Corporate Tax Reform: Issues for Congress

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Summary

Interest in corporate tax reform that lowers the rate and broadens the base has developed in the past several years. Some discussions by economists in opinion pieces have suggested there is an urgent need to lower the corporate tax rate, but not necessarily to broaden the tax base, an approach that presents some difficulties given current budget pressures. Others see the corporate tax as a potential source of revenue.

Arguments for lowering the corporate tax rate include the traditional concerns about economic distortions arising from the corporate tax and newer concerns arising from the increasingly global nature of the economy. Some claims have been made that lowering the corporate tax rate would raise revenue because of the behavioral responses, an effect that is linked to an open economy. Although the corporate tax has generally been viewed as contributing to a more progressive tax system because the burden falls on capital income and thus on higher income individuals, claims have also been made that the burden falls not on owners of capital, but on labor income—an effect also linked to an open economy.

The analysis in this report suggests that many of the concerns expressed about the corporate tax are not supported by empirical data. Claims that behavioral responses could cause revenues to rise if rates were cut do not hold up on either a theoretical basis or an empirical basis. Studies that purport to show a revenue maximizing corporate tax rate of 30% (a rate lower than the current statutory tax rate) contain econometric errors that lead to biased and inconsistent results; when those problems are corrected the results disappear. Cross-country studies to provide direct evidence showing that the burden of the corporate tax actually falls on labor yield unreasonable results and prove to suffer from econometric flaws that also lead to a disappearance of the results when corrected, in those cases where data were obtained and the results replicated. Similarly, claims that high U.S. tax rates will create problems for the United States in a global economy suffer from a misrepresentation of the U.S. tax rate compared to other countries and are less important when capital is imperfectly mobile, as it appears to be.

Although these new arguments appear to rely on questionable methods, the traditional concerns about the corporate tax appear valid. While an argument may be made that the tax is still needed as a backstop to individual tax collections, it does result in some economic distortions. These economic distortions, however, have declined substantially over time as corporate rates and shares of output have fallen. Moreover, it is difficult to lower the corporate tax without creating a way of sheltering individual income given the low rates of tax on dividends and capital gains.

A number of revenue-neutral changes are available that could reduce these distortions, allow for a lower corporate statutory tax rate, and lead to a more efficient corporate tax system. These changes include base broadening, reducing the benefits of debt finance through inflation indexing, and reducing the tax at the firm level offset by an increase at the individual level. Nevertheless, the scope for reducing the tax in a revenue neutral way may be limited.

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Introduction

On October 25, 2007, then-Ways and Means Committee Chairman Charles B. Rangel introduced H.R. 3970, a tax reform plan that included revisions in the corporate tax to lower the rate and broaden the base. This proposal would cut the corporate tax rate and, in a roughly revenue-neutral sub-section of the proposal, broaden the tax base. In the 111th Congress, S. 3018, introduced by Senators Ron Wyden and Judd Gregg, also provides for a lower corporate tax rate in exchange for a somewhat broader corporate tax base. A similar bill, S. 727,was introduced by Senators Wyden and Coats in the 112th Congress. The Fiscal Commission proposed a corporate reform similar to the Wyden-Gregg bill.

Interest in corporate rate cuts and other corporate revisions had been developing for some time. In November 2005, President George W. Bush's Advisory Panel on Tax Reform reported on a variety of proposals for major reform of the tax system, including those for corporate and business income taxes.[1] Hearings were held on these proposals in 2006, but no further action occurred. On July 16, 2007, *The Wall Street Journal* published an opinion article by Treasury Secretary Henry M. Paulson addressing concerns that the U.S. corporate tax rate is high relative to other countries and announcing a conference to be held July 26 that would examine the U.S. business tax system and its effects on the economy.[2]

On July 23, 2007, the Treasury Department released a background paper (hereafter, the Treasury Study) that addressed several issues associated with the corporate tax: (1) special tax provisions that narrow the corporate tax base; (2) the efficiency effects of the tax (distortions in the size and allocation of investment); (3) the size of the unincorporated sector; and (4) a comparison of corporate taxes in the United States with other countries.[3] The paper, however, did not discuss important justifications for a corporate tax, such as its role in the progressivity of federal taxes assuming the burden of the tax falls on capital, and the need for a corporate tax to avoid the use of the corporate form as a tax shelter by high-income individuals.

While the Treasury Study focused largely on efficiency issues and international comparisons, on the day of the conference, R. Glenn Hubbard, President Bush's first chairman of the Council of Economic Advisors, also published an opinion article in *The Wall Street Journal* referring to the conference.[4] His article echoed some arguments that had been made in recent months that are based partly, or largely, on empirical studies of differences across countries. He addressed the distributional issue, but referred to some evidence that the burden of the corporate tax falls on labor. In addition to theoretical arguments, he cited an empirical paper by Kevin Hassett and Aparna Mathur of the American Enterprise Institute.[5] His article also discussed empirical evidence suggesting that the United States might raise revenue by cutting corporate tax rates because of large behavioral responses.[6] Hubbard concluded by suggesting that cutting the

[1] *Simple, Fair, and Pro-Growth: Proposals to Fix America's Tax System*, November 2005, which can be found at http://www.taxreformpanel.gov/.

[2] Henry M. Paulson, Jr., "Our Broken Corporate Tax Code," *The Wall Street Journal*, July 19, 2007.

[3] United States Department of the Treasury, "Treasury Tax Conference on Business Taxation and Global Competitiveness: Background Paper," July 30, 2007, at http://www.ustreas.gov/press/releases/hp500.htm.

[4] R. Glenn Hubbard, "The Corporate Tax Myth," *The Wall Street Journal*, July 26, 2007.

[5] Kevin A. Hassett and Aparna Mathur, *Taxes and Wages*, American Enterprise Institute, working paper, March 6, 2006, presented at a conference of the American Enterprise Institute on May 2, 2006.

[6] Hubbard's article cites Michael Devereux, and apparently refers to a paper also presented at the American Enterprise (continued...)

corporate tax rate would reduce a tax that is largely, or even fully, borne by labor and that behavioral responses would offset much of the static revenue cost.

During the conference, discussions included whether business representatives would trade tax preferences for lower rates, whether reform should take the form of lower rates or write-offs of investments, and methods of avoiding the corporate tax by income shifting in a global economy. Some participants complained that the corporate tax is outdated, too complex, distorts decisions, and undermines the ability of firms to complete in a global economy. Echoing some issues raised in Hubbard's article, Kevin Hassett indicated that the corporate tax was not an effective way to raise revenues and suggested that lowering the rate would raise revenues.[7]

Prior to the 2007 conference, Congress held hearings in 2006 on the Advisory Panel's proposals, with a general hearing followed by one concentrating on business tax issues. In the 110th Congress, attention to capital income taxes has been targeted to narrower issues such as the tax gap and offshore tax havens.[8] At the time of the Treasury conference, Chairman Charles B. Rangel of the House Ways and Means Committee released a statement inviting the Bush Administration to discuss such issues as tax reform, especially the Alternative Minimum Tax (AMT), addressing tax havens, and increasing equity and fairness in the tax structure.[9]

H.R. 3970 included some of the base broadeners included in the Treasury Study and others that were not. The rate reduction, from 35% to 30.5% was not as large as that discussed in the Treasury Study, 27%. Base broadeners in H.R. 3970 were criticized by some business groups.[10]

The corporate tax debate continued to be in the news. In May 2008, N. Gregory Mankiw published an article suggesting that most of the burden of the tax falls on labor, and citing research suggesting the corporate tax is borne by labor and that revenue losses may be fully or largely offset by behavioral responses.[11] In addition to the Wyden-Gregg and Wyden-Coats proposals and the Fiscal Commission proposals, there were general proposals by Republican leaders in the House (Majority Leader Eric Cantor, Ways and Means Chairman Dave Camp, and Budget Committee Chairman Paul Ryan) for corporate tax reform with rate reductions. President Obama also supported revenue neutral corporate tax reform, although some groups proposed raising additional revenue from corporations.[12]

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Institute Symposium.

[7] This summary and other references to the issues discussed at the conference are based on two detailed media accounts of the conference; although the conference was televised, there is no transcript at this time. The articles are Heidi Glenn, "Business Leaders would Give Up Tax Breaks for Lower Rates," *Tax Notes,* July 30, 2007, pp. 324-327, and Joanne M. Weiner, "U.S. Corporate Tax Reform: All Talk, No Action," *Tax Notes*, August 27, 2007, pp. 716-728.

[8] Hearings were held by the Senate Finance Committee on August 3, 2006, with a follow-up focused on business tax issues on September 20, 2006. The committee also held hearings on May 3, 2007 on tax havens.

[9] Statement released by the Honorable Charles B. Rangel, Chairman, Ways and Means Committee, July 26, 2007.

[10] See Jeffrey H. Birnbaum, "Democrat Overhall of Taxes: Rangel Would Annul AMT, Shift Burden," *Washington Post*, October 26, 2007, p. D1.

[11] N. Gregory Mankiw, "The Problem with the Corporate Tax," *New York Times*, June 2, 2008. For empirical evidence on incidence he cites an empirical study by Wiji Aralampalam, Michael P. Devereux, and Giorgia Maffini, *The Direct Incidence of Corporate Income Tax on Wages*, Oxford University Center for Business Taxation, May, 2008. For empirical evidence on the feedback effects on revenue, he cites Alex Brill and Kevin Hassett, *Revenue Maximizing Corporate Income Taxes*, AEI working paper # 137, American Enterprise Institute, July 31, 2007.

[12] See "Leader Cantor Unveils Pro-Growth Economic Plan at Stanford University," press release, March 21, 2011, (continued...)

This report provides an overview of corporate tax issues and discusses potential reforms in the context of these issues, with particular attention to some of the recent research concerning large behavioral responses and their implications for revenue and distribution. The first section reviews the size and history of the corporate income tax, and discusses an important issue that has been given little attention by those who propose deep cuts in the corporate tax: its role in preventing the use of the corporate form as a tax shelter by wealthy business owners. This section also discusses the potential effect of behavioral responses on corporate tax revenues. The second section examines the role of the corporate tax in contributing to a progressive tax system and discusses claims that the burden falls on workers. The third section reviews arguments relating to efficiency and revenue yield, and traditional criticisms of the corporate tax as one that causes important behavioral distortions. One aspect of this discussion is the question of how the tax might be viewed differently in a more global economy. The final section examines options for reform.

The Corporate Tax as a Revenue Source

The corporate tax is the third largest source of federal revenue, but its importance as a revenue source has diminished considerably over time.

Magnitude and Historical Pattern

Despite concerns expressed about the size of the corporate tax rate, current corporate taxes are extremely low by historical standards, whether measured as a share of output or based on the effective tax rate on income.[13] In 1953, the corporate tax accounted for 5.6% of GDP and 30% of federal tax revenues. In recent years the tax has fluctuated round 2% of GDP and 10% of revenues, reaching a low of 1.2% of GDP in 2003, and standing at 2.7% in 2006. Although the tax revenue is currently low as a percentage of GDP, due to the recession and certain measures to stimulate the economy, the tax is projected to subsequently raise revenues of slightly under 2% of GDP. Today, it is the third largest federal revenue source, lagging behind the individual income tax, which was about 8% of GDP, and the payroll tax, which was about 6.5% in 2006. It is much more significant, however, than excise taxes, which are slightly over 0.5%, and estate and gift taxes at 0.2%. (Note that the income tax share, while low during the recession is expected to grow and will exceed 10% if the 2001-2003 tax cuts are not made permanent; estate and gift tax revenues will also rise slightly.)

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http://majorityleader.house.gov/newsroom/2011/03/embargoed-leader-cantor-unveils-pro-growth-economic-plan-at-stanford-university.htm and "Obama Backs Corporate Tax Cut If Won't Raise Deficit," *Bloomberg*, January 25, 2011, http://www.bloomberg.com/news/2011-01-26/obama-backs-cut-in-u-s-corporate-tax-rate-only-if-it-won-t-affect-deficit.html. For proposals in the deficit reduction plans, see CRS Report R41970, *Addressing the Long-Run Budget Deficit: A Comparison of Approaches*, by Jane G. Gravelle and CRS Report R41641, *Reducing the Budget Deficit: Tax Policy Options*, by Molly F. Sherlock.

[13] The data discussed in this paragraph are taken from Jane G. Gravelle, "The Corporate Tax: Where Has it Been and Where is it Going?," *National Tax Journal,* vol. 57 (December 2004), pp. 903-923; U.S. Congressional Budget Office, Historical Data, http://cbo.gov/budget/historical.shtml , and Congressional Budget Office, *The Budget and Economic Outlook, Fiscal Years 2011-2021*, http://www.cbo.gov/ftpdocs/120xx/doc12039/01-26_FY2011Outlook.pdf.

Much of the historical decline arises from legislated reductions in the corporate effective tax rate on the return to new investment, which has fallen from 63% of corporate profits in 2003 to about 30% today. These changes include a reduction in the top statutory rate from 52% to 35% and much more liberal depreciation rules. The total tax burden on corporate source income has declined even more due to lower rates on dividends and capital gains at the shareholder level and the increased fraction of stocks held in tax exempt form.

While a large fraction of the decline in corporate tax revenues is associated with these changes in rates and depreciation, other causes may be more liberal rules that allow firms to obtain benefits of corporate status (such as limited liability) while still being taxed as unincorporated businesses and tax evasion, particularly through international tax shelters. The Treasury Report documents the significant rise in the share of total business net income received by unincorporated businesses since 1980, from 21% of total net income to 50%. While the share of proprietorships (which have no limited liability) has declined slightly, from 17% to 14%, the share of Subchapter S firms (firms that are incorporated but are allowed to elect taxation as an unincorporated business) rose from 1% to 15%. These changes followed a dramatic increase in the number of shareholders allowed for the election (the limit of 10 was raised to 35 in 1982, to 75 in 1996, and to 100 in 2004). Partnerships (including limited liability corporations and limited liability partnerships) increased from 3% to 21%, with most of the increase occurring after 1990. This growth reflects in part the growth of limited liability corporations established under state law (the first state adopted such a provision in 1982), which qualify as unincorporated business for corporate tax purposes. While Subchapter S firms are constrained by the shareholder limit, partnerships are not.[14]

Although it has declined considerably in importance, the corporate tax remains a major source of federal revenue, and a significant change in individual income taxes would be required to offset a substantial reduction in corporate taxes. Current pressures to find revenue sources to pay for relief from the AMT make an overall corporate tax cut difficult to envision. For that reason, most proposals would trade off rate reductions, or possibly broad investment subsidies that reduce the effective burden on new investment, for base broadening, through reduction of corporate tax preferences.

The Role of the Corporate Tax in Backstopping the Individual Tax

Measuring corporate tax revenue falls short of describing the full role of the corporate tax in contributing to federal revenues because the corporate tax protects the collection of individual income taxes. As long as taxes on individual income are imposed, a significant corporate income tax is likely to be necessary to forestall the use of the corporation as a tax shelter. Without a corporate tax, high-income individuals could channel funds into corporations, and, with a large part of earnings retained, obtain lower tax rates than if they operated in partnership or proprietorship form or in a way that allowed them to be taxed as such. As suggested by the growth in unincorporated business forms above, wealthy business owners may be quick to take advantage of tax rate differentials, which currently tend to favor unincorporated businesses. (Since 1986, when individual tax rates were lowered dramatically, the corporate tax rate has been

[14] See also CRS Report R42113, *Reasons for the Decline in Corporate Tax Revenues*, by Mark P. Keightle, which traces the decline in average effective tax rates, the reduction in the share of business income represented by the corporate sector, and the falling rate of profit.

high relative to the individual tax rate). The Treasury Study indicated that 61% of the income of unincorporated businesses was associated with taxpayers in the top income tax bracket.

Although the top tax rate on corporations is equal to the top individual rate (35%), the corporate tax is graduated. Consequently, for high-income taxpayers, there is an advantage to shifting part of one's income into a corporation because corporate tax rates are graduated (15% on the first $50,000 and 25% on the next $25,000) and are lower than the top marginal tax. This opportunity, however, is restricted by (1) limiting to one the number of corporations income can be shifted to; (2) the amount on which rates are graduated; and (3) disallowing graduated rates for personal service corporations. There are over 600,000 corporations with earnings less than $50,000, according to Internal Revenue Service statistics, suggesting some shifting occurs. In recognition of the potential use of the corporation as a shelter, tax law has in the past contained a tax on accumulated earnings. As long as dividends were taxed as ordinary income and the accumulated earnings tax was strict enough, it was difficult to use the corporate form to shelter a great deal of income.

This tax shelter constraint on lowering the corporate rate may be more binding today because of the lower rates on dividends and capital gains enacted as part of the Administration's corporate relief package in 2003. **Table 1** calculates the effective tax rate for operating through a corporation, versus an unincorporated business, for an individual in the 35% tax bracket. If dividends are taxed at 15% and the corporate rate is lowered to 27% as suggested in the Treasury conference, the tax rate in the corporate form would be less than the tax rate on unincorporated businesses. In fact, with a 15% rate on dividends, corporations that distributed less than 73% of their income would present a tax shelter opportunity with a 27% tax rate. This outcome would occur even without the benefit of graduated rates and could potentially benefit labor income as well as individual capital income. Moreover, although there are rules restricting accumulated earnings, it is common for corporations to reinvest a significant fraction of their earnings. This unlimited sheltering option would not exist as long as the corporate tax were as high as the individual tax, and its scope would be limited if dividends and capital gains were taxed at higher rates.

Table 1. Tax Rates For Alternative Forms of Organization Under Alternative Rate Structures, Individual at 35% Rate

	100% of Income Distributed	50% of Income Distributed	No Income Distributed
Corporate Business			
	Dividends Taxed at 15% Rate		
Corporate Tax Rate of 35%	45	40	35
Corporate Tax Rate of 27%	38	32	27
	Dividends Taxed at Ordinary Rates		
Corporate Tax Rate of 35%	58	46	35
Corporate Tax Rate of 27%	46	36	27
Unincorporated Business	35	35	35

Source: CRS analysis.

Some reforms might address these shelter issues directly, including raising tax rates on dividends and capital gains at the individual level while lowering the rate at the firm level, eliminating the graduated rate structure, and more formal methods of integrating the individual and corporate income taxes.

