Corporate Income Taxation in a Modern Economy

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Abstract. The corporate income tax has been an important part of the U.S. tax code for decades. Beginning with Harberger, economists have argued that the corporate income tax reduces economic efficiency by more than alternative tax instruments. These arguments typically assume perfectly competitive markets, ignore risk, and do not consider economic growth through innovation, even though these elements are key features of any modern economy. The true economic cost of the corporate income tax is much greater than conventionally believed when we consider how it interacts with investment and growth in a modern, technologically advanced economy.

The corporate income tax has been part of the U.S. tax code for several decades. In recent years, it has produced roughly ten percent of federal revenues, and between one and two percent of national income. While the corporate income tax is smaller than other sources of revenue for the federal government and has declined in importance in the postwar era, it is still a significant burden on economic growth due to its effects on capital accumulation. Economists have pointed out many shortcomings of the corporate income tax, as well as asset income taxation in general. Harberger's (1962) pathbreaking contribution focused on how the corporate income tax misallocates capital between corporate and noncorporate sectors. Asset taxation in general hinders capital accumulation. In fact, Atkinson and Stiglitz (1976), Atkinson and Sandmo (1980), Feldstein (1974), and Judd (1985) present many cases where there should be no tax on capital income in the long run in a competitive economy. Eaton (1981) showed that capital income taxation slows economic growth and Hamilton(1987) demonstrated that asymmetric treatment of different forms of capital substantially damages economic efficiency.

This study argues that there are many considerations often ignored in the tax literature that substantially strengthen the case against the corporate income tax. In particular, most studies assume no risk, competitive markets, and no technological change. These assumptions are clearly wrong in any modern growing economy, where investment is risky, many firms have nontrivial market power, and innovation is an important, if not dominant, component of economic growth. All three of these features are particularly important in the corporate sector. The major motivation for incorporation is to spread risks across many investors; therefore, treatments of the corporate income tax that ignore risk miss a key way in which the corporate income tax hurts the economy. Many corporations have market power through patents and trade secrets. In fact, the only way for corporations to recover the costs of R&D is to price their products above unit cost. Much of the risky innovation that fuels economic growth comes from activities in the corporate sector or from businesses that are not corporations but view incorporation as part of its future.

Any economic study, including ours, makes simplifying assumptions. The key question is whether the elements of risk, market power, and innovation, affect our evaluation of the corporate income tax. We find that each of these factors substantially increases our estimates of the economic burden of the corporate income tax, and strengthens the case against the corporate income tax.

The approach in this study differs from much of the tax policy literature. Many studies use data to "calibrate" their models, that is, they use empirical estimates to pick values for critical parameters such as factor shares, risk aversion, and savings elasticities. Unfortunately, we do not have precise estimates of the critical parameters in the models discussed in this paper. In any case, our knowledge of these parameters is imprecise and we want to know how robust any conclusions are. Therefore, we will instead examine the implications of our models for a broad range of plausible parameter values and look for results that are not sensitive to these numbers. Despite our lack of precise information about the critical parameters, the results are surprisingly robust.

Although the details are different, the central points in this paper are consistent with the general case against the corporate income tax. A central theme in the analysis of the corporate income tax is that it adds taxes some enterprises but not others, creating asymmetries with little if any rationale. Harberger (1962) focused on how the corporate income tax increases the prices paid by consumers for products made by corporations, making those good more expensive relative to other goods. Harberger's case against the corporate income tax is based on the reasonable presumption that it does not tax the good that would be taxed in an efficient tax system.

We extend this idea to other asymmetries created or aggravated by the corporate income tax in a modern economy. While we examine the corporate income tax in contexts with either risk or imperfect competition or innovation, it is arguable that the costs are cumulative, and that the economic cost of the corporate income tax in a real economy is even greater than indicated by any one of these analyses. The case for reducing, if not eliminating, the corporate income tax is already strong, and made stronger when we include those features which make our economy a modern and technologically advanced one.

This study proceeds from the familiar Harberger analysis to ours incorporating new elements. We first motivate our findings by reviewing the inverse elasticity and production efficiency results from optimal tax theory, and show how the classic Harberger analysis is related to those principles. We then look at a dynamic model with risk and examine the costs of asymmetric taxation across assets. The next element we consider is the presence of imperfect competition and the economic harm created by adding the burden of a corporate income tax on top of the existing distortions. Our next example integrates the imperfect competition into a model of innovation, and examines the costs of capital income taxatoin and the benefits of an R&D tax credit. We end our presentation arguing that entrepreneurship is discouraged by the asymmetric treatment of noncorporate and corporate entities. All of these considerations substantially strengthen the case for eliminating the corporate income tax.

