

# Some economics of anti-COVID-19 drug development and pricing: student exercises

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Responses to the urgent need for a vaccine during COVID-19 pandemic have varied. In March 2020 US President Donald Trump sought to get a German company to relocate to the US to give Americans priority access to the vaccine they were developing (the CEO of the company who apparently sought to broker this deal lost his job a week later).

The drug firm AstraZeneca recently agreed with Oxford University, whose scientists are developing a vaccine with UK government funding, that they would provide the drug "at cost" and even (in poor countries) free for the duration of the pandemic. Read Oxford University's [press release](#).

In these exercises, we are going to work through some of the key characteristics of the market for drugs and vaccines, focusing our attention on IPRs and their implications for drugs and vaccines' prices.

The works referred to in the exercises are the following:

- Hill, A., Wang, J., Levi, J., Heath, K. and Fortunak, J., 2020. Minimum costs to manufacture new treatments for COVID-19. *Journal of Virus Eradication*, [online] 6. Available at: <[http://viruseradication.com/journal-details/Minimum\\_costs\\_to\\_manufacture\\_new\\_treatments\\_for\\_COVID-19/](http://viruseradication.com/journal-details/Minimum_costs_to_manufacture_new_treatments_for_COVID-19/)> [Accessed 26 April 2020]
- A [note](#) on drugs' mark-up ratios based on Bowles, S. and Halliday, S., 2020. *Microeconomics. Competition, Conflict & Cooperation*. Oxford: Oxford University Press
- The [article](#) by J. E. Stiglitz, A. Jayadev and A. Prabhala

## A. Market failures in the development and distribution of drugs

Stiglitz *et al.* (2020) discuss the problems related to the type of market which characterises the development, production and distribution of vaccines. Bowles and Halliday, in their note, provide a summary of markup ratios (using data from Hill *et al.* (2020)).

By using information from these two papers and concepts from *The Economy/Economy, Society, and Public Policy*, address the following questions:

1. What type of market characterises the development, production and distribution of most vaccines and pharmaceutical drugs? How can such a high markup ratio (e.g. for Hepatitis C drugs) be sustained?
2. Define the term market failure and explain whether or not you think it is present in the market for vaccines and pharmaceutical drugs. (You may find it helpful to use a price and cost diagram found in [Section 12.2](#) in *The Economy*/[Section 11.7](#) in *Economy, Society, and Public Policy* to make your argument).
3. Explain how the proposal of Stiglitz *et al.* could affect market outcomes, considering both direct outcomes (e.g. price and quantity) and indirect outcomes (e.g. public health). (You may wish to use your diagram from Q2 to illustrate how the proposal works.)

## B. Market structure and property rights in pharmaceuticals: do they promote efficiency and fairness?

Stiglitz *et al.* (2020) discuss the problems related to the type of markets which characterises the development, production and distribution of vaccines. Hill *et al.* (2020) estimate the costs of production of a selection of drugs (which researchers hope can be ‘repurposed’ to treat COVID-19) and compare them against the price at which they are sold. They also make recommendations for efficiently distributing a drug against COVID-19, when it becomes available. By using the information provided by these pieces, as well as from CORE’s *The Economy* and your own knowledge, address the following points:

1. Explain the factors that ensure drug-producing companies’ monopoly of the drugs they produce and distribute. Illustrate the pros and cons of the intellectual property rights involved using a diagram similar to [Figure 21.13](#). Explain how the knowledge on which drug treatments are based can be considered to be a public good and how intellectual property rights may transform them into private goods (using [Section 12.5](#)). Can we describe this situation as a ‘market failure’? Why/why not?
2. Among their four main recommendations, Hill *et al.* (2020) suggest that ‘[t]here should be no intellectual property barriers preventing mass production of these treatments worldwide’. Use your diagram from Q1 to illustrate and explain the effects of removing intellectual property barriers.
3. Similarly, Stiglitz *et al.* (2020) suggest ‘patent pooling’ as a remedy, aiming at replacing ‘a monopoly-driven system with one based on cooperation and shared knowledge’. Do you think this might work? What could the role of the government be? (You may find it helpful to refer to the concepts discussed in [Sections 21.3, 21.4, 21.6, 21.7, and 21.8.](#))
4. Evaluate the incentives for companies provided by the current market for vaccines and pharmaceutical drugs in terms of efficiency. Discuss (with relevant diagrams where appropriate) how the recommendations of Stiglitz *et al.* and Hill *et al.* could improve market outcomes.

