Taxes, Incorporation, and Productivity*

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Abstract

U.S. businesses can be C-corporations or pass-through entities in the forms of S-corporations, partnerships, and sole proprietorships. C-corporate status conveys benefits from perpetual legal identity, limited liability, potential for public trading of shares, and ability to retain earnings. However, legal changes have enhanced pass-through alternatives, notably through the invention of the S-corporation in 1958, the advent of publicly-traded partnerships in the early 1980s, and the improved legal status of limited liability companies (LLCs) at the end of the 1980s. C-corporate form is typically subject to a tax wedge, which offsets the productivity benefits. We use a theoretical framework in which firms' productivities under C-corporate and pass-through form are distributed as bivariate log-normal. The tax wedge determines the fraction of firms that opt for C-corporate status and also determines overall business output (productivity), the share of output generated by C-corporations, and the sensitivity of this share to the tax wedge. This framework underlies our empirical analysis of C-corporate shares of business economic activity. Long-difference regressions for 1968-2013 show that a higher tax wedge reduces the C-corporate share of net capital stocks, equity (book value), gross assets, and positive net income, as well as the corporate share of gross investment. The C-corporate shares also exhibit downward trends, likely reflecting underlying legal changes. We infer from the quantitative findings that the reduction in the tax wedge since 1968 has expanded overall business productivity by about 4%.

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In an assessment of the 2017 U.S. tax reform, Barro and Furman (2018) focused on the incentives of businesses to invest in capital within a given legal form of organization: C-corporation or various forms of pass-through business. In addition, the analysis considered the impact of differential taxation of C-corporations versus pass-throughs on the incentives to choose one legal form versus another. Reductions in the relevant tax wedge, as in the 2017 reform, tend to raise the frequency of C-corporate ownership. Moreover, if there are typically productivity advantages associated with C-corporate form—as must be the case if many businesses have chosen this form despite the often large tax penalty—then shifts in the form of legal ownership affect overall productivity. This paper assesses the effects of business taxation on choices of legal form and, thereby, on productivity.

Previous Research and Framework

Previous research on choices of C-corporate versus pass-through status includes Mackie-Mason and Gordon (1997), Goolsbee (1998), Goolsbee (2004), and Prisinzano and Pearce (2018). Following Mackie-Mason and Gordon, suppose that firm i has output (or productivity) $Y_c(i) > 0$ in corporate (meaning C-corporate) form and $Y_p(i) > 0$ in non-corporate or pass-through form. The respective tax rates, taken here as proportionate to output, are $\tau_c < 1$ and $\tau_p < 1$. Negative tax rates, constituting subsidies, can be admitted. The tax rates for each legal form are assumed to be the same for all firms, although they could instead be allowed to vary across firms. Firm i opts for corporate form if

$$(1) \qquad (1 - \tau_c)Y_c(i) \geq \left(1 - \tau_p\right)Y_p(i).$$

(We resolve the equality in favor of corporate form, but that assumption is inconsequential.) This condition is analogous to the one derived by Mackie-Mason and Gordon (1997, equations [1] and [2]).

We can rewrite equation (1) as

$$(2) \qquad y(i) \equiv \log\left(\frac{Y_c(i)}{Y_p(i)}\right) \geq \left(\frac{1-\tau_p}{1-\tau_c}\right) \equiv \tau.$$

The term on the far right is the tax wedge, τ; that is, the tax penalty for being corporate rather than pass-through. Equation (2) says that if this wedge is positive, a business has to enjoy at least the offsetting proportionate productivity advantage, *y(i)*, in order to opt for corporate form. If the magnitudes of τ_c and τ_p are much less than one, then $\tau \approx \tau_c - \tau_p$. Generally, τ is increasing in τ_c and decreasing in τ_p.

If tax rates are the same for all firms, the key matter for choices of legal form is the frequency distribution of the proportionate productivity advantage, *y(i)*. In the overall population of firms, the fraction opting to be corporate is one minus the cumulative density of *y(i)* evaluated at the cutoff τ.

Comments on the Setup

The framework treats a firm's potential outputs, $Y_c(i)$ and $Y_p(i)$, as dependent only on the choice of legal form of organization. We could extend the model to include variable factor inputs, such as labor and capital chosen by corporate and pass-through businesses.[1] The tax rates τ_c and τ_p would then have the usual effects on quantities of inputs demanded. If taxes are levied on net business income with labor payments fully expensed, then the tax rates would not directly distort the margins associated with labor input. Similarly, if capital outlays are fully expensed (with loss realizations fully allowed), there would be no direct distortion on the margins associated with capital input (as in King and Fullerton [1984]). This last result applies also to

[1]See, for example, Gravelle and Kotlikoff (1989).

labor when labor has capital-like dimensions; for example, when output and sales depend on lagged labor input.

In the present setup, the only distortion comes from the difference in the tax rates levied on corporations and pass-through businesses; that is, the tax wedge τ given in equation (2). In this setting, the first-best outcome will correspond to $\tau=0$, because distortions arise only when the two forms of business organization are taxed at different rates. The levels of taxation—τ_c and τ_p—will not matter as long as the tax rates are equal. We could extend the framework to have distortions from levels of tax rates as well as from differences between the rates. However, that extension would leave the distortion associated with differential taxation, and that effect is likely to be largely separable from those involving the levels of tax rates. Hence, it seems desirable to focus on a framework that abstracts from choices of factor inputs and in which only differential taxation matters.

The Tax Wedge

To implement equation (2) for U.S. business data, we need a time series for the tax wedge, τ, which depends on the tax rates τ_c on C-corporations and τ_p on pass-through businesses. Conceptually, we think of a business as choosing whether to have a block of income, $Y_c(i)$, taxed on a C-corporate basis or else have a corresponding block, $Y_p(i)$, taxed on a pass-through basis. Although this choice involves a discrete amount of income accruing in one form or the other, the income in each case is "marginal" with respect to other forms of income that owners have. For example, the owners of a C-corporation (shareholders) typically have labor income and other types of asset income. Similarly, in most cases, the owners of a pass-through business have significant income in other forms. For this reason, we think that the relevant rates τ_c and τ_p correspond more closely to marginal than to average tax rates.

Corporate-profits taxes and pass-through taxes

Figure 1 shows an approximate empirical measure of the tax wedge, τ, based on data available for the United States back to 1914. The rate τ_{prof}, the top federal rate on C-corporate profits, is our principal measure of the C-corporate tax rate, τ_c.[2] (A later section considers taxes on dividends.) The use of the top rate on C-corporate profits ignores the graduation in the tax schedule that prevailed from 1937 to 2017. We think the neglect of this graduation is satisfactory because most of taxable profits appear to have been taxed (on average and at the margin) at the top rate.[3]

Our measure of the pass-through tax rate, τ_p, is the average marginal tax rate or AMTR from the federal individual income tax, as constructed by Barro and Sahasakul (1983), Barro and Redlick (2011), and the Tax Policy Center.[4] This measure uses as weights a broad concept of labor income. An important consideration is that owners of pass-through businesses likely have relatively high incomes and, therefore, relatively high tax rates in the graduated individual income tax. For this reason, the AMTR may understate the pass-through tax rate. However, the AMTR is well above a simple average of marginal tax rates (see Barro and Sahasakul [1983]). Moreover, Cooper et al. (2016, Figure 7) estimate that the average[5] federal income-tax rates in 2011 on individual income derived from pass-through entities were 15.9% for partnerships, 25.0% for S-corporations, and 13.6% for sole proprietorships. These numbers are lower, overall, than the AMTR of 22.0% that we used for 2011.

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[2]Data are in IRS, *Statistics of Income Bulletin*, Fall 2003, and in recent issues of IRS *Statistics of Income*.

[3]We are neglecting the taxation of corporate profits by state governments. Preliminary analysis suggests that the average state tax rate on C-corporate profits (after factoring in the deductibility of these levies for federal purposes) was between 0.04 and 0.05 since 1979, compared to the top federal rate between 0.34 and 0.46. Goolsbee (2004) has examined corporate-profits taxes across states.

[4]This variable does not count levies other than federal income taxes (particularly state income taxes and self-employment taxes) that may apply to pass-through income.

[5]Their concept of an average tax rate is the ratio of the addition to federal income taxes due to the inclusion of the whole of pass-through income to the total amount of pass-through income.

Figure 1 shows the U.S. time series for τ_{prof}, τ_p, and τ. Note that the wedge, computed from equation (2) as τ=log($\frac{1-\tau_p}{1-\tau_{prof}}$), peaked at 0.48 in 1954 and 1968 and has since had a strong downward trend. To understand the post-1968 pattern, note first that, in 1968, the C-corporate tax rate, τ_{prof}=0.53, was well above the pass-through rate, τ_p=0.24, so that τ was very high, 0.48. Then, up to 1986, τ_{prof} fell to 0.46, while τ_p rose to 0.26—both changes contributed to a fall in τ, which reached 0.32. The Reagan 1986 tax reform, applying between 1986 and 1988, is well-known to have lowered individual marginal income-tax rates. However, the fall in the C-corporate rate, to τ_{prof}=0.34, more than offset the fall in τ_p to 0.20, so that τ fell further, to 0.20. From 1988 to 2017, τ_{prof} was virtually unchanged, but τ_p rose back to 0.24, as the Reagan tax changes were substantially undone. Therefore, τ fell again, to 0.15. Finally, in 2018, the large cut in τ_{prof}, to 0.21, more than offset the fall in τ_p, which reached 0.22. Consequently, τ became negative, -0.01, for the first time.

In the earlier period, the main elements behind the increases in τ were the rises in τ_{prof} in World War I, the late 1930s, World War II, and the Korean War. The wedge, τ, did not change appreciably between 1954 and 1969.

Dividend tax rates

As mentioned, our main measure of the C-corporate marginal tax rate, τ_{prof}, is the federal rate on C-corporate profits. This measure neglects the double-taxation of C-corporate income, whereby owners are taxed in a second stage on dividends and capital gains. One point is that dividend payouts and, hence, owners' dividend taxes can be deferred by corporate retention of earnings (an option unavailable for pass-through businesses). The corporate retention leads to increases in stock prices, which result in capital-gains taxes if owners choose to realize their

gains. However, in a reasonable baseline setting, retained earnings affect the timing of dividends but not their present value. Or, to put it alternatively, the present value of capital gains and losses created by retentions equals zero.[6] In this context, we can neglect capital-gains taxes as an approximation.[7]

Another point is that double-taxation can be mitigated by replacing dividends with stock repurchases. Despite this option, C-corporations typically choose to pay dividends, and the tax rate on these payments should enter into the overall C-corporate tax rate. However, this effect would be small if shareholders have relatively low tax rates on dividends. In this context, Rosenthal and Austin (2016, Figure I) document a large and increasing share of U.S. corporate stock held by entities that have zero or low tax rates, including retirement plans, non-profits, and foreigners (whom they treat as non-taxable). Our analysis assumes that the fraction of foreign holdings held in taxable form equals that of domestic holdings. In that case (when we also use data from Poterba [2004, Table 1]), we get the series for the estimated fraction of U.S. corporate stock held in taxable form as the red graph in Figure 2. This fraction declined from 88% in 1958 to 30% in 2015. We assume that this share for ownership of corporate stock applies to the share of dividends accruing to taxable entities.

We also constructed a dividend-income-weighted average marginal federal income-tax rate on dividends (or dividend AMTR), a concept that parallels the one used for the labor-income-weighted average marginal tax rate in Figure 1. Before the sharp cut in the qualified-

[6]These results apply if a corporation's expected rate of return on retained earnings equals the discount rate used to price the corporation's stock. We also need a transversality or no-Ponzi condition, which requires the discount rate, asymptotically, to exceed the expected growth rate of dividends. This last condition parallels one needed for Ricardian equivalence—that is, so that government borrowing does not affect the present value of taxes that have to be collected.