1. Principles of a Good Tax System

We first review the key concepts from optimal tax theory and illustrate some basic implications for corporate income taxation. There are two basic results that help us understand the arguments in most tax analyses. First, the inverse elasticity rule[1]

[1] See Atkinson and Stiglitz (1972) and Atkinson and Sandmo (1980) for formal presentations of optimal commodity taxation, and the generalized "inverse elasticity" result.

argues that the tax on a good should be inversely proportional to its demand and supply elasticities. Second, the productive efficiency principle of Diamond and Mirrlees arguing against the taxation of intermediate goods, such as capital.

1.1. The Inverse Elasticity Rule and Corporate Income Taxation. The inverse elasticity rule says that the optimal tax on a commodity is inversely proportional to its demand elasticity. This comes from the basic Harberger formula relating the efficiency cost of taxing a good and its elasticity of demand[2]. Suppose that a good is taxed at the rate τ, its demand is Q, and its elasticity of demand is η. If it is the only good taxed, then tax revenue is τQ and the efficiency cost of the tax is $\frac{1}{2}\eta\tau^2 Q$, If their are two goods where good i had elasticity of demand η_i, tax τ_i, and demand Q_i, then the total efficiency cost is $\frac{1}{2}\eta_1\tau_1^2 Q_1 + \frac{1}{2}\eta_2\tau_2^2 Q_2$ and the total revenue is $\eta\tau_1 Q_1 + \eta\tau_2 Q_2$. The tax system that minimizes efficiency costs for a given revenue target would choose taxes so that $\eta_1\tau_1 = \eta_2\tau_2$, or

$$\frac{\tau_1}{\tau_2} = \frac{\eta_2}{\eta_1}$$

which says that the optimal tax on a good is inversely proportional to its elasticity of demand.

The inverse elasticity rule has many implications for the corporate income tax. First, the corporate income tax will raise the price of goods produced by corporations relative to goods produced by firms not subject to the corporate income tax. There is no reason to believe that the corporate form is most appropriate for firms producing goods with low demand elasticity. Therefore, through its impact on the prices of final goods, the corporate income tax produces inefficient taxation on consumption goods.

The cost of asymmetric taxation is a key point of the Harberger model of the corporate income tax and much of the literature that followed. Table 1 displays the quantitative importance of this argument. We will use the excess burden of a tax, defined to be the loss of economic efficiency and output per dollar of revenue[3], as our measure of the efficiency cost of a tax. Table 1 displays the excess burden of a tax τ on the consumption of a good with a constant elasticity of demand equal to η. For low levels of taxation, the ratio of efficiency cost and revenue is proportional in τ, as predicted by our simple formula. For higher levels of taxation, such as a 300% consumption tax, the ratio is far higher.

[2] Our simple intuitive formula assumes that tax rates are small and ignores cross-elasticities in demand. However, the inverse elasticity formula turns out to be surprisingly good as a rule of thumb.

[3] We are taking a partial equilibrium approach in these examples.

Table 1: Excess Burden of a Consumption Tax

η \ τ	0.1	0.2	0.5	1.	1.5	2.	3.
2	0.16	0.32	0.88	2.	3.4	5	9
3	0.21	0.46	1.38	3.7	7.1	12	27
4	0.28	0.61	2.05	6.5	14.8	29	84
5	0.34	0.79	2.96	11.4	31.2	72	272

The Harberger cost of a corporate income tax is the excess burden of having a higher tax on some goods with elasticity η than on others. For example, if the corporate income tax is 35%, and the noncorporate income tax is 20%, and elasticity of demand is 2, then the efficiency cost of the corporate income tax is 0.88-0.32=0.56, or about 56 cents per dollar or revenue.

Second, the inverse elasticity rule tells us that taxation of capital income in general is inefficient. At first, the inverse elasticity rule may seem to have little application to discussions of income taxation and savings. However, the only correct way to understand any tax policy is through its implications for the prices of final goods purchased by households[4] Suppose that goods 1 and 2 correspond to consumption today and consumption at time t. Suppose r is the before-tax interest rate, and τ is the interest tax rate. If there were no tax, you could take $(1+r)^{-t}$ today, invest it for t periods, and have \$1 at time t; therefore, the social cost of one dollar of consumption at time t in units of the time 0 good is $(1+r)^{-t}$. However, when faced with the tax, you need to invest $(1+(1-\tau)r)^{-t}$ today in order to have \$1 at time t; hence, the after tax price is $(1+(1-\tau)r)^{-t}$. The effective tax rate on consumption at time t is

$$\tau^{eff} = \left(\frac{1+r}{1+(1-\tau)r}\right)^t - 1 \tag{1}$$

The key fact illustrated by this formula is that the commodity tax equivalent is exploding exponentially in time!

