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School Property Tax Reform:
An Analysis of Options

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Executive Summary

Texas' property taxes have been a source of widespread contention for more than 20 years. There are many potential reasons why the property tax system in Texas is so controversial, including the structure of the property tax system, the piecemeal approach to reforming the system over the last two decades, the magnitude of the tax burden, and the differences in taxpayers' circumstances and tax liabilities across taxing units.

Following recent attempts to and ongoing discussions about how to reduce the growing magnitude of the property tax burden, this paper examines the economic effects of two options for eliminating the school maintenance and operations (M&O) property tax.

The first option slows state spending growth to finance elimination of the school M&O property tax. The second option increases the state sales tax to finance elimination of the school M&O property tax. The simulations show that both options lead to increases in gross domestic product, aggregate private consumption of goods and services, investment, and the capital stock, as well as leisure or employment or both, depending on assumptions regarding migration and labor supply. In particular, assuming Texas is a small open economy, employment could increase by roughly 183,000 under the first option and 217,000 under the second option soon after reform.

Key Points

- Texas' property taxes have been a source of widespread contention for more than 20 years for many reasons, but the fact remains that the burden to Texans continues to rise.
- This paper examines the economic effects of two options—one that finances school maintenance and operations property tax reductions with a reduction in spending growth and another that replaces those property taxes with state-level sales taxes over time.
- Assuming Texas is a small open economy, our results show that the economy could expand by at least $12.5 billion and employment could increase by at least 183,000 soon after reform under either option. These results are indicative of the inefficiency from taxing mobile capital under the property tax.

Introduction

Public school finance in Texas has been a growing issue of concern for several decades. Most recently, the Texas Legislature passed House Bill 21, which established the Texas Commission on Public School Finance "to develop and make recommendations for improvements to the current public school finance system or for new methods of financing public schools."[1] This was partly in response to repeated lawsuits brought by school districts arguing that more funding was necessary, with seven of the attempts since late 1980 making it to the Texas Supreme Court. While the most recent lawsuit brought by school districts made it to the Texas Supreme Court, the highest court ruled against the school districts and upheld the public school funding system as constitutional. However, the Court's decision made it clear that fundamental reform of the school funding system is needed by stating that "Our Byzantine school funding 'system' is undeniably imperfect, with immense room for improvement. But it satisfies minimum constitutional requirements."[2] In addition, the Court stated that "…children deserve better than serial litigation.…They deserve transformational, top-to-bottom reforms that amount to more than Band-Aid on top of Band-Aid."[3]

1 HB 21, 2017, 85th Texas Legislature (1).

2 *Morath v. Texas Taxpayer & Student Fairness Coal.*, 490 S.W.3d 826 (Tex. 2016), 99.

3 *Morath v. Texas Taxpayer & Student Fairness Coal.*, 490 S.W.3d 826 (Tex. 2016), 2.

In this paper, we simulate the economic effects of two property tax reform options:

- Spending Financed Elimination of the School Maintenance and Operations (M&O) Property Tax, and
- Sales Tax Financed Elimination of the School M&O Property Tax.

The first option reduces the growth of spending from general revenue-related funds at the state level and uses any resulting surplus of state funds to permanently buy down local property taxes used to fund the maintenance and operations of public schools, such that the state fully reimburses local school districts for the decrease in revenues from reducing the local property tax. More details on this plan are available in Belew et al. (2018). The second option would increase sales tax revenues (which could be accomplished by increasing the rate, increasing the tax base, or both) to eliminate the school M&O property tax over time.

The paper is organized as follows. The following section provides a brief review of property taxation in Texas and briefly reviews the academic literature on the property tax. Section III describes the computable general equilibrium model we use to simulate the effects of two property tax reform options. Section IV provides our simulation results for each of the property tax options analyzed, and Section V summarizes our report. An appendix provides additional technical details of the analysis.

Background on Property Taxes

Texas property taxes have been a source of widespread contention for more than 20 years. There are many potential reasons why the property tax system in Texas is so controversial, including the structure of the property tax system, the piecemeal approach to reforming the system over the last two decades, the magnitude of the tax burden, and the differences in taxpayers' circumstances and tax liabilities across taxing units.