[7]We are neglecting here the tax advantage from the deferral of dividend payments; that is, returns accumulate in the interim free of dividend taxes.

dividend tax rate in 2003, the dividend AMTR, shown by the blue graph in Figure 2,[8] is higher than the labor-income-weighted AMTR in Figure 1. To measure the overall dividend tax rate, τ_d, we multiplied the fraction of corporate stock held in taxable form (red graph in Figure 2) by the dividend AMTR (blue graph) to get the tax wedge shown by the green graph (which plots the magnitude of $log(1-\tau_d)$.[9] In the theory, the contribution of C-corporate taxation to the tax wedge, τ, in equation (2) should enter as $\log(1-\tau_c) = \log(1-\tau_{prof}) + \log(1-\tau_d)$, where τ_{prof} is the tax rate on C-corporate profits.

The Corporate Productivity Advantage

We start with a list of productivity benefits that associate with corporate legal ownership. We include historical context on how U.S. legal changes have shifted these benefits when compared to those arising from pass-through alternatives.

1. A corporation is a distinct and perpetual legal entity, the structure of which—unlike the typical partnership—is not compromised substantially by the departure of its owner(s). Kuran (2004) argues that, despite the availability of partnerships, the lack of independent corporate identity was a major constraint on economic development of Muslim countries after the Industrial Revolution. The Ottoman Empire instituted its first law of corporations only in 1908, and Egypt followed within a year.

2. C-corporations offer the potential for convenient public trading of shares, often on organized markets. This public trading is important for the

[8]The data for 1960-2012 were provided by Dan Feenberg, based on the National Bureau of Economic Research's TAXSIM program. The value for 2013 was unavailable and was assumed to equal that for 2012. Values before 1960 were estimated by Tatjana Kleinberg, using issues of IRS, *Statistics of Income, Individual Income Tax Returns*. A similar measure of the dividend AMTR (but including state income taxes) appears in Poterba (2004, Table 1).
[9]Our assumption is that taxable foreign stock holdings face the same marginal tax rate on dividends as that on domestic holdings.

raising of capital and for gaining information from market prices. Notably, this information is useful for executive-compensation decisions, bond financings, and valuing interests of departing owners. Starting in 1981 with Apache Petroleum, public trading became available for limited partners in the form of master limited partnerships (MLPs) or publicly traded partnerships (PTPs). Subsequently, these types of ownership were mostly limited to companies operating in the energy sector, due to restrictions on a company's sources of income specified in a 1987 federal law. However, some financial firms, such as Blackstone, qualified for MLP status. (Blackstone is currently considering a shift to C-corporate form, following the 2017 tax reform and the apparently successful transformation of KKR into a C-corporation in 2018.[10])

3. Limited liability for C-corporations. This status applies also to pass-through S-corporations, which were created in 1958. However, S-corporations have major limitations on numbers and types of shareholders—although the allowable number increased substantially over time from the original 10 to the current 100.[11] As an example of restrictions, S-corporate shareholders have to be U.S. entities and cannot be corporations or partnerships. In addition, there can be only one class of stock with respect to rights to distributions and liquidation proceeds. The major pass-through alternative to the S-corporation is the partnership, which does not feature the restrictions on ownership that apply to S-corporations. The partnership form has a long history (even in Muslim

[10]See *Institutional Investor*, July 19, 2018.
[11]The number rose to 15 in 1976, 25 in 1981, 35 in 1983, 75 in 1997, and 100 in 2004. Additionally, the effective number of shareholders was expanded by the treatment of some family members as constituting a single shareholder. See Sicular (2014).

countries), but a key innovation was the invention of the limited liability company (LLC) in Wyoming in 1977. LLCs, which offer limited liability for owners,[12] are regulated at the state level and became increasingly popular after the IRS determined in 1988 that LLCs could be taxed as pass-through partnerships. Thus, although an LLC is not formally a partnership, it effectively functions that way—and the IRS data on "partnerships" include most LLCs.[13] The growth in the share of "partnerships" in limited-liability form—more specifically, in LLCs—has been dramatic since the mid-1990s. DeBacker and Prisinzano (2015, Figure 9) report that, from 1996 to 2011, the share of partnerships with limited liability rose from 30% to 80%, and the share that were LLCs went from 10% to 64%.

4. The retention of earnings is permissible in C-corporations. This retention may be useful for financing of investment and for deferring taxes on dividends. Partnerships and S-corporations can also retain earnings, but the owners are taxed as though all the earnings had been distributed. That is, there is no deferral of owners' taxable income.

5. C-corporations and pass-through businesses have numerous differences in regulations, filing rules, requirements to hold regular meetings, and government supervision.

Overall, legal changes over recent decades have favored pass-through alternatives to C-corporations—notable here are the invention of the S-corporation in 1958, the advent of publicly-traded partnerships in the early 1980s, and the IRS tax ruling in 1988

[12]In contrast, limited partnerships have limited liability for limited partners but not for the general partner(s), who actively manage the business and have signing authority.
[13]A multiple-member LLC that opts for partnership (rather than corporate) tax status files the usual partnership information return, Form 1065.

that allowed LLCs to be taxed as pass-through partnerships. However, we have not been successful in quantifying the precise timing whereb changes in legal provisions affect the share of business economic activity carried out within C-corporations.

We now describe our formal treatment of the frequency distribution of the corporate productivity advantage, $y \equiv \log(\frac{Y_c}{Y_p})$, which appears in equation (2) (where we now drop the index i). We consider this distribution at a point in time, which features a given legal/regulatory regime applying to C-corporations and pass-through alternatives. Over time, changes in laws and regulations can shift the entire distribution of *y*. Implicitly, we are also holding constant the structure of production across sectors—changes in this composition can affect the distribution of *y*; that is, benefits from corporate form may be more useful in some types of business than in others.

We assume that $log(Y_c)$ and $log(Y_p)$ are distributed bivariate normal with respective means and standard deviations of μ_c, σ_c, μ_p, and σ_p. The correlation coefficient between the two random variables is ρ. This specification implies that $y \equiv \log(\frac{Y_c}{Y_p})$ is distributed normally with mean $\mu=\mu_c-\mu_p$ and variance $\sigma^2 = \sigma_c^2 + \sigma_p^2 - 2\rho\sigma_c\sigma_p$. The fraction of firms that opt to be pass-through is the cumulative normal value for *y* corresponding to the cutoff τ, and the fraction corporate is one minus this cumulative normal value.[14]

We want to assess the impact of τ on overall business output (productivity) and the fraction of this output generated by the corporate sector. To make these calculations, we have to

[14]The fraction corporate is $1-\Phi[(\tau-\mu)/\sigma]$, where $\Phi(\cdot)$ is the cumulative standard normal density.

derive the expectations of corporate output, Y_c, conditional on $y \equiv \log(\frac{Y_c}{Y_p}) \geq \tau$, and of pass-through output, Y_p, conditional on $y < \tau$.

The appendix shows that the expectation of Y_c, conditional on y, is given by:

$$(3) \qquad E(Y_c|\mathrm{y}) = \exp\{\mu_c + \left(\frac{1}{\sigma^2}\right) \cdot \left[\sigma_c \cdot \left(\sigma_c - \rho\sigma_p\right) \cdot (y - \mu) + 0.5 \cdot (1 - \rho^2)\sigma_c^2\sigma_p^2\right]\}.$$

Equation (3) says that $E(Y_c|\mathrm{y})$ effectively emerges from a regression of Y_c on y. Using equation (3), the appendix shows that corporate output is given by:

$$(4) \qquad Prob.(y \geq \tau) \cdot E(Y_c|y \geq \tau) = [\exp(\mu_c + 0.5\sigma_c^2)] \cdot [1 - \Phi(\tau')],$$

where $\tau' = \left(\frac{1}{\sigma}\right)\left[\tau - \mu - \sigma_c\left(\sigma_c - \rho\sigma_p\right)\right]$, Prob. denotes probability, and $\Phi(\cdot)$ is the cumulative standard normal density. The formula for pass-through output is analogous except that the parameters related to *c* and *p* are switched, and τ is replaced by $-\tau$ in the expression for τ'.

The quantitative results involve five parameters: μ_c, σ_c, μ_p, σ_p, and ρ. However, one parameter can be eliminated as a normalization related to the level of overall output. We choose a normalization so that the maximum output, corresponding to a zero tax wedge, τ=0, equals 1.0.

We know in the data (described below) that the C-corporate share of economic activity is high—in a range of roughly 0.6 to 0.9—even when the tax wedge, τ, is as high as 0.5. To replicate this pattern, the model requires μ_c to be well above μ_p—that is, corporate productivity must typically be well above pass-through productivity. A gap of μ_c-μ_p=0.75, assumed in the baseline specification, delivers reasonable values for the corporate share of economic activity. (The levels of the two μ parameters, which turn out to be μ_c=*-0.146* and μ_p=*-0.896* in the baseline case, are chosen to get the peak level of output equal to 1.0, given the values of the other parameters.)

The baseline specification assumes, in the absence of direct evidence, that the two standard deviations, σ_c and σ_p, are equal. We assume that the levels of these standard deviations correspond to the dispersion in U.S. plant-level productivity found in empirical studies. Foster, Haltiwanger, and Syverson (2008) use data from the U.S. Census of Manufacturers for 1977, 1982, 1987, 1992, and 1997. From this broad data set, they select information on 11 products that are sufficiently homogeneous so that quantities (and, hence, physical productivity) can be directly calculated across plants.[15] Based on these data, they report (in their Table 1) a standard deviation of 0.26 for the log of physical total factor productivity (TFPQ). Hsieh and Klenow (2009, Table II) use the same underlying data to compute the dispersion of the log of revenue-based total factor productivity (TFPR) for a much broader array of manufacturing plants. They find that this standard deviation was 0.49 in 1997 and slightly lower before that.[16] Since the findings from Foster, Haltiwanger, and Syverson's 11 homogeneous products may not be representative even of the manufacturing sector, we use Hsieh and Klenow's results to set the common standard deviation at $\sigma_c=\sigma_p=0.5$ in the baseline specification of our model. The alternative of $\sigma_c=\sigma_p=0.25$ (corresponding to Foster, Haltiwanger, and Syverson) applies in an alternative case.

Finally, in the absence of direct evidence, we assume that the correlation coefficient, ρ, between $log(Y_c)$ and $log(Y_p)$ is positive and set it to 0.25 in the baseline. We assume $\rho=0.5$ in an alternative specification. The results turn out not to be highly sensitive to variations in ρ.

[15]The products are boxes, bread, carbon black, coffee, concrete, flooring, gasoline, block ice, processed ice, plywood, and sugar.

[16]They report (in their Table I) substantially higher standard deviations for TFPQ, around 0.8. However, their TFPQ values are not actually observed—they are inferred from their TFPR values given an assumed elasticity of substitution between alternative products in final demand. Foster, Haltiwanger, and Syverson (2008, Table 1) calculate a TFPR value, 0.22, that is only slightly below their TFPQ value.

Figures 3-7 give the model's results for the baseline parameter values: μ_c=*-0.146*, μ_p=*-0.896*, σ_c= σ_p=*0.5*, and ρ=*0.25*. Figure 3 shows that the fraction of firms opting to be corporate declines monotonically with the tax wedge, τ. For τ between 0 and 0.5 (the empirical range indicated in Figure 1), the corporate share of numbers is between 0.66 and 0.89. However, it is unclear that the number of firms is an empirically meaningful concept, and we focus on results related to corporate and total output.

Figure 4 shows the relation of overall output (productivity) to the tax wedge, τ. Because the only distortion in the model is this tax wedge, the maximum of output occurs at τ=*0*. (As mentioned, the parameters were chosen, as a normalization, so that this maximal output equals 1.0.) Figure 5 shows explicitly the marginal effect of τ on output (and productivity). This marginal effect is positive when τ<*0* and negative when τ>*0*.

Note that we are using the revealed preference of business owners to infer the effects of the tax wedge, τ, on overall output and productivity. Specifically, when τ>*0*, a firm opts to be corporate only if the productivity advantage associated with corporate form is sufficient to justify the tax penalty. Moreover, a firm at the margin must have a productivity advantage that exactly compensates for the tax penalty.