The exponential explosion in (1) appears dramatic and is over reasonable horizons. Table 2 displays the consumption tax equivalents, τ^{eff}, for various combinations of r and τ. We see that the results depend substantially on the magnitude of r. For $r = .01$, the mean real return on safe assets, the effects are small. For example, even a 50% tax on interest income implies only a 22% tax on consumption tax 40 years hence. However, the situation is much different when $r = .10$, which is the average marginal product of capital. When $\tau = 0.5$, which is close to total tax rate on equity-financed capital for many investors, the effective consumption tax rate is a whopping 543% over a 40-year horizon! The effect over shorter horizons is also large.

[4]This was a key theme in Diamond and Mirrlees (1971).

It is hard to imagine any government passing a 59% sales tax in 2016, but that is effectively what we do to many investors if we continue with the current income tax system between 2006 and 2016.

We can combine the results of Tables 1 and 2 to illustrate the efficiency costs of the corporate income tax. If $r = 0.10$, and the corporate income tax had the effect of raising the tax on capital from 10% to 50%, then the change in the effective tax on consumption 20 years in the future is is 154-20=134, and is like going to Table 1 and comparing the the excess burden of a 20% tax to the excess burden of a 100% or 150% consumption tax. This combination invariably leads to large estimates of the cost of the corporate income tax.

Table 2: Consumption Tax Equivalents, τ^{eff}

r	τ	t					
		1	5	10	20	30	40
.01	10	.1	.5	1	2	3	4
	50	.5	2	5	20	16	22
.10	10	1	5	10	20	31	44
	50	5	26	59	154	304	543

Is there any reason to have an exploding tax on future consumption? This is rational only if the elasticity of demand for future goods is declining rapidly, a strange hypothesis with no empirical support. The implications of this analysis are clear. While the exposition above focuses on a special case, the result is robust. The results in Judd (1985, 1999) show that the optimal tax on asset income is zero in the long-run, even when preferences are far more general than those used in dynamic tax analyses. The key idea is that exploding consumption tax rates are not efficient.

1.2. Productive Efficiency Principle and the Corporate Income Tax. The second important principle is the Diamond-Mirrlees result about productive efficiency. The essential argument is that a tax system will unavoidably cause distortions in consumption of final goods by consumers since some things, like leisure, cannot be taxed but many other goods will be taxed. Any tax system will affect an economy's output. However, Diamond and Mirrlees tells us that there is no need to also force the economy to produce that output in an inefficient fashion. The chief implication of the Diamond-Mirrlees efficiency result is that an optimal tax system would tax only final goods, not intermediate goods.

For example, it makes sense to tax clothing, but we should not tax sewing machines. If we taxed sewing machines, clothing producers would substitute away from mechanical production and towards labor-intensive methods, reducing the productivity of the economy. A tax on sewing machines is ultimately paid by clothing consumers in any case. Diamond-Mirrlees tells us that it is better to directly tax clothing and do nothing that would distorted producer decisions.

The productive efficiency principle applies to any analysis of income taxation since capital goods are intermediate goods. In fact, from the point of view of a business any tax on capital income (net of depreciation) is equivalent to a sales tax on the purchase of the capital that produces that income. Suppose that a firm faces a 50% tax rate. This essentially says that the government owns half of any capital after the business buys it. Therefore, a firm that pays two dollars for capital receives only the income from the capital purchased with one dollar. His situation is the same as if he paid no income tax but instead spent one dollar on capital, and gave the government another dollar in the form of a 100% sales tax. Since intermediate good taxation will generally reduce the productivity of an economy, capital income taxation will likely produce similar factor distortions, such as a reduced demand for labor. Also if there are many capital goods taxed at different tax rates, businesses will switch to using the less taxed forms of capital.

The corporate income tax interferes with productive efficiency in three ways. First, the capital used in corporations and financed by equity is taxed more heavily than in other firms, implying that, relative to noncorporate firms, corporations will use less capital than is efficient. Second, capital that can be financed by debt or leased from firms not covered by the corporate income tax will be cheaper for a corporation than forms of capital that require equity financing. Third, the capital goods that are produced by corporations will be taxed more heavily than capital goods produced outside the corporate sector. This distortion will lead all firms to use an inefficient mix of capital goods.

We use a simple Cobb-Douglas example to show how the corporate income tax can substantially reduce productive efficiency. Suppose that a firm uses three kinds of capital with output described by a CRTS Cobb-Douglas production function. Suppose that the income from each type of capital is subject to different tax rates due to the corporate and personal income tax systems This variation can be large, as would be the case, for example, of a firm that rents its factory buildings from a noncorporate firm but uses equity to finance its machinery. Next suppose that there is a fixed total supply of capital that will be allocated to the alternative forms of capital; this describes the situation in a dynamic economy over a short period of time.