A property tax levy is equal to the product of the taxable value and the tax rate of the taxing unit. The taxable value is the market value of property on January 1 of the tax year and is determined by the county tax assessor. The tax rate is determined by the taxing units. Taxing units include counties, cities, independent school districts, and other special purpose districts (e.g., hospital districts, municipal utility districts, navigation districts, and many more). In general, special purpose districts fit into one of six categories: water and wastewater, health and safety, education, transportation, agriculture, or economic and community development. This implies a taxpayer's total tax levy will be the sum of taxes owed to multiple taxing units, with each taxing unit determining its own tax rate. The composition of local taxing units in 2017 included 254 counties, 1,215 cities, 1,555 school districts, and 2,090 special districts.[4] The complexity of determining and maintaining a market value of assessed properties at the county level and the multiple layers of taxes imposed at differing rates imposes a cumbersome system onto Texas residents. Note that the Texas Constitution prohibits a statewide property tax levy.

Belew et al. (2018) show that property taxes have increased by 233 percent from 1996 to 2016, while personal income has only increased by 199 percent over this period (all nominal values). The breakdown is even more striking as the growth in tax revenues was 373 percent for special purpose districts (other than school districts), 256 percent for counties, 239 percent for cities, and 201 percent for school districts. This implies that reform aimed at controlling the growth of property taxes must consider non-school-district property taxes. In fact, there have already been several recent attempts to reduce or reform property taxes.

Dissatisfaction with the structure and level of property taxes has resulted in four different legislative actions that attempted to reduce or reform property taxes in Texas in the last two decades. In 1997, a constitutional amendment (known as the Texas School Property Tax Relief Amendment) increased the school property tax homestead exemption by $10,000 (from $5,000 to $15,000) and required the state to refund any revenue losses to school districts. In 1999, the state again attempted to reduce the property tax burden by creating the new Existing Debt Allotment, which committed state funds to school districts to pay for debt service costs previously funded by local property taxes, and enacted other tax relief measures. The total tax relief was valued at $1.35 billion in 2000-01.[5] In 2006, the Legislature reduced the school M&O property tax rate cap by one-third, or 50 cents (this was phased-in with a 17 cent reduction beginning in 2007 and an additional 33 cent reduction beginning in 2008), and committed to replace the revenue with state level funding. In 2015, the Texas Legislature again increased the school property tax homestead exemption by $10,000 and committed to fund the school districts the amount of lost revenue.

Even with these reforms, school district property tax revenues have increased slightly faster than personal income, while other property taxes have increased at a much faster

4 See "Tax Rates and Levies," Comptroller's Office.

5 See Summary of SB 4: School Finance and Property Tax Relief, House Research Organization, Texas House of Representatives, June 4, 1999.

pace. Given the growth in property tax revenues, it is important to examine the effects of property taxes in terms of creating distortionary changes in market prices, the allocation of the factors of production, and consumer and firm behavior.

The property tax has been the subject of a voluminous literature examining the incidence and economic effects of property taxation. This is unsurprising given that the property tax is a widely used source of local finance (which has been around for centuries). Analyses of the academic literature on the property tax often group the most recent arguments about the effects of property taxation into three views: the traditional view, the benefit view, and the capital tax view.[6]

The traditional view is based largely on partial equilibrium analyses that examine the effects of the property tax. This approach implies that after-tax returns to local capital must eventually return to the nationwide rate of return available to capital owners. Thus, an increase in the local property tax rate will cause local capital to relocate until the after-tax return on local capital is equal to the nationwide return.

Proponents of the benefit view of the property tax argue that the property tax is an efficient user fee for local public service provision; relatively strong assumptions are required to convert the property tax into such a benefit tax. For example, the necessary assumptions include sorting all individuals into localities that offer exactly the level of public services they desire, that all individuals can find a locality that provides the right mix of housing and public services, and that zoning laws are perfectly binding. In addition, proponents of this view assume that municipal governments operate like corporations acting in the best interest of its shareholders (i.e., homeowners). Accordingly, municipal governments choose the tax rate and public provision of local services that best suit the desires of the homeowners.

The capital view takes a generalized approach to describing the traditional view by considering the characteristics of "the broader market." In particular, the capital view accounts for the imposition of property taxes across the broader economy, suggesting that the average property tax rate is a nationwide tax on capital owners. Variations in the property tax rate imply that some localities would impose an above average property tax rate and others would impose a below average property tax rate. These differences lead to distortions in the allocation of mobile capital across localities, and thus can affect wages and the return to land locally. Consequently, differences in property tax rates across localities affect market prices and lead to tax-induced inefficiencies. Because Texas property taxes are relatively high compared to the U.S. average, the capital tax view implies that significant distortions in the location of mobile capital across states are likely to arise.

