to access cheaper alternatives. A good way to change consumer's behaviour and hence, the production of meat is to subsidise the production of healthier food such as fruits, vegetables, legumes and nuts.

2. Subsidise sustainable livestock farming practices

If sustainable livestock farming practices can be made cheaper, through subsidies, farmers could have greater incentives to adopt these practices. The sustainable livestock farming practices include the use of organic feed and fertilisers, animal supplements and vaccines that can cut the methane emissions during the animals' digestion process. This could even lower the pressure on meat prices.

3. Empower consumers at all income levels to make more sustainable purchasing decisions

This means investing in education to consumers on ways to achieve healthier diets. It could mean clearer food labelling and display of nutrition information, as well as campaigns to promote the benefits of eating plant-based diet instead.

Source: World Economic Forum, 21 May 2022

Questions and Suggested Answers

(a) Table 1 shows various global food commodity prices. Compare the **key** changes in global food prices and global meat prices between 2017 and 2022. [3]

- Both global food prices and global meat prices generally increased.
- The overall percentage increase in global food prices was larger than the increase in global meat prices.
- From 2017 to 2018, both global food prices and global meat prices decreased. / From 2018 to 2019, global food prices decreased while global meat prices increased. / From 2019 to 2020, global food prices increased while global meat price decreased.

Marking scheme:
1m each. Answers that say 'global food prices are always greater than global meat prices' are not accepted as the question is asking about changes.

(b) **(i)** With reference to Extract 1, explain **one demand** and **one supply** factor that have caused the global food prices to rise. [4]

Identify and explain demand factor:

- Extract 1: Exponential growth in the world's population size coupled with longer lifespan.
- Increase in global demand resulted in a shortage of food at the original market equilibrium price, exerting upward pressure on price hence causing global food prices to rise.

Identify and explain supply factor:

- Extract 1: Rising energy prices led to an increase in food production costs, as energy is a factor input for the production of food. Russia-Ukraine war causing decrease in wheat and mazie exports. Droughts and Covid-19 restrictions have also affected food production and distribution.
- Global supply decreases, leading to a shortage of food at the original market equilibrium price, exerting upward pressure on price hence causing global food prices to rise.

Marking scheme:
2m for identification and explanation of each factor.

(ii) In Extract 1, it was mentioned that food protectionism has severely impacted developing countries that rely on international markets for food imports.

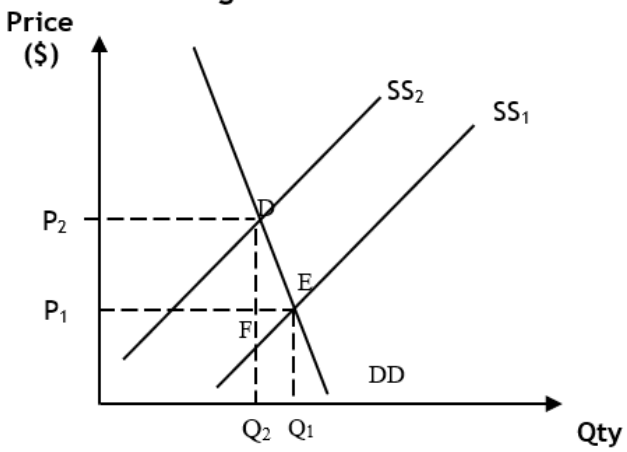
With the aid of a diagram, explain the impact of 'food protectionism' on the food import expenditure for developing countries. [5]

- Extract 1 mentioned that food protectionism could take the form of export quotas, taxes or outright bans on food exports.
- These policies by food exporting countries would **decrease the supply of food in importing countries since they rely on the international markets for imported food as shown by the leftward shift of the SS curve from SS_1 to SS_2.**
- Given that developing countries depend on international markets for food imports (Extract 1), **their demand for imported food is likely price inelastic due to a**

lack of close substitutes in the form of alternative food sources, e.g. domestic food supply.