If we assume equal shares for all types of capital, we get a Harberger-style expression for the impact of tax asymmetries. Suppose that the three types of capital are taxed at rates τ, $\tau + v$, and $\tau - v$. Then, we find

$$\begin{aligned} OUTPUT &= 1 - \frac{2}{3}\frac{v^2}{(1-\tau)^2} \\ REVENUE &= \tau\, OUTPUT \end{aligned}$$

implying that as the variation in tax rates, v, increases both output and revenue fall! This implies that if there is any deviation from uniform taxation, both economic output and tax revenue could be increased by equalizing the tax rates.

The surprising simple result that any deviation from equal taxation reduces both output and revenues depends on the Cobb-Douglas production function: factor shares will be invariant to the tax rate, implying that the tax base will be a constant share of output, implying that any deviation from productive efficiency will reduce output and revenue. However, these results would be overturned only by dramatically reducing the elasticity of substitution across different types of capital.

The productive inefficiency of the corporate income tax and the distortion to final goods consumption are the key features of Harberger-style of models. We now go beyond the conventional framework by adding considerations of imperfect competition, innovation, and risk, elements that we will show are equally if not more important when studying real-world taxation.

2. Risk and the Corporate Income Tax

Investment is generally risky, but risk is often ignored in tax reform analyses. This is potentially an important problem since the corporate income tax discriminates against the risky ventures financed by equity investment in favor of safer business ventures financed by debt or ventures small enough to be financed by individuals or partnerships. This discrimination appears to violate optimal taxation principles: if both risky and safe assets produce the same good, why should the tax system discriminate between alternative investment strategies?

The U.S. tax system puts an extra burden on any asset financed by equity instead of debt. Since a primary purpose of incorporation is to spread risks across a large number of investors, this leads to discrimination against risky investments and in favor of safer investments. For example, an individual can easily borrow money to finance 80% of the value of a home. Real estate investments, such as homes, are not perfectly safe, but they have access to the debt market because it is unlikely that the value of the home will fall below the value of the loan. However, entrepreneurs face far more risk since there is often a good chance that all the money invested in a new venture will be lost. These risks make it difficult to borrow money from a bank or the bond market, and lead risky enterprises to the equity market to finance their operations.

We need to keep in mind that there are two kinds of risks. First, there is the idiosyncratic risk faced by any business related to its particular product, the performance of competitors, and technological luck. This is the kind of risk that incorporation addresses by spreading it out across many investors. Second, there is aggregate risk related to the movements of the stock market and aggregate output. No market can diversify it away. Some corporations face both high idiosyncratic risk and high correlation with aggregate risk, but some corporations face risks that are more specific to their industry and not strongly related to the aggregate economy. Consider, for example, food processing firms. The demand for many foods is stable, but the costs of input may vary substantially depending on crop successes or failures. These risks may make the corporate form natural even though the company faces modest aggregate risk.

The most important fact about asset returns in the U.S. is that over the last century the annual real return to individuals (before personal taxation but after corporate taxation) on equity investments has averaged 7% with a standard deviation of 20%, and the mean real return on safe assets has been 1%. Since the corporate income tax over that period has usually been between 30% and 50%, corporate tax adjustments imply that both mean and variance should be 20-40% higher for risky assets in corporate form to approximate the opportunities offered to society. While these corporations may also face idiosyncratic risks, they do not affect the price of risk. We use these facts in our numerical examples below.

This section offers a basic portfolio analysis of the taxation of multiple risky assets. This builds in the static analysis of Domar and Musgrave (1948), and the dynamic analysis of Hamilton (1987). We use our model to examine the cost of differential taxation among assets. We find several striking results indicating that differential taxation of assets not only reduces economic efficiency but that differential taxation does so while producing little revenue, and in many cases reduces both economic output and revenue. Since the corporate income tax is a source of differential taxation, this indicates that it is fundamentally irrational from any point of view.

Here we will deviate from the Harberger approach of equating the corporate income tax to a tax on specific sectors. There are very few goods that are produced in a purely corporate manner. Many enterprises are financed by a mix of inputs. For example, consider a manufacturing firm that buys its machine tools and pays its workers with corporate funds but rents its building from a partnership. The noncorporate owners of the building will be able to use debt if there is little downside risk on the building's value, but the manufacturer uses equity financing for its other costs if it faces a good chance that its product does not sell. So, even though the manufacturing firm is a publicly traded corporation, the actual production process is effectively a mix of corporate and noncorporate entities. So, contrary to the Harberger approach, we will not split the economy into a corporate sector and a noncorporate sector.

Instead, we examine a model where all enterprises produce the same good. The difference is that some businesses have to be organized in a corporate form whereas others, due to lower risks and scale, can be organized as partnerships or individual-owned firms. This will allow us to focus on the effect of the corporate income tax on the allocation of investment over activities with different risks.