Behavioral Responses and Revenue Maximizing Tax Rate

Although it has long been recognized that there are behavioral responses to the corporate tax (even aside from the tax sheltering issues indicated above), and that these responses have important implications for the efficiency of the economy and the burden of the tax, the issue of a revenue maximizing tax rate, popularly associated with the "Laffer" curve, has rarely entered into the discussion. A Laffer curve graphs revenue against the tax rate, and is based on the notion that revenue is zero at a zero tax rate and zero at a 100% tax rate (at least with respect to some taxes).[15] In a Laffer curve, the revenue first rises with the tax rate and then falls, and at the point it reverses direction is the revenue-maximizing tax rate.

A Laffer curve for the corporate tax has been proposed or alluded to recently in several articles in the popular press. One is the article by Glenn Hubbard, cited above. In *National Review*, Kevin Hassett discusses the Laffer curve and presents a chart that he indicates is an illustration that appears to show a negative relationship between corporate revenues as a share of GDP and the tax rate.[16] Only 13 countries are shown on this graph, however, and the negative relationship is clearly strongly affected by an outlier, Ireland, which is a well known tax haven; most economists would not find this illustration persuasive proof. Another discussion of this issue appeared in an editorial in *The Wall Street Journal*, which also presented a chart with a number of OECD countries on it.[17] In this chart, the editors simply drew a curve, which passed through a couple of points. There was no statistical fitting to the data and no informative value to such an analysis; moreover the two points through which the freehand curve was drawn were questionable: one was the United Arab Emirates with no tax, which is neither a typical country nor in the OECD, and the other was Norway, whose corporate tax revenue tends to be high because of oil. The bulk of the data showed no obvious trend.[18]

The Hubbard and Hassett articles do, however, cite some more sophisticated research. Hassett referred to a paper by Kimberly Clausing,[19] and Hubbard referred to a paper by Michael

[15] Excise taxes can be set at more than 100% and still yield revenue. Taxes on real capital income in excess of 100% can also yield revenues because inflation is an implicit tax on the holding of cash.

[16] Kevin A. Hassett, "Art Laffer, Righter Than Ever," *National Review*, February 13, 2006.

[17] "We're Number One, Alas," *The Wall Street Journal*, July 13, 2007, p. A12.

[18] For insight into how this graph was viewed by economists, see Brad DeLong, an economist at Stanford and author of a website, *Brad DeLong's Daily Journal*, who titled his entry "Most Dishonest Wall Street Journal Editorial Ever." There was some perception, which was incorrect, that this graph was prepared by Kevin Hassett because he was mentioned as a source, but that was not the case; he provided some of the data (personal communication with Kevin Hassett). Based on data provided by one of the correspondents in that debate, a simple regression of corporate share on tax and tax squared showed no significant coefficients for tax variables, indicating no relationship: http://delong.typepad.com/sdj/2007/07/most-dishonest-.html.

[19] Kimberly A. Clausing, "Corporate Tax Revenues in OECD Countries," *International Tax and Public Finance*, vol. 14 (April 2007), pp. 115-133.

Devereux.[20] In addition, Alex Brill and Kevin Hassett also prepared a statistical analysis examining the change in the relationship over time.[21] A cross country study was also prepared by Mintz.[22]. Clausing, who is referred to in the Hassett article, is quoted as claiming that the United States is likely to the right of the revenue maximizing point on the Laffer curve, but this statement, presumably from an earlier draft, is not found in her published article. That article finds a revenue maximizing tax rate of 33%, in her simple specification, but as she added variables and accounted for other features the revenue maximizing tax rate seemed to rise, as indicated in **Table 2**. Large countries and countries that are less open, such as the United States, have a revenue maximizing tax rate of 57%—much larger than the combined federal and state rate for U.S. firms of 39%.[23]

Table 2. Revenue Maximizing Tax Rates and Share of Variance Explained in the Clausing Study

Specification	Tax Rate	R-Squared
(1) Basic	33%	0.13
(2) Additional Variables	39	0.43
(3) Additional Variables	42	0.46
(4) Additional Variables	41	0.23
(5) Additional Variables	37	0.21
(6) Openness	43	0.27
(7) Size	45	0.23
(8) Openness and size	57	0.28

Source: Kimberly Clausing (2007).

Note: The R-Squared is a statistical term that measures the share of the variance in the dependent variable explained by the independent variables.

Michael Devereux's paper indicates that, while he finds a revenue maximizing rate of 33% under the same specification as Clausing, he finds only weak evidence of a relationship between tax rates and corporate tax revenues as a percentage of GDP. Many of his specifications do not yield statistically significant effects. Brill and Hassett find a rate of around 30%, which has been falling over time. Mintz finds a rate of 28%, but his data span only a few years (2001-2005).[24]

In the remainder of this section, we first discuss theoretical expectations of this relationship and then examine these empirical studies. Both the theoretical and empirical assessments suggest that the results of these analyses are questionable.

[20] Michael P. Devereux, *Developments in the Taxation of Corporate Profit in the OECD Since 1965: Rates, Bases and Revenues*, May 2006 presented at a conference of the Alliance for Competitive Taxation and the American Enterprise Institute, June 2, 2006.

[21] Alex Brill and Kevin Hassett, *Revenue Maximizing Corporate Income Taxes*, AEI working paper # 137, American Enterprise Institute, July 31, 2007.

[22] Jack M. Mintz, *2007 Tax Competitiveness Report: A Call for comprehensive Tax Reform*, C.D. Howe Institute, No. 254, September 2007.

[23] The 33% tax rate is from the simplest regression; the other regressions, which include other variables, or control for country size and/or openness, lead to higher revenue maximizing rates.

[24] Hence, most of the variation is across countries, which, as discussed below, is a potentially serious problem.

Theoretical Issues

The issue of a Laffer curve has not been a part of the debate because the notion of a revenue maximizing tax rate other than at very high tax rates is inconsistent with most of the models of the corporate tax. Traditionally, the main behavioral response associated with the corporate tax was the substitution of noncorporate capital for corporate capital within an economy where the amount of capital was fixed. Imposing a corporate tax (in excess of the noncorporate tax) caused capital to earn a lower return in the corporate sector and to flow out of that sector and into the noncorporate sector, thereby lowering the return in the noncorporate sector and raising the return, before taxes, in the corporate sector. The higher pre-tax return on capital also caused prices to go up in the corporate sector and fall in the noncorporate sector, causing a shift towards non-corporate sector total production. The corporate profits tax base, therefore, had two opposing forces: the amount of capital was falling but the profit rate was rising. The taxable base could, therefore, either increase as tax rates increased, or it could decrease. The direction depended on the substitutability of capital and labor in the corporate sector. The central tendency of most models (with unitary elasticities) suggested, however, that the tax base was relatively invariant to tax rates, and revenues would always rise with the tax rate. Consequently, under any reasonable set of assumptions there would either be no revenue maximizing tax rate or an extremely high one.[25]

If behavioral responses caused the total capital in the U.S. economy to contract, the outcome could be different. One such model, the open economy model, appears to be a motivation for the belief in a relatively low revenue maximizing tax rate. Brill and Hassett discuss elasticity estimates of foreign capital flows to after tax returns in the range of 1.5 to 3 (they also cite a recent study with an elasticity of 3.3) in their paper that finds a revenue maximizing tax rate of around 30%. They conclude that "[t]hese high elasticities are consistent with the view that reductions in corporate rates could lure a significant enough amount of economic activity to a locality to create a Laffer curve in the corporate tax space."[26]

As shown in the **Appendix A**, however, one cannot achieve this tax rate even with infinite elasticities. In the most extreme case, where (1) the country is too small to affect worldwide prices and rates of return; (2) capital is perfectly mobile; and (3) products in international trade are perfectly substitutable, the revenue maximizing tax rate would be the ratio of the labor share of income to the factor substitution elasticity. Assuming fairly common values for a model without depreciation of 75% for labor's share of income and a factor substitution elasticity of 1, the tax rate would be 75%—far above the rates of around 30% reported by Brill and Hassett. This rate could rise as these conditions are relaxed. If the U.S. is assumed to have 30% of world resources, the rate rises to 81%; if imperfect substitutability between investments across countries and between foreign and domestic products is allowed, it would rise further.

Although it is possible to have a revenue maximizing tax rate that does not asymptotically approach 100% it is probably not possible to find a rate that maximizes revenues as a percentage of GDP, because GDP falls as well as tax revenues. In this case, we are back to the same

[25] An invariant tax base would occur when both production and utility were of the Cobb Douglas form, that is unitary factor substitution elasticities and unitary product substitution elasticities. At 100% tax rate a corner solution would be presumably be reached where the corporate sector would entirely disappear, but only at that extreme rate would such an effect occur.

[26] Brill and Hassett, *Revenue Maximizing Corporate Income Taxes*, p. 6.

circumstances as in the reallocation of capital in the closed economy: with unitary elasticities, the corporate share of income is constant relative to GDP, and with other elasticities it can rise or fall.

A related circumstance where capital can contract would be in a model where savings responds so powerfully that the savings supply is infinitely elastic, that is, when a tax is imposed, the capital stock must contract so much, and the pre-tax rate of return rises so much that the after-tax return comes back to its original value. This extreme savings response model yields the same revenue maximizing tax rate as the extreme open economy, 75%, and probably no revenue maximizing tax rate for revenues as a percentage of GDP. Moreover, the slowness with which the capital stock adjusts (most models allow 150 years for full adjustments) means that the revenue would be affected by tax rates in the past.

The result of this discussion makes it clear that revenue maximizing tax rates cannot arise from physical reallocations or contractions of capital. Nor are they likely to arise from a substitution between debt and equity, since the debt share has changed very little despite significant changes in the relative tax burden, and estimates of elasticities that do exist are small.[27]

A remaining source of a different outcome is profit shifting. This effect could involve firms maintaining the same activity and shifting the form of operation to unincorporated businesses. Profit shifting could be a possibility (although the point of revenue maximization would be much too low because much of the tax has not disappeared, but rather has shifted). But, at least in the United States, this shift is probably less the result of high corporate tax rates and more the result of increasingly loose restrictions on operating with limited liability outside the corporate form, actions that have not been taken by other countries.[28] The other profit shifting issue is the shifting of profits (rather than activity) to foreign countries. Such effects are possible, but it would seem unlikely that tax avoidance could be of this magnitude, given that only 5% of the U.S. capital stock is invested abroad. While a small low-income country, as is characteristic of most tax havens, might have little enough domestic capital that they could afford the loss from lowering the rate in order to attract more capital, such an outcome is much less likely for the United States.

Revenue Feedback From a General Equilibrium Model to Illustrate Likelihood of a Laffer Curve Near Current Rates

A Laffer curve with a revenue maximizing tax rate implies that there is a point where the tax base contracts so much that no revenue is gained from a tax increase, and, conversely that cutting tax rates could raise revenue. Revenue offsets that arise from behavioral responses are often referred to as a revenue feedback. For a tax cut, revenue feedback would be the revenue gain from an expanded base as a percentage of the original revenue loss (for a tax increase, it would be the loss

[27] See Ruud de Mooij, *The Tax Elasticity of Corporate Debt: A Synthesis of Size and Variations*, International Monetary Fund, Working Paper, WP-11-95, April, 2011, http://www.imf.org/external/pubs/ft/wp/2011/wp1195.pdf.

[28] The Treasury Study provides data on the growth over time in unincorporated business forms and suggests that the large share of this income in the United States relative to other countries is due to the ability to avoid the corporate tax and still retain limited liability in the United States. The growth in Subchapter S income (partnerships that can elect to be taxed as corporations) corresponds to increasing limits on the number of permissible shareholders, and the growth in partnership income to the growth in the number of states allowing limited liability companies that do not fall under the corporate tax. Proprietorship income shares have changed very little. In any case, this growth occurred during a period when the corporate tax was constant or falling.

from a contraction in the base as a percentage of the original gain). The revenue maximizing tax rate is the point where induced changes in the tax rate provide 100% revenue feedback.

An approach that is empirically based but which is not the result of a direct estimate involves using a general equilibrium model, which is based on empirical estimates of underlying relationships (such as capital mobility). A recent CRS report used such a model and concluded that cutting the corporate tax from 35% to 25% in isolation would result in a revenue offset of 5% due to taxes on increased output in the United States.[29] This effect was not due to the increase in corporate taxes on the additional output, which was negligible, but to an increase in both labor and capital income taxes on increased output. Thus the revenue maximizing tax rate can be no where near the current 35% tax rate.

Some have argued that the revenue feedback for the corporate tax arises not from real changes in investment but from artificial profit shifting, where multinationals use a variety of techniques to declare income in low tax countries. Significant feedback effects from profit shifting were also estimated to be small. Even if all profit shifting ended, estimates suggest they were between 14% and 20% of corporate tax revenues and, thus, if they declined proportionally would add a feedback of no more than 20%. These are far from Laffer curve effects. Moreover, because the jurisdictions where profits are shifted have much lower (sometimes zero) tax rates, very little improvement in profit shifting might occur.

Finally, all of these feedback effects would be swapped for a stand-alone tax cut by the increase in the debt, which would crowd out capital and reduce output, leading to an additional loss of revenues of 23% by the 10th year. This loss of revenues on reduced out are in addition to the direct effect on the budget deficit due to an increase in interest costs of 25% of the revenue loss over the first 10 years.

Reduced Form Empirical Analysis

As noted above, several recent studies have examined the relationship between corporate tax rates and corporate tax revenues as a percentage of gross domestic product (GDP). The data used for two of these studies were obtained to replicate and extend the analyses. Both studies and our analysis estimate the effect of the top corporate tax rate (and its square) on corporate tax revenues as a percentage of GDP. Panel data for 29 OECD countries is used for the analysis.

Brill and Hassett Study

In their study, Brill and Hassett use panel data for the OECD countries from 1981 to 2003.[30] They use regression analysis (OLS) to estimate the effects. Brill and Hassett find that the corporate tax rate has at first a positive effect on corporate tax revenues as a percentage of GDP and then a decreasing effect—the effect looks like an inverted U, the shape of the classic Laffer curve. All of their coefficient estimates are statistically significant. However, they do not account for problems

[29] CRS Report R41743, *International Corporate Tax Rate Comparisons and Policy Implications*, by Jane G. Gravelle.

[30] See Alex Brill and Kevin A. Hassett, *Revenue-Maximizing Corporate Income Taxes: The Laffer Curve in OECD Countries*. We obtained our data from the same sources as Brill and Hassett.

often encountered with the use of panel data, and their coefficient estimates would appear to be biased and inconsistent.[31]

The estimation results from our re-analysis of the Brill and Hassett study are reported in **Table 3**. The regression includes a tax rate and a tax rate squared to allow for a curve. Panel A of the table displays the results for central government corporate tax data (in the case of the U.S., this is federal government tax data). The coefficient estimates for the full time period (1980 to 2003) and the four subperiods defined by Brill and Hassett are reported. In all cases, the coefficient estimates are fairly small and none are statistically significant at conventional confidence levels. Panel B of the table displays the results for total government (that is, governments at all levels) corporate tax data. Again, the coefficient estimates are fairly small and none are statistically significant. Once appropriate estimation methods are used to correct problems arising with panel data, there appears to be no statistically significant relation between corporate tax rates and corporate tax revenues as a percentage of GDP.

Table 3. Coefficient Estimates: Dependent Variable is Corporate Revenues as a Percentage of GDP (Brill and Hassett Model)

	1980-1986	1987-1992	1993-1997	1998-2003	1980-2003
A. Central government corporate tax revenues; federal corporate tax rate					
Tax rate	-0.037 (0.090)	-0.110 (0.081)	0.048 (0.087)	0.049 (0.117)	-0.040 (0.040)
Tax rate squared	0.087 (0.109)	0.122 (0.100)	-0.082 (0.129)	-0.060 (0.178)	0.052 (0.053)
F (joint)	5.15	1.21	0.33	0.21	0.51
Prob>F	0.008	0.303	0.719	0.809	0.603
B. Total government corporate tax revenues; total corporate tax rate					
Tax rate	0.204 (0.195)	-0.042 (0.077)	0.069 (0.076)	0.037 (0.094)	-0.016 (0.038)
Tax rate squared	-0.193 (0.214)	0.044 (0.091)	-0.106 (0.109)	-0.008 (0.123)	0.028 (0.047)
F (joint)	2.25	0.21	0.51	0.74	0.44
Prob>F	0.112	0.811	0.602	0.481	0.612

Source: Authors' analysis.

Notes: Standard errors in parenthesis. Fixed effects linear model with AR(1) disturbance. Other variables include time dummy variables.

Clausing Study

Clausing uses panel data for the OECD countries from 1979 to 2002 to study the effect of corporate tax rates on corporate tax revenue as a percentage of GDP.[32] She includes more

[31] The terms "biased" and "inconsistent" are technical statistical terms. See **Appendix B** for a description and the consequences of these problems, and the statistical definitions for biased and inconsistent.

[32] See Kimberly A. Clausing, "Corporate Tax Revenues in OECD Countries." The authors thank Kimberly Clausing for providing her data.

explanatory variables than did Brill and Hassett, but her overall research findings and conclusions are essentially the same as theirs—there is a Laffer curve relationship between corporate tax rates and corporate tax revenue as a percentage of GDP. However, her estimation methods would lead to biased and inconsistent coefficient estimates.[33]

The estimation results for five different specifications are reported in **Table 4**. The five specifications differ by what explanatory variables are included in the analysis. In all five specifications, the coefficient estimates of the corporate tax rate (and its square) are smaller than those estimated by Clausing and have the opposite signs. Most of the coefficient estimates are not statistically significant at conventional confidence levels, but two are statistically significant at the 10% level only. (In these cases where the coefficients are significant on the tax squared term they still do not produce the Laffer curve shape but rather suggest rising revenue with a rising tax rate). Overall, these results suggest that the corporate tax rate has little effect on corporate tax revenues as a percentage of GDP. Consequently, there is little evidence to support the existence of a corporate tax Laffer curve.