The Diamond-Zodrow Model

This section provides a very brief description of the model used in this analysis; for more details, see Zodrow and Diamond (2013). The Diamond-Zodrow model is a dynamic, overlapping generations, computable general equilibrium (CGE) model of the U.S. economy that focuses on the economic, distributional, and transitional effects of tax reform. For the purposes of this report, the model has been calibrated to represent the Texas economy. To simplify the analysis, we use a single income group (within each age group) version of the model and thus ignore distributional effects across income groups. The model includes three consumer/producer sectors—non-housing composite good sector (*C*), owner-occupied housing sector (*H*), and rental housing (*R*) sector—all characterized by profit-maximizing firms and competitive markets.

On the consumption side, each household has an "economic life" of 55 years, with 45 working years and a fixed 10-year retirement,[7] and makes its consumption and labor supply choices to maximize lifetime welfare subject to a lifetime budget constraint that includes personal income, taxes, transfers, and a fixed "target" bequest.

State and local governments purchase fixed amounts of the composite goods at market prices and make transfer payments; they finance these expenditures with revenues from sales taxes, business taxes, and property taxes. A federal government purchases fixed amounts of the composite goods at market prices, makes transfer payments, and pays interest and principal on the national debt; it finances these expenditures with revenues collected from the corporate income tax, a progressive labor income tax, and flat rate taxes on capital income. All markets are assumed to be in equilibrium in all periods, and the economy must begin and end in a steady-state equilibrium, with all of the key economic variables growing at the exogenous growth rate, which equals the sum of the exogenous population and productivity growth rates. We turn next to an analysis of the simulation results in our model for the two reform options described above.

Economic Effects of Property Tax Reform

As noted above, we simulate the economic effects of two property tax reform options:

6 See Zodrow (2001) for a comprehensive overview.

7 Thus, for example, an individual with an "economic age" of one year has completed her education and has been in the labor force for one year.

- State spending financed elimination of the school M&O property tax, and
- Sales tax financed elimination of the school M&O property tax.

In each case, we compare the economic effects of the policy change to the values that would have occurred in the absence of any changes—that is, under a baseline "current policy scenario." The baseline property tax rate is 1.5 percent on housing capital and 1.3 percent on non-housing capital. For each of the policy reforms, the reduction in the property tax rate is phased-in so that the school M&O property tax rate is reduced by 5.4 percent in 2020, by 40 percent in 2025, by 88.6 percent in 2030, and by 100 percent in every year after 2030—in other words, the school M&O property tax is eliminated by 2031. The decrease in property tax revenues is offset by state surplus funds from limiting state spending or an increase in state sales tax revenues. The increase in the state sales tax revenues is modeled as an increase in the state sales tax rate but could also be accomplished by increasing the size of the sales tax base by collecting the tax on goods and services that are currently exempt from the sales tax.

Simulation Results

Slowing the Growth of Spending to Finance Elimination of the School M&O Property Tax

Table 1 shows the economic effects for the case in which slowing public service spending growth is used to finance elimination of the school M&O property tax. Total property taxes across all levels of government (i.e., county, city, school district, and other special districts) decrease in the year after reform (2021) by 3.4 percent, by 15.4 percent in 2025, by 32.2 percent in 2030, by 35.2 percent in 2040, and by 34.5 percent in the long run—the school M&O property tax is eliminated in 2031. To offset the decrease in revenues and maintain a balanced budget, total state and local government spending is reduced (relative to the baseline level) by 1.8 percent in the year after reform, by 8.3 percent in 2025, by 17.6 percent in 2030, by 19.0 percent in 2040, and by 18.6 percent in the long run.

The simulation results indicate that the net effect on Texas' GDP is positive, with GDP increasing by 0.7 percent ($12.5 billion noting that all values are real) in the year after reform, by 0.6 percent in 2025, by 0.6 percent in 2030, by 0.7 percent in 2040, and by 0.8 percent in the long run. Aggregate private consumption of goods and services increases by 0.7 percent ($6.3 billion) in the year after reform, by 0.8 percent in 2025, by 1.1 percent in 2030, by 1.3 percent in 2040, and by 1.5 percent in the long run. Total investment increases by 0.7 percent ($1.9 billion) in the year after reform, by 1.6 percent in 2025, by 3.1 percent in 2030, by 3.0 percent in 2040, and by 2.6 percent in the long run. In addition, non-housing capital increases as inflows of capital into Texas (from elsewhere in the U.S. and abroad) increase by 34.1 percent relative to the baseline level. Note that baseline capital inflows are roughly 9 percent of the non-housing capital stock so that the 34.1 percent increase is roughly a 3 percent increase in non-housing capital (in addition to the increase in investment in the non-housing sector). The total capital stock increases by 1.7 percent in the year after reform, by 1.9 percent in 2025, by 2.4 percent in 2030, by 3.6 percent in 2040, and by 4.6 percent in the long run. The stock of non-housing capital increases by 3.0 percent in the year after reform and in 2025, by 3.1 percent in 2030, by 3.9 percent in 2040, and by 4.7 percent in the long run. The stock of owner-occupied (rental) housing increases by 3.8 (1.9) percent in the year after reform, by 5.6 (3.7) percent in 2025, by 7.6 (6.0) percent in 2030, by 6.0 (4.9) percent in 2040, and by 4.6 (3.7) percent in the long run. The increase in the capital stock raises the productivity of labor and leads to an increase in the wage rate of 1.0 percent in the year after reform. The wage rate continues to slowly rise (relative to the baseline value) until it is 1.7 percent higher in the long run.