Figure 6 shows the relation of the corporate share of output to the tax wedge, τ. At a given τ, the corporate output share exceeds the corporate share of numbers, shown in Figure 3. This pattern applies because, when μ_c>μ_p and σ_c=σ_p, the typical corporate firm is more productive that the typical pass-through firm. The results for the corporate output share in Figure 6 can be matched with data, described below, on the C-corporate share of business economic activity. In particular, the model (with the baseline parameters) implies that the corporate output share is between 0.79 and 0.89 when τ in Figure 1 is in the range from 0.13 to

0.48 that applies in the main regression sample from 1968 to 2013. This predicted range of corporate output shares accords roughly with the data—but, of course, the relative values of the parameters μ_c and μ_p were chosen to deliver this match.

Figure 7 shows the marginal effect of the tax wedge, τ, on the corporate share of output. Consistent with Figure 6, this marginal effect is negative throughout. Quantitatively, the marginal effect in Figure 7 is between -0.24 and -0.35 when τ in Figure 1 is in the range from 0.13 to 0.48 that applies in the regression sample from 1968 to 2013. This result suggests that a linear relation between the corporate output share and the tax wedge may be a reasonable approximation; that is, the slope does not vary greatly over the relevant range of τ. The marginal effects in the model (Figure 7) should correspond to regression coefficients in a linear relation between the C-corporate share of economic activity and the tax wedge. The magnitudes of regression coefficients found empirically turn out to accord reasonably well with those generated by the model with the baseline parameters.

The results in Figures 3-7 depend on the baseline parameter settings. Table 1 shows how the predictions about the corporate output share, Y_c/Y, and the slope of this share with respect to τ change when different parameter values are assumed. The table considers alternative values of σ_c, σ_p, and ρ. We focus here on implications for the slope of the corporate output share with respect to τ when τ is the range from 0.13 to 0.48.

With the baseline parameters, shown as specification (1) in Table 1, the slope—that is, the marginal effect of τ on the corporate output share—varies in the relevant range of τ between -0.24 and -0.35. When σ_c and σ_p are each reduced in specification (2) from the baseline value of 0.5 to 0.25, the slope varies in the relevant range between -0.11 and -0.53; that is, more widely than in the baseline.

Specification (3) raises the correlation coefficient, ρ, from the baseline value of 0.25 to 0.5. This change has little impact on the results; in particular, the slope now varies in the relevant range between -0.23 and -0.42.

Specifications (4) and (5) allow for differences between σ_c and σ_p. In specification (4), where σ_p is lowered to 0.25 and σ_c is kept at 0.5, the slope varies in the relevant range from -0.17 to -0.34. In specification (4), where σ_c is lowered to 0.25 and σ_p is held fixed at 0.5, the slope varies from -0.30 to -0.49.

Overall, the allowance for alternative values of σ_c, σ_p, and ρ widens the range of admissible slopes of the corporate output share with respect to τ. Instead of being confined to an interval from -0.24 to -0.35, the range can be more like -0.1 to -0.5. These results relate to the regression evidence discussed below.

C-Corporate Shares of Economic Activity

We have several empirical measures of the C-corporate share of businesses' economic activity, based on IRS data and mostly covering the period 1958 to 2013.[17] (See the various items under Internal Revenue Service in the References.) Since it is unclear how to relate the measures of business economic activity in the model to those in the data, we think it instructive to consider the overall patterns revealed by the various empirical constructs.

Figures 8-10 apply to stock measures of business economic activity—net capital stocks, equity (book value), and gross assets. These variables are available for C-corporations, S-corporations, and partnerships, but not for sole proprietorships. The partnership numbers on

[17]These data do not include economic activity by governments, non-profits, real estate investment trusts (REITs), and regulated investment companies (RICs).

net capital stocks and equity were interpolated for part of the sample, based on data available from the IRS every two years from 1959 to 1975 and annually for 1977-1982 and 1988-2013.

Figure 8 has shares of business net capital stocks (in the total of business that includes C-corporations, S-corporations, and partnerships). The C-corporate share was 0.95 in 1958 and trended downward to 0.53 in 2013. The main offsetting increase, shown in the figure, was in the partnership share, which went from 0.04 in 1958 to 0.40 in 2013. Legal changes noted before, especially for LLCs, are likely responsible for much of this trend, but it is hard to be precise on the timing. The share for S-corporations was 0.004 in 1958 (the first year of existence), rose to 0.025 in 1986, then jumped upward to 0.074 by 1999. The share then fell to 0.067 in 2013, probably because of increased competition from partnership form, especially LLCs.

Figure 9 has shares of business equity (book value). The trends are similar to those for net capital stocks, although the share of C-corporations in equity at 0.69 in 2013 is notably higher than that for net capital stocks. Correspondingly, the partnership share in 2013 was 0.29. There is also more of an indication that S-corporations are being driven out of the market, with the share down to 0.024 in 2013, compared to a peak of 0.038 in 1990. Eventually, the attractiveness of the LLC may make the S-corporation obsolete.

Figure 10 has shares for business gross assets. This concept of C-corporate share was used by Mackie-Mason and Gordon (1997). The trends in business gross assets are similar to those for net capital stocks and equity, but the C-corporate share of gross assets has not declined as much—the share in 2013 was 0.75, whereas that for partnerships was 0.22. The S-corporation share of gross assets in 2013 was 0.033, compared to 0.037 in 1990.

Figures 11 and 12 apply to business net income, which is a flow measure of economic activity. Variants of these data were used by Mackie-Mason and Gordon (1997) and Prisinzano

and Pearce (2018).[18] Figure 11 shows shares in positive net income (excluding businesses with losses). In this case, data are available for sole proprietorships as well as C-corporations, S-corporations, and partnerships. The shares of positive net income are highly volatile because of the strong sensitivity of the various forms of net income to the business cycle. However, recent trends are similar to those shown in Figures 8-10. From 1979 to 2013, the C-corporate share of positive net income fell from 0.71 to 0.43, the partnership share rose from 0.09 to 0.31, the S-corporate share increased from 0.02 to 0.15 (but has been flat since 2001), and the sole proprietor share fell from 0.18 to 0.11.

Figure 12 shows shares in overall business net income—thereby including businesses with losses. These share measures are even more volatile than those in Figure 11 because of the extreme sensitivity of the various forms of negative net income to the business cycle.

Figure 13 shows data from the Bureau of Economic Analysis (BEA) on the corporate share of business gross investment.[19] These data, available from 1901 to 2017, have the drawback of combining C- corporations with S-corporations (originating in 1958). On the plus side, the BEA data may be a useful supplement to the IRS information because the two agencies draw mostly from different sources.[20] Surprisingly, the BEA data indicate that the corporate

[18]As discussed by Prisinzano and Pearce (2018), double-counting of net income applies particularly for partnerships. These considerations seem unimportant for net capital stocks, equity, and gross investment (considered below), but numerous aspects of double-counting arise for gross assets.

[19]The BEA also reports the share of the business capital stock held by corporations (a combination of C- and S-corporations), based on a perpetual-inventory method. However, these data are problematic because they do not reflect, in a timely way, the effects on business ownership of stocks of capital that arise from changes in ownership; for example, when a business shifts from C-corporate to LLC status or vice versa. In the BEA data, these ownership changes do not show up contemporaneously as shifts in ownership of capital stocks—that are picked up only over time when investment outlays are associated with the new form of ownership. See Bureau of Economic Analysis (2003, p. M-26). Goolsbee (1998) says that he used the BEA data on corporate share of capital stock from 1900 to 1939. However, he actually used, apparently because of confusion over the BEA table headings, the data on corporate share of gross investment.

[20]The BEA data are gathered primarily from the Economic Census conducted every five years by the Census Bureau. The BEA interpolates these data over non-Census years in a sophisticated manner involving a variety of sources, including the BEA's survey of plant & equipment expenditures, IRS data, and multiple other government surveys that focus on specific sectors. See Bureau of Economic Analysis (2003, 2019).

share of gross investment shows no clear trend over the period that coincides with the various IRS series. For example, the BEA's corporate investment share varies only between 84% and 89% from 1974 to 2017.

Regression Framework

Baseline results

The main regression analysis relates the C-corporate shares of net capital stock (Figure 8), equity (Figure 9), gross assets (Figure 10), and positive net income (Figure 11) to the tax wedge, τ. We start with the measure of τ that neglects the dividend tax rate, τ_d—because we think that our other measures of tax rates are more reliable. We discuss subsequently the effects from introducing τ_d into the regressions.

As previously noted, the tax wedge τ graphed in Figure 1 depends on the federal C-corporate top tax rate, τ_{prof}, our representation of the C-corporate tax rate, and the AMTR on individual income, which is our measure of the pass-through tax rate, τ_p. Specifically, $\tau=\log\left(\frac{1-\tau_p}{1-\tau_{prof}}\right)$ from equation (2). The regressions enter the two parts of τ separately—as $log(1-\tau_{prof})$ and $log(1-\tau_p)$—and then check whether the sum of the two estimated coefficients differs significantly from the theoretical value of zero. Additional regressions use the corporate shares of gross investment (Figure 13), although these data combine C-corporations with S-corporations.

In principle, we would like to isolate variables, such as changes in the legal/regulatory environment and shifts in the composition of production, that influence the relative attractiveness of C-corporate and pass-through forms. As mentioned before, most legal changes over recent decades have favored pass-through alternatives to C-corporations. However, we have been unable to quantify the timing in the response of C-corporate shares of economic activity to these

legal changes or to shifts in the composition of production. In the regressions, we allow for linear and quadratic trends as crude ways to proxy for these omitted determinants.

Level regressions for C-corporate shares, as implemented in Mackie-Mason and Gordon (1997, Table III), are probably not meaningful. Specifically, as is evident from Figures 8-11, the C-corporate share measures have strong persistence and may be non-stationary. This problem was noted by Prisinzano and Pearce (2018, Tables IV and V), who emphasized regressions (for variables based on C-corporate shares of net income) with annual first-differences. However, this specification is likely to be heavily influenced by measurement error, particularly because the timing between changes in the tax system and changes in C-corporate shares are not well determined. Given these concerns, our empirical analysis relies on long-difference estimation; specifically, on 10-year changes in C-corporate or corporate shares and the tax-rate variables. Because this procedure creates or intensifies serial dependence in the error terms for the overlapping data, we use the Newey-West procedure with a bandwidth of ten or more years to construct standard errors of the estimated coefficients.

Table 2, parts 1 and 2, has regressions where the dependent variable is the ten-year difference of the C-corporate share of net business capital stocks (columns 1 and 2), of equity or book value (columns 3 and 4), of gross assets (columns 5 and 6), and of positive net income (columns 7 and 8).[21] The sample period is 1968 to 2013. In these regressions, the only regressors are a constant (which picks up a trend in the levels) and the ten-year changes in the

[21]Mackie-Mason and Gordon (1997, Table III) and Prisinzano and Pearce (2018, Tables II-V) note that tax effects would have the opposite sign for business negative net income if these losses were expected ex ante (and to the extent that losses can be taken for tax purposes). Hence, they look separately at regressions involving positive or negative net income. We find tax effects of roughly zero if we look at C-corporate shares of business negative net income.

two tax-rate variables, $log(1-\tau_{prof})$ and $log(1-\tau_p)$. Columns 2, 4, 6, and 8 add a year variable, which allows for a quadratic trend in the levels.

Consider first the regressions without a quadratic trend (columns 1, 3, 5, and 7). The estimated coefficients on $log(1-\tau_{prof})$ are all positive, as predicted; that is, the estimated effects of τ_{prof} on the C-corporate shares are negative. These estimated coefficients are statistically significantly from zero at least at the 5% level for net capital stock, equity, and gross assets (columns 1, 3, and 5) but not for positive net income (column 7). The magnitudes of these estimated coefficients are in a range between 0.2 and 0.6. The estimated coefficients on $log(1-\tau_p)$ are all negative, as predicted; that is, the estimated effects of τ_p on the C-corporate shares are positive. These estimated coefficients are statistically significantly different from zero at least at the 5% level. The magnitudes of these estimated coefficients are in a range from 0.3 to 1.0.