Table 4. Coefficient Estimates: Dependent Variable is Corporate Revenues as a Percentage of GDP (Clausing Model)

	Specification				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Tax rate	-0.055 (0.035)	-0.073 (0.111)	-0.075 (0.046)	-0.048 (0.036)	-0.067 (0.047)
Tax rate squared	0.078* (0.047)	0.118 (0.147)	0.102* (0.061)	0.069 (0.048)	0.093 (0.061)
Profit rate		X			
Corporate share		X			
Unemployment rate			X		X
Per capita GDP growth rate			X		X
Per capita GDP			X		X
Openness				X	X
F (joint)	1.39	0.75	1.45	1.04	1.21
Prob>F	0.251	0.473	0.236	0.354	0.298

Source: Authors' analysis.

Notes: Standard errors in parenthesis. Fixed effects linear model with AR(1) disturbance. Other variables include the indicated variables and time dummy variables. *significant at 10% level.

[33] Clausing included two variables in her analysis indicating the type of corporate tax system that do not vary over time for a country. The coefficients of these variables are not identified when using the fixed effect estimation method, which is probably why she estimated the coefficients using OLS. While she obtained coefficient estimates for these two variables, the estimates are biased and inconsistent.

Cross Country Investment Estimates: The Djankov Study

Cross country empirical studies, as noted above, have recently been employed to address the Laffer curve issue and, as will be discussed subsequently, the incidence of the corporate tax on wages. In addition to these direct estimates, there are numerous empirical studies that examine underlying relationships, such as the effect of the user cost of capital (which incorporates the tax rate along with other variables) on investment. Most of these studies have found modest effects on domestic investment and have employed times series estimates within the United States.[34]

One recent study on investment, Djankov et al.,[35] is similar to the other studies in that it employs a cross country data base and an independent variable reflecting the tax rate to directly estimate the effect of the corporate tax rate on investment, entrepreneurship and other variables. The study found no effect on investment for statutory tax rates, but very large effects for constructed first year and five year cash flow tax rates. This study, unlike the others discussed in this paper, is a single cross section, so there is no way to introduce fixed country effects.

Theoretical Issues

Several difficulties arise in the Djankov analysis. First, the cash flow tax rate variable they construct is hypothetical one (for a hypothetical firm) which is not representative of the capital stock or the firm size in a country (or in all countries). The denominator is income measured before labor income taxes paid by the firm (such as social security taxes in the United states) and economic depreciation. The first is very problematic because the capital income tax rate increases as the labor income tax rate falls, which is a relationship that seems to have no obvious economic justification. It also measures taxes on a cash flow basis for the first year (or the first five years in an alternative scenario), rather than over the life of the investment.

An examination of scatter-plots of their data suggest that the results are highly affected by outliers, particularly Bolivia (which has a very high tax rate and a very low investment rate) and Mongolia, a low tax country where investment has been flowing in recently due to mining.

The tax rate for Bolivia is about twice the typical tax rate and is inconsistent with the corporate rate in Bolivia. According to the authors, the tax rate reflects an alternative transactions tax. However, a transactions tax is not a tax on corporate income but falls on all income in the economy. Assuming that about a quarter of income is capital incomes, the tax should be reduced by 75%.

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[34] For reviews see Robert Chirinko, "Investment Tax Credits," in *The Encyclopedia of Taxation and Tax Policy*, ed. by Joseph J. Cordes, Robert D. Ebel and Jane G. Gravelle, Washington, D.C., the Urban Institute. 2005, pp. 226-229 and Kevin A. Hassett and R. Glenn Hubbard, "Tax Policy and Business Investment", *Handbook of Public Economic*s, New York, Elsiever, 2002, pp. 1293-1343.

[35] Simeon Djankov, Tim Ganser, Caralee McLiesh, Rita Ramalho, and Andrei Shleifer, "The Effect of Corporate Taxes on Investment and Entreprenuership," National Bureau of Economic Research, Canbridge, MA, Working Paper 13756, January 2008. This paper was subsequently published in the *American Economic Journal: Macroeconomics*, Vol. 2, pp. 31-64.

As with the Laffer-curve estimates, the results of this study, at least for the United States, are not plausible. According to their estimates, a 10 percentage point drop in corporate tax increased investment by 2.2 percentage points. According to an open economy model developed by Gravelle and Smetters,[36] however, U.S. capital would increase a maximum of 0.7 percentage points with the elimination of corporate tax; with more reasonable elasticities, it would increase by 0.3 percentage points. (This study was directed at the question of tax incidence and will be discussed in more detail in the section below which addresses distributional issues and the burden on labor). Moreover, these effects may understate the investment effects because they do not take into account debt. Thus, their results suggest an investment increase that is at least 11 times too large and that could be 25 or more times too large.

Empirical Analysis

While the issue of fixed effects would cause this study to remain problematic in any case, this section explores the effects of the tax rate changes and of specifications that include multiple control variables.

The Djankov et al. sample consists of 2004 tax and economic data for 85 countries. They examine the effect of the corporate tax rate on (1) aggregate investment, (2) foreign direct investment, and (3) two measures of entrepreneurial activity. The main results of their study and our reanalysis are reported in **Table 5**. The first row of the table displays the coefficient estimate of the effective corporate tax rate variable taken from the Djankov et al. study. Their basic specification includes only the tax rate as an independent variable. The second row of the table reports the range of estimates when a single additional independent variable is added—the authors add 10 variables, one at a time. In all but one instance, the estimates are statistically significant at the 1% or 5% confidence level, and at the 10% level in the remaining case.

We reanalyzed their data after correcting an error in their tax rate for Bolivia, and cumulatively added selected independent variables that Djankov et al. included in their analysis; we also included a region-of-the-world variable for each country. The first row of the bottom panel in **Table 5** presents the coefficient estimates for the basic model with only a single independent variable: the effective corporate tax rate. For each dependent variable, the coefficient estimate of the tax rate variable is smaller than Djankov et al.'s estimate, which illustrates the importance of Bolivia to their results. Furthermore, the estimated effect of the tax rate on aggregate investment is not statistically significant. The final row of **Table 5** reports the coefficient estimate of the tax rate when the full set of independent variables is included in the analysis. The estimated effect of the tax rate on aggregate investment is much smaller than Djankov et al.'s estimate and not statistically significant. The estimated effect of the corporate tax rate on foreign direct investment and entrepreneurial activity is somewhat smaller than the effects estimated by Djankov et al., but the estimates are statistically significant.

[36] Jane G. Gravelle and Kent A. Smetters, "Does the Open Economy Assumption Really Mean That Labor Bears the Burden of a Capital Income Tax?" *Advances in Economic Policy and Analysis*, vol. 6, No. 1, 2006.

Table 5. Coefficient Estimates: Key Independent Variable is Constructed Effective Tax Rate (Djankov, Ganser, McLiesh, Ramalho, and Shleifer Model)

	Dependent Variable			
	Investment	**Foreign Direct Investment**	**Business Density per 100 People**	**Average Business Entry Rate**
Original Basic Estimate	-0.218*** (0.074)	-0.226*** (0.045)	-0.194*** (0.063)	-0.138*** (0.057)
Range of Estimate	-0.165 to -0.236	-0.189 to -0.233	-0.090 to -0.196	-0.110 to -0.141
Coefficient Estimates of Tax Rate Variable with Corrected Data				
Basic Estimate	-0.108 (0.073)	-0.194*** (0.044)	-0.150** (0.060)	-0.116** (0.055)
PLUS				
Region Indicators	-0.046 (0.071)	-0.191*** (0.045)	-0.115* (0.058)	-0.126** (0.056)
PLUS				
Per Capital GDP	-0.031 (0.070)	-0.190*** (0.045)	-0.148*** (0.050)	-0.146** (0.055)
PLUS				
Number of Tax Payments Employment Rigidity Index Procedures to Start a Business	-0.025 (0.076)	-0.179*** (0.048)	-0.154*** (0.055)	-0.097* (0.057)

Source: Author's analysis.

Notes: Standard errors in parenthesis.
* significant at 10% level.
** significant at 5% level;
*** significant at 1% level

Distributional Effects

A second issue that was a focus of the Hubbard article, but was not in the Treasury Report was the distributional effects of the corporate income tax. If the corporate tax falls on owners of the corporation, or on capital in general, it contributes to a progressive tax system, since higher income individuals have more income from capital than from labor. Based on tax data, for taxpayers with incomes up to $100,000, over 90% of income is labor income, while for those over $1,000,000, less than a third is labor income.[37] The traditional analysis of the corporate income tax indicates that the burden generally spread to all capital, but does not fall on labor income. Most government and private agencies that routinely do distributional analysis allocate the corporate tax to capital income.[38]

[37] See CRS Report RL33285, *Tax Reform and Distributional Issues*, by Jane G. Gravelle.

[38] This is the allocation used by the Congressional Budget Office, the Treasury Department, and the Urban-Brookings Tax Policy Center.

Hubbard refers to three studies in his article: one a working paper by economist Arnold Harberger,[39] one a working paper by William Randolph of the Congressional Budget Office,[40] and one a recent empirical cross-country study using data similar to the studies discussed above, by Hassett and Mathur.[41] At about the same time or shortly thereafter three other empirical studies that use cross country data were released in 2006-2008, by Felix,[42] by Desai, Hines and Foley,[43] and by Arulampalam, Devereux, and Maffini.[44] Mankiw refers to the Randolph and Arulampalam, Devereux, and Maffini studies, although as will be shown subsequently the Arulampalam et al. study is examining an entirely different phenomenon which is unlikely to be very relevant to the United States corporate tax.

The Harberger and Randolph Studies

The first two studies explicitly focus on the effects of an open economy. It is a standard finding that for a small open single-good economy with perfect capital mobility and perfect product substitution, the burden of any source based capital income tax falls on labor (whereas for residence based taxes, that is taxes that apply to domestic owners of capital regardless of where they are domiciled, the burden would fall on capital). The corporate tax has some aspects of a source based tax and some of a residence based tax.

Both the Harberger and the Randolph studies are based on this simple model of perfect substitution, altered to account for the United States as a large county (which lowers the elasticities) and to account for multiple sectors. Randolph's study does not so much predict the burden of the tax as explore incidence in certain types of models; he acknowledges that less capital mobility causes the burden to shift from labor to capital. Harberger's model has four sectors, corporate and non-corporate tradeable sectors and corporate and non-corporate nontradeable sectors. He assumes that the corporate tradeable sector is more capital intensive that the average industry, which leads to a burden of greater than 100% of the tax falling on capital. Despite the vision of the manufacturing sector as highly capital intensive, it actually is not: housing services, which are 100% capital, account for over a third of the capital stock in the country, and many other industries, such as utilities and agriculture are also more capital intensive than manufacturing. Using the same assumptions about mobility, but with a less capital intensive manufacturing sector, Randolph finds 70% of the corporate tax burden falls on labor.

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[39] It is not clear which of Harberger's papers is being referred to, but it is presumably the more recent one: Arnold C. Harberger, *Corporate Tax Incidence: What is Known, Unknown, and Unknowable*, University of California, 2006. This paper was presented at a conference at Rice University in 2006, and subsequently published as in Fundamental Tax Reform: Issues, Choices, and Implications, ed. John W. diamond and George R. Zodrow, Cambridge, MA, MIT Press, 2008.

[40] The paper in question is not an official CBO paper but rather a working paper by William Randolph. William C. Randolph, *International Burdens of the Corporate Tax*, CBO working paper 2006-09, August 2006.

[41] Kevin A. Hassett and Aparna Mathur, *Taxes and Wages*, American Enterprise Institute, working paper, April 2008.

[42] Rachel Alison Felix, *Passing the Burden: Corporate Tax Incidence in Open Economies*, November 2006. This paper was a dissertation essay, University of Michigan.

[43] Mihir A. Desai, C. Fritz Foley, and James R. Hines, Jr., *Labor and Capital shares of the corporate Tax Burden: International Evidence*. Prepared for the International Tax forum and Urban-Brookings Tax Policy Center conference on Who Pays the Corporate Tax in an Open Economy, December 18, 2007.

[44] Wiji Aralampalam, Michael P. Devereux, and Giorgia Maffini, *The Direct Incidence of Corporate Income Tax on Wages*, Oxford University Center for Business Taxation, May, 2008. A revised version was subsequently released in March, 2011.

To permit other than perfect substitutability, a much more complex computable general equilibrium model would be required, which neither Harberger nor Randolph has provided. Such a model has been developed by Gravelle and Smetters[45] who find, with reasonable elasticities, that capital still bears most of the burden, about 80%. A recent CBO working paper by Jennifer Gravelle provides an extensive review of the existing general equilibrium models and the factors that drive the results.[46] She finds that five factors tend to move the burden toward falling on capital: a smaller willingness of consumers to substitute between foreign and domestic products, a higher substitutability of labor and capital in the production process, a smaller willingness of investors to substitute investments in different countries, a less capital intensive corporate tradeable sector, and a larger country. Her review of the evidence on these factors suggests that, based on these models, the majority of the tax (about 60%) is born by capital, with results differing from the Gravelle and Smetters findings due to a lower substitution elasticity between capital and labor in production. She subsequently considers, however, other factors that could increase the burden on capital (and even benefit labor), including the use of debt (discussed below).

While the general equilibrium models can be very complex, they still abstract from some important features of the corporate tax. There are two other factors that would further push the corporate tax burden towards capital. First, the current corporate tax has elements of a residence based tax, and the burden of a residence based tax falls on capital. Second, the current corporate tax actually subsidizes debt finance at the firm level, and if debt is much more substitutable than equity, total capital would be less likely to be exported: indeed, raising the corporate tax rate could cause capital to flow in. A study by Grubert and Mutti[47] found that in a general equilibrium model that included debt, such a capital inflow occurred when capital income taxes were raised, an outcome that would lead to labor benefitting from the corporate tax.

Finally, note that as long as countries tend to choose tax rates similar to each other, which appears to be the case, the world becomes like the original closed economy, a model stressed by Harberger, with the burden falling on capital. According to the Treasury Study, the U.S. combined state and federal corporate statutory rate is 39%, the G-7 average is 36%, and the OECD average is 31%. Effective tax rates, which should govern the movement of capital, are even closer together, and in some cases are lower for the U.S. than for other countries. More recent updates of tax rates indicate that U.S. rates are similar to the rest of the world.[48] Jennifer Gravelle uses OECD tax rates to estimate the share of the U.S. tax falling on labor using a global approach and finds that over 90% falls on capital.[49]

An argument is often made that the burden of any capital income tax tends to fall on labor because it reduces savings, an effect that would also occur in a closed economy. While one model predicts that the entire burden of a capital income tax eventually falls on labor, this model

[45] Jane G. Gravelle and Kent A. Smetters, "Does the Open Economy Assumption Really Mean That Labor Bears the Burden of a Capital Income Tax?" *Advances in Economic Policy and Analysis*, vol. 6, No. 1, 2006.

[46] Jennifer Gravelle, *Corporate Tax Incidence: Review of General Equilibrium Estimates and Analysis*, Congressional Budget Office Working Paper 2010-03, May 2010, http://www.cbo.gov/ftpdocs/115xx/doc11519/05-2010-Working_Paper-Corp_Tax_Incidence-Review_of_Gen_Eq_Estimates.pdf.

[47] Harry Grubert and John Mutti, "International Aspects of Corporate Tax Itegration: The Role of Debt and Equity Flows," *National Tax Journal*, vol. 47, March, 1994, pp. 111-133.

[48] See CRS Report R41743, *International Corporate Tax Rate Comparisons and Policy Implications*, by Jane G. Gravelle.

[49] Jennifer Gravelle, *Corporate Tax Incidence: Review of General Equilibrium Estimates and Analysis, op cit.*

requires some extreme assumptions about human behavior such as perfect information, an infinite planning horizon, perfect liquidity, and asexual reproduction. Models allowing for finite lives (such as the life-cycle models) find results that vary, but if the revenue loss is made up by higher taxes on labor, there is little or no effect. Some economists believe that these models are inappropriate, as they assume too much information and skill on the part of individuals; they suggest that individuals use rules of thumb, such as fixed savings rates or targets, instead. These rules of thumb suggest that a cut in capital income taxes either has no effect on saving or reduces savings. These economists also point out that most empirical evidence does not point to an increase in savings; historically, savings rates do not appear to respond to reduced tax rates.[50]

The Hassett and Mathur Study

While the theoretical models do not provide much support for the corporate tax burden falling on labor, Hubbard also refers to an empirical study by Hassett and Mathur that uses the corporate tax rate to explain differences in manufacturing wages.[51] They find a statistically significant result that indicates a 1% increase in the corporate tax causes manufacturing wages to fall by 0.8% to 1%. These results are impossible, however, to reconcile with the magnitudes in the economy. Through competition, wage changes in manufacturing should be reflected in wages throughout the economy, implying that a 1% rise in corporate revenues would cause an 0.8% to 1% fall in wage income. However, corporate taxes are only about 2.5% of GDP, while labor income is about two thirds. These results imply that a dollar increase in the corporate tax would decrease wages by $22 to $26 dollars, an effect that no model could ever come close to predicting.[52]

The lack of theoretical reasonableness of the results may be explained by statistical issues. The Hassett and Mathur study used data from 72 developed and developing countries for the 1981 to 2003 period.[53] For their analysis, their dependent variable is the logarithm of the five-year average of the average manufacturing wage. They justify their use of the five-year average wage by (1) noting that due to capital adjustment costs, the economic effects of corporate tax rate

[50] These issues surrounding savings are discussed in greater detail in CRS Report R42111, *Tax Rates and Economic Growth*, by Jane G. Gravelle and Donald J. Marples; CRS Report RL32517, *Distributional Effects of Taxes on Corporate Profits, Investment Income, and Estates*, by Jane G. Gravelle; CRS Report RL33545, *The Advisory Panel's Tax Reform Proposals*, by Jane G. Gravelle; and CRS Report RL33482, *Saving Incentives: What May Work, What May Not*, by Thomas L. Hungerford. The recognition that replacement of capital income taxes by wage taxes in a life cycle model could have little effect on savings or contract them can be found in numerous simulation studies, for example, Alan Auerbach and Laurence Kotlikoff, *Dynamic Fiscal Policy* ,Cambridge, MA: Cambridge University Press, 1987.

