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The Dynamic Economic Effects of a US Corporate Income Tax Rate Reduction

John W. Diamond, George R. Zodrow, Thomas S. Neubig, and Robert J. Carroll

Introduction

The U.S. corporate income tax system has not been changed significantly since the much celebrated Tax Reform Act of 1986 (TRA86). In the interim, most countries have dramatically reduced their statutory corporate income tax rates below the US rate, prompted in large part by the inexorable forces of globalization and increasing international tax competition (Zodrow, 2008). The U.S. statutory corporate income tax rate is now the highest in the world among the industrialized countries, sparking concerns about the extent to which the tax system makes it difficult for the U.S. to compete successfully in the modern world economy. These issues were the focus of a recent comprehensive report prepared by the U.S. Treasury (2007) entitled *Approaches to Improve the Competitiveness of the U.S. Business Tax System for the 21st Century*.

Such concerns have prompted calls for reform, ranging from dramatic changes in the corporate income tax system to replacing the income tax system with some form of consumption-based taxation. This paper focuses on one such reform—a reduction in the statutory corporate income tax rate. Of course, a reduction in the corporate tax rate would have to be financed by expansion of the corporate tax base, an increase in other taxes, a reduction in spending, and/or an increase in the deficit. The analysis considers three potential financing alternatives: elimination of a wide range of business tax expenditures, an increase in individual income taxes on labor income, and a decrease in government expenditures in the form of income transfers. Each package is designed to be revenue neutral in a dynamic sense, that is, taking into account the effects of the reform over time on saving, investment, labor supply, and other

macroeconomic variables. The dynamic analysis in the paper reflects simulations of the macroeconomic effects of reform using a modified version of a dynamic, overlapping generations, computable general equilibrium model developed by Diamond and Zodrow.

The paper proceeds as follows. The case for a significant reduction in the statutory corporate income tax rate in the United States is discussed in the following section, focusing on several key issues that must be addressed in any analysis of corporate income tax reform in the modern global economy. An outline of the model, including various extensions made to more accurately analyze the effects of such a reform, is presented in Section III; details of the model are provided in Zodrow and Diamond (2013). The simulation results are presented in Section IV, and Section V concludes.

The Case For A Corporate Income Tax Rate Cut

In this section, we describe the case for corporate income tax reform in the US. We then discuss the case for a specific reform—a revenue neutral corporate tax rate reduction, with business tax base broadening as the principal financing mechanism, similar to the approach utilized in TRA86 (Diamond and Zodrow, 2011); this discussion includes a brief description of some relevant empirical work. We also compare the advantages and disadvantages of this particular reform to the alternative approach of keeping the statutory tax rate at its current relatively high level while adding investment incentives.

The Need for Reform

Policymakers and economists have long advocated income tax reforms that lower tax rates while broadening the base of the tax structure by eliminating tax expenditures, generally defined as deviations from a broad-based income tax. TRA86 is a prime example in the United

States of this classic approach to tax reform.[1] Such reforms are generally desirable because they reduce costly distortions of economic decisions and thus promote economic growth and economic efficiency in resource allocation, simplify tax administration and compliance, reduce incentives for tax evasion and tax avoidance, and create both the perception and the reality of a fairer tax system.

These arguments are especially compelling in the case of the corporate income tax, which has often been characterized as a singularly complex and inefficient tax instrument, as it significantly distorts a wide variety of decisions, including those regarding asset mix and thus the allocation of investment across different industries, the method of finance (debt vs. equity in the form of retained earnings or new share issues), organizational form (corporate vs. non-corporate), and the mix of retentions, dividends paid and share repurchases (Gravelle, 1994; Cnossen, 1996; U.S. Treasury, 2007; Nicodème, 2008). Moreover, in the case of equity finance, the magnitude of these distortions is increased to the extent that the effective tax rate on corporate income is increased by the double taxation of such income at both the business level under the corporate tax and then again at the individual level as dividends or capital gains (and, although to an increasingly limited extent, under the estate tax).[2] The taxation of capital income inherent in the corporate income tax also reduces saving and investment, which in turn reduces the size of the capital stock, labor productivity, and wage growth.

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[1] Numerous other countries also enacted base-broadening, rate-reducing reforms during this time period; see Boskin and McLure (1990). More recently, Devereux (2007) documents that recent corporate income tax reforms in numerous OECD countries have also moved in the direction of lower rates and broadened tax bases.

[2] Note, however, that under the still controversial "new view" of dividend taxation, the taxation of dividends at the individual level has no effect on marginal incentives for investment financed with retained earnings. Our analysis follows most of the existing literature, including the US Treasury (1992) report on the integration of business and individual level taxes, in assuming the validity of the traditional "double taxation" view of dividend taxes.

In addition, many recent proposals for tax reform have focused on international issues, especially increasing international capital mobility, more aggressive international tax competition from both advanced and emerging economies, and legitimate tax planning that arises in response to significant differences in tax rates across countries, often referred to as "income shifting".[3] Proponents of such reforms argue that both statutory tax rates and the overall tax burden on capital income in the United States are quite high by international standards, and that the corporate income tax should be reformed in the interest of attracting and retaining mobile capital, promoting economic growth, improving economic efficiency, reducing opportunities for tax arbitrage, and reducing administrative and compliance costs.[4] The ongoing process of globalization also implies that the tax system increasingly has important effects on the competitiveness of U.S. multinationals and on the investment decisions of multinationals based in both the United States and in other countries. All of these factors suggest that the corporate income tax is ripe for reform.

The need for corporate income tax reform has also been recognized in the political arena. Indeed, both parties have supported reform plans that included reductions in the corporate income tax rate, including House Ways and Means Committee chair Dave Camp tax reform discussion draft and President Obama's framework for reforming business taxation.[5] The case for such an approach is buttressed by the U.S. Treasury (2007, p. i) report noted above, which stresses that, "The United States, which had a low corporate tax rate in the late 1980s as

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[3] We shall refer to such activities as "tax arbitrage," defined narrowly to include only such arbitrage that takes advantage of differences in corporate income tax rates across countries.

[4] Indeed, some recent proposals would completely replace the current income tax system with a tax based on consumption, which would eliminate the taxation of "normal" returns to capital while subjecting "above-normal" returns to capital to taxation at the statutory rate; for a recent review of these arguments, see Zodrow (2007).

[5] See http://waysandmeans.house.gov/taxreform/ and http://www.treasury.gov/resource-center/tax-policy/Documents/The-Presidents-Framework-for-Business-Tax-Reform-02-22-2012.pdf

compared to other countries in the Organisation for Economic Co-operation and Development (OECD), now has the second-highest statutory corporate tax rate among OECD countries. Moreover other OECD countries continue to reduce their corporate income tax rates leaving the United States further behind."

Clear evidence of this trend in corporate tax rates is provided by a comprehensive data set on international statutory and effective marginal tax rates (EMTRs) in 19 OECD countries maintained by the Institute for Fiscal Studies (IFS).[6] Prior to the passage of TRA86, the US statutory corporate income tax rate, including both federal and state corporate income taxes, was 49.6%, roughly equal to the average tax rate of the G-7 countries and 3.3 percentage points higher than the (unweighted) average rate for the 19-country sample of 46.3 percent. In 1987, the United States combined statutory rate fell to 38.4 percent, 8.0 percentage points below the G-7 average rate of 46.4 percent and 6.0 percentage points lower than the 19-country average rate of 44.4%. However, by 2005 (the last year of the IFS data available at the time of publication), the U.S. statutory tax rate of 39.3 percent was 3.0 percentage points above the G-7 average rate of 36.3 percent and 7.9 percentage points higher than the 19-country average rate of 31.4 percent, in the latter case reflecting a swing of nearly 14 percentage points in relative statutory rates since the passage of TRA86. Recent rate reductions among the OECD countries have only exacerbated these trends; indeed, with recent reforms in Japan (formerly the highest tax country), the United States in 2013 had the highest combined national and subnational corporate income tax rate among the 34 nations that comprise the OECD (Table 1).

A roughly similar, though less pronounced, pattern is observed for effective marginal tax rates (EMTRs), defined by the Institute for Fiscal Studies as the business level tax rate applied to

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[6] See the data set compiled by the Institute for Fiscal Studies, "Corporate Tax Rate Data," which is available at the IFS website http://www.ifs.org.uk/publications.php?publication_id=3210.

a marginal (breakeven) equity financed investment in plant and machinery. Because TRA86 was in general a base-broadening, rate-reducing reform, it left the EMTR in the US largely unchanged; indeed, it increased slightly from 21.8 percent to 22.9 percent between 1986 and 1987. In 1987, the EMTR in the United States was 5.2 percentage points below the G-7 average rate of 28.1 percent and 4.8 percentage points below the 19-country sample average of 27.7 percent. However, by 2005, the EMTR in the United States had increased slightly while EMTRs in the other OECD countries had declined considerably; as a result, the EMTR in the United States of 23.6percent, was equal to the G-7 average and 3.3 percentage points higher than the 19-country sample average of 20.3 percent.

As discussed above, relatively high corporate income taxes cause a variety of problems, distorting a wide variety of economic decisions, magnifying problems of administration and compliance, and increasing incentives for tax arbitrage. Beyond these problems, a central question is the degree to which the relatively high tax rates on capital income in the United States reduce investment and thus the size of the capital stock, thereby resulting in lower levels of output, reduced growth rates, and diminished labor productivity and thus lower wages and living standards. Although the early empirical evidence on the tax sensitivity of investment was mixed, the more recent evidence, which accounts for the costs of adjusting the capital stock in response to changes in taxes and uses improved econometric techniques, is consistent with significant effects of taxes on investment as captured by tax-induced changes in the cost of capital (Cummins, Hassett, and Hubbard, 1994; Hassett and Newmark, 2008; de Mooij and Ederveen, 2008). For example, de Mooij and Ederveen (2008) conduct a meta-analysis of the literatures on tax effects on various corporate decisions and conclude that a consensus estimate of the elasticity of domestic investment with respect to the cost of capital is between –0.5 and

–1.0. They also provide consensus estimates of the corporate tax rate semi-elasticities of the corporate share of business activity (–0.7), and the corporate debt-asset ratio (0.3).

