Pure profits taxation would be a progressive lump-sum tax. Taxing profits would not distort a firm’s incentives, as the firm would continue to maximize profits despite the tax, as long as it’s not big enough to make them go out of business. And of course it would be progressive as long as more profits were taxed more. But the corporate tax is not a pure profits tax.

Under the following three assumptions:

1. nominal interest payments are deductible
2. economic depreciation is deductible
3. production possibilities are exogenous (i.e. not affected by the tax)

the corporate income tax would be a pure profit tax, and it would thus have no effect on investment. Production possibilities may be close to exogenous is older businesses. Probably not in newer ones; tax policy affects entrepreneurs’ incentives. Also, the tax deduction for depreciation cannot exactly match economic depreciation.

A simplified version of the corporate tax

Taxes of a corporation are

\[ \text{Taxes} = (\text{Revenues} - \text{Expenses}) \times \tau - \text{Investment tax credit}. \]

Revenues are the firm’s earnings from selling goods and services.

Expenses have three components.

First component is cash-flow costs of doing business. This is expenditures for goods and services over the past year. Examples: compensation to employees, payment for purchase of steel or energy (intermediate inputs), advertising costs, rent on buildings.

Second component is interest payments: Payments to creditors of the firm.

Cash-flow costs and interest payments are deductible from corporate earnings in the period they were incurred. To compute the firm’s tax burden, the cash-flow costs and interest payments are subtracted from that year’s earnings.

Third component is depreciation on capital investment. This is the rate at which capital investments lose their value over time. When a company buys equipment or a new building, the good invested in will deliver services for many years. The tax code generally doesn’t allow the full costs of a machine to be deducted in the period of purchase. But the tax code allows depreciation allowances to be deducted. These are tax allowances that approximate the rate at which the capital loses its value.

The tax code should allow firms to deduct economic depreciation as an expense.
Suppose a firm buys a machine this year for $100,000. Each year the machine is worth $10,000 less, so that after 10 years it needs to be replaced.

The cost to the firm of using the machine for one year is the purchase price minus the value after one year, which is $100,000 – $90,000 = $10,000. Using a year of a machine costs the reduction in value of the machine over that year. This is what should be deducted from earnings.

Problem with this: The true rate of economic depreciation usually can’t be observed. It varies across assets. The tax code has made depreciation schedules for different classes of assets. One way is to take the typical life of an asset and divide depreciation equally over each year of the asset’s life. This is straight-line depreciation.

Sometimes depreciation could be more rapid in the beginning of an asset’s life and less rapid after that. In extreme cases, the government can allow corporations to deduct the entire cost of the asset in the year the investment is made.

The value of depreciation deductions to the firm rises with the speed with which they are allowed. Depreciation deductions are more valuable the sooner they can be made.

Suppose the firm from the above example can borrow at a 10% interest rate. First consider straight line depreciation. The PDV of the depreciation allowances is $10,000 + \frac{10,000}{1.1} + \frac{10,000}{1.1^2} + ... + \frac{10,000}{1.1^9} = 61,446.

If the firm is allowed accelerated straight-line depreciation allowances, so that it can deduct $20,000 a year for five years, the PDV of the depreciation allowances would be $20,000 + \frac{20,000}{1.1} + ... + \frac{20,000}{1.1^4} = 75,816. Thus the quicker the depreciation can be counted, the more of a tax allowance the firm gets.

Application - personal computers

From data on the market values of PCs at different ages, Doms et al. (2003) found that the depreciation period for a PC is about 5 years. The depreciation is exponential rather than linear. In each period the value declines by 50% of the value at the beginning of the period.

The reason for this quick depreciation is not wear and tear, but because new models become much better quickly, at similar prices. Also, software advances that older machines can’t use.

Corporations are taxed on net earnings, which are earnings minus expenses. Tax schedule is approximately progressive. Very small firms (net earnings below $15,000 per year) pay 15% tax rate. Most firms pay 35% tax rate.

Investment tax credit (ITC) allows firms to deduct a percentage of their annual qualified investment expenditures from their amount owed in taxes. Since 1986 the ITC has not been in effect. Last ITC was 6 to 10% of investment expenditures.

There is a "research and experimentation" tax credit, enacted in 1981, set to
expire at the end of 2009. Obama proposed to make it permanent.

Incidence of the corporate tax.