[51] This study is one of a number of empirical studies that try to estimate incidence from a direct examination of wages (as opposed to embedding capital flow and other elasticities into a model). For other reviews of these studies see William M. Gentry, *A Review of the Evidence on the Incidence of the Corporate Income Tax*, U.S. Department of Treasury, Office of Tax Analysis, Working Paper 101, December 2007, http://www.treasury.gov/resource-center/tax-policy/tax-analysis/Documents/ota101.pdf; Jennifer C. Gravelle, *Corporate Tax Incidence: A Review of Empirical Estamates and Analysis*, Congressional Budget Office, Working Paper 2011-01, June 2011, http://www.cbo.gov/ftpdocs/122xx/doc12239/06-14-2011-CorporateTaxIncidence.pdf; and Kimberly A. Clausing, In Search of Corporate Tax Incidence, September 2011, Presented at a Conference of the American Tax Policy Institute, http://americantaxpolicyinstitute.org/15papers/Clausing%20ATPI.pdf.

[52] Two other studies using cross country data have examined the incidence of the tax on labor income. Passing the Burden: Corporate Tax Incidence in Open Economies, by Rachel Alison Felix, November 2006, finds smaller effects than Hassett and Mathur, but ones that are still too large to be predicted by a theoretical model. This study has problems similar to those that are discussed subsequently and, in addition, do not control for country fixed effects.

[53] Hassett and Mathur, *Taxes and Wages*. We are grateful to Kevin Hassett and Aparna Mathur for providing their data. Several of the countries only have data for shorter periods.

changes show up over longer time periods, and (2) arguing that this may control for possible measurement error induced by the business cycle.[54] The wage rates for all countries were converted to U.S. dollars using annual exchange rates. Hassett and Mathur include the price level of consumption as an explanatory variable to capture cost of living differences across countries. The main explanatory variable of interest is the logarithm of the top corporate tax rate. Hassett and Mathur also use the average effective and marginal effective corporate tax rates (in logarithms) as explanatory variables in some specifications.

We repeated the Hassett and Mathur basic estimation exercise; the results are reported in the first row of **Table 6**.[55] The coefficient estimate reported in the first column (-0.759) suggests that a 10% increase in the top corporate tax rate will lead to an 7.6% decrease in the average manufacturing wage rate. This estimate is statistically significant at the 5% level.[56] The results are not as strong (the estimates are closer to zero) when using alternative measures of the corporate tax rate (see the next two columns of **Table 6**).

The exchange rate between two currencies reflects the relative supply and demand for those two currencies, and is affected by financial markets and government policies. Exchange rates may not be good indicators of the relative buying power of wage rates in two countries. Purchasing Power Parities (PPPs), however, are specifically designed to equalize the internal purchasing power of the currencies. Workers in Australia, for example, are concerned with what their wages will purchase in Australia, and not how many dollars their wages will buy. Using PPPs is a more appropriate way to convert national currencies to a common currency (U.S. dollars).

The second row of **Table 6** reports the coefficient estimates when the wage rates are converted to U.S. dollars using the consumption PPPs. Consumption PPPs are more appropriate for converting wages than using general PPPs (over GDP) because they omit national expenditures for government and investment goods. Again, nominal wages are the dependent variable. The coefficient estimates are closer to zero than the estimates reported in the first row, but the coefficient estimate reported in the first column (-0.728) is statistically significant at the 5% level. The estimates for the alternative measures of the corporate tax rate are not statistically significant at the conventional confidence levels.

[54] Their independent or explanatory variables take their value from the beginning of the five-year period over which wages are averaged. It should also be noted that Hassett and Mathur calculate the five-year average with nominal wages (that is, they are not corrected for inflation).

[55] See **Appendix B** for a description of the estimation method. Visual inspection of the Hassett and Mathur data uncovered some errors with their 5-year averages of wage rates—some averages were based on 6 years of data and others were based on less than 5 years of data. We corrected the errors so that each 5-year period for each country contains 5 years of data. Some of the averages are based on less than 5 years of data because of missing values in the wage series; most of the missing valued are in the 2001 to 2005 period.

[56] The specific test of statistical significance of the coefficient estimates is the t-test. This is a test of whether or not the estimate is equal to zero (the null hypothesis is the estimate is equal to zero). The significance level indicates the risk of rejecting the null hypothesis when it is, in fact, true. A significance level of 5% indicates that the null hypothesis will be inadvertently rejected only 5% of the time. Significance levels commonly used in empirical social science work are the 1%, 5%, and 10% levels.

Table 6. Coefficient Estimates: Dependent Variable is the Logarithm of the 5-Year Average of Wage Rates

How Wage Variable Converted to U.S. Dollars	Corporate Tax Rate Variable		
	Top Tax Rate	Effective Average	Effective Marginal
Exchange Rate	-0.759** (0.297)	-0.630* (0.334)	-0.384* (0.226)
Purchasing Power Parity Exchange Rate (PPP)	-0.728** (0.303)	-0.528 (0.340)	-0.334 (0.230)
PPP—Constant Dollars	-0.488* (0.298)	-0.294 (0.318)	-0.218 (0.215)
Observations with 5-year Averages based on 5 Years of Data			
Exchange Rate	0.089 (0.353)	-0.229 (0.363)	-0.184 (0.240)
Purchasing Power Parity Exchange Rate (PPP)	-0.037 (0.354)	-0.187 (0.373)	-0.156 (0.246)
PPP—Constant Dollars	-0.064 (0.350)	-0.230 (0.351)	-0.180 (0.231)

Source: Authors' analysis.

Notes: Standard errors in parenthesis. Fixed effects linear model. Other variables include time dummies, log personal tax rate, log real value-added, log consumer price variable (except for real PPP). ** significant at 5% level; *significant at 10% level.

The most appropriate measure of wages is the inflation-adjusted consumption PPP-adjusted wage rate. Wages in each country were converted to U.S. dollars using the consumption PPP and then converted to constant (inflation-adjusted) dollars using the CPI-U before calculating the 5-year average. The final row of **Table 6** displays the coefficient estimates for the model using this measure as the dependent variable. The estimates are closer to zero than in the other two cases. The coefficient estimate in the first column (-0.488) is statistically significant at the 10% level but not at the 5% level. The other two estimates in columns two and three are not statistically significant at the conventional confidence levels. While there is still some evidence of corporate tax rates having a negative influence on wage rates in manufacturing, the effect is smaller and less robust than reported in the Hassett and Mathur study.

Hassett and Mathur averaged wages over 5-year periods. They justify using 5-year averages by arguing that it helps to control for possible measurement error induced by the business cycle. But, because of missing values in the wage data, 66 observations have the average wage based on less than 5 years of data (60 observations use only 2 consecutive years of data for the calculation of the average, which would likely not affect any measurement error). The bottom panel of **Table 6** reports the estimation results when these 66 observations are excluded from the analysis (leaving 153 observations). In all cases, the coefficient estimates for all measures of the corporate tax rate are not statistically significant.

Averaging the wage data over five years and using the beginning of period value for the explanatory variables, however, eliminates much of the variation in wages and tax rates, thus throwing away much of the information needed to estimate the economic effects. The statistical

analysis is repeated using annual data and including various lagged values of the corporate tax rate as explanatory variables.[57] The results are reported in **Table 7**. The first column of the table displays the coefficient estimates for the current value of the corporate tax rate (labeled t in the first column) and the values for the previous five years (t-1 to t-5), which allows for longer term effects of tax rates on wages. In each case, the coefficient estimates are negative but very close to zero; none are statistically significant at the conventional confidence levels. Furthermore, all the tax rate variables in column (1) are not jointly statistically significant. The next six columns report the results when the corporate tax rate values (current and lagged) are entered individually. In every case, the coefficient estimates are close to zero and are not statistically significant at conventional confidence levels. In using annual data, we can find no evidence that changes in the top corporate tax rate affects wage rates in manufacturing.[58]

Table 7. Coefficient Estimates: Dependent Variable is Annual Logarithm of Real PPP-Adjusted Wage Rates

Tax Rate Lag	(1)	(2)	(3)	(4)	(5)	(6)	(7)
t	-0.031 (0.208)						0.010 (0.140)
t-1	-0.217 (0.188)					-0.219 (0.143)	
t-2	-0.076 (0.166)				-0.074 (0.144)		
t-3	-0.040 (0.159)			0.021 (0.145)			
t-4	-0.113 (0.156)		-0.070 (0.146)				
t-5	-0.154 (0.155)	-0.165 (0.147)					
F (joint)	0.49						
Prob>F	0.819						

Source: Authors' analysis.

Notes: Standard errors in parenthesis. Fixed effects linear model with AR(1) disturbance. Other variables include time dummies, log personal tax rate, log real value-added. ***significant at 1% level; ** significant at 5% level; *significant at 10% level.

Hassett and Mathur recently produced a revision of their initial paper.[59] One of several generic problems with cross-country wage studies is that a proper specification should take into account not only the country tax rate but the rates of other countries. (Other generic problems include the direction of causation, for example, that countries with lower or slowly growing wages may choose to rely on corporate taxes as a revenue source, so that the wage changes may drive the

[57] Including the lagged values of the corporate tax rate allows the tax rates for the previous five years to individually have an impact on wages. All tax rates are entered into the model in logarithms.

[58] We obtain the same estimation results when the exchange rate is used to convert wage rates to U.S. dollars—the method used by Hassett and Mathur.

[59] Kevin A. Hassett and Aparna Mathur, "Spatial Tax Competition and Domestic Wages," December, 2010, http://www.aei.org/docLib/SpatialTaxCompetitionandDomesticWages.pdf.

corporate rate.) [60] Hassett and Mathur address the first issue, in a limited fashion, by adding tax characteristics of neighboring or economically similar countries. This addition, in some cases, reduced the coefficient on taxes and made it statistically significant at a lower level. The study also included some local price indices, but this change did not fully address the issue of comparing wages using purchasing power and did not address other issues raised about the original Hassett and Mathur study. Their results continued to produce implausible estimates. In the case where average tax rates of countries with similar income levels was added, the percentage change in wages for a 1% change in corporate taxes is 0.5%. This level implies a decrease of $13 in wages for each dollar fall in corporate taxes.[61]

Other Empirical Wage Studies

Several other studies have examined the incidence of the tax on labor income. They are discussed in three different categories: studies that rely on cross country data as in the case of Hassett and Mathur, studies that rely on cross state data, and studies that examine not the general incidence of the tax, but the share affecting wages through bargaining over excess profits. The Arulampalam, et al. study cited by Mankiw was the first of these latter types of studies.

Other Cross Country Studies of General Burden

Three studies in addition to the Hassett and Mathur study have relied on cross country data. Felix,[62] in a study that controls for education, finds much smaller effects than Hassett and Mathur, but ones that are still too large to be predicted by a theoretical model (about $4 dollars for each dollar of corporate tax revenue). This study has problems similar to those for Hassett and Mathur and, in addition, does not control for country fixed effects, therefore not controlling for unobserved country-specific factors. The sample is unusual as well, with 19 countries covered for varying years. Out of the total of 65 observations (countries and years), about a quarter of the sample is drawn from Italy and Mexico and seven of the 19 countries had only one or two years of data.

Another study, by Desai, Foley and Hines[63] uses observations on foreign owned affiliates of U.S. firms across countries and in different time periods. This study uses data on multinational subsidiaries of U.S. firms to estimate the allocation of the tax burden between labor and capital using a seeming unrelated regression for capital income (which they measure by the interest rate) and labor income. In their model, labor and capital burdens are restricted to the total of taxes, and they impose a cross-equation restriction on the estimated burdens. They find the share of the

[60] These generic problems are discussed by Jennifer C. Gravelle, *Corporate Tax Incidence: A Review of Empirical Estimates and Analysis*, Congressional Budget Office, Working Paper 2011-01, June 2011, http://www.cbo.gov/ftpdocs/122xx/doc12239/06-14-2011-CorporateTaxIncidence.pdf.

[61] Thus authors indicate that the fall in wages is $4, a lower but still implausible number. However, they calculate this incidence with the ratio of wages to taxes in the manufacturing sector, which is much smaller. Effects of the corporate tax on wages are, however, economy wide effects that should lower wages in the other sectors, including noncorporate sectors.

[62] Rachael Alison Felix, Passing the Burden: Corporate Tax Incidence in Open Economies, November 2006. This paper was a dissertation essay at the University of Michigan.

[63] Mehir A. Desai, C. Fritz Foley, and James R. Hines, Jr., "Labor and Capital Shares of the Corporate Tax Burden: International Evidence," Prepared for the International Tax Policy Forum and Urban-Brookings Tax Policy Center conference on Who Pays the Corporate Tax in an Open Economy?, December 18, 2007.

burden on labor income to fall between about 45% and 75% of the total, a number that is not inconsistent with theoretical expectations.

This approach, however, has the fundamental theoretical problem that wages at an individual firm should not reflect tax burdens at an individual firm. In deriving a model that assumes it does, they assume that the price level of their goods is fixed and base their results only on their sample of firms (which is comprised solely of multinational corporate sector firms). This approach creates both econometric problems in their analysis and also means that their results cannot be construed as reflecting actual burdens in any of their economies, as discussed in more detail in **Appendix C**.

They also represented equity returns through the interest rate, under the assumptions that investors equate (net of risk) debt and equity returns. If these assets are generally substitutable, the increase in corporate tax should cause portfolios to shift toward debt and drive the interest rate up (while driving the equity return down). Moreover, the tax burdens on debt and equity differ at the individual level and those differences depend, among other things, on any special tax rates for dividends and capital gains, the deferral advantage of capital gains, and the inflation rate.

Aside from these theoretical problems, an important issue with their study is that it appears that their results are forced by the cross equation restriction. William Randolph, a discussant at a recent conference, found that if the restriction is eliminated there are no statistically significant results from their study.[64] In an example he presented, the estimates of the wage effect was 48% of the burden, with a standard error of 18% in the original study; in a regression without the restriction the share was 19% with a standard error of 100%.[65] Randolph considered a number of other specifications, including excluding the largest countries, but found no statistically significant results. He also suggested that only manufacturing subsidiaries be considered since other subsidiaries may be involved in tax sheltering operations. In the case where he considered only manufacturing subsidiaries, the sign reversed (indicating labor benefitted from the tax) but it was not statistically significant.

The most recent of the cross country studies was undertaken by Clausing using a data set covering the OECD countries.[66] Her study examined a number of different specifications, econometric approaches, and alternative data measurements. Two aspects that differed from the Hassett and Mathur study were comparing wages using purchasing power parity and excluding value-added variables, which Clausing suggests is capturing the effect of corporate taxes (whose burden on labor operates by reducing labor productivity). She expects this latter change would make results for the corporate tax variable larger. Overall, however, while trying many specifications and approaches, she characterizes the results as indicating no robust evidence that corporate tax burdens have large depressing effects of wages. She notes, however, that this outcome does not necessarily mean there is no incidence on labor, but that these effects cannot be detected with aggregate cross country data, a point also made by Jennifer Gravelle in her review of empirical studies.[67]

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[64] His remarks were made at a seminar at the American Enterprise Institute, March 17, 2008.

[65] The coefficient must be close to twice the standard error to be statistically significant; thus the result from the unrestricted regression showed no relationship between taxes and wages.

[66] Kimberly A. Clausing, "In Search of Corporate Tax Incidence," November 2011.

[67] Jennifer C, Gravelle, *Corporate Tax Incidence: A Review of Empirical Estamates and Analysis*, Congressional Budget Office, Working Paper 2011-01, June 2011, http://www.cbo.gov/ftpdocs/122xx/doc12239/06-14-2011-CorporateTaxIncidence.pdf.

Cross State Regressions

Three studies estimate tax incidence based on cross state comparisons, as if each state were a separate country. Felix examines wages by residents of states depending, among other factors, on the state corporate tax rates.[68] She finds a smaller effect than the Hassett and Mathur or her own cross country study, although the results remain implausible, suggesting that a $1 dollar increase in taxes reduces wages by between $1.40 and $3.60.[69] Other problems with her data set is that it is not a panel, so there is no individual specific control, and the data set also does not allow the identification of place of work, but rather place of residence.

Felix and Hines use a similar cross state data set.[70] Although the stated objective of this study is to examine rent sharing by considering union and non-union differentials, the paper also contains direct estimates of the effects on tax rates on wages. The relationships, however, are positive, not negative. Although the authors conclude that higher corporate tax rates reduce union wage differentials (a point associated with bargaining over surplus discussed in the next section), this differential arises in their empirical estimates because union wages rise less with corporate taxes than do nonunion wages. Thus these results directly contradict the results in the previous Felix study.

Carroll also examines individual workers across the states using a different data set. He estimates the effects of the statutory rate (combined federal and state) and also an average state tax rate.[71] The first is only marginally statistically significant (and he does not highlight that result), but the second is highly significant. However, the average tax rate is measured not as taxes divided by profits but as taxes divided by personal income. Since personal income is strongly correlated with wages, this measure of tax would likely produce a powerful negative relationship without any direct relationship with taxes. As with other studies, the incidence estimated in this study is very large relative to the expected shares (he calculates $2.50 for every dollar of tax).

Another issue with respect to cross-state studies is whether, even were there no concerns with particular studies, the results provide little guidance to the effects of the federal tax. Capital is likely significantly more mobile across states and products across states are probably closer substitutes, both factors that make the incidence more likely to fall on labor. Labor, however, is also mobile. As in the case of cross-country studies, the tax rates of other states should be included in the regression. Finally, states often allocate profits based on formulas and these formulas change the dynamics of capital flows. For example, if a firm's taxes are based on the share of sales, changing the location of production would not be relevant to the state tax burden.

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[68] R. Alison Felix, "Do State Corporate Income Taxes Reduce Wages*?" Economic Review*, Federal Reserve Bank of Kansas City, Vol. 94, No. 9, 2009.

[69] Jennifer C, Gravelle, *Corporate Tax Incidence: A Review of Empirical Estamates and Analysis*, Congressional Budget Office, Working Paper 2011-01, June 2011, http://www.cbo.gov/ftpdocs/122xx/doc12239/06-14-2011-CorporateTaxIncidence.pdf.

[70] R. Alison Felix, and James R. Hines, *Corporate Taxes and Union Wages in the United States*, National Bureau of Economic Research, Working Paper 15263, August, 2009.