The simulation results also indicate that the reform would lead to an increase in leisure, as a reduction in the property taxes, coupled with a decrease in government expenditures, would lead to an increase in the after-tax income of Texas households. This increase in income implies households would demand more consumption goods and services as well as more leisure. Thus, the model predicts a decrease in aggregate hours worked as individuals decrease their supply of labor as after-tax income increases. In addition, the increase in the before-tax wage and the inflow of capital imply firms would substitute capital for labor at the margin. Note that the effect of a decrease in hours worked is more than offset by the increase in the before-tax wage as total wages increase by 0.7 percent ($7.6 billion) in the year after reform and by 0.8 percent in the long run. Note that the model assumes the population is fixed and that the labor market clears in each period. However, an alternative, and widely used and accepted assumption for a small open economy, such as Texas, is that the number of available workers would increase (either because of migration or because those currently not in the labor force decide to re-enter the labor force) such that the after-tax wage is constant at its initial level.

In this case (i.e., assuming Texas is a small open economy), an increase in wages in Texas relative to other states would lead to an increase in the size of the labor force in Texas so that the wage rate is constant before and after the reform. Our results suggest that employers would be able to hire roughly 183,000 full-time workers at $20 per hour.

Table 1 shows that state and local tax revenues would decrease by 1.8 percent in the year after reform, by 8.3 percent by 2025, by 17.6 percent by 2030, by 19.0 percent by 2040, and by 18.6 percent in the long run. The reduction in property tax revenues follows a similar pattern, with a long run decline in revenues of 34.5 percent relative to baseline revenues. Sales taxes and business taxes would both increase as an increase in economic activity and a constant tax rate would imply an increase in revenues, with sales tax revenues increasing by 1.7 percent in the long run and business taxes increasing by 5.3 percent in the long run. This implies a dynamic revenue offset (i.e., the change in the predicted revenue losses after considering how changes in economic activity would alter the static revenue estimate) of about 7.8 percent ($10.2 billion) over the first 11 (from 2020 to 2030) years after reform. This number is calculated by taking the percentage change in the predicted revenue losses from 2020-30 after accounting for changes in economic activity relative to the baseline (the dynamic revenue estimate) and the predicted revenue losses from 2020-30 assuming no change in economic activity relative to the baseline (the static revenue estimate). The dynamic revenue offset is slightly larger in the long run as the dynamic effects continue to increase after 2030.

Sales Tax Financed Elimination of the School M&O Property Tax

We next consider the economic effects of financing the elimination of the school M&O property tax with an increase in the state portion of the sales tax over time. **Table 2** shows the economic effects for this case. Total property tax revenues decrease by 3.6 percent in the first year after the phased-in reform, by 15.2 percent in 2025, by 31.9 percent in 2030, by 35.0 percent in 2040, and by 34.5 percent in the long run—the school M&O property tax is eliminated in 2031. The decrease in property tax revenues is offset by an increase in sales tax revenue in this case. Sales tax revenues increase by 4.7 percent in the year after reform, by 20.2 percent in 2025, by 42.7 percent in 2030, by 46.8 percent in 2040, and by 46.1 percent in the long run.