Consider the effect of the corporate tax on the goods market. If demand for a good is not perfectly elastic, a tax on producers will be shifted to some extent to consumers. Elasticity of demand for a good is determined by how easy it is for consumers to shift their purchases to non-corporate or foreign producers. The corporate sector produces majority of goods in the economy. Thus demand not likely to be perfectly elastic, and some of a corporate tax will be shifted to consumers.

Corporations bear some of the tax, too, as long as demand is not perfectly inelastic. How is the tax on corporations distributed across labor and capital? The corporate sector employs a large share of workers in the US. Thus it is likely that labor supply to corporations is not perfectly elastic, and that some of a corporate tax is passed on to workers as lower wages.

In the short run the capital supply to the corporate sector is quite inelastic, so capital bears a lot of the incidence of a corporate tax. In the long run, owners of capital can turn to the non-corporate sector or to foreign markets. Capital is more mobile than labor in the long run because workers are less likely to move abroad for higher wages.

Corporate taxation also has general equilibrium effects on the non-corporate sector through spillovers. The corporate tax causes capital to move from the corporate to the non-corporate sector. The supply of capital rises in the non-corporate sector. This lowers the rate of return to capital in the non-corporate sector until the after-tax return in the corporate sector equals the return in the non-corporate sector. So capital in the non-corporate sector bears some of the incidence of a tax on corporations in the form of lower returns.

The burden of the corporate tax is shared by consumers, workers, corporate investors and non-corporate investors. There is little convincing evidence about the exact incidence. The CBO assumes all of the corporate tax burden is on investors, which is unlikely.

Chapter 8 - Cost-benefit analysis

Motivation. For private goods with a private, competitive market, it is easy to find the socially optimal quantity if there are no externalities. The intersection of the demand (marginal social benefit) curve with the supply (marginal social cost) curve leads to the socially optimal amount. The market adjusts to this amount in equilibrium. But for publicly provided goods, whether they are private or public goods or something in between, there is no such market to determine the socially optimal quantity of the good. Thus a different method of finding the socially optimal quantity must be used.

Given a proposed public project, it is efficient to undertake it if the benefit to society from the project exceeds the social cost. Cost-benefit analysis compares
the costs and benefits of a project to see whether it is worth undertaking.
Introduce an example:
Cost-benefit analysis of a highway project
Costs:
Asphalt: 1 million bags
Labor: 1 million hours of construction labor (500 workers for 2000 hours each)
Maintenance: $10 million/year
Benefits:
Driving time saved: 500,000 hours/year
lives saved: 5 lives/year
The goal of cost-benefit analysis is to quantify these costs and benefits.
Measuring current costs. To determine the social marginal cost, you can’t necessarily just add up what the government pays for each input to the highway project. You have to determine the opportunity cost of each resource: its value in its next best use. The cost to society of any input is the next best use to which society could put that input.
If a good is sold in a perfectly competitive market with no externalities then the opportunity cost equals the price. Suppose the market for asphalt is perfectly competitive with a price of $100 per bag. Then the social marginal cost of the asphalt is $100 per bag, and the total cost of asphalt is $100 million.
If the labor market is perfectly competitive the value of an hour of labor used on this project is the market wage. If the market wage for construction workers is $10 an hour, then the opportunity cost of labor for the project is $10 million.
But suppose that the market for construction workers is not perfectly competitive. Maybe state law has a $20 minimum wage for construction workers, and there is unemployment among construction workers. Suppose to the unemployed construction workers, an hour of leisure is worth $10. Then for an unemployed construction worker, the opportunity cost of working is only $10. If half of the workers employed for this project were previously unemployed and half were previously employed, then the opportunity cost of hiring 1 million worker hours is $20 \times 500,000 + $10 \times 500,000 = $15 million. Even though the government will actually pay $20 million in cash, the opportunity cost to society is less.
The cash cost (what the government actually pays out) for labor has two components: the opportunity cost of the input, and the transfer of rents - payments to the input supplier beyond those required to get the input. The opportunity cost of one hour of labor is only $10 for the unemployed workers. By paying them $20 an hour, a transfer of $10 extra is given to them. This is not a cost to society, but only money changing hands, from the government to the workers.
Therefore it is not counted as a direct cost in cost-benefit analysis. Of the $20 million paid by the government, $5 million are a transfer to workers, and only $15 million are opportunity cost. The money changing hands changes the distribution of wealth in society, since the government’s money came from taxes. The government may find such a change in wealth distribution desirable or undesirable, depending on its social utility function. Also, if there is deadweight loss due to the taxation financing the transfer, that is counted as a loss. But the transfer is not counted directly as a cost in cost-benefit analysis.