[71] Robert Carroll, *Corporate Taxes and Wages: Evidence from the 50 States*, Tax Foundation Working Paper No. 8, August 2009, http://www.taxfoundation.org/files/wp8.pdf.

Rent Sharing Studies

Several studies have appeared recently that discuss the potential burden of the corporate tax on wages via an entirely different mechanism, which has been misinterpreted in some ways. As noted earlier, Greg Mankiw[72] cited a study by Arulampalam, Devereux, and Maffini (hereafter ADM) finding a labor share of the corporate tax burden of 96% as evidence that the corporate tax fell largely on labor. (The most recent version of their study reports 49%).[73] This study does not estimate the general equilibrium effects of corporate taxes on economy wide wages but rather the share of the tax on excess profits that falls on workers due to bargaining and rent sharing, as do the other studies reviewed in this section. They have relatively little relevance to the general issue of the corporate income tax for the United States (in part, because the shares of workers who belong to unions that bargain on wages is so small). However, their results have been invoked as evidence on the general tax burden and these types of studies appear to be proliferating. The ADM study has apparently inspired several other studies of this nature, which are discussed here. These studies use individual firm observations, which, as noted earlier, are not appropriate for the general incidence of the corporate tax, but are appropriate for the study of rent-sharing.

Before proceeding to examine both the ADM study and other studies specifically, it is important to make some general points about these types of studies as measures of the share of the corporate tax borne by labor. First, even if a reliable measure of labor's share could be found, the share cannot be interpreted as the share of total tax falling on wages because the analysis relates only to excess profits, which are in turn only a part, perhaps a small part, of total profits. Moreover, the burden relates only to those firms that both have some profits and engage in bargaining. While bargaining may be common in some European countries, in the United States, where unions would be expected to do the bargaining, less than 7% of private wage and salary workers are covered by unions.

Second, there is an existing literature that has attempted to estimate the share of labor in excess profits (without focusing on tax issues). Most studies have found that, even in those circumstances where bargaining is to be expected, labor tends to capture a relatively small share, typically less than10% and rarely more than 20% or 30%.[74] This small share suggests the amount

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[72] N. Gregory Mankiw, "The Problem with the Corporate Tax," *New York Times*, June 2, 2008

[73] The lower share is due to valuation at the mean rather than the median. Most studies evaluate at the mean since the estimates reflect the mean values.

[74] Most studies found labor's share of to be less than 10%. See Andrew K. Hildreth and Andrew T. Oswald, "Rent-Sharing and Wages: Evidence from Country and Establishment Panels," *Journal of Labor Economics*, Vol. 15, April 1997, pp. 318-337. Based on the means of the sample, their study of the UK indicated that labor's share of excess profit was about 5%. Four other articles, and a book, were cited as having similar results: Kevin Denny and Steve Machin, "The Role of Profitability and Industrial Wages in Firm-Level Wage Determination*," Fiscal Studies*, May 1991, pp. 34-45; Louis Christofides and Andrew J. Oswald, "Real Wage Determination and Rent-sharing in Collective Bargaining Agreements," *The Quarterly Journal of Economics*, Vol. 107, august 1992, pp. 985-1002; David G. Blanchflower, Andrew J. Oswald and Peter Sanfey, 'Wages Profits and Rent-Sharing," *The Quarterly Journal of Economics*, Vol. 111, February 1996, pp. 227-251; and Alan A. Carruth and Andrew J. Oswald, *Pay Determination and Industrial Prosperity*, Oxford University Press: New York, 1989. These studies generally used U.K. data, although one used U.S. data and one used Canadian data. These studies were generally not economy wide but confined to sectors such as manufacturing. Two studies found, in one case larger effects, and in the other, mixed effects. John A. Abowd and Thomas Lemieux, "The Effects of Product market Competition on Collective Bargaining Agreements: The Case of Foreign Competition in Canada," *The Quarterly Journal of Economics* Vol. 198, November 1993, pp.. 983-1014 found a larger effect of 18% when they used instrumental variables to address endogeneity. John Van Reenen, "The Creation and Capture of Rents: Wages and Innovation in a Panel of U.K. Companies," *Quarterly Journal of Economics*, Vol.111, February 1996, pp. 195-226, also using instruments, finds a share of about 5% when using quasi-rents (sales (continued...)

of labor income due to rent sharing is small, and that is consistent with estimates that the union wage premium about 15% (with a range of 0 to 30%).[75] Thus the share of the total wage bill that reflects rents of union workers is 1% (the share of union workers, 7%, times the wage premium of 15%).

Thirdly, and perhaps the most important point to make, in the standard bargaining model (such as that employed by ADM), a corporate tax rate that applies to excess profits would not be expected to affect wages through the bargaining process. If taxes are treated in a standard way as a rate applied to a firm's revenue minus cost, the tax term does not appear (see **Appendix D**). The economic intuition behind this is that while a higher tax rate reduces the surplus or size of the pie to be divided, it also makes the "price" of giving a dollar to labor lower because wages are deductible. Economists might think of these as offsetting income and substitution effects and in this model they offset exactly.[76]

The only tax effect left is the one that arises (potentially) from the general equilibrium effects on the economy that occur due to the imposition of the tax on normal profits, an effect that applies to firms without excess profits and unions as well and could only be uncovered through some analysis appropriate to economy-wide effects. Under reasonable assumptions the proportional effect on rents is similar to the proportional effect of wages. Because the taxes on the excess profits themselves do not directly drive payments to labor, considering the possibility of rents simply means that an even smaller share of the total corporate tax burden falls on labor than suggested by the general equilibrium models. (For example, if the model estimates 20% of the burden will fall on labor and 25% of profits is excess, then only 75% times 20%, or 15%, of the burden falls on labor.) Given these theoretical insights, one might question why empirical studies of rent-sharing are being pursued at all as a question of tax incidence, and why such significant effects have been found.

The ADM study used firm level data (for about 55,000 firms) from several European countries (primarily France, Italy, Spain and Germany) over a relatively short time frame of 1996-2003.[77] It controlled for firm-specific effects. About a quarter of the observations are for only four years and about 45% only five years so that the panel, like that of Felix, shows changes over the short run. The same authors had a earlier version of their study with a smaller sample. Although the authors control for firm level fixed effects, they do not control for country-specific effects. The authors have subsequently revised their study reporting, for the preferred specification, that labor bears 64% of the tax in the short run and 49% in the long run.[78]

(...continued)

minus the alternative wage) but 35% when using profits. (Note: All of the shares presented in this note are derived by CRS and are calculated using the sample means). These studies, of course, vary in quality and are subject to various critiques.

[75] This literature is summarized in R. Alison Felix and James R. Hines, Corporate Taxes and Union Wages in the United States, National Bureau of Economic Research Working Paper 15263, August 2009.

[76] Nadine Riedel, "Taxing Multi-Nationals Under Union Wage Bargaining," *International Tax and Public Finance*, Vol. 18, August 2011, pp. 399-421 makes this point when she argues that increasing the domestic tax on a multinational with a surplus would actually, through this mechanism, cause domestic wages to rise and foreign wages to fall since the latter do not benefit from the higher value of deductibility.

[77] Wiji Arulampalam, Michael P. Devereux, and Georgia Maffinin, *The Direct Incidence of Corporate Income Tax on Wages*, Oxford University Centre for Business Taxation, March, 2011.

[78] Prior versions of this study reported larger results (in a 2008 version, that labor bears 96% of an increase in tax in the short run, and 92% in the long run, and in a 2007 version that labor bore 54% in the short run and 176% in the long run, (continued...)

The ADM study properly derives a model where the tax on revenues minus wages disappears and claims not to consider the tax on normal profits. Instead the authors hypothesize an extra tax term that is not associated with profit that will affect wages directly. It is difficult to imagine exactly what type of tax provision would fall into this category. In any case, the share of the corporate tax arising from this type of provision seems likely to be vanishingly small.[79]

Whatever the authors theorize about, it is not what they include in their regression. The variable is total taxes paid per worker (although it is instrumented with tax rates and other variables). The study also excludes other important variables which cannot be observed such as the competitive wage (they use a minimum wage which is obviously far too low). The empirical implementation examines the change in wages as a function of the change in output and taxes (all taxes, not just lump sum taxes) which are closely linked as major elements of a contemporaneous identity and may explain their findings. Thus, it is possible that the statistically significant relationships obtained derive from some other linkage and do not represent a share of the tax burden.[80] There are also some important reservations about the econometric methods. Panel data with short time periods (where persistence effects can be serious) and the need to control for firm specific effects face some significant econometric problems. The authors use a number of different specifications, with widely varying results, which suggest that the results are not robust.[81] There are several other aspects of the econometrics that are not transparent.[82]

Overall, it is not clear what relationship or phenomenon the study is measuring. Interest ideally is in how an exogenous tax change affects wages. Yet for some of the countries that constitute a large share of the data, there were no changes in tax rates. In others, tax rate changes were virtually all declines, with most of those declines occurring during the growth period of the late 1990s, when productivity and output was rising. It is possible that the results are capturing that phenomenon.

Another study using European data directed at capturing the bargaining share was recently released by aus dem Moore, Kasten, and Schmidt.[83] This study compared the changes in wages of German manufacturing compared with French manufacturing, spanning a time when the German taxes were reformed (including rate cuts) and the French tax was not. This analysis finds a very large effect: an increase in German wages of 6.4% due to the rate cuts. This finding seems large. According to the reported means of the data, the ratio of wages to taxes is 11.9; that is wages are

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at least for the specification that the authors reported.), which appear to reflect initially a increase in the sample and subsequently measuring incidence based on the mean rather than the median. These results seemed quite implausible.

[79] A number of proposed types of provisions, such as interest deductions, losses, and pension contribution would nevertheless be costs that are related to profits.

[80] This point is made by Jennifer C, Gravelle, *Corporate Tax Incidence: A Review of Empirical Estimates and Analysis*, Congressional Budget Office, Working Paper 2011-01, June 2011, http://www.cbo.gov/ftpdocs/122xx/doc12239/06-14-2011-CorporateTaxIncidence.pdf. Note also that the regression is also run in logs which does not allow for negative tax liability even though the model is in levels.

[81] The tests used by the authors to determine their preferred specification are not without problems. See David Roodman, "How to Do xtabond2: An Introduction to "Difference" and "System" GMM in Stata," Center for Global Development, Working Paper 103, December 2006.

[82] For example, no reason is presented for using a dynamic specification or the specific number of lagged variables, and the number of instruments was not reported.

[83] Nils aus dem Moore, Tanja Kasten, and Christoph M. Schmidt, "Do Wages Rise When Corporate Tax Rates Fall? Evidence from the German Business Tax Reform 2000," January 11, 2011.

about 12 times the amount of taxes. If wages rose by 6.4%, that amount is 76% of the **total** corporate tax. It appears that the reduction in German taxes was around 20%, which implies, in dollar terms, that wages rose $4 for each dollar reduction in tax, when it should have been a share of only a small part of the tax. It seems likely that the empirical estimates are capturing some other type of influence, and the authors indicate their study is preliminary and uncertain. The authors never discuss the theoretical finding that this type of tax rate change is the kind of change that would not be expected to show up as a part of rent sharing.

Another study, by Dwenger, Rattenhuber, and Steiner, also uses firm data to examine the German tax cut .[84] As with the aus dem Moore, et al. study, they do not address theoretical concerns and simply assume that labor will bear some of the burden of the tax via bargaining. Their estimates of this initial wage effect indicate labor bears 156% of the tax. They also assume that the higher or lower wages will lead to employment shifts (so that when wages rise, employment falls and thus the wage bill does not fall as much), which results in a total wage bill effect of 47% of the tax. This line of reasoning regarding employment is also inconsistent with theory, as the wage does not change from the direct bargaining effect. Rather it arises from the increase in the cost of capital via increased taxes, which, while decreasing the demand for capital (assuming there is a non-taxed noncorporate or foreign sector), has effects on employment in the corporate sector that are uncertain. In a general equilibrium model, employment is assumed to be fixed in the economy. In any case, these general equilibrium effects cannot be uncovered with firm specific data within a country because the effect should not relate to the specific taxes of the firm. As with the aus dem Moore, et al. study, it is not clear what the authors are measuring when they regress wage rates on tax rates, although it could reflect differential wage growth across industries.

Two studies have been based on data in the United States. As noted earlier, Felix and Hines actually found wages to rise with increases in state tax rates, but the union differential fell. They indicate that their findings show that workers in a unionized firm bear 54% of the tax burden. Several important points should be understood about their analysis. First, as they make clear, they are not trying to estimate the effect of direct taxes on rents, as this effect disappears from their model. They are rather examining the indirect effect that would arise due to the increase in the cost of capital and the subsequent general equilibrium effects that would arise. Although they have correctly measured a statewide tax rate as their tax variable (rather than a firm specific rate), the model they use to drive their theoretical expectations has a mistake (as shown in **Appendix D**) and the expectation from a properly derived model is likely a close to zero effect, and if not zero probably positive. Their estimate appears outside the range of reasonable theoretical prediction and probably in the wrong direction. In addition in calculating incidence they have applied the elasticity to the entire wage bill, not the share that is rent. If the rent share is about 15%, 8% of the tax, not 54%, falls on rents. As shown in the appendix, for a nationwide incidence taking into account union membership and theoretical expectations, the share of the tax that falls on rents is no more than 3% (keeping wages constant) and rents would more likely benefit.

The most recent study of the United States is one by Liu and Altshuler. Their theoretical approach is difficult to interpret. As discussed in this review, there are general equilibrium effects that can shift the tax to wages, but within a closed economy with a fixed capital stock the central tendency is for the burden to be spread to all capital, but not to wages.[85] Only in an open economy, where

[84] Nadja Dwenger, Pia Rattenhuber and Victor Steiner, Sharing the Burden: Empirical Evicend on Corporate Tax Incidence, Max Planck Insitute for Tax Law and Finance, 2011-14, October, 2011, http://www.tax.mpg.de/files/pdf1/Dwenger-Rattenhuber-Steiner_Incidence_MPI.pdf

[85] This outcome occurs with unitary production and utility functions; when these functions are changed labor can bear a (continued...)

capital can flow across countries (and which would require country observations) could wage shares be estimated through this mechanism and the wage would be an economy-wide (country-wide) wage.

Generally, using a single country's data is aimed at measuring a burden that would fall on labor through the rent-sharing mechanism, except that the standard bargaining framework shows that while rents might be shared by labor, the tax on rents should not be. Liu and Altshuler never discuss a bargaining equilibrium and therefore never confront the offsetting price and income effects that tend to eliminate rent-sharing arising from taxes. In fact, at one point in their model, the wage rate becomes the numeraire (is fixed) which implies there are no industry wage differentials.

Their empirical approach is to examine how relative wage rates in each industry changed over time based on the mix of assets and the change in marginal tax rates over that period. They conclude that labor bears 60% to 80% of the tax. Why do they obtain such large effects, when theory says they should be zero or negligible? The most likely reason is because the marginal tax rate fell primarily for equipment, and those industries whose investments were more concentrated in equipment (manufacturing, transportation, construction, but especially manufacturing) probably saw slower wage growth over the period due to the decline in unions and international competition.

What Should Be Concluded About Incidence?

Although there has a resurgence of interest in direct empirical estimates of incidence, this review suggests that these reduced form empirical studies are seriously flawed, produce an unreasonable estimates, are not robust (changes in specification change the results), or are inconsistent with theory, as is the case in the rent-sharing studies. Certainly, a serious problem with even the best of these studies is that the corporate tax tends to be dwarfed by the size of labor income so that it is difficult to detect this relationship or control for other factors that affect wages. The advantage of studying incidence through a general equilibrium model is that such a model can control for the factors affecting the incidence, and, even though they are models, they are informed by empirical evidence.

Based on these models, it appears that most of the burden of the corporate tax falls on capital (and were debt considered it is possible that labor benefits from the tax). Thus the tax is a progressive one.

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small amount of the burden, or labor can benefit from the tax with capital bearing slightly more than 100% of the burden. Labor can bear some non-negligible share of the tax when factor substitution is much smaller in the corporate as compared to the noncorporate sector, but the reverse is likely to be the case since a large part of the noncorporate sector is housing services. See Jane G. Gravelle and Laurence J. Kotlikoff, "The Incidence and Efficiency Costs of Corporate Taxation When Corporate and Noncorporate Firms Produce the Same Goods, *Journal of Political Economy*, Vol. 97, No. 4, August 1979, pp. 749-780. This article has tables of incidence measures with different elasticities.

Economic Efficiency Issues

The traditional criticism of the corporate tax, as spelled out in the Treasury Study, is that the tax causes distortions, and that these distortions are exacerbated by corporate tax preferences that prevent, for a given level of tax revenue, a lower tax rate. The issues discussed in this section include allocation of capital within the domestic economy, savings effects, and international capital flows.

Allocation of Capital Within the Domestic Economy

Traditionally, the efficiency concern about the corporate tax is related to the misallocation of resources between corporate and noncorporate production (including owner-occupied housing). Over time, efficiency issues have also encompassed differential taxation of the returns to assets of different physical types, and financial distortions, which affect the debt-equity ratio, payout choice, and decision to realize capital gains.

Some efficiency costs, including those that alter the mix of a firm's physical assets, arise not so much from the existence of a corporate tax but from its design. **Table 8** captures the effects of the two most significant generally available provisions that affect tax burdens on different assets: depreciation rules and the recently enacted production activities deduction, which in effect allows a lower tax rate on certain domestic activities that are deemed production (manufacturing, construction, etc.). The tax rates in this table account only for the corporate tax (that is, they do not include the benefits of deducting interest or the tax at the individual level on interest, dividends, and capital gains). They are also forward looking and marginal: they estimate the share of the return on a prospective investment that is paid in tax. If income were correctly measured and taxed that share would be the statutory rate; most assets face lower tax rates.

The variations within a column illustrate the distortions firms face in choosing the mix of capital within a firm. Overall the variations not only distort the mix of capital within a firm, but also the allocation of capital across different industries. In general, the most favored major industry is oil and gas extraction where a large fraction of investment is deducted when incurred. Other things equal, firms eligible for the production activities deduction and firms that have a larger share of their capital stock in equipment than average will be favored.