In addition, of particular interest in the modern global economy is whether high corporate tax rates reduce foreign direct investment (FDI). Again, empirical evidence demonstrates clearly that FDI is sensitive to tax factors, and suggests that this sensitivity is increasing over time. For example, recent surveys by Gordon and Hines (2002) and de Mooij and Ederveen (2003, 2005, 2008) conclude that FDI is quite responsive to corporate tax rates, with the most recent and careful studies tending to obtain the largest estimates (Altshuler and Grubert, 2006). For example, de Mooij and Ederveen (2008) conclude that a consensus estimate of the semi-elasticity of foreign direct investment with respect to the effective marginal tax rate is –4.0, and with respect to the effective average tax rate which, as will be discussed below, better captures tax effects on the location of highly mobile firm-specific capital that earns economic rents, of –3.2.

If the relatively high rate of corporate income taxation in the United States is a problem that should be addressed with reform, the next logical question is the direction that such a reform should take. In this paper, we focus on reform of the existing corporate income tax system, rather than "fundamental" tax reform in the form of replacing the existing income tax with some form of consumption-based tax system.[7] In particular, we analyze the dynamic economic effects of a reduction in the statutory corporate income tax rate, financed in three alternative ways under the constraint of dynamic revenue neutrality. Before proceeding to a description of the model and a simulation analysis of the effects of corporate income tax rate reduction, we examine in more detail the case for such a reform, especially in comparison to the alternative—discussed at length

[7] For recent discussions of potential reforms in the United States, including various forms of consumption-based taxation, see the articles in Zodrow and Mieszkowski (2002), Auerbach and Hassett (2005), Aaron, Burman, and Steuerle (2007), and Diamond and Zodrow (2008b).

in the US Treasury (2007) report—of reducing effective marginal tax rates by increasing tax incentives for new investment while maintaining statutory tax rates at relatively high levels.

Rate Reduction vs. Tax Incentives

A question that inevitably arises in discussions of lowering the corporate tax rate is whether maintaining a high statutory rate, coupled with investment incentives such as an investment tax credit or more accelerated depreciation allowances (including partial expensing) for new investment, is not a preferable approach. The investment incentive approach is often touted as having more "bang for the buck" in that the revenue cost per dollar of induced investment is lower than with a rate reduction[8]; that is, revenue losses are comparatively small because the new tax incentives apply only to new investment while the relatively high statutory rate continues to apply to the income earned by old investments.[9] In addition, the use of investment incentives implies that the effective marginal tax rate applied to normal returns is reduced, while above normal returns are still taxed at the statutory rate. By comparison, revenue losses are argued to be significantly higher under a reduction in the statutory tax rate because the rate reduction applies to both the income earned by old investments and by investments that generate above normal returns. Finally, to the extent that a lower statutory corporate tax rate increases a positive rate differential between the personal and corporate income tax rates, it creates incentives for shifting income from the personal tax base to the corporate tax base (Gordon and Slemrod, 2000).

Each of these three arguments clearly has some validity; nevertheless, each must also be qualified. First, there is no question that a corporate tax rate reduction benefits existing

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[8] For example, see U.S. Treasury (2007).

[9] Note, however, that even in this case, much of the incentives for new investments will nevertheless be inframarginal and will reduce taxes for investments that would have been made even in the absence of the incentive.

investments, an issue that does not arise with investment incentives. However, the "bang for the buck" from rate reduction may not be as small as sometimes envisioned, because the rate cut may result in larger investment responses than those associated with investment incentives in the form of increased deductions from income. As stressed by Neubig (2007), the key distinction is that investment incentives lower the taxation only of "normal" returns to investment, while a rate reduction applies to both normal and "above-normal" returns. As a result, to the extent that above-normal returns reflect firm-specific rents attributable to highly mobile investments in invention and innovation or firm-created intangible assets, a lower corporate tax rate will stimulate such investments by lowering the average effective tax on such returns—a result that does not obtain under investment incentives.

Second—and closely related—is the fact that although a lower statutory tax rate reduces the taxation of above-normal returns, the implications of such reduced taxation of above-normal returns must be examined carefully (Zodrow, 2010). To the extent that above-normal returns are location specific (e.g., rents associated with access to lucrative markets), a statutory tax rate reduction lowers the level of taxation of relatively immobile factors of production. However, to the extent that above-normal returns are firm specific (e.g., returns that arise from unique entrepreneurial or managerial skills, or intangibles such as unique technological knowledge, proprietary production techniques, patents, goodwill and reputations, etc.), a lower statutory tax rate is desirable because it increases the returns to those investments, including especially investments by multinationals—both those based in the United States and in other countries—that represent capital that is highly mobile internationally. By comparison, investment incentives are of relatively little value to firms with assets that generate firm specific above-normal returns, as their level of profit will be affected primarily by the statutory tax rate applied to such returns. Indeed, Devereux and Griffith (2003) argue that under these circumstances, the key tax factor

affecting investment decisions is the average effective tax rate (AETR), which they define as a weighted average of the EMTR and an adjusted statutory tax rate, with the weights equal to the normal and above-normal rates of return available on a representative firm's investments.[10]

Recent empirical evidence confirms the importance of AETRs and thus statutory tax rates in determining the investment decisions of U.S. multinationals that are relatively likely to make investments that generate above-normal returns. For example, Devereux and Griffith (2003) construct a model in which the level of investment is determined primarily by the effective marginal tax rate, while the choice of investment location among several alternative options is determined primarily by the average effective tax rate. Their empirical results indicate that a one percentage point increase in the effective average tax rate in a country reduces the probabilities of a U.S. firm choosing to produce there by between 0.5–1.3 percentage points. As discussed above, many other studies have linked foreign direct investment and average tax rates and found rather high elasticities. Finally, recent empirical evidence indicates that the dispersion of relative profitability in the United States has increased significantly in recent years, suggesting an increase in the relative importance of investments that generate above-normal returns (Auerbach, 2006).

Third, a corporate tax rate that is low relative to the top personal income tax rate does encourage shifting labor income to a corporation, and recent empirical work suggests that the magnitude of this effect is important. For example, Gordon and Slemrod (2000) estimate that a one percentage point increase in the tax rate differential between corporate and personal income raises reported personal income by 3.2 percent. Of course, the importance of this effect depends on the extent to which tax administration and enforcement are effective in limiting opportunities

[10] In their empirical application, Devereux and Griffith (2003) calculate average effective tax rates for prospective investments that earn various arbitrary pre-tax rates of return (30 percent, 70 percent, and 100 percent).

for tax rate arbitrage, and on the extent to which a decrease in the relative corporate income tax rate results only in deferral, rather than complete exemption, of individual level taxation on the income—e.g., because the income is eventually distributed as taxable dividends, capital gains, or wages.

Lower statutory tax rates have the important advantage of reducing the importance of tax planning in all types of business decision-making. A high statutory corporate tax rate exacerbates the tax bias favoring debt financing over issuing new shares or retained earnings. It also encourages new firms to structure if possible as S corporations or partnerships where income is taxed currently at the individual owners' personal tax rates. A high statutory corporate tax rate encourages firms to use legal tax planning strategies, including supply chain management, location of debt, and location of patents and other intangible assets, to reduce the share of taxable income realized in relatively high tax rate countries, like the United States, while increasing the share of taxable income realized in relatively low tax countries. Such "financial reallocation," which is much easier to put into effect than physical reallocation of capital assets, can reduce taxable corporate income reported and taxes paid in high statutory tax rate countries. In addition, a high corporate tax rate increases the returns to illegal tax evasion.

A number of empirical studies show that tax rate arbitrage takes place despite various governmental mechanisms, such as thin capitalization rules, advance pricing agreements, interest allocation rules, and special treatment of passive investment income. Taken together, these empirical results, discussed in detail in Appendix B, strongly suggest that a lower US corporate tax rate would have a positive effect on the U.S. corporate tax base due to reduced tax arbitrage, thereby offsetting a significant part of any static revenue loss.

Another potentially important rationale for a low statutory corporate income tax rate is the "headline tax rate" argument. Specifically, multinationals may, at least in the initial stages of

choosing among competing locations, focus on a comparison of statutory tax rates across competing locations, independent of special provisions that might lower the effective marginal tax rate, such as accelerated depreciation allowances, etc., which are considered only in a subsequent evaluation of countries that make the "short list" of potential investment locations.

For all these reasons, a move to a corporate income tax with a lower statutory rate could be desirable in the United States, depending on the overall design of the tax reform. This is especially true since, as discussed above, the statutory tax rate in the United States is the second highest among the OECD countries and differentials in statutory tax rates between the United States and its competitors have been increasing in recent years. Moreover, recent experience around the world suggests that many countries have arrived at this same conclusion. The tax reform experience in the mid-1980s, including TRA86 in the United States, was largely one of base-broadening, rate-reducing reforms (Boskin and McLure, 1990). Moreover, more recent tax changes, prompted in large part by increasing international tax competition in the face of increasing globalization, have followed a similar pattern. In particular, Devereux (2007) stresses that statutory tax rates in the OECD have fallen significantly in recent years, but that these rate reductions have been accompanied by base-broadening efforts, so that overall corporate tax revenues as well as average and especially effective marginal tax rates have declined considerably less; indeed, he notes that despite significant statutory rate reductions, corporate tax revenues as a fraction of GDP have been roughly constant over the past forty years, and indeed have increased in recent years. More generally, a revenue neutral lowering of the corporate tax rate has both positive and negative effects, and its desirability can be determined only with an explicit analysis of its economic effects. We turn next to the details of our analysis of this issue.

Modeling The Effects Of A Corporate Income Tax Rate Reduction

In this and the following section we present our analysis of the economic effects of lowering the corporate income tax rate. This section first provides a short description of the dynamic, overlapping generations, computable general equilibrium model used for our simulation analysis, and then turns to a number of extensions to the basic model that were made for purposes of this analysis. The simulation results are presented in the following section.