The simulation results indicate that the net effect on Texas' GDP is positive and slightly larger than the case with a reduction in government spending. In this case, GDP increases by 0.8 percent ($14.3 billion) in the year after reform, by 0.9 percent in 2025 and 2030, by 1.0 percent in 2040, and 1.1 percent in the long run. Aggregate private consumption of goods and services increases by 0.3 percent in the year after reform, and then declines slowly to a decrease of 0.2 percent in 2030, before rebounding to 0.1 percent above its baseline level in the long run. Total investment increases by 2.1 percent in the year after reform, by 2.9 percent in 2025, by 3.4 percent in 2030, by 3.1 percent in 2040, and by 2.8 percent in the long run. In addition, non-housing capital increases as inflows of capital into Texas increase by 34.3 percent relative to the baseline level. As noted above, the baseline capital inflows are roughly 9 percent of the non-housing capital stock so that the 34.3 percent increase is roughly a 3 percent increase in non-housing capital. The total capital stock increases by 1.8 percent in the year after reform, by 2.2 percent in 2025, by 2.9 percent in 2030, by 3.9 percent in 2040, and by 4.7 percent in the long run. Non-housing capital increases by 3.1 percent in the year after reform, by 3.4 percent in 2025, by 3.7 percent in 2030, by 4.4 percent in 2040, and by 5.0 percent in the long run. The stock of owner-occupied (rental) housing increases by 5.1 (3.4) percent in the year after reform, by 6.7 (4.9) percent in 2025, by 7.5 (5.9) percent in 2030, by 5.7 (4.7) percent in 2040, and by 4.5 (3.6) percent in the long run. The increase in the capital stock raises the productivity of labor and leads to an increase in the wage rate of 0.9 percent in the year after reform. The wage rate continues to slowly rise relative to the baseline value until it is 1.7 percent higher in the long run.

The simulation results also indicate that this reform would lead to an increase in leisure as after-tax income increases. This increase in after-tax income implies households would demand more consumption goods and services as well as more leisure. Thus, the model predicts a decrease in aggregate hours worked as individuals decrease their supply of labor as after-tax income increases, but this increase is smaller than in the simulation that assumes a government spending offset. For example, in the long run aggregate hours worked decreases by 0.9 percent in the simulation that assumes a reduction in government spending and by 0.6 percent in the simulation that assumes an increase in sales taxes. The effect of a decrease in hours worked is more than offset by the increase in the before-tax wage as total wages increase by 0.9 percent in the year after reform and by 1.1 percent in the long run. Note the model assumes that the population is fixed and that the labor market clears in each period. However, as noted above, an increase in wages in Texas relative to other states would lead to additional growth in the Texas labor force. This would occur such that the after-tax wage remains constant. This implies that employers would be able to hire about 217,000 full-time workers at $20 per hour.

Table 2 shows that state and local taxes would be unchanged relative to the baseline in this case as the reduction in property tax revenues is completely offset by an increase in sales tax revenues over time. In addition, government spending is held constant at the baseline value. Business taxes would increase as an increase in economic activity and a constant tax rate would imply an increase in revenues, with business taxes increasing by 5.8 percent in the long run. This implies a dynamic revenue offset (i.e., a reduction in the predicted revenue losses that assumes economic activity is constant) of about 9.1 percent ($11.9 billion) over the first 11 years (from 2020 to 2030) after reform. This number is calculated by taking the percentage change in the predicted revenue losses from 2020-30 after accounting for changes in economic activity relative to the baseline (the dynamic revenue estimate) and the predicted revenue losses from 2020-30 assuming no change in economic activity relative to the baseline (the static revenue estimate). The dynamic revenue offset would be slightly larger in the long run as the dynamic effects continue to increase after 2030.

Conclusion

After several attempts to reduce the property tax burden on Texas residents over the last two decades, the upcoming legislative session provides state policymakers with yet another opportunity to create a lasting improvement in public school finance. In this paper, we evaluated two specific options—one that finances school maintenance and operations property tax reductions with a reduction in spending growth and another that replaces those property taxes with state-level sales taxes over time (through base expansion and/or increased tax rate).

Using the Diamond-Zodrow computable general equilibrium model calibrated to the Texas economy, we find that both options lead to long-term increases in private consumption, investment, capital inflows, and total stock of capital as well as leisure or employment or both depending on assumptions regarding migration and labor supply. In particular, assuming Texas is a small open economy, employment could increase by roughly 183,000 under the first option and 217,000 under the second option soon after reform. The increase in private consumption is larger in the case in which a decrease in government spending on public services is the fiscal offset. While this result is expected, comparing a decrease in government spending on public services and an increase in private consumption is a normative issue that voters will assess differently based on their own preferences and the specific reductions in public expenditures. The results are indicative of the inefficiency that results from taxing mobile capital under the property tax.

References

Auerbach, Alan J., and Laurence J. Kotlikoff. 1987. *Dynamic Fiscal Policy*. Harvard University Press, Cambridge, MA.

Ballard, Charles F. 2002. "International Aspects of Fundamental Tax Reform." In Zodrow, George R., and Peter Mieszkowski (eds.), *United States Tax Reform in the 21st Century*. Cambridge University Press, Cambridge, UK.