In the aggregate, the tax rate on equipment is estimated at about 25%, a full 10 percentage points below the statutory tax rate, while structures (covering the last seven rows of **Table 8**) are subject to a 30% rate. Inventories are subject to a 37% rate and the overall rate on reproducible capital is 29%.[86]

The Treasury Study reports aggregated asset specific data, which provide a similar result, indicating that equipment is favored. Their measures include the total tax burden, including the benefit of deducting interest, and individual level taxes. They estimate a tax rate of 25% on equipment, 34% on structures, and 33% on land and inventories.

[86] These estimates are reported in CRS Report RL33545, *The Advisory Panel's Tax Reform Proposals*, by Jane G. Gravelle.

These estimates are somewhat overstated because they do not include intangible investments, such as research and advertising. Some research and experimentation expenditures are expensed (leading to a zero tax rate on those expenditures) and eligible for a credit as well (leading to a negative rate, but only intangible expenditures, however, are eligible). Spending on advertising is expensed and subject to a zero rate even though some advertising has future benefits.

Table 8. Differential Tax Rates across Asset Types

Asset	No Production Deduction	With Production Deduction
Autos	34	31
Office/Computing Equipment	31	28
Trucks/Buses/Trailers	29	26
Aircraft	29	26
Construction Machinery	23	21
Mining/Oilfield Equipment	28	25
Service Industry Equipment	28	25
Tractors	27	24
Instruments	28	25
Other Equipment	27	24
General Industrial Equipment	25	23
Metalworking Machinery	23	21
Electric Transmission Equipment	33	30
Communications Equipment	19	17
Other Electrical Equipment	24	21
Furniture and Fixtures	23	20
Special Industrial Equipment	21	19
Agricultural Equipment	21	19
Fabricated Metal	29	26
Engines and Turbines	36	33
Ships and Boats	17	15
Railroad Equipment	18	16
Mining Structures	7	6
Other Structures	40	37
Industrial Structures	37	34
Public Utility Structures	27	24
Commercial Structures	34	31
Farm Structures	26	23
Residential Structures	31	NA

Source: Congressional Research Service, from CRS Report RL33545, *The Advisory Panel's Tax Reform Proposals*, by Jane G. Gravelle.

Table 9 reports the types of distortions that are an artifact of the corporate tax as a separate tax. These estimates, unlike those in **Table 8**, take into account all levels of taxes. One of the complications of estimating these tax rates is whether the estimates should consider the significant (over 50%) fraction of individual passive income that is held in tax exempt form through pensions, IRAs, life insurance annuities and non-profits. In some ways, these sources can be viewed largely as not affecting marginal investment (for example, overall savings) because they are capped or not controlled directly by the investors and in other ways they affect choices (such as debt or equity of pension funds). For this reason, in addition to the estimates presented by Treasury, two sets of CRS estimates are provided which assume either no tax exempt investment or half is tax exempt.

Within the corporate sector, in addition to asset differences, there is a larger differential with respect to debt versus equity finance. The aggregate tax burden on debt is slightly negative, while equity is taxed at close to 40%. If economic income were measured correctly, interest would be subject to the individual income tax rate, which is typically slightly above 20%. Debt is subsidized at the firm level, however, because nominal interest is deducted (including the inflation premium) while corporate profits before this deduction are effectively taxed at a rate below the statutory rate on real income. The result is that at the firm level, equity is subject to a tax rate of around 30% while debt is subsidized at about the same level (a negative 32% tax rate). At the individual level, the tax on interest for taxable recipients is higher than the statutory rate because nominal interest is taxed, which pushes the overall tax rate towards a small but negative rate.

Table 9. Effective Tax Rates by Sector and Type of Finance

Sector	Treasury Estimates	CRS Estimates, No Tax Exempt Investment	CRS Estimates, Half of Investment Tax Exempt
All Business	26	28	22
Corporate Business	30	32	25
Debt	-2	9	-11
Equity	40	37	33
Non-corporate business	20	20	14
Owner Occupied Housing	4	-3	-13
Economy wide	17	18	11

Source: Treasury Report; CRS Report RL33545, *The Advisory Panel's Tax Reform Proposals*, by Jane G. Gravelle.

Evidence on the size of this distortion is limited, but since there appears to be limited substitution between debt and equity, it is probably less than 5% of corporate tax revenue.[87] Some simple measures, however, could significantly reduce this distortion (such as indexing interest payments for inflation). Lower corporate tax rates would also reduce this distortion.

[87] See Jane G. Gravelle, *The Economic Effects of Taxing Capital Income* (Cambridge: MIT Press, 1994), pp. 82-83, suggesting a distortion of about 0.17% of total consumption. With consumption (including government spending) about 83% of output, and the corporate tax 2.7%, this amounts to about 5% of corporate revenue. This amount has fallen slightly due to lower rates on capital gains and dividends. For estimates of the substitutability of debt and equity see Ruud de Mooij, The Tax Elasticity of Corporate Debt: A Synthesis of Size and Variations," International Monetary Fund Working Paper WP/11/95, April 2011, http://www.imf.org/external/pubs/ft/wp/2011/wp1195.pdf.

The distortion that has probably received the most attention by those studying the corporate tax is the misallocation of capital between the corporate and noncorporate sectors. One source of the distortion arising from the corporate tax system is the taxation of corporate business at around 30%, while unincorporated business is taxed at only 20%. The higher corporate tax also contributes to a larger wedge between corporate production and owner-occupied housing, which is generally taxed at a negligible rate. The magnitude of the estimated distortion produced by having a separate corporate tax varies depending on the model used and ranges from less than 10% of corporate tax revenue to about a third.[88] Since the deadweight loss varies with the square of the tax rate, the recent decline in the differential due to lower tax rates on dividends and capital gains suggests the distortion relative to revenue would be smaller—probably no more than 4% to 7% of revenue.[89]

A distortion not captured in **Table 9** is the one that affects corporate payouts. Given that appreciation in stock values is not taxed until realized, there is a benefit to retaining earnings. There is a dispute about what determines payout ratios, and what the consequences of the tax are, but, in general, the welfare cost is small. There is also some distortion due to the lock-in effect for capital gains realizations.[90]

Considering all of these distortions together, they are probably in the range of 10% to 15% of corporate tax revenues, a magnitude that could be considered as a significant component of the burden of the tax. However, given the revenue needs of the government, there would also be distortions, perhaps smaller, associated with alternative taxes. Ways to reduce these distortions may, however, be worth considering.

Savings Effects

Much of the Treasury Study's discussion emphasized effects on savings although this is not normally the focus of efficiency concerns about the corporate income tax. This distortion is not unique to corporate income taxes, but occurs with all capital income taxes. There are many difficulties with analyzing this issue. The first is that, as noted above in the discussion about the potential effect of savings on the wage rate, the economic distortion depends on the behavioral response of savings to tax changes, and what tax replaces them. Some economists have a strong view that taxes on the rate of return are always distorting, but these views are based on dynamic infinite-horizon models that may not be very realistic. With life-cycle models, the distortions

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[88] See the review in Gravelle, *The Economic Effects of Taxing Capital Income*, pp. 77-82.

[89] The distortion is proportional to the square of the wedge between pretax returns, which is $t_c/(1-t_c) - t/(1-t)$, where t_c is the corporate tax rate and t the unincorporated. The corporate tax fell from about 44% in the mid-1980s to 32% today, while the noncorporate tax fell from 22% to 20% and the rate on owner occupied housing remained about the same (roughly zero). Holding the after-tax return constant, the wedge between corporate and noncorporate capital fell by over a half, and the square of the wedge by 80%. A calculation for owner-occupied housing suggests that the wedge fell by 40% and the deadweight loss by two thirds. For the largest deadweight loss estimates, virtually all of the distortion was due to the corporate non-corporate differential, so that the current deadweight loss would be only 20% as large, while for the others, both assets played an important role.

[90] Estimates of 0.04% to 0.11% of consumption translate into 1% to 4% of corporate revenues, see Gravelle, *The Economic Effects of Taxing Capital Income*, p. 89. With the reduction in tax rates of almost 50%, and the welfare cost proportional to the square of the tax wedge, the welfare cost would be about 30% of its former value or less than 1%. There is also a welfare cost from the realizations response of about 1%, but recent evidence has shown this response to be small, about the same size as the pay-out distortion.

depend on what revenue substitute is provided; substituting taxes on wages for taxes on capital, the most likely substitute in the U.S. tax system, could potentially increase distortions, depending on the responses in the models.[91] In models of bounded rationality, where savings are based on rules of thumb such as fixed shares of income or fixed targets, there is no response, or only an income effect, which would not produce a distorting effect.

International Capital Flows

Tax rules can affect the efficiency of allocation of capital around the world, and, if the U.S. rate is different from other countries, it can cause misallocations of capital. According to a recent study, the U.S. corporate tax rate is 39% compared to an average of 30.7% for the largest 15 countries outside the United States and an average of 29.6% for OECD countries outside the United States (both weighted by output).[92] For firms eligible for the U.S. production activities deductions, characteristic of most multinationals, the rate was 36.3%. The effective tax rate (taxes divided by profits) was about the same and the marginal effective tax rates only slightly higher.

These data do not indicate the U.S. is a high tax country with respect to investment. The main source of international distortion, therefore, is probably the increased investment that occurs in low tax and tax haven countries because the United States and other developed countries do not tax that income at all or tax it on a deferred basis. This inefficiency is not due to the corporate effective tax rate, but rather is due to the provision of a tax benefit for investment abroad.[93]

Even when tax rates diverge, the efficiency costs appear to be relatively insignificant because the evidence suggests, as noted in previous sections, limited mobility of capital as a result of varying tax rates and natural constraints of the economy.[94]

Potential Revisions in the Corporate Tax

There are a variety of potential revisions that could be made to the corporate tax to permit lowering the rate. The revisions discussed here include (1) broadening the corporate tax base and using the revenues to reduce the rate or to provide investment incentives, (2) correcting interest deductions and income for inflation, and (3) increasing the individual level tax to permit a lower tax at the firm level or taxing large unincorporated firms as corporations.

[91] See Jane G. Gravelle, "Income Consumption and Wage Taxation in a Life Cycle Model: Separating Efficiency from Redistribution," *American Economic Review*, vol. 81, no. 4 (September 1991), pp. 985-995.

[92] CRS Report R41743, *International Corporate Tax Rate Comparisons and Policy Implications*, by Jane G. Gravelle

[93] The issues of efficiency in international taxation are discussed in much more detail in CRS Report RL34115, *Reform of U.S. International Taxation: Alternatives*, by Jane G. Gravelle

[94] Jane G. Gravelle and Kent A. Smetters, "Does the Open Economy Assumption Really Mean That Labor Bears the Burden of a Capital Income Tax?" *Advances in Economic Policy and Analysis*, vol. 6, No. 1, 2006 find efficieny gains of 3% to 5% of revenue assuming the rest of the world had no tax and the United States had a 35% effective tax rate. Since tax rates are similar to those in the rest of the world, the effeciency effect is negligible and approaching zero.

Eliminating Corporate Tax Preferences

One type of revision that would probably be supported by many economic analysts is to eliminate certain corporate preferences in exchange for a lower statutory corporate tax rate. The 2007 Treasury Study estimated that eliminating corporate preferences would allow the tax rate to be lowered to 27%. **Table 10** shows the preferences the Treasury Study listed and the average FY2008-FY2017 revenue costs they reported at that time.[95]

Table 10. Corporate Tax Preferences and Projected Revenue Costs, FY2008-FY2017

Preference	Average Annual Revenue Cost ($ billions)
Expensing and accelerated depreciation	41.0
Deduction for U.S. production activities	21.0
Exclusion of interest on state and local debt	13.5
Research and experimentation (R&E) credit	13.2
Deferral of income of controlled foreign corporations	12.0
Low-income housing credit	5.5
Exclusion of interest on life insurance savings	3.0
Inventory property sales source rule	2.9
Deductibility of charitable contributions	2.8
Special Employee Stock Ownership Plan (ESOP) rules	2.3
Exemption of credit union income	1.9
New technology credit	0.8
Special Blue Cross/Blue Shield Deduction	0.8
Excess of percentage over cost depletion	0.7
Other corporate preferences.	2.7

Source: Treasury Study.

The largest preference in the list is expensing and accelerated depreciation ($41 billion) and the second largest is the production activities deduction ($21 billion); both provisions are captured in effective tax rates cited above. Other significant provisions (worth over $10 billion each in these years) include the exclusion of interest on state and local bonds, the research and experimentation tax credit, and the deferral of income from foreign sources, which is probably responsible for much of the international distortions.[96]

Interestingly, their list did not include graduated rates for small corporations, which costs slightly over $4 billion per year. Since owners of small corporations are typically as wealthy (or more

[95] The purpose of most of the provisions is self explanatory; note, however, the property sales source rule (also known as the title passage rule) is effectively an export subsidy. Percentage depletion benefits independent oil and gas producers and mineral and coal producers and allows a deduction of costs based on a percentage of receipts rather than the actual costs.

wealthy) than owners of large ones, there appears to be little economic justification for not including these rates.

Also in 2007, H.R. 3970 (110th Congress) was introduced by then Chairman of the Ways and Means Committee Rangel. It was a more limited bill that would have lowered the tax rate to 30.5% (at a 10 year cost in FY2008-FY2017 of $363.8 billion), as well as allowing a permanent extension of provisions allowing expensing for small business (at a cost of $20.5 billion). As shown in **Table 11**, this proposal did not alter depreciation, and eliminating the production activities deduction was the proposal's largest revenue raising provision. (Note that the revenue estimates were quite different, however.) It also included an alternative to eliminating the deferral of foreign source income that was somewhat more limited: disallowing expenses associated with foreign source income that is tax-deferred and allowing foreign tax credits only to the extent foreign income is currently subject to tax. The proposal also included two other international provisions, one eliminating a provision adopted in 2004 that included worldwide (rather than domestic) interest allocation rules for the foreign tax credit limit and one restricting the availability of lower withholding tax rates on income invested in the United States under treaty rules. However, a delay in the worldwide interest allocation has already been a revenue raiser for other legislation. Another major revenue raiser was a restriction in inventory accounting rules. The only depreciation base broadener in the proposal is one to extend the depreciation period for acquired intangibles. As is often the case in tax legislative proposals, revenue raisers are not always in the tax expenditure list.

Table 11. Corporate Revenue Raisers in H.R. 3970

(110th Congress)

Provision	Average Annual Revenue Gain, FY 2008-2017, $ billions
Repeal production activities deduction	11.5
Repeal of LIFO and lower of cost or market inventory	11.4
Allocation of expenses for repatriation of foreign income; pooling of foreign tax credits	10.6
Amortize intangibles over 20 years	2.6
Treaty shopping	0.6
Reduce dividend received deduction	0.5

Source: Reported in Gravelle (2007), estimates originally provided by the Joint Committee on Taxation.

Note: The bill also included repeal of worldwide income allocation at average benefit at $2.6 billion; this provision has been delayed to 2020 by other legislation but could include revenue in the future. The bill also included the economic substance doctrine ($0.4 billion) which was enacted in health care legislation in 2010.

Over several Congresses, Senator Wyden, along with co-sponsors, has introduced a broad tax reform proposal. His proposal for the 111th Congress, S. 3018 (co-sponsored with Senator Gregg) was scored by the Joint Committee on Taxation. It would also eliminate a range of corporate tax preferences and lower the rate to 24%. This legislation would eliminate several of the provisions in **Table 10** (accelerated depreciation, the production activities deduction, deferral, the inventory property sales source rule, and some smaller provisions), as well as index corporate debt for inflation (discussed below). This bill is able to achieve more rate reduction because it uses provisions outside the standard tax expenditures to raise revenue. As shown in **Table 12**, a major revenue raiser in that study was a provision not in the tax expenditure list to provide a per country

foreign tax credit limit (rather than an overall limit) for foreign source income and it was almost as large as accelerated depreciation. S. 3018 also raises significant revenue from disallowing interest deductions that reflect inflation (discussed below).

The Fiscal Commission proposed a measure very similar to the Wyden Gregg bill except that they did not include the deferral and per country foreign tax credit limit. Rather, they included a territorial tax that would raise somewhat less revenue than repealing deferral alone.

Table 12. Corporate and Business Tax Provisions in the Wyden-Gregg Bill, S. 3018, Introduced in 2010

Provision	Average Cost: FY2011-2020, $billions
Eliminate deferral of foreign source income and impose a per country foreign tax credit limit	58.3
Accelerated depreciation	56.9
Index interest for inflation	16.3
Eliminate production activities deduction	15.4
Eliminate title passage rule (inventory sales source rule)	7.7
Prohibition on advance refunding	1.2
Eliminate percentage depletion, capitalize intangible drilling costs and mine development costs	1.6
Repeal LIFO for large oil and gas producers, eliminate lower of cost or market inventory	0.8
Apply inversion rules retroactively to 2002	0.2
Eliminate special tax rate on nuclear decommissioning	0.1

Source: Joint Committee on Taxation, 2010b Estimates of the Revenue Effect of S. 3018, The Bipartisan Simplification Act of 2010, November 2, 2010, at http://wyden.senate.gov/imo/media/doc/Score.pdf.

President Obama's annual budgets have also included corporate tax reform provisions, concentrated in a few areas: international provisions, insurance provisions, inventory accounting, and fossil fuels. The first two of the international provisions are the same allocation of deduction and foreign credit provisions contained in H.R. 3790.

Table 13. Corporate Revenue Raisers in President Obama's FY2012 Budget

Provision	Average Annual Revenue Gain, FY2012-FY2021
International Provisions	14.0
—Disallow interest expense for unrepatriated income	3.8
—Foreign tax credit pooling	5.1
—Restrictions on intangibles profit shifting, including taxing excess returns to United States	2.3
—Disallow credits for dual capacity taxpayers (e.g. oil producers)	2.1
—Limit earnings stripping by expatriates	0.4
—Disallow deduction of insurance company premiums to foreign affiliates	0.3
Insurance Company Provisions	14.0
—Expand pro-rata interest expense disallowance for life insurance company separate accounts	7.7
—Reduce dividend-received deduction for life insurance companies	5.1
—Modify rules that apply to sales of life insurance contracts	1.2
Eliminate LIFO and lower of market or cost inventory	6.1
Eliminate oil and gas preferences	4.4
Eliminate coal preferences	2.6

Source: U.S. Department of the Treasury, General Explanations of the Administration's Fiscal Year 2012 Revenue Proposals, February, 2011

The Congressional Budget Office includes revenue raising corporate and business tax options in their budget options study, which are shown in **Table 14**. Their options include a more limited proposal to restrict depreciation that raises less than half the revenue as replacing accelerated depreciation with the alternative depreciation system (which is the standard against which the tax expenditure is measured).