The hypothesis of equal magnitudes of the coefficients of the two tax variables (as implied by the form of the tax wedge, τ, in equation [2]) is rejected at a p-value less than 0.01 for net capital stock and positive net income (columns 1 and 7), with a p-value of 0.04 for gross assets (column 5), and with a p-value of 0.34 for equity (column 3). Thus, some of the econometric results deviate from the precise theoretical restriction—possibly because the empirical measures of tax wedges are imperfect. Nevertheless, the estimated magnitudes of the coefficients accord roughly with those predicted by the model. As noted before, the predicted magnitude of marginal tax-wedge effects in Figure 7 was between 0.24 and 0.35 when τ was in the range from 0.13 to 0.48 that applies in the regression sample, 1968 to 2013.

Regressions that allow for a quadratic trend are in Table 2, columns 2, 4, 6, and 8. The magnitudes of the estimated tax coefficients are smaller than before, but the broad nature of the results does not change. For example, the estimated coefficients on $log(1-\tau_{prof})$ are still all

positive, but statistically significantly different from zero at the 1% level only for gross assets (column 6) and at the 10% level for equity (column 4). The estimated coefficients on $log(1-\tau_p)$ are still all negative, and all except for equity (column 4) are statistically significantly different from zero at least at the 5% level. Similar to before, the hypothesis of equal magnitudes of the two tax coefficients is rejected at a p-value less than 0.01 for net capital stock and positive net income (columns 2 and 8), with a p-value of 0.10 for gross assets (column 6), and with a p-value of 0.73 for equity (column 4). Also as before, the magnitudes of the estimated coefficients accord roughly with those predicted by the model (Figure 7).

The estimated trends in C-corporate shares (corresponding to the constant terms in the regressions) are significantly negative at the 1% level for net capital stocks, equity, and gross assets (columns 1, 3, and 5 of Table 2). These results accord with the patterns shown in Figures 8-10, although the negative trend for equity seems to set in only around 1980. The estimated trend is significantly negative at the 5% level for positive net income (column 7). This result accords with Figure 11, which shows a downward trend since around 1980. The quadratic trend terms in C-corporate shares (corresponding to the year variables in the regressions) are significantly negative at the 1% level for equity, gross assets, and positive net income (columns 4, 6, and 8) and at the 5% level for net capital stock (column 2).

The results show that there are substantial trend-like changes in our concepts of C-corporate shares of economic activity over the regression sample, 1968-2013. At this point, we have not related these trends to fundamental forces, such as the legal/regulatory changes that we discussed qualitatively or to shifts in the composition of output.[22] On a positive note, the

[22]We have a sectoral breakdown from the IRS for business gross assets and net income. The eight sectors are agriculture, construction, finance-insurance-real estate, manufacturing, mining, services, trade, and transportation-communications-utilities. We have not found any clear effects from changing sectoral composition on C-corporate shares of gross assets or positive net income.

estimated tax effects on C-corporate shares emerge even when the trend terms are held constant. And the magnitudes of these estimated tax effects accord in a rough way with theoretical expectations.

We should stress that the estimated effects of the tax changes from 1968 to 2013 involve a substantial overall drop in the tax wedge, τ (see Figure 1). Thus, this tax effect goes against the estimated trends, which associate with declining C-corporate shares of economic activity (Figures 8-11). That is, on their own, the tax changes from 1968 to 2013 should have led to increases in the C-corporate share of economic activity.

Table 2, part 3, has results using the BEA data on corporate share of business gross investment (Figure 13). As already noted, the BEA information combines C- and S-corporations; hence, the tax variables do not match up precisely with the corporate data (which partly include pass-through businesses). However, this consideration may not be too important because the data on S-corporate shares of net business capital stocks in Figure 8 suggest that S-corporations would not comprise a major share of business gross investment.

The estimated tax coefficients with the BEA data in columns 9 and 10 align well with those found with the IRS data in columns 1-8. These results obtain even though the estimated trends are very different for the BEA and IRS data. For example, in column 9, the estimated trend for the BEA corporate gross investment share is nil, consistent with the pattern in Figure 13, whereas the corresponding trends for the IRS C-corporate share data (columns 1, 3, 5, and 7 and Figures 8-11) were strongly negative.

The results on business gross investment in columns 11 and 12 apply to the period 1924-2017, which can be used because of the long-term availability of the BEA data. The

estimated coefficients accord roughly with those from the shorter sample, 1968-2013. However, the fit of the regression is poor for 1924-1967.

As mentioned, the 10-year difference estimates shown in Table 2 calculate the standard errors of the estimated coefficients by the Newey-West procedure with a bandwidth of 10 years. The results change little if the bandwidth is raised to 15 years (to allow for serial dependence in the error term independently from that created by the overlapping data). For example, with a 10-year bandwidth, the estimated standard errors on the two tax coefficients in column 1 were 0.105 and 0.110. These values change with a 15-year bandwidth to 0.110 and 0.111, respectively. Similar changes apply to the other regressions in Table 2.

Results with dividend taxes

Table 3 gives a selection of results when the dividend tax wedge, $log(1-\tau_d)$ (shown in Figure 2), is added to the regressions from Table 2. We use as dependent variables the C-corporate share of net capital stock, equity, gross assets, and positive net income. The results presented in Table 3 exclude a year variable (quadratic time trend). In the theory, the coefficient on $log(1-\tau_d)$ should be positive and equal to that on $\log(1-\tau_{prof})$, where τ_{prof} is the tax rate on C-corporate profits.

The estimated coefficients in Table 3 on the C-corporate and pass-through tax variables, $log(1-\tau_{prof})$ and $log(1-\tau_p)$, are close to those shown in Table 2 (columns 1, 3, 5, and 7). Those for the constant (trend) are similar except for the higher magnitude of the coefficient in the case of equity (Table 2, column 3, and Table 3, column 2).

For the C-corporate share of equity (Table 3, column 2), the estimated coefficient on $log(1-\tau_d)$ is significantly positive at the 1% level and significantly larger than that on $log(1-\tau_{prof})$ with a p-value of 0.06. For gross assets, the coefficient on $log(1-\tau_d)$ is significantly positive at

the 1% level but insignificantly different from that on $log(1-\tau_{prof})$ (p-value of 0.7). For net capital stock and positive net income, the estimated coefficients on $log(1-\tau_{d})$ are positive but insignificantly different from zero. These values differ from those on $log(1-\tau_{prof})$ with a p-value of 0.07 in the case of net capital stock and 0.7 for positive net income.

Overall, the inclusion of a dividend tax rate leaves intact the main conclusions from Table 2.[23] In some cases, there is an indication (in Table 3) that dividend taxation adds to the tax rate on C-corporate profits as a disincentive for carrying out business in C-corporate form.

Historical Productivity Effects

Table 4 shows the implications of the model for the productivity effects from the sizable cut in the tax wedge, τ, that occurred over recent decades. We neglect the effects of dividend taxation and, therefore, return to the setting of Table 2. We gauge the effects of τ on overall business productivity (output) from the results shown in Figure 4—with the regression results in Table 2 providing some evidence that these modeling predictions would be informative. Note that these effects on productivity reflect only the associated changes in legal form of organization—the present analysis does not deal with effects on capital accumulation (the focus of Barro and Furman [2018]).

Table 4 shows the main historical tax changes—discussed before—that affected the tax wedge, τ, since the start of the regression sample in 1968. In 1968, when τ was at 0.476, the model's associated level of productivity, corresponding to Figure 4, is 0.964 (relative to the peak, which was normalized to equal 1.0). By 1986, the cut in τ to 0.318 is estimated to have raised productivity to 0.986 or by 2.3% compared to 1968. The further cut in τ to 0.199 in 1988 is then estimated to raise productivity to 0.996 or by another 1.0%. In 2017, τ reached 0.151, which

[23]This conclusion applies to the full set of regressions contained in Table 2, not only to those shown in Table 3.

implied a 0.2% rise in productivity (to 0.998) compared to 1988. Finally, the 2017 tax reform implied that τ fell to -0.006 in 2018, which raised estimated productivity by another 0.2% (to 1.000). Note that, although the cut in τ in 2018 is large (from 0.151 to -0.006), the estimated response of productivity (due to the shift in legal form of organization) is only moderate. A key point here is that the comparatively low level of the initial τ (0.15 in 2017) implies that the economy is gauged to be operating in a range where the sensitivity of productivity to the tax wedge is small (Figures 4 and 5).

In terms of cumulative effects, the full cut in the tax wedge, τ, from 1968 to 2018 is estimated to have raised overall business productivity by 3.7%. Thus, this cumulative effect is substantial. Moreover, in the model, this change corresponds to reduced distortion and, hence, to a gain in efficiency. In terms of annual productivity growth, the contribution from this 50-year cumulation of cuts in tax wedges—and the resulting shifts in legal form of organization—would be around 0.1 percentage points per year.

In the background, there are also substantial trend effects, which led to declines in the various measures of C-corporate shares of economic activity. However, since we have not related these trend changes to fundamentals, we cannot assess these changes from a welfare standpoint.

Concluding observations

We dealt theoretically and empirically with the relation between tax rates and the composition of U.S. business economic activity between C-corporate and pass-through forms. The main tax wedge that we isolated from 1968 to 2013 involves the tax rate on C-corporate profits considered relative to the average marginal tax rate on individual income. We also found effects from the tax rate on dividends. Our estimates indicate that the declining tax wedge since

1968 raised the C-corporate share of economic activity. And we further estimated, based on the revealed preference of owners with respect to choices of business legal form, that the cumulative effect from this reduced tax wedge raised overall business productivity by about 4%.

Despite the overall decline in the tax wedge, our measures of C-corporate share of economic activity mostly exhibit strong downward trends since 1968. We attributed these trends particularly to legal changes that favored pass-through forms, such as LLCs. But we were unable to gauge these effects quantitatively.

In future research, we plan to examine further the determinants of the longer-term trends in the composition of business between C-corporations and pass-through alternatives. Part of this investigation involves legal changes and part the changing composition of production. These variables complement the effects from tax rates, which we will also examine in more detail.

References

Barro, Robert J. and Jason Furman. 2018. "Macroeconomic Effects of the 2017 Tax Reform." *Brookings Papers on Economic Activity* Spring: 257-345.

Barro, Robert J. and Charles J. Redlick. 2011. "Macroeconomic Effects from Government Purchases and Taxes." *Quarterly Journal of Economics* 126(1): 51-102.

Barro, Robert J. and Chaipat Sahasakul. 1983. "Measuring the Average Marginal Tax Rate from the Individual Income Tax." *Journal of Business* 56(4): 419-452.

Bureau of Economic Analysis. 2003. *Fixed Assets and Consumer Durable Goods in the United States, 1925–99*. Washington, DC: U.S. Government Printing Office, September.

Bureau of Economic Analysis. 2019. "Fixed Assets Accounts Table." Web resource: https://apps.bea.gov/itable/index_FA.cfm. Accessed January 22.

Cooper, Michael, John McClelland, James Pearce, Richard Prisinzano, Joseph Sullivan, Danny Yagan, Owen Zidar, and Eric Zwick (2016). "Business in the United States: Who Owns It, and How Much Tax Do They Pay?" in Jeffrey R. Brown, ed., *Tax Policy and the Economy*, 30, Chicago, University of Chicago Press.

DeBacker, Jason and Richard Prisinzano (2015). "The Rise of Partnerships." *Tax Notes*, June 29.

Foster, Lucia, John Haltiwanger, and Chad Syverson (2008). "Reallocation, Firm Turnover, and Efficiency: Selection on Productivity or Profitability?" *American Economic Review* 98(1): 394-425.

Goolsbee, Austan. 1998. "Taxes, Organizational Form, and the Deadweight Loss of the Corporate Income Tax." *Journal of Public Economics* 69(1):143-152.