The Basic Model

Our basic model is dynamic general equilibrium model of the U.S. economy that is well suited for analyzing major business tax reforms. It builds on several other well-known general equilibrium models, but includes important extensions that facilitate the analysis of the short and long run economic effects of tax policy changes. Versions of the model have been used in analyses of tax reforms by the U.S. Department of the Treasury (President's Advisory Panel on Federal Tax Reform, 2005), the Congressional Joint Committee on Taxation (Joint Committee on Taxation, 2005), and in a number of other recent tax policy studies (Diamond and Zodrow, 2007, 2008a; Diamond and Viard, 2008; Carroll, Cline, Diamond, Neubig and Zodrow, 2010; Zodrow and Diamond, 2013).

Overview

The distinguishing feature of the analytical approach used in the basic model is the treatment of both composite consumption goods and owner-occupied and rental housing markets in the context of a dynamic, overlapping-generations, life-cycle, computable general equilibrium model that explicitly calculates reform-induced changes in all asset values during the transition to a new equilibrium.

The model has owner-occupied housing and rental housing production sectors, and corporate and non-corporate composite good production sectors that include all non-housing

goods and services. The time path of investment demands in all production sectors is modeled explicitly, taking into account capital stock adjustment costs. On the consumption side, consumer demands for all housing and nonhousing goods and for a bequest are modeled using an overlapping generations structure in which a representative individual in each generation maximizes lifetime utility.

Thus, the model allows for a fairly detailed description of both the transitional and the long run effects of implementing a base-broadening, rate-reducing corporate income tax reform. The basic structure of the model combines various features from similar and well-known models constructed by Auerbach and Kotlikoff (1987), Goulder and Summers (1989), Goulder (1989), Keuschnigg (1990), Fullerton and Rogers (1993), and Hayashi (1982). A short description of the structure of the model and details on the calibration of the initial equilibrium are provided in Appendix C. More detailed descriptions of the basic model are provided in Diamond and Zodrow (2007, 2008a) and Zodrow and Diamond (2013).

Extensions to the Basic Model

The basic model is extended in this analysis in several ways in order to better capture the economic effects of eliminating business tax expenditures and reducing the corporate income tax rate. The key feature of the reform proposal being analyzed is a significant reduction in the corporate income tax rate in the United States, coupled with the elimination of a wide variety of business tax expenditures. In the benchmark case analyzed, the reform analyzed is revenue neutral, with the corporate rate reduction fully financed by the elimination of business tax expenditures. Note that revenue neutrality in this context is defined in the aggregate, that is for both the corporate and noncorporate business sectors. This implies that effective tax rates on the noncorporate sector would increase, since the elimination of noncorporate tax expenditures is not offset by a reduction in the personal income tax rates at which such income is taxed. As a result,

the effective tax rate differential between the corporate and noncorporate sectors is narrowed, which improves the efficiency of capital allocation across the two sectors,[11] but at the same time raises effective tax rates on, and thus reduces investment in, the noncorporate sector.[12]

In order to analyze these reforms, the model is extended to take into account explicitly a wide variety of such business tax expenditures, modeling in detail how their elimination would affect the cost of capital in the corporate and noncorporate sectors. Business tax expenditures are classified into four types with different economic effects: rate reducing preferences, production incentives, investment incentives, and lump-sum deductions.[13] The classification of tax expenditures and descriptions of their different economic effects are provided in Appendix A.

In addition to this differentiated modeling business tax expenditures, we modify the structure of the basic model in three ways to better capture the effects of the base-broadening rate-reducing reform analyzed in this paper. Specifically, we add an imperfectly competitive sector earning above-normal returns, allow for reform-induced capital inflows from abroad, and consider in a relatively ad hoc way the effect of a rate reduction on corporate tax rate arbitrage. The latter two extensions are especially important in modeling the effects of tax reform in the modern globalized economy, and have been the focus of much recent attention, including—among many others—reports issued by the President's Advisory Panel of Federal Tax Reform (2005) and the U.S. Department of the Treasury (2007); both of these reports considered

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[11] For example, the Congressional Budget Office (2005) estimates that combined business and individual level effective marginal tax rates are 26.3 percent for corporate income and 20.6 percent for the noncorporate sector.

[12] This reform thus differs from the proposal analyzed in Treasury (2007), which assumed that the elimination of tax expenditures in the noncorporate sector was accompanied by the introduction of a new relatively low individual-level tax rate applied to noncorporate income and thus did not finance any reduction in the corporate tax rate.

[13] We do not, however, address the issue of deferral of foreign source income. The JCT (2008) tax expenditure estimates do not include deferral as a "business synthetic tax expenditure," but rather as a "major provision not classified as a tax subsidy." Subsequently, the JCT has reverted back to its traditional approach and includes deferral of active income and active financing income of controlled foreign corporations (CFCs) as tax expenditures. Our

sweeping reforms to the taxation of foreign income, including the possible movement from the current worldwide tax system with a foreign tax credit to a "territorial" tax system that would exempt active foreign source income from tax and is currently being debated in Congress and the broader policy-making community. Appendix B describes these three additional model extensions in detail.

Simulation Results

In this section, we report the results of several simulations of rate-reducing corporate income tax reforms with alternative deficit-neutral financing approaches. We focus on short-run and long-run effects on GDP, but include some discussion of reform-induced changes in other macroeconomic variables as well.

Overview of Modeling

We begin with a dynamic revenue-neutral corporate tax rate reduction, assuming the elimination of all business tax expenditures, simulated in the basic Diamond-Zodrow model. We then consider the implications of adding the three extensions to the basic model described above: an imperfectly competitive sector, an elastic supply of foreign capital, and a reduction in tax rate arbitrage.

We also consider an alternative treatment of business tax expenditures that follows the approach used in Treasury (2007). The Treasury report assumed that all business tax expenditures other than accelerated depreciation have no effects on marginal investment decisions, that is, they do not affect the cost of capital and thus the level of investment. Although this is true for tax expenditures that can accurately be characterized as lump sum in nature, the vast majority of the tax expenditures detailed in Table 2 reflect investment incentives, production incentives, or rate reductions that would affect the cost of capital. As noted previously, recent

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analyses do not include a change in the tax treatment of active income of CFCs other than the lower US corporate

empirical evidence is consistent with the view that reductions in the cost of capital have a positive effect on investment, as predicted by the theory of firm behavior (Hassett and Newmark, 2008). Accordingly, in most of our simulations, we distinguish between the different tax expenditures and model explicitly the effects of investment incentives, production incentives, or rate reductions in lowering the cost of capital; we refer to this as "differentiated treatment of business tax expenditures."

However, in two of our simulations (one with the basic model and one with the extended model), we examine the effects of adopting the Treasury approach of treating all business tax expenditures other than accelerated depreciation as lump-sum deductions. Note that one possible rationale for this approach is that, as noted above, our analysis understates the efficiency gains from a base-broadening, rate-reducing corporate income tax reform because it ignores the benefits of improved intrasectoral allocation of capital and reduced reliance on debt finance. These effects might be significant, as the Congressional Budget Office (2005) estimates that effective corporate taxes on different types of assets vary widely. Such variation in effective tax rates suggests that intra-sectoral distortions are sizable and moving to a more neutral system could generate some modest additional efficiency gains.[14]

Finally, we consider three modified versions of rate-reducing corporate income tax reforms. In each of these simulations, the federal corporate income tax is reduced, but the extent

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tax rate that would apply to such income.

[14] For example, although these results are quite dated, Fullerton, Henderson and Mackie (1987) estimate that the Tax Reform Act of 1986, which broadened the corporate base while significantly reducing both corporate and individual tax rates (while slightly increasing marginal effective tax rates in the corporate sector), reduced the overall capital stock by 0.6 percent, but increased output by 0.2 percent due to the improved allocation of capital attributable to more neutral taxation of business investment. Although effective tax rate differentials are smaller under current law than prior to the enactment of TRA86 (Fullerton, Henderson and Mackie (1987) estimate effective tax rates across different types of assets that vary from zero to 51 percent), these results suggest that improved allocation of capital under the base-broadening, rate-reducing reform analyzed in this paper might result in an increase in GDP on the order of 0.2–0.3 percent. This effect would be augmented by the gains attributable to reduced reliance on debt finance but diminished by the costs of income shifting from labor to capital and any losses in efficiency due to the elimination of well-targeted provisions that encourage activities that generate positive economic externalities.

of corporate income base broadening is either limited to dampen its negative effects on investment incentives or there is no base broadening and the lost revenues are made up with a proportional increase in wage taxes or reductions in government spending in the form of transfer payments.

Corporate Rate Reduction with Business Tax Base Broadening

The first simulation considers a business base-broadening, corporate rate-reducing reform. All of the business income tax expenditures listed in Table 2—including special provisions for corporate, non-corporate and rental housing—are eliminated, with all of the resulting increase in revenues devoted solely to corporate income tax rate reduction.[15] With the elimination of $81.7 billion in annual corporate tax expenditures and an additional $21.1 billion in annual noncorporate tax expenditures (with no offsetting rate decrease for noncorporate income), a dramatic reduction in the federal corporate income tax rate is possible.[16] Initially, the corporate rate declines from 35 percent to 25.6 percent, and in the long run the corporate rate declines to 19.7 percent.[17] As shown in Table 3, the effects of such a reform on GDP, however, are moderately negative in the long run, as GDP increases by 0.08 percent two years after the enactment of reform, but then declines by 0.01 percent after five years, by 0.14 percent after 10 years, by 0.30 percent after 20 years, by 0.51 percent after 50 years and by 0.56 percent in the long run (150 years). The 50-year figure translates into a loss of GDP per household of $1,081.

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[15] The particular reform analyzed results in an increase in taxation of the noncorporate sector, since its tax expenditures are eliminated while personal income tax rates remain constant. This reduces the distortion between corporate and non-corporate investment, but has an adverse effect on investment in the non-corporate business sector.

[16] Note, however, that the amount of rate reduction is overstated to the extent that the cumulative effects of eliminating the tax expenditures are less than their simple sum, due to interaction effects that we do not consider. On the other hand, Carroll, Neubig, and Cox (2011) report that over 40 percent of the corporate base broadening in the 1986 Tax Act was not from eliminating tax expenditures, and suggest that additional business base broadening could be possible to lower rates further.