The options also consider a different foreign tax return which would combine allocation of deductions rules with an exemption for active income, a territorial type of tax treatment.

Table 14. Corporate and Business Revenue Options, CBO

Provision	Average Annual Revenue Gain, FY2012-FY2021
Extend depreciable lives of equipment from 3,5,7,10,15, and 20 years to 4,8,11,20,30, and 39 years	24.1
Eliminate production activities deduction	16.3
Eliminate deferral	11.5
Eliminate LIFO and lower of cost or market inventory	9.8
Territorial tax with allocation of deductions	7.6
Eliminate title passage rule	5.4

Provision	Average Annual Revenue Gain, FY2012-FY2021
Eliminate graduated corporate rates	2.4
End expensing of exploration and development for the extractive industries	1.0

Source: Congressional Budget Office,(2011) Reducing the Deficit: Spending and Revenue Options, http://www.cbo.gov/ftpdocs/120xx/doc12085/03-10-ReducingTheDeficit.pdf.

How much could corporate tax rates be cut while maintaining revenue neutrality? Proposals discussed above have indicated rate reductions to 27% (Treasury 2007), to 24% (S. 3018, although there was a small corporate revenue loss), and to 30.5% for a more limited proposal.

Two important determinants of this potential rate reduction are whether to use revenues associated with unincorporated businesses which are included in these revenue raising options and how to treat provisions that arise largely from timing differences. The options listed in the tables above not only include unincorporated business provisions but also measure revenue gains in the first ten years which can be almost twice as much as the steady state gain in the case of accelerated depreciation. Although calculations vary slightly given the particular year of estimation, the largest tax expenditure, accelerated depreciation, would allow a rate reduction of almost 5 percentage points using standard scoring approaches and allowing revenues from both corporate and noncorporate businesses to be used to reduce the corporate tax rate. It would be one percentage point smaller if only corporate revenues were used. Slowing depreciation raises considerably more revenue in the first ten years (relative to corporate revenues) than it does in the long run. If the rate reduction were based on steady state revenues rather than short term revenues the reduction would be slightly over 2 percentage points.[97]

Recently, the Joint Committee on Taxation has estimated that relying solely on elimination of corporate tax expenditures, the rate could be reduced to 28%, although this proposal did not include the repeal of deferral.[98] At a 28% rate, revenue of $30 billion per year would be gained if noncorporate businesses expenditures were included. However, since these revenues reflect the first ten years, such a reform would lose revenue in the longer run. As shown in **Table 15**, where provisions are expressed in terms of their rate reduction capacity, but using steady state revenue neutrality, eliminating all corporate tax expenditures would achieve a revenue neutral rate of 29.4%. The difference between a 7 percentage point reduction (to 28%) and a 5.6 percentage point reduction might reflect estimating differentials and deferral, but it also may captures the effects of short term versus steady state neutrality.

Also, as shown in the table, most traditional tax expenditures individually account for a very limited amount of rate reduction. Moreover, because each provision becomes less valuable the lower the rate, the tax reductions for a combination is slightly smaller than the sum of the individual points.

[97] See Jane G. Gravelle, Reducing Depreciation Allowances to Finance a Lower Corporate Tax Rate," *National Tax Journal*, vol. 64, December 2011, pp. 1039-1054.

[98] Memo from Thomas A. Barthold, Joint Committee on Taxation, October 27, 2011.

Table 15. Rate Reduction Permitted by Certain Options, Steady State Revenues

Possible Change in Provision	Percentage Point Reduction in Corporate Tax Rate
Eliminate Accelerated Depreciation for Equipment (steady state)	3.3
Repeal Production Activities Deduction	1.2
Taxation of Foreign Source Income	
—End Deferral	0.8
—End Deferral Plus Per Country Foreign Tax Credit Limit	4.0
—President Obama's Proposals	1.0
—Territorial Tax with Deduction Allocation	0.5
Repeal Title Passage Rule	0.4
Repeal LIFO Inventory Accounting	0.8
Eliminate Subsidies for Fossil Fuels	0.3
Eliminate Graduated Rates for Corporations	0.3
Eliminate Insurance Subsidies	0.1
Eliminate Credit Union Exemption	0.1
Eliminate Deduction for Inflation Portion of Interest	2.5
Eliminate all Corporate Tax Expenditures (foreign source provisions other than deferral and disallowing interest deductions not part of tax expenditures; includes other tax expenditures not listed, does not include benefits to unincorporated businesses)	5.6
Shifting Into Corporate Form[a] (see table notes)	2.3
Rolling Back 2003 Rates for Dividends and Capital Gains[b]	4.0

Source: CRS calculations, see CRS Report R41743, *International Corporate Tax Rate Comparisons and Policy Implications*, by Jane G. Gravelle.

Notes: These provisions are all estimated beginning at a 35% corporate rate and the sum would be larger than the combined effect. If evaluated at the lower rate the reduction would fall proportionally for most base broadening provisions, so the reduction would be 86% as large (.30/.35) if evaluated at a 30% rate.

a. Assumes income distributed as in the early 1980s, a starting corporate rate of 30% and an individual rate of 30%. See text of CRS Report R41743, *International Corporate Tax Rate Comparisons and Policy Implications*, for other calculations.

b. Assumes a lower realization elasticity consistent with more recent evidence. With elasticity currently in use by the Treasury Department, the reduction would be 2.3 percentage points.

A full discussion of the economic merits of these provisions is beyond the scope of this paper, but the standard tax expenditure items are discussed in the Senate Budget Committee Print, *Tax Expenditure Compendium*;[99] most would be regarded as provisions that lead to economic distortions.[100] One possible exception is the Research and Experimentation (R&E) credit, since

[99] See U.S. Congress, Senate Committee on the Budget, *Tax Expenditures*, committee print, 109th Cong., 2nd sess., December 2006, S. Prt. 109-072 (Washington: GPO, 2006). The document is posted at http://frwebgate.access.gpo.gov/cgi-bin/useftp.cgi?IPaddress=162.140.64.88&filename=31188.pdf&directory=/diskb/wais/data/109_cong_senate_committee_prints. These provisions are also discussed in

[100] A number of individual provisions are discussed in CRS Report R41743, *International Corporate Tax Rate Comparisons and Policy Implications*, by Jane G. Gravelle including accelerated depreciation, the production activities (continued...)

social returns to research and development appear higher than private returns, but many economists believe that the credit is probably poorly targeted and possibly abused. Arguments could also be made that the tax exempt bond benefit is shifted to state and local governments (which can charge lower interest rates) and that these assets and revenue loss would be shifted to individuals. Arguments could also be made that the benefits of the charitable contribution deduction and the low-income housing credit ultimately accrue to charities and lower income tenants, at least in part. Many other provisions have some support, and may, therefore, be difficult to repeal.

Trading accelerated depreciation, the major revenue raiser from the tax expenditure provision , for a rate reduction would raise the cost of capital, because rate reductions provide windfalls for existing capital. How this effect is viewed depends on the objective of reform. If, for example, it reflects a concern about international capital flows, increasing the cost of capital is a concern.

The Treasury Study also discussed the possibility of using this base broadening to provide an investment incentive, such as a partial expensing. Such a provision would lower the tax rate on new investment. It is difficult, however, to design investment subsidies in a fashion that is both neutral across types of assets and generates an even revenue loss pattern over time. Historically, investment subsidies have been restricted to equipment. The provision used most frequently in the past is the investment tax credit which, if allowed at a flat rate, favors short-lived assets. Partial expensing is neutral across investments if allowed for all types but its revenue loss is very large in the short run. Accelerated depreciation can be designed to be neutral, but it also has an uneven revenue loss pattern and cannot be applied to non-depreciable assets, such as inventories. A benefit of lowering the statutory rate is that it reduces the incentive to shift profits abroad to tax havens, although that incentive would probably be considerably lessened in any case if deferral of taxation of foreign source income were ended, as proposed in H.R. 3018.

Although there are large potential gains from taxing foreign source income, as in H.R. 3018, and there are economic justifications for taxing foreign source income the same as domestic source income, and a lesser amount through ending deferral, international reforms are controversial. Indeed some pressure has been exerted to move in the other direction, toward a territorial tax.[101] Both the Chairman of the Ways and Means Committee and the Fiscal Commission proposed a territorial tax. There are, however, some more limited approaches. For example, the President's advisory panel proposed to exempt dividends of active businesses but disallow costs such as interest to the extent income is exempt. And, as proposed in H.R. 3970 and the President's proposals, one could also defer interest deductions associated with deferred income without making any other changes, or direct restrictive rules to tax havens.

(...continued)

deduction, the title passage rule, inventory accounting and other provisions. For a detailed discussion of corporate revenue raising provisions, see Raising Revenue From Reforming the Corporate Tax Base, by Jane G. Gravelle, Congressional Research Service, November 2011, presented at Rice University, October 2011.

[101] A territorial tax system is one where the tax is imposed only in the country where business activity occurs and not in the country of ownership. While the present international tax system results in distortions, it is not clear how moving to a territorial tax would reduce these distortions, and even less clear how it would improve tax compliance and profit shifting. For a more detailed discussion, see CRS Report RL34115, *Reform of U.S. International Taxation: Alternatives*, by Jane G. Gravelle.

Interest Deduction Inflation Correction

If the inflation premium were disallowed for interest deductions, assuming that about half of interest is inflation, the savings would eventually be $30 billion per year at the corporate level, which would be offset by about a $10 billion loss at the individual level. This could allow a 2.5 percentage point reduction in the corporate tax rate. The important aspect of this change is that it would virtually eliminate the distortion between debt and equity, which is responsible for a significant portion of the overall distortion in the corporate tax, while maintaining the overall corporate tax burden. S. 3018 makes this revision at the corporate level.

Reducing Tax at the Firm Level and Increasing Individual Level Taxes; Shifting Between Corporate and Individual Form

Given the value of lowering the corporate tax rate to reduce the shifting of income into tax havens and concerns over the U.S. position among other countries, one change that would allow this reduction is to raise the tax at the individual level and use the revenues to lower the corporate tax rate. Since individual taxes tend to be collected regardless of where income is earned, these taxes are neutral with respect to international allocation. This approach also allows more scope for lowering corporate tax rates without creating sheltering opportunities for high-income individuals. If the 2003 tax changes that lowered rates on dividends and capital gains to 15% were rolled back, the federal corporate tax rate could be reduced to 31%.[102] Taxing capital gains at full rates, as was enacted in 1986 and remained largely in place until 1997 would allow two or three more percentage points in reduction. One could go even further, by taxing corporate capital gains on an accrual basis, which would yield dramatically more revenue. This type of change would also eliminate distortions arising from payout policies and realizations response. Even lower corporate rates could be achieved by taxing non-profits enough to offset their savings from the lower corporate rates—a change that would leave them unaffected, but would simply shift the source of tax collection. These latter proposals would arguably be broad enough to move much of the way towards an integration of the corporate and individual income taxes.

Another provision that might be used to raise revenues is to tax the increasing number of large passthroughs as corporations. How much, if any revenue, that would raise depends on any changes in taxation of dividends and capital gains and the individual and corporate income rates.

Conclusion

Is there an urgent need to lower the corporate tax rate, as some recent discussions and analyses have suggested? On the whole, many of the new concerns expressed about the tax appear not to stand up under empirical examination. The claims that behavioral responses could cause revenues to rise if rates were cut does not hold up on both a theoretical basis and an empirical basis. Studies that purport to show a revenue maximizing tax rate of 30% contain econometric errors that produce biased and inconsistent results; when those problems are corrected the results disappear. Cross-country studies to provide direct evidence showing that the burden of the

[102] Details of these proposals are provided in CRS Report RL34115, *Reform of U.S. International Taxation: Alternatives*, by Jane G. Gravelle.

corporate tax actually falls on labor in some cases yield unreasonable results and prove to suffer from econometric flaws that also lead to a disappearance of the results when corrected. Similarly, claims that high U.S. tax rates will create problems for the United States in a global economy suffer from a misrepresentation of the U.S. tax rate compared to other countries and are less important when capital is imperfectly mobile, as it appears to be.

While these new arguments appear to rely on questionable data, the traditional concerns about the corporate tax appear valid. While many economists believe that the tax is still needed as a backstop to individual tax collections, it does result in some economic distortions. These economic distortions, however, have declined substantially over time as corporate rates and shares of output have fallen. There are a number of revenue-neutral changes that could reduce these distortions, allow for a lower corporate statutory tax rate, and lead to a more efficient corporate tax system. At the same time, the amount of rate reduction that could be achieved with a long run, revenue neutral corporate tax reform seems limited to a few percentage points.

Appendix A. Revenue Maximizing Tax Rates in an Open Economy

For an exploration of corporate tax revenue, consider a very simplified example where there is a U.S. corporate sector and the rest of the world with no tax. The lowest revenue maximizing rate would apply in a case where there is a small country which is a price-taker (that is, worldwide price and rate of return after tax are fixed because there is perfect capital mobility and perfect product substitutability). To determine the revenue maximizing tax rate, begin with the equation for corporate tax revenues:

(A1)

$$REV = \frac{tRK}{1 - t}$$

where K, the corporate capital stock, and R, the after-tax rate of return, are potentially functions of the tax rate, t. Revenue is maximized when the total differential of equation (A1) with respect to taxes is equal to zero, which is:

(A2)

$$(1 - t)\left(tR\frac{dK}{dt} + tK\frac{dR}{dt} \right) + RK = 0$$

Assuming the rest of the world can be treated as a aggregate and has a zero capital income tax rate, Gravelle and Smetters[103] show that, in a case of a small country with perfect substitutability, R does not change and

(A3)

$$\frac{dK}{K} = -\frac{\mu}{\sigma}\frac{dt}{(1 - t)}$$

where μ is the labor share of income and σ is the factor substitution elasticity.

Substituting equation (A3) into equation (A2) we obtain the revenue maximizing rate of μ/σ. To use some common values, if μ is 0.75 and σ is 1, the revenue maximizing rate is 75%.

Since the United States is a large country, the rates would be even higher, because the tax can affect the world wide interest rate. The Gravelle and Smetters paper provide effects for R and K for a given country share, which can also be substituted into equation (A2). As a result, the revenue-maximizing tax rate is $\mu/(\mu\gamma + \sigma(1 - \gamma))$ where γ is the output share. For example, if

[103] Jane G. Gravelle and Kent A. Smetters, "Does the Open Economy Assumption Really Mean That Labor Bears the Burden of a Capital Income Tax?" *Advances in Economic Policy and Analysis*, vol. 6, No. 1, 2006.

the United States has approximately 30% of the total output, the tax rate would be 81%. The rates would rise further if capital were not perfectly mobile or products not perfectly substitutable, since these factors would allow R to fall further. At the extreme, it would return to a closed economy solution. Gravelle and Smetters present evidence to suggest that the outcome is more similar to a closed economy than a small open economy solution.

This same outcome, a 75% rate, would also apply for the most extreme case of growth models, the Ramsey model, where the supply of savings is perfectly elastic.

Note that in both of these extreme cases, the after tax return is fixed and the total burden falls on wage income, so that labor income would fall. One could also calculate a corporate tax rate than maximizes revenue while taking into account the effect on wages and keeping the wage rate constant. Again, relying on the model in Gravelle and Smetters and maximizing,

(A4)

$$REV = \frac{tRK}{(1-t)} + t_l WL$$

Where t_l is the tax rate wages, we obtain a revenue maximizing corporate tax rate of $t = (\mu(1-t_l))/(\sigma - t_l\mu)$. With an approximate 20% tax rate on labor income, the revenue maximizing corporate tax rate is 70%. Note however, that this is not the rate that would be found in the cross-section analysis.

Appendix B. Data and Estimation Methods

We obtained the data used in the Hassett and Mathur study and the Clausing study.[104] The data used to replicate the Brill and Hassett study were obtained from the original sources cited in the study.[105] We were able to replicate the results reported for all studies.

The data we use are for several countries for a period of several years, and are known as panel data. The model of the relationship between the corporate tax rate (the independent variable) and the various dependent variables takes a linear form:

(B1)

$$t = (\mu(1 - t_l))/(\sigma - t_l\mu)$$

where Y_{it} is the dependent variable, X_{it} is the independent variable (the corporate tax rate in our case), α and β are the regression parameters to be estimated, and ε_{it} is a random error term.[106] The subscripts, *i* and *t*, indicate that information for a particular observation comes from country *i* for year *t* (for example, information for Australia for 1992). The random error term, ε_{it}, is a random variable and captures omitted and unobservable factors or variables that affect the dependent variable. The error term will be discussed in further detail below.

If the following conditions are met:

- the expected value (mean) of the random error term, ε_{it}, is zero;
- the variance of the random error term is constant for all observations;
- the random error term for one observation is uncorrelated with the error term for another observation; and
- the random error terms are uncorrelated with the explanatory variables...

then the ordinary least squares (OLS) estimators will yield the best linear unbiased estimators of the parameters (α and β). The β parameter shows the true relationship between the dependent variable and the independent variable, and is the parameter of interest to us. Denote the estimate of β as $\hat{\beta}$. Since $\hat{\beta}$ is an estimate, it is a random variable drawn from a probability or sampling distribution with an expected value (mean) and variance. This estimator will have the following desirable properties:

- unbiased: the expected value of $\hat{\beta}$ is β;

[104] We thank the authors for providing their data to us. The studies are Kevin A. Hassett and Aparna Mathur, *Taxes and Wages*, American Enterprise Institute, working paper, 2006; and Kimberly A. Clausing, "Corporate Tax Revenues in OECD Countries," *International Tax and Public Finance*, vol. 14 (2007), pp. 115-133.