Goolsbee, Austan. 2004. "The Impact of the Corporate Income Tax: Evidence from State Organizational Form Data." *Journal of Public Economics* 88: 2283-2299.

Gravelle, Jane G. and Laurence J. Kotlikoff. 1989. "The Incidence and Efficiency Costs of Corporate Taxation when Corporate and Noncorporate Firms Produce the Same Good." *Journal of Political Economy* 97(4): 749-780.

Hogg, Robert V. and Allen T. Craig. *Introduction to Mathematical Statistics*, 2nd ed., New York, Macmillan.

Hsieh, Chang-Tai and Peter J. Klenow. 2009. "Misallocation and Manufacturing TFP in China and India." *Quarterly Journal of Economics* 124(4): 1403-1448.

Internal Revenue Service. 1958-2013. *Statistics of Income: Corporation Income Tax Returns*. Washington, D.C.: Government Printing Office.

Internal Revenue Service. 1958-1976. *Statistics of Income: Business Income Tax Returns*. Washington, D.C.: Government Printing Office.

Internal Revenue Service. 1977-1981. *Statistics of Income: Sole Proprietorship Returns*. Washington, D.C.: Government Printing Office.

Internal Revenue Service. 1982-2013. *Statistics of Income Bulletin: Sole Proprietorship Returns*. Washington, D.C.: Government Printing Office.

Internal Revenue Service. 1977-1982. *Statistics of Income: Partnership Returns*. Washington, D.C.: Government Printing Office.

Internal Revenue Service. 1983-2013. *Statistics of Income Bulletin: Partnership Returns*. Washington, D.C.: Government Printing Office.

King, Mervyn A., and Don Fullerton. 1984. "Chapter 2: The Theoretical Framework." In *The Taxation of Income from Capital: A Comparative Study of the United States, the United Kingdom, Sweden, and West Germany*. Chicago: University of Chicago Press.

Kuran, Timur. 2004. "Why the Middle East Is Economically Underdeveloped: Historical Mechanisms of Institutional Stagnation." *Journal of Economic Perspectives* 18(3): 71-90.

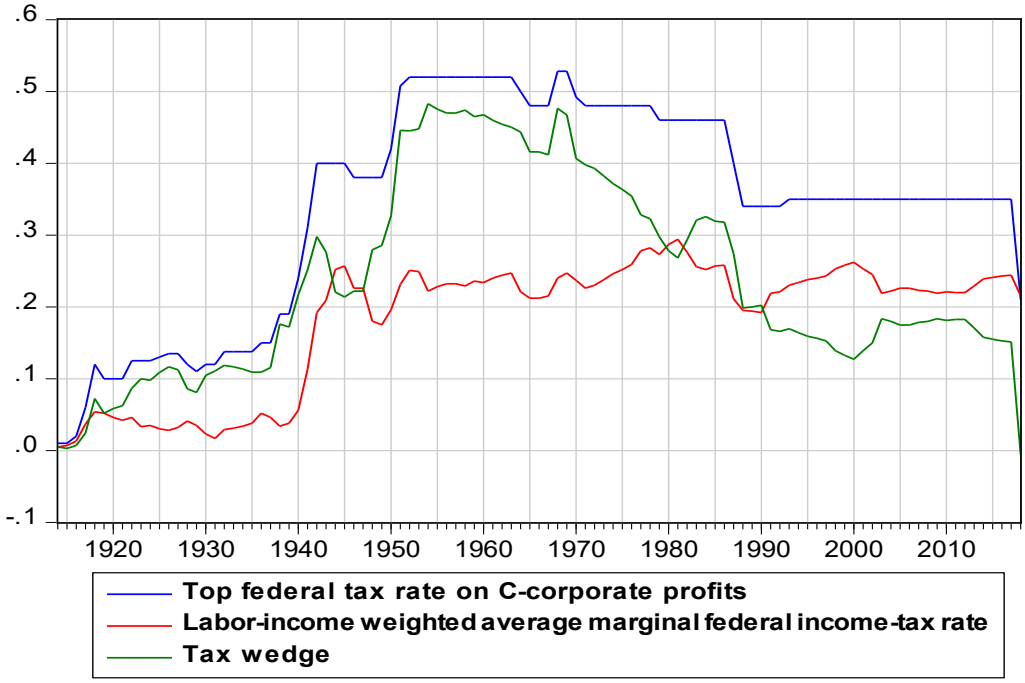
Mackie-Mason, Jeffrey K. and Roger H. Gordon. 1997. "How Much Do Taxes Discourage Incorporation?" *Journal of Finance*. 52(2): 477-505.

Prisinzano, Richard and James Pearce. 2018. "Tax-Based Switching of Business Income." Working paper W2018-2, Penn-Wharton Budget Model, March.

Rosenthal, Steven M. and Lydia S. Austin. 2016. "The Dwindling Taxable Share of U.S. Corporate Stock." *Tax Notes*, May 16.

Sicular, David R. 2014. "Supchapter S at 55—Has Time Passed this Passthrough By? Maybe Not." *Tax Lawyer*, 68(1), Fall, 185-238.

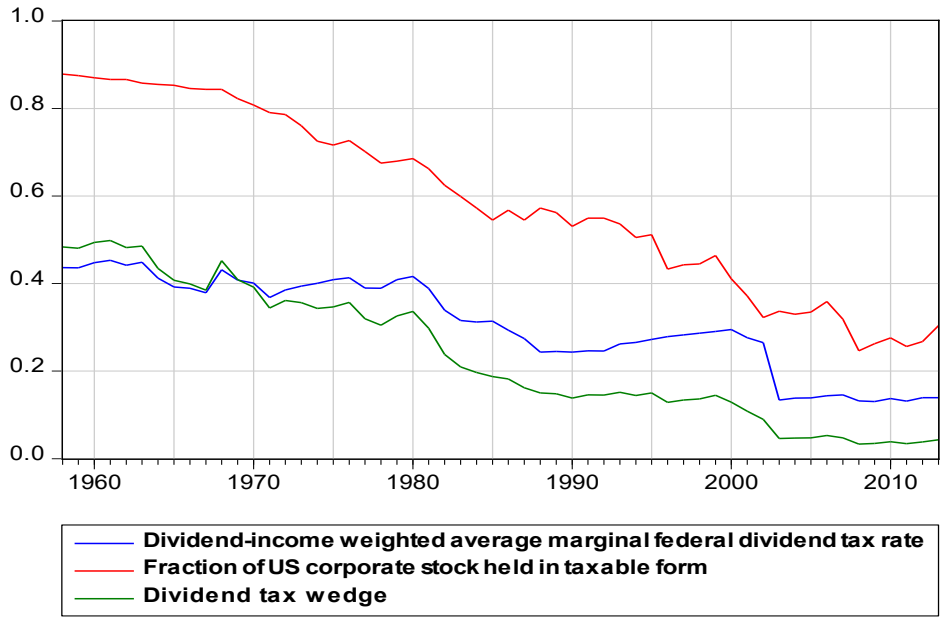
Figure 1 Estimated U.S. Tax Wedge, 1914-2018



Note: τ_{prof} (measured by the top federal tax rate on C-corporate profits) corresponds to the blue graph and τ_p (measured by the labor-income weighted average marginal tax rate from the federal income tax) to the red graph. The tax wedge, $\tau = \log(\frac{1-\tau_p}{1-\tau_{prof}})$ from equation (2), corresponds to the green graph.

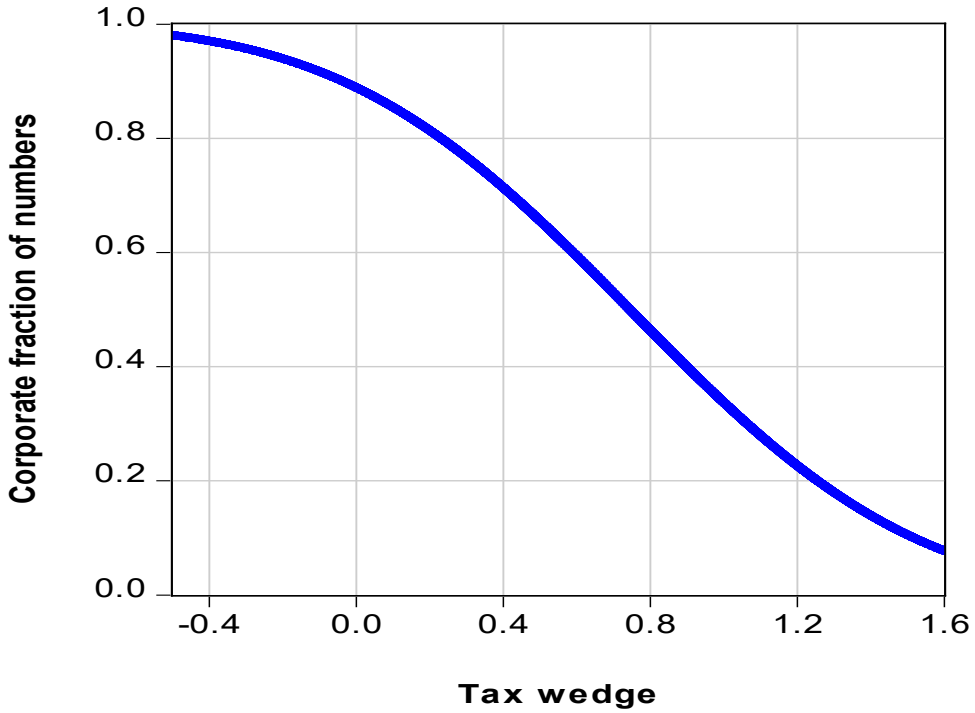
Figure 2

Dividend Tax Rates



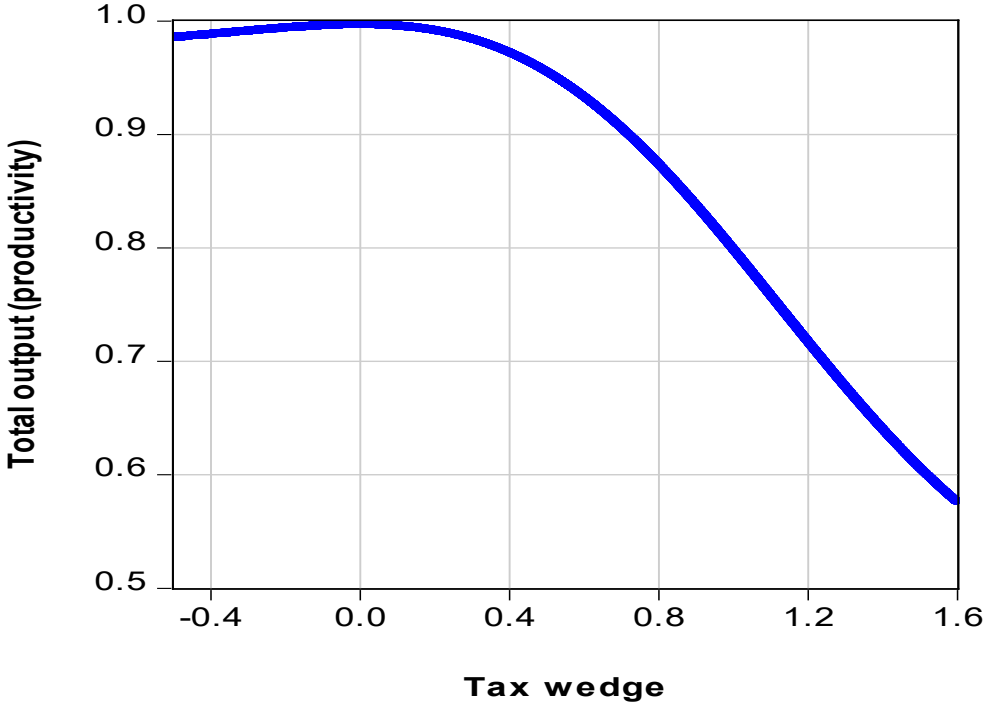
Note: The dividend-income weighted average marginal federal dividend tax rate in the blue graph was provided for 1960-2012 by Dan Feenberg, using the TAXSIM program of the National Bureau of Economic Research. (Qualified dividends are used since 2003.) The value for 2013 was unavailable and was assumed to equal that for 2012. Values before 1960 are estimates made by Tatjana Kleineberg, using issues of IRS, *Statistics of Income, Individual Income Tax Returns*. The fraction of U.S. corporate stock held in taxable form in the red graph is from Rosenthal and Austin (2016, Figure I) and Poterba (2004, Table 1). We measure the dividend tax rate, τ_d, as the product of the values in the blue and red graphs. The dividend tax wedge in the green graph is the magnitude of $log(1- \tau_d)$.

