

Public Goods : (a) Definitions

The subject matter of AP/ECON 4080 is the expenditures of the different levels of government. Rather than begin with an overview of that expenditure — who spends how much on what — we start the course with the economists' explanation of why the government should be providing any goods and services at all.

Warning : This explanation does not explain very well which goods and services actually are provided by the public sector in Canada (or in any other country). It is not meant to. Instead, it explains why it might be efficient to have some goods and service provided by the public sector.

How do governments actually spend the revenue they raise from taxes? More than half the expenditure of the federal government goes to **transfers** of various kinds — transfers to old people and to poor people, transfers to businesses, and the interest on the national debt. Provincial and local governments devote a smaller percentage of their expenditure to these transfers than does the federal government, but overall, nearly half the expenditure of all the levels of government in Canada (combined) is in the form of transfers.

It may seem odd to lump together welfare payments to poor single parents with interest on government bonds which may be accruing to financial institutions. But what these payments have in common is that the government is **not** itself providing goods and services. All it is doing is taking money from some people, and giving it back to others (or even to the very same people). It does not require many government employees, or direct government purchases of goods and services, in order to spend the 31 billion dollars we spend on interest on the national debt annually. All we need is someone to write cheques.

In contrast, the other part of the expenditure of the various levels of government, the spending which is not transfers, involves the government in providing goods and services. Here the most important normative question to ask is why it is some government agency which is providing these goods and services, rather than some private firm. Conversely, why do private firms provide some goods and services, rather than the public sector?

The extent to which the public sector is involved in the provision of goods and services varies among countries and among provinces. But there are certain commodities which are provided by the public sector almost everywhere : primary education, fire protection, police services, defence (for example). On the other hand, agriculture (at least the actual growing of the crops), distribution of food, and car repairs are hardly ever provided by the public sector, except in centrally planned economies where everything is in the public sector. [And how many of these economies are left?]

The theory of public goods, the subject of this section, is an attempt to explain which goods and services **should** be provided by the public sector. This is (at least in part) a normative theory. According to this theory, the sort of goods and services which are best provided by the public sector are what are called “pure public goods”. As the term might suggest, there also are goods which are “impure”, that is which have some of the characteristics of public goods, but not

all the characteristics. As well, there are **pure private goods**, which the theory suggests may best be provided by the private sector.

What are pure **private** goods? Two characteristics of private goods, which are often taken for granted, are that they are *excludable* and *rivalrous*.¹

What does it mean that a good is **excludable**? Beer being excludable means that the person at the Brewers' Retail will not give me my case of beer until I have paid her. That is, a good is said to be excludable if people can be excluded — costlessly — from consuming the good. This excludability is more or less taken for granted in most of microeconomics. In intermediate microeconomics (AP/ECON 2300 and 2350), for example, much attention is paid to the price that is charged for goods, and how efficiency requires the price to equal the marginal cost. But underlying the story is the assumption that the people who don't pay the price don't get the good. Otherwise, running a private firm in a market seems rather difficult.

Of course, when I go to the beer store I find it rather annoying that I am excluded in this way. But usually, for the “ordinary” commodities — commodities which will now be called **pure private goods**, this exclusion serves a very useful purpose. The beers I consume are costly to produce. Recall that economic efficiency (also known as Pareto efficiency) requires that each person's marginal benefit from beer, or from any other good, should equal the marginal cost of production of the good. Basically, society should devote the resources to the production of more beer only if consumers value the consumption of that additional beer more than the cost of its production. How do we figure out if a person values consumption of a beer more than the cost of its production? In a centrally planned, non-market economy, figuring this out requires some ingenuity, maybe even psychic abilities. A very easy way to learn this information is to use the excludability : you only get a unit of a good if you pay a price equal to the opportunity cost of making it, and conveying it to you. Then I will buy the beer precisely when I value it at more than its opportunity cost. Using exclusion, via the price mechanism, helps to achieve an efficient allocation.

Of course it is not exactly true that any good is **costlessly** excludable. Monitoring customers is costly. But for most “ordinary” goods and services the cost of enforcing exclusion is relatively low. In contrast, there are some goods and services for which exclusion is very expensive, if not impossible.

National defence is a classic example of such a pure public good. Here, the “good” is whatever services a secure defence provides — protection from invasion, for example. The point is that we cannot exclude some Canadians from deriving the benefits of these services, and not others. If my neighbour is protected against nuclear strikes, then so am I. It is physically impossible for my

¹ Stiglitz's textbook (“Economics of the Public Sector”, Norton, 2000) does not use these terms, although most other textbooks do use them, as does the original Samuelson paper on the subject. The Stiglitz text says that “rationing is *feasible*” instead of “excludable” and that “rationing is *desirable*” instead of “rivalrous”, for pure private goods.

neighbour to consume those services without my consuming them as well. That is why national defence is not excludable. It is also not **rivalrous**, but that is another story, which will follow a little later.