- Decrease in supply would lead a shortage at the initial market equilibrium price, there is an upward pressure on price and Qd will fall and Qs will increase to clear shortage. **The increase in price leads to a less than proportionate decrease in quantity demanded, ceteris paribus.**
- Since food import expenditure is calculated by **multiplying price and quantity of imported food**, the increase in import expenditure from the increase in price (area P_2DFP_1) will be greater than the decrease in import expenditure (area FEQ_1Q_2) from the decrease in quantity, resulting in an **overall increase in import expenditure.**

Figure 1: Meat Market



Marking scheme:
1m: identifying SS decreased
1m: explaining PED<1 using Extract 1
1m: stating import expenditure = import price x quantity
1m: explaining overall change in import expenditure (and not just stating)
1m: correct diagram

(c) **(i)** Define opportunity cost. [1]

Value of the next best alternative foregone.

(ii) Using the information in Extract 2, explain how the concept of opportunity cost can be used to justify the Singapore government's decision to increase local food production. [3]

- The Singapore government has to decide whether the country's scarce **land** space should be used for **food or non-food production.**
- Extract 2 mentioned that Singapore imports more than 30% of its food and there is rising danger of climate change. This makes Singapore very vulnerable to global food supply disruptions. Given this context presented, **land used for non-food production will now incur a higher opportunity cost compared to using land for food production.**
- This can take the form of forgoing **the stronger food security that could have been gained from increasing local food production,** thus justifying the Singapore government's decision to use the land for food production.

Marking scheme:
1m: stating a valid alternative to food production using scarce land area/budget resources
1m: using Extract 2 to give an example of the opportunity cost incurred from using land for non-food production
1m: recognising that the opportunity cost of using land for non-food production is higher, given the context presented

(d) With reference to Extract 3, comment on whether fresh water has the two characteristics of a public good. [6]

- A public good is **non-rival** and **non-excludable.**
- Non-rivalry means that **the consumption of an additional unit of good does not diminish the quantity and/or quality of that good available for others to consume.**
- Non-excludability means that **once the good is produced, it is impossible or economically not feasible to prevent a non-payer from enjoying the good.**
- **Fresh water is rival** since global warming and farming activities could lead to the depletion of its supply (Extract 3), suggesting that one person's consumption of fresh water could reduce the quantity available to another person.
- **Fresh water is non-excludable** since it is derived from sources such as melted icebergs and rainfall, hence it is not possible to prevent anyone from consuming these naturally occurring water that is available outdoors, even if they do not pay for it.

Marking scheme:
2m: state and define non-excludable
2m: state and define non-rival
2m: any valid comment on whether fresh water possesses the 2 characteristics using case evidence, answers must examine both characteristics

(e) With reference to Extract 3, discuss whether efficiency or equity issues are more important for a government to intervene in the market for meat. [8]

Question analysis

Command word(s)	Explain how (i.e., cause-effect analysis)
Concept	Efficiency issues (negative externalities in meat production) and Equity issues
Context	Meat market

Requirement 1: Explain market failure caused by negative externalities in meat production that requires government intervention

Explain how market equilibrium output is determined
Producers seek to maximise their profit. In the absence of government intervention, farmers would produce meat at Qm where the marginal private benefit (MPB) equals to the marginal private cost (MPC) of doing so. MPB refers to the additional revenue

gained from producing an additional unit of meat while MPC includes the additional cost such as poultry feed used to produce an additional unit of meat.

Explain the presence of negative externalities in production

When producing meat, producers do not consider the negative externalities generated that in turn affect third parties who are not involved in the production and who do not receive compensation. Extract 3 mentioned that rearing livestock generates greenhouse gas emissions that contribute to climate change and global warming. An example of the negative externalities is the healthcare costs incurred by residents staying near the farm and end up suffering heat-related illnesses caused by climate change. This implies there is a positive marginal external cost (MEC>0).