Figure 3 Corporate Fraction of Numbers of Firms as Function of Tax Wedge, τ



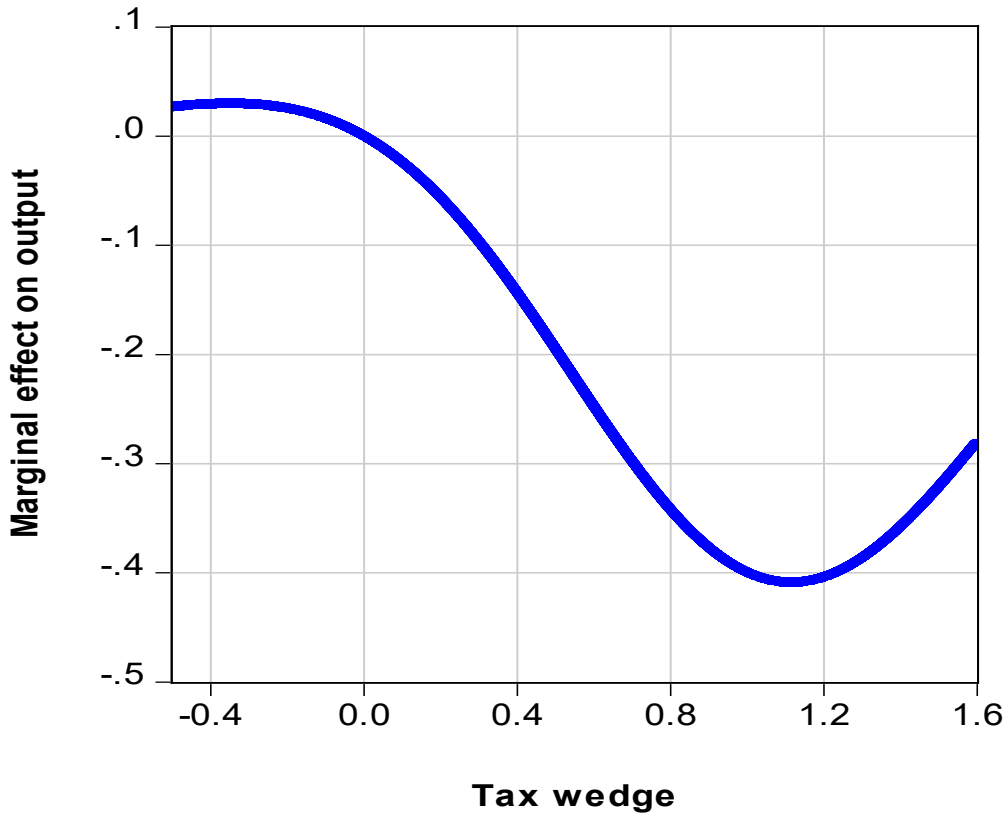
Note: This graph uses the baseline parameter values: μ_c=*-0.146*, μ_p=*-0.896*, σ_c= σ_p=*0.5*, and ρ=*0.25*. The corporate share of numbers of firms declines monotonically with the tax wedge, given in equation (2) as $\tau = \log(\frac{1-\tau_p}{(1-\tau_c)})$, where τ_c is the tax rate on C-corporations and τ_p is the pass-through tax rate. This share approaches 1 as τ approaches -∞ (as τ_p approaches 1) and approaches 0 as τ approaches ∞ (as τ_c approaches 1).

Figure 4 Total Output (Productivity) as Function of Tax Wedge, τ



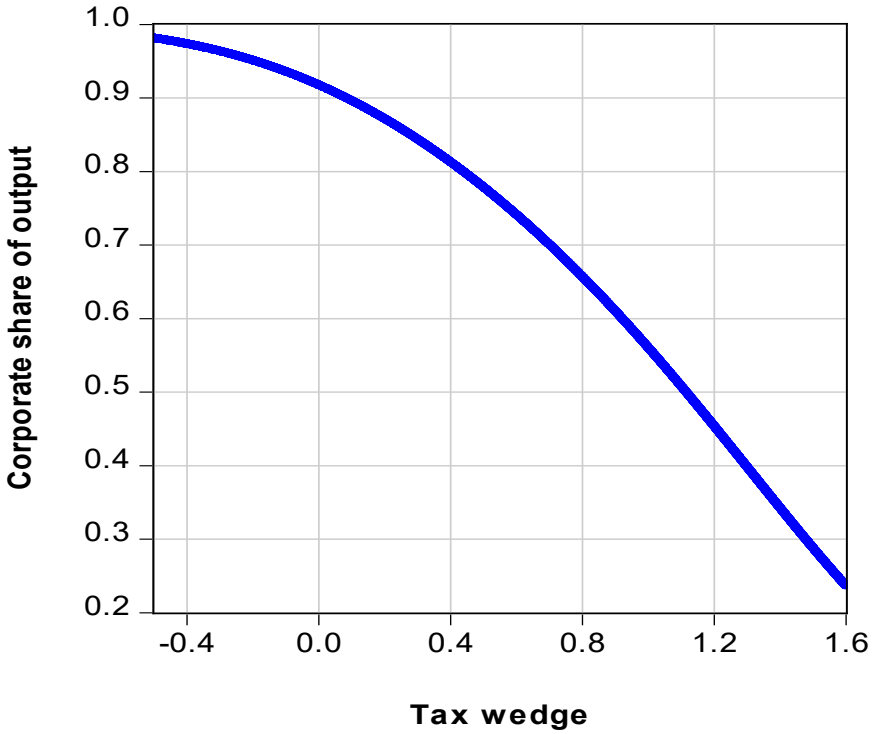
Note: This graph uses the baseline parameter values: μ_c=*-0.146,* μ_p=*-0.896,* σ_c= σ_p=*0.5*, and ρ=*0.25*. Total output peaks at a value normalized to 1.0 at a tax wedge, τ, of 0. Total output falls with τ when $\tau>0$ and rises with τ when $\tau<0$. See also the note to Figure 3.

Figure 5 Marginal Effect of τ on Total Output (Productivity)



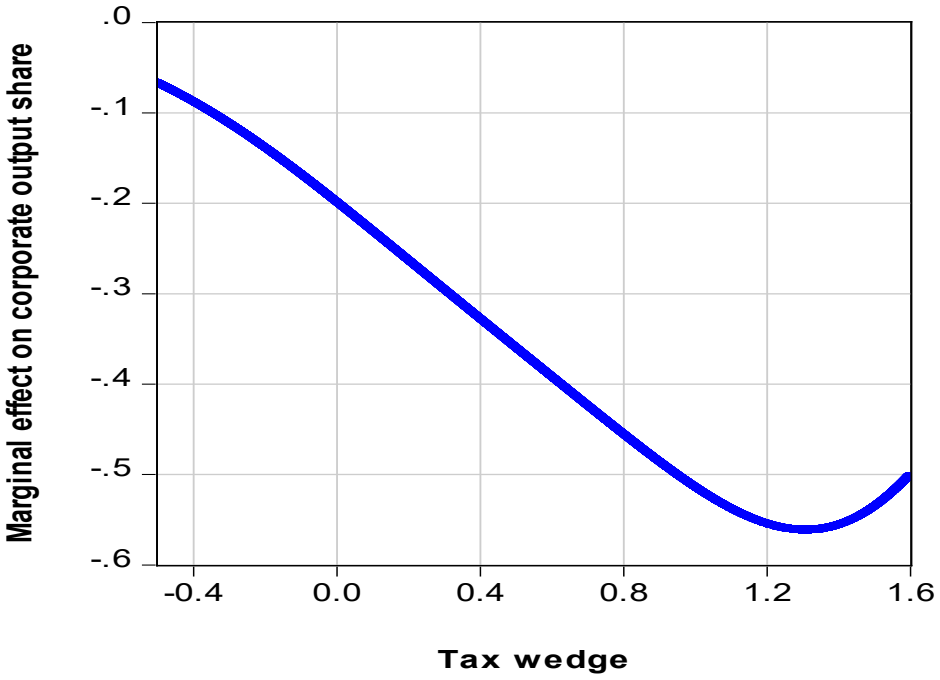
Note: This graph uses the baseline parameter values: μ_c=*-0.146,* μ_p=*-0.896,* σ_c= σ_p=*0.5*, and ρ=*0.25*. The marginal effect of the tax wedge, τ, on total output is positive for τ<*0* and negative for τ>*0*. See also the note to Figure 3.

Figure 6 Corporate Share of Output as Function of Tax Wedge, τ



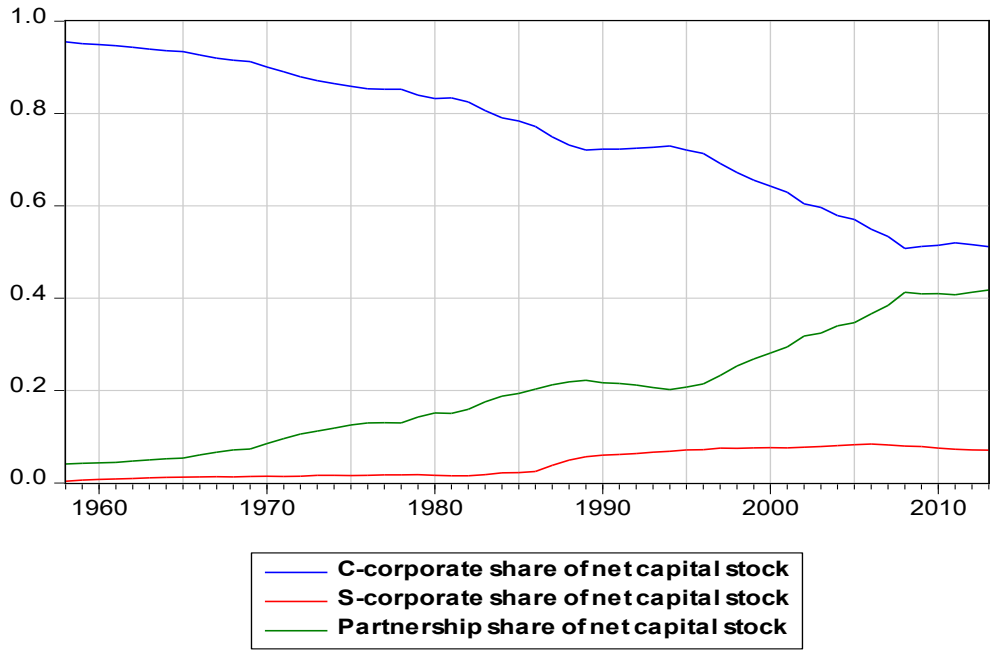
Note: This graph uses the baseline parameter values: μ_c=*-0.146,* μ_p=*-0.896,* σ_c= σ_p=*0.5*, and ρ=*0.25*. The corporate share of output declines monotonically with the tax wedge, τ. This share approaches 1 as τ approaches -∞ and approaches 0 as τ approaches ∞. For τ between 0.13 and 0.48 (as in Figure 1 for the regression period 1968-2013 used later), the corporate output share is between 0.79 and 0.89. See also the note to Figure 3.