[105] Alex Brill and Kevin A. Hassett, *Revenue-Maximizing Corporate Income Taxes: The Laffer Curve in OECD Countries*, AEI working paper #137, American Enterprise Institute, July 31, 2007.

[106] For ease of exposition only one independent variable is written in the equation. Generally, several independent variables are included in the linear model. This simplification does not change the following discussion of our model and estimation techniques.

- efficient: the variance of $\hat{\beta}$ is smaller than the variance of all other unbiased estimators; and
- consistent: the probability distribution of $\hat{\beta}$ collapses on β as the number of observations gets arbitrarily large.

Estimation problems often arise with panel data because one or more of the conditions listed above are not met. The result is the OLS estimator will be biased and inconsistent. Problems arise with panel data, as is demonstrated when equation (B1) is rewritten as:

(B2)

$$Y_{it} = \alpha + \beta X_{it} + \nu_i + \phi_t + \eta_{it}.$$

The term ν_i is an effect (unobserved heterogeneity) specific to a particular country capturing differences among countries in (1) the measurement of economic data, (2) economic institutions, (3) laws and regulations applying to business, and (4) attitudes toward business, among other things. The term ϕ_t is a time specific effect capturing such things as the international business cycle. Since the corporate tax rate is a reflection of the attitudes toward business in a country, X_{it} and ν_i will be correlated. Ignoring the country-specific unobserved heterogeneity means that the OLS estimate of β is biased and inconsistent because the error term in equation (B1) is correlated with the explanatory variable—one of the conditions listed above is violated. Another problem often encountered with data that has a time dimension is the error terms are correlated from one year to the next year (called autocorrelation). Statistical tests indicate that these problems exist with the data we obtained. Consequently, we estimate the parameters of the model using the fixed effect estimation procedure allowing for an AR(1) error structure.[107]

Identification

Neither Brill and Hassett nor Clausing offer any justification in their studies for using OLS rather than the fixed effects method to estimate the parameters of their model. A well-known drawback of the fixed effects method is variables that vary across countries, but not across time within a country, cannot be included in the estimation (that is, the parameters associated with these variables are not identified). Devereux (2006) claims "changes in the statutory [corporate tax] rate within a country are comparatively rare. In practice, as found by Clausing (2006), there is not enough variation within country to identify an effect of the statutory rate, conditional on country fixed effects."[108]

To check the correctness of this statement and the justification for using OLS, we directly examine the variation of the corporate tax rate across countries and over time. **Table B-1** displays the results for the data from the three studies we reanalyzed. The first row displays the relevant

[107] See Christopher F. Baum, *An Introduction to Modern Econometrics Using Stata* (College Station, TX: Stata Press, 2006) for a description of this technique. Our overall results and conclusions are not changed when using the random effects estimation procedure allowing for an AR(1) error structure.

[108] Michael P. Devereux, *Developments in the Taxation of Corporate Profit in the OECD Since 1965: Rates, Bases and Revenues*, University of Warwick, working paper, May 2006, p. 20.

explanatory corporate tax rate variable used in the study. The second row reports of mean of the variable. The third row reports the standard deviation (a measure of variation of a variable) of the corporate tax rate variable. The last two rows decompose the standard deviation into the between country component and the within country component. If there is no variation in the variable over time within countries, then the within component of the standard deviation will be zero. Consequently, the effect of that variable on the dependent variable is not identified conditional on fixed effects (that is, it cannot be estimated using the fixed effects procedure). As can be seen from the table, there is almost as much variation within countries (the within component) as there is between countries (the between component).

Table B-1. Standard Deviation of Corporate Tax Rate Variables in the Three Data Sets

	Brill and Hassett Data	Clausing Data	Hassett and Mathur Data
Variable	Corporate tax rate	Corporate tax rate	Logarithm of corporate tax rate
Mean	0.362	0.354	-1.106
Overall Standard Deviation	0.092	0.101	0.396
Between Component	0.065	0.078	0.307
Within Component	0.064	0.063	0.248

Source: Authors' analysis of data.

In addition, we find that all OECD countries changed their corporate tax rate at least once between 1979 and 2002. Four countries (Ireland, Norway, Spain, and Switzerland) changed their corporate tax rate only once during this period. In contrast, Luxembourg changed their corporate rate 12 times over this period. On average, OECD countries changed their corporate tax rates once every five years. Therefore, we can find no evidence to support the argument that the effect of the corporate tax rate on corporate tax revenues is not identified conditional on fixed effects.

Appendix C. Modeling Problems of the Desai, Foley, and Hines Study

This appendix explains in further detail the modeling problems associated with the Desai, Foley, and Hines study (hereafter DFH) study, which include the failure to recognize price variability. This means that their cross-equation restriction is not justified (and that restriction is what gives rise to their results). The DFH study also fails to correctly interpret their results given that other sectors exist in the economy.

The DFH model effectively begins with an equation that forms a basic part of any general equilibrium model, namely that a percentage change in price is a weighted average of the percentage in costs for small changes. In the case of an imposition of a tax, that is:

(C1) $\hat{p} = \alpha(\hat{r} + \hat{\tau}) + (1 - \alpha)\hat{w}$

where p is price, r is rate of return, w is the wage rate, τ is the tax rate and α is the share of capital income. The hat notation refers to a percentage change except in the case of the tax variable, where the hat means the change in tax rate divided by one minus the tax rate. Beginning with a no tax world, that variable is simply $d\tau$. This relationship can be derived from a profit maximization problem. DFH derive such an equation to motivate their seemingly unrelated regression model. They then assume that p, the price of the good, does not change, which produces an equation of the form:

(C2) $0 = \alpha(\hat{r} + \hat{\tau}) + (1 - \alpha)\hat{w}$

Since τ is an exogenous variable this equation indicates that the change in the tax would be shared by interest rates and wages, and this is the basis for the two seemingly unrelated regressions where the dependent variables are r and w, and the coefficients are constrained so that the burden will add up to one.

The argument for keeping the price fixed is that such a good would have its price fixed due to trade (e.g., all commodities have to sell at the same price). There are two difficulties with this assumption. First, if consumers in different countries have different preferences for goods based, in part, on country of origin (i.e., they do not consider French wine and German wine to be perfect substitutes) these prices will not be fixed. Indeed, this phenomenon is widely recognized, and the price responses are referred to as Armington elasticities—and they have been estimated empirically. Second, their observations are the weighted average of firms in each country but the firms themselves produce heterogeneous products, and all of these product prices cannot stay fixed because they have different capital intensities and because the products will vary from one country to another. Indeed, the trading of heterogeneous products means that fixed prices cannot be assumed because, in such a model, countries could not produce, consume and trade numerous products with differential taxation because such a world economy would be characterized by corner solutions (i.e., no internal equilibrium).

This problem means that there is another variable, price, that is affecting the results and presumably is correlated with the error term (that is, the price would tend to be higher when the tax rate is higher, making the regression suspect and that the coefficient restriction is not appropriate.

Even if these problems did not exist, there is an additional problem with the interpretation of their findings, namely that they did not adjust for other sectors in the economy, including non-traded sectors and sectors not subject to the corporate tax. Incidence results must be adjusted for the fact that the tax is only a partial one.

To illustrate in the simplest fashion, suppose the remaining sector of the economy is a non-corporate non-traded sector of the economy whose price is denoted by a capital P:

(C3) $\hat{P} = \beta(\hat{r}) + (1 - \beta)\hat{w}$

This commodity has no taxes and if we estimate the effects on r and w, those can be used to determine the change in P.

What we ultimately want to determine is the fraction of the tax, $rK_c d\tau$ (where K_c is the capital in the corporate traded sector) that falls on labor, that is what share of Ldw, where L is total labor in the economy, is of $rK_c d\tau$.

To derive the real change in wages, we want the change in nominal wage divided by the change in total price level in the economy, or, if the corporate sector is responsible for (1-θ) of output in the economy the percentage change in real wage (which we denote with a capital W) can be expressed as follows:

(C4) $\hat{W} = \hat{w} - (1 - \theta)\hat{p} - \theta\hat{P}$

If s is the share of the burden falling on labor income, from equation (1), $\hat{r} = -(1 - s)d\tau$ and $\hat{w} = -\frac{-s\alpha d\tau}{(1 - \alpha)}$.

And, by substitution of these values into (3) and in turn into (4), and allowing the initial price level to be normalized at 1, we obtain the equation for incidence in the economy, noting that $\alpha / (1 - \alpha)$ equals rK_c/wL_c:

(C5) $Ldw = -(L / L_c)(s - \theta s(1 - \beta) - \theta(1 - s)(1 - \alpha)\beta / \alpha)rK_c d\tau$

The first term, total labor divided by labor in the tax sector reflects the increased burden from the spread of the nominal fall in wages to the other sector, while the negative terms inside the next parenthesis reflects the rise in real wages due to the fall in the price of the untaxed sector. Whether the burden rises or falls depends on a variety of factors. As the capital intensity of the untaxed sector rises the burden falls; at the extreme when β becomes 1, the first term collapses to 1 and the second term is less than s, so the total burden on labor is less in the economy than it is in the estimation. This possibility is more important than it might initially appear, because one of the most important uses of capital not subject to the corporate income tax is in housing in the United States.

Appendix D. Bargaining Models and Rent-Sharing of Corporate Taxes

With a number of studies appealing to a bargaining model and rent sharing, it is important to understand the theory implied.

Bargaining models start from a standard Nash equilibrium which maximizes the product of the welfare of the two recipients. Using the ADM notation:

(D1) $B = \{[u(w)-u(w^*)]\ N\}^{(1-\mu)}\ \{\Pi-\Pi^*\}^{\mu}$

where w is the wage earned, u(w) is the utility of the wage earned, w* is the competitive wage, u(w*) is the utility of the competitive wage, N is the number of employees, Π is the profit in the current undertaking and Π* is the alternative profit that could be earned in the competitive industry. The exponents $(1-\mu)$ and μ reflect the bargaining strength of the parties. The first term in curly brackets is the value of an excess wage to the workers, while the second is the value of excess profits to the owners.

Begin with a no tax world. To maximize B differentiate with respect to the wage (which appears in the value of excess profits because they are reduced by wN), the number of employees and the capital stock (which is embedded in profits). The result is a bargaining solution of the form:

(D2) $wN= w^*N+[(1-\mu)/\mu]\ (\Pi-\Pi^*)$

This solution is derived in ADM although they express all of their variables in per worker terms.

Assuming away intermediate goods and other costs (which will make no difference) Π can be defined as PQ-wL (where P is price and Q is quantity). Π* can be defined as rK where r is the return required to attract capital and the amount earned in the competitive sector.

(D3) $wN= w^*N + [(1-\mu)/\mu]\ (PQ-wN-rK)$

This form of the bargaining formula is used by ADM because they are estimating wages.

It is more instructive in understanding the model, however, to examine not the wage but the excess wage. With some manipulation, and now dividing the variables by N to get per capita amounts (with lower cases indicating per capita), we obtain

(D4) $w-w^* = (1-\mu)\ (Pq-w^*-rk)$

The last term on the right hand side is excess profit (revenue minus the competitive wage minus the competitive return. The left hand side is the wage in excess of the competitive wage. The workers share is $(1-\mu)$ and it is an estimate of this coefficient that the empirical rent sharing literature is intended to identify.

Suppose now this bargaining model is being estimated assuming a tax of τ. Now profit, $(\Pi-\Pi^*)$ is now equal to $(PQ - wN)(1-\tau) - rK$. The first order conditions for wages and labor now contain a tax term to reflect the fact that wages are deductible from the tax. Therefore equation D2 now becomes:

(D5) $wN= w^*N+[(1- \mu)/\mu] [(\Pi-\Pi^*)/(1- \tau)]$

Since the tax term is in the denominator, it suggests that the wage would go up through this effect, which basically indicates that adding to wages saves taxes, and hence the price of paying the surplus in wages is smaller.

At the same time the excess profit is reduced because taxes are applied to revenues, with wages, but not capital deducted, making the profit term $(PQ-wN)(1- \tau) –rK$.

When this term is substituted to provide a version of (4) the tax term in the numerator cancels with the tax term in the denominator with the only effect of taxes on rK.

(D6) $w-w^* = (1- \mu) (Pq-w^*-rk/(1- \tau))$

A term similar to this one is contained in the Felix and Hines study.

The important point that comes from this last equation is that in discussing rent-sharing we are not considering burden of the tax that falls directly on excess profits because that tax effect disappears from the formula. Although the pie is smaller by $\tau(Pq-w)$, the price of the wage share is also lower so the owners bear the entire direct burden of the tax on the firm's excess profits. The only way that taxes enter is to increase the normal cost of capital.

ADM ignore this term in their model because this term and its effects on wages are part of the indirect burden (which would be determined by general equilibrium economy-wide results). That is, they are interested in the direct effect of taxes outside the general equilibrium effects. They posit a term (which is neither observable nor clearly defined) which is not related to profit, of the form;

(D7) $w-w^* = (1- \mu) (Pq-w^*-\phi/(1- \tau) - rk/(1- \tau))$

where ϕ represents a tax payment that is not part of profits or of the cost of capital. It is not clear what qualifies as part of ϕ or how important it is. Most of the examples they mention such as deductions for interest and contributions to pension funds seem to qualify as either part of deductible costs of funds or wage compensation. And when actually estimating the relationship in D(7) they have no way to measure this value so the regression they run is actually roughly on total taxes per worker (conceptually $\tau(VA –w) + \phi$) where VA is value added. The tax term is estimated using instrumental variables such as tax rates since w is a left hand side variable and VA. Because of this issue, it is difficult to interpret the importance of their result even if they are capturing a rent-sharing effect rather than some other relationship.

Felix and Hines are estimating the union wage premium, and their version of (D6) is not per worker and the premium is divided by the non-union (competitive) wage. To use their notation, they use L to denote labor. The left hand side variable is the total excess labor return, $(w-w^*)L$ which is equal to R. Also they denote the competitive wage as w. They also use α as the bargaining share.

(D8) $R = \alpha (Q-wL-rK/(1- \tau))$

One peculiar point, which we return to, is that they do not have a product price P.

They then divide the equation by wL to obtain a ratio:

(D8) $R/(wL)= \alpha (Q/wL-1-rK/(wL(1- \tau)))$

They want to deal with the effect of tax rates on the demand for capital and labor and obtain an expression for (D8). They also use an optimization model for the firm's factory choices to simplify the expression and this term contains both w and the tax rate.

The Felix Hines derivation is in error because they have omitted the product price; as quantity changes so do prices. The proper form of (D8) is:

(D9) $R/(wL)= \alpha (PQ/wL-1-rK/(wL(1- \tau)))$

First, to maximize profit:

(D10) $Profit = PQ-wL –rK = P(Q(K,L)Q(K,L) –wL –rK/(1- \tau)$.

Q is a function of K and L and P is a function of Q which is in turn a function of K and L. Q in turn is a Cobb Douglas function:

(D11) $Q = aK^{\gamma}L^{(1-\gamma)}$

The two first order conditions for K and L are:

(D12) $P(1-1/e)\gamma Q/K = r/(1- \tau)$

(D13) $P(1-1/e)(1-\gamma)Q/L = w$

where e is the absolute value of the elasticity of demand.

One can see from equation (D13) that $PQ/wL = (e/(1-e))(1/(1- \gamma))$ and that the last term by dividing D12 by D13 is $\gamma/(1- \gamma)$. Combining all of the terms together:

(D14) $R/(wL) = \alpha [\{1/(e-1)\}\{1/(1-\gamma)\}]$

What equation (D14) indicates is that there is no effect of the tax or any other factor price on the wage premium. It is also quite sensible. If e is infinite which would be the case with a competitive price taking firm, the premium is zero; as e falls towards one with a less elastic demand (although one that is of necessity greater than 1) the premium becomes larger. In any case, for a Cobb Douglas function there is no reason to estimate a wage premium as a function of tax rates.

It also means that rent per employee would fall proportionally with wages.

Without presenting the complicated mathematics, the ratio will rise with higher taxes with a factor substitution elasticity of less than one and decline with a factor substitution elasticity higher than one. In the latter case the effect of the tax on rents via general equilibrium effects is ambiguous. That is (D14) becomes:

(D14) $R/(wL) = \alpha [\{1/(e-1)\}\{1+ (b/(1-b)^{s} (r/(w(1- \tau^{))(1-s)}\}]$

where s is the factor substitution elasticity. It is easier to see what happens if we express this as an elasticity:

(D15) $d(R/wl)/(R/wL) = (1-s)\ \gamma(dr/r - dw/w + d\tau/(1-\tau))$

The last set of terms is expected to be positive, and measures how much the ratio of returns to wages changes. Our calculations indicate this is a small semi-elasticity (assuming an overall federal and state tax rate of 30%). If the entire burden is borne by capital the semi-elasticity, as s ranges from 0.5 to 1.5 is 0.09 to -0.09, (as compared to the elasticity of 0.36 found in the study). If the burden were borne entirely by wages, the elasticity would range from 0.21 to -0.21. These calculations assume that γ is 0.25 in the sector under consideration and in the economy as a whole, and the corporate capital stock is half of the total capital stock. If the incidence falls on returns, $Kdr = -rK_1dt/(1-\tau))$ where K is the total capital stock and K_1 is the corporate. If the incidence falls on wages, $Ldw = -rK_1dt/(1-\tau))$. Since evidence suggests that, if the factor substitution elasticity is not one, it is probably below 1, the expectation is that ratio of rents to wages

It is difficult to interpret these results without knowing the effect on wages which, in their estimates was actually positive (although not always statistically significant). However, their interpretation that 54% of the tax falls on rents is not consistent because they are calculating a reduction in the entire corporate wage bill, not the small portion that is the rent. Assume, for example, that the wage does not change and take their 0.36 semi-elasticity. Their formula indicates that $dR/R = -.36d\tau$. To translate that into incidence on rents, multiply 0.36 times the ratio of rents to corporate tax collects. Rents are the rent premium (15%) times the union share (7%) times the wage share (about 70%), which is 0.7% of output. Corporate taxes are around 2% of output, so the ratio is .0.37. Thus, at their elasticity the share would 13%. If the highest elasticity assuming the tax is borne by capital is used the share is about 3% and if the highest amount assuming the tax is fully borne by capital is used, the share is about 5%.

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