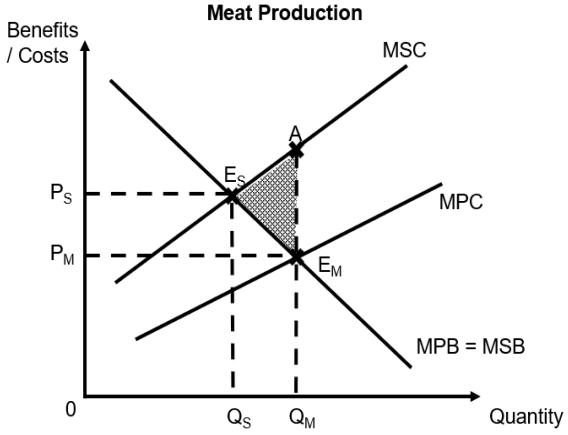
Explain how the socially optimal output is determined

Given that MSC = MPC + MEC, MSC > MPC. Assuming that there are no positive externalities, MSB = MPB. The quantity of meat that maximises social welfare, Qs, should be where the marginal social benefit (MSB) equals to the marginal social cost (MSC) of doing so i.e., MSB = MSC.

Explain the deadweight loss / welfare loss incurred by the society

As Qm is more than Qs, there is over-production of meat. Between Qm to Qs, MSC > MSB, implying a net loss to social welfare from producing these additional units of meat. This suggests that social welfare can be improved by reducing the production from Qm to Qs, reflecting market failure that requires government intervention.

Figure 2: Market Failure due to Negative Externalities in Meat Production



Note: Students are encouraged to draw a diagram if drawing and referring to it helps to enhance the clarity and / or comprehensiveness of the answer.

Checklist for R1 Analytical Answer:

- Use Extract 3 to identify source of market failure as -ve externalities in production
- Explain determination of market and social equilibrium output levels using valid examples
- Identify that Qm > Qs
- Explain deadweight loss (and not just state)

Requirement 2: Explain equity issues present in the market of meat

Extract 3 mentioned that meat consumption is still considered an important part of diet, so the demand for meat is likely price inelastic due to the lack of close substitutes available. This means that an increase in price caused by production disruptions will lead to a more than proportionate decrease in quantity demanded, ceteris paribus.

Consumers' meat expenditure will therefore increase since the increase in expenditure caused by the increase in price outweighs the decrease in expenditure caused by the decrease in quantity.

Lower-income consumers may thus not be able to demand for meat due to their lack of ability. As meat prices continue to increase (Table 1), equity issues will be a reason for government intervention in the meat market.

OR

Extract 3 mentioned that the current meat consumption is on the rise due to meat being an important part of the diet and that it takes years to produce poultry and hence meat. This suggests that the demand for meat will only increase and that the PES for producing meat is likely to be less than 1.

This means that as demand increases, the shortage created at the original equilibrium is likely to require a huge price increase to clear, since the quantity supplied will only increase less than proportionately when price increases.

The huge price increase will affect the lower-income families more, as they have lower purchasing power and the proportion of income spent on meat is relatively higher than those from higher-income families. As such, equity could also be a reason for government to intervene.

Checklist for R2 Analytical Answer:

- Use Extract 3 to justify PED < 1 and SS falling / PES < 1 and DD rising
- Explain higher meat prices leading to higher consumer expenditure / meat prices rising sharply
- Explain lower-income consumers' inability to demand for meat when prices increase / lower-income consumers being affected more due to the larger proportion of income spent on meat

Conclusion: Overall well-reasoned judgement that answers the question
Whether efficiency or equity issues are more important depends on country-specific circumstances.

For **developing countries,** equity issues could be a stronger justification for government intervention due to a much bigger number of lower-income households compared to the situation in developed countries.
OR
In **meat-producing countries,** efficiency issues could be a stronger reason since there is market failure caused by meat production compared to countries that do not produce meat.