Figure 7 Marginal Effect of τ on Corporate Output Share



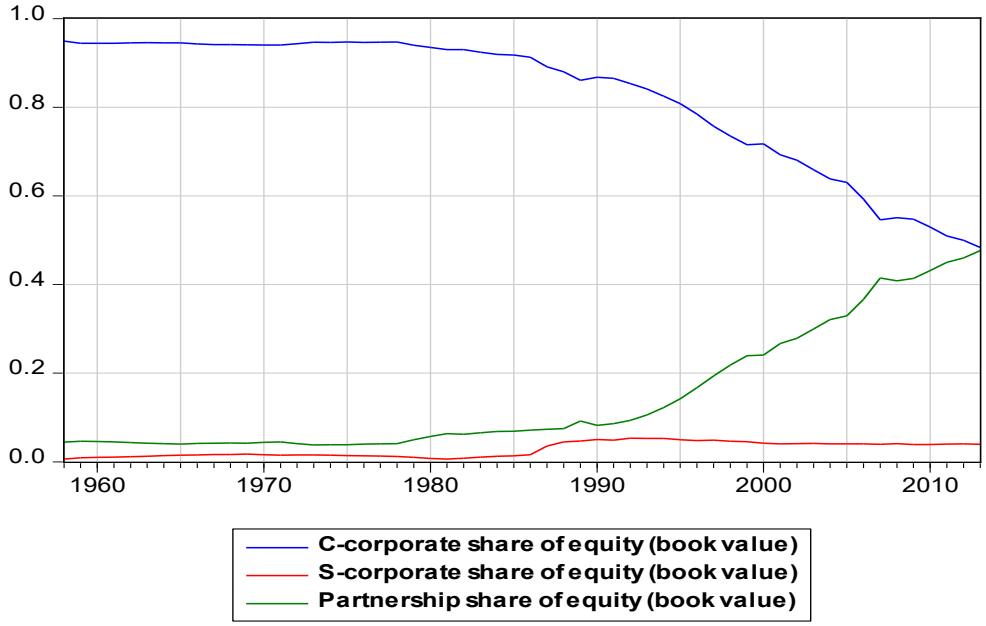
Note: This graph uses the baseline parameter values: μ_c=*-0.146,* μ_p=*-0.896,* σ_c= σ_p=*0.5*, and ρ=*0.25*. The marginal effect of the tax wedge, τ, on the corporate output share is negative throughout. For τ between 0.13 and 0.48 (as in Figure 1 for the regression period 1968-2013 used later), the slope is between -0.24 and -0.35. See also the note to Figure 3.

Figure 8 Shares of Business Net Capital Stock



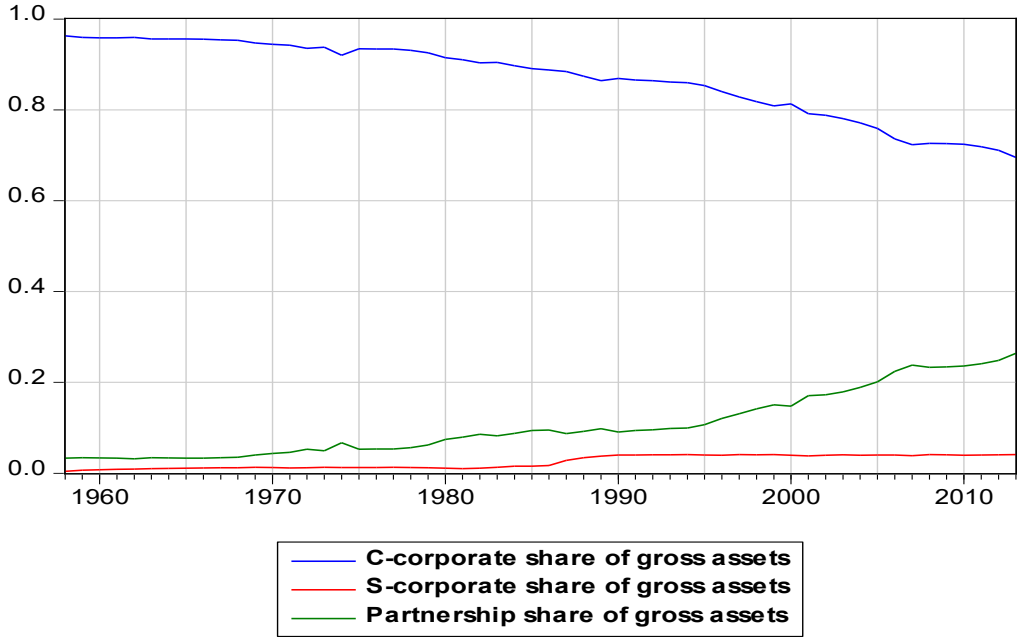
Note: The underlying data on business capital stocks net of depreciation are from various IRS sources, noted in the references. Data for sole proprietorships are unavailable. The partnership numbers are interpolated based on data available every two years from 1959 to 1975 and annually for 1977-1982 and 1988-2013.

Figure 9 Shares of Business Equity (Book Value)



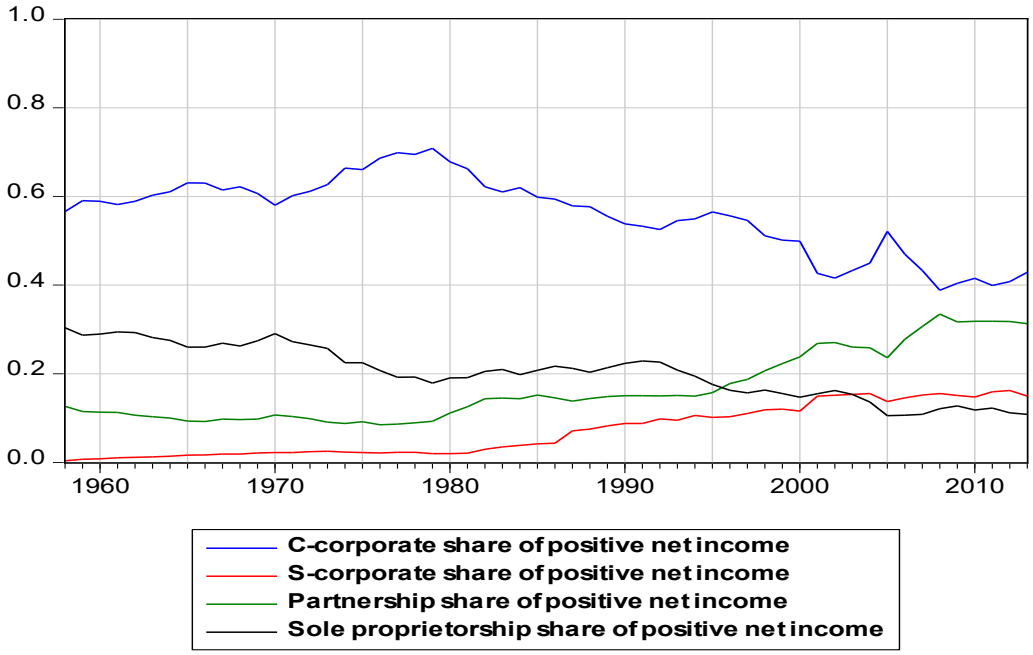
Note: The underlying data on business equity (book value) are from various IRS sources, noted in the references. Data for sole proprietorships are unavailable. The partnership numbers are interpolated based on data available every two years from 1959 to 1975 and annually for 1977-1982 and 1988-2013.

Figure 10 Shares of Business Gross Assets



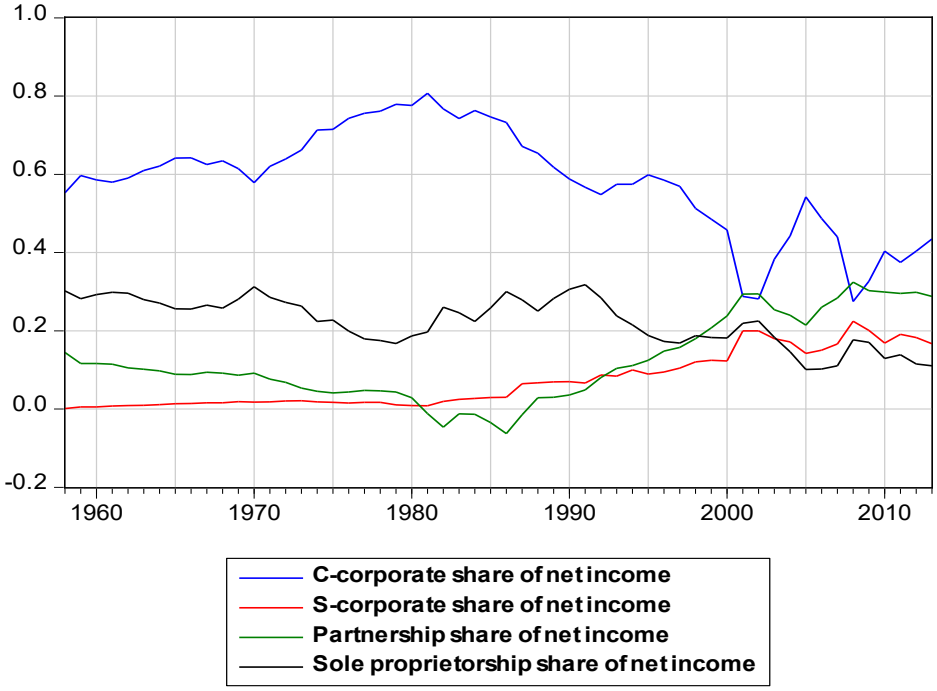
Note: The underlying data on business gross assets are from various IRS sources, noted in the references. Data for sole proprietorships are unavailable.

Figure 11 Shares of Business Positive Net Income



Note: The underlying data on business positive net income are from various IRS sources, noted in the references.

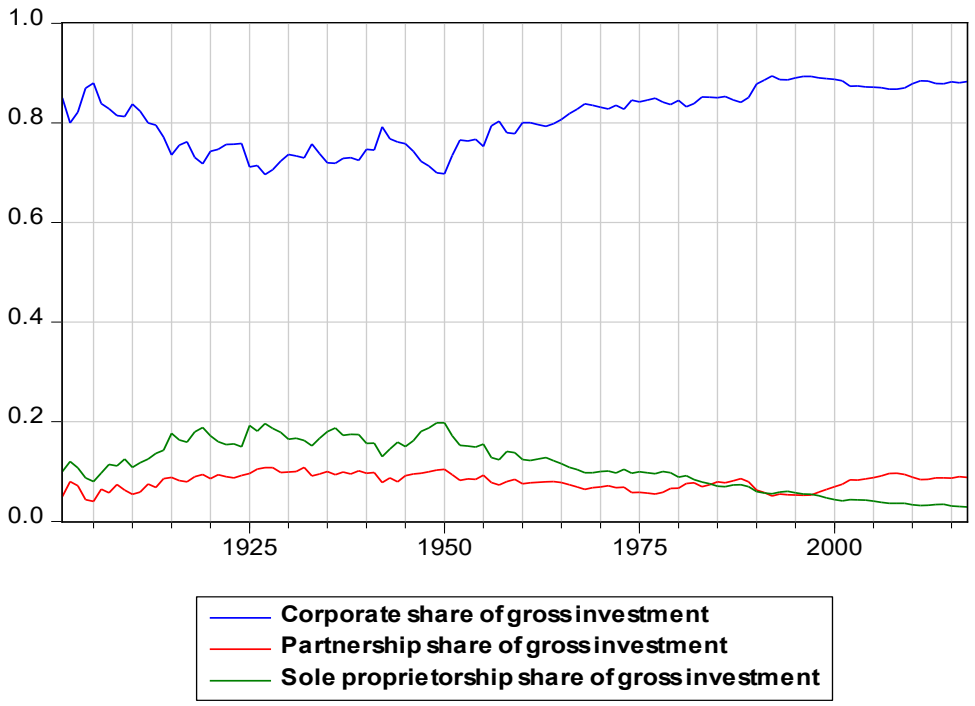
Figure 12 Shares of Business Net Income



Note: The underlying data on business net income are from various IRS sources, noted in the references.

Figure 13

Shares of Business Gross Investment (BEA Data)



Note: The underlying data are from Bureau of Economic Analysis (2019). These corporate numbers combine C-corporations with S-corporations (which originated in 1958).