Belew, Kara, and Emily Sass, Vance Ginn, and Bill Peacock. 2018. *Abolishing the Robin Hood School Property Tax*. Texas Public Policy Foundation.

Diamond, John W., and Alan D. Viard. 2008. "Welfare and Macroeconomic Effects of Deficit-Financed Tax Cuts: Lessons from CGE Models." In Viard, Alan D. (ed.), *Tax Policy Lessons from the 2000s*: 145–193. The AEI Press, Washington, D.C.

Diamond, John W., and George R. Zodrow. 2007. "Economic Effects of a Personal Capital Income Tax Add-On to a Consumption Tax." *Finanzarchiv* 63(3): 374–395.

Diamond, John W., and George R. Zodrow. 2008. "Consumption Tax Reform: Changes in Business Equity and Housing Prices," 227–260. In Diamond, John W., and George R. Zodrow (eds.), *Fundamental Tax Reform: Issues, Choices and Implications*. MIT Press, Cambridge, MA.

Diamond, John W., and George R. Zodrow. 2011. "Fundamental Tax Reform: Then and Now," Baker Institute for Public Policy Report, Rice University, published in the Congressional Record, JCX-28-11: 27–38. Joint Committee on Taxation, Washington, D.C.

Diamond, John W., and George R. Zodrow. 2013. "Promoting Growth, Maintaining Progressivity, and Dealing with the Fiscal Crisis: CGE Simulations of a Temporary VAT Used for Debt Reduction." *Public Finance Review* 41(6): 852–884.

Diamond, John W., and George R. Zodrow. 2014. "Dynamic Macroeconomic Estimates of the Effects of Chairman Camp's 2014 Tax Reform Discussion Draft." Tax Policy Advisers, LLC, Houston, TX.

Diamond, John W., and George R. Zodrow. 2015. "Modeling U.S. and Foreign Multinationals in a Dynamic OLG-CGE Model." Rice University, Houston, TX.

Diamond, John W., George R. Zodrow, Thomas S., and Robert J. Carroll. 2014. "The Dynamic Economic Effects of a US Corporate Income Tax Rate Reduction." In Diamond, John W., and George R. Zodrow. *Pathways to Fiscal Reform in the United States.* MIT Press, Cambridge, MA.

Fullerton, Don, and Diane L. Rogers. 1993. *Who Bears the Lifetime Tax Burden?* Brookings Institution Press, Washington, D.C.

Goulder, Lawrence H. 1989. "Tax Policy, Housing Prices, and Housing Investment." *Regional Science and Urban Economics* 19(2): 281–304.

Goulder, Lawrence H., and Lawrence H. Summers. 1989. "Tax Policy, Asset Prices, and Growth." *Journal of Public Economics* 38(3): 265–296.

Gravelle, Jane G. 2002. "Behavioral Responses to a Consumption Tax." In Zodrow, George R., and Peter Mieszkowski (eds.), *United States Tax Reform in the 21st Century*. Cambridge University Press, Cambridge, UK.

Gunning, Timothy G., John W. Diamond, and George R. Zodrow. 2008. "Selecting Parameter Values for General Equilibrium Model Simulations." *Proceedings of the One Hundredth Annual Conference on Taxation*: 43–49. National Tax Association, Washington, D.C.

Joint Committee on Taxation. 2005. "Macroeconomic Analysis of Various Proposals to Provide $500 Billion in Tax Relief." JCX-4-15. Joint Committee on Taxation, Washington, D.C.

Joint Committee on Taxation. 2017. "Macroeconomic Analysis of the 'Tax Cut and Jobs Act' as Ordered Reported by the Senate Committee on Finance on November 16, 2017." JCX-61-17. Joint Committee on Taxation, Washington, D.C.

Keuschnigg, Christian. 1990. "Corporate Taxation and Growth, Dynamic General Equilibrium Simulation Study." In Brunner, J., and H. Petersen (eds.), *Simulation Models in Tax and Transfer Policy*: 245–277. Campus Verlag, Frankfurt, Germany.

President's Advisory Panel on Federal Tax Reform, 2005. *Simple, Fair, and Pro-Growth: Proposals to Fix America's Tax System.* U.S. Government Printing Office, Washington, D.C.

Zodrow, George R. 2001. "The property tax as a capital tax: A room with three views." *National Tax Journal* 54(1): 139-156.

Zodrow, George R., and John W. Diamond. 2013. "Dynamic Overlapping Generations Computable General Equilibrium Models and the Analysis of Tax Policy." In Dixon, Peter B., and Dale W. Jorgenson (eds.), *Handbook of Computable General Equilibrium Modeling*, *Volume 1*, 743–813. Elsevier Publishing, Amsterdam, Netherlands.