[17] State corporate income taxes add approximately four percentage points to the corporate income tax rate.

These results reflect the classic problem with a base-broadening, rate-reducing reform of the corporate income tax — the combination of reducing the rate and eliminating tax expenditures (the vast majority of which are assumed to reduce the cost of capital at the margin in our analysis) has offsetting effects on the incentives for new investment, and the rate reduction reduces revenues on income earned by existing capital.[18] The reduction in revenues implies that the tax rate is higher than it would be in the absence of this effect, which in turn reduces incentives for new investment. Indeed, investment decreases by 2.57 percent two years after the enactment of reform, by 2.65 percent after five years, by 2.76 percent after 10 years, and declines by 2.99 percent in the long run. The smaller capital stock (a decline of 2.35 percent in the long run) implies that labor is less productive, wages decline and labor supply declines as well, by 0.06 percent in the long run.

These negative macroeconomic effects are exacerbated when an imperfectly competitive sector is added to the model, as the corporate rate reduction applies to the above-normal returns earned in this sector, further driving down revenues and thus further limiting the rate reductions that can be achieved with a revenue neutral reform. Allowing for an elastic supply of foreign capital could in principle increase the amount of reform-induced investment, especially in the imperfectly competitive sector where above-normal returns are taxed at lower rates. However, the net effect of the reform on after-tax interest rates is very small, as the beneficial effects of the rate cut are roughly offset by the negative effects of eliminating tax expenditures that benefit capital investment. This in turn implies that changes in capital inflows and outflows, which are assumed to be determined by differences in relative after-tax interest rates, are similarly very

[18] Recall, however, that our analysis does not capture any reform-induced efficiency gains from eliminating the distortions across industries within the corporate and non-corporate production sectors.

small.[19] More positive results occur, however, when reform-induced reductions in tax rate arbitrage are added to the model, which results in higher revenues at each tax rate. Thus, reduced tax arbitrage results in a reduction in the corporate tax rate that does not require offsetting base-broadening measures that increase the cost of capital and reduce investment. Indeed, the effects of incorporating reduced tax rate arbitrage are sufficiently large that implementation of the base-broadening, rate-reducing reform results in small gains in GDP in the model.

The effects of incorporating the three additions to the basic Diamond-Zodrow model are shown in Table 4. In this simulation, the changes in GDP are small but positive, always on the order of 0.1–0.2 percent, and equal to 0.12 percent in the long run. The effects of corporate base broadening and reduced tax arbitrage allow the corporate tax rate to be reduced to 16.8 percent in the long run.

These results may appear to be surprising, given the negligible or slightly positive effects on GDP from a base-broadening, rate-reducing reform reported by the U.S. Treasury (2007) that did not consider reductions in tax arbitrage. The Treasury study examined the effects of eliminating an average $93.2 billion in corporate tax expenditures[20] and an additional $39.4 billion in noncorporate tax expenditures (although the effect of eliminating these noncorporate tax expenditures on the corporate tax rate was largely eliminated by assuming that noncorporate income was taxed at a lower rate). The Treasury analysis assumed that all tax expenditures other than accelerated depreciation had no effects on marginal investment decisions, that is, they did not affect the cost of capital and thus the level of investment. At the same time, however, our analysis ignores the efficiency gains that would arise from eliminating intrasectoral distortions in

[19] One potentially interesting extension to the analysis, left to future research, would be to model international capital flows as also responsive to differences in after-tax returns in the imperfectly competitive sector.

the allocation of capital and reducing tax incentives for debt finance, so that the Treasury treatment might be rationalized as a rather ad hoc means of adjusting the results to reflect the potential for such efficiency gains.

Primarily for purposes of comparison to the Treasury results, we provide two sets of simulation results for the case in which all tax expenditures other than accelerated depreciation are treated as lump-sum deductions. In the first case, we follow Treasury in assuming that all markets are perfectly competitive, the economy is closed, and there is no income shifting. However, we maintain our assumption that noncorporate tax expenditures are also eliminated, with no offsetting decrease in the tax rate on income that is passed through to the owners of noncorporate businesses. In this case, as shown in Table 5, the effects of eliminating all business tax expenditures and lowering the corporate tax rate are, unsurprisingly, significantly more positive than when virtually all tax expenditures are assumed to affect the cost of capital (compare to Table 3). Indeed, rather than declining, GDP increases by 0.12 percent two years after the enactment of reform, by 0.27 percent after five years, by 0.41 percent after ten years, and by 0.52 percent in the long run. The long run effect translates into an increase in GDP per household of $1,104. The corporate tax rate declines significantly in this case—to 20.3 percent initially and to 17.0 percent in the long run.

For the reasons discussed above, the magnitudes of these positive effects are increased when the model is expanded to include an imperfectly competitive sector, foreign capital flows, and especially the income shifting response. For example, as shown in Table 6, GDP increases by 0.17 percent two years after the enactment of reform, by 0.46 percent after five years, by 0.77 percent after ten years, and by 1.25 percent in the long run. The corporate tax rate declines to

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[20] The Treasury estimates of corporate tax expenditures differ from those of JCT in many dimensions, and in the aggregate is about $12 billion greater. One important difference is that the JCT estimate of accelerated depreciation

20.0 percent initially and to 12.9 percent in the long run. The treatment of tax expenditures other than accelerated depreciation is thus critical in determining the simulated effects of a base broadening, rate reducing corporate income tax reform.

We now return to our standard approach under which we assume that virtually all business tax expenditures reduce the cost of capital (rather than treating all such expenditures other than accelerated depreciation as lump sum deductions). As discussed previously, the GDP effects under this assumption are either negative or relatively small (Tables 3 and 4), reflecting the negative effects of reducing the taxation of the income earned by existing capital. A natural question is whether it is possible to design alternative reforms that lower the corporate income tax rate and have more positive macroeconomic effects. We consider three such reforms.

Three Reforms with a 25 percent Corporate Tax Rate and Alternative Financing

We conclude our study by analyzing three reforms under which the long run corporate income tax rate is cut to 25 percent, and financed by (1) selective business base broadening, (2) a proportionate increase in wage taxation, and (3) a reduction in government spending in the form of income transfers. In each case, we utilize the fully expanded version of the model, including an imperfectly competitive sector, international capital flows, and tax rate arbitrage.

Under the first reform, we take into account the fact that, of the various categories of business tax expenditures, investment incentives, including accelerated depreciation, have the largest effect on the cost of capital since they are focused solely on investment decisions; by comparison, other tax expenditures, such as production incentives and rate-reducing expenditures have smaller effects on investment since they are general incentives that apply to all production, and lump-sum tax expenditures have no effects on marginal investment decisions.

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is on average roughly $16 billion lower than that of the Treasury.

Specifically, in the simulation presented in Table 7, we reduce the corporate income tax rate to 25 percent in the long run and finance the rate reduction with partial base-broadening in which we order the elimination of tax expenditures so that investment incentives, including accelerated depreciation, are "stacked" last. (By comparison, recall that the elimination of all business tax expenditures allowed a reduction in the corporate tax rate to 19.7 percent in the long run.) This implies that all tax expenditures in categories other than investment incentives are eliminated, but accelerated depreciation is maintained and only 35 percent of the remaining investment incentives are repealed. The macroeconomic effects of this reform are somewhat more favorable than the full base-broadening option analyzed above (compare to Table 4). For example, GDP increases by 0.06 percent two years after the enactment of reform, by 0.13 percent after five years, by 0.19 percent after 10 years, and by 0.41 percent in the long run.

In the second simulation, the corporate rate is reduced to 25 percent but there is no corporate tax base broadening whatsoever, as the rate reduction is assumed to be financed with a proportionate increase in wage taxation. The results of this simulation, presented in Table 8, show that this reduction in capital income taxation stimulates investment, which increases by 0.43 percent two years after the enactment of reform, by 1.37 percent after five years, by 2.27 percent after ten years, and by 2.73 percent in the long run. Labor supply declines slightly — by 0.44 percent two years after reform, and by 0.14 percent in the long run. Although GDP also declines initially, it increases by the fifth year after reform (by 0.13 percent), by 0.47 percent ten years after enactment and by 1.02 percent in the long run.

In the third simulation, the corporate rate is reduced to 25 percent and is financed with a reduction in federal government spending in the form of transfer payments. The simulation results in this case, shown in Table 9, indicate that this reform, which finances rate reduction with a non-distortionary reduction in transfer payments rather than a distortionary increase in

wage taxes, has somewhat more positive effects than the previous reform analyzed. Investment increases by 1.63 percent two years after the enactment of reform, by 2.38 percent after five years, by 3.00 percent after ten years, and by 3.05 percent in the long run. Labor supply increases by 0.09 percent two years after reform and by 0.04 percent in the long run. GDP increases by 0.17 percent two years after enactment of reform, by 0..49 percent after five years, by 0.81 percent ten years after enactment and by 1.23 percent in the long run.

To summarize the results, Table 10 below compares the results of the different versions of the model, different treatments of tax expenditures, and alternative methods of financing a corporate rate reduction. The table shows the dynamic revenue neutral corporate tax rate that can be achieved in the long run, and presents the economic effects in terms of the changes in GDP over 10 and 50 years as well as the effects on GDP per household. For example, the proposal that finances a reduction in the corporate tax rate to 25 percent with a proportional wage tax increase would increase annual GDP per household by over $650 within ten years.

Conclusion

The U.S. corporate income tax system has not changed significantly since 1986, while most other countries have dramatically reduced their statutory corporate income tax rates below the U.S. rate. This paper analyzes the dynamic macroeconomic effects of a reduction in the U.S. corporate tax rate financed in a revenue neutral manner through different types of business tax base broadening, a wage tax increase, and a reduction in government spending.

Focusing on the results which assume that virtually all business tax expenditures affect the cost of capital, the model simulations of standard corporate rate-reducing, business base-broadening tax reforms show fairly modest effects on overall U.S. GDP, capital stock, labor supply and consumption. These results obtain primarily because the revenue neutral rate reduction reform plans analyzed include offsetting base-broadening measures that have adverse

effects on capital investment and because the lower corporate tax rates apply not only to new investments but also to the income earned from existing capital (and also because the model does not capture all of the economic efficiency improvements that would occur with implementation of the reforms). The more positive results occur when corporate rate reductions reduce the extent of tax arbitrage and when most investment incentives are retained. These results suggest that the effects of corporate income tax reform depend both on how the reform is designed and the context in which it is imposed.