Marking scheme:

Level	Descriptor	Marks
L2	For an answer that ● Presents a rigorous analysis of both requirements with few / no conceptual mistakes. ● Supports the analysis with good use of case evidence	4 – 6
L1	For an answer that misses any of the L2 requirements.	1 – 3
E2	● An overall judgement that addresses the question is presented ● Apart from presenting the judgement, the use of criteria or reasons is used to explain why the judgement is made	2
E1	● For attempts made at evaluating by using simple evaluative statements ● An overall judgement is not presented	1

(f) With reference to the case study materials and/or your own knowledge, discuss whether a meat tax is the best policy to achieve an efficient and equitable outcome in the market for meat. [10]

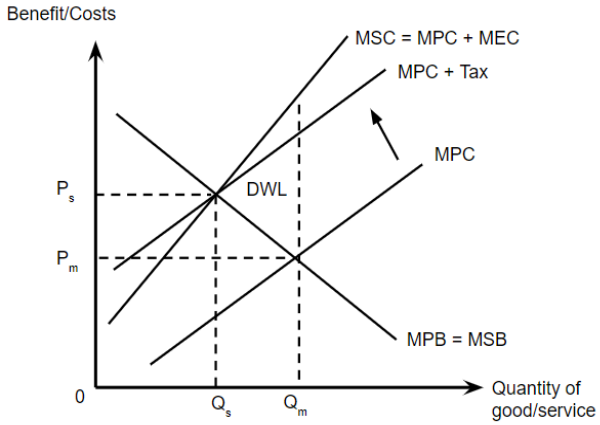
Question analysis

Command	Discuss whether Answers are to present a two-sided analysis before making an overall well-reasoned judgement Note: "best policy" Answers are to include an alternative policy for comparison
Concept	Marginal analysis Efficiency Equity
Context	Meat market

Requirement 1: Imposing a meat tax is an appropriate policy in achieving an efficient allocation of resources in the meat market

Governments can impose an indirect tax on meat producers (Extract 4) to force producers to internalize the external cost. Producers will then incur a higher cost of production as they now have to pay an additional cost for every unit of meat produced. The increase in MPC of producing meat is reflected as a leftward shift of the MPC curve from MPC to MPC + tax. With the increase in MPC, Qm is no longer the profit maximising quantity for producers since MPB is now < MPC. Producers, still seeking to maximise their own profit, will now produce less meat at the new market equilibrium output level where MPB = MPC + tax. The tax thus helps to address the market failure caused by meat production given that the new market equilibrium output level now coincides with the socially optimal output level Qs.

Figure 3: Indirect tax imposed on the meat market



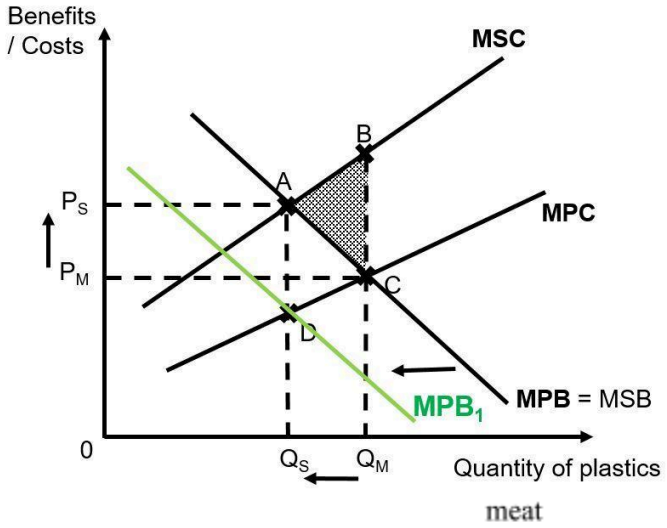
Evaluation 1: Explain possible limitations of the above policy

- However, a meat tax does not address equity concerns. Instead, it leads to an increase in meat prices as shown from P_m to P_s. This would increase cost of living, reducing purchasing power for all households with lower-income families being affected most (Extract 4).
- Meat is still considered an important part of a diet. Hence PED for meat is likely to be < 1. This means that farmers can easily pass on a meat tax to the consumers by raising the price of meat. The quantity demanded of meat will fall less than proportionately, hence the total revenue for the meat farmers may still increase with the meat tax. This means that meat tax itself may not be enough to correct the over-production of meat.