Table 1
Economic Effects of Spending Financed Property Tax Reduction
(Percentage changes in variables, relative to steady state)

Variable % Change in Year:	2021	2025	2030	2040	2070	LR
GDP	0.7	0.6	0.6	0.7	0.8	0.8
Total Consumption	0.7	0.8	1.1	1.3	1.5	1.5
Total Investment	0.7	1.6	3.1	3.0	2.6	2.6
Capital (K) Inflows (U.S. and Abroad)	34.1	34.1	34.1	34.1	34.1	34.1
Total K	1.7	1.9	2.4	3.6	4.5	4.6
Corporate	3.0	3.0	3.1	3.9	4.6	4.7
RH	1.9	3.7	6.0	4.9	3.8	3.7
OH	3.8	5.6	7.6	6.0	4.7	4.6
Employment	-0.3	-0.4	-0.7	-0.8	-0.9	-0.9
Total Wages	0.7	0.6	0.5	0.6	0.7	0.8
State and Local Taxes	-1.8	-8.3	-17.6	-19.0	-18.6	-18.6
School M&O Property Tax	-3.6	-15.4	-32.2	-35.2	-34.6	-34.5
Sales Taxes	0.6	0.8	1.1	1.4	1.7	1.7
Business Taxes	1.5	2.6	4.1	5.2	5.3	5.3
Government Spending	-1.8	-8.3	-17.6	-19.0	-18.6	-18.6

Table 2
Economic Effects of Sales Tax Financed Property Tax Reduction
(Percentage changes in variables, relative to steady state)

Variable % Change in Year:	2021	2025	2030	2040	2070	LR
GDP	0.8	0.9	0.9	1.0	1.1	1.1
Total Consumption	0.3	0.0	-0.2	-0.1	0.1	0.1
Total Investment	2.1	2.9	3.4	3.1	2.8	2.8
Capital (K) Inflows (from U.S. and Abroad)	34.3	34.3	34.3	34.3	34.3	34.3
Total K	1.8	2.2	2.9	3.9	4.6	4.7
Corporate	3.1	3.4	3.7	4.4	4.9	5.0
RH	3.4	4.9	5.9	4.7	3.7	3.6
OH	5.1	6.7	7.5	5.7	4.6	4.5
Employment	-0.1	-0.2	-0.3	-0.5	-0.5	-0.6
Total Wages	0.9	0.9	0.9	0.9	1.1	1.1
State and Local Taxes	0.0	0.0	0.0	0.0	0.0	0.0
School M&O Property Tax	-3.6	-15.2	-31.9	-35.0	-34.5	-34.5
Sales Taxes	4.7	20.2	42.7	46.8	46.2	46.1
Business Taxes	2.1	3.4	5.1	5.7	5.8	5.8
Government Spending	0.0	0.0	0.0	0.0	0.0	0.0

Appendix
Details of the Diamond-Zodrow Model

This appendix provides a brief description of the Diamond-Zodrow model used in this analysis; for a complete description, see Zodrow and Diamond (2013).

The version of the Diamond-Zodrow model used in this paper is a dynamic, overlapping generations, computable general equilibrium (CGE) model of the Texas economy that focuses on the economic effects of tax reforms, including the immediate impact, transitional, and long run effects. The model combines various features from other broadly similar CGE models, including those constructed by Auerbach and Kotlikoff (1987), Goulder and Summers (1989), Goulder (1989), Keuschnigg (1990), and Fullerton and Rogers (1993). Key model parameter values used in our simulations are listed in **Table A1**.[8] Versions of the model have been used in analyses of federal tax reforms by the U.S. Department of the Treasury (President's Advisory Panel on Federal Tax Reform 2005), the Joint Committee on Taxation (2005, 2017), and in a number of recent tax policy studies (Diamond and Zodrow 2007, 2008, 2013, 2014, 2015; Diamond, Zodrow, Neubig, and Carroll, 2014; and Diamond and Viard, 2008).

As discussed above, the version of the model used in this paper includes three consumer/producer sectors—non-housing composite good sector (*C*), owner-occupied housing sector (*H*), and rental housing sector (*R*). The non-housing sector is subject to a federal level corporate income tax and a state-level business tax. Using Cobb-Douglas production functions, firms in each sector combine labor and capital to produce their outputs to minimize after-tax costs. The time paths of investment are determined by profit-maximizing firm managers who take into account all business taxes as well as the costs of adjusting their capital stocks, correctly anticipating the economic changes that will occur after the tax reform is enacted. The non-housing sector firms finance their investments with a fixed mix of equity and debt and pay out a fixed fraction of their earnings as dividends. A portfolio capital equation allows for out-of-state capital to flow into or out of Texas if the return to capital in the Texas economy changes.