Additional model simulations show that rate-reducing reforms coupled with increases in wage taxes or cuts in government spending in the form of income transfers can have more positive macroeconomic effects, with increases in GDP ranging from roughly 0.5–0.8 percent ten years after the enactment of reform, and long run increases of 1.0–1.2 percent.

These results illustrate the importance of differentiating among current business tax expenditures, examining alternative financing mechanisms, and considering the positive benefits of a lower corporate tax rate in reducing tax rate arbitrage when analyzing the economic effects of a base-broadening, rate-reducing corporate income tax reform. In particular, including imperfect competition, internationally mobile capital, and reductions in tax arbitrage in the simulation model resulted in increases in long run GDP on the order of 0.7 percent. Moreover, note that these results are likely to understate the potential positive economic effects of a lower corporate tax rate due to the incomplete modeling of the global economy—including the movements of highly mobile firm-specific capital that earns above-normal economic rents and the effects on domestic demand of reform-induced reductions in income shifting, as well as the potential benefits of a more level playing field across different types of assets and industries—all topics we plan to investigate in future research.

Appendix A

Extension of the Basic Diamond-Zodrow Model to Differentiate Among Business Tax Expenditures

In order to analyze these reforms, the model is extended to take into account explicitly a wide variety of such business tax expenditures, modeling in detail how their elimination would affect the cost of capital in the corporate and noncorporate sectors. Specifically, the simulated reform assumes that a wide variety of business tax expenditures, as delineated in the annual report on tax expenditures issued by the Joint Committee on Taxation (2008), are eliminated, with the resulting revenues used to finance a reduction in the corporate tax rate. Such a reform is modeled as follows.

The various business tax expenditures under current law are classified into the four categories listed below. Examples are provided in each category, with an estimate of the cost of each tax expenditure at the corporate level provided in parentheses; all estimates come from Joint Committee on Taxation (2008) unless otherwise noted. The examples listed include all tax expenditures in excess of $1 billion, which account for virtually the entire corporate tax expenditure budget ($81.7 billion in FY2008), which in turn is roughly four times the size of the tax expenditure budget for the noncorporate sector ($21.1 billion).[21]

(1) **RR** refers to *rate-reducing* preferences that effectively lower the tax rate applied to corporate income, such as the graduated corporation income tax rate structure ($3.3 billion), and various income exemptions (for which the tax rate is zero) including exemption of income earned by credit unions ($1.4 billion);

[21] An additional $7.3 billion of tax expenditures apply to the rental-housing sector and is included in the $21 billion of non-corporate tax expenditures.

(2) **PI** refers to provisions that provide *production incentives* for specific business activities, such as the deduction for domestic production activities ($5.5 billion), the credit for low income housing ($4.8 billion), the special treatment of life insurance reserves ($2.0 billion), deferral of gain on non-dealer installment sales ($1.1 billion), and the special deduction for Blue Cross and Blue Shield insurance companies ($1.0 billion);

(3) **II** refers to provisions that provide *investment incentives* for certain types of investment activities, such as accelerated depreciation of buildings, machinery and equipment in excess of that required to offset the effects of inflation ($20 billion)[22], the inventory property sales source rule exception ($6.8 billion)[23], research tax credits for incremental investment in science, space and technology ($4.9 billion), the LIFO and LCM methods of inventory accounting ($6.7 billion[24]), deferral on like-kind exchanges ($3.0 billion), expensing of research and experimentation expenditures ($3.1 billion), and various provisions that provide for expensing of costs related to energy exploration and development ($2.1 billion), percentage depletion for the oil and gas industry ($1.3 billion), and expensing of depreciable property for small businesses ($1.0 billion);

(4) **LD** refers to deductions in the calculation of taxable income that we treat as *lump-sum deductions*, on the grounds that the deductions are unrelated to either production levels or investment levels, such as the exclusion of investment income on life insurance and annuity contracts ($2.6 billion), and separate grouping of affiliated financial companies ($1.0 billion). In

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[22] The treatment of accelerated deductions for depreciation is discussed further below.

[23] This provision allows revenue from selling U.S. inventory to be counted as foreign source income which increases the foreign tax credits available for firms in excess foreign tax credit positions.

[24] This estimate comes from Joint Committee on Taxation (2007) and includes the first year of the recovery of LIFO reserves, which is assumed to be phased in over eight years; this point is discussed further below.

addition, the revenues gained from recapturing the LIFO reserve associated with eliminating LIFO inventory accounting are treated as reflecting the elimination of a lump sum deduction.

These preferences are then included in the expressions for total taxes paid in the revenue equations for the representative corporate and noncorporate firms in the model. Corporate tax rates are adjusted to reflect the rate reducing preferences, while production and investment incentives are assumed to reduce the sizes of the corporate and noncorporate tax bases by amounts sufficient to generate revenue losses equal to the estimated tax expenditures.[25] The resulting modified expressions for corporate and noncorporate firm profits are then used in determining the cost of capital and the profit-maximizing investment and output decisions of the firm.

The classification of the business tax expenditures listed in the JCT report into these four categories is noted in Table 2. Several items listed as business tax expenditures in the JCT report are not included as business base broadeners in our analysis. These include incentives for state and local governments (e.g., tax exemption of interest on state and local bonds) or tax expenditures that reduce labor income taxes (e.g., ESOP rules for tax preferred compensation on company stock). Our analysis focuses solely on provisions that affect capital income, and thus is conservative in the sense that it ignores these particular tax expenditures that could be used to finance further corporate rate reduction.

Several issues merit further discussion. In particular, the treatment of LIFO inventory accounting, which is the fifth largest item on the JCT list of corporate tax expenditures, is controversial. Proponents of eliminating LIFO, such as Kleinbard, Plesko and Goodman (2006), argue that LIFO is a highly imperfect method of inflation adjustment and is undesirable because

it often results in quasi-permanent deferral of taxes on increases in inventories. In contrast, Viard (2006) argues that the current ad hoc inflation adjustments due to the combination of LIFO inventory accounting and accelerated depreciation for depreciable assets achieves rough neutrality across investment in inventories and depreciable assets. Moreover, as long as one adopts the LIFO rule for ordering which items are sold from inventory, the increases in wealth attributable to the use of LIFO accounting for the stock of inventory are unrealized capital gains which are typically exempt under the current U.S. income tax code.[26]

In any case, LIFO accounting is currently treated as a tax expenditure by the JCT and eliminating LIFO accounting was included in House Ways and Means Committee Chairman Rangel's tax reform proposal. Thus, we include it among our base broadening provisions in this analysis. The JCT (2007), in its analysis of the Rangel proposal, estimates the effects of eliminating LIFO accounting under the assumption that bringing the existing "LIFO reserve"—the difference between the valuation of inventory under FIFO accounting and the considerably smaller value under LIFO accounting rules, which reflects prices in effect at the time the assets were initially added to inventory—is spread out over eight years. In addition, the Rangel proposal would eliminate on a phased-in basis the "lower of cost or market" (LCM) inventory method, which allows taxpayers who do not use LIFO inventory accounting to choose between valuing inventories at cost or the lower of cost or market value. Together, these provisions would raise $6.7 billion in 2008, and $113.7 billion over 2008–17.[27]

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[25] The base reduction equals the tax expenditure divided by the corporate tax rate.

[26] See Kleinbard, Plesko, and Goodman (2006) and Viard (2006) for further details.

[27] Since the JCT study provides estimates only for corporations, we do not consider the much smaller effects of eliminating these provisions in the noncorporate sector,

A separate but closely related issue is the treatment of generally accelerated deductions for depreciation—that is, accelerated deductions that apply to all depreciable assets. JCT (2008) no longer treats accelerated depreciation as a tax expenditure but instead classifies it as a "tax-induced structural distortion." Such a distortion is defined as an element of the tax code that is similar to most tax expenditures in that it causes substantial economic efficiency costs, but different in that the resulting inefficiencies cannot be eliminated by reverting to "the general rule of present law" and instead requires "a more fundamental re-examination and redesign of present law."[28]

Accelerated deductions for depreciation can be thought of as consisting of two components: a substantial element that adjusts deductions based on historical costs for inflation and thus improves the measurement of real economic income, and a second component that serves as an incentive for investing in depreciable assets, much like the sector-specific investment incentives classified as tax expenditures above. It is difficult to separate accelerated depreciation deductions into these two components, especially since the inflation rate varies over time. The JCT (2008) estimates of accelerated depreciation deductions vary widely over 2008–2012, ranging from $6–32 billion. For our simulations, we simply take the average value over that five-year period, which is $20 billion, and treat that as the size of the tax expenditure associated with accelerated depreciation deductions. Even if one believes that only the portion of accelerated depreciation in excess of that required for inflation adjustment should be treated as a

[28] See Joint Committee on Taxation (2008, p. 25).

tax expenditure, the JCT estimate is sufficiently low (e.g., relative to the Treasury (2007) average estimate of 35.6 billion) that it could be interpreted as roughly reflecting such treatment.[29]

Before proceeding further, several limitations of the analysis in capturing the efficiency gains of a reform that involves eliminating business tax expenditures and reducing corporate income tax rates should be noted. First, because we consider only four production sectors in our model, we understate the intersectoral efficiency gains obtained from eliminating tax expenditures and thus tax distortions across the many different industries within these four aggregated production sectors. Second, because it does not include uncertainty or the costs of bankruptcy, the model does not capture the efficiency gains from reduced reliance on debt rather than equity finance in response to reductions in the corporate tax rate and thus the value of interest deductions, including any external costs associated with excessive leverage. Third, our model overstates the efficiency gains from a base-broadening, rate-lowering reform to the extent that there are economic benefits associated with the eliminated tax expenditures—for example, any beneficial effects on productivity and economic growth of the research and experimentation tax credit or the benefits of less pollution due to various environmental provisions. Finally, the model also does not capture the revenue costs arising from the shifting of labor income by the individual owners of closely-held corporations from the personal tax base to the business tax base in response to relatively low corporate tax rates, or any equity benefits that might arise from certain corporate tax expenditures, such as lower-priced housing for the poor due to the credit for low-income housing.