## C. Market structure and property rights in pharmaceuticals – writing your own blog post / op-ed column

Stiglitz *et al.* (2020) discuss the problems related to the type of markets which characterises the development, production and distribution of vaccines. Hill *et al.* (2020) estimate the costs of production of a selection of drugs (which could be ‘repurposed’ to treat COVID-19) and compare them against the price at which they are sold. They also make recommendations for efficiently distributing a drug against COVID-19, when it becomes available.

Read both articles and write a blog post or op-ed (an opinion piece) of roughly 500-800 words in response. Your op-ed should be written for a general audience (readers who are interested in this topic but may not have studied economics). It could begin with “Economics Nobel Laureate Joseph Stiglitz and co-authors have recently proposed ...”. It could cover the following points:

- Outline the policy recommendations of these authors
- Explain whether or not you agree with these recommendations, and why, with reference to economic concepts where relevant.
- Your own suggestions of ways to address the issues discussed, or specific ways to implement the authors’ policy recommendations.

## D. Evaluating the evidence on drug price markups – a data-based exercise

In the global search for an effective COVID-19 treatment, researchers are currently trialing a number of drugs that are used to treat other diseases. If any of these drugs are shown to be successful in treating COVID-19, they would need to be mass-produced and provided at an affordable cost, so that treatment can be affordable and accessible for patients worldwide.

[Researcher Andrew Hill and his team](#) estimated the minimum cost of producing these drugs, and compared them with prices at which they were sold (‘list prices’,  $P$ ) in a range of countries around the world. The markup ratio measures the difference between the list price and the marginal cost of production, relative to the marginal cost of production ( $MC$ ):

$$\text{Markup ratio} = \frac{P - MC}{MC}$$

You will use the [data](#) they collected to calculate and compare markup ratios across countries. You can find information on working with Excel in [Doing Economics](#).

1. The first column of the spreadsheet contains the drug names, the second column contains the estimated cost per course (treatment for a single patient), and the remaining columns contain the list price for various countries. Some entries are blank, because data for some drugs was unavailable for certain countries.
  - a) Looking at the rows of the spreadsheet, you can see that the list price for any particular drug varies across countries. Suggest one or two explanations for this variation. (Hint: Think about factors that affect the costs of production across countries).
  - b) The cost per course (Column B) is an estimate and not the actual value, because companies usually do not make information about their costs of production publicly available. Andrew Hill and his team explained how they estimated the minimum cost of

production ('generic estimate') in Figure 2 and the 'Methods' section of [their paper](#). With reference to these parts of their paper, explain how the estimated cost of production would change under different assumptions about specific costs of production (for example, what would happen to cost estimates if the transport costs were higher than assumed?).

- c) For each country and drug where data is available, calculate the markup ratio. (Here we assume the cost per course is the marginal cost.)

Now we will calculate summary statistics and visualize the distribution of markup ratios across drugs.

- 2. Create and fill in a summary table like the one shown in Figure 1 below. (For step-by-step guidance with calculating the standard deviation in Excel, check [this walk-through](#).)

Drug	Mean	Standard deviation	Minimum	Maximum
Lopinavir/ritonavir				
Chloroquine				
Azithromycin				

**Figure 1** Summary table of markup ratios for different drugs

- 3. Make a box and whiskers plot of the markup ratio for each drug, and comment on any similarities/differences in the distributions that you notice. (Hint: To make comparisons between drugs easier, you may want to ask Excel [not to display outlier points](#)). How do your answers to Q2 and Q3 complement each other? (For example, do drugs with higher standard deviations in Q2 also have wider boxes in Q3?)
- 4. For each drug, calculate the median markup ratio across countries. Explain why the median is a useful summary measure in this context.
- 5. Make a bar or column chart showing the mean and median markup ratio. Plot all drugs on the same chart. Comment on any similarities/differences you see in the markup ratio for drugs, and potential implications for the affordability of these drugs. (Hint: To make your chart more visually appealing, before plotting the chart you may want to sort the data from the smallest to the largest median, or the largest to the smallest median.)
- 6. Based on a similar analysis to what you did in Q1-Q5, Andrew Hill's team made four policy recommendations (page 8 of their paper). For two recommendations of your choice, explain how it addresses issues related to costs of production, and the affordability/accessibility of treatment.