On the consumption side, each household has an "economic life" of 55 years, with 45 working years and a fixed 10-year retirement. Households supply labor and saving for capital investment and their demands for all housing and non-housing goods are modeled using an overlapping generations structure in which representative households[9] in each of the 55 different generations alive in any given year (each period in the model represents one year) make consumption choices to maximize lifetime welfare subject to a lifetime budget constraint that includes personal income and other taxes, and make a fixed "target" bequest.[10]

The federal, state, and local governments purchase fixed amounts of the composite goods and make transfer payments. The federal government finances its spending with the corporate income tax, a progressive labor income tax, and constant capital income tax rates applied to the three forms of individual capital income in the model—interest income, dividends, and capital gains.[11] The state and local governments finance spending with the sales tax (with taxed and untaxed goods), a property tax on housing and non-housing capital, and a state business tax. The modeling of the corporate income tax includes explicit consideration of deductions for depreciation or immediate expensing for both new and old assets (which are treated separately), other production and investment incentives, and state and local income and property taxes. The model includes a simple representation of the Social Security system, including its progressive benefit structure and the earnings cap on payroll taxes.

All markets are assumed to be competitive and in equilibrium in all periods, and the economy must begin and end in a steady-state equilibrium, with all of the key economic variables growing at the exogenous growth rate, which equals the sum of the exogenous population and productivity growth rates. The model does not include unemployment, so that any labor supply response reflects changes in labor supply in the context of a full employment economy.

8 For a discussion of some of these choices, see Gunning, Diamond, and Zodrow (2008).

9 Households are not differentiated according to family size.

10 This relatively simple approach to modeling bequests follows Fullerton and Rogers (1993). One advantage of the target bequest approach is that it addresses the concern that the responsiveness of the saving of far-sighted households to after-tax returns is unreasonably large in life-cycle models (Ballard, 2002; Gravelle, 2002); with a target bequest, an increase in the after-tax rate of return reduces bequest saving since the target bequest is more easily attained and thus mutes savings responses in the model.

11 The tax rates used in the model reflect the changes enacted in the 2017 Tax Cut and Jobs Act. The tax rate applied to capital gains is an effective annual accrual tax rate.

Table A1. Parameter Values Used in the Diamond-Zodrow Texas Model

Symbol	Description	Value
	Utility Function Parameters	
ρ	Rate of time preference	0.015
σ_U	Intertemporal elasticity of substitution (EOS)	0.35
σ_C	Intratemporal EOS	0.60
σ_H	EOS between composite good, housing	0.80
σ_M	EOS between taxed and nontaxed non-housing goods	0.50
σ_I	EOS between in-state and out-of-state produced goods	5.00
σ_R	EOS between rental and owner-occupied housing	2.00
α_C	Utility weight on the composite consumption good	0.62
α_H	Utility weight on non-housing consumption good	0.76
α_M	Utility weight on taxed non-housing good	0.61
α_R	Utility weight on owner-occupied housing	0.74
α_{LE}	Leisure share of time endowment	0.48
	Production Function Parameters	
ε_N	EOS for non-housing good	1.00
ε_H, ε_R	EOS for owner and rental housing	1.00
γ_C	Capital shares for non-housing goods	0.3
γ_H, γ_R	Capital share for owner and rental housing	0.98
$\beta_X, \beta_N, \beta_H$	Capital stock adjustment cost parameters	5.0
ζ	Dividend payout ratio in corporate sector	0.32
b_n, b_R, b_H	Debt-asset ratios	0.35
	Other Parameters	
ε_K	Portfolio elasticity for ordinary capital	20
n	Exogenous growth rate (population plus productivity)	2.0

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Diamond is co-editor of *Pathways to Fiscal Reform in the United States* (MIT Press, 2015) and "Fundamental Tax Reform: Issues, Choices and Implications" (MIT Press, 2008). He has testified before the U.S. House Ways and Means Committee, the U.S. House Budget Committee, the Senate Finance Committee, the Joint Economic Committee and other federal and state committees on issues related to tax policy and the U.S. economy. Diamond served as forum editor for the *National Tax Journal* (2009-2017) and on the staff of the Joint Committee on Taxation, U.S. Congress (2000-2004). He has also served as a consultant for the World Bank on the efficacy of structural adjustment programs.

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