[29] Calculations by the authors suggest that at a two percent inflation rate roughly 60–70 percent of the acceleration of depreciation deductions (relative to unadjusted economic depreciation) under current law reflects inflation adjustment.

Appendix B

Diamond-Zodrow Model Extensions for Corporate Tax Reform Analysis

This appendix describes three extensions made to the basic Diamond-Zodrow model in order to capture additional dimensions of the U.S. economy and better measure tax effects important for modeling corporate tax reform. It also provides some empirical support for the parameters chosen.

An Imperfectly Competitive Corporate Sector Earning Above-Normal Returns

An important difference between lowering the statutory corporate tax rate and the alternative reform option of using tax investment incentives such as accelerated depreciation is that only the former approach reduces the tax rate applied to above-normal returns (both reforms reduce the tax rate applied to normal returns). In order to capture the effects of a reduction in the statutory corporate tax rate on above-normal returns, we extend the model to include an imperfectly competitive sector in which investments permanently earn such above-normal returns. This is accomplished by splitting the corporate sector into two production sectors—a perfectly competitive sector characterized by normal returns, and an imperfectly competitive corporate sector that is characterized by above-normal returns, even in the long run steady state equilibrium.

In the imperfectly competitive corporate sector, the equilibrium price of output is assumed to reflect a markup at a fixed rate m_{IPC}, that is, the gross price of output in this sector received by firms is $p(1+m_{IPC})$. The remainder of the profit function for firms in this sector is the same as the profit function in the perfectly competitive sector. The above-normal returns that arise due to the price markup are assumed to be attributable to firm-specific factors such as unique entrepreneurial or managerial skills, or intangibles such as unique technological

knowledge, proprietary production techniques, patents, goodwill and reputations, etc. Note that these above-normal returns are assumed to persist in the long run, so that in the steady state the after-tax return to capital invested in the imperfectly competitive corporate sector always exceeds the analogous return to capital in the perfectly competitive sector by the same factor, which equals the after-tax revenues attributable to the price markup, expressed as a percentage of firm value in the imperfectly competitive corporate sector. The ownership shares of capital in the two corporate sectors are determined in the initial equilibrium and are assumed to remain constant. In particular, these ownership shares are passed on to an individual's heirs as part of the bequest.

Thus, capital is allocated (1) to the imperfectly competitive corporate sector in the model until in equilibrium it earns a rate of return that reflects the after-tax value of the price markup and is thus permanently higher than the normal return, and (2) to the perfectly competitive sector until it earns the normal rate of return. This implies that the model captures the greater inflow of capital into the imperfectly competitive sector (relative to the perfectly competitive sector), including capital inflows from abroad, that occurs in response to the reduction in the statutory corporate income tax rate; that is, since average tax rates fall relatively more in the imperfectly competitive sector, a relatively larger capital inflow is required to return the system back to the differential rate of return equilibrium described above. At the same time, the model also captures the reduction in revenues associated with reduced taxation of above-normal returns associated with the corporate rate reduction—that is, the reduction in the relatively high average tax rate in that sector due to the taxation of all above-normal returns at the statutory tax rate often stressed by proponents of increasing investment incentives rather than lowering corporate tax rates.

Choosing the size of the markup in the imperfectly competitive sector is difficult, given the problems associated with measuring this parameter accurately and the resulting wide range of

estimates. For example, Bayoumi et al. (2004) estimate a price markup of 23 percent, and Judd (1997) argues that a range of 10–40 percent is plausible, given the existing empirical literature. We assume a price markup of 20 percent.

Similarly, the size of the imperfectly competitive sector is far from clear. The firms in this sector are characterized by investments that generate firm-specific above-normal returns, and we assume that such returns characterize investments by large U.S. multinational corporations. The analysis thus assumes that the imperfectly competitive sector is comprised of large U.S. multinational corporations, with all remaining corporations in the perfectly competitive sector. The division of the corporate sector into perfectly competitive and perfectly competitive components is based on Compustat data for 2007. These data provide information on over 4,300 U.S.-based multinationals with assets of $24.7 trillion and pretax income of $906 billion, almost evenly split between domestic and foreign source income. Accordingly, for the simulation analysis, we assume that the imperfectly competitive sector accounts for $451.4 billion or 21.3 percent of total U.S. corporate gross income in 2007 of $2.1 trillion; the remainder of U.S. corporate gross income is attributed to the perfectly competitive corporate sector. Capital and labor are allocated between the two components of the corporate sector in such a way as to be consistent with this split of corporate income. For purposes of the international income shifting calculation, we assume that one-half of total income earned by U.S. multinationals comes from foreign sources.

Effects of Increased Imports of Capital

Even if the U.S. economy were closed, a reduction in the statutory corporate tax rate that increased after-tax returns to saving would stimulate increased saving and thus increased investment. However, in an open economy context, this effect would be augmented by additional

imports of capital from abroad in response to an increase in the after-tax rate of return to investment in the United States. In this paper, the basic model is extended to include the potential for such capital imports as follows.

Following Goulder, Shoven and Whalley (1983), capital imports (or exports) in period s are governed by the constant elasticity expression

$$\frac{K^W - K_s^F}{K^W} = \left(\frac{r_s^{US}}{r^W} \right)^{\varepsilon\kappa}$$

where K^W is the fixed rest-of-the-world capital stock,[30] r^W is the fixed rest-of-the-world return to capital after corporate-level taxes, r_s^{US} is the return after corporate taxes to capital in the United States (given the fixed debt-asset ratio of b), K_s^F is foreign exports of capital to the United States in period s, and $\varepsilon\kappa$ is a constant (positive) elasticity that determines the extent of international capital flows in the model. Thus, foreign exports of capital to the United States are

$$K_s^F = K^W \left[1 - \left(\frac{r^W}{r_s^{US}} \right)^{\varepsilon\kappa} \right].$$

For example, if $r_s^{US} > r^W$ as a result of the reform, then the United States has positive capital imports in period s $(K_s^F > 0)$. The appropriate value of $\varepsilon\kappa$ is difficult to determine.[31] Gravelle and Smetters (2006) stress that the U.S. economy cannot be modeled as a small open economy that faces a perfectly elastic supply of capital. They argue that the empirical literature suggests values of the foreign/domestic capital portfolio elasticity roughly between 1.0–3.0, and we use a capital supply elasticity consistent with the bottom of that range. Note that a relatively low value

[30] Note that the world capital stock is fixed within a period, but must increase in each period at a rate equal to the growth rate of the U.S. economy so that a long-run equilibrium can be attained.

is appropriate to the extent that a dramatic reduction in the U.S. corporate income tax rate may prompt further reductions in the corporate income tax rates of our competitors, which would mute reform-induced capital inflows from above.[32] Note also, however, that we do not consider the possibility that certain types of capital—for example, firm-specific capital that earns above normal rents such as patents or other proprietary technology, brand names, good will, unique managerial skills or knowledge of production processes, etc.—are much more mobile than other forms of capital; such capital would be likely to be more responsive to taxes, including changes in the statutory tax rates that are more relevant to the taxation of above-normal profits than the taxation of normal profits analyzed in this paper. We leave this extension to future research.

Capital imports are treated as perfect substitutes for domestic capital in all production functions. Given the level of capital imports in each period, the model is closed simply by assuming that the returns, after U.S. corporate taxes, to foreign capital are included in aggregate demand for the corporate good and non-corporate goods, in fixed proportions equal to the ratio of these two goods in the initial equilibrium. This approach effectively implies that the United States is renting capital services from abroad in each period, with foreign capital owners spending an amount equal to their after-tax returns on purchases of exports of the two U.S. composite goods, so that aggregate demands equal aggregate supplies for those goods. These goods do not enter the utility functions of U.S. residents.

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[31] See Harberger (2008) and Gravelle (2008) for differing perspectives on this issue.

[32] Note that such a response may be limited to the extent that the US is perceived to be merely catching up to the rate reductions in other countries described above.

Effects of Reducing Tax Arbitrage

As discussed above, an important advantage of a lower U.S. statutory tax rate is that it reduces the tax rate differentials between the U.S. rate and other countries' tax rates; these differentials encourage legal tax rate arbitrage, which can lower the amount of taxable profit reported in the United States. Corporations have some discretion with respect to where they earn and report taxable income, as companies make incremental investment decisions about the location of new factories, research facilities, and supply chain, as well as financial decisions that can affect the location of debt and intangibles.

The key factor in determining the extent of tax rate arbitrage is the magnitude of the statutory tax rate in the United States, relative to statutory rates in competing countries, since shifted taxable income is taxed at the statutory rate. In particular, a reduction in the statutory tax rate in the United States relative to statutory tax rates in other countries increases the U.S. corporate tax base compared to what it would be in the future if there is less tax rate arbitrage against the United States. Since some tax rate arbitrage can occur without significant reallocation of the physical assets, it is likely to be significantly more sensitive to tax factors than reallocations of physical assets and personnel.

To capture tax rate arbitrage, the basic model is extended in an admittedly ad hoc way to include a reform-induced increase in government tax revenues from a lower relative U.S. tax rate. Tax rate arbitrage is assumed to occur only in the imperfectly competitive sector, which consists solely of large multinationals. Specifically, suppose that in the initial equilibrium the representative firm in the imperfectly competitive industry has a pool of domestic and foreign profits, and that there is no residual U.S. tax on the firm's foreign income. When the United States lowers its statutory corporate tax rate from an initial value of τ_c^o by an amount $\Delta\tau_c$, some

fraction ϕ_{IS} of the static domestic revenue loss in the imperfectly competitive sector that would occur in the absence of any tax rate arbitrage (the product of $\Delta\tau_c$ and initial profits in the imperfectly competitive corporate sector) is offset by an increase in taxable income in the United States.