In this section, we will take a highly aggregated approach. We will assume that there is one good being produced, but that it is produced by a variety of processes, some subject to the corporate income tax and some not. We assume that there are three types of investment projects behind three assets. Asset 1 is a safe asset with return r, asset 2 is a risky asset with mean return μ_i and variance σ_i^2, $i = 1, 2$. gross returns Z_2 and subject to only personal income taxation, and asset 3 is a risky asset with gross return Z_3 and is subject to both personal and corporate income taxation. For the sake of simplicity, we will initially assume that the two risky assets are not correlated.

We assume that agents have a constant coefficient of relative risk aversion, equal to γ, implying that utility is

$$u\left(c\right) = c^{1-\gamma}/\left(1-\gamma\right)$$

and discount the future at rate ρ. Therefore, the individual investor faces the problem

$$\begin{aligned}
\max_{c,\theta} \quad & E\left\{\int_0^{\infty} e^{-\rho t}u\left(c\right)dt\right\} \\
dW &= ((\theta_b r(1-\tau_b) + \theta_1\mu_1(1-\tau_1) + \theta_2 r(1-\tau_2))W - c)dt \\
& \quad + W(\theta_1\sigma_1(1-\tau_1) + \theta_2\sigma_2(1-\tau_2))dz \\
1 &= \theta_b + \theta_1 + \theta_2 \\
W(0) &= W_0
\end{aligned}$$

This problem can be solved by applying the Hamilton-Jacobi-Bellman equation for the value function, $V\left(W\right)$

$$\begin{aligned}
0 = \max_{c,\theta} \quad & u\left(c\right) - \rho V + V'\left(W\right)((\theta_b r(1-\tau_b) + \theta_1\mu_1(1-\tau_1) + \theta_2 r(1-\tau_2))W - c) \\
& + \frac{1}{2}V''\left(W\right)(\theta_1^2\sigma_1^2(1-\tau_1)^2 + \theta_2^2\sigma_2^2(1-\tau_2)^2)
\end{aligned}$$

The constant relative aversion utility function implies that the solutions for consumption and investment take the form of $c = \psi W$ for some constant ψ, and the portfolio weights, $\theta_b,\ \theta_1,\ \theta_2,$ being constants.

When we use values for the key parameters that produce reasonable predictions for portfolios, we find that tax differentials produce substantial economic costs. In

Table 3, we assume that $\gamma = 5$, $\rho = 0.03$, $r = .01$, $\mu_1 = 0.05$, $\sigma_1^2 = 0.04$, $\mu_2 = 0.09$, and $\sigma_2^2 = 0.08$. These values produce portfolios that are reasonable in that individuals hold positive amounts of all types of assets, and the mean returns and variances line up on the security market line observed in the U.S. Table 3 displays the marginal excess burdens of each tax. That is, in the first row under MEB_1, the number 0.06 means that if τ_1 were raised enough to produce one more dollar of revenue then the extra waste of the tax is 6 cents, and investor welfare drops by 6 cents plus the extra revenue. The MEB index tells us what direction tax changes should go if we are to maximize the gain per dollar of revenue lost.

Table 3: Marginal Excess Burden of Taxes on Assets

τ_b	τ_1	τ_2	MEB_b	MEB_1	MEB_2
-0.2	0.0	0.4	-0.08	0.06	0.17
-0.2	0.2	0.4	-0.10	0.20	0.20
-0.2	0.4	0.6	-0.24	0.64	0.64
-0.2	0.6	0.4	-0.31	16.8	0.27
0.2	0.2	0.2	0.11	0.11	0.11
0.2	0.4	0.6	-0.03	0.37	0.44
0.2	0.6	0.4	-0.10	.75	0.30
0.4	0.4	0.4	0.23	0.23	0.23

The tax rates in Table 3 were chosen to represent a variety of asymmetries in the U.S. tax code. The negative tax rate cases represent the subsidies that some capital, particularly owner-occupied housing, receives. The two other assets, one with higher systematic risk than the other, represent differences between the corporate and noncorporate sectors. The higher tax rate represents the personal plus corporate tax rates. Notice that I did not automatically assume that the corporate sector faced higher aggregate risk.

The results followed a basic theme: the higher the tax rate, the larger the efficiency cost. Table 3 shows that if all taxes were equal, the efficiency cost of the marginal tax dollar is small, only about 11 to 23 cents per dollar of revenue at tax rates of 20 and 40%. At first, most of the numbers appear small, but close examination reveals the irrational nature of tax asymmetries in this model. Note that one of the MEB numbers in each row is negative, except where taxes are equalized across assets. These negative numbers tell us that an increase in the tax will not only raise revenue but also increase economic wellbeing!

This pattern was robust across many parameterizations. The conclusion is that asymmetric taxation of asset income taxation has high economic costs with little, if any, revenue gain.

3. Imperfect Competition and Taxation

While the competitive model may be a valid simplification for markets like agricultural production, it is certainly not a reasonable view when studying the corporate sector. Patent protection, increasing returns to scale, and learning curves all tell us that firms will have some market power to set their prices. This is surely true for sectors with high rates of innovations, such as computer software and computer hardware, where many firms are subject to the corporate income tax.