Table 1

Model Predictions on Corporate Output Share with Alternative Parameters

	σ_c	σ_p	ρ	τ	Y_c/Y	Slope
(1)	0.5	0.5	0.25	0	0.917	-0.20
	"	"	"	0.13	0.889	-0.24
	"	"	"	0.48	0.786	-0.35
(2)	0.25	0.25	0.25	0	0.995	-0.04
	"	"	"	0.13	0.986	-0.11
	"	"	"	0.48	0.885	-0.53
(3)	0.5	0.5	0.5	0	0.951	-0.17
	"	"	"	0.13	0.925	-0.23
	"	"	"	0.48	0.812	-0.42
(4)	0.5	0.25	0.25	0	0.968	-0.12
	"	"	"	0.13	0.949	-0.17
	"	"	"	0.48	0.860	-0.34
(5)	0.25	0.5	0.25	0	0.926	-0.23
	"	"	"	0.13	0.892	-0.30
	"	"	"	0.48	0.753	-0.49

Note: These results for corporate output share, Y_c/Y, and the marginal effect of the tax wedge, τ, on this share correspond to the model described in the text and to the results shown in Figures 5 and 6. The results are for alternative values of the underlying parameters, as shown. Specification (1) is the baseline used in Figures 6 and 7. The mean parameters are set throughout at μ_c=*-0.146* and μ_p=*-0.896*. These values generate a peak level of output, Y, of 1.0 when the other parameters are set at their baseline values.

Table 2, part 1

Regressions for C-Corporate Shares of Net Business Capital Stock and Equity (Book Value)

	(1)	(2)	(3)	(4)
Dependent variable:	**C-corporate share of net business capital stock**		**C-corporate share of equity (book value)**	
Independent variables:				
Constant (trend)	-0.1039*** (0.0128)	-0.0712*** (0.0138)	-0.1191*** (0.0316)	0.0332 (0.0167)
C-corporate top federal profits tax rate, log(1-τ_{prof})	0.267** (0.105)	0.163 (0.097)	0.590** (0.254)	0.137* (0.077)
AMTR federal individual income tax, log(1-τ_p)	-0.542*** (0.110)	-0.382*** (0.135)	-0.805** (0.356)	-0.109 (0.140)
Years since 1968 (quadratic trend)	--	-0.00119** (0.00046)	--	-0.00517*** (0.00057)
p-value for equal magnitude of tax coefficients	0.0000	0.0004	0.34	0.73
R-squared	0.50	0.66	0.30	0.93
s.e. of regression	0.0250	0.0208	0.0653	0.0205

***Significant at 1%, **significant at 5%, *significant at 10%.

Table 2, part 2

Regressions for C-Corporate Shares of Gross Assets and Positive Net Income

	(5)	(6)	(7)	(8)
Dependent variable:	**C-corporate share of gross assets**		**C-corporate share of positive net income**	
Independent variables:				
Constant (trend)	-0.0631*** (0.0112)	-0.0186*** (0.0034)	-0.0482** (0.0212)	0.0178 (0.0163)
C-corporate top federal profits tax rate, log(1-τ_{prof})	0.234*** (0.080)	0.093*** (0.033)	0.222 (0.161)	0.012 (0.126)
AMTR federal individual income tax, log(1-τ_p)	-0.339*** (0.085)	-0.121*** (0.036)	-1.006*** (0.280)	-0.683** (0.265)
Years since 1968 (quadratic trend)	--	-0.00162*** (0.00013)	--	-0.00240*** (0.00088)
p-value for equal magnitude of tax coefficients	0.043	0.099	0.0023	0.0026
R-squared	0.39	0.89	0.47	0.63
s.e. of regression	0.0215	0.0094	0.0521	0.0439

***Significant at 1%, **significant at 5%, *significant at 10%.

Table 2, part 3

Regressions for Corporate Shares of Gross Investment (BEA data)

	(9)	(10)	(11)	(12)
Dependent variable:	**Corporate share of gross investment, 1968-2013**		**Corporate share of gross investment, 1924-2017**	
Independent variables:				
Constant (trend)	-0.0008 (0.0118)	0.0320** (0.0119)	0.0062 (0.0076)	0.0040 (0.0193)
C-corporate top federal profits tax rate, log(1-τ_{prof})	0.254** (0.099)	0.150 (0.094)	0.123* (0.070)	0.117 (0.078)
AMTR federal individual income tax, log(1-τ_p)	-0.390*** (0.104)	-0.229* (0.127)	-0.261** (0.120)	-0.258** (0.121)
Years since 1968 or 1924 (quadratic trend)	--	-0.00119*** (0.00038)	--	0.00004 (0.00035)
p-value for equal magnitude of tax coefficients	0.001	0.083	0.050	0.053
R-squared	0.41	0.63	0.14	0.15
s.e. of regression	0.0234	0.0187	0.0327	0.0328

***Significant at 1%, **significant at 5%, *significant at 10%.

Notes to Table 2: Variables in the regressions are 10-year differences. The sample periods are 1968-2013 in columns 1-10, 1924-2017 in columns 11-12. Standard errors, shown in parentheses, are calculated from the Newey-West method with a 10-year bandwidth. The dependent variable in columns 1 and 2 is the C-corporate share of business net capital stocks (Figure 8), in columns 3 and 4 is the C-corporate share of equity (Figure 9), in columns 5 and 6 is the C-corporate share of gross assets (Figure 10), in columns 7 and 8 is the C-corporate share of positive net income (Figure 11), and in columns 9-12 is the corporate share of business gross investment from BEA data (Figure 13). The business totals in columns 1-6 comprise C-corporations, S-corporations, and partnerships. In columns 7 and 8, sole proprietorships are also included in the business totals. In columns 9-12, the BEA corporate data combine C-corporations with S-corporations; the BEA business totals include sole proprietorships. The top federal tax rate on C-corporate profits, τ_{prof}, and the AMTR for the federal individual income tax, τ_p, are in Figure 1. The tax variables enter (as in equation [2]) as $log(1\text{-}\tau_{prof})$ and $log(1\text{-}\tau_p)$. The p-values are for tests that the sum of the two coefficients add to zero, as implied by the model.

Table 3

Regressions with Dividend Tax Rate Included

	(1)	(2)	(3)	(4)
Dependent variable:	**C-corporate share net capital stock**	**C-corporate share equity**	**C-corporate share assets**	**C-corporate share positive net income**
Independent variables:				
Constant (trend)	-0.1061*** (0.0143)	-0.2011*** (0.0372)	-0.0800*** (0.0128)	-0.0587 (0.0381)
C-corporate top federal profits tax rate, log(1-τ_{prof})	0.265** (0.107)	0.533*** (0.167)	0.223*** (0.071)	0.215 (0.153)
Dividend tax rate, log(1-τ_d)	0.027 (0.068)	0.961*** (0.190)	0.198*** (0.049)	0.123 (0.287)
AMTR federal individual income tax, log(1-τ_p)	-0.555*** (0.118)	-1.263*** (0.166)	-0.434*** (0.075)	-1.065*** (0.273)
p-value for equal coefficients, log(1-τ_{prof}) and log(1-τ_d)	0.073	0.061	0.69	0.74
R-squared	0.50	0.57	0.48	0.48
s.e. of regression	0.0253	0.0517	0.0201	0.0524

***Significant at 1%, **significant at 5%, *significant at 10%.

Note: See the notes to Table 2. The dividend tax rate, τ_d, is the dividend-weighted average marginal federal rate on dividends multiplied by the estimated share of U.S. corporate stock held in taxable form. See Figure 2.

Table 4

Estimated Productivity Effects from Major U.S. Historical Tax Changes

- 1968, τ_{prof}=0.53, $\tau_p = 0.240$, τ=0.476, estimated productivity=0.964;
- 1986, τ_{prof}=0.46, $\tau_p = 0.258$, τ=0.318, estimated productivity=0.986, up 2.3%;
- 1988, τ_{prof}=0.34, $\tau_p = 0.195$, τ=0.199, estimated productivity=0.996, up 1.0%;
- 2017, τ_{prof}=0.35, $\tau_p = 0.244$, τ=0.151, estimated productivity=0.998, up 0.2%;
- 2018, τ_{prof}=0.21, $\tau_p = 0.215$, τ=-0.006, estimated productivity=1.000, up 0.2%.

Note: In Figure 1, τ_{prof} equals the top federal corporate-profits tax rate and τ_p equals the labor-income weighted average tax rate from the federal individual income tax. The tax wedge, τ, is calculated from equation (2) as $\tau = \log(\frac{1-\tau_p}{1-\tau_{prof}})$. (These results neglect dividend taxation.) The estimated productivity, normalized to 1.0 at the peak, corresponds to Figure 4.

Appendix

Derivation of Expectations of Corporate and Pass-Through Output

We start with the derivation of equation (3), which gives the conditional expectation of corporate output, Y_c. The setup is that $log(Y_c)$ and $log(Y_p)$ are bivariate normal with respective means and standard deviations of μ_c, σ_c, μ_p, and σ_p. The correlation coefficient between the two random variables is ρ. This specification implies that $y \equiv log(\frac{Y_c}{Y_p})$ is distributed normally with mean $\mu=\mu_c-\mu_p$ and variance $\sigma^2 = \sigma_c^2 + \sigma_p^2 - 2\rho\sigma_c\sigma_p$.

The distribution of $log(Y_c)$, conditional on y, is normal with respective mean and standard deviation of $\tilde{\mu}_c=\mu_c + \left(\frac{\sigma_c}{\sigma}\right)\cdot\left(\frac{\sigma_c-\rho\sigma_p}{\sigma}\right)\cdot(y-\mu)$ and $\tilde{\sigma}_c^2 = \sigma_c^2\sigma_p^2(1-\rho^2)/\sigma^2$ (see Hogg and Craig [1965, pp. 102-104]). That is, $\left(\frac{\sigma_c}{\sigma}\right)\cdot\left(\frac{\sigma_c-\rho\sigma_p}{\sigma}\right)$ is the regression coefficient of $log(Y_c)$ on y. The expectation of Y_c conditional on y is $exp(\tilde{\mu}_c+0.5\cdot\tilde{\sigma}_c^2)$. The expectation of Y_c is then

$$Prob.(y \geq \tau)\cdot E(Y_c|y \geq \tau) = \frac{1}{\sigma\sqrt{2\pi}}\int_{\tau}^{\infty}\exp(\tilde{\mu}_c + 0.5\cdot\tilde{\sigma}_c^2)\cdot\exp[\frac{-(y-\mu)^2}{2\sigma^2}]dy.$$

Using the expressions for $\tilde{\mu}_c$ and $\tilde{\sigma}_c^2$, the result can be written as:

$$Prob.(y \geq \tau)\cdot E(Y_c|y \geq \tau) = \frac{\exp(\mu_c+0.5\sigma_c^2)}{\sigma\sqrt{2\pi}}\int_{\tau}^{\infty}\exp[(\frac{-1}{2\sigma^2})\cdot[y-\mu-\sigma_c(\sigma_c-\rho\sigma_p)]^2dy.$$

Finally, using the change of variable $z=\left[y-\mu-\sigma_c\left(\sigma_c-\rho\sigma_p\right)\right]/\sigma$, the lower limit of integration becomes $\tau' = \left(\frac{1}{\sigma}\right)\cdot[\tau-\mu-\sigma_c\left(\sigma_c-\rho\sigma_p\right)]$. We then get equation (4):

$$Prob.(y \geq \tau)\cdot E(Y_c|y \geq \tau) = [\exp(\mu_c + 0.5\sigma_c^2)]\cdot[1-\Phi(\tau')],$$

where $\Phi(\cdot)$ is the cumulative standard normal density. We can also replace $1-\Phi(\tau')$ by $\Phi(-\tau')$.

The result for pass-through output, $Prob.(y < \tau) \cdot E(Y_p | y < \tau)$, is analogous, with the parameters for c and p switched (including that μ is now μ_p-μ_c) and τ replaced by -τ in the expression for τ'.