In addition, the model assumes that the associated increase in after-tax profits is reinvested abroad; this simplifying assumption is necessary, given the incomplete open-economy treatment in the current model, so that U.S. private income is not increased and thus does not affect domestic demand. Note, however, that this assumption implies the model may understate the potential beneficial effects of the reduced income shifting due to a lower U.S. corporate tax rate. For example, if a reduction in the U.S. corporate rate reversed income shifting by U.S. parent firms to subsidiaries in foreign countries with lower tax rates, foreign source income used to purchase imports to the U.S. would decline and domestic income and consumption would increase. A closely related point is that if a foreign subsidiary in the U.S. reduced the income it shifted abroad, more foreign source income would be available abroad to purchase U.S. exports. Both of the effects would tend to increase demand for U.S.-produced goods and services but are not captured in the model—and reflect extensions left to future research.

The magnitude of the tax rate arbitrage parameter, ϕ_{IS}, is difficult to determine. A number of empirical studies have estimated the effects of different types of tax rate arbitrage. For example, studies have found that after-tax profitability tends to be high in low-tax countries (Hines, 1999). Grubert (2003) estimates that tax-minimizing choices regarding the location of intangible income and the allocation of debt explain all of the observed differences in profitability across countries with high and low statutory tax rates. Other studies find that deductible interest payments tend to be made by subsidiaries in high tax countries, while non-

deductible dividend payments tend to be made in low-tax countries (Altshuler and Grubert, 2002; Grubert, 1998; Huizinga, Laeven and Nicodème, 2006), and that deductible royalties are substituted for non-deductible dividends in host countries with high tax rates (Grubert, Randolph and Rousslang, 1996; Grubert, 1998).

Also important is the fact that research and development expenses and other intangible inputs are increasingly mobile. Hines (1996) finds that the allocation of research and development expenditures is highly sensitive to international tax differentials, Altshuler and Grubert (2004) show that low-tax countries are becoming much more important destinations for intangibles initially produced in the United States, and Mutti and Grubert (2006) estimate that less than half of the contribution of parent research and development expenditures to subsidiary income is reflected as royalties. Moreover, increasing economic integration, including especially the greater intra-firm trade that now accounts for nearly 40 percent of all U.S. international trade (Clausing 2003), suggests that such tax arbitrage is likely to become more prevalent over time. This conjecture is supported by empirical evidence presented in Grubert (2001) and Altshuler and Grubert (2006), who find large increases in tax arbitrage over time.

The most striking results are obtained in four recent studies that directly estimate the effect of tax arbitrage. Bartlesman and Beetsma (2003) find that a 1 percent increase (decrease) in a country's tax rate leads to a decline (an increase) in reported before-tax income of 2.7 percent, based on a sample of fifteen industrial sectors in a group of sixteen OECD countries. Their estimates suggest that the revenue increase (decrease) from a unilateral increase (decrease) in the statutory tax rate is on average reduced by roughly more than 65 percent. Broadly similar results are obtained by Huizinga and Laeven (2008), who estimate that the elasticity of the taxable corporate income tax base to the statutory corporate tax rate in Europe is 0.45. Clausing

(2003) finds that prices for intra-firm imports and exports are strongly affected by international tax differentials. Her estimates indicate that, relative to goods that are not traded within the firm, a reduction in a country's statutory tax rate of one percentage point results in changes in the prices of intra-firm traded goods of roughly 2 percent, in the directions predicted by a tax minimization strategy. Clausing (2009) estimates that in 2004 "income shifting" reduced U.S. corporate income tax revenues by about 35 percent.

As discussed above, the most relevant paper is by Bartlesman and Beetsma (2003), who estimate that the revenue increase from a unilateral tax increase (decrease) by one country in their sample of 16 OECD countries is reduced (increased) by more than 65 percent due to tax rate arbitrage in intercompany pricing (which doesn't include other forms of tax rate arbitrage). However, their tax rate arbitrage coefficient for the United States is statistically insignificant and of the wrong sign. In our analysis, we assume a value somewhat smaller than the OECD average found by Bartlesman and Beetsma – specifically, we assume $\phi_{IS} = 0.5$.

We conclude by noting that, as in the case of the supply elasticity of capital, the appropriate value of ϕ_{IS} depends on the response of other governments. For example, a significant rate reduction in the U.S. corporate tax rate might be met with competing rate reductions in other countries, as was certainly the experience following the dramatic reduction in the statutory corporate income tax rate that occurred with the Tax Reform Act of 1986 in the United States, as foreign tax rates declined over time to the point that the United States is once again a relatively high tax country. On the other hand, to the extent that a statutory rate reduction in the United States is perceived as merely "catching up" to recent trends, it might not result in significant rate reductions in other countries, implying that a relatively high value of ϕ_{IS} would be appropriate. Finally, note that a lower corporate income tax rate in the United States would

also encourage tax rate arbitrage by foreign multinationals resulting in increased taxable profits in the United States not considered in our analysis—a consideration that argues for using a somewhat higher value for ϕ_{IS} than otherwise would be the case.

Appendix C

Model Description and Parameter Values Used in the Analysis

The Composite Good Production Sectors

Firms in the two composite good production sectors produce output using a Cobb-Douglas production function with capital and labor as inputs. One sector is subject to the corporate income tax, while the other reflects noncorporate production and is subject to pass-through tax treatment, with all income taxation occurring at the individual level. Firms are assumed to choose the time path of investment to maximize the present value of firm profits or, equivalently, maximize firm value, net of all taxes and subject to quadratic costs of adjusting the capital stock. Total taxes assessed on the composite good production sectors include the corporate income tax, state and local property taxes, and individual level taxes on capital income. Each firm is assumed to maintain a fixed debt/asset ratio and pay out a constant fraction of earnings after taxes and depreciation in each period.

The model assumes individual level arbitrage in the absence of uncertainty about rates of return, which implies that the after-tax return to bonds must equal the after-tax return received by the shareholders of the firm. The values of the firms in the composite good sectors equal the present value of all future net distributions to the owners of the firm.

The Owner-Occupied and Rental Housing Production Sectors

Housing services are produced in the owner-occupied and rental housing production sectors where, following Goulder and Summers (1989) and Goulder (1989), rental housing services are produced by non-corporate landlords and owner-occupied housing services are produced by homeowners. The technology used in the production of rental housing and owner-occupied housing services is assumed to be identical—capital and labor combined in the same Cobb-

Douglas production function. Landlords and owner-occupiers are also are assumed to choose time paths of investment to maximize the equivalent of "firm" value, net of total taxes.

In the case of the rental-housing sector, the firm is modeled as a non-corporate entity, which implies that landlords are simply taxed at the individual level. In the owner-occupied housing sector, the tax burden takes into account the facts that imputed rents are untaxed and depreciation and maintenance expenditures are not deductible under the individual income tax, while mortgage interest and property taxes are deductible. The optimal investment path is calculated as above.

Individual Behavior

On the individual side, the model has a dynamic overlapping generations framework with fifty-five generations alive at each point in time. There is a representative individual for each generation, who has an economic life span (which begins upon entry into the work force) of fifty-five years, with the first forty-five of those years spent working, and the last ten years spent in retirement. Individual tastes are identical so that differences in behavior across generations are due solely to differences in lifetime budget constraints. An individual accumulates assets from the time of "economic birth" that are used to finance both consumption over the life cycle, especially during the retirement period, and the making of a bequest. The model follows Fullerton and Rogers (1993) in assuming a "target bequest" motive under which individuals give a fixed bequest.

The consumer is assumed to choose the time paths of consumption and leisure to maximize rest-of-life utility, which is a discounted sum of annual utilities, subject to a lifetime budget constraint that requires the present value of lifetime wealth including inheritances to equal the present value of lifetime consumption including bequests. Annual utility is assumed to

be a CES function of consumption of an aggregate consumption good, leisure and the bequest. The aggregate consumption good is modeled as a CES function of the composite good and aggregate housing services, with aggregate housing services in turn modeled as a CES function of owner-occupied and rental housing services. In addition, the model includes a simple social security system, government purchases of the composite good, transfer payments, a hump-backed wage profile over the life cycle, a progressive tax on wage income, and constant average marginal tax rates applied to interest income, dividends, and capital gains.

Table A1
Parameter Values Used in the Model Simulations

Symbol	Description	Value
	Consumer Parameters	
ρ	Rate of time preference	0.001
σ	Intertemporal elasticity of substitution	0.35
ε	Intratemporal elasticity of substitution	0.8
σ_{CH}	Elasticity of substitution for composite good and housing	0.8
σ_{CN}	Elasticity of substitution for corporate and non-corporate	5.0
σ_{CM}	Elasticity of substitution for competitive and non-competitive corporate good	0.75
σ_{RO}	Elasticity of substitution for rental and owner housing	2.0
α_E	Utility weight on leisure	0.28
α_C	Utility weight on composite consumption	0.71
α_G	Utility weight on composite good consumption	0.8
α_H	Utility weight on composite housing consumption	0.2
α_{C1}	Utility weight on corporate good	0.68
α_{C12}	Utility weight on corporate competitive good	0.71
α_R	Utility weight on owner housing	0.74
α_{LE}	Leisure share of the initial endowment	0.38
n	Population growth rate	0.01
	Producer Parameters	
g	Technological growth rate	0.01
α_1	Capital share in composite good production	0.25
α_2	Capital share in housing production	0.99

β_X	Composite good adjustment cost parameter	2
β_{rh}	Rental housing adjustment cost parameter	2
β_{oh}	Owner housing adjustment cost parameter	2
μ_X	Composite good adjustment cost function constant	0.1031
μ_h	Housing adjustment cost function constant	0.0451
ζ	Dividend payout ratio in the composite good sector	0.6
b	Debt-to-capital ratio (in all three sectors)	0.35
δ	Economic depreciation in the composite good sector	0.083
δ_h	Economic depreciation in the housing sector	0.025

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Table 1
Statutory Corporate Income Tax Rates, 2013 (Combined National and Subnational)