While it is clear that competition is imperfect in many industries, we need to have some idea of how important it is before we look at the tax implications. Fortunately, many studies have looked at this and tell us that the gap between prices and marginal costs is large. The empirical Industrial Organization literature contains some industry-specific studies on price-cost margins, and tell us that price-cost margins are around 20% for some capital goods (see, e.g., Appelbaum, 1982). Both Hall (1986) and Domowitz et al. (1988) indicate that the margins in the equipment sectors are substantial in size, lying generally between 15% and 40% of the price. Our discussion here does not rely solely on these estimates of price–cost margins, particularly for investment goods. In particular, R&D expenditures equalled 9.2% of sales for machinery and 4.7% for electrical equipment in 1990. Learning curves also produce increasing returns to scale which act essentially as a fixed initial cost. These considerations plus a conservative view for learning curve effects, economies of scale effects, and other long–run fixed costs puts us in a range relevant for our policy discussions.

The second idea we use in this study is that distortions produced by imperfect competition in the private sector are similar to taxes imposed by the government. This is displayed in Figure 1. Suppose that a good is not sold at its marginal cost, which is equal to 1 in Figure 1, but is sold at a marked up price, $1 + m$. Any markup above marginal cost acts essentially as a tax. In Figure 3, H_m, is the efficiency cost of such a markup. The box $P + H_{\tau m}$ in Figure 1 is the monopolist's "tax revenue" constituting profits in excess of economic costs. The economic effects of any markup is similar to taxation whether it arises from monopoly, oligopoly, or any other form of imperfect competition.

The analogy between taxation and monopolistic markups is particularly appropriate in the case of patents. The key feature of a patent is not that the holder is a monopoly producer. In fact, many patent holders do not produce their product. The key feature is that the patent holder can impose a tax on the purchase of the patented good, either directly through being a monopoly producer or indirectly through a royalty. These taxes are justified by the incentives they create for innovation. Therefore, we do not want to destroy the monopolies and taxes that patents create. But, these distortions are still effectively taxes. This analogy shows that even a low estimate of 10% for the price-cost margin is important for us since it is equivalent to a 10% sales

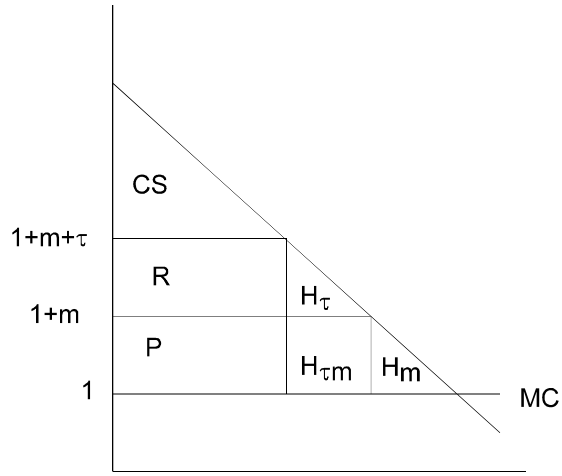

Figure 1: Taxation and Monopolistic Competition

tax.

Suppose that we introduce a tax τ into such an imperfect market. The buyer now pays both the markup and the tax, resulting in a total price of $1+m+\tau$. The $m+\tau$ portion acts as a tax, raising price above the marginal cost and producing revenues now for the government. In this case, the government's revenue is the box R and the firm's profits are P. The tax τ causes the monopolist to lose the box $H_{\tau m}$ in profits and causes the consumers to lose H_τ in consumer surplus. Notice that in this case the cost of the tax is not just a triangle of consumer surplus but also a box of pure profits. The efficiency cost of the tax is now larger relative to the revenue raised because of the pre-existing distortion.

This example motivates us to use $(\tau+m)^2$ as an approximation to the total efficiency cost of these distortions. Furthermore, $\tau+m$ is the marginal efficiency cost of raising the tax τ; hence, even if the current tax is zero, the marginal efficiency cost is nontrivial.

This example concerned a consumption tax. We next report on an example where a corporate income tax also aggravates the pre-existing distortions. Suppose that a firm faces a demand curve, $D(p) = p^{-\eta}$, and uses a production function, $q = f(k,l) = k^{1/3}l^{2/3}$, but pays a tax, τ_k, on the rental of capital, a tax which is equivalent to an income tax. This reflects both personal taxation on dividends and capital income as well as any corporate income tax. To the extent that debt can be used to finance hiring capital, this rate will equal the personal rate. Otherwise, τ_k will reflect both personal and corporate income taxation. Furthermore, suppose that the corporate income tax plus personal taxation of the owners taxes the pure profits at rate τ_π.

