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## Looking at the Management of the COVID-19 Lockdown Through the Lens of Real Options Analysis

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**Whether we like it or not, imposing or lifting the lockdown is about striking an optimal balance between the economic cost of the lockdown and the value of the lives saved by “flattening the curve” and not overburdening the health system. Given the tremendous amount of uncertainty involved, striking the balance between economic costs and lives saved is a challenging task.**

Whether we like it or not, imposing or lifting the lockdown is about striking an optimal balance between the economic cost of the lockdown and the value of the lives saved by “flattening the curve” and not overburdening the health system. Given the tremendous amount of uncertainty involved, striking the balance between economic costs and lives saved is a challenging task.

Decision-makers can choose to lift the lockdown for specific regions or economic sectors progressively. They can even decide to overturn their decision depending on the evolution of the virus. Many strategies are available, but how do we choose the right one? Also, by acting progressively, authorities can learn more about the spread of the virus and adjust future actions. Learning has value. Real Options Analysis (ROA) is a framework to help structure an optimal strategy. We aim here to describe carefully and non-technically the ingredients of the real option approach, which is useful in deconstructing a project or course of action into sub-components and assessing the value and cost of such courses of actions along a decision path.

To give context, let us start by financial options, which are contracts that provide the right, but not the obligation to buy or sell an asset at a specific price during a specified period. At each instant between now and the expiry of the option, there is a trade-off. For American options, the compromise consists in determining at what price level it is optimal to exchange cash for the risky asset. Optimally making these trade-offs is referred to as dynamic optimization under uncertainty.

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Outside financial markets, we are continually valuing and exercising options. We are regularly evaluating trade-offs and making decisions in the face of an uncertain future. For example, our willingness to pay extra for cancellable/refundable airplane tickets in case our plans change between the purchase date and the flight date. Or to stock resources (water) in a warehouse (reservoir) to be used when conditions are right, for instance, when the price has reached a trigger level that balances the net value of destocking or not the resources.

Non-financial options are called Real Options. Real Options Analysis borrows from the methods developed to value and manage financial options and applies them to a “Real” project. The applications of ROA are diverse as they range from capital budgeting to strategic interactions between firms.

**Creating options means investing resources now to be ready to act when conditions are ripe.**

For many reasons, ROA did not gain traction in the business community even though ROA can provide valuable insights to businesses and governments who are always evaluating trade-offs and making decisions in a highly uncertain world. In some sense, expressing a “gut feeling that we should move” is an informal ROA, such as in the current context where our governments are putting together a strategy to manage the current COVID-19 lockdown. Given the current level of uncertainty and the irreversible nature of many decisions, creating and optimally exercising options is crucial. Creating options means investing resources now to be ready to act when conditions are ripe, for example warehousing supplies and having personnel ready to be deployed.

The following three ingredients define the context for applying ROA: uncertainty, irreversibility, and flexibility.

1. **The first ingredient is uncertainty about the future state of the world.** For example, uncertainty can be relative to the price of an input/output such as oil or gas, a discovery bringing the obsolescence of existing technology, the outcome of a clinical trial, or the evolving R0 of an infectious disease.
2. **The second ROA ingredient is total or partial irreversibility.** A decision or investment is irreversible if committed resources cannot be recovered when things do not go as expected. Bygones are bygones! A hydroelectric dam is an excellent example of irreversible investment. Having invested billions of dollars to build it is irrelevant if it turns out that we do not need it at some time in the future. Sacrificing current income and incurring a deficit are two other examples of a decision to commit resources that is irreversible.

3. **The third and most crucial ingredient of ROA is flexibility.** What are my options? The most common options are: The option of delaying an investment: Should I delay or not? The option to stop and restart production or action: Should I stop it or not? The option to invest in stages: Should I divide my project into phases, never committing to future phases? The option to switch: Should I switch strategy or not? The option to abandon a project: Should I abandon it for good or not.

Flexibility has value if we have time, that is, if we do not need to act immediately. Managing the current COVID-19 lockdown is all about ROA. In fact, before executing, decision-makers face the following sources of uncertainty (first ingredient):

1. The degree of contagion of COVID-19, the likelihood of future outbreaks, the death rate, and health care costs, all uncertain.
2. The uncertain future economic consequences associated to lockdowns and social distancing.

For its part, irreversibility (second ingredient) can be characterized as follows:

1. The direct and indirect losses of lives caused by maintaining or lifting the lockdown.
2. The immediate and future harm to the economy caused by the lockdown.

Finally, decision-makers have the flexibility (third ingredient) to:

1. Choose in due time the date at which to impose a total or partial lockdown.
2. Choose in due time the date at which to lift a total or partial lockdown.

In each case, we balance the net value or cost of not acting with the net benefit or cost of going forward with some action, given the forthcoming probabilistic development of the relevant variables.

Modelling uncertainty is a huge challenge, which can be met though appropriate stochastic processes whose evolution depends on parameters to be calibrated on the basis of hard and soft scientific knowledge, which is itself evolving. Simulations then provide the decision makers with informative scenarios of probabilized future worlds and with assistance in balancing the value and cost of different actions and different timings.

**In this context, managing the lockdown is similar to managing a sequence of options.**

In this context, managing the lockdown is similar to managing a sequence of options. The first option was exercised when the first lockdown was decreed. The partial lockdown lift for daycare centers, schools, and part of the economy is the second option to be exercised. If the virus remains under control, the third option to be exercised will be another partial lockdown lift. However, if the results are negative, the third option to be exercised will most likely be a re-tightening of the lockdown.

The optimal course of action for an American option is defined according to the price level of the underlying financial asset. For lockdown options, thresholds would probably be determined according to the evolution of the number of COVID-19 cases/deaths. As mentioned, using ROA, these thresholds would be chosen to achieve an optimal balance between the costs and benefits of lockdowns considering uncertainty and the fact that the consequences to decisions are partially or totally irreversible.

**These reversals should not be associated with the incapacity of our governments to manage the situation. They are probably the result of the optimal exercise of real options!**

Given the amount of uncertainty involved, it should not be surprising to see partial lifts on lockdowns followed by reversals. These reversals should not be associated with the incapacity of our governments to manage the situation. They are probably the result of the optimal exercise of real options! We often hear the expression that we are building the plane while flying it. Making the best of this situation means creating options and exercising them optimally.

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## NOTE

The concept of the monetary value of human life may at first appear cold and heartless. As discussed in Martin Boyer (2020), the monetary value of human life often implicitly or explicitly comes into play in many individual and collective decisions.

If your answer to the question “Would you support a complete lockdown until a COVID-19 vaccine is available, notwithstanding the damage to the economy?” is NO, you are attributing a monetary value to human life.

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## REFERENCES

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