Country	Statutory Tax Rate
Australia	30.0
Austria	25.0
Belgium	34.0
Canada	26.1
Chile	20.0
Czech Republic	19.0
Denmark	25.0
Estonia	21.0
Finland	24.5
France	34.4
Germany	30.2
Greece	26.0
Hungary	19.0
Iceland	20.0
Ireland	12.5
Israel	25.0
Italy	27.5
Japan	37.0
Korea	24.2
Luxembourg	29.2
Mexico	30.0
Netherlands	25.0
New Zealand	28.0
Norway	28.0
Poland	19.0
Portugal	31.5
Slovak Republic	23.0
Slovenia	17.0
Spain	30.0
Sweden	22.0
Switzerland	21.1
Turkey	20.0
United Kingdom	23.0
United States	39.1

Source: OECD Tax Database, Corporate and Capital Income Taxes, Table II.1, http://www.oecd.org/tax/tax-policy/tax-database.htm#C_CorporateCaptial

Table 2
Business Tax Expenditures, Average Annual FY2008

Tax Expenditure Item	Corporate (Billions)	Non-Corporate (Billions)	Category
Business Synthetic Tax Expenditures			
Inventory property sales source rule exception	$6.8	$0.0	II
Deduction for income attributable to domestic production activities	$5.5	$1.8	PI
General science, space, and technology credit for increasing research activities	$4.9	$0.1	II
Housing: credit for low-income housing	$4.8	$0.0	PI
Inventory methods and valuation: last in, first out	$3.5	$0.5	II
Reduced rates on first $10,000,000 of corporate taxable income	$3.3	$0.0	RR
Expensing of research and experimental expenditures	$3.1	$0.1	II
Deferral of gain on like-kind exchanges	$3.0	$0.0	II
Exclusion of investment income on life insurance and annuity contracts (estimate of $26.8b ignored on non-corporate side)	$2.6	$0.0	DL
Lower of cost or market	$2.2	$0.6	II
Expensing of exploration and development costs: oil and gas	$2.1	$0.0	II
Special treatment of life insurance company reserves	$2.0	$0.0	PI
Financial institutions: exemption of credit union income	$1.4	$0.0	RR
Excess of percentage over cost depletion: oil and gas	$1.3	$0.0	II
Deferral of gain on non-dealer installment sales	$1.1	$0.5	PI
Separate grouping of affiliated financial companies	$1.0	$0.0	DL
Special deduction for Blue Cross and Blue Shield companies	$1.0	$0.0	PI
Expensing under section 179 of depreciable business property	$1.0	$4.4	II
60-40 rule for gain or loss from section 1256 contracts	$0.1	$2.2	II
Accelerated Depreciation Tax Expenditure	$19.6	$4.9	II
JCT Social Spending Business Tax Expenditures			
Social services: deduction for charitable contributions, other than for education and health	$2.4	$0.0	DL
Gulf opportunity zone	$0.3	$1.3	PI
Other Tax Expenditures	$8.7	$4.7	
Total Tax Expenditures	**$81.7**	**$21.1**	

Category Definitions: RR=Rate Reducing; PI=Production Incentive;
I=Investment Incentive; DL=Deduction Lump Sum.
Source: JCT (2008)

Table 3
Dynamic Macroeconomic Effects of Revenue Neutral Corporate Rate Reduction Financed by Repealing All Business Tax Expenditures with Basic Model
Percentage changes from initial steady states

Years After Reform	2	5	10	20	50	150
GDP	0.08%	–0.01%	–0.14%	–0.30%	–0.51%	–0.56%
Capital Stock	–0.19%	–0.64%	–1.15%	–1.72%	–2.22%	–2.35%
Labor Supply	–0.09%	–0.10%	–0.08%	–0.07%	–0.07%	–0.06%
Consumption	0.26%	0.03%	–0.19%	–0.33%	–0.17%	–0.14%
Investment	–2.57%	–2.65%	–2.76%	–2.81%	–2.95%	–2.99%

Basic Diamond-Zodrow model with differentiated treatment of business tax expenditures.

Table 4
Dynamic Macroeconomic Effects of Revenue Neutral Corporate Rate Reduction Financed by Repealing All Business Tax Expenditures with Expanded Model
Percentage changes from initial steady states

Years After Reform	2	5	10	20	50	150
GDP	0.11%	0.17%	0.19%	0.22%	0.18%	0.12%
Capital Stock	0.31%	–0.25%	–0.21%	–0.20%	–0.23%	–0.36%
Labor Supply	–0.13%	–0.17%	–0.17%	–0.16%	–0.17%	–0.16%
Consumption	0.47%	0.25%	0.21%	0.28%	0.70%	0.73%
Investment	–1.16%	–1.06%	–0.91%	–0.77%	–0.78%	–0.94%

Diamond-Zodrow model with differentiated treatment of business tax expenditures, imperfectly competitive sector, foreign capital flows, and tax rate arbitrage.

Table 5
Dynamic Macroeconomic Effects of Revenue Neutral Corporate Rate Reduction Financed by Repealing All Business Tax Expenditures with All Expenditures Treated as Lump Sum except Accelerated Depreciation with Basic Model
Percentage changes from initial steady states

Years After Reform	2	5	10	20	50	150
GDP	0.12%	0.27%	0.41%	–0.51%	0.53%	0.52%
Capital Stock	–0.08%	–0.22%	–0.25%	–0.11%	0.07%	0.06%
Labor Supply	–0.01%	0.00%	0.01%	0.02%	0.01%	0.01%
Consumption	0.02%	–0.12%	–0.15%	0.00%	0.51%	0.60%
Investment	–0.97%	–0.58%	–0.24%	0.00%	0.00%	–0.01%

Basic Diamond-Zodrow model.

Table 6
Dynamic Macroeconomic Effects of Revenue Neutral Corporate Rate Reduction Financed by Repealing All Business Tax Expenditures, with All Expenditures Treated as Lump Sum except Accelerated Depreciation with Expanded Model
Percentage changes from initial steady states

Years After Reform	2	5	10	20	50	150
GDP	0.17%	0.46%	0.77%	1.09%	1.25%	1.25%
Capital Stock	0.29%	0.35%	0.75%	1.46%	1.84%	1.85%
Labor Supply	–0.06%	–0.07%	–0.07%	–0.08%	–0.10%	–0.10%
Consumption	0.26%	0.20%	0.30%	0.66%	1.40%	1.58%
Investment	0.41%	1.10%	1.70%	2.30%	2.26%	2.24%

Diamond-Zodrow model with imperfectly competitive sector, foreign capital flows, and tax rate arbitrage.

Table 7
Dynamic Macroeconomic Effects of Long Run Revenue Neutral 25% Corporate Rate Reduction Financed with Partial Base-Broadening, Retaining Accelerated Depreciation and other Investment Incentives with Expanded Model
Percentage changes from initial steady states

Years After Reform	2	5	10	20	50	150
GDP	0.06%	0.13%	0.19%	0.30%	0.40%	0.41%
Capital Stock	0.27%	0.08%	–0.04%	0.35%	0.54%	0.56%
Labor Supply	–0.04%	–0.07%	–0.07%	–0.06%	–0.07%	–0.07%
Consumption	0.21%	0.16%	0.13%	0.24%	0.54%	0.65%
Investment	–0.04%	0.07%	–0.03%	0.43%	0.52%	0.52%

Diamond-Zodrow model with differentiated treatment of business tax expenditures, imperfectly competitive sector, foreign capital flows, and tax rate arbitrage. Reform assumes accelerated depreciation and 65% of investment incentives are retained.

Table 8
Dynamic Macroeconomic Effects of Long Run Revenue Neutral 25% Corporate Rate Reduction Financed by a Proportionate Wage Tax Increase with Expanded Model
Percentage changes from initial steady states

Years After Reform	2	5	10	20	50	150
GDP	–0.22%	0.13%	0.47%	0.82%	1.01%	1.02%
Capital Stock	0.38%	0.90%	1.75%	2.01%	2.32%	2.35%
Labor Supply	–0.44%	–0.31%	–0.21%	–0.14%	–0.14%	–0.14%
Consumption	–0.15%	–0.02%	0.21%	0.44%	0.82%	0.95%
Investment	0.43%	1.37%	2.27%	2.68%	2.76%	2.73%

Diamond-Zodrow model with differentiated treatment of business tax expenditures, imperfectly competitive sector, foreign capital flows, and tax rate arbitrage.

Table 9
Dynamic Macroeconomic Effects of Long Run Revenue Neutral 25% Corporate Rate Reduction Financed by Reduction in Government Spending with Expanded Model
Percentage changes from initial steady states

Years After Reform	2	5	10	20	50	150
GDP	0.17%	0.49%	0.81%	1.10%	1.22%	1.23%
Capital Stock	0.40%	1.10%	1.95%	2.27%	2.52%	2.54%
Labor Supply	0.09%	0.10%	0.10%	0.07%	0.04%	0.04%
Consumption	0.07%	0.22%	0.46%	0.69%	1.04%	1.15%
Investment	1.63%	2.38%	3.00%	3.10%	3.08%	3.05%

Diamond-Zodrow model with differentiated treatment of business tax expenditures, imperfectly competitive sector, foreign capital flows, and tax rate arbitrage.

Table 10
Summary of Simulated Dynamic Economic Effects of Corporate Rate Reductions

	Description of Modeling						Change in GDP (%)		Change in GDP per household ($)	
	Revenue neutral base-broadening reform?	Imperfectly competitive sector?	Foreign capital inflows?	Tax rate arbitrage response?	Tax expenditures treated as lump-sum changes?	Long run revenue neutral corporate rate (%)	10 years	50 years	10 years	50 years
Table 3	Yes	No	No	No	Generally no	19.7	–0.14	–0.51	–202	–1,081
Table 4	Yes	Yes	Yes	Yes	Generally no	16.8	0.19	0.18	272	379
Table 5	Yes	No	No	No	Yes, except depreciation	17.0	0.41	0.53	572	1,104
Table 6	Yes	Yes	Yes	Yes	Yes, except depreciation	12.9	0.77	1.25	1,184	2,623
Table 7	Yes; retain accelerated depreciation and 65% of investment incentives	Yes	Yes	Yes	Generally no	25.1	0.19	0.40	269	849
Table 8	No; wage tax offset	Yes	Yes	Yes	NA	25.0	0.47	1.01	657	2,120
Table 9	No; spending reduction offset	Yes	Yes	Yes	NA	25.0	0.81	1.22	1,143	2,564

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