Table 4 reports our findings for $\eta = 2, 4$, and a variety values for τ_k. We set $\tau_\pi = 0.40$ since little was different for other values.

Table 4: Marginal Excess Burden of Taxes on Capital

η	τ_k	MEB_k
2	0.1	0.15
	0.2	0.23
	0.3	0.48
	0.4	2.50
4	0.1	2.17
	0.2	2.62
	0.3	9.19
	0.4	-4.42

We see that even small levels of capital income taxation will have substantial negative effects, particularly if the elasticity of demand is high. Even when $\eta = 2$, the relatively small tax of 40% on capital says that the efficiency gain from reducing τ_k by 1% is \$2.50 per dollar of revenue lost, even though capital costs constitute only a third of total production costs. The MEBs for $\eta = 4$ are extremely high; in fact, at τ_k, a reduction in the tax increases both revenue and economic performance.

The presence of imperfect competition in capital goods markets substantially raises the efficiency costs of the corporate income tax. Since we do not want to destroy the incentives to innovate created by the ability of innovators to markup their prices over marginal cost, it is unwise to further distort the capital goods market by imposing a corporate income tax.

This analysis was static. To examine the dynamic importance of this we recall the findings in Judd (1995), which examines a simple dynamic model. We assume a fixed number of goods, all of which are produced in a monopolistically competitive market. Each good can be used for both consumption and investment, and each of these goods is used in the production of all goods. Judd(1995) uses a representative agent model with elastic labor supply, assumed that pure profits are taxed at the rate τ_Π, and that income on marginal investment is taxed at rate τ_D. For this model, Judd (1995) shows that the long-run optimal choice for τ_D is

$$\tau_D^{opt} = -m\frac{1 + \tau_\Pi\, MEB}{1 + MEB} \tag{2}$$

where m is the markup of price over marginal cost and MEB is the marginal efficiency cost of taxation in general.

This formula has several implications. First, it is negative! If the efficiency cost of taxation is zero or if, as in Diamond-Mirrlees, the tax rate on pure profits is 100%, then the optimal tax is a subsidy that completely neutralizes the monopolistic price distortion. This repeats the old, but often rejected, Robinson (1938) argument.

While our optimal tax formula (2) is clean, it is not clear that the desirable subsidy is economically significant when we use reasonable values for the markup, pure profits tax, and the marginal excess burden. Table 5 addresses this concern. We assume $m \in [.1, .3]$ as suggested by our discussion of price-cost margins. The range for the MEB is a wide range covering most views on the true MEB. In Table 5 we assume that the profits tax is $\tau_\Pi = 0.2$, surely an underestimate that biases the results against our points. Table 5 shows that even if MEB, the shadow price of funds, is nontrivial, the optimal tax substantially reduces the monopolistic distortion.

Table 5: Optimal Tax Rates

MEB m :	.2	.5	1.0	2.0
.05	-.04	-.04	-.03	-.02
.10	-.09	-.07	-.06	-.05
.20	-.17	-.15	-.12	-.09
.30	-.26	-.22	-.18	-.14

When we consider the corporate income tax, we see how far the current system is from being optimal. No one should take this analysis and recommend massive subsidies of capital investment. Instead, we should remember that the efficiency cost of taxation is roughly the square of the distance from the current tax and the optimal tax. Even if it is only feasible to reduce the net tax on capital to zero, or just to eliminate the corporate income tax, considerations of imperfect competition substantially raise our estimates of the resulting economic benefits.

4. The Corporate Income Tax and R&D Tax Credits

Tax analyses usually ignore the innovation process. This is particularly inappropriate when discussing the corporate income tax since corporations are a source of many of the innovations producing economic growth, and private innovation is affected by the corporate income tax since the corporate form is often necessary for an innovator to maximize the potential of successful innovation.

One tax policy that has been advocated to help innovation has been the R&D. tax credit. The advocates of the R&D tax credit normally base their arguments on externalities and spillover effects from an innovating firm to other firms. While such externalities certainly do exist, it is difficult to precisely measure their importance. I will instead consider the importance of the R&D tax credit by focusing on the imperfect competition that is generally associated with firms that engage in a substantial amount of R&D. This approach has the advantage of relying only on markups which have been estimated.

To illustrate the importance of innovation, we examine a simple dynamic model where R&D reduces the cost of producing a product. Consider a firm that is a monopolist for a product and faces a constant elasticity demand curve, $D(p) = p^{-\eta}$. It can also reduce its unit cost by m percent at a cost proportional to m^2. The firm's market power will lead it to charge a price above marginal cost, a markup that is required if a firm is to recover its R&D costs. A corporate income tax will reduce the incentives to make those investments, and reduce the rate of productivity improvements, but an R&D tax credit will partially alleviate this.