Requirement 2: Subsidising the production of healthier meat alternatives could help to achieve an efficient and equitable allocation of resources in the meat market

- Extract 4 mentioned that the presence of cheaper and healthier substitutes could help to reduce meat consumption. Examples given include fruits and vegetables.
- Governments could thus subsidise the production of these alternatives which would lead to part of the production cost being absorbed, leading to an increase in supply, exerting a downward pressure on price. Production cost savings are then passed to consumers in the form of lower prices of these alternatives.
- Assuming that healthier meat alternatives are substitutes to meat, the demand of meat will decrease, causing price and quantity to decrease.
- This translates to a decrease in producers' MPB as they earn lesser additional revenue for each unit of meat produced.
- The new market equilibrium output level is formed at Qm_2 where new MPB = MPC which coincides with Qs.
- The decrease in meat prices will improve lower-income households' ability to purchase meat, thus addressing both efficiency and equity concerns.

Figure 4: Impact of subsidy on healthier meat alternatives on the meat market



Note: Students are allowed to propose alternative solutions such as the government subsidising sustainable livestock farming practices (which would reduce MEC hence MSC) or the government using public education to influence consumer's purchasing decisions (this could reduce the demand of meat, causing producers to earn lesser revenue, hence reducing producers' MPB of producing meat).

Evaluation 2: Explain possible limitations of the above policy

- Subsidies can be costly and adds strain to the government budget. If the government is already incurring a budget deficit, it may have to resort to raising taxes or borrowing from other countries, which incurs debt. This also adds to the opportunity cost of the government, in terms of the reduced spending in other areas such as healthcare and education.
- The subsidies will only be effective if meat and healthier meat alternatives are close substitutes. However, they may not be in reality due to tastes and preferences, which means the MPB for meat may not be reduced significantly to achieve allocative efficiency.

Conclusion: Overall well-reasoned judgement that addresses the question

Whether or not a meat tax is the best policy will depend on several criteria such as the following

- **Use of time period as evaluation criterion**

The imposition of a meat tax will take effect faster. If the extent of inefficiency caused by negative externalities in meat production is large, the use of taxes as a stop-gap measure would be more appropriate as it could more quickly correct market failure since it has an immediate effect on meat producers' MPC. In contrast, the use of government subsidies will take more time as governments may need to source for

funding and it is also dependent on consumers' tastes and preferences, thus marking this policy more appropriate in the long run.

- **Use of mitigating government policies**

Though a meat tax could worsen equity concerns, governments are able to provide targeted subsidies to the lower-income households so that they can continue to purchase meat even after meat prices have risen. This would allow a meat tax to continue to work since the unintended consequence of worsening equity is mitigated.

- **Use of country-specific circumstances as evaluation criterion**

The relative appropriateness of the two policies also depends on whether we are examining developing or developed countries. The provision of government subsidies may be less feasible in developing countries due to the competing needs for government budget since there are other pressing needs that require government expenditure. In contrast, developed countries with budget surplus would be more able to provide government subsidies, hence finding subsidies more appropriate

Hence, a meat tax alone is unlikely to be the best policy as it has its own limitations. Therefore, there is a need to complement a meat tax with other policies such as public education and subsidies to effectively reduce the demand for meat and also increase sustainable and healthier farming methods to protect the climate and equity concerns.

Note: Answers are not required to include all the points provided above. But minimally, the conclusion should have a final stand that is supported using at least two evaluation criteria.

Marking scheme:

Level	Descriptor	Marks
L2	For an answer that ● Presents a rigorous analysis of how the two policies can achieve efficiency and equity outcomes with few / no conceptual mistakes. ● Supports the analysis with good use of case evidence.	5 – 7
L1	For an answer that: ● Describes the policies without relevant economic analysis. ● Has major and/or recurrent conceptual mistakes.	1 – 4
E2	For an evaluation that: ● Discusses the downsides / limitations of each policy, as well as, ● Provides a clear and justified judgement of which policy is more appropriate.	2-3
E1	For an evaluation that: ● Attempts to evaluate using simple evaluative statements.	1

[Total: 40]