Suppose that asphalt was sold to the government by a monopoly, charging a price above marginal cost. The resource cost of the asphalt is the marginal cost, which is the cost of the resources used to make it. The difference between price and marginal cost is just a transfer from government to firm.

In this situation, again, it does matter to the government how much it actually pays out. The transfer has a value too in terms of distribution of income.

Next, we need to add costs of maintenance, which are a stream of future costs, to one-time construction costs. This is done using present discounted value. How do you choose the right social discount rate $r$?

If it was a private firm making an investment decision, it would use for $r$ the best alternative after tax return rate that it can get on another investment. If an existing investment yields a sure 10% per year and the firm pays a tax rate of 50%, the net of tax return would be 5% a year, and $r=5\%$.

The government should also base its discount rate on the private sector opportunity cost, as the next best use for the government’s investment money is in the private sector. If a private firm could make a return of 10%, the government should count 10% as the opportunity cost, as the government is the one who gets the taxes. The social cost of removing the money from the private sector is 10% per year: The 5% after-tax return to the firm and the 5% in tax revenues to the government. Thus 10% should be used as the discount rate.

The Office of Management and Budget (OMB) recommended in 1992 that a 7% discount rate be used. This is the historical pre-tax rate of return on private investments. Using $r=7\%$, the PDV of a $10$ million stream for all future years is $10$ million/$0.07 = 143$ million.

Measuring the benefits of public projects

This is more difficult than measuring the costs because it is harder to place a monetary value on the benefits.

Valuing driving time saved. For producers, the cost of transporting goods is less if it takes less time to transport them. Lower costs lead to an increase in supply. This raises social surplus.

To measure the value of time saved for consumers, need a measure of society’s valuation of individuals’ time. Several approaches:
1. Suppose that individuals spend the time saved at work. Suppose also that labor market is perfectly competitive. Then calculate value of time savings using drivers’ wages.

If time saved is spent partly at work and partly at leisure, then as long as labor market is still perfectly competitive (individuals can freely choose the hours they want to work), wage is still the right measure for value of time.

In a competitive market, in equilibrium, the value to an individual of an additional hour of leisure equals wage. This is because if the value of an additional hour of leisure exceeded the wage, the individual would take that extra hour of leisure; if the wage exceeded the value of an additional hour of leisure, the individual would work more.

Problems in practice: Individuals can’t freely trade hours of leisure with hours of work. Many jobs come with hours restrictions. If a person would like to work more than 40 hours per week at current wage, but employer won’t allow it because of required overtime pay, then wage could exceed value of leisure. But the person is unable to make them equal by working more. Then the wage overstates the value of saving time if the time is spent partly on leisure.

Nonmonetary compensation from the job. The total compensation from working may be higher than the wage. Then the wage understates the value of saving time.

2. Contingent valuation - asking individuals what their time is worth to them. Sometimes this is the only method available. But there are problems:

Answers to different contingent valuation surveys often seem inconsistent with each other. When asked only one question on how much they would be willing to pay to improve visibility at the Grand Canyon, respondents answered 5 times more than when that question was 3rd in a list of questions. Also, the order of issues matters, and the ”embedding effect” matters.

3. Using revealed preference to value time: Let people’s actions reveal their valuation. Example: Compare the prices of two identical houses, one 5 minutes closer to the central city where commuters work. The additional price paid for the closer house should reflect the time savings. But the two houses really have to be otherwise identical for this to work.

A quasi-experimental approach was used by Deacon and Sonstelie (1985) to find out the value of time saved. During the 1970s oil crisis, the government imposed price ceilings on large gasoline companies. These price ceilings did not apply to smaller independently owned stations. There were long lines at the large gas companies and shorter lines at the smaller stations. People revealed themselves to be willing to wait on average an hour for savings of $17.60, which is close to the average hourly wage of $17.80.

Valuing saved lives. There are many possible uses for the government’s budget, each of which might save lives. For this reason one needs to find a way to
compare them.

Using wages to value a life. This approach assumes that life’s value is the present discounted stream of earnings (taking life to be time spent living). Leisure time can be valued by wages as well (though this is not always accurate if labor market not competitive). Keeler (2001) calculated that a worker under 50 will spend 10-20% of future hours working so value of life is about 5-10 times future lifetime earnings. Thus average 20-year old female will have future earnings of $529,000 and will value life at $3.4 million. This decreases with age.

Problems with this approach - market wage may not accurately reflect value of leisure time, and life may be worth more than time spent living.