There is no need of a table or formula. The results were robust over a large range of parameters. In general, the gain from an R&D tax credit was much greater, generally by a factor 2 and often by a factor of more than 4, than the marginal efficiency cost of raising the necessary revenues. The optimal tax credit always exceeded 10%, and generally was much higher. In fact, in many cases a small R&D tax credit paid for itself!

Again we see that the combination of investment dynamics and imperfect competition reduces economic performance even without taxation, and that the sensible tax policy is to help R&D. This argument would be strengthened if we added the externality arguments that others have used but are ignored here. Any corporate income tax creates an even bigger drag on the economy.

5. The Corporate Income Tax and Private Innovation and Entrepreneurship

Economic growth depends heavily on innovation by individuals and small, unincorporated firms. This may initially sound wrong for many important industries, such as computer hardware and software, where large corporations are the major actors in innovation. This static view misses important historical facts. For example, Microsoft, Apple, Hewlett-Packard, and countless other large corporations began as individuals or small firms. When we consider the impact of the corporate income tax, we need to remember that corporate business are not born, but instead are a mature phase of an ongoing enterprise.

We consider a simple example to illustrate the importance of the corporate income tax. Suppose that a noncorporate firm considers spending funds on research and development projects. Furthermore, suppose that these costs are expensed. We now consider two possibilities for this investment. First, the project could fail producing no revenues. Second, the project succeeds with probability p, but in order to fully exploit the innovation, the firm needs to go to the equity market.

This sets up an asymmetric situation. If the firm fails, its expenses are deducted at the personal tax rate, but if it succeeds the result quasi-rents are taxed at the personal plus the corporate rate. In essence, the corporate income tax gives the government a call option on the quasi-rents of the innovation project. This asymmetric treatment of success and failure will reduce the incentive to innovate. If there were no corporate income tax, and the personal income was a flat tax of τ_p then there would be no distortion on entrepreneur's decisions because of the expensing I assumed.

However, if the corporate income tax, τ_c, were positive, then examination of an entrepreneur's decision of whether to pursue this activity shows that the effective tax rate, τ_E, faced by risk-neutral[5] entrepreneurs is

$$\tau_E = \frac{\tau_c}{1 - \tau_p}$$

This means that if a project costs C to pursue, a risk-neutral entrepreneur will pursue it only if the expected profits are $C\,(1 + \tau_E)$. Projects with expected profits between C and $C\,(1 + \tau_E)$ would be socially valuable but would not be pursued because of the corporate income tax. The effective tax rate reveals an interesting interaction between the corporate and personal tax systems. The effective tax rate due to the corporate income tax is not just τ_c but instead is the corporate rate leveraged by the personal rate. The combination of even moderate personal and corporate rates results in a substantial effective tax rate.

This simple example assumed that the corporate entity can expense all of its costs. This is not true. Therefore, the total effective tax rate on the entrepreneur would be greater due to the other distortions the corporate income tax creates for the corporate entity.

This asymmetry also has important implications for the location of innovative activity. If a corporation spends money on R&D, then it can deduct those expenditures at the same rate at which the income is taxed. Therefore, innovation activity within a corporation is taxed less than innovation by noncorporate entities that later need to incorporate. It is difficult to state precisely the quantitative importance of this bias against noncorporate innovation, but it is another cost adding to the burden of the corporate income tax.

This life-cycle view of a corporation also tells us that corporate income tax revenues overstate the life-cycle tax revenue collected from entrepreneurial activity. The corporate income tax is a tax on winners' earnings. Many, if not most, entrepreneurs lose. These losses include both the value of time of individuals as well as any expenditures on employees, materials, and equipment. The true tax revenue collected on entrepreneurship includes the revenue lost from deductions taken by the losers as well as the taxes collected from the winners.

[5] Risk-neutrality is not a reasonable description of most individuals but allowing risk aversion would make the analysis substantially more complex. Also, I would argue that the personal tax system is where the issues of how to tax idiosyncratic risk is best handled. I don't see why we would want to tax lucky entrepreneurs any differently than we tax lucky football players, movie stars, or real estate investors. So, I look only at the case of risk-neutral entrepreneurs.

The message of this simple example is clear. The revenue collected from entrepreneurs is overstated if we focus on successful entrepreneurs, but distortions created by the corporate income tax distortion are significant.

6. CONCLUSIONS

Harberger (1962) began a long literature on the corporate income tax that has shown it to be a poor tool for raising tax revenue. We extend this analysis by adding elements of risk, imperfect competition, and innovation, all of which are important in any modern economy. Each of these examples produced estimates for the burden of the corporate income tax that exceeds the estimates in Harberger's initial analysis.

When we pursue a more sophisticated analysis that integrates these elements of risk, imperfect competition, entrepreneurship, and innovation, the results will almost surely be even stronger since the effects discussed above are cumulative. The conclusion is clear: the corporate income tax is even more wasteful and damaging than is conventionally thought, and the benefits of eliminating it are high.

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