Actually, the classic example of a pure public good used in economics texts for a long time is a lighthouse. Here the service is a light which warns me that there is a rock which I don't want my boat to hit. But this service is not excludable ; it is impossible to have some people able to see the light and others not. Thus people cannot be prevented from consuming the services of the lighthouse if they do not pay for it ; either everybody can use it or no-one can.

Of course the same is true for national defence. If some missile defence system (or treaty) is successful at preventing a nuclear attack on Canada, then everyone in Canada gets to consume the services of national defence. One individual, or a group of individuals, cannot be prevented from enjoying the services of national defence just because they have not paid for it (or for any other reason).

Another example of a commodity which may be very difficult to exclude is a television or radio programme. Anyone with a radio (or television set) can pick up the programme. Of course the statement I just made is not entirely accurate. By scrambling the signal, producers of a television programme can exclude people from consuming. For typical Canadian cable users, some programmes cannot be excluded, and some can. And my lighthouse could perhaps be excluded, if it emits a radio signal, instead of flashing a beam. What these examples suggest is that whether a commodity can be excluded or not depends on the technology chosen. Often, purveyors of a commodity can choose to make it excludable, but usually at some cost. An issue considered later is whether it is a good idea for such exclusion to be chosen.

Along the same lines, computer programmes can be excluded, but not that well. The technology exists to prevent people from copying software. But this technology isn't always used. Various other devices exist for companies to try and make sure that an illegal copy of some popular programme is less useful than the original ; no manuals, no telephone support, maybe difficult access to some secret code words. But to some degree at least, software has one of the characteristics of a pure public good. It is not very easy to ration use. Of course music CD's face similar problems in exclusion ; the battles a few years ago involving Napster and Kazaa and other file-sharing technologies existed only because exclusion is so difficult with music. Musicians complain to politicians about people "stealing" their work, but we do not see great chefs complaining about people "stealing" their works. That's because it's pretty easy to exclude someone from eating a meal without paying for it.

With a pure private good, such as a beer in a tavern, a haircut, a shirt, copying is not a problem at all, and preventing customers from consuming without paying is relatively cheap.

But some of these commodities which seem difficult to exclude actually are often provided by private firms. Computer software is certainly produced by private firms, some of which are quite profitable. Private firms transmit television programmes, some of which are not scrambled. Private firms sell information — about tomorrow's weather, about yesterday's sports scores, about

today's stock prices. Any form of information will be very difficult to exclude. If someone buys information from a firm, what is to prevent the buyer from passing on that information to other people? Legal action seems impractical. Yet firms sell this information, as well as tapes, software, and books, knowing full well that they are not completely able to prevent some people from using their products without paying.

Such users are called "free riders" in economics, for what I hope are obvious reasons. When exclusion is not feasible, or is very costly, or imperfect, then we expect free riding to occur. Why pay for a service when you can consume it for free? So the private incentives here are clear. Rational, selfish economic agents should ride free, rather than pay for the service.

The problem here is that there is a conflict between private incentives and public incentives, a conflict which does not exist with pure private goods. Adam Smith noted that the public interest was best served by every individual pursuing his or her own private self-interest. That is the essence of the fundamental theorems of welfare economics. But Adam Smith was talking about pure private goods.

So one of the aspects of pure public goods is that they cannot be excluded. This aspect is but one of the two aspects of pure public goods ; the other aspect is that it is **non-rivalrous**. Pure private goods — the "ordinary" goods considered in most of microeconomics — are excludable, and rivalrous.

A good is **rivalrous** if only one person can consume each unit. That is, if I consume one more bottle of beer, that means one bottle fewer for other people. That property holds not just for beer, but for shirts, and for haircuts, and for most ordinary goods and services. If a certain amount X of a rivalrous good has been produced in the economy, then if one person consumes x units, that will leave $X - x$ units for everyone else. If one person's consumption goes up, someone else's consumption must go down.

For rivalrous goods, if exclusion is possible, then exclusion is a very useful procedure. Exclusion ensures that no-one will choose to consume a unit of a commodity unless the benefit she obtains from consuming it is at least as large as its price. If the price equals the marginal cost — as would be the case under perfect competition — then people will choose to consume each good up to the quantity such that the person's marginal benefit equals the marginal cost of the unit of the commodity. This efficiency condition can be achieved even if no-one has any knowledge of other people's tastes. Using the price mechanism and exclusion with pure private goods achieves an efficient outcome with minimal informational requirements.

But not every good is rivalrous. Consider the following service : watching a baseball game (live and in person) at the Skydome (which may have another name now). That is a commodity which provides benefits to some people, just like shirts, and food, and haircuts. But — if the stadium is not very full — then one more person consuming the commodity does not reduce anyone else's consumption. If 10,000 people are watching the game, and if the stadium holds 45,000 people, then allowing one more person to watch the game does not reduce anyone else's consumption opportunities.

Of course, in that example, the commodity (watching a baseball game) was non-rivalrous only if the stadium was not very crowded. But there are other goods which are non-rivalrous under even more general circumstances. Some of these goods also happen to be non-excludable (or difficult to exclude). One example is television programmes. Suppose that a certain quantity X of a certain television programme has been produced — say 100 hours of new episodes of “Glee”. What happens if I choose to watch one more hour of this show? How does this affect anyone else’s opportunities? It has no affect at all. Whether I watch 1 episode of the show, or all 100, or any other number, does not affect anyone else’s viewing opportunities.