Contingent valuation - asking individuals what their lives are worth. For example, ask about valuation of things that change probability of dying - a question on a survey asked how much less they would be willing to pay for a house in an area with environmental pollution that would reduce their life span by 1 year. Contingent valuation studies gave a wide range of values of life.

Revealed preference

Suppose a passenger air bag could be added to a new car for $350 and there is a 1 in 10,000 chance that it would save the life of a passenger. Then the value of life to individuals who buy airbags is at least $3.5 million.

Another way is to estimate how much more people must be paid to take risky jobs that increase chance of dying (compensating differentials). If in one job a worker has a 1% higher chance of dying each year, and it pays $30,000 more than another job with similar qualifications, then $30,000 is called the compensating differential. If people must be compensated by $30,000 to take a 1% increased risk of dying then life is valued at $3 million = $30,000/0.01. Consensus from this approach is a value of life at $7.6 million.

Strong information assumptions are needed to use this approach - need to assume coal miner knows the increased risk of dying due to job. But this information isn’t easily available to workers. So their choices are based on perceived risk rather than actual risk.

Also, you need to control for other attributes of the jobs you are comparing. The more dangerous job (coal mining) may also be more unpleasant than the safer job (cashier). Compensating differentials will pay for this too in addition to the added risk of dying. This factor tends to make the revealed preference approach overstate the value of life.

There must be different values of life for different individuals. Estimates gotten from the revealed preference approach may not be valid for society as a whole. Since less risk-averse people should be the first to take risky jobs, the revealed preference method should understate the value of life to the average person.

Government revealed preference. Look at existing government programs, what they cost and how many lives they save. Costs vary from $110,000 per life saved
for childproof cigarette lighters to $109 billion per life saved from regulations for solid waste disposal facilities. Either the public sector values life very highly, or it is inconsistent in its valuation.

Discounting future benefits. Many projects have immediate costs and long-term benefits. For calculating the long-run benefits, the discount rate chosen matters a lot. A dollar benefit in 100 years is worth 13.8c if the discount rate is 2%, 5.2c if the discount rate is 3% and 2c if the discount rate is 4%.

Also, long-term projects provide benefits to future generations. Should the benefits to future generations be discounted? This question is left to whoever is doing the calculations.

Benefits of the highway construction project are 500,000 reduced hours of driving per year and 5 reduced fatalities per year. Value the savings in time to producers and consumers at $17 per hour. That gives time savings benefits of $8.5 million per year. The 5 lives saved are valued at $7 million each, so the total life saved value is $35 million. The total value of the project is $43.5 million per year. Apply the discount rate of 7% to benefits. That gives a present discounted value of 43.5/0.07=$621.4 million. The cost of the project was found to be $258 million. As the benefit exceeds the cost, the project should be undertaken.

An Income Multiplier

Definition: Value added of a firm is its revenue minus its expenditures on services or goods from other firms. One way in which this differs from profits is that labor costs are not subtracted to get value added unless the labor was hired from another firm. Also, resources that are already owned by the owners of the firm are not subtracted to get value added; they are subtracted to get profits.

We would like to count how much income from the project stays within the community and creates additional income for the community. In the cost-benefit analysis we will consider spending on local value added. This means that some of the money (costs) of the project is spent buying goods and services from the community. This is like revenue to the community. But the community may have been buying goods from outside. One should consider only the income to the community net of their cost of buying these goods.

For example, suppose that a large-scale construction project uses labor, steel and concrete as inputs. Half the labor is local and half comes from outside. The steel all comes from outside, and the concrete is provided by a local firm using all local materials. Then all the money spent on concrete by the project is local value added, the money spent on local labor is local value added, and none of the money spent on the steel is local value added. Only the local value added can be considered as local income.

Some fraction of the local income will be spent locally, creating more local value added, and some fraction of that will be spent locally, and so on. The sequence
of increase in local spending due to the local value added probably does not go on indefinitely, because local resources for use in construction are finite.

This generated income is not equal to net benefit. This is because there were other uses for the labor and other inputs - for example the workers could have enjoyed their leisure, as discussed above. The concrete could have been put to other uses (the steel is being bought from outside anyway, so its price equals its opportunity cost to the community). The net benefit to the community is the profit, which is the difference between the opportunity cost of what the community provides and what they are paid for it. For labor this is the difference between the wage and the reservation wage.

Multiplier: Suppose that locals’ marginal propensity to consume local value added is \( c \). This means that if their income were $100 higher, locals would spend $100c more dollars on local value added. With the project, net new spending of $100 on local value added creates $100 of local income, and 100c additional expenditure by locals on local value added, which becomes additional local income. From this income, locals spend 100c^2 more on local value added, and from this income, they spend an additional 100c^3 on local value added, etc.

Thus net new spending of $100 on local value added leads to additional income of $100/(1 - c) = 100/(1 - c)$. (To see why this last equation is true, multiply both sides by \((1 - c)/100\).) If the marginal propensity to consume local value added is \( c = 2/3 \), then locals spend 2/3 of each additional dollar of income on local value added. Then the $100 of net new spending creates $100/(1 - c) = 100/(1/3) = 300$ dollars of income. The income gets multiplied by 3 in that case.

As noted above, if the community economy is operating near full capacity, the resources needed to satisfy the extra demand for local value added will already be in use. Then the extra demand is likely to raise prices, so real income does not increase. This effect can be approximated by assuming that the multiplier series \( 1 + c + c^2 + \ldots \) stops at \( 1 + c \) or \( 1 + c + c^2 \). The marginal propensity to consume local value added has been estimated to be around 0.8 for the U.S. For a smaller community such as a city, it is much smaller, maybe 0.3 for a city with a population of one million. This would lead to a multiplier of 1.3 or 1.4.

As discussed above, the generated income is not net benefit to the community since there are opportunity costs of the resources the community provides. The net benefit can be obtained by multiplying the net generated income by a profit rate. This rate is often estimated to be around 0.2 in normal times. In summary, when the project leads to $100 of net new spending on local value added, the generated income creates around $100(1 + c)(\text{profit rate}) in net benefits for the community. With common estimates of \( c \) and the profit rate, this equals $100 \times (1.3) \times (0.2) = 26$ dollars of net benefit.

When the economy of a community is in recession (inputs use is much below capacity) the multiplier could be higher because more terms from the multiplier series can be added without inducing price increases. Also the profit rate is
higher because the opportunity costs of the resources are lower. Therefore the generated net benefit from expenditure is higher than in normal times. Saving, which reduces the marginal propensity to consume local value added is less desirable. It provides funds for expanding capacity through investment in capital, but when the capacity is already not being used entirely, this has little value. Current spending creates more net benefit in this case.

Direct benefits are benefits locals get from the goods or services provided by the project. In the case of a bridge or highway, the benefits could be estimated by estimating the locals’ demand curve for the service. A unit of service provided by a bridge is trip across the bridge. The locals’ demand curve shows the number of crossings they would take at any given price (toll) per crossing. Their demand curve is also their marginal benefit curve, so the area under the curve above the segment from 0 to Q units is a consumer surplus measure of the total benefit the locals get when they take Q crossings during a given period. If the demand curve can be estimated reasonably accurately, then this consumer surplus measure of total direct benefit is better than the measure obtained by attaching a dollar value to the time saved. The reason is that different time intervals saved might have very different values and it is difficult to say how much the time is worth on average for the entire population on average. Another advantage of using the demand curve is that it can also be used to estimate efficient price and quantity of the service. The demand curve can be estimated by surveying potential users asking how many crossings they would make given different toll levels, or it can be estimated from experiments with different toll levels on similar bridges in other similar communities.

Common counting mistakes in cost-benefit analysis.

- counting secondary benefits. If the government improves a highway there may be an increase in commercial activity along the highway. This should not be counted as a benefit of the project, as it may be taking away from commercial activity somewhere else. What matters is the increase in total surplus from the new activity.

- counting labor as a benefit. Wages are part of the costs of the project, not benefits. If there is unemployment, the opportunity cost of the workers is lower, but the cost does not become a benefit. It is a mistake to count jobs created by the project as net benefit. However, if part of the wage payments are made by outsiders, then that is new income, and the profit from that income and from the other income it generates through the multiplier is net benefit.

- double-counting benefits. Public projects often lead to increases in values of some assets. Because workers save time driving to work due to the highway project, values of houses farther away from the city may increase. Because the rise in house values results from the reduction in travel time, they should not both be counted as benefits. If the direct benefit is measured by consumer surplus, using an estimated demand curve for highway use, then the value of the time saved should not be counted. It is an alternative measure of the same
value of use.

Distributional concerns

The benefits and costs of a project may go to different people. For example, when a highway is expanded commuters benefit but those living near it are hurt. In theory it would be possible for those benefitting from the project to redistribute the money to those who are hurt, but this rarely happens in practice. We may care about who is benefitted and who is hurt by a project. For example if the benefits go to the rich and the losses to the poor, we may want to discount the benefits and raise costs.