Computer programmes, music, and information also are non-rivalrous. In each case, one more person using the good will not reduce the consumption opportunities of anyone else. This contrasts with the earlier examples of rivalrous “ordinary” goods : if one more person gets a haircut, then either someone else will not get a haircut, or the barber will have to produce more haircuts ; if one more person orders a pizza, then either some other person does without pizza, or the pizzeria must produce more pizza.

Now the formal definition of a pure public good is :

Definition : A **pure public good** is a good which is both non-excludable and non-rivalrous.

The polar opposite case, what might be called “ordinary” commodities, can be referred to as pure private goods.

Definition : A **pure private good** is a good which is both excludable and rivalrous.

These definitions are the standard definitions in the economics literature, dating from a 1954 paper by Paul Samuelson. But it should be noted that the text by Rosen et al actually does things slightly differently, treating “non-rivalrous” as a synonym for “pure public good”, whether or not the good is excludable. ²

In most of the examples given here, the properties of rivalry and excludability seem to be correlated. Beer, pizza, shirts and haircuts are pure private goods : both rivalrous and excludable. National defence, television programmes, music and information seem to be both non-excludable, and non-rivalrous and thus are classified as pure public goods.

But the two properties [rivalry and excludability] are different, and some good can have one property, and not the other. Examples are slightly harder to find (than examples of goods which are pure private goods, or pure public goods). But the earlier example of baseball game for which the stadium is not full is certainly an example of a good which is non-rivalrous but excludable. It is quite cheap and easy to set up turnstiles at a stadium or arena, so that admission to a live sporting event (or concert) seems to be an excludable good. But, if the venue is not filled to capacity, then

² And Stiglitz’s text has the right definition, but uses different terms for “rivalrous” and “excludable”.

the good is non-rivalrous : one more person watching does not affect anyone else's opportunities.

The table below gives a few examples to show some examples of the two properties, excludability and rivalry, and how goods can have one property but not the other.

	<i>rival</i>	<i>non-rival</i>
<i>excludable</i>	beer, shirts, haircuts	Blue Jays' game, pay TV
<i>non-excludable</i>	clean air, cod	national defence, weather forecasts

The second entry in the bottom left corner refers to the problems faced by ocean fisheries, especially in international waters. Fish stocks are definitely rivalrous : the more fish caught by one boat, the less fish are available for others. But it seems very difficult to exclude boats from catching fish in the ocean, in part because there is so much territory to patrol. The first entry in the top right corner is meant to describe a sporting event at which the stadium is not full : the 2013 Blue Jays, if all goes according to plan, should be very successful, and that might attract a lot of fans. In that case, their games probably would better be described as "rivalrous". With a stadium filled to capacity, one more person entering the stadium would mean some other person would have to leave.

The example of the baseball game shows that there may as well be intermediate cases. In fact, one could go to the opposite extreme and say that there is no such thing as a pure private good or a pure public good, just goods which vary in the cost of exclusion, and vary in the extent to which one more person's consuming adds costs. Consider the services of a park, or a highway. Are they rivalrous? To answer that, we must know what are the costs imposed by one more person's enjoying the services of the park or the highway. If the park, or highway, is nearly empty, these costs are minimal. One more person in the park has no effect on my enjoyment of the park ; one more person on the highway won't get in my way at all. But then as the park or highway gets congested, adding new users does impose costs on me. In the limit, the park or highway becomes so congested that its services are perfectly rivalrous. One more user in means some other user must get out. So these facilities are sort of an intermediate case. They are often referred to as "impure public goods", or "congestible public goods".

Now, as suggested at the very start of this note, many of the goods and services actually provided by the different levels of government are not really pure public goods. Education, and health care are two examples. It is certainly feasible to use the price system to ration education. That is what private schools do. It also is what York does. So education is quite excludable. Prices can be used to ration health care just as they are used to ration so many other services. After all, much of our non-emergency health care is still rationed ; no health card means no services.

So education and health care are pretty easily excludable. Are they rivalrous or not? My visiting a doctor, or my occupying a hospital bed, means someone else cannot see the doctor at that time, or cannot use the services (including nursing and other support) of the hospital bed.

Doctors' services are as rivalrous as barbers' services or auto mechanics' services. A case might be made that adding one more person into the school system adds no costs, but it's still not a very plausible story. There would be something of a case if the school system were operating below capacity. But that does not seem an accurate description of most Canadian schools. Adding more students reduces the quality of the education of those already there, or increases the costs. So education may be a congestible public good, but it's pretty congested much of the time. At least it certainly is at York.

Those are two examples of goods which are publicly provided in Canada, and in many many other countries : medical care and education. Yet the goods seem pretty close to perfect pure private goods. On the other hand, music, literature, computer programmes, and television shows seem close to perfect pure public goods. And all these commodities are provided predominantly by the private sector, in Canada and in